RED CAP HOOGLAND
SOUTHERN WIND FARM CLUSTER
DRAFT BASIC ASSESSMENT (BA) REPORT

Prepared for: Red Cap Hoogland 3 (Pty) Ltd and
Red Cap Hoogland 4 (Pty) Ltd

Authority References: TBA

SLR Project No.: 720.18062.00001
Report No.: 1
Revision No.: 2
August 2022

DOCUMENT INFORMATION

Title	Red Cap Hoogland Southern Wind Farm Cluster Draft Basic Assessment (BA) Report
Project Manager	Liandra Scott-Shaw
Project Manager Email	lscottshaw@slrconsulting.com
Author	Stuart Heather-Clark and Liandra Scott-Shaw
Reviewer	Stuart Heather-Clark
Keywords	Renewable Energy, Wind Farm, Battery Energy Storage
Status	Draft
Report No.	1
SLR Company	SLR Consulting (South Africa) (Pty) Ltd

DOCUMENT REVISION RECORD

Rev No.	Issue Date	Description	Issued By
1	18 March 2022	Pre-Application Report	LSS
2	15 August 2022	Draft Basic Assessment (BA) Report	LSS

REPORT SIGN OFF AND APPROVALS

Liandra Scott-Shaw
(Project Manager and assistant author)

Stuart Heather-Clark
(Author and Reviewer)

BASIS OF REPORT

This document has been prepared by an SLR Group company with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with **Red Cap Energy (Pty) Ltd** (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

GENERAL SITE INFORMATION

HOOGLAND 3 WIND FARM

The infrastructure associated with the Hoogland 3 Wind Farm includes the following:

- Wind turbines (namely 58 at this stage) with targeted nameplate generation capacity up to a maximum of 420 MW (see Table 2-2 for turbine specifications).
- Turbine foundations (circular foundation for each turbine with diameter of up to 35 m, alongside 40 m hardstand - 1,400 m^2).
- Hardstands/laydown areas (temporary areas up to max of 5,200 m^2 per turbine), which include the following:
  - permanent 80 m x 40 m crane pad placed adjacent to each turbine foundation;
  - additional 20 m x 40 m temporary hardstand area near each crane pad;
  - 104 m x 20 m blade laydown area;
  - approx. 104 m x 5 m additional embankment area (where necessary due to slopes); and
  - temporary 120 m x 15 m crane boom assembly area.
- Underground cabling (up to 66kV) to connect turbines to on-site Substation.
- Internal wind farm overhead powerlines (up to 66 kV lines supported by 132 kV monopole style pylons approx. 22 m high, as well as tracks for access to pylons) where burying is not possible due to technical, geological, environmental or topographical constraints.
- Permanent and temporary site roads, which include the following:
  - permanent 6 m wide roads (may require side drains on one or both sides, depending on topography);
  - up to 15 m wide temporary road corridor (temporarily impacted during construction & rehabilitated to allow for 6 m road surface after construction); and
  - total road network also includes permanent upgrades to sections of public roads (12.8 km), as well as permanent shared road infrastructure (8.7 km) with the Hoogland 4 Wind Farm.
- Wind Farm substations (two 150 m x 75 m substation yards that will include an O&M building, Substation building & High Voltage Gantry).
- Battery Energy Storage System (BESS) (2 x ±3.5 ha areas which may be adjacent or slightly removed from each of the 2 Substations, depending on local constraints).
- Operations and maintenance (O&M) area (includes all offices, stores, workshops & laydown area), which forms part of the substation yard.
- Security gate and hut at most entrances to Wind Farm site (4 x entrances each at 20 m^2).
- Up to 2.4 m high fence for enclosure of temporary and permanent yard areas (with access control). No fencing around individual turbines (existing fencing shall remain around perimeter of properties).
- Temporary areas required for the construction/decommissioning phase, which include the following:
  - temporary site camp area/s of ±20,000 m^2;
  - batching plant area of ±2,000 m^2;
  - general laydown area of ± 36,000 m^2; and
  - bunded fuel & lubricants storage facility at the site camp of Wind Farm.

Please refer to Section 2.2 (specifically Table 2-3) and Section 2.4 for full descriptions related to the technical details of the infrastructure associated with the Hoogland 3 Wind Farm. This includes the footprints associated with all project infrastructure. A summary of the technical details for the proposed Wind Farm, including descriptions and/or dimensions, is provided in the table below.

Information	Description / Details		
Descriptions of all affected farm portions; and	**Farm Number**	**Farm Name**	**21-Digit SG Code**
	Wind Farm Site		
	2/28	PLATFONTEIN	C00900000000002800002
	3/28	PLATFONTEIN	C00900000000002800003
	4/28	PLATFONTEIN	C00900000000002800004

21-Digit Surveyor General (SG) code of all affected farm portions	RE1/28	PLATFONTEIN	C00900000000002800001
	88	SWART RUG	C00900000000008800000
Central co-ordinates of the wind farm site and activity location	Also refer to Figure 1-2 and *Appendix B: Maps* for Locality Plan		
	31° 58' 43.408" S	22° 8' 19.330" E	
Corner point coordinates of the wind farm site and activity location	31° 56' 8.745" S	22° 8' 27.906" E	
	31° 56' 18.000" S	22° 9' 17.529" E	
	31° 56' 42.817" S	22° 9' 38.382" E	
	31° 57' 8.246" S	22° 10' 53.947" E	
	31° 56' 50.636" S	22° 11' 26.800" E	
	32° 2' 13,478" S	22° 7' 47,153" E	
	32° 2' 36,957" S	22° 6' 33,096" E	
	32° 0' 53,908" S	22° 4' 46,691" E	
	32° 0' 6.878" S	22° 5' 43.743" E	
	31° 57' 39.768" S	22° 4' 57.268" E	
	31° 56' 25.826" S	22° 5' 56.390" E	
	31° 55' 38.715" S	22° 5' 38.913" E	
	31° 55' 27,608" S	22° 6' 1,446" E	
	31° 55' 5,770" S	22° 8' 6,371" E	
	31° 59' 29,337" S	22° 11' 36,938" E	
	31° 57' 15.364" S	22° 13' 21.744" E	
Photos of areas that give a visual perspective of all parts of the site	Photos from Visual Impact Assessment illustrating the characteristics of the site (Lawson and Oberholzer, 2022):		

Photos from Terrestrial Biodiversity Assessment illustrating the characteristics of the site (Todd, 2022):

	 Please refer to Section 7 for more photographs of the site, as provided by the specialists.
Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	The Visual Impact Assessment (Lawson and Oberholzer, 2022) (*Appendix C11: Visual*) shows photomontages from key viewpoints with high visibility.
Facility design specifications including:	
Type of technology	Wind Energy – onshore turbines
Number of turbines	Up to a maximum of 58 wind turbine generators.
Structure height	The following wind turbine envelope is proposed: • Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius) • Hub height: 80 m to 150 m • Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5m blade = 247.5m) • Rotor bottom tip height: minimum of 20 m (and not lower). See Figure 2-7 in Section 2.4.1 for a visual representation of the wind turbine envelope proposed.
Surface area to be covered (including associated infrastructure such as roads)	**Total disturbance footprint:** 121 ha temporary and 105.5 ha permanent **Turbine foundations (40 m x 35 m):** 8.2 ha permanent **Crane pads (80 m x 40 m):** 18.6 ha permanent **Turbine hardstands (20 m x 40 m), including blade laydown area (104 m x 20 m), embankment where necessary (104 m x 5 m) & crane boom assembly area (120 x 15 m):** 30.2 ha temporary **Cabling:** 15.6 km in length and 9.3 ha (temporary) in extent **Internal WEF overhead powerlines:** 4 km in length and 2.4 ha (permanent) in extent **Site Roads**: total road network = 83.9 km. 67.1 ha permanent and 75.5 ha temporary **Upgrades to sections of public roads:** 12.8 km (permanent) in length **Shared road infrastructure with Hoogland 4 Wind Farm:** 8.7 km (permanent) in length **Two Wind farm substation and two battery energy storage systems (BESS):** 2.3 ha permanent for substations and 7 ha permanent for BESS **Operations and maintenance (O&M) area:** Forms part of substation yard **Security:** 80 m^2 **Temporary construction area (including site camp, batching plant, general laydown area and bunder fuel & lubricants storage facility):** 6 ha temporary
Structure orientation	The turbine blades will not be fixed and will be able to rotate in order to catch the prevailing winds.
Laydown area dimensions (construction period and thereafter)	See above - taken into account in the overall surface area.

Generation of the facility as a whole at delivery points	Up to a maximum of 420 MW

Please refer to Table 2-2 in Section 2.2 for all details related to the project components, including specifications.

HOOGLAND 4 WIND FARM

The infrastructure associated with the Hoogland 4 Wind Farm includes the following:

- Wind turbines (namely 55 at this stage) with targeted nameplate generation capacity up to a maximum of 420 MW (see Table 2-2 for turbine specifications).
- Turbine foundations (circular foundation for each turbine with diameter of up to 35 m, alongside 40 m hardstand - 1,400 m^2).
- Hardstands/laydown areas (temporary areas up to max of 5,200 m^2 per turbine), which include the following:
  - permanent 80 m x 40 m crane pad placed adjacent to each turbine foundation;
  - additional 20 m x 40 m temporary hardstand area near each crane pad;
  - 104 m x 20 m blade laydown area;
  - approx. 104 m x 5 m additional embankment area (where necessary due to slopes); and
  - temporary 120 m x 15 m crane boom assembly area.
- Underground cabling (up to 66kV) to connect turbines to on-site Substation.
- Internal wind farm overhead powerlines (up to 66 kV lines supported by 132 kV monopole style pylons approx. 22 m high, as well as tracks for access to pylons) where burying is not possible due to technical, geological, environmental or topographical constraints.
- Permanent and temporary site roads, which include the following:
  - permanent 6 m wide roads (may require side drains on one or both sides, depending on topography);
  - up to 15 m wide temporary road corridor (temporarily impacted during construction & rehabilitated to allow for 6 m road surface after construction); and
  - total road network also includes permanent upgrades to sections of public roads (2.7 km), as well as permanent shared road infrastructure (8.7 km) with the Hoogland 3 Wind Farm.
- Wind Farm substations (two 150 m x 75 m substation yards that will include an O&M building, Substation building & High Voltage Gantry).
- Battery Energy Storage System (BESS) (2 x ±3.5 ha areas which may be adjacent or slightly removed from each of the 2 Substations, depending on local constraints).
- Operations and maintenance (O&M) area (includes all offices, stores, workshops & laydown area), which forms part of the substation yard.
- Security gate and hut at most entrances to Wind Farm site (4 x entrances each at 20 m^2).
- Up to 2.4 m high fence for enclosure of temporary and permanent yard areas (with access control). No fencing around individual turbines (existing fencing shall remain around perimeter of properties).
- Temporary areas required for the construction/decommissioning phase, which include the following:
  - temporary site camp area/s of ±20,000 m^2;
  - batching plant area of ±2,000 m^2;
  - general laydown area of ± 36,000 m^2; and
  - bunded fuel & lubricants storage facility at the site camp of Wind Farm.

Please refer to Section 2.2 (specifically Table 2-3) and Section 2.4 for full descriptions related to the technical details of the infrastructure associated with the Hoogland 4 Wind Farm. This includes the footprints associated with all project infrastructure. A summary of the technical details for the proposed Wind Farm, including descriptions and/or dimensions, is provided in the table below.

Information	Description / Details		
Descriptions of all affected farm portions; and 21-Digit Surveyor General (SG) code of	**Farm Number**	**Farm Name**	**21-Digit SG Code**
	Wind Farm Site		
	2/28	PLATFONTEIN	C00900000000002800002
	3/28	PLATFONTEIN	C00900000000002800003
	RE1/28	PLATFONTEIN	C00900000000002800001
	3/39	EYERKUIL	C00900000000003900003

<table>
<tr><td rowspan="6">all affected farm portions</td><td>33</td><td>ANNEX KARROO PLAATS</td><td>C00900000000003300000</td></tr>
<tr><td>1/32</td><td>THE ROSARY</td><td>C00900000000003200001</td></tr>
<tr><td>RE/83</td><td>ADJOINING QUAGGAS FONTEIN</td><td>C00900000000008300000</td></tr>
<tr><td>RE1/39</td><td>EYERKUIL</td><td>C00900000000003900001</td></tr>
<tr><td>RE2/39</td><td>EYERKUIL</td><td>C00900000000003900002</td></tr>
<tr><td>RE/37</td><td>DRIEFONTEIN</td><td>C00900000000003700000</td></tr>
<tr><td rowspan="2">Central co-ordinates of the wind farm site and activity location</td><td colspan="3">Also refer to Figure 1-2 and Appendix B: Maps for Locality Plan</td></tr>
<tr><td colspan="2">31° 56' 17,600" S</td><td>22° 15' 32,061" E</td></tr>
<tr><td rowspan="21">Corner point coordinates of the wind farm site and activity location</td><td colspan="2">31° 56' 21.979" S</td><td>22° 8' 29.815" E</td></tr>
<tr><td colspan="2">31° 56' 52.944" S</td><td>22° 9' 28.840" E</td></tr>
<tr><td colspan="2">31° 57' 21.170" S</td><td>22° 10' 52.371" E</td></tr>
<tr><td colspan="2">31° 57' 27.841" S</td><td>22° 13' 17.315" E</td></tr>
<tr><td colspan="2">31° 57' 11.543" S</td><td>22° 13' 23.100" E</td></tr>
<tr><td colspan="2">31° 57' 3.664" S</td><td>22° 11' 29.998" E</td></tr>
<tr><td colspan="2">31° 56' 27.930" S</td><td>22° 9' 7.405" E</td></tr>
<tr><td colspan="2">31° 55' 30.494" S</td><td>22° 8' 23.220" E</td></tr>
<tr><td colspan="2">31° 55' 5,770" S</td><td>22° 8' 6,371" E</td></tr>
<tr><td colspan="2">31° 56' 52.948" S</td><td>22° 13' 43.452" E</td></tr>
<tr><td colspan="2">31° 58' 34,121" S</td><td>22° 15' 18,115" E</td></tr>
<tr><td colspan="2">31° 57' 2.649" S</td><td>22° 17' 20.253" E</td></tr>
<tr><td colspan="2">32° 0' 9.557" S</td><td>22° 17' 34.829" E</td></tr>
<tr><td colspan="2">31° 59' 38.307" S</td><td>22° 17' 10.703" E</td></tr>
<tr><td colspan="2">31° 59' 33.949" S</td><td>22° 21' 26.887" E</td></tr>
<tr><td colspan="2">31° 56' 10.799" S</td><td>22° 20' 48.612" E</td></tr>
<tr><td colspan="2">31° 52' 12.056" S</td><td>22° 13' 54.037" E</td></tr>
<tr><td colspan="2">31° 54' 33.438" S</td><td>22° 11' 11.319" E</td></tr>
<tr><td colspan="2">31° 53' 39.022" S</td><td>22° 12' 30.628" E</td></tr>
<tr><td colspan="2">31° 53' 43,539" S</td><td>22° 11' 52,787" E</td></tr>
<tr><td colspan="2">31° 58' 6,454" S</td><td>22° 14' 21,375" E</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Photos of areas that give a visual perspective of all parts of the site</td><td colspan="3">Photos from Visual Impact Assessment illustrating the characteristics of the site (Lawson and Oberholzer, 2022):
</td></tr>
</table>



Photos from Terrestrial Biodiversity Assessment illustrating the characteristics of the site (Todd, 2022):

	 Please refer to Section 7 for more photographs of the site, as provided by the specialists.
Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	The Visual Impact Assessment (Lawson and Oberholzer, 2022) (*Appendix C11: Visual*) shows photomontages from key viewpoints with high visibility.
Facility design specifications including:	
Type of technology	Wind Energy – onshore turbines
Number of turbines	Up to a maximum of 55 wind turbine generators[1].
Structure height	The following wind turbine envelope is proposed: • Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius) • Hub height: 80 m to 150 m • Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5m blade = 247.5m) • Rotor bottom tip height: minimum of 20 m (and not lower). See Figure 2-7 in Section 2.4.1 for a visual representation of the wind turbine envelope proposed.
Surface area to be covered (including associated infrastructure such as roads)	**Total disturbance footprint:** 123.3 ha temporary and 112.9 ha permanent **Turbine foundations (40 m x 35 m):** 7.7 ha permanent **Crane pads (80 m x 40 m):** 17.6 ha permanent **Turbine hardstands (20 m x 40 m), including blade laydown area (104 m x 20 m), embankment where necessary (104 m x 5 m) & crane boom assembly area (120 x 15 m):** 28.6 ha temporary **Cabling:** 10.7 km in length and 6.4 ha (temporary) in extent **Internal WEF overhead powerlines:** 8.7 km in length and 5.2 ha (permanent) in extent **Site Roads**: total road network = 91.4 km. 73.1 ha permanent and 82.3 ha temporary **Upgrades to sections of public roads:** 2.7 km (permanent) in length **Shared road infrastructure with Hoogland 3 Wind Farm:** 8.7 km (permanent) in length **Two Wind farm substation and two battery energy storage systems (BESS):** 2.3 ha permanent for substations and 7 ha permanent for BESS **Operations and maintenance (O&M) area:** Forms part of substation yard **Security:** 80 m^2 **Temporary construction area (including site camp, batching plant, general laydown area and bunder fuel & lubricants storage facility):** 6 ha temporary
Structure orientation	The turbine blades will not be fixed and will be able to rotate in order to catch the prevailing winds.

[1] 74 potential turbine locations were considered feasible and assessed as part of the screening / pre-application phase for Hoogland 4, however, the number of turbines has been reduced to 55 potential sites to be developed and are being assessed as part of the BA process.

Laydown area dimensions (construction period and thereafter)	See above - taken into account in the overall surface area.
Generation of the facility as a whole at delivery points	Up to a maximum of 420 MW

Please refer to **Table 2-2** in Section 2.2 for all details related to the project components, including specifications.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Red Cap Hoogland Southern Wind Farm Cluster Draft Basic Assessment (BA) Report

ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AC	- Alternating Current
BA	- Basic Assessment
BAR	- Basic Assessment Report
BESS	- Battery Energy Storage System
BID	- Background Information Document
CARA	- Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CBA	- Critical Biodiversity Area
CKDM	- Central Karoo District Municipality
DBAR	- Draft Basic Assessment Report
DC	- Direct Current
DFFE	- Department of Forestry, Fisheries and the Environment
DM	- District Municipality
DoE	- Department of Energy
DWS	- Department of Water and Sanitation
EA	- Environmental Authorisation
EAP	- Environmental Assessment Practitioner
ECA	- Environmental Conservation Act (ECA) (Act No. 73 of 1989)
ECO	- Environmental Control Officer
EHS	- Environmental, Health, and Safety
EIA	- Environmental Impact Assessment
EIAr	- Environmental Impact Assessment Report
EMPr	- Environmental Management Programme
EP	- Equator Principles
ERA	- The Electricity Regulation Act No. 4 of 2006
ESA	- Ecological Support Area
FBAR	- Final Basic Assessment Report
GA	- General Authorisation
GDP	- Gross Domestic Product
GHG	- Green House Gases
GIS	- Geographic Information System
GW	- Gigawatts
GWh	- Gigawatt Hours
Ha	- Hectares
HIA	- Heritage Impact Assessment
HV	- High Voltage
I&AP(s)	- Interested and/or Affected Party/Party(ies)

Acronym / Abbreviation	Definition
IBA(s)	- Important Bird Area(s)
IDP	- Integrated Development Plan
IEP	- Integrated Energy Plan
IFC	- International Finance Corporation
IPP(s)	- Independent Power Producer(s)
IRP	- Integrated Resource Plan
IUCN	- International Union for the Conservation of Nature and Natural Resources
kV	- Kilo Volt
LM	- Local Municipality
LED	- Local Economic Development
MSL	- Mean Sea Level
MW	- Megawatt
NEA	- The National Energy Act (Act No. 34 of 2008)
NEMA	- National Environmental Management Act (Act No. 107 of 1998) as amended
NEM:AQA	- National Environmental Management: Air Quality Act (Act No. of 2004) as amended
NEM:BA	- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) as amended
NEM:PAA	- National Environmental Management: Protected Areas Act (Act No. 57 of 2003) as amended
NFA	- The National Forest Act (Act No. 84 of 1998) as amended
NFEPA	- National Freshwater Ecosystem Priority Areas
NHRA	- National Heritage Resources Act (Act No. 25 of 1999) as amended
NPAES	- National Protected Area Expansion Strategy
NRTA	- National Road Traffic Act (Act No. 93 of 1996) as amended
NWA	- National Water Act (Act No. 36 of 1998) as amended
OHSA	- Occupational Health and Safety Act (Act No. 85 of 1993) as amended
O&M	- Operations and Maintenance
OoS	- Organs of State
PDP	- Provincial Development Plan
PES	- Present Ecological Status
PoS	- Plan of Study
PM	- Public Meeting
PPA	- Power Purchase Agreement
PPP	- Public Participation Process
PP Plan	- Public Participation Plan
PV	- Photovoltaic
RDP	- Rural Development Plan
REDZ	- Renewable Energy Development Zone
REIPPP	-Renewable Energy Independent Power Producer Procurement Programme
RE	- Renewable Energy

Acronym / Abbreviation	Definition
SA	- South Africa
SABAP2	- Southern African Bird Atlas Project 2
SACAA	- South African Civil Aviation Authority
SAHRA	- South African Heritage Resources Agency
SAHRIS	- South African Heritage Resources Information System
SALA	- Subdivision of Agricultural Land Act (Act No. 70 of 1970)
SANBI	- South African National Biodiversity Institute
SDF	- Spatial Development Framework
SEF	- Solar Energy Facility
SKA	- Square Kilometre Array
STP	- Screening Tool Report
SWMP	- Storm Water Management Plan
TASCS	- Terrestrial Animal Species Compliance Statement
VIA	- Visual Impact Assessment
VU	- Vulnerable
WC	- Western Cape
WEF	- Wind Energy Facility
WMA	- Water Management Area
WUL	- Water Use License
WULA	- Water Use License Application

DEFINITIONS

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc.

Archaeological resources: This includes:

i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
iii. wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Basic Assessment Report: An assessment report compiled in accordance with Appendix A of the NEMA: EIA Regulations of 2014, as amended, to relay the information gathered and assessments undertaken during the Environmental Impact Assessment phase of a project.

Battery Energy Storage System: A technology developed for storing electric charge by using specially developed batteries. These systems complement intermittent sources of energy such as wind, tidal and solar power in an attempt to balance energy production and consumption.

Biodiversity: The diversity of genes, species and ecosystems, and the ecological and evolutionary processes that maintain that diversity.

Construction Phase: The stage of project development involving site preparation as well as all construction activities associated with the development of the project.

Cultural landscape: A representation of the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal (World Heritage Committee, 1992).

Cultural Significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Cumulative Impact: In relation to an activity, cumulative impact means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Endemic: Restricted or exclusive to a particular geographic area and occurring nowhere else. Endemism refers to the occurrence of endemic species.

Environmental Assessment Practitioner: An independent individual with the appropriate qualifications and experience who is appointed by the Applicant to manage the Environmental Impact Assessment process.

Environmental Authorisation: An approval granted by the Competent Authority allowing the Applicant to undertake listed activities in terms of the NEMA: EIA Regulations 2014, as amended.

Environmental Impact Assessment: In relation to an application, means the process of collecting, organising, analysing, interpreting, assessing and communicating environmental and socio-economic information that is relevant to the consideration of the application.

Environmental Impact Assessment Report: An assessment report compiled in accordance with Appendix 3(3) of the NEMA: EIA Regulations of 2014, as amended, to relay the information gathered and assessments undertaken during the Environmental Impact Assessment phase of a project.

Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.

'Equator Principles': A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Habitat: The area of an environment occupied by a species or group of species, due to the particular set of environmental conditions that prevail there.

Heritage: That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage Resources: This means any place or object of cultural significance, such as the caves with archaeological deposits identified close to both development sites for this study.

Impact: A change to the existing environment, either adverse or beneficial, that is directly or indirectly due to the development of the project and its associated activities.

Kilovolt (kV): a unit of electric potential equal to a thousand volts (a volt being the standard unit of electric potential. It is defined as the amount of electrical potential between two points on a conductor carrying a current of one ampere while one watt of power is dissipated between the two points).

Mitigate: The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action. Design or management mitigation measures are those that are intended to minimise or enhance an impact, depending on the desired effect.

'No-Go' option: The "no-go" development alternative option assumes the site remains in its current state, i.e. there is no construction of a facility and associated infrastructure in the proposed project area.

Operational Phase: The project phase following the Construction Phase, during which the development will function or be used as per the design.

Palaeontology: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Red Data Species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Red List: A publication that provides information on the conservation and threat status of species, based on scientific conservation assessments.

Rehabilitation: Less than full restoration of an ecosystem to its pre-disturbance condition.

Restoration: To return a site to an approximation of its condition before alteration.

Riparian: The area of land adjacent to a river or stream that is, at least periodically, influenced by flooding.

Sense of place: The unique quality or character of a place, whether natural, rural or urban. It relates to uniqueness, distinctiveness or strong identity.

Specialist study: A study into a particular aspect of the project, undertaken by a suitably qualified expert in that discipline.

Species of Special / Conservation Concern: Species that have particular ecological, economic or cultural significance, including but not limited to threatened species.

Stakeholders: All parties affected by and/or able to influence a project, often those in a position of authority and/or representing others.

Sustainable development: Sustainable development is defined as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. NEMA defines sustainable development as the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations.

Threatened Ecosystems: An ecosystem that has been classified as Critically Endangered, Endangered or Vulnerable, based on analysis of ecosystem threat status. A threatened ecosystem has lost, or is losing, vital aspects of its structure, composition or function. The Biodiversity Act makes provision for the Minister or Environmental Affairs, or a provincial MEC of Environmental Affairs, to publish a list of threatened ecosystems.

Threatened Species: A species that has been classified as Critically Endangered, Endangered or Vulnerable, based on a conservation assessment using a standard set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct. A threatened species faces a high risk of extinction in the near future.

Visual Assessment Zone: The visual assessment zone or study area is assumed to encompass a zone of 10km from the outer boundary of the proposed application site.

CONTENTS OF A BASIC ASSESSMENT (BA) REPORT

Contents of a Basic Assessment (BA) Report as per Appendix 1 of the 2014 NEMA EIA Regulations, as amended on 7 April 2017

NEMA requirements for Basic Assessment		
Appendix 1	**Content as required by NEMA**	**Section**
1 (1)(a)	(i) details of the EAP who prepared the report; and	1.3.1 and *Appendix A: EAP Details*
	(ii) details of the expertise of the EAP, including a curriculum vitae;	
(b)	the location of the activity, including	2.1 and Appendix B: Maps
	(i) the 21-digit Surveyor General code of each cadastral land parcel;	
	(ii) where available, the physical address and farm name;	
	(iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is-	2.4 and *Appendix B: Maps*
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	

NEMA requirements for Basic Assessment		
Appendix 1	**Content as required by NEMA**	**Section**
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	
(d)	a description of the scope of the proposed activity, including-	4.2.1
	(i) all listed and specified activities triggered and being applied for; and	
	(ii) a description of the associated structures and infrastructure related to the development’	
(e)	a description of the policy and legislative context within which the development is proposed including	4.1
	(i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	
	(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	
(f)	a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	5
(g)	a motivation for the preferred site, activity and technology alternative;	2
(h)	a full description of the process followed to reach the proposed preferred alternative within the site, including	6 and 3
	(i) details of the development footprint alternatives considered;	
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	6.2
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	7
	(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	6.2.5 and 6.4
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	7 and 8
	(viii) the possible mitigation measures that could be applied and level of residual risk;	
	(ix) the outcome of the site selection matrix;	3

NEMA requirements for Basic Assessment		
Appendix 1	**Content as required by NEMA**	**Section**
	(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	3 and 10
	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including—	3, 6 and 7
	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	
(j)	an assessment of each identified potentially significant impact and risk, including -	7
	(i) cumulative impacts;	
	(ii) the nature, significance and consequences of the impact and risk;	
	(iii) the extent and duration of the impact and risk;	
	(iv) the probability of the impact and risk occurring;	
	(v) the degree to which the impact and risk can be reversed;	
	(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	
	(vii) the degree to which the impact and risk can be mitigated;	
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	8
(l)	an environmental impact statement which contains -	8
	(i) a summary of the key findings of the environmental impact assessment;	
	(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	8.3 and *Appendix B: Maps*
	(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	8 and 8.3
(m)	based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr	7, and 8.3
(n)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	7, 8.3 and 10.3
(o)	a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	6.5 and *Appendix C: Specialist Reports*

NEMA requirements for Basic Assessment		
Appendix 1	**Content as required by NEMA**	**Section**
(p)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	10.2
(q)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalized;	10.3
(r)	an undertaking under oath or affirmation by the EAP in relation to-	*Appendix A: EAP Details*
	(i) the correctness of the information provided in the reports;	
	(ii) the inclusion of comments and inputs from stakeholders and I&APs;	
	(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	
	(iv) any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs;	
(s)	where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A - No financial provisions for the rehabilitation, closure, and on-going post decommissioning management of negative environmental impacts are required. Decommissioning has been dealt with in the EMPrs (*Appendix F: Environmental Management Programmes*). Section 7 and 8 detail all identified impacts associated with the proposed development during all phases (i.e., planning, construction, operation and decommissioning).
(t)	any specific information that may be required by the competent authority; and	*Appendix A: EAP Details* to Appendix *H: Additional Information*
(u)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	

NEMA requirements for Basic Assessment		
Appendix 1	**Content as required by NEMA**	**Section**
		Should there be any specific information requested after the submission of the Draft BA Report, this will be provided as part of the Final BA Report.
(2)	Where a government notice gazetted by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such a notice will apply.	
	The BA process has been based on the findings of the Site Sensitivity Verification and guided by Specialist Protocols which have applied by the specialists in their assessments (in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020).	

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Red Cap Energy (Pty) Ltd ('Red Cap') is proposing to develop four Wind Farms and associated grid connections (together referred to as the Hoogland Project) in an area located between Loxton and Beaufort West in the Western Cape Province. Hoogland 1 Wind Farm (14/12/16/3/3/2/2147) and Hoogland 2 Wind Farm (14/12/16/3/3/2/2146) are located to the north closer to Loxton and form the Northern Cluster of Wind Farms that will share a grid connection named the Hoogland Northern Grid Connection. The applications for the Hoogland 3 and Hoogland 4 Wind Farms also include shared road infrastructure with each wind farm. Hoogland 3 and 4 Wind Farms (the subject of this BA Report) are located closer to Beaufort West and comprise the Southern Cluster which will similarly share a separate grid connection, named the Southern Grid Connection. The two Grid Connections are each in the form of 132 kV overhead power lines and will connect the Hoogland Wind Farms to the Nuweveld Collector Substation on Red Cap's adjacent Nuweveld Wind Farms Project. It is intended that these projects would be bid in a forthcoming round of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP).

The proposed development area falls primarily within the Central Karoo District Municipality and is adjacent to Red Cap's three Nuweveld Wind Farm Projects which have environmental authorisation (Figure 1-1 and Figure 1-2). The Wind Farms are predominantly located to the west of the R381 which runs between Beaufort West and Loxton. The main land use of the Wind Farm sites, and surrounding properties is low-density livestock farming (grazing).

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations (4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the DFFE, prior to the commencement thereof.

Red Cap has appointed SLR Consulting (South Africa) (Pty) Ltd as the Independent Environmental Assessment Practitioner (EAP) to undertake the required Scoping and EIA (SEIA) and Basic Assessment (BA) processes for the proposed Hoogland Wind Farms and Grid Connection Projects, in terms of the EIA Regulation 2014 (as amended) promulgated under the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA). The Southern Wind Farm Cluster is subject to a BA process, and this is explained in Section 4.2.1.

The scope of this report is the **Hoogland 3 Wind Farm** and **Hoogland 4 Wind Farm** (the **Southern Wind Farm Cluster**). The Applicant for these Wind Farms is Red Cap Hoogland 3 (Pty) Ltd, and Red Cap Hoogland 4 (Pty) Ltd respectively. Even though these are two separate applications (DFFE reference numbers to be allocated), they will be considered in the same BA Report. The Department of Forestry, Fisheries and the Environment (DFFE) has granted Red Cap permission to combine the two Wind Farms into one Environmental Authorisation (EA) Application processes under Regulation 11 (1) of GN R. 982[2] (*Appendix D: Public Participation*). The baseline environment and impact assessment in Section 7 distinguishes features and impacts respective to either the Hoogland 3 Wind Farm and Hoogland 4 Wind Farm, where they differ. Further to this the Summary of impacts and mitigation measures are documented separately for each of the two Wind Farms (Section 8).

[2] Regulation 11 of Government Notice 982 (National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment Regulations, 2014) states that
"(1) If a proponent or proponents intend to undertake one or more than one activity of the same type at different locations within the area of jurisdiction of a competent authority, the competent authority may, on written request, grant permission for the submission of a single application.
(2) If the competent authority grants permission in terms of subregulation (1), the application must be dealt with as a consolidated assessment process, but the potential environmental impacts of each activity must be considered in terms of the location where the activity is to be undertaken.
(5) Where a combined application is submitted as contemplated in these Regulations, the proponent must, prior to submission of the application, confirm with the competent authority the fee payable in terms of the applicable regulations for such combined application."

The Hoogland Wind Farm Projects aim to achieve a targeted nameplate generation capacity of a maximum of 420 MW per wind farm. Red Cap originally identified approximately 68,500 hectares (ha) of land for the development of the four wind farm projects. As part of the Southern Cluster, the Hoogland 3 Wind Farm will comprise of up to 58 turbines, while the Hoogland 4 Wind Farm will comprise of up to 55 turbines (Section 2.4). Therefore, as part of the BA process for the Southern Cluster, 58 and 55 potential turbine locations are considered and assessed by the specialists respectively (See Table 2-2 for wind farm specifications). Should an EA be obtained, some additional turbine positions may be dropped due to other permitting or technical issues.

Ancillary infrastructure for each Wind Farm would include underground cables linking the turbines to each other and to the substation (with limited overhead powerlines to get over steep slopes/ drainage lines etc), two onsite substations, two battery energy storage systems (BESS), foundations to support turbine towers, a transformer at the base of each turbine, hardstands to support cranes at each turbine, and permanent operations/maintenance buildings, office, stores, workshop and laydown areas (included in the substation footprint). Service and access roads will be constructed in addition to upgrading existing roads, with the relevant stormwater infrastructure and gates constructed as required. Designated construction areas will include temporary site camp/s and general laydown areas and associated maintenance and storage buildings/areas along with guard cabins, as well as a concrete batching plant. Individual turbine temporary laydown areas including crane boom laydown areas and blade laydown areas will be established at each turbine.

The Environmental Process for the Hoogland Southern Cluster, in summary, comprises of the following main phases:

- Screening and initial design phase;
- Pre-application[3] Basic Assessment Phase;
- Formal Basic Assessment Process comprising of:
  - Submission of Application for Environmental Authorisation to the DFFE; and
  - Basic Assessment (BA) Phase *(current phase)*.

The purpose of a BA Report (this report), amongst others, is to provide the background and context to the projects and to describe the process and outcome of how the most suitable location and layout were identified. The BA Report presents the assessment of the impacts and the respective mitigation measures. In summary, a BA Report aims to:

1 Describe the projects.
2 Outline the legal and policy framework.
3 Describe the process/tasks undertaken to date.
4 Describe the PPP undertaken to date as well as future PPP to be undertaken during the BA Phase.
5 Provide a description of the methodology used to assess the environmental impacts.
6 Present the baseline biophysical and socio-economic context as per specialist assessments.
7 Present the impacts identified by each specialist, the specialists' assessment of each impact and proposed mitigation measures.
8 Discuss alternatives and outline the detailed screening and iterative design approach adopted and how this informs an environmentally, socio-economically and technically feasible project layout.

The BA Report (this report) has been informed by the outcomes of the detailed Screening and Initial Design Phase, the Pre-Application Phase and Specialist Assessments (refer to Section 6.1 for more detail).

The formal BA process has now commenced, with the submission of the application for EA and Draft BA Report to the DFFE. The Draft BA Report is being made available to all registered I&APs, including the public and key stakeholders (including authorities) for a 30-day review and comment period, **from 15 August 2022 – 14 September 2022** (excluding

[3] Prior to the submission of the BA Application Form to the Component Authority and onset of the formal BA process. The Pre-application phase was voluntary undertaking, but the approach was supported by the CA as it promotes a more robust BA process.

public holidays). All comments and inputs received during the comment period for the Draft EIA Report will be considered and responded to by the project team.

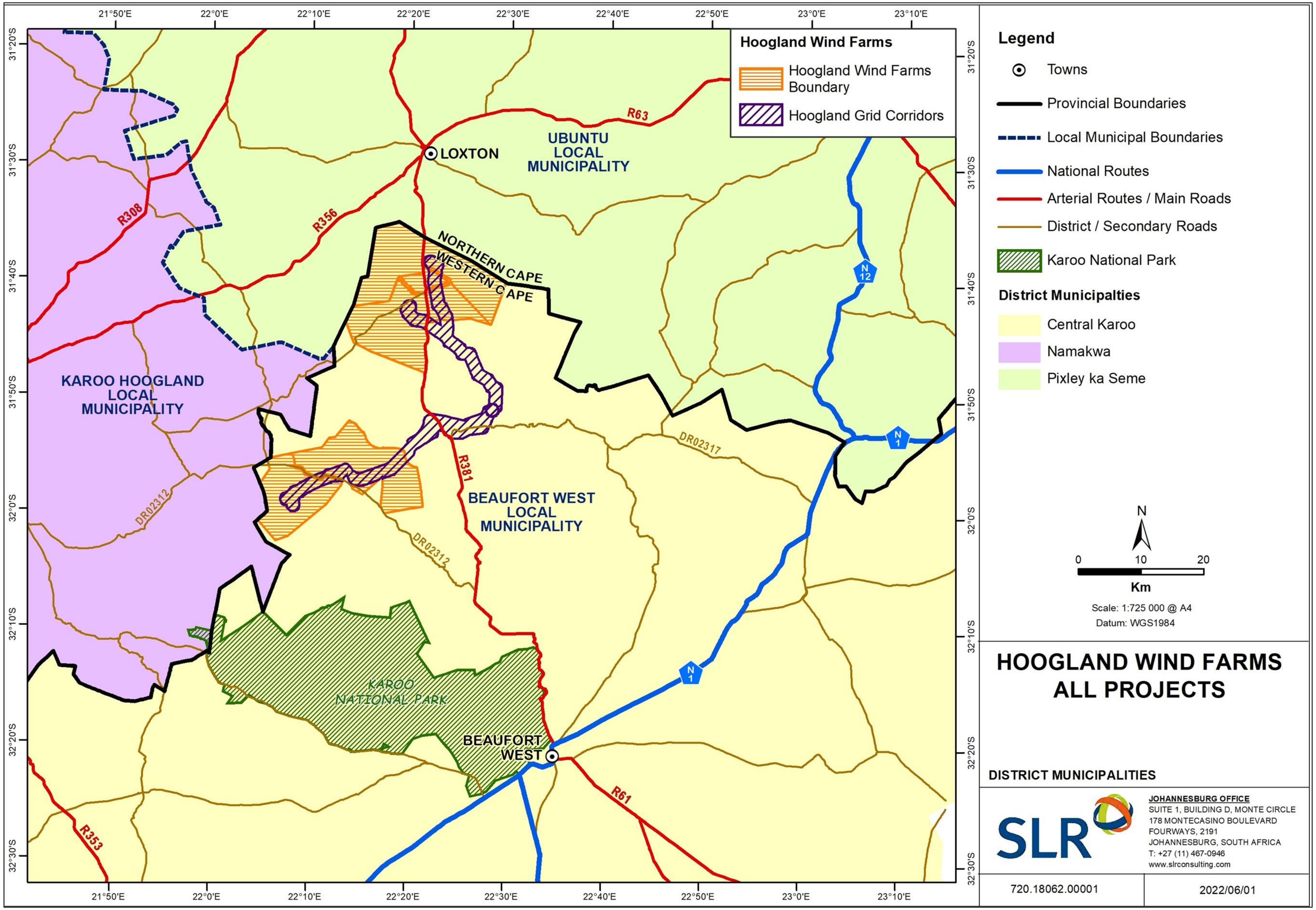


Figure 1-1: Regional Locality Map presenting the location of the Hoogland Wind Farms and Grid Connection

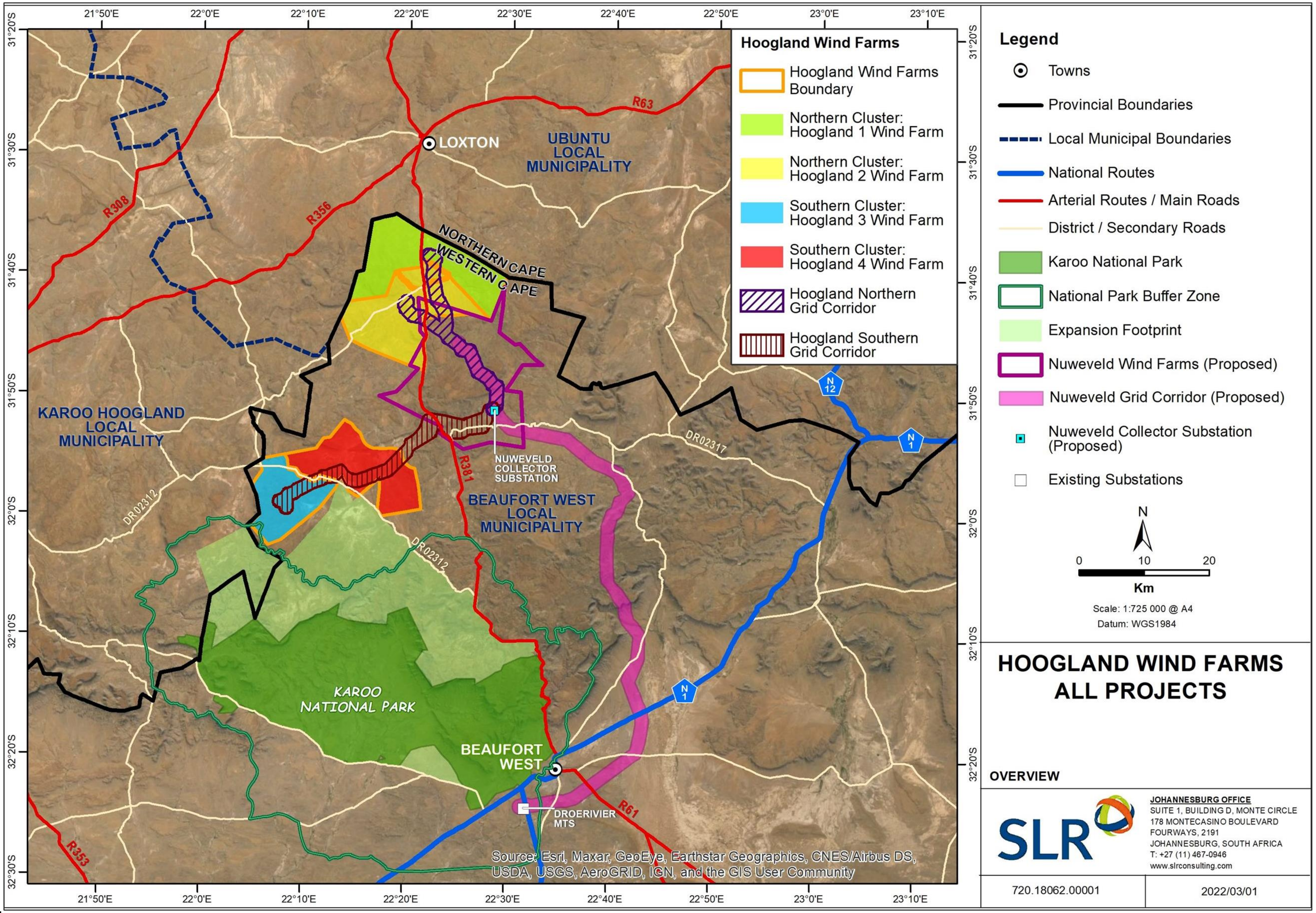


Figure 1-2: Locality Map presenting the context of the project components (including location of the Nuweveld Wind Farms Project)

1.2 STRUCTURE OF THE BA REPORT

This BA Report has been prepared in compliance with Appendix 1 of the EIA Regulations, 2014 (as amended), and is divided into various chapters and appendices, the contents of which are outlined below.

Table 1-1: Structure of the Pre-Application Report

SECTION	CONTENTS
General Site Information as Required by DFFE / Technical Details Summary	Provides a comprehensive summary of the project components and specifications (i.e., technical details) for each wind farm (including surface area to be covered).
Section 1	**Introduction** Provides a background of the project; describes the purpose of the BA Report; outlines the structure of the report; and provides information on the project team.
Section 2	**Project description** Provides general project information; presents a description of the proposed projects; and presents a motivation for not considering project alternatives.
Section 3	**Alternatives** Provides an overview of the comprehensive iterative design process has been undertaken to inform the respective Wind Farm layouts and associated Grid Connection infrastructure for the Hoogland Projects.
Section 4	**Administrative and Legal Framework** Outlines the key legislative requirements applicable to the proposed projects.
Section 5	**Need and desirability** Provides an overview of the need and desirability for the proposed projects and guided by the DFFE and Western Cape DEA&DP.
Section 6	**Approach and Process** Outlines the iterative and comprehensive design process and provides the methodology for the assessment. It also includes a summary of the public participation process undertaken to date, including the results thereof, as well as further public participation tasks planned.
Section 7	**Baseline Environment and Impact Assessment** Describes the receiving environment respective to each specialist discipline and assesses the significance of each identified impact for all phases of the development, including cumulative impacts. Provides appropriate mitigation measures.
Section 8	**Summary of Impact Assessment and Key Recommendation** Provides a summary of the potential environmental impacts that have been identified, including cumulative impacts; as well as a summary of key recommendations provided by each specialist.
Section 9	**Sensitivity Maps** Visual representation of the Specialist findings based on the iterative and comprehensive design process, as well as inputs/comments receive during the Pre-Application Phase.
Section 10	**Conclusion** Provides a summary of the process, the findings and the overall conclusion, including an environmental impact statement and cumulative environmental impact statement. The proposed conditions of authorisation are also detailed in this section.
Section 11	**References** Provides a list of the references used in compiling this report.
Appendices	Appendix A: EAP Details Appendix B: Maps Appendix C: Specialist Reports Appendix C1: Climate Change Appendix C2: Geotechnical

SLR

SECTION	CONTENTS
	Appendix C3: Agriculture Appendix C4: Terrestrial Biodiversity Appendix C5: Flora Appendix C6: Riverine Rabbit Appendix C7: Karoo Dwarf Tortoise Appendix C8: Bats Appendix C9: Avifauna Appendix C10: Aquatic Ecology Appendix C11: Visual Appendix C12: Heritage Appendix C13: Palaeontology Appendix C14: Noise Appendix C15: Shadow Flicker Appendix C16: Traffic Appendix C17: Socio-Economic Appendix C18: Geohydrology Appendix D: Public Participation Appendix D1: Screening Phase Appendix D2: Pre-Application Phase Appendix D3: BA Phase Appendix E: DFFE Screening Tool Reports Appendix F: Environmental Management Programmes Appendix G: Battery Energy Storage Risk Assessment

1.3 PROJECT TEAM

The details of the independent EAP Project Team that were involved in the preparation of this report are provided in Table 1-2. SLR has no vested interest in the proposed projects other than fair payment for consulting services rendered as part of the EIA process and has declared its independence as required by the EIA Regulations 2014, as amended. The project team's curricula vitae (include proof of registrations and membership) and the Declaration of Independence and Affirmation under Oath by the EAP are included in *Appendix A: EAP Details* of this Report.

1.3.1 Details of the EAP

Table 1-2: Details of the EAP Project Team

General				
Organisation	SLR Consulting (South Africa) (Pty) Ltd			
Postal address	PO Box 798 RONDEBOSCH 7701			
Tel No.	+27 (0)21 461 1118 / 9			
Fax No.	+27 (0)21 461 1120			
Name	**Qualifications**	**Professional registrations /memberships**	**Experience (Years)**	**Tasks and roles**
Stuart-Heather Clark	B.Sc. (Hons) Civil Engineering M.Sc. Environmental Management	IAIA EAPASA	24	Report and process review

Liandra Scott-Shaw	B.Sc. (Hons) Ecological Science B.Sc. Biological Science	SACANASP (*Pri.Sci. Nat*) SAWEA	7	Management of the EIA process, including process review, specialist study review, management of the public participation process and report compilation
Stephan Jacobs	B.Sc. (Hons) Environmental Management & Analysis B.Sc. Environmental Sciences	IAIA	6	Project administration, undertaking of public participation process activities and report compilation

1.3.2 Qualifications and Experience of the EAP Project Team

- **Stuart Heather-Clark** is a Technical Director in SLR's Environmental Management Planning and Approvals (EMPA) team in Africa and EAP for the Hoogland Wind Farms and Grid Connection Projects. He holds a B.Sc. (Honours) in Civil Engineering and a Master's degree in Environmental Science and has 24 years of relevant experience. He has expertise in a wide range of environmental disciplines, including EIAs, EMPs, environmental planning and review and public consultation and is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA).
- **Liandra Scott-Shaw** is the Project Manager for the Hoogland Wind Farms and Grid Connection Projects. She has a B.Sc. and B.Sc. (Honours) in Ecological Science from the University of KwaZulu-Natal and has worked as an EAP since 2013. She has been involved in a number of projects covering a range of environmental disciplines, including Basic Assessments, Environmental Impact Assessments and Environmental Management Programmes. She has gained experience in a wide range of projects relating to renewable energy.
- **Stephan Jacobs** is the Project Assistant for the Hoogland Wind Farms and Grid Connection Project and holds a B.Sc. undergraduate degree in Environmental Sciences as well as a B.Sc. Honours degree in Environmental Management & Analysis from the University of Pretoria. He has worked as an Environmental Consultant / EAP since 2015. His key focus is undertaking and managing Basic Assessment (BA) and Environmental Impact Assessment (EIA) processes for various types of projects, especially for renewable energy projects which form part of South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) as well as the 2020 Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP). He also has experience in compiling Environmental Management Programmes (EMPRs) and undertaking and facilitating Public Participation and stakeholder engagement processes, especially for renewable energy projects. He has gained e experience in a wide range of projects relating to infrastructure development and renewable energy.

1.3.3 Details of Independent Specialists

As described in Section 4.2.2, the DFFE National Screening Tool prescribes a number of specialist studies. Table 1-3 lists the specialist studies undertaken for the report as guided by the Screening Tool. More detail regarding their level of study with reference to the relevant protocols is described in Table 6-2. It should be noted Specialist reports have been compiled to comply with the content requirements for specialist reports applicable, as detailed in Section 6.1.3.1.

Table 1-3: Details of the specialist team

Discipline	Company	Specialist
Climate Change	Promethium Carbon	Robbie Louw
Geotechnical	R.A. Bradshaw & Associates cc	Richard Bradshaw
Agriculture	Johann Lanz Consulting	Johann Lanz
Terrestrial Ecology (including Flora and Riverine Rabbits)	3Foxes Biodiversity Solutions	Simon Todd
Herpetology (specifically Karoo Dwarf Tortoise)	Sungazer Faunal Surveys	Marius Burger
Bats	Animalia Consultants	Werner Marais
Avifauna	Wildskies Ecological Services	Jon Smallie
Aquatic Ecology	EnviroSci (Pty) Ltd	Dr Brian Colloty

Discipline	Company	Specialist
Geohydrology	GEOSS	Shane Teek, Dale Barrow and Julian Conrad
Visual	Bernard Oberholzer Landscape Architects (BOLA) and qARC	Bernard Oberholzer, Quinton Lawson
Archaeology	ASHA Consulting	Dr Jayson Orton
Palaeontology	Natura Viva	Dr John Almond
Noise	Enviro-Acoustic Research	Morné de Jager
Shadow Flicker	Arcus	Emma Lewis, Martin Stevenson
Traffic	Athol Schwarz	Athol Schwarz
Socio-economic / tourism	Independent Economic Researchers	Dr Hugo van Zyl, James Kinghorn

2 PROJECT DESCRIPTION

2.1 SITE LOCATION AND DESCRIPTION

The Hoogland Southern Wind Farm Cluster comprising Hoogland 3 Wind Farm and Hoogland 4 Wind Farm is proposed for development in the Nuweveld hinterland within the Central Karoo District Municipality. These two Wind Farms share a Grid Connection, named the Hoogland Southern Grid Connection. The Hoogland Wind Farms are more than 10 km away from the Karoo National Park (KNP) and outside its Protected Area Expansion Area and Buffer Zone (Figure 1-2). The Hoogland Southern Cluster is within the Beaufort West Renewable Energy Development Zone (REDZ) (GN R 144 of 2021)[4] and follows a BA process (GN R 145 of 2021) (Figure 2-3)[5].

Both wind farms are located approximately 40 km north of Beaufort West and approximately 45 km south of Loxton to the west of the R381 (Figure 1-2). The Hoogland 3 Wind Farm site is centred on the following coordinates: 31° 58' 43,408" S, 22° 8' 19,330 E and has an area of approximately 10,369 ha. In addition, the layout supports 58 turbine locations. The Hoogland 4 Wind Farm site is centred on the following coordinates: 31° 56' 17,60" S; 22° 15' 32,061" E and has an area of approximately 14,450 ha, while the layout supports 55 turbine locations.

The proposed Hoogland Southern Wind Farms (HL03 and HL04) are located on the Nuweveld plateau in the Great Karoo. The site is located on, and surrounded by, active agricultural properties with low-density livestock grazing being the main land use. An arid climate with poor soil development and low moisture precludes most cropping. The landscape is characterised by horizontal sills of erosion-resistant dolerite forming steep cliffs in places, boulder-strewn mesas or plateaus and flat-topped koppies while the gentler, lower hillslopes and plains consist of more easily weathered mudstone, with occasional narrow ledges of harder sandstone (Figure 2-1). Of key interest to wind energy development are the high lying areas where the wind resources are at their best, like those shown in Figure 2-2. Detailed descriptions of the various baseline environmental factors making up the site are included in Section 7.

[4] Notice of Identification in Terms of Section 24(5)(a) and (b) ff The National Environmental Management Act, 1998, of the Procedure to be Followed in Applying for Environmental Authorisation for Large Scale Wind and Solar Photovoltaic Energy Development Activities Identified in Terms of Section 24(2)(a) of the National Environmental Management Act, 1998, when occurring in Geographical Areas of Strategic Importance

[5] The Northern Cluster Wind Farms are situated outside of the Beaufort West Renewable Energy Zone (REDZ) (GN R 144 of 2021) while the Southern Cluster Wind Farms are situated within the Beaufort West REDZ. Although the layout and sites are not yet final due to the iterative nature of the process, the current proposals indicate that the Northern Cluster requires a Scoping and EIA process while the Southern Cluster, which is situated in the REDZ, will require a Basic Assessment (BA). The Hoogland Grid Connections comprise two 132kV powerlines (Northern Grid and Southern Grid), connecting the Northern and Southern Cluster Wind Farms to the Nuweveld Collector Substation. The Northern Grid is not within the thresholds of the REDZ (GN R 145 of 2021) and thus will require a traditional Basic Assessment (BA) in terms of the GN R. 982. The greater part of the Southern Grid is within the REDZ and as such will qualify for a BA process as outlined in GN R 145.

Figure 2-1: Photo illustrating the topography that characterises the Hoogland Southern Wind Farm Cluster

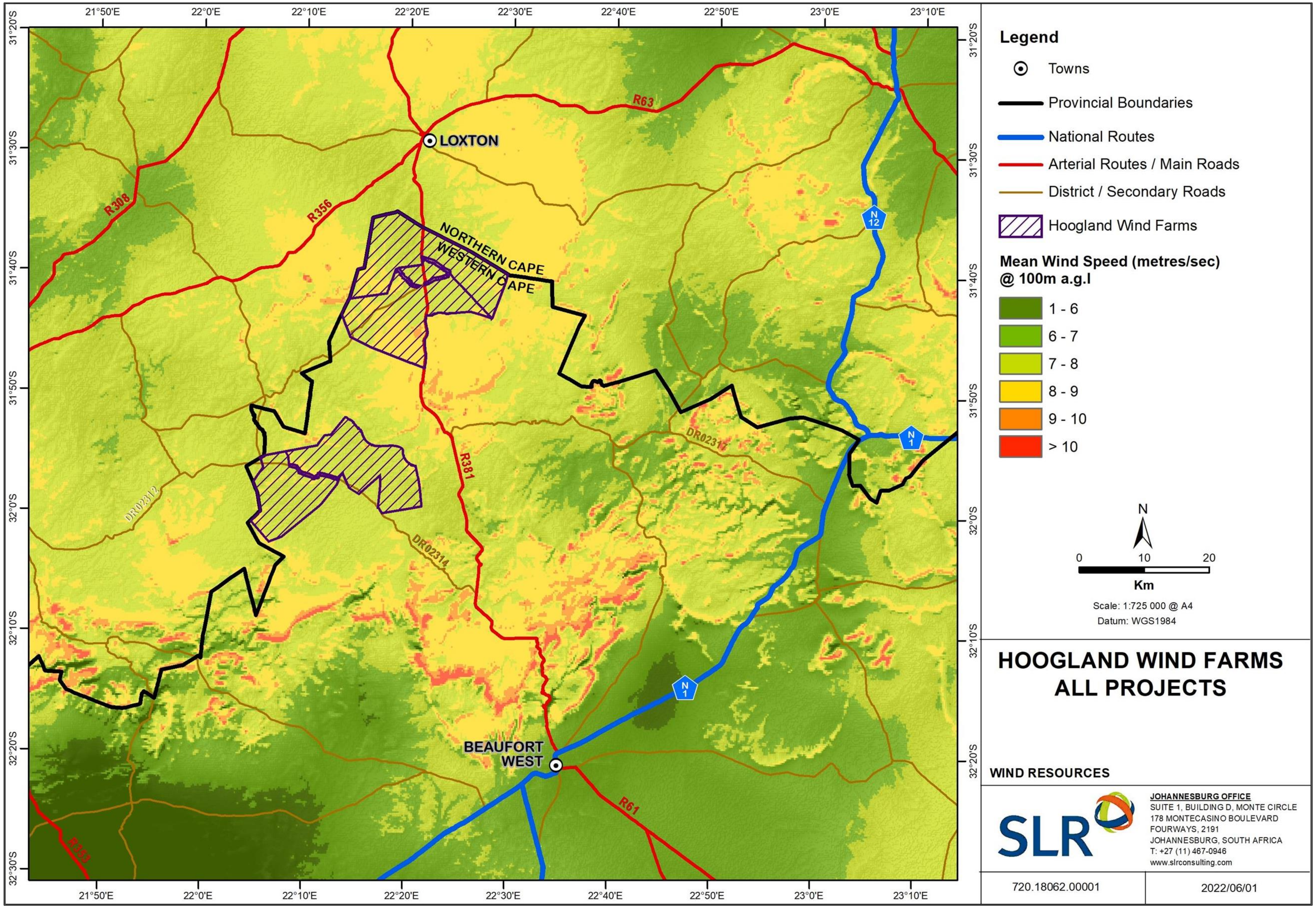


Figure 2-2: Wind resources map for the Hoogland Wind Farms

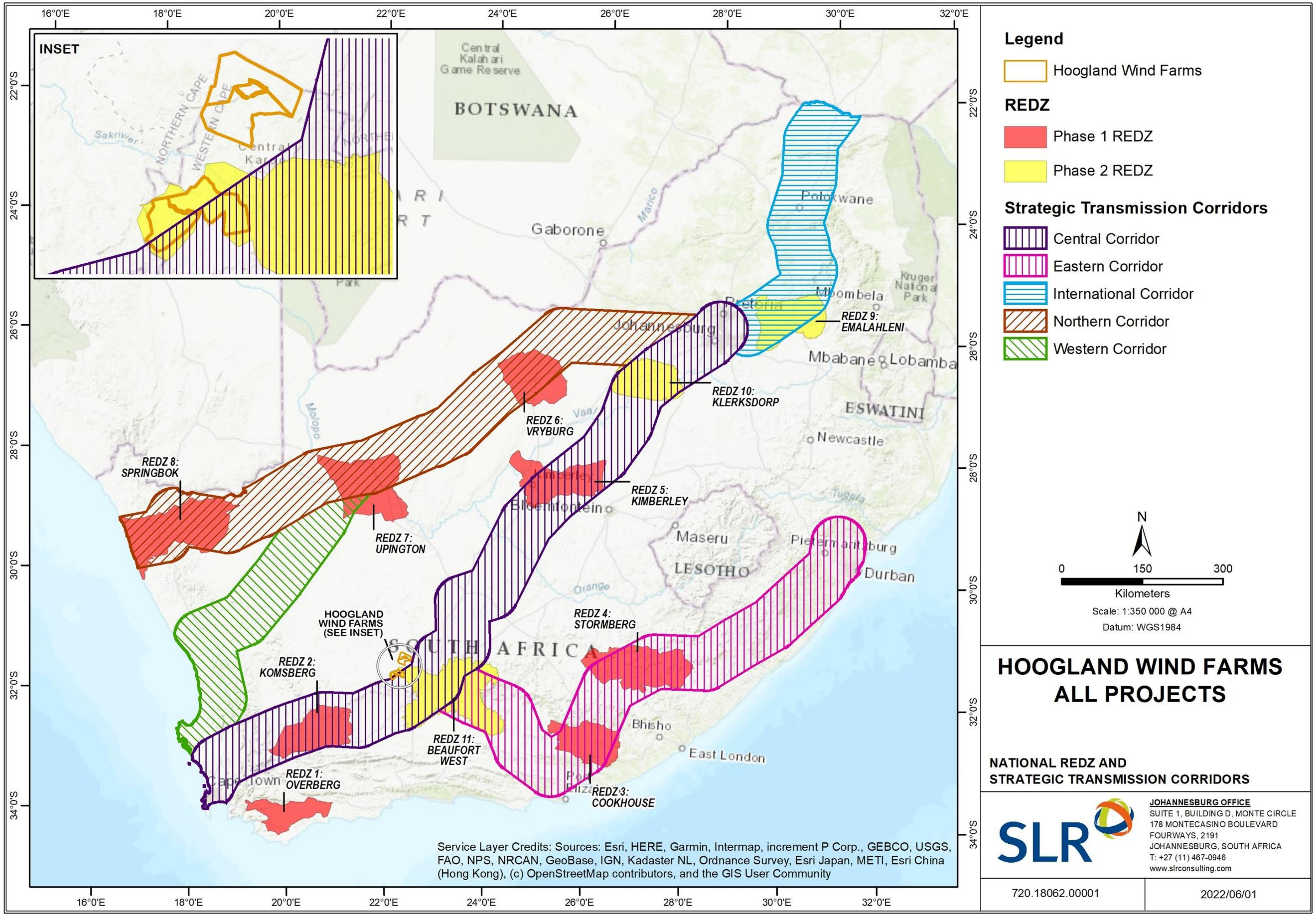


Figure 2-3: REDZ map showing the Hoogland Wind Farm Projects

The Hoogland 3 and Hoogland 4 Wind Farms are made up of a number of adjoining farm properties as listed in Table 2-1 and shown on Figure 2-4.

Table 2-1: Details of the properties affected by the proposed Hoogland Southern Cluster Wind Farms Projects *(Appendix B: Maps* for Cadastral Map)

Hoogland Southern Cluster		
SG Code	**Farm Number**	**Farm name**
Hoogland Wind Farm 3		
C00900000000002800002	2/28	PLATFONTEIN
C00900000000002800003	3/28	PLATFONTEIN
C00900000000002800004	4/28	PLATFONTEIN
C00900000000002800001	RE1/28	PLATFONTEIN
C00900000000008800000	88	SWART RUG
Hoogland Southern Cluster		
SG Code	**Farm Number**	**Farm name**
Hoogland Wind Farm 4		
C00900000000002800002	2/28	PLATFONTEIN
C00900000000002800003	3/28	PLATFONTEIN
C00900000000002800001	RE1/28	PLATFONTEIN
C00900000000003900003	3/39	EYERKUIL
C00900000000003300000	33	ANNEX KARROO PLAATS
C00900000000003200001	1/32	THE ROSARY
C00900000000008300000	RE/83	ADJOINING QUAGGAS FONTEIN
C00900000000003900001	RE1/39	EYERKUIL
C00900000000003900002	RE2/39	EYERKUIL
C00900000000003700000	RE/37	DRIEFONTEIN

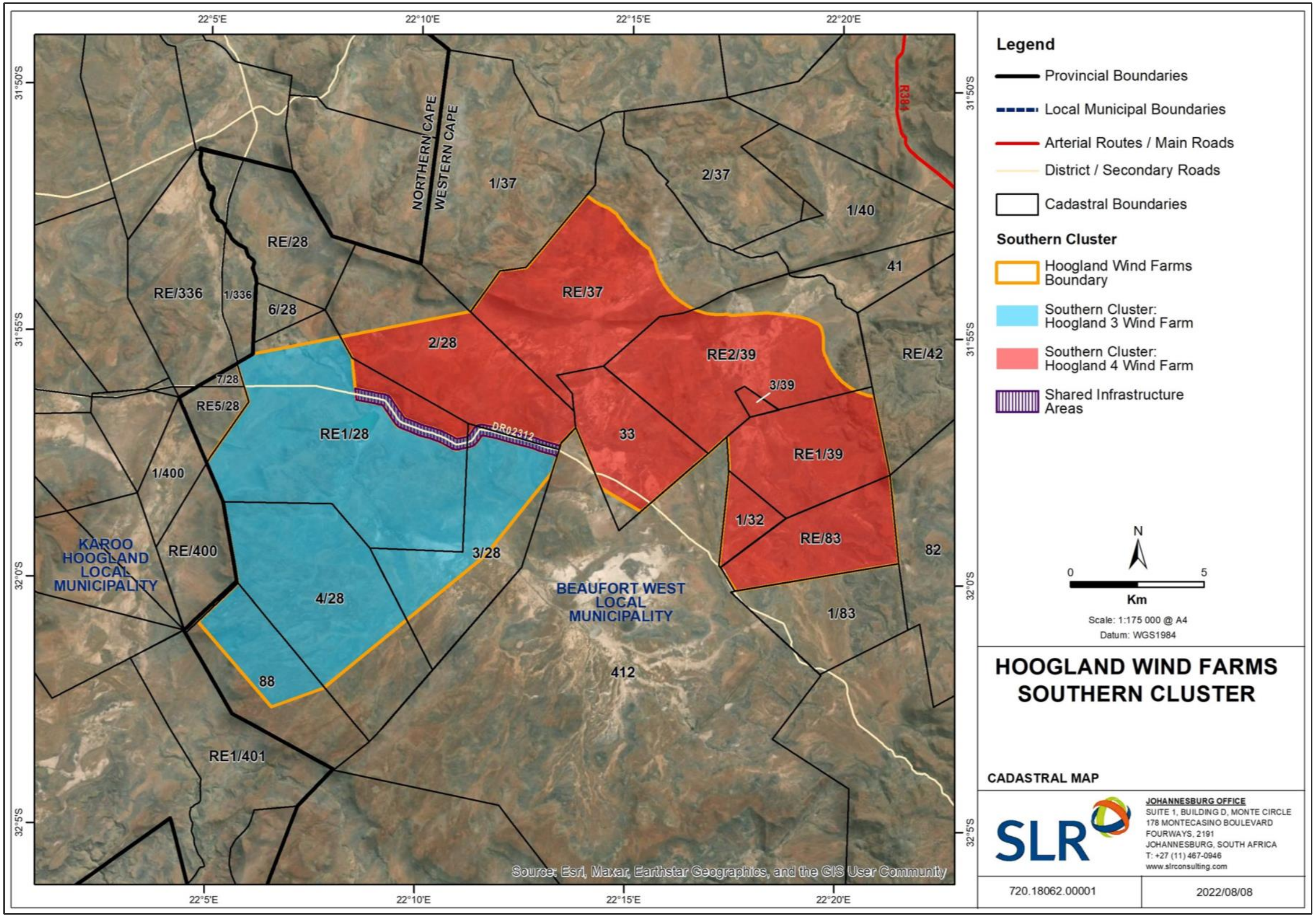


Figure 2-4: Hoogland Southern Cluster Wind Farms Cadastral map

2.2 SUMMARY

An operational Wind Farm is comprised of several components which support large scale energy generation. These components are described in this section and a summary of the projects components and specifications are included in Table 2-2 below.

Table 2-2: Summary of the components, specifications, and approximate areas of impact of each of the Hoogland Wind Farms

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 3	HOOGLAND 4
Location	Central coordinates:	31° 58' 43,408" S; 22° 8' 19,330" E	31° 56' 17,600" S; 22° 15' 32,061" E
Access	For commuter traffic and some small loads, access from the south would be via Beaufort West via the N1 and R381 travelling between Beaufort West and Loxton. For abnormal loads the main access routes for each Wind Farm are as follows:	Through Loxton, via R356 and south along the DR02314 and DR02312 towards Hoogland 3 and Hoogland 4	
Extent	The total area of the site being considered for developing each Wind Farm (including shared infrastructure sections where relevant):	10,369 ha	14,450 ha
Number of wind turbines and generation capacity	The targeted nameplate generation capacity for each wind farm is up to a maximum of 420 MW. The number of turbines included in the layout for approval for each Wind Farm is as follows:	58	55
Wind turbine specifications	• Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius) • Hub height: 80 m to 150 m • Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5 m blade = 247.5 m) • Rotor bottom tip height: minimum of 20 m (and not lower). See Figure 2-7 below.	-	-
Turbine Foundations	Each turbine will have a circular foundation with a diameter of up to 35 m, alongside the 40 m hardstand (1,400 m^2). The permanent total footprint is as follows:	8.2 ha (permanent)	7.7 ha (permanent)
	Each turbine will have a permanent crane pad of 80 m x 40 m placed adjacent to each turbine foundation. The total permanent footprints are as follows:	18.6 ha (permanent)	17.6 ha (permanent)

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 3	HOOGLAND 4
Turbine Hardstands and Laydown Areas	An additional 20 m x 40 m of temporary hardstand area will also be required near each of the crane pads. Further, a blade laydown area of 104 m x 20 m and an additional embankment area (where necessary due to slopes) of approximately 104 m x 5 m will be required. A temporary crane boom assembly area of 120 x 15 m will also be accommodated. Temporary areas are up to a maximum of a maximum of 5,200 m^2 per turbine. The total temporary footprints per Wind Farm are as follows:	30.2 ha (temporary)	28.6 ha (temporary)
Cabling	Turbines to be connected to on-site Substation via up to 66 kV cables. Cables to be laid underground in trenches mainly adjacent to proposed Wind Farm roads (as part of the temporary impact of 'Site roads' below) but in some instances the cables will deviate from the road. Such sections of off-road cables amount to the following length and footprint:	5.2 km 3.1 ha (temporary)	4.5 km 2.7 ha (temporary)
	Where it has been possible, cables have been routed along existing local roads. Note that cables running next to public roads will not be able to run within the road reserve, but as close as possible to the road reserve in the adjacent private owned land. These have the following length and footprint:	10.4 km 6.2 ha (temporary)	6.2 km 3.7 ha (temporary)
Internal Wind Farm overhead power lines	In limited instances, overhead monopole lines will be used where burying is not possible due to technical, geological, environmental or topographical constraints. Up to 66 kV overhead power lines supported by 132 kV monopole style pylons of approximately 22 m high will be required, as well as tracks for access to the pylons. The total length of the line and the footprint of the pylons and tracks are as follows:	1.5 km 0.9 ha (permanent)	1.0 km 0.6 ha (permanent)
	Where possible, to reduce areas of new impact, sections of overhead line have been routed next to proposed Eskom overhead lines. Such sections of overhead lines have the following additional length and footprint:	2.5 km 1.5 ha (permanent)	7.7 km 4.6 ha (permanent)
Site roads	The total road network for each Wind Farm is as follows:	83.9 km	91.4 km
	Permanent roads will be 6 m wide and over above this may require side drains on one or both sides depending on the topography. Many roads will have underground cables running next to them.	67.1 ha	73.1 ha

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 3	HOOGLAND 4
	The permanent footprint of the road network for each Wind Farm is as follows:	(permanent)	(permanent)
	An up to 15 m wide road corridor may be temporarily impacted during construction and rehabilitated to allow for a 6 m road surface after construction. The temporary footprint of the road network for each Wind Farm is as follows:	75.5 ha (temporary)	82.3 ha (temporary)
	This total road network also includes upgrades to sections of public roads, to the following extent:	12.8 km (permanent)	2.7 km (permanent)
	This total road network also includes shared road infrastructure with the other wind farm in the respective cluster:	8.7 km (permanent)	8.7 km (permanent)
Wind Farm Substations	Each Wind Farm will have two 150 m x 75 m Substation yards that will include an Operation and Maintenance (O&M) building, Substation building and a High Voltage Gantry. The area for the two substation yards per wind farm are as follows:	2.3 ha (permanent)	2.3 ha (permanent)
Battery energy storage system (BESS)	Each Wind Farm will also potentially have two ±3.5 ha areas for a battery energy storage system (BESS) which may be adjacent or slightly removed from each of the two Substations depending on the local constraints. Each BESS may either be connected to the Wind Farm Substation by an underground or overhead cable or may require its own substation which would be located within the BESS footprint and would be connected directly to the Eskom Switching Station via a short 132 kV overhead line.	7 ha (permanent)	7 ha (permanent)
Operations and maintenance (O&M) area	The O&M area will include all offices, stores, workshops and laydown area. The Substation building will be housed in the Substation yard.	Forms part of Substation yard	Forms part of Substation yard
Security	Security gate and hut to be installed at most entrances to each Wind Farm site (estimated as 4 entrances each at 20 m^2). No fencing around individual turbines, existing fencing shall remain around perimeter of properties. Temporary and permanent yard areas to be enclosed (with access control) with an up to 2.4 m high fence.	80 m^2	80 m^2

PROJECT COMPONENTS	DESCRIPTION	HOOGLAND 3	HOOGLAND 4
Temporary areas required for the construction / decommissioning phase	Each Wind Farm will have the following temporary construction areas: • Temporary site camp/s areas of ±20,000 m^2 • Batching plant area of ±2,000 m^2 • General laydown area of ± 36,000 m^2 • Each Wind Farm will have a bunded fuel & lubricants storage facility at the site camp. Individual turbine temporary laydown areas including crane boom laydown areas, blade laydown areas and other potential temporary areas are detailed above under "turbine hardstands".	6 ha (temporary)	6 ha (temporary)
Total disturbance footprint		121 ha temporary and 105.5 ha permanent	123.3 ha temporary and 112.9 ha permanent

2.3 SITE LAYOUT

The site layout has been through various iterations during the Screening and Initial Design Phase, as well as the Pre-Application Phase (described in Section 6), and the outcomes of these phases have guided the layout presented and assessed within this BA Report. The layout makes provision for the development of 58 potential turbine positions in the Hoogland 3 Wind Farm and 55 potential turbine positions in the Hoogland 4 Wind Farm, including associated infrastructure, as shown in the following maps (Figure 2-5 and Figure 2-6, A3 maps available in *Appendix B: Maps*). Please refer to Section 6.1.3 for details regarding the layout updates following the completion of the Pre-Application Phase

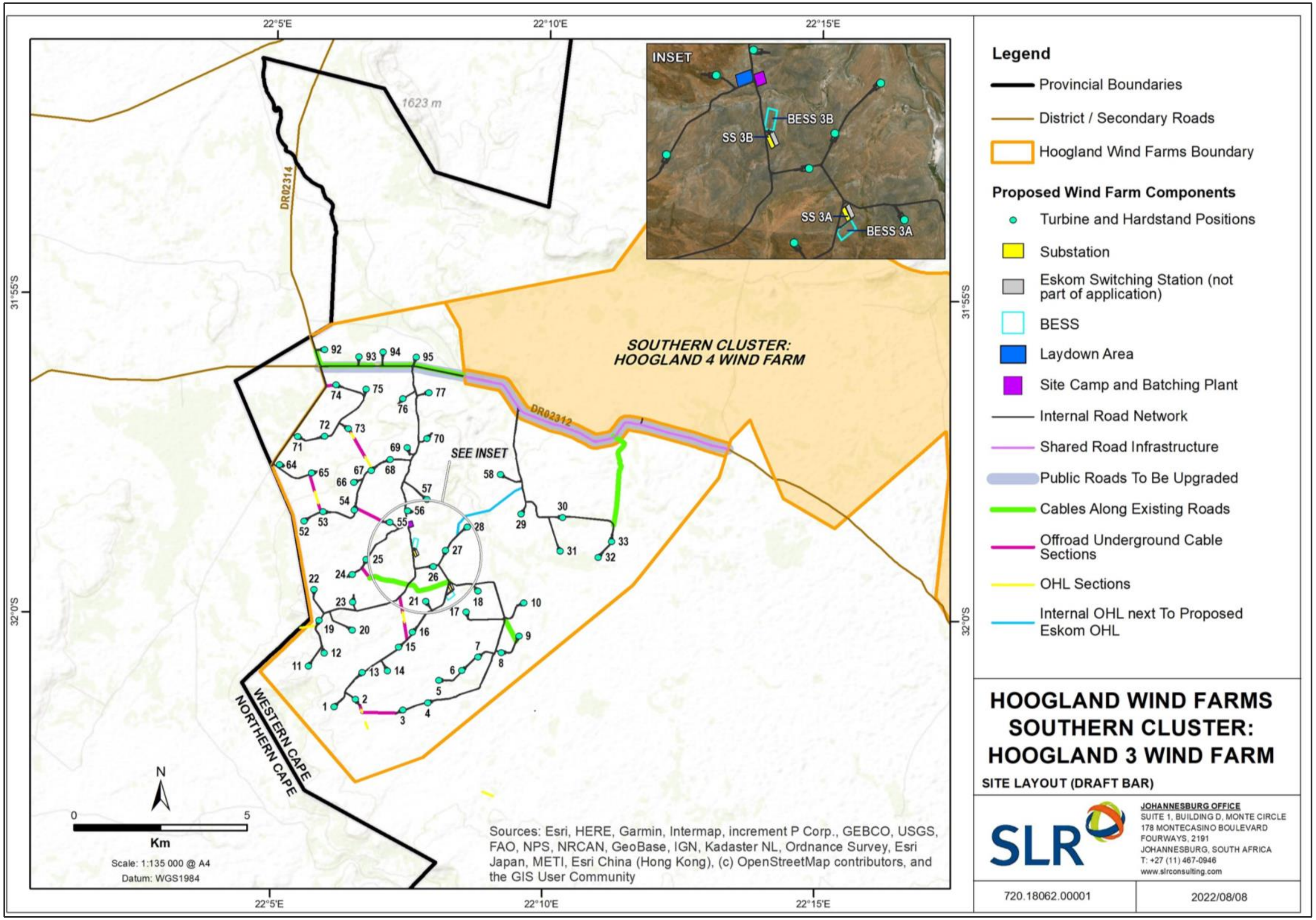


Figure 2-5: Hoogland 3 Wind Farm Layout (58 turbines)

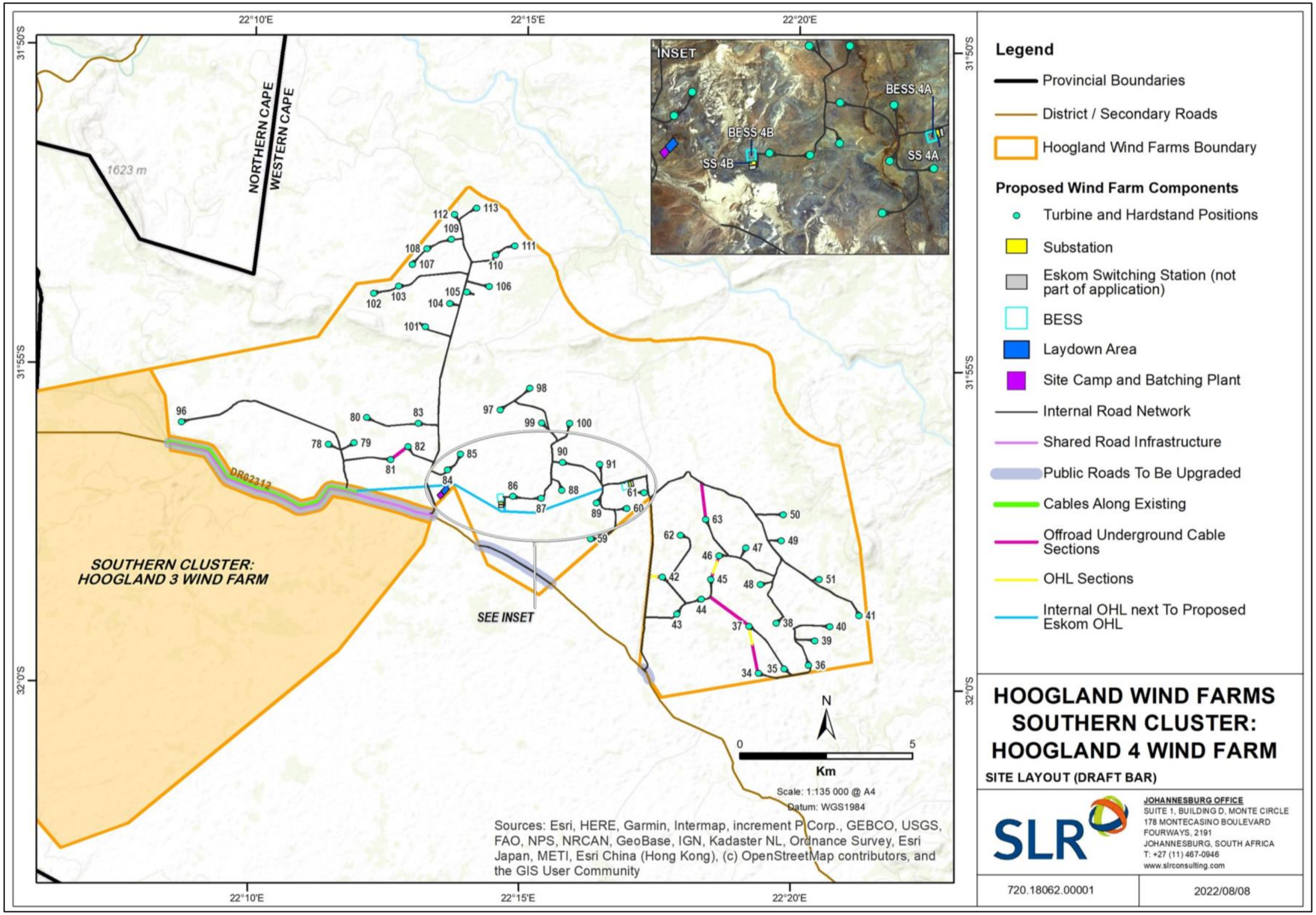


Figure 2-6: Hoogland 4 Wind Farm Layout (55 turbines)

2.4 WIND FARM COMPONENTS

Each Wind Farm requires several key components to facilitate the generation of electricity at a large scale. This includes:

- Wind turbines;
- Roads;
- Underground cables and overhead high voltage power lines (up to 66 kV);
- Two Substations (including and operations and maintenance area for control, operation, workshop, storage buildings / areas); and
- A battery storage facility in the vicinity of each Substation.

The various Wind Farm components are described, and illustrative figures are also provided, within this section.

2.4.1 Wind Turbines

A wind turbine is a rotary device that extracts energy from the wind. The mechanical energy generated is converted to electricity. Wind turbines can rotate either on a horizontal or vertical axis. Larger capacity turbines used in large scale Wind Farms for the commercial production of electricity are typically horizontal axis wind turbines (HAWT), which are three-bladed and mechanically pointed into the wind by computer-controlled motors, as is proposed for this project. These have high blade tip speeds of up to about 325 km/hour, high efficiency, and low torque ripple, which contribute to good reliability. Figure 2-8 illustrates the external and internal components that make up a typical wind turbine and also key aspects associated with the turbine erection process.

Since the turbine technology is continually evolving it is not possible at this early stage in the development process to specify the exact turbine model and specification (or even what would be available in the marketplace). Assumptions have been made as to the maximum possible area of impact by the potential turbine blades based on a range of turbine sizes. This area of impact is referred to as the "exaggerated rotor swept area envelope", as it 1) takes into account multiple turbine size scenarios at once, and 2) assumes each turbine has the largest blade it can from the lowest hub height and extends this all the way up to the highest hub height (see Figure 2-8). This reflects an exaggerated worst-case area of impact that would never be realised in any scenario of turbine model. Therefore, specialist assessments using this exaggerated envelope will result in their findings being more conservative and thereby ensuring a precautionary approach to the assessment (i.e., ensuring the impacts associated with the actual swept area are likely to be less than that reported in the assessment).

For the Hoogland Wind Farms the following wind turbine envelope is proposed (Figure 2-7):

- Rotor diameter: 100 m to 195 m (50 m to 97.5 m blade / radius)
- Hub height: 80 m to 150 m
- Rotor top tip height: 130 m to 247.5 m (maximum based on 150 m hub + 97.5 m blade = 247.5 m)
- Rotor bottom tip height: minimum of 20 m (and not lower).

The nameplate capacity of each Wind Farm will be up to a maximum of 420 MW.

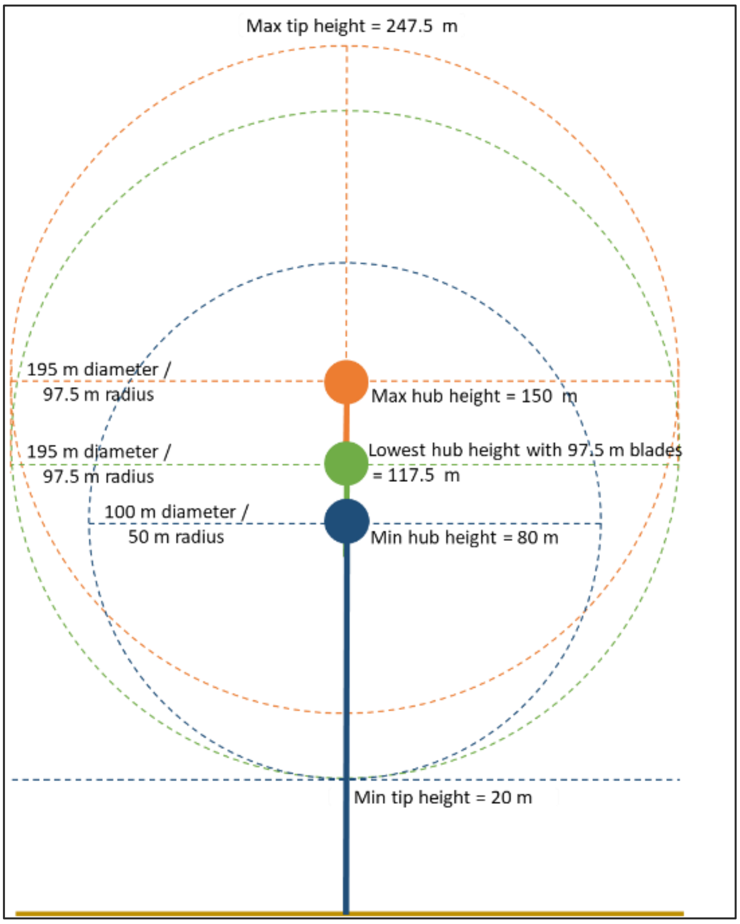


Figure 2-7: Rotor swept area envelope

2.4.1.1 Rotor and Blades

The rotor has three blades that are usually coloured white or light grey for aviation safety and thermal reflectivity.

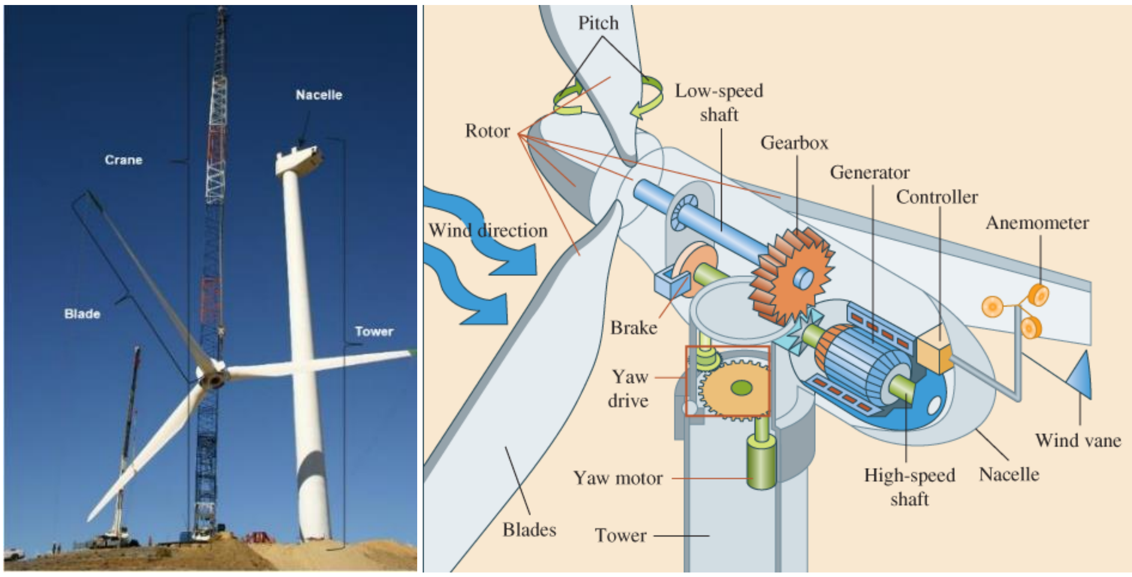


Figure 2-8: External (left) and internal[6] (right) components of a typical wind turbine.

---

[6] http://9.dragonpark-bonn.de/this-diagram-describe-the-wind-turbine-parts.html

2.4.1.2 Nacelle

Larger wind turbines are actively controlled to face the oncoming wind direction, which is measured by a wind vane situated on the back of the nacelle. By reducing the misalignment between wind and turbine pointing direction (yaw angle), the power output can be maximised, and non-symmetrical loads minimised. The nacelle turns the turbine to face into the wind ('yaw control'). The nacelle also contains the generator, control equipment, gearbox and wind speed instrument (anemometer) to monitor the wind speed and direction.

The turbine controls the angle of the blades ('pitch control') to make optimal use of the available wind and avoid damage at high wind speeds. By turning the blades sideways into the wind, i.e., away from the direction of the wind ('furling'), the turbine ceases its rotation, accompanied by both electromagnetic and mechanical brakes. This would typically occur at very high wind speeds, typically over 72 km/h (20 m/s), depending on the characteristics of the specific turbine. The wind speed at which shut down occurs is called the cut-out speed. The cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level. Refer to Figure 2-8 illustrating the typical components of the nacelle.

2.4.1.3 Generator and Transformer

The generator converts the mechanical turning motion of the blades into electricity. A gear box is commonly used for stepping up the speed of the generator. Inside the generator, wire coils rotate in a magnetic field to produce electricity. Each turbine has a transformer that steps up the voltage to match the power line frequency and voltage for transmission to the Wind Farm Substation. The transformer may be located inside the turbine tower, or within a small housing at the base of the tower depending on the make and model. Refer to Figure 2-8 for the typical location of generator inside the nacelle.

2.4.1.4 Tower

The tower is constructed from tubular steel or steel reinforced concrete and supports the rotor and nacelle. Towers can vary in height and are dependent on the turbine make and model. The nacelle is attached to the top of the tower and the point or axis where the rotor attaches to the nacelle is referred to as "hub height." Wind velocity and consistency generally increases with altitude, therefore increasing the height of a turbine places the rotor into the higher velocity laminar winds that are good for power generation. For this, and other reasons, there has been steady increase in turbine size as the industry and technology have developed.

2.4.1.5 Hardstand and Foundation

Development of each turbine would require a permanent and temporary disturbance footprint to allow for their construction and maintenance. This area includes the permanent turbine gravity foundation as well as the compacted construction area (hardstand) required to support the heavy-duty equipment (most notably the cranes), machinery and components (e.g., blades) during the construction and maintenance phases. Additional areas will be temporarily required in the construction phase for the staging, assembly and erection of the crane and turbine blades. These areas may also be used for temporary stockpiling of excavated materials and topsoil. The various components of the hardstand and the specifications are included in Table 2-3 below whilst a typical hardstand design is illustrated in Figure 2-10.

Gravity foundations (footings) are designed to withstand both the weight (static vertical load) and lateral loads exerted by wind pressure and rotor movements (dynamic horizontal loads). Considerable attention is given to the design the footings to ensure that the turbines are adequately grounded and able to operate safely and efficiently. Due to the high loads, large and heavy steel-reinforced concrete gravity foundations are required to keep the turbines upright. Figure 2-9 provides a view of a gravity foundation under construction. In terms of the footprint, a circular foundation with a diameter up to 35 m is proposed.

Table 2-3: Turbine hardstand specification and approximate disturbance footprint (Figure 2-10)

HARDSTAND COMPONENT	DESCRIPTION	FOOTPRINT (ESTIMATED)	TEMPORARY/PERMANENT
Turbine Foundation	Concrete turbine foundation	± 1,400 m^2 (35 x 40 m)	Permanent
Crane Pad	Area where construction crane would be placed	± 3,200 m^2 (80 x 40 m)	Permanent
Additional temporary hardstand area near Crane Pad	Additional temporary hardstand area near Crane Pad	± 800 m^2 (20 x 40 m)	Temporary
Blade Laydown Area	Area where blades would be stored prior to installation (with potential additional embankment area if on slope)	± 2,600 m^2 (25 x 104 m)	Temporary
Crane Boom Assembly Area	Area where the crane boom would be assembled	± 1,800 m^2 (120 x 15 m)	Temporary

Figure 2-9: Example of a typical turbine foundation under construction

The layout and orientation of the foundation, hardstand and laydown areas and access roads will vary from location to location based on slope, terrain and other constraints that characterise each site. The general layout of a turbine work site is set out in Figure 2-10 to follow.

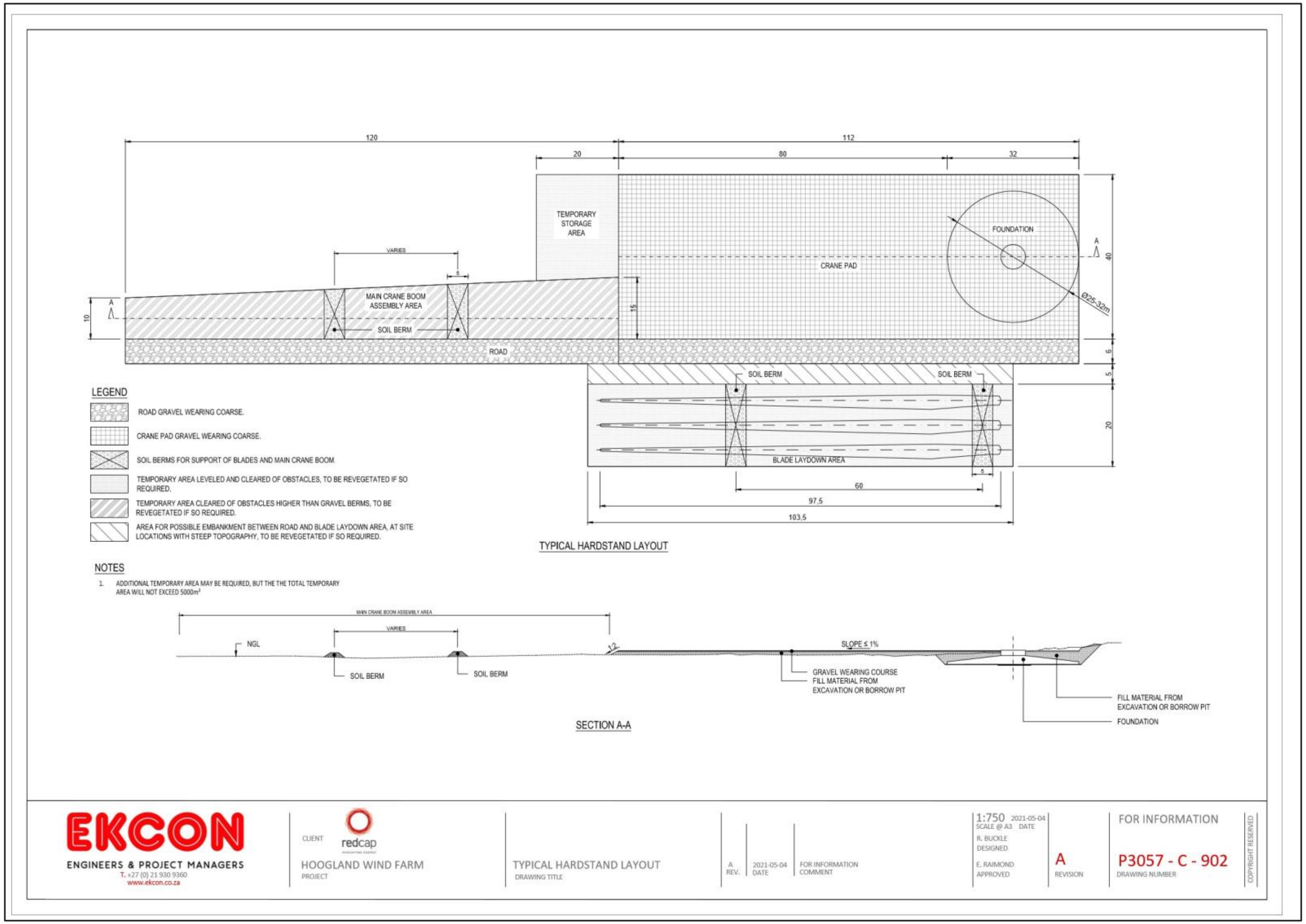


Figure 2-10: Plan of a typical wind turbine hardstand

2.4.2 Power transmission

The electricity generated by the turbines on each Wind Farm needs to be collected, transformed and then evacuated to the national grid. To allow efficient transmission, the electricity undergoes a voltage "step-up" process that occurs at each wind turbine where power is stepped up to a maximum of 66 kV (either in the turbine or in a transformer container next to the turbine), and again at one of the Wind Farm Substations where power is stepped up to 132 kV. The power is then transferred through a Switching Station next to the Substation along a 132 kV line to the proposed Nuweveld Collector Substation (refer to Figure 2-11). The Wind Farm Grid Connection infrastructure, which consists of a Switching Station next to each Wind Farm Substation and the 132 kV power line to the Nuweveld Collector Substation, is the subject of a separate application as once constructed it will be handed over to Eskom who will own and manage it as part of the national grid. The Wind Farm Substation and all the up to 66 kV internal lines are part of each respective Wind Farm application.

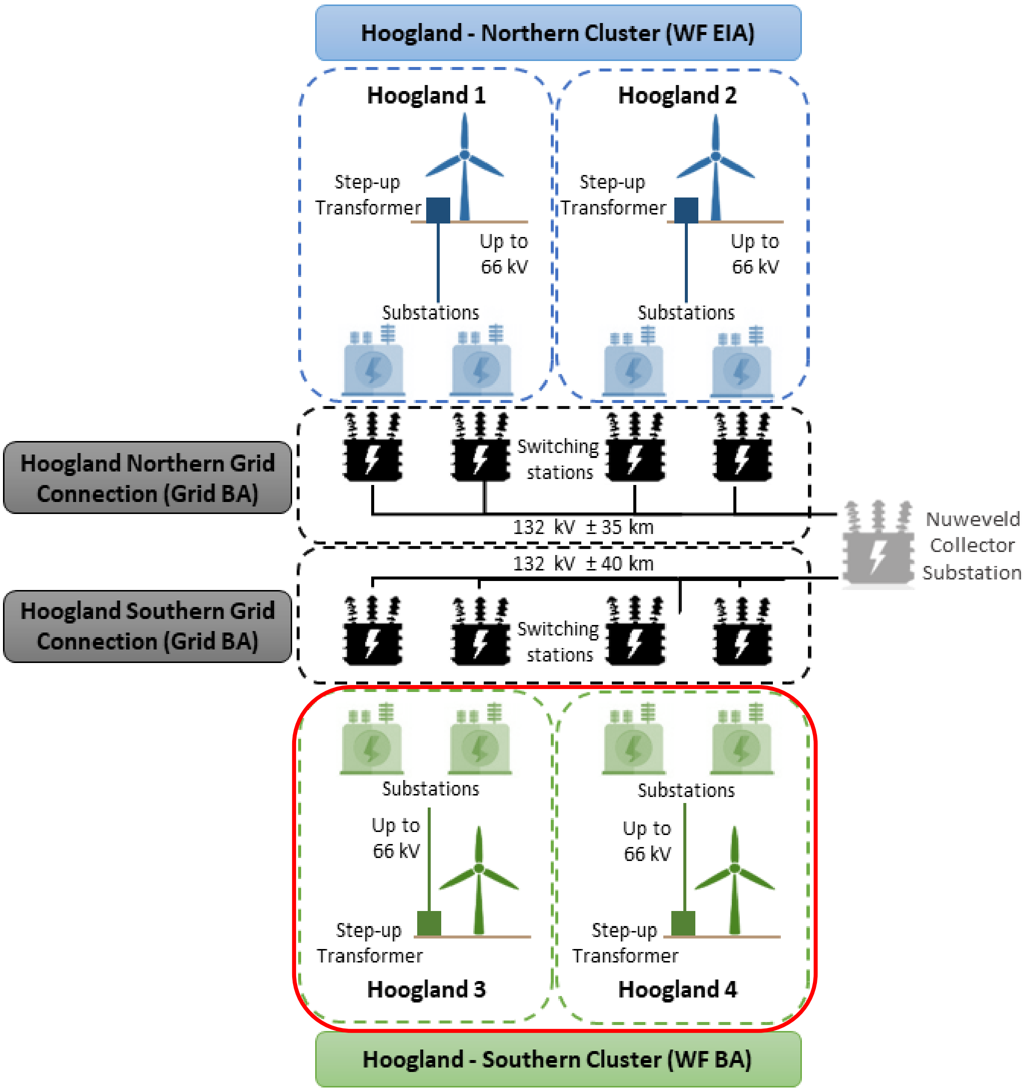


Figure 2-11: Power transmission - Wind Farm and Grid Connection interface (Hoogland 3 and Hoogland 4 Wind Farms shown in the red block)

2.4.2.1 Cabling

At each turbine, power is stepped up to a maximum of 66 kV (either in the turbine or in a transformer container next to the turbine). Each turbine will be connected to their respective Wind Farm Substation via high voltage power lines (~66 kV lines). For the most part cables will be laid underground in trenches (~1 m deep), generally running alongside new or proposed internal roads, but sometimes deviating from these. In limited instances, where burying of cables is not possible due to technical, geological, environmental or topographical constraints, then short overhead power lines will be erected to traverse these constrained areas.

Figure 2-5 and Figure 2-6 depicts the Hoogland 3 Wind Farm and Hoogland 4 Wind Farm site layouts respectively and differentiate between 'Roads and Cables' where cables run alongside proposed or existing roads, 'Off-road Cables' where cables will not run alongside proposed or existing roads, and the 'Internal Overhead Power Lines' where trenching is not possible and overhead cables must be spanned. Where possible, to reduce areas of new impact, sections of overhead line have also been routed next to proposed Eskom overhead lines.

Internal overhead power lines will be spanned using short 132 kV type monopoles approximately 22 m in height. In some sections, two parallel rows of lines and pylons could be required. These more expensive shorter 132 kV monopoles have been selected rather than the standard 33 or 66 kV monopoles as they significantly reduce the risk of bird electrocutions and are therefore preferred by the bird specialist. The typical design for the proposed internal overhead power line monopoles is depicted in Figure 2-12

As described in Section 2.4.3, there is the potential that each BESS may require its own Substation and would be connected directly to the respective Eskom Switching Station via a short 132 kV overhead line which would be supported in monopoles up to 32 m in height. This is the only section of 132 kV overhead line included in each Wind Farm application.

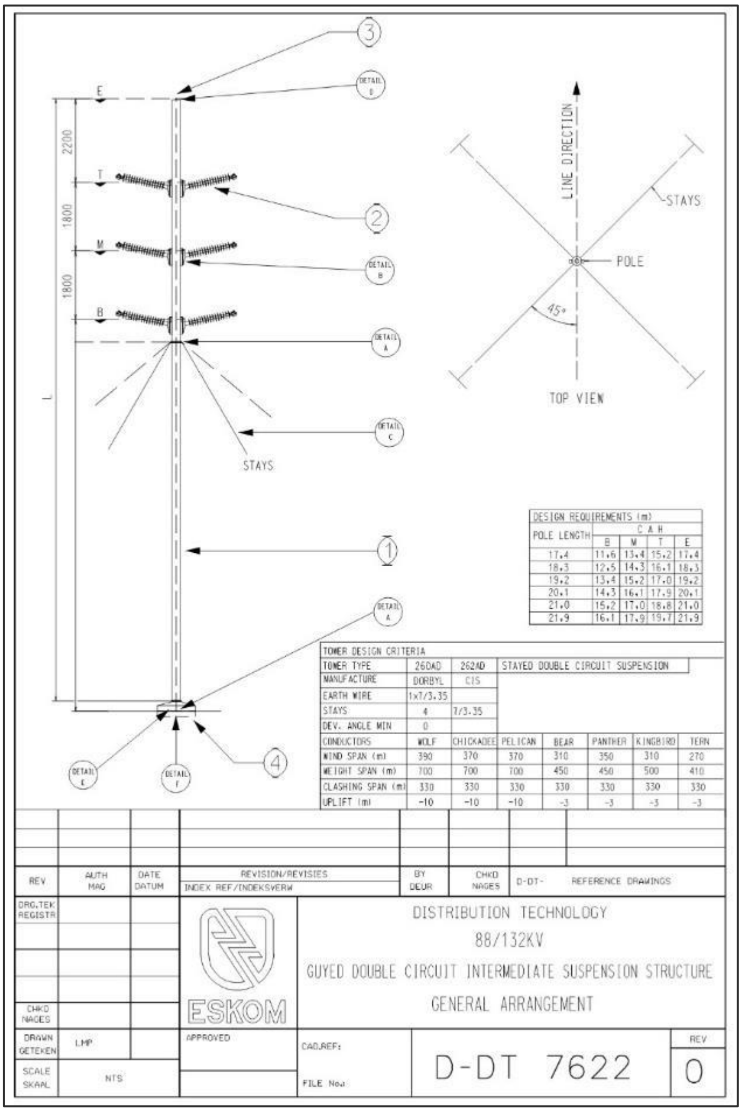


Figure 2-12: Typical design of the proposed monopoles to be used for the up to 66 kV internal overhead power lines (where trenching is not possible)

2.4.2.2 On-Site Substations

Two substations have been provided for each wind farm. Once the high voltage (~66 kV) electricity reaches each on-site Wind Farm Substation (with transformer), it will be stepped-up to 132 kV. The Substation yard will house Operation and Maintenance (O&M) buildings, Substation building and a High Voltage Gantry, and will be approximately 11,250 m^2 in extent (150 m x 75 m). The Substation would typically include an area with a subterranean earthing mat onto which a number of concrete plinths are constructed. This, together with several earthing rods, will provide an earth for lightning and possible short circuit currents. Switching gear, step-up transformers and protection equipment are also mounted on concrete plinths as part of the Substation.

Once stepped-up to 132 kV the electricity would pass to a ringfenced Eskom Switching Station abutting each Substation (the Switching Station is part of the separate Grid Connection application). The adjoining Eskom Switching Station would be of a similar size to that of the Wind Farm Substation and include metal gantries where the Eskom power lines are connected in a "busbar" arrangement so that multiple lines can be joined together and where specialised equipment is used to switch these lines on and off. The adjacent Eskom Switching Station is described in Section 2.4.2.3.1 below. Figure 2-5 and Figure 2-6 show two potential substation / switching locations for each Wind Farm site.

Information relating to the Grid Connection (132 kV power line and Switching Stations) is provided below for information purposes, but the reader should note the Grid Connection is the subject of a separate application and should refer to that application for details.

Figure 2-13: Example of a Wind Farm Substation (right) and adjoining Eskom Switching Station (left) on the Kouga Wind Farm

2.4.2.3 Grid Connection (Not part of this application – included for contextual purposes)

The Nuweveld Project falls to the east of the Hoogland Project and comprises three Wind Farms. In order to evacuate the energy generated by the Nuweveld Wind Farms, Red Cap is proposing to develop the Nuweveld Collector Substation for Eskom and from this a ~120 km (400 kV) high voltage overhead transmission power line to the Eskom Droërivier Substation (see Figure 1-2 for Locality Map). The Nuweveld Gridline and associated Collector Substation has received environmental authorisation[7] and if developed will be considered part of the Eskom national power line network. The Hoogland Projects will connect to the national Grid via the Nuweveld Collector Substation.

The proposed Hoogland Northern Grid Connection is the 132 kV overhead power line required to connect the Hoogland Northern Wind Farm Cluster (Hoogland 1 Wind Farm and Hoogland 2 Wind Farm) to the Nuweveld Collector Substation as part of the grid. Similarly, the Hoogland Southern Grid Connection is required to connect the Hoogland Southern Wind Farm Cluster (Hoogland 3 Wind Farm and Hoogland 4 Wind Farm) to the Nuweveld Collector Substation as part of the grid. These are two separate applications for Environmental Authorisation which will be formally submitted to the DFFE and will include the Switching Stations next to each respective Wind Farm Substation as well as the 132 kV overhead lines connecting into the Nuweveld Collector Substation. These applications will run as far as possible in parallel to the Wind Farm EIA/BA processes. Refer to Figure 2-12 in the previous section. These would be developed by Red Cap but handed over to Eskom once constructed for Eskom to own and operate and thus to become part of the national grid network.

2.4.2.3.1 Switching Stations

Each Wind Farm will interface with its respective Grid Connection via the Eskom Switching Station adjacent to each of the two Wind Farm Substations as referred to in Section 2.4.2.2 above. The Eskom Switching Station abutting each

[7] 14/12/16/3/3/1/2336

Substation would be ringfenced and of a similar size to that of the Wind Farm Substation (11,250 m^2 in extent, 150m x 75 m). It will include metal gantries where the Eskom power lines are connected in a “busbar” arrangement so that multiple lines can be joined together and where specialised equipment is used to switch these lines on and off.

2.4.2.3.2 Overhead Power Lines

The Switching Stations will then connect to the Nuweveld Collector Substation via two overhead 132 kV high voltage power lines; one serving Hoogland 1 and 2 Wind Farms in the Northern Cluster; and another serving Hoogland 3 and 4 Wind Farms in the Southern Cluster. The overhead lines will largely be supported by monopole style pylons and these specifications are described in the respective Grid Connection Basic Assessment report/s.

2.4.3 Battery Storage Facility

Each Wind Farm proposal includes the possibility for the development of a battery energy storage system (BESS). This will allow for a more continuous source of electricity to the grid as battery facilities can help to smooth out the fluctuations in energy generation from the renewable energy sources and allow them to be closer to conventional generation systems in this regard.

A BESS will be located in close proximity to each respective Wind Farm Substation and therefore there will be two BESS per wind farm. Each BESS will be fenced off and will be linked to the Substation via up to 66 kV cables and will not have any additional office / operation / maintenance infrastructure as those of the Substation. However, each BESS may require its own substation, and if this is the case this substation would include typical substation components and be located within the BESS footprint. If the BESS does have its own substation, then it will not have an up to 66 kV cable connection to the Wind Farm Substation but would rather have a short 132 kV connection from the BESS substation to the Eskom Switching Station (which is situated next to the Wind Farm Substation), and this would use monopole pylons up to 32 m in height.

The battery facilities will either be Lithium Ion or Redox Flow and both technologies will be assessed as it is unknown which technology will be selected. Each BESS will be compliant with all local laws and regulations and health and safety requirements governing battery facilities. A risk assessment is included in *Appendix G: Battery Energy Storage Risk Assessment.* The physical footprint of each BESS, regardless of technology and grid connection will be approximately 3.5 ha with a peak discharge value of 140 MWac. A brief description of each technology is provided below.

2.4.4 Lithium-Ion

Charged lithium ions are carried via electrolytes between anode (negative electrode) and cathode (positive electrode) within each Lithium-Ion battery cell. There are a number of different battery chemistries that are available. These cells are combined into battery modules, which are housed in battery racks, a number of which are collectively enclosed in sealed containers. These are all assembled in factories and no electrolytic liquid is handled on site. In addition to the battery racks, other components within the containers includes a HVAC or air conditioning system, a fire detection and suppression system (that normally uses inert gas), battery management system and other electrical components required to manage the batteries. The containers are normally a standard size of about 12 m long x 2.5 m wide x 2.7-3 m high. The BESS on the Wind Farm site will comprise multiple containers (e.g., approximately 240, with an extra 3-5 containers for electrical connections and controls), refer to Figure 2-14 for an example of an installation. The main risk to health and the environment relating to for Lithium-Ion BESS is overheating that leads to spontaneous ignition and subsequent explosion i.e., fire. Since the batteries arrive on site sealed and kept in racks inside sealed containers the risk of chemical spills are extremely low.

Figure 2-14: Example of a Lithium-Ion BESS installation

2.4.5 Redox Flow

Redox flow batteries are charged and discharged by means of the oxidation–reduction reaction of a chemical whereby ions are transferred from one element to another. Redox flow batteries therefore comprise an electrochemical battery cell and a flowable electrolyte which is pumped through the cell for charging or discharging electricity and is stored in electrolyte tanks (one tank acting as a cathode and one as an anode). The most common Flow battery electrolytes are based on a water solution including vanadium, zinc or iron salts. Electrolyte storage tanks and cells are typically installed in specially designed steel containers providing secondary and tertiary containment measures (double wall). The containers are filled with electrolyte on site during project installation. Adjacent to this is another container housing the conversion systems and auxiliary systems necessary for the operation of the system (these include HVAC, fire detection and suppression, leak detection and suppression, BESS management), refer to Figure 2-15. The height of the installation will not exceed 3 m. The main environmental risk specific to Flow batteries during construction and operation is the accidental leak or spillage to the environment of the liquid electrolyte. The risk of fire and explosion is low.

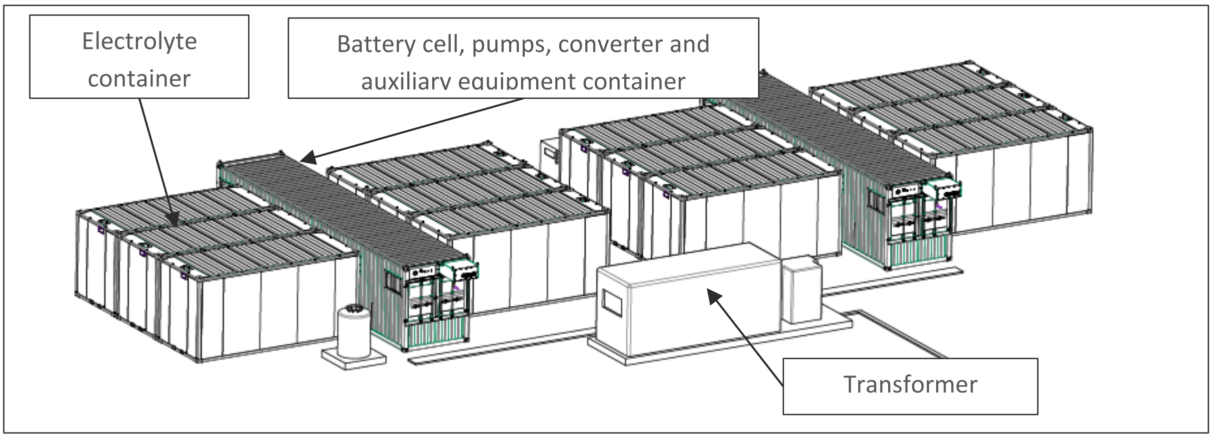


Figure 2-15: Indicative layout of a Flow battery of approximately 0.1 ha

2.4.6 Additional Infrastructure

2.4.6.1 Access, Service Roads and Sidings

The site can be accessed via the well-established existing road network in the area. For commuter traffic and some small loads, access from the south would be via Beaufort West using the N1 and R381 travelling between Beaufort West and Loxton. Due to restrictions in this route, the abnormal loads (including the large turbine components like blades, towers and nacelle etc) will be delivered from the north. The Northern Cluster (Hoogland 1 and 2 Wind Farms) will primarily use the R381 (south of Loxton) for the delivery of abnormal loads, whilst the Southern Cluster (Hoogland 3 and 4 Wind Farms) will primarily use the DR02314 and DR02312 (off the R356).

On site access and service roads will be required to access each turbine site and related Wind Farm infrastructure. These roads are shown in Figure 2-5 (Hoogland 3) and Figure 2-6 (Hoogland 4).

The internal gravel roads will have an approximate 6 m wide surface and there will be up to 15 m wide impacted during the construction phase, with additional space required for cut and fill, side drains and other stormwater control measures, turning areas and vertical and horizontal turning radii to ensure safe delivery of the turbine components. Where possible, existing roads have been proposed to be upgraded to avoid additional clearance of vegetation. New roads will be established where needed and aim to avoid sensitive areas and features, bar specific allowances and exceptions provided for by the specialists. In exceptional circumstances short sections of the roads may be surfaced with bitumen or concrete on steeper areas to provide necessary traction and limit erosion.

2.4.6.2 Shared Infrastructure

The total road network required for each respective wind farm also includes shared road infrastructure (permanent) with the other wind farm in the respective cluster. 8.7km of shared road infrastructure will be required for the Hoogland 3 and Hoogland 4 Wind Farms respectively.

2.4.6.3 Security (Fencing, gates and access control)

A security gate and guard house may be placed at the entrances to each Wind Farm site. This is aimed at preventing unauthorised vehicular access to the facility. No fencing will be used around individual turbines and existing fencing will remain around the perimeter of the properties. This will enable livestock and wild fauna to continue to utilise the area underneath the turbines as rangeland or a migratory corridor. Fencing will be erected around each onsite Substation and Battery Facility operations and maintenance complex for security and safety reasons during the operational phase. The temporary construction/site camp (described further below) will also be fenced and should be kept secure for the duration of the construction period. Additional construction phase fencing will be used where needed in consultation with landowners.

2.4.6.4 Water, Electricity and Communications

A preliminary approximation of the water requirements for the construction phase of the proposed Wind Farm are as follows:

- During the construction period (18 - 24 months) water will largely be used for road construction; hardstand compaction; concrete foundations; cleaning equipment after concrete pours and dust suppression on roads. It is anticipated that 90,000 m^3 per year during construction phase would be required.
- During the 20-year operational phase water would be required for staff ablutions. It is anticipated that water consumption would be approximately 2,500 m^3 per annum.

Several water header tanks will likely be used to provide potable water and the water will be sourced from licensed boreholes and treated to potable quality where required.

Basic sanitation will be provided on site during the construction and operational phases in the form of portable/chemical toilets and conservancy tanks. Wastewater will be collected at regular intervals and transported to a Municipal Wastewater Treatment Works with sufficient capacity. Sections 22 and 40 of the National Water Act (36 of 1998) must be complied with when disposing sewage.

Electricity for construction could be obtained from Eskom through the existing 22 kV network in the area, alternatively temporary diesel generators and/or possibly small scale mobile photovoltaic units will be used to provide power.

Communication on site will be "wired" / fibre. The project is located on the eastern boundary the Karoo Central Astronomy Advantage Area 1, an area set aside for the purposes of radio Astronomy in 100 MHz to 2,170 MHz range and related scientific endeavours. The advantage area does not extend across the provincial boundary into the Western Cape. However, in keeping with the protection of this area against Electromagnetic interference (EMI), or radio-frequency interference (RFI), and through consultation with the Square Kilometre Array (SKA) radio telescope, it has been agreed the turbine communication systems will be hardwired as opposed to telemetric (wireless communications).

2.4.7 Temporary infrastructure for construction

All temporary areas required for construction of the plant will be restored to near pre-impact condition wherever possible. During construction, temporarily impacted areas will be stripped of topsoil to allow for the works to occur, and the topsoil reinstated on completion. Revegetation will be implemented to reduce further risk of erosion and to restore ecological function as far as possible. This will apply to all temporary disturbance areas.

2.4.7.1 Site Camp (yards, offices laydowns and staff areas)

During the construction phase of each Wind Farm, the Contractor/s would require space for equipment and operations i.e., site camps. The areas identified for the site camps will have a total combined area of 2 ha on each Wind Farm and the proposed locations are depicted on the respective Wind Farm Layout maps in Figure 2-5 and Figure 2-6 above (refer to *Appendix B: Maps* for A3 Layout Map). The area would be stripped of topsoil and vegetation, grubbed of rocks and debris, levelled where necessary for the duration of the disturbance and reinstated on completion.

Contractors would likely establish a series of temporary or mobile structures for offices, staff areas, storage areas, and workshops. Portable/chemical toilets and wash facilities will be provided for staff.

The remainder of the area would serve as a yard for the parking of equipment and vehicles, stockpiling of key construction materials and supplies, and spoil and waste items.

2.4.7.2 Laydown area

Each Wind Farm proposal includes an additional temporary laydown area on the site of ± 3.6 ha which could get used for turbine component storage or storage of other large components required for construction. Refer to Figure 2-5 above for the proposed location on each Wind Farm site.

2.4.7.3 Waste management

During the construction phase solid domestic waste would need to be collected in rubbish bins placed in the contractor yards and at various work areas across the site. Rubbish bins will be emptied at regular intervals and the waste collected at a weather shielded central waste area located in the contractor's yard. Waste will be separated wherever possible. Once sufficient volume of waste has been collected, the Contractor would remove the wastes for disposal at a registered waste disposal facility, which would likely be the municipal facilities located in Beaufort West (namely the Vaalkoppies waste disposal facility), or other registered facilities in neighbouring towns.

2.4.7.4 Fuel and lubricants storage

Due to the remoteness of site, the Contractor would establish a temporary fuel and lubricants storage area on the site to ensure that they can fuel and maintain the various items of equipment and plant machinery. In addition, as is standard practise, transformers in Substations are located within a bunded area. The combined storage capacity of all of the above facilities/infrastructure will fall above 80 m^3 but below 500 m^3. As these qualify as dangerous goods, they would need to be stored in bespoke area with necessary protections including spill protection measures, secondary containment, oil separator/s, adequate weather proofing, firefighting equipment and added security (i.e., fencing and lockable access points, etc. to ensure that untrained or unauthorised persons cannot gain access). The site would need to carry the necessary hazard warning signage typical for such facility. The facility may have to be outfitted with a forecourt and dispensing equipment to allow vehicles to fill up at the facility or otherwise decant into mobile bowsers that would transport fuel out to the site works areas.

2.4.7.5 Concrete batching plant

Due to the distance from large towns and the remoteness of the area, concrete (e.g., for the turbine gravity foundations, road stabilisation and stormwater structures where needed, potential concrete turbine towers etc) would need to be batched on each Wind Farm site to ensure timeous delivery. Concrete materials (cement, sand, aggregate and water – plus any additives) would be brought to and stored at a batching plant. Batches of concrete would then be made and dispatched via truck to the work site. Since cement powder can be dangerous to handle, harmful to the environment and reactive with water, this will need to be stored in weather (wind and rain) proof areas to ensure it is contained and remains suitable to use. The batching facility would also need to have necessary provisions to container and prevent pollution of the environment by cement powder and concrete wash and spoil.

Each batching plant will be included in the respective site camp and comprise an area of 0.2 ha, refer to Figure 2-5 and Figure 2-6 for the proposed location of each Site Camp and Batching Plant area.

2.5 MATERIALS, RESOURCES AND HAULAGE

There will be the movement of materials, resources and waste onto and off the site for the duration of the construction period. This will include turbine components that require abnormal load transportation.

It must be noted that the final haulage route/s will be confirmed pre-construction by the appointed logistics company/contractor in line with the requirements of the traffic impact study and all relevant outstanding transport permits will be obtained.

During construction, internal roads are needed to accommodate low bed trucks delivering turbine components and large electrical equipment as well as the mobile high lift cranes where needed to erect the turbines themselves, amongst other heavy construction vehicles. Typical heavy loads are illustrated in Figure 2-16. Existing farm roads and tracks will be used and upgraded as far as practical as part of this road network, to reduce the disturbance footprint. In rough terrain, additional measures will be required for the reinforcement of the site roads whereby they may require hard surfacing on steeper areas to support the traffic and avoid erosion.

Figure 2-16: Tower section in low load configuration shown in top figure and blade shown in bottom figure

2.6 EMPLOYMENT

During the construction phase of the project, a number of temporary job opportunities will be created. These include highly-, medium- and low-skilled positions. To meet the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) objectives or requirements (see Section 4.3.5) many of these jobs will be reserved for individuals from the local community, where the skills are available.

It is estimated that the construction phase of each individual Wind Farm would result in an estimated 160-200 direct jobs (27-33 highly-skilled, 62-78 medium-skilled and 71-89 low-skilled jobs). Most of low-skilled jobs (60%) will likely come from the local municipal area.

Similarly, each Wind Farm will also generate permanent job opportunities throughout operation. It is intended that preference will be given, as far as possible, to those people living in the area.

2.7 TIMEFRAMES

The formal BA process typically takes 1 to 2 years to complete and if authorised the developer / applicant would then prepare the project for submission to the REIPPPP during a forthcoming bidding window. It is currently unknown when the future bidding windows will be (See Section 4.3.5).

Should any of the Wind Farm projects be selected and given "preferred bidder" status, the project would then move into the next phase which includes obtaining other permits, licenses, including Water Use Licences, Rezoning permission, and other consents before reaching financial close which is normally less than 1 year after preferred bidder status is announced. Thus, construction is likely to commence no earlier than about 1 to 1.5 years after the issuing of an EA, but this is all dependent on how soon after obtaining the EA the next bidding window is and what the requirements are in the bidding round. The construction period for each Wind Farm is estimated to be between 18 to 24 months and could run concurrently with the other Hoogland Wind Farm projects if also developed.

The operational life of a Wind Farm is typically around 20 years where after it could be refurbished / upgraded, or decommissioned depending on the situation at the time, and all subject to the relevant environmental processes and authorisations.

3 ALTERNATIVES

A comprehensive iterative design process has been undertaken to inform the respective Wind Farm layouts and associated Grid Connection infrastructure for the Hoogland Projects.

By integrating the screening and assessment of environmental and social constraints alongside the technical components of the project, early in a project lifecycle, allowed for the reduction in risks to the project and supports the application of the mitigation hierarchy by demonstrating the avoidance and minimisation of impacts. This integrated design approach negates the need for an alternative's assessment in the detailed Environmental Impact Assessment (EIA) process (as per NEMA) as due to the thorough process entailed, it is unlikely that there will any fatal flaws to prevent the project proceeding.

However, the preferred layouts of the Hoogland Wind Farms, and respective Grid Corridors, have each been assessed against the '**no-go' alternative**. The 'no-go' alternative is the option of not constructing the Project where the status quo of the current farming activities on the sites would prevail.

The table below highlights the iterative approach:

Table 3-1: Description of the main layout iterations and key change drivers

DATE	NUMBER OF TURBINES			COMMENTS
	NORTHERN CLUSTER	SOUTHERN CLUSTER	TOTAL	
October 2020	N/A		493	**Preliminary layout** based on developer identified environmental and technical constraints. This was based on one continuous site. Refer to Figure 3-1
January 2021	N/A		451	Layout revised to exclude nests identified in Avifauna Screening Study, VERA modelling and EWT data re: Riverine Rabbits. Potential for five Wind Farms.
January 2021	212	117	429	Site area adjusted to remove large central corridor namely on the basis of the Sak River sensitivities. This layout was circulated to specialist upon appointment.
February 2021	150	117	367	Martial Eagle nest confirmed in north west area and therefore site area adjusted to remove a number of properties and turbines from the Northern Cluster. Refer to Figure 3-2
Sept 2021	176	172	348	Specialists initial Screening No-Go mapping applied to refine the preliminary layout. This included the discovery of a new Martial Eagle nest in the Southern Cluster with its resultant no-go buffer. The technical team also spent considerable effort optimising the layout based on a higher confidence in the layers provided by the specialists. Input regarding constraints from landowners and adjacent landowners was also considered. This layout was the basis for the **Pre-Application Phase** as shown in Figure 3-3. The detailed Pre-Application layouts for Hoogland 3 and Hoogland 4 are also provided in *Appendix B: Maps*.
April 2022	167	134	301	The site layouts presented in the Pre-Application Phase (as part of the Pre-Application Report) were refined mainly based on specialist recommendations, as well as relevant information that has arisen during the PPP

DATE	NUMBER OF TURBINES			COMMENTS
	NORTHERN CLUSTER	SOUTHERN CLUSTER	TOTAL	
				(including input from landowners and adjacent landowners). The project areas of Hoogland 3 Wind Farm that were in the Northern Cape were also removed from the wind farm. The technical team also spent considerable effort optimising the layout based on technical changes (see Section 6.1.3.2) and updated layers provided by the specialists following additional work undertaken.
May 2022	167	113	280	Current layouts for EIA Phase (Northern Cluster) and **BA Phase (Southern Cluster)** (See Figure 3-4). Only the Southern Cluster (Hoogland 3 and Hoogland 4) layout was updated and an additional 21 turbines positions dropped, the reasons are detailed in Section 6.1.3. In summary, the main changes included a further setback from the Karoo National Park and associated boundary change and reduction in turbines following SANParks engagement. The individual layouts for the Southern Cluster Wind Farms remain as shown in Figure 2-5 and Figure 2-6.

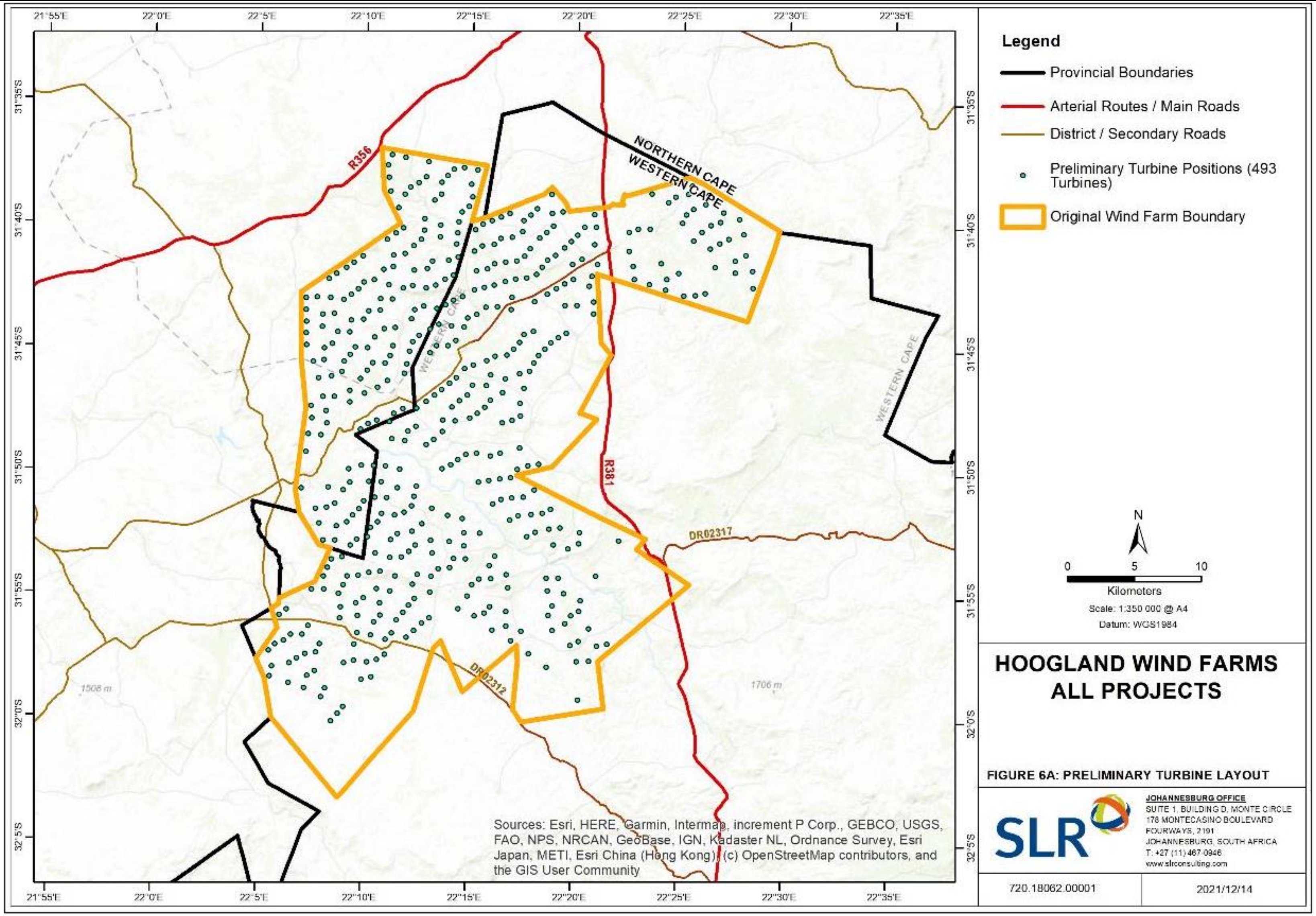


Figure 3-1: Preliminary 493 turbine layout based on developer identified environmental and technical constraints (October 2020)

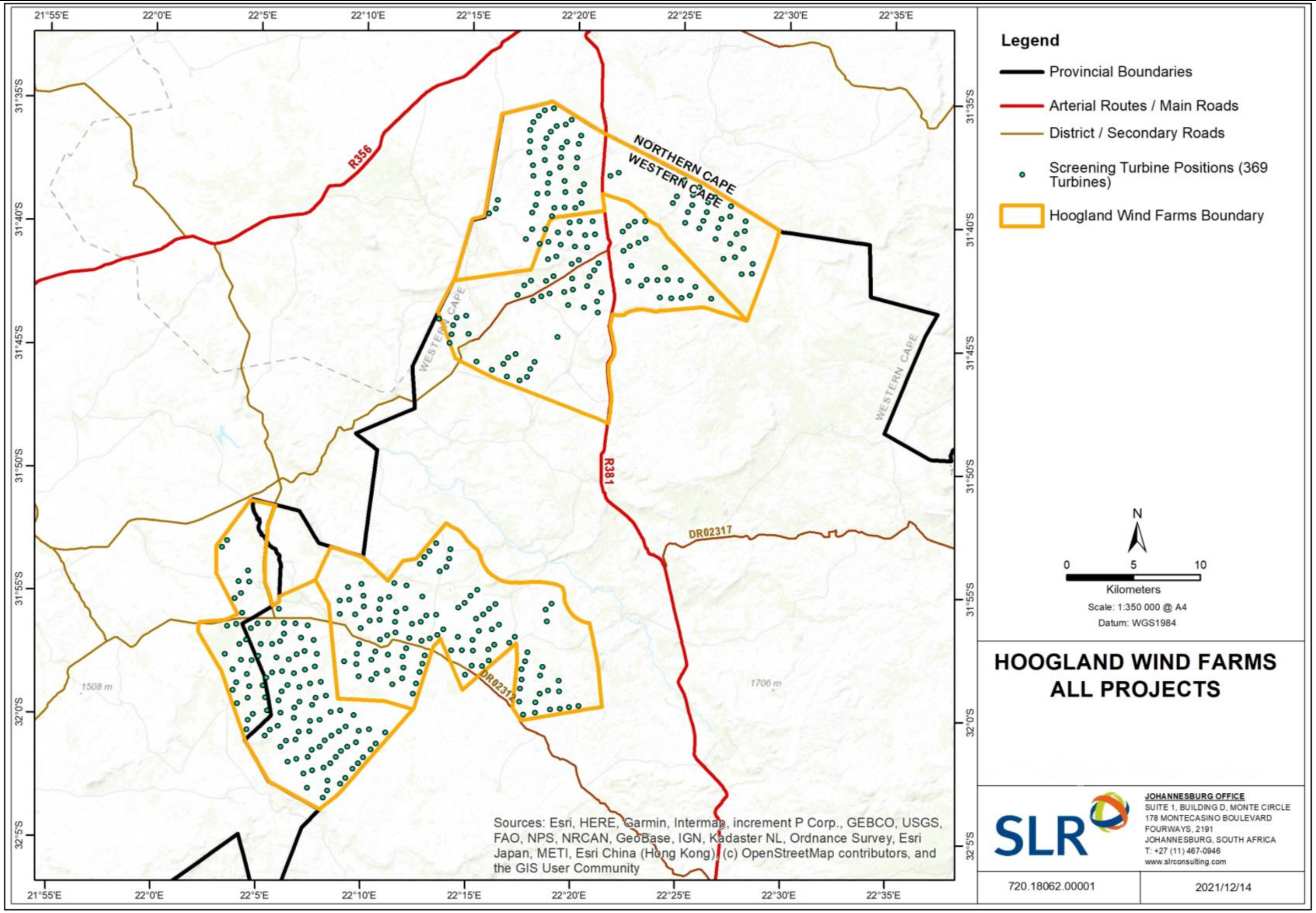


Figure 3-2: Screening Phase 367 turbine layout (February 2021)

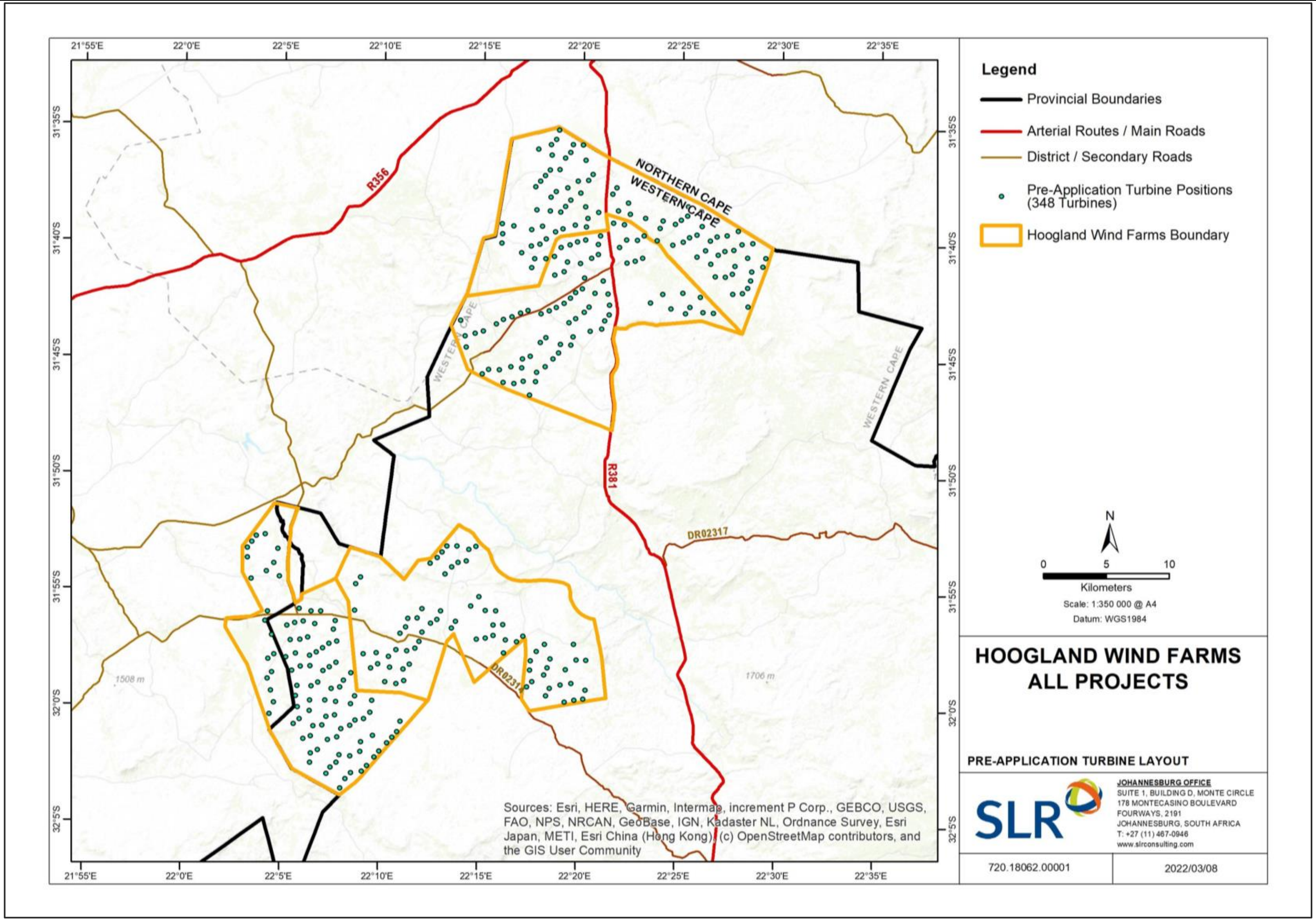


Figure 3-3: Pre-Application Phase 348 turbine layout (September 2021)

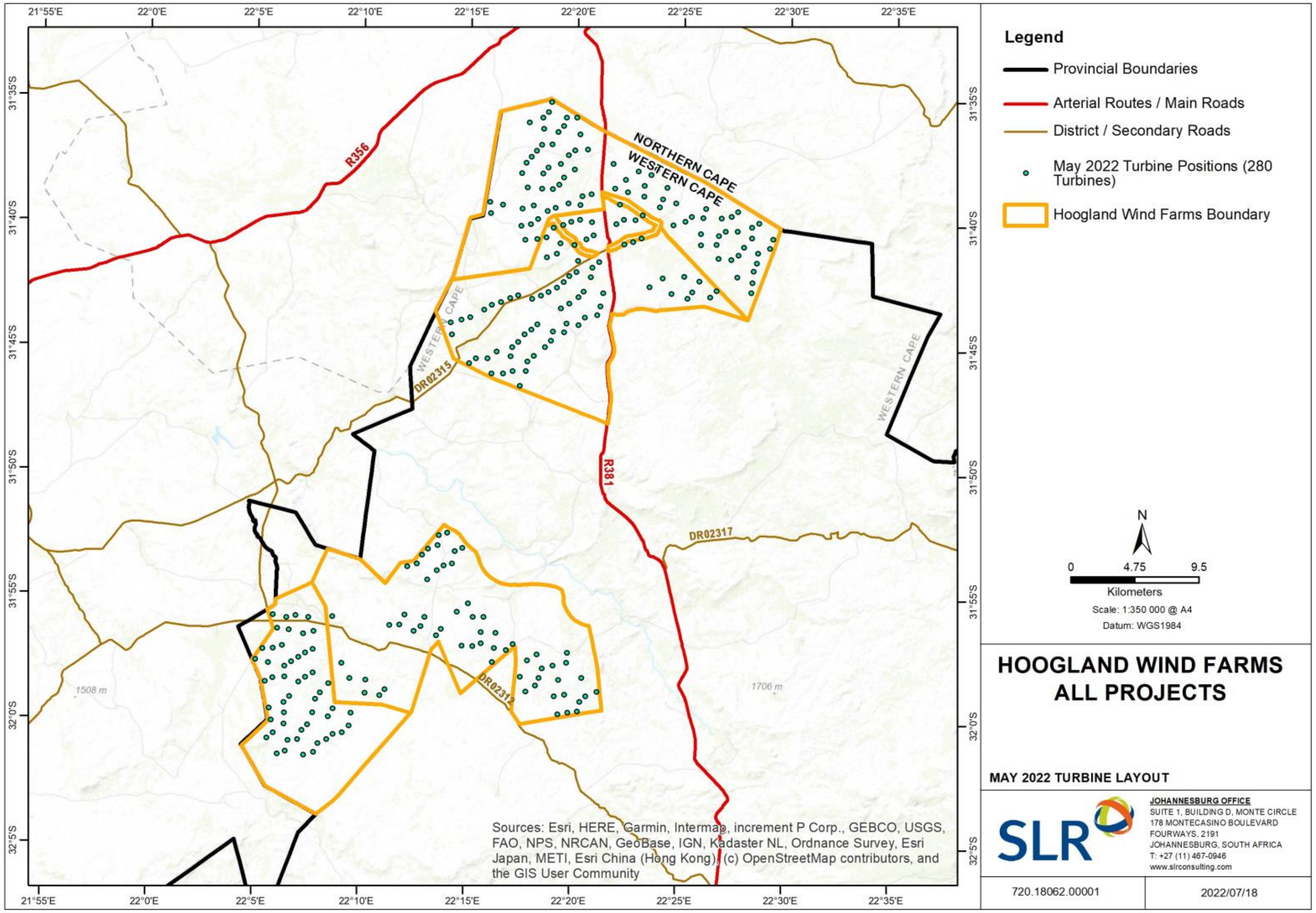


Figure 3-4: EIA Phase (Northern Cluster) and BA Phase (Southern Cluster) 280 turbine layout currently proposed (May 2022)

4 ADMINISTRATIVE AND LEGAL FRAMEWORK

This section provides an overview of the legal framework, with consideration given to legislation that is of relevance to the way the BA process is conducted. It therefore covers more than the requirements of the National Environmental Management Act; 107 of 1998 (NEMA) and the regulations made under it (the EIA regulations).

4.1 RELEVANT LEGISLATION

Table 4-1: Relevant legislation

Legislation	Relevant Organ of State / Authority	Relevance
Astronomy Geographic Advantage (Act 21 of 2007)	Department of Science & Technology transitioning to Department of Science and Innovation and the Square Kilometre Array (SKA)	Electromagnetic interference (EMI), also called radio-frequency interference (RFI) when in the radio frequency spectrum, is a disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction. This aspect is of importance to the Radio telescopes associated with the Square Kilometre Array (SKA). According to the DFFE Screening Tool, the site is in a Very High sensitive rating area partly within the Karoo Central Astronomy Advantage Area (KCAAA). The Applicant engaged with SARAO with regard to the proposed development and SARAO undertook a preliminary risk assessment, the outcome of which found that "*the project presented a medium risk of interference to the SKA radio telescope*". The recommendations were as follows: "*The developer will be required to implement an EMC control plan and mitigation measure prior to construction to ensure that these are retained to levels that do not produce harmful interference to the SKA radio telescopes.* *Due to the above-mentioned medium risk to the SKA, SARAO hereby request, that if the EA is granted, a detailed EMC Control Plan should be developed by the renewable energy facility developer and that the development will not resume prior to complying with the AGA Act. The level of risk and possible mitigations should be included in the EMPr that will be submitted as part of the Final Impact Assessment Reports (EIA)*". On this basis, the RFI assessment as stipulated in the DFFE Screening Tool will not be required at this stage of the Project.
Aviation Act (74 of 1962)	Civil Aviation Authority (CAA)	Wind turbine generators can interfere with radio navigation equipment. Turbines are also present potential physical obstacles and may need to be a certain colour (white) or fitted with aviation warning lights as required by the CAA. Comment on the project will be sought from the CAA as part of the public participation process. As part of the REIPPPP requirements the Applicant will apply with the CAA for approval of the final site layout. The site DFFE screening tool has identified the Wind Farms as Low Sensitivity and the Civil Aviation protocol therefore does not identify any assessment requirement.

Legislation	Relevant Organ of State / Authority	Relevance
Conservation of Agricultural Resources Act (43 of 1983) (CARA)	Department of Agriculture, Land Reform and Rural Development (DALRRD)	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. Most of the provisions are accounted for in more recent legislation such as NEMBA and NEMA and no applications are required in terms of CARA. Measures to mitigate potential impacts on agricultural resources, such as soil erosion, alien invasion and protection of vegetation and water resources, have been included in the Environmental Management Programme (EMPr).
Environmental Conservation Act (73 of 1989) (ECA)	Department of Forestry, Fisheries and the Environment (DFFE)	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. In accordance with the Act, two procedures exist for assessing and controlling noise, respectively: • South African National Standard (SANS) 10328:2008 'Methods for environmental noise impact assessments'. • SANS 10103:2004 'The measurement and rating of environmental noise with respect to annoyance and to speech communication' • Other South African National Standards. The proposed development is likely to increase ambient noise levels during operation as well as temporarily during construction. Noise emitted by Wind Farms include aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. A noise assessment has been conducted in accordance with the relevant SANS and is included in this Report.
Hazardous substances Act (15 of 1973)	Department of Health (DOH)	Hazardous Substances Act aims to control the production, import, use, handling and disposal of hazardous substances. Under the Act, hazardous substances are defined as substances that are toxic, corrosive, irritant, strongly sensitising, flammable and pressure generating under certain circumstances and may injure, cause ill-health or even death in humans. Where hazardous substances from any of the 4 groups below are to be used, care must be taken to ensure that or sourced from a licensed sourced, transported, handled and disposed of in compliance with the provisions of the Act. • Group I: industrial chemicals (IA) and pesticides (IB)

Legislation	Relevant Organ of State / Authority	Relevance
		• Group II: 9 classes of wastes excluding Class 1: explosives and class 7: radioactive substances • Group III: electronic products and group • Group IV: radioactive substances • The list of group IA hazardous substances provided in the Act).
Minerals and Petroleum Resources Development Act (28 of 2002) (MPRDA)	Department of Mineral Resources (DMR) transitioning to Department of Mineral Resources and Energy (DMRE)	In terms of section 53 of the MPRDA, any person who intends to use the surface of any land in a manner which may be contrary to the objects of the MPRDA or is likely to impede such objects, must apply to the Minister for approval in the prescribed manner. Later in the assessment process, once the layout is fairly certain an application will be made to the Minister to obtain a letter of approval. As per the requirements of the MPRDA, all mining activities, including the extraction of material from borrow pits and quarries, require authorisation from DMR. No mining permits for borrow pits are included in this application, however, should borrow pits be required, the appropriate approvals in terms of the MPRDA would need to be sought from the DMR.
National Environmental Management Act (107 of 1998) (NEMA), as amended	Department of Forestry, Fisheries and the Environment (DFFE)	The National Environmental Management Act 107 of 1998 (NEMA, as amended) provides the framework for environmental decision-making predominantly though the EIA Regulations (GN No. R982 in the Government Gazette of 8 December 2014, as amended) which serve as the instrument through which development decisions can be made. Specifically, for those developments which comprise certain 'listed activities' identified in GN R983, R984 and R985 (as amended), that are considered to have potentially detrimental impacts on the environment. Several listed activities (detailed in Table 4-2 below) will be triggered by each proposed Wind Farm and Environmental Authorisation must therefore be sought as per the requirements of the 2014 EIA Regulations (GN R982, as amended). The Act also sets out various principles that have been adopted in this assessment process e.g., the precautionary principle, duty of care, and polluter pays principle.
National Environmental Management: Air Quality Act (39 of 2004)	Western Cape Government: Department of Environmental Affairs and Development Planning (DEA&DP)	The Act aims to regulate and protect the environment by providing reasonable measures for the prevention of air pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incidental thereto. No activities are envisaged that would require an Atmospheric Emissions License.

Legislation	Relevant Organ of State / Authority	Relevance
		Specific to the project are the regulations pertaining to the control of fugitive noise and dust emissions that may arise from the project activities.
National Environmental Management: Biodiversity Act (10 of 2004) (NEMBA)	Department of Forestry, Fisheries and the Environment (DFFE)	The Act aims for the management of all biodiversity within South Africa. The 2007 Threatened or Protected Species Regulations (GN R150, as amended) provides protection through a permit system as well as through the identification of restricted activities. If required, the relevant permits will be applied for. The Act also provides for duty of care with regards to control of alien species and provides a listing of threatened or protected ecosystems and species in one of the following four categories: critically endangered (CR), endangered (EN), vulnerable (VN), protected (species only), and least threatened (LT). A terrestrial ecologist has been appointed to assess the impact of the proposed development on the natural biodiversity of the area.
National Environmental Management: Waste Act (Act 59 of 2008)	Western Cape Government: Department of Environmental Affairs and Development Planning (DEA&DP) (for general waste), DFFE (for hazardous waste) and Municipalities and their register landfill and Waste Management facilities Northern Cape Government: Department of Environment and Nature Conservation (DENC) (for general waste), DFFE (for hazardous waste) and Municipalities and their register landfill and Waste Management facilities	The Act aims to regulate waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith. The project would not trigger any waste management activities requiring a permit but must manage solid hazardous and domestic waste streams in phases of the project and wastes must be handled, stored and disposed of in a manner that is consistent with the provisions of this legislation.
National Forests Act (84 of 1998), as amended (NFA)	Department of Forestry, Fisheries	There are 47 protected tree species in terms of the NFA, that may not be cut, destroyed, damaged or removed unless a permit has

Legislation	Relevant Organ of State / Authority	Relevance
	and the Environment (DFFE)	been granted by the DAFF. To date no protected tree species have been identified on the project sites.
National Heritage Resources Act (25 of 1999) (NHRA)	Heritage Western Cape (HWC)	In terms of the National Heritage Resources Act (25 of 1999) (NHRA), any person who intends to undertake *"any development … which will change the character of a site exceeding 5,000 m^2 in extent", "the construction of a road…powerline, or pipeline…exceeding 300 m in length"* must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely SAHRA or the relevant provincial heritage agency. In response, to the respective Notifications of Intent to Develop (NIDs), the relevant provincial heritage agency (Heritage Western Cape, HWC) indicated that a full Heritage Impact Assessment (HIA) making specific reference to visual impacts on cultural landscape, archaeological impacts and palaeontological impacts, is required (*Appendix D2: Pre-Application Phase*). Heritage, archaeological and palaeontological assessments have been undertaken to fulfil these requirements. In addition, HWC have been provided opportunities to comment on the HIA for the projects as part of the Pre-Application Phase public participation process (*Appendix D2: Pre-Application Phase*), with further opportunities to be provided as part of the BA Phase (*Appendix D3: BA Phase*).
National Environmental Management: Protected Areas Act (Act 57 of 2003) (NEM:PAA) and the National Protected Areas Expansion Strategy (2016) (NPAES)	Department of Forestry, Fisheries and the Environment (DFFE) and relevant NPAES implementing agencies such as provincial conservation authorities (agencies and government departments) and SANParks	The Act provides for the establishment and management of protected areas in South Africa. It specifies that protected areas in terms of the Act require management plans and sets out the contents thereof. The NPAES for South Africa sets out targets for protected area expansion, identifies possible expansion areas and recommends mechanisms for protected area expansion. The Karoo National Park is the closest protected area to the Southern Cluster Wind Farms, and is ±13.5km to the south. All of the Hoogland project sites are outside the Karoo National Park's potential expansion areas and buffer zones identified in the Park Management Plan (2017-2027).
National Road Traffic Act (93 of 1996) (NRTA)	Western Cape Department of Transport and Public Works Northern Cape Department of Roads and Public Works	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 of the NRTA. Due to the large size of many of the facility's components (e.g., tower segments and blades) they will need to be transported via "abnormal loads". Access to the site will be via existing roads. SANRAL, Northern Cape Department of Roads and Public Works and Western Cape Department of Transport and Public Works have been included as I&APs for the project. A traffic assessment has been undertaken and is included in this Report. If the project

Legislation	Relevant Organ of State / Authority	Relevance
		goes ahead, traffic and transport related permits and approvals will be obtained from all the relevant transport authorities.
National Water Act (36 of 1998) (NWA)	Department of Water and Sanitation (DWS)	Section 21 of the NWA recognises and defines water uses that require the approval of DWS in the form of a General Authorisation or Water Use Licence. There are restrictions on the extent and scale of identified activities, determined through a risk assessment, for which General Authorisations apply. The project may constitute the following water uses in terms of Section 21 of the Act: (a) Abstraction of water from boreholes and rivers or dams; (b) Storage of water (dams or reservoirs); (c) Impeding or diverting flows when construction occurs within a watercourse or within 500m of a wetland; (g) Storage of domestic waste in conservancy tanks; and (i) Alteration of the bed or banks of a watercourse of any activities within 500m of a wetland. The information in the aquatic specialist's report must be used in support of any Water Use Licence Applications (WULA). (*Appendix C10: Aquatic Ecology*)
Subdivision of Agricultural Land Act (70 of 1970) (SALA)	Department of Agriculture, Land Reform and Rural Development (DALRRD)	The purpose of this Act is to control the subdivision and, in connection therewith, the use of agricultural land. Applications should be made to DALRRD to allow for long term leases, the subdivision or rezoning of agricultural land, as well as other prohibited actions in terms of the Act. An application will be submitted to DALRRD for approval should an EA be granted. DALRRD has been included as an I&AP in order to obtain preliminary consent as part of the process.
Western Cape Land Use Planning Act (3 of 2014) (LUPA)	Beaufort West Local Municipality	Should the proposed development go ahead, the appropriate subdivision, rezoning or consent use applications in terms of LUPA must be submitted.
Western Cape Nature Conservation Laws Amendment Act (Act 3 of 2000)	CapeNature	Should the proposed development go ahead, and protected plants species have been identified for removal, the necessary permits for such removal must be obtained from CapeNature.

4.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT 107 OF 1998 (AS AMENDED) (NEMA)

NEMA, as amended, establishes principles, and provides a regulatory framework for decision-making on matters affecting the environment. Section 2 of NEMA sets out a range of environmental principles that are to be applied by all organs of state when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically, and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural, and social interests equitably. The participation of I&APs is stipulated, as is that decisions must consider the interests, needs and values of all I&APs.

Chapter 5 of NEMA provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 specifically provides a framework for granting of environmental authorisations. To give effect to the general objectives of Integrated Environmental Management (IEM), the potential impacts on the environment of listed or specified activities must be considered, investigated, assessed, and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment, management, and communication of the potential impacts.

4.2.1 Environmental Impact Assessment (EIA) Regulations, 2014

The EIA Regulations 2014 (as amended) ('EIA Regulations') promulgated in terms of Chapter 5 of NEMA control certain listed activities. These activities are listed in GN R983 (Listing Notice 1), R984 (Listing Notice 2) and R985 (Listing Notice 3) and are prohibited until an EA has been obtained from the competent authority. Such an EA, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations.

The EIA Regulations set out the procedures and documentation that need to be complied with when applying for an EA. A BA process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notices 1 and/or 3, whereas a full SEIA process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notice 2. As the proposed Wind Farms trigger activities listed in Listing Notices 1, 2 and 3 (see Table 4-2), it is necessary that a full SEIA process is undertaken for the DFFE to consider the application in terms of NEMA.

However, since the Southern Cluster Wind Farm boundary falls entirely within the Beaufort West REDZ (as described in Section 2.1 and shown in Figure 2-3), it qualifies for a fast-tracked BA process in terms of (GN R 144 and 145 of 2021) regardless of the listed activities being triggered.

Note that with reference to Table 4-2, the same project components, and therefore listed activities, apply to both the Hoogland 3 Wind Farm and Hoogland 4 Wind Farm and therefore the table is applicable to both projects.

Table 4-2: NEMA listed activities to be applied for as part of each proposed project

ACTIVITY NO(S):	PROVIDE THE RELEVANT ACTIVITY(IES) AS SET OUT IN THE EIA REGULATIONS, 2014 AS AMENDED.	DESCRIBE THE PORTION OF THE PROPOSED PROJECT TO WHICH THE APPLICABLE LISTED ACTIVITY RELATES.
LISTING NOTICE 1 (GN R 983): BASIC ASSESSMENT ACTIVITY(IES)		
11(i)	The development of facilities or infrastructure for the transmission and distribution of electricity – outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	The proposed site is zoned as Agricultural land which falls outside of an Urban area. The infrastructure will include two 132kV substations (including control, operation, workshop, storage buildings / areas) and high voltage (maximum up to 66kV) underground cables and overhead powerlines. Short sections of 132kV overhead powerlines may also be required.
12(ii)(a)(c)	The development of – (ii) infrastructure or structures with a physical footprint of 100 square metres or more, where such development occurs (a) within a watercourse; and (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	The proposed project will require the placement of linear infrastructure, i.e., internal access roads, underground cables, and internal overhead power lines with a combined physical footprint of more than 100m^2 within a watercourse, or within 32m of a watercourse. Watercourse crossing upgrades will also be required.

ACTIVITY NO(S):	PROVIDE THE RELEVANT ACTIVITY(IES) AS SET OUT IN THE EIA REGULATIONS, 2014 AS AMENDED.	DESCRIBE THE PORTION OF THE PROPOSED PROJECT TO WHICH THE APPLICABLE LISTED ACTIVITY RELATES.
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	Fuel (and lubricants), electrolyte solution and powder cement may be required on site during various stages of the project. The combined capacity of all of the above goods will exceed $80m^3$ but will be below $500m^3$.
19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 10 cubic metres from a watercourse.	The proposed project will require the infilling or depositing of material from a watercourse in excess of $10m^3$ or the dredging, excavation, removal or moving of material in excess of $10m^3$ from a watercourse, as a result of the construction of internal roads, upgrades to existing roads and laying of underground cables.
24(ii)	The development of road with (ii) a road reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 m.	A temporary road corridor of up to 15m will be impacted during the construction phase. This will be rehabilitated after the completion of construction activities to allow for a permanent 6m wide road surface, with side drains on one or both sides where necessary.
28(ii)	Residential, mixed, retail, commercial, industrial, or institutional developments where such land was used for agriculture, game farming, equestrian purposes, or afforestation on or after 01 April 1998 and where such development will (ii) occur outside an urban area, where the total land to be developed is bigger than 1 hectare.	The land is currently used for agriculture however some areas will be converted to commercial / industrial land use to accommodate the wind farm infrastructure. These areas equate to an area of more than 1ha.
48(i)(a)(c)	The expansion of (i) infrastructure or structures where the physical footprint is expanded by 100 square metre or more, (a) within a watercourse and (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	The proposed project will require the upgrading of existing roads within the project area, as well as watercourse crossing upgrades, where such upgrades may take place within watercourses and within 32m from the edge of these watercourses. The total footprint of the upgrades to be undertaken on the existing roads would be in excess of $100m^2$ within a watercourse, or within 32m of a watercourse.
56(i)(ii)	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (i) where the existing reserve is wider than 13, 5 meters; or (ii) where no road reserve exists, where the existing road is wider than 8 metres.	Existing roads will be upgraded where possible. A temporary road corridor up to 15m will be impacted during the construction phase. This will be rehabilitated after the completion of construction activities to allow for a permanent 6 m wide road surface with side drains on one (1) or both sides where necessary. The development will also involve the lengthening of these existing roads, where required, in excess of 1km.

ACTIVITY NO(S):	PROVIDE THE RELEVANT ACTIVITY(IES) AS SET OUT IN THE EIA REGULATIONS, 2014 AS AMENDED.	DESCRIBE THE PORTION OF THE PROPOSED PROJECT TO WHICH THE APPLICABLE LISTED ACTIVITY RELATES.
LISTING NOTICE 2 (GN R 984): ENVIRONMENTAL IMPACT ASSESSMENT ACTIVITY(IES)		
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 proposed wind farm will have a total generating capacity of up to 420 MW.
15	The clearance of an area of 20 hectares or more of indigenous vegetation.	The proposed project will require the clearance of more than 20ha of indigenous vegetation for the placement of infrastructure. Footprints are depicted in Table 2-2.
LISTING NOTICE 3 (GN R 985): BASIC ASSESSMENT ACTIVITY(IES)		
4 (i)(ii)(aa)	The development of a road wider than 4 metres with a reserve less than 13,5 metres in the (i) Western Cape (ii) areas outside urban areas and (aa) areas containing indigenous vegetation.	A temporary road corridor up to 15m will be impacted during the construction phase. This will be rehabilitated after the completion of construction activities to allow for a permanent 6m wide road surface with side drains on one (1) or both sides where necessary. Most of the site in the Western Cape constitutes indigenous vegetation.
12 (i)(ii)	The clearance of an area of 300 square metres or more of indigenous vegetation in the (i) Western Cape (ii) within critical biodiversity areas identified in bioregional plans.	In some areas, development of infrastructure will require the clearance of more than 300m^2 of indigenous vegetation. Although the Western Cape CBAs have not been gazetted, the impact on these features will be assessed as part of the impact assessment process.
14(ii)(a)(c) (i)(i)(ff)	The development of infrastructure or structures with (ii) infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs (a) within a watercourse; and (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse in the (i) Western Cape (i) outside urban areas within (ff) critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	Internal roads, underground cables, and overhead power lines with a total physical footprint in excess of 10m^2 will be required within and adjacent to watercourses and will traverse CBAs in places. Although the Western Cape CBAs have not been gazetted, the impact on these features will be assessed as part of the impact assessment process.
18 (i)(ii)(aa)	The widening of a road by more than 4 metres and the lengthening of a road by more than 1 kilometre in the (i) Western Cape (ii) all areas outside urban areas (aa) areas containing indigenous vegetation.	Existing roads may require widening of up to 6m (up to 15m during construction) and/or lengthening by more than 1km, to accommodate the movement of heavy vehicles and cable trenching activities. This includes a number of watercourse crossing upgrades, on site. Most of the site in the Western Cape constitutes indigenous vegetation.

4.2.2 National Screening Tool

Government Notice 960, gazetted on 05 July 2019, in accordance with regulation 19 and regulation 21 of the NEMA EIA Regulations 2014 (as amended) requires the applicant must submit the report generated by the National Web Based Screening Tool with their EA application to the DFFE from 05 October 2019 and onwards (90 days after the date of notice publication).

These reports are appended in *Appendix E: DFFE Screening Tool Reports.* These reports show, on a high level, the site's sensitivity to wind development based on different environmental themes (including, *inter alia*, terrestrial biodiversity, avifauna, heritage) and outlines assessment protocols for some of these themes that must be applied depending on the environmental theme's sensitivity rating within the development site.

The assessment protocols GN 320 and GN 1150 were gazetted on 20 March 2020 and 30 October 2020, respectively under the notice the "*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*". In short, this notice requires, *inter alia*, that a Site Sensitivity Verification process must be undertaken, which confirms or disputes the findings of each of the environmental themes included in the Screening Tool Report.

Each specialist study has its own Site Sensitivity Verification report included either within the report or in its respective appendices. The relevant protocols that have also been gazetted with this notice have been incorporated into the specialist studies where necessary. Table 1-2 lists the specialists studies undertaken to inform the applications while more detail regarding the specifics is shown in Table 6-2, including which protocols were applicable.

4.3 National Policy Framework Governing Renewable Energy

Several policies have been developed with the aim of diversifying the electricity generation mix for South Africa, these include:

4.3.1 White Paper on the Energy Policy of the Republic of South Africa (December 1998)

The White Paper (national energy policy) set out to ensure that national energy resources will be efficiently used and developed to provide for the needs of the South African people. It was formulated to address the supply and consumption of energy over the following 10 years, however, it remains in place today. The policy laid out a set of Energy Sector Policy Objectives which included: increasing access to affordable energy services, improving energy governance, stimulating economic development, managing energy-related environmental and health impacts and securing supply through diversity. These objectives were formulated to help with the transformation of certain industries and governance systems. Energy policy priorities were also developed to help in achieving these policy objectives. The document identifies the significance of the medium and long-term potential of renewable energy, with the advantages of minimal environmental impacts and higher labour intensities than conventional energy generation technology.

4.3.2 Renewable Energy White Paper (2003)

The Department of Energy (DoE) gazetted its White Paper on Renewable Energy in 2003 and introduced it as a 'policy that envisages a range of measures to bring about integration of renewable energies into the mainstream energy economy.' At that time, the national target was fixed at 10 000GWh (0.8Mtoe) renewable energy contribution to final energy consumption by 2013. The White Paper proposed that this would be produced mainly from biomass, wind, solar and small-scale hydropower. It went on to recommend that this renewable energy should be utilised for power generation and non-electric technologies such as solar water heating and biofuels. Since the White Paper was gazetted, South Africa's primary and secondary energy requirements have remained heavily fossil-fuel dependent, both in terms of indigenous coal production and use, as well as the use of imported oil resources. Alongside this, the projected electricity demand of the country has led the national utility Eskom, to embark upon an intensive build programme to secure South Africa's longer-term energy needs, together with an adequate reserve margin.

4.3.3 National Climate Change Response Policy White Paper (2011)

This White Paper presents the South African Government's vision for an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society. South Africa's response to climate change has two objectives:

- Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity.
- Make a fair contribution to the global effort to stabilise greenhouse gas (GHG) concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.

4.3.4 Integrated Resource Plan (IRP), 2019

Section 1 of 2019 National Integrated Resource Plan (IRP) (Department of Energy, 2019) sets out targets for energy generation from renewable sources. Most of the energy targets set by the IRP will be from renewable sources, of which wind energy makes up the bulk. The IRP envisions an additional 14,400 MW of power being produced from wind, 6,000 MW from photovoltaic solar plants, 3,000 MW from gas, 2,500 MW from hydropower and an additional 1,500 MW from coal by 2030. This translates to approximately 15-18% of the country's energy needs being serviced through wind energy by 2030. The renewable energy targets are procured through a competitive tendering process called the REIPPPP run by DoE. The success of this programme has been internationally recognised, with the United Nations Environmental Programme (UNEP) 2014 Report placing South Africa among the top-10 countries in respect to renewable energy investment.

4.3.5 Renewable Energy Independent Power Producer Procurement Program (REIPPPP)

The renewable energy targets set out in the IRP are procured through a competitive tendering process called the REIPPPP run by DoE. The DoE gazetted the Electricity Regulations (GN R 399 of 4 May 2011) on New Generation Capacity under the Electricity Regulation Act (4 of 2006) (ERA). The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. In terms of the New Generation Regulations, the IRP developed by the DoE sets out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity must be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be executed in accordance with the specified capacities and technologies listed in the IRP.

A decision that additional capacity be provided by an IPP must be made with the concurrence of the Minister of Finance. Once such a decision is made, a procurement process needs to be embarked upon to procure that capacity in a fair, equitable and transparent process.

The New Generation Regulations set out the procurement process. The stages within a bid programme are prescribed as follows:

i. Request for Qualifications
ii. Request for Proposals
iii. Negotiation with the preferred bidder(s).

A successful bidder will be awarded a Power Purchase Agreement (PPA) subject to signature by the Regulator, namely Eskom. The programme has effectively implemented five bid windows, with bid window six having been recently launched in April 2022.

REIPPPP has determined that 6 800MW of capacity is to be generated from renewable energy sources (PV and Wind), 513MW from storage, 3 000MW from gas and 1 500MW from coal. This will enable the development of an additional 11 813MW of power in total from the year 2022. This is in addition to the 2 000MW already being procured under the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) (Gazetted on the 7th of July 2020) (as per media statement released 10 September 2020. The DMRE launched a RMIPPPP on the 23rd of August 2020.

The objective of the RMIPPPP is to fill the current short-term supply gap, alleviate the current electricity supply constraints and reduce the extensive utilisation of diesel-based peaking electrical generators.

It is intended that these projects would, in the first instance, be bid in a forthcoming round of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) but there is a possibility that they could be considered for business-to-business purposes.

4.3.6 Summary

The proposed Wind Farm development thus aligns with South Africa's national policy direction and contributes to the country being able to meet some of its international climate change obligations. These include the targets and commitments for nations that are members or signatories of the United Nations Framework Convention on Climate Change (UNFCCC) and the associated Kyoto Protocol (2005) and a Paris Agreement (2015).

4.4 National, Provincial and Municipal Planning Context

The renewable energy industry has substantial support in the South African planning context, which is detailed in Table 4-3 through the following national and provincial plans. Noting that although the projects are located in the Western Cape, the project's area of influence would extend into the Northern Cape.

Table 4-3: National, Provincial and Municipal Plans and documents

National	National Development Plan (NDP) (2030)
	National Integrated Energy Plan (2016)
	National Integrated Resource Plan for Electricity (2010-2013) and successor, IRP2019
	National Infrastructure Plan (2012)
	The DEA Strategic Environmental Assessment (SEA) for the roll-out of large-scale wind and solar development which identifies strategic Renewable Energy Development Zones (REDZs) Phase 1 (2015) and Phase 2 (2020)
	The DEA National Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) which identifies the strategic Transmission Corridors linked with the REDZ
Provincial	Western Cape Provincial Spatial Development Framework (2014)
	Western Cape Land Use Planning Guidelines for Rural Areas (2019)
	Western Cape Climate Change Mitigation Scenarios for the Energy Sector Report (2015)
	Northern Cape SDF 2012 updated in 2018
Municipal	Central Karoo District Municipality IDP 2021/22
	Central Karoo District Municipality SDF 2014 and draft SDF 2019
	Namakwa District Municipality IDP 2021/22
	Namakwa District Municipality Rural Development Plan 2017
	Pixley ka Seme District Municipality draft IDP 2021–2022
	Beaufort West Municipality IDP 2017-2022 and 2021/22 Review
	Beaufort West Municipality SDF 2013
	Namakwa District Municipality Rural Development Plan 2017
	Karoo Hoogland Local Municipality IDP 2021/22
	Karoo Hoogland Local Municipality SDF 2019
	Ubuntu Local Municipality IDP 2020/21

The assessment of the 'Need and Desirability' of the proposed development considering the strategic planning context of the district and local municipalities is included in Section 5.

5 NEED AND DESIRABILITY

The 'need and desirability' of the project should be evaluated against the strategic context of the development proposal along with the broader societal needs and public interest. According to the DEA Guideline on Need and

Desirability (DEA, 2017), the concept of 'need and desirability' relates to the "nature, scale and location of the development being proposed, as well as the wise use of land". The concept of 'need and desirability' can be explained in terms of the broader meaning of its two components, need primarily referring to 'time', and desirability to 'place'. It is acknowledged that 'need and desirability' are interrelated and the two components should be considered in an integrated and holistic manner. The DEA Guideline (DEA, 2017) further states that the need and desirability of an activity should be evaluated against the principles of "promoting justifiable economic and social development" as well as the principles of "securing ecological sustainable development and use of natural resources" as set out set out in the bill of rights in the Constitution.

The overall need and desirability of the proposed development, in the context of developing renewable energy generation in South Africa and globally, is considered and described below. In summary wind energy is desirable as it:

- Creates a more **sustainable economy** by promoting South Africa's energy policy towards energy diversification.
- **Reduces the demand on scarce resources** such as water by promoting energy generating facilities which are less resource intensive.
- Assists in meeting international commitments to carbon emission targets in line with global climate change commitments.
- **Reduces pollution** by using 'cleaner' energy generating mechanisms and reducing the demand on carbon-based fuels.
- Promotes local economic development by creating jobs and promoting skills development.
- Enhances **energy security** by diversifying generation.

Table 5-1 below aims to provide more detailed responses with regards to the project specific questions raised in the Need and Desirability guidelines of DEA (2017) and the Western Cape Government: Department of Environmental Affairs and Development Planning (DEA&DP) (DEA&DP, 2013). The responses below take into consideration relevant municipal planning documents as well as the outcome of the Screening Phase (Section 6.1) which identified No-Go areas based on environmental and socio-economic considerations.

Noting that although the Southern Cluster falls entirely in the Western Cape, the project's area of influence is not limited entirely to the site. Socio-economic impacts may extend to the Northern Cape given that employment and goods and services may be derived from towns such as Loxton and Fraserberg. Also, traffic will be routed via Loxton and the Northern Cape road network will therefore be used. For the purpose of the Need and Desirability, however, the focus remains on the Western Cape.

Table 5-1: Need (timing) of the proposed project (based on the 2017 DEA and 2013 DEA&DP Guidelines)

NEED	
CONSIDERATION	**RESPONSE / MOTIVATION**
Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority i.e., is the proposed development in line with the projects and programmes identified as priorities within the Integrated Development Plan (IDP)?	Yes. Renewable energy projects have been prioritised in strategies at various municipal scales in the area. At a provincial level, the 2014 Western Cape Provincial Spatial Development Framework (PSDF) (DEA&DP, Western Cape Provincial Spatial Development Framework, 2014) identifies the development of wind energy facilities as one of the focus areas for mitigating climate change impacts. The PSDF recognises the potential positive economic impact, but also mentions that Wind Farms could have negative impacts on scenic resources and that the possible impact needs to be investigated. At a District Municipal level, the 2019 Draft CKDM SDF recognises the Karoo region's potential in terms of wind energy generation and states "*The Karoo should leverage this asset to encourage Independent Power Producers to locate in the region, also making the Central Karoo a well-managed and desirable place to locate, if one is connected to this industry*." Both CKDM IDP Revision 2021/2022 and Namakwa District Municipality (NDM) IDP 2021/2022 recognises investment in wind energy facilities as an opportunity through which significant economic and social benefits can be derived. The NDM has a Rural Development Framework which balances various development priorities including agriculture, tourism and mining. It lists renewable energy generation as one of six development priorities within the area (DRDLR, 2017). Within both the Beaufort West Local Municipality and the Karoo Hoogland Local Municipality, renewable energy (wind and solar) has been identified as key contributors to the economy of each municipality. The relevant SDFs and IDPs for each municipality note the wind resource of the area and supports the development of renewable energy generation facilities as they are major infrastructure projects that would contribute to the economic development.
Should development, or if applicable, expansion of the town/ area concerned in terms of this land use (associated with the activity being applied for) occur at this point in time?	Yes. The 2019 IRP supports a diverse energy mix and has indicated significant growth targets in terms of wind energy developments. The proposed project is in line with the Districts' and Local Municipalities strategic framework that focuses on investment in renewable energy sources, that will stimulate secondary opportunities for economic growth. The proposed project aligns with national policy direction as well as contributing to South Africa being able to meet some of its international climate change obligations, by aligning domestic policy with internationally agreed strategies and standards as those set by the United Nations Framework Convention on Climate Change. At present South Africa's power supply is highly constrained. Any downtime (breakdowns or maintenance) may lead to the need for load shedding which has significant adverse effects for the South African economy and the safety and wellbeing of its citizens. There is an urgent need for new, low carbon energy generation capacity that can be quickly deployed and linked into the national grid (with wind and solar being suitable options). This strategy is evident in the 2019 IRP whereby the largest portion share of new generation capacity between now and 2030 will be wind energy.
Does the community/ area need the activity and the associated land use concerned (is it a societal priority)?	Yes. Both the CKDM 2019 Draft SDF and the NDM 2021/2022 IDP note that such investments are likely to have significant economic spinoffs for the region. The proposed Wind Farms would also directly benefit the local community. Firstly, they would be a source of income to the landowners of the properties on which the wind turbines are located and would improve the economic viability of the landowner's current farming operations (i.e.,

NEED	
CONSIDERATION	**RESPONSE / MOTIVATION**
	mainly low-density grazing). Secondly, they would also create direct and indirect job opportunities (with associated skills development and transfer) for the community (local, district/regional and provincial). Secondary economic benefits may include an increase in service amenities through an increase in contractors and associated demand for accommodation and other services. A percentage of the operational revenue of the project will be utilised to support local socio-economic development initiatives, due to the requirements in this regard of the REIPPPP. The local municipality will play a strong role in guiding how the funds are utilised, thus ensuring that relevant and pressing needs in the community will be addressed.
Are there necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	Access to the site will be from existing roads in the area with new internal roads will be constructed as part of the Wind Farm development. No municipal services will be required at the site, as the project contractor or appointed sub-contractor/s will be responsible for providing the necessary services to the site during the construction and decommissioning phases. Electricity will be supplied to the site via existing Eskom lines (existing 22kV in the area), generators and/or on-site renewable energy installations (e.g., solar panels). Waste produced at the site (construction waste and wastewater collected in the conservancy tanks or chemical toilets) will be collected and taken to an appropriate facility with sufficient capacity to accept the waste, for recycling, re-use, treatment or disposal (as appropriate). This will be done by the contractor or their sub-contractor/s in the construction phase and the owner’s team in operations phase and thus no municipal waste collection will be required at the site. Should any need for other services arise the relevant authority will be communicated with, and the necessary approvals/ agreements obtained before proceeding.
Is this development provided for in the infrastructure planning of the municipality, and if not, what will the implication be on the infrastructure planning of the municipality (priority and placements of services)?	Yes. Although the proposed project is not specifically mentioned in the municipal planning reports, reference is however made to renewable energy generation projects and growing this sector within the CKDM’s and NDM’s jurisdiction. Both Districts recognise that national and provincial governments have prioritised renewable energy developments to supplement the national grid. The economic and social benefits associated with employment of renewable energy development are noted in both District and Local Municipal planning documents and forms part of the Municipal strategies and policies to create a sustainable municipal area. The proposed development will have little bearing on the infrastructure planning of the municipality. Water will be sourced from licenced boreholes and electrical services required for the construction of the project will be via existing Eskom lines (existing 22kV in the area), generators and/or on-site renewable energy installations (e.g., solar panels), and apart from trucking waste to licenced waste sites and sewerage from conservancy tanks / chemical toilets to municipal waste water plants no additional municipal services are required for the proposed development. Should any other municipal services be required, these will be confirmed and agreed with the municipality prior to commencing. Should the municipality be unable

NEED	
CONSIDERATION	**RESPONSE / MOTIVATION**
	to provide the necessary services, then the applicant (or their appointed contractor) will be responsible for providing the necessary services to the site via use of private service providers.
Is this project part of a national programme to address an issue of national concern or importance?	Yes. The establishment of the proposed project would maintain the national DoE mandate to ensure efficient supply of electricity to service the South African economy and society by augmenting electrical supply. Since 2015 South Africa has experienced serious energy constraints which act as a barrier to economic growth. The proposed development will promote the delivery of reliable and sustainable energy to the national grid and therefore contribute to resolving an issue of national concern. Moreover, the project would contribute towards meeting the national energy targets as set by the DoE, of which a share of all new power generation is derived from IPPs. The 2019 Integrated Resource Plan (IRP) developed by the DoE for the 2010 to 2030 period aims to achieve a "balance between an affordable electricity price to support a globally competitive economy, a more sustainable and efficient economy, the creation of local jobs, the demand on scarce resources such as water and the need to meet nationally appropriate emission targets in line with global commitments". The final IRP provides for an additional 20,409 MW of renewable energy in the electricity mix in South Africa by 2030. Furthermore, the National Development Plan (NDP) proposes to create 11 million jobs and grow the economy at an average rate of 5.4% per annum by 2030. In respect of renewable energy, the NDP seeks to ensure that half of the new future generation capacity comes from renewable energy sources. It also recognises the importance of the transition to a low carbon economy. As such the NDP suggests the following modified from (Greening the South African Economy: Scoping the issues, challenges and opportunities, 2016, p. 199): • Supporting carbon budgeting. • Establishing an economy wide price for carbon by 2030 complemented by energy efficiency and demand management interventions. • Support a target of 5 million solar water heaters by 2030. • Implementing zero emission building standards that promote energy efficacy. • Simplifying regulatory regime to encourage renewable energy, regional hydroelectric initiatives and independent power producers (IPPs). • The project will also contribute toward South Africa's transition to low carbon economy and its commitments to under the Paris Agreement.
Do location factors favour this land use (associated with the activity applied for) at this place?	Yes. The site is very favourable due to reliable wind sources. The location favours this land use also based on the ability of wind energy to operate in conjunction with farming (mainly natural grazing) which is the current main land use on site; the support of the landowners concerned; being situated predominantly within the Beaufort West REDZ whilst also being situated away from the Karoo National Park and outside its proposed buffers and expansion areas; as well as various economic considerations which include the feasibility of the project in terms of financial and technical perspectives. However, the changes in the visual (scenic) environment could also impact the local tourism industry which is an important contributor to the economy in this area. Visual and socio-economic specialist assessments have considered the impact to the tourism industry (refer to Section 7.8 and 7.14) and have found the impact to be of Medium to Low (negative) significance.

NEED	
CONSIDERATION	**RESPONSE / MOTIVATION**
	The ecological sensitivity of the site has been considered in detail through a screening and iterative design process detailed in Section 6.1 of this report and various site assessments. The environmental Screening Phase investigated the environmental sensitivities of the site and the possible impact on the receiving environment because of the proposed development. This screening process allowed for the design of an optimised, site specific, Wind Farm layout which can be assessed in the formal BA process. Unacceptable locations within the site have been identified through these assessments and the layout determined have been informed by the findings. Refer to Section 7 for a description of the baseline environment and potential impacts as identified by the various specialists.
Considering the socio-economic 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? Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programmes?	Yes. According to the Socio-economic Specialist Study (see Section7.14 and *Appendix C: Specialist Reports*, the proposed project would have positive impacts related to GDP growth, limited local and preferential procurement (BBBEE, etc.), enterprise development, the creation of employment and skills development opportunities, which is compatible with the economic development vision of the District and Local municipalities. Renewable energy developments would create direct and indirect job opportunities (with associated skills development and transfer) for the community (local, district/regional and provincial). The proposed development would thus create employment (temporary and full-time) and business opportunities in addition to skills development and on-site training.
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?	The potential for the proposed development to negatively impact on the natural, social and economic environments have been recognised and a number of investigative steps have been identified to ensure a good understanding of these potential impacts throughout the project's life cycle. The first step involved a screening exercise undertaken with specialists which resulted in a proposed layout which minimised impact to sensitive receptors as far as possible. The outcome of the formal BA process has culminated in an EMPr that is applicable to the pre-construction, construction, operational and decommissioning phases of the proposed projects (see Section 8) to ensure that an environmentally and socio-economically sustainable approach is implemented. The EMPr will be managed and implemented as a living document, to allow the projects to adapt to and accommodate unforeseen environmental and/or social and/or political and/or economic changes and needs. For more information on the identified impacts please refer to Section 7.
What measures were taken to ensure the participation of all interested and affected parties? What measures were taken to 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	The regulated BA process is stringently bound by legislative timeframes in terms of NEMA and thus provide limited opportunity to incorporate and respond to issues raised by I&APs. To identify possible community issues and concerns early in the process, key stakeholders were identified and engaged (authorities, organs of state and affected and adjacent landowners) during the Screening Phase. The approach to stakeholder engagement is in Section 6.2. All stakeholder engagement related documents and proofs are included in Appendix D.

<table>
<tr><th colspan="2">NEED</th></tr>
<tr><th>CONSIDERATION</th><th>RESPONSE / MOTIVATION</th></tr>
<tr><td>knowledge, including traditional and ordinary knowledge?</td><td>It is important to note that Red Cap have followed a similar process for their adjacent authorised Nuweveld Wind Farms and Grid connections projects, and as such many of the stakeholders for the Hoogland Wind Farms were involved in the stakeholder engagement process for the Nuweveld Wind Farm applications and are familiar with Red Cap's approach and process.</td></tr>
<tr><td>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.</td><td>Please refer to Section 7 for information on anticipated cumulative impacts which was assessed in accordance with the methodology outlined in Section 6.4. The project is situated away from highly populated areas so direct impacts are minimal. Employing between 160 and 200 people in the construction phase and 40-60 in the operational phase of the project is likely to have a medium (positive) impact on the local socio-economic environment. The socio-economic specialist identified the following impacts (Van Zyl & Kinghorn, 2022):
• Positive impacts on regional employment and household income associated with project activities and expenditure in all phases.
• Negative impacts on surrounding landowners and communities arising from construction, increased crime, poaching, damage to infrastructure, litter, fire risk, dust, noise, safety concerns, deterioration of roads, etc.
• Negative impacts on local communities associated with the influx of job seekers in the construction phase through increased alcohol and drug use, increased HIV and TB risks, prostitution and unwanted pregnancies, etc.
• Negative impacts on tourism associated with visual impacts of the Wind Farm and increased traffic and disturbance in the construction phase.</td></tr>
<tr><td>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 for the proposed development alternative?)</td><td>Yes. As described above, the provincial, district and local strategic planning documents have identified the socio-economic and environmental benefits of the renewable energy developments and promotes investment in these projects for growth and development. The proposed use of the natural resources of the area is therefore in line with these planning documents.

Project infrastructure will be located on agricultural land with low productivity and according to the agricultural specialist such use would not negatively impact existing agricultural activities as the total footprint of the facility excludes agricultural land use or impacts agricultural land. The specialist states that the Wind Farm infrastructure would have an added benefit to the local farmers by providing an alternative income source that would improve the economic viability of existing farming operations.

Please also refer to Section 7.3 and 7.14 for further detail on potential impacts and recommendations with regards to anticipated agricultural and socio-economic impacts.</td></tr>
<tr><td>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)?</td><td>Stakeholder engagement is as an important aspect of sustainable development to ensure that adverse environmental impacts are appropriately addressed and not result in discriminating distribution of these impacts. For this reason, the public participation process has been expanded beyond what is legally required and to enable the project team to better incorporate and communicate the views of the I&APs into the proposed development. Please refer to Section 6.2 and Appendix D: Public Participation which details the public engagement process.

National government places significant emphasis on the local economic development initiatives which renewable energy project developers must commit to in their bids. The Hoogland projects will be such projects. This should ensure that only projects which have made significant commitments to this aspect will be selected as preferred bidders in the REIPPPP. The DoE scorecard includes aspects such as job creation, local content, ownership, management control, preferential procurement, enterprise development and socio-economic development. Among other things, the scorecard should ensure that project developers pay attention to (1) Setting targets for how much local labour should be used based on the needs</td></tr>
</table>

NEED	
CONSIDERATION	**RESPONSE / MOTIVATION**
	of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. (2) Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. (3) Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. The following provisional mitigations are proposed in this regard: • The applicant must establish a communications committee early in the project to ensure regular feedback from stakeholders. • Community development should be guided by a community needs analysis, drawn up by a third party and based on local socio-economic conditions, a review of planning documents such as the IDP, and discussions with local government and community representatives. Interventions should be planned in collaboration with other energy developers in the area where relevant. • Close liaison with local municipal managers, local councillors and other stakeholders involved in socio-economic development is required to ensure that any projects are integrated into wider socio-economic development strategies and plans.
What measures were taken to 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?	To date meetings have been undertaken with key stakeholders, authorities and some of the affected landowners to inform them of the proposed development. Refer to Section 6.1 and *Appendix D: Public Participation* which details the PPP undertaken to date, as well as any activities still to be undertaken.
How was a risk-averse and cautious approach applied in terms of socio-economic impacts?	Screening was undertaken at the pre-feasibility stage to allow environmental and social impacts to be considered early in the project lifecycle and evaluated in an integrated manner with the engineering design considerations. The screening process was specifically based on the identification and mapping of No-Go areas of the site to avoid all environmental and socio-economic sensitive areas and considered both impacts from turbines and other infrastructure (internal overhead power lines, roads, underground cables and buildings) to inform separate No-Go layers (see Section 9). Further avoidance recommendations proposed by the specialists during the Pre-Application Phase have been taken into account to refine the layout for the BA Phase. The overall approach has therefore been avoidance as advocated for in the mitigation hierarchy in NEMA, which is a risk averse approach. For example, the proposed wind turbines have not been in visual, cultural (incl. sense of place) and noise sensitive areas, nor in crop areas which are socio-economically valuable. Furthermore, the project is sited in a remote rural area with a very low and dispersed population. The study to date has shown that the project is viable and that there are no fatal flaws that should prevent the project moving forward.

Table 5-2: Desirability (placing) of the proposed project (based on the 2017 DEA guideline and 2013 DEA&DP Guideline).

DESIRABILITY	
CONSIDERATIONS	**RESPONSE / MOTIVATION**
Is the development the best practicable environmental option (BPEO) for this land/ site?	The land use within the project site boundary is low density livestock farming (arid rangeland grazing) which, according to the agricultural specialist, will be able to successfully co-exist with the proposed Wind Farms. The specialist also stated that the Wind Farm infrastructure would have benefit to the local farmers by providing an alternative income source that would improve the economic viability of existing farming operations. During the Screening and Initial Design Phase a screening exercise with the project specialists was undertaken and No-Go areas were mapped and incorporated in the proposed layout. Refer to Section 6.1.1 for further detail. Some further No-Go areas were identified during the Pre-Application BA Phase (refer to Section 6.1.3). The layout was therefore updated accordingly and is being assessed and made available for comment as part of the BA Phase (current phase). As explained above, the overall approach has therefore been avoidance as advocated for in the mitigation hierarchy in NEMA, which would ensure the least cost to the environment. As an example, habitat for threatened species such as the Riverine Rabbit habitat and Verreaux's Eagle has been avoided in the various design iterations as the project seeks to avoid and minimise impacts to these species and their potential habitat.
How will this development use and/or impact on non-renewable and renewable natural resources and the ecosystem of which they are part?	The Screening process was undertaken in support of the mitigation hierarchy advocated in NEMA to avoid and minimise impacts as the most preferred approach to mitigation. This process and the outputs were collaborative and involved a large multi-disciplinary team of environmental specialists, the EAP, the project engineers and Red Cap as the developer, most of which have extensive knowledge of the area and experience in Wind Farm assessments generally. The results from this exercise (i.e., the preferred project layout as documented in Section 6.1) have guided the development of the layout assessed within this report to further the effect of potential negative impacts and enhance positive impacts to ensure an environmentally sensitive and sustainable project is taken forward.
Would the approval of this application compromise the integrity of the existing approved Municipal IDP and SDF as agreed to by the relevant authorities?	No. The proposed development aligns with the Municipal IDPs and SDFs which recognises the need for development of renewable energy and pursues economic development through renewable alternatives and promotion of energy efficiency. A focus group meeting was also undertaken with key stakeholders, including the municipalities, to involve them with the planning process and to better incorporate and communicate the stakeholder's views into the proposed development, as documented in Section 6.2. This was in addition to the public participation process undertaken as part of the Pre-Application and BA Phases (see Section 6.2 and *Appendix D: Public Participation*). No fatal flaws or issues compromising IDPs and SDFs have been raised by municipal representatives to date.
Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g., as defined in Environmental Management Framework (EMF), and if so, can it be justified in terms of sustainability considerations?	No. Currently there is no EMF adopted by the area. However, the Western Cape Biodiversity Spatial Plan (WCBSP), which sets out the land use objectives spatially, has been considered in the listed activities of the project. Sensitive areas such as CBAs as identified in the WCBSP have been largely avoided in this regard (Section 7.4).

DESIRABILITY	
CONSIDERATIONS	**RESPONSE / MOTIVATION**
How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/ natural environment)?	A screening exercise and detailed specialist assessments have been undertaken to identify sensitive No-Go areas and avoid and/or minimise development (within acceptable limits) within these areas. Information on potential impacts related to natural and cultural areas are available in Section 7 and have been assessed according to the methodology contained in Sections 6.2.5 and 6.4.
How will the development impact on people's health and wellbeing (e.g., in terms of noise, odours, visual character and sense of place, etc.)?	Preliminary impacts were identified during the preceding assessment phases and the results have been incorporated in the current proposed Wind Farm layout plan. The revised turbine layout has helped to reduce the siting of the proposed wind turbines in environmental, visual, cultural (incl. sense of place) and noise sensitive areas. The direct impacts associated with the wind energy facility are not deemed to be significant as the project is sited in a remote rural area with a very low and dispersed population. The socio-economic specialist has considered impacts relating to the influx of workers into surrounding towns and communities during construction phase and the risks for local communities including increases in drug and alcohol use, unwanted pregnancies, prostitution, crime, HIV and TB risks, etc. The specialist is of the opinion that these will be of Low - Medium (negative) significance. Baseline environmental information and anticipated impacts are included in Section 7.14. These impacts and mitigation measures have been assessed and refined for the BA Phase in accordance with the methodology proposed in Section 6.1.3.
How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage?	Visual, palaeontological and archaeological specialists were appointed to undertake specialist investigations that would contribute towards the Screening and BA phases of the project. No-Go areas were identified during the Screening Phase and have been avoided or minimised (within acceptable limits) in the layout of the proposed infrastructure, as presented in this BA Report (Figure 9-1 - Figure 9-8). Mitigation has been identified where avoidance has not been possible. The aspects considered in the heritage impact assessment includes: archaeology, palaeontology, graves, built environment and the cultural landscape. For more detail on potential impacts related to heritage resources, please refer to Section7.8, 7.9, 7.10.
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 other planned developments in the area	Terrestrial ecology and aquatic assessments have been completed and are in *Appendix C: Specialist Reports*, as well as summarised in Sections 7.4 and 7.7 respectively. In terms of impact to terrestrial and aquatic ecology, none of the impacts or cumulative impacts have been found to be unacceptable or considered to be a fatal flaw to the development.
Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area	The approach developed for this project is based on the precautionary principles of NEMA and has aimed to avoid impacts as the primary form of mitigation, as identified through spatial plans, specialist desktop and site-based research, and stakeholder engagement. Specialist studies have also applied acceptable thresholds where relevant to their discipline where avoidance is not possible in certain circumstances. The residual impacts were therefore assessed as part of the Pre-Application phase and have also been further interrogated by specialists during the BA phase of the project (current phase), as a result of the layout changes that occurred. To minimise, manage and remedy the potential

DESIRABILITY	
CONSIDERATIONS	**RESPONSE / MOTIVATION**
	negative residual impacts, and enhance the positive impacts, identified mitigation measures are proposed by specialists and have been included in an EMPr (*Appendix F: Environmental Management Programmes*). The project area is largely an open rural setting with low levels of human impact. Sheep farming is the predominate land use and this will continue alongside the Wind Farms. As a result of this, the site does provide habitat for numerous fauna and serves an ecological function. Most of this function would remain largely unaffected by the Wind Farms with the notable exceptions pertaining to Avifauna and potentially the endangered Riverine Rabbit and Karoo Dwarf Tortoise habitat. As per the Site Verification (SSV) assessment for the Karoo Dwarf Tortoise, the occurrence of Karoo Dwarf Tortoise has been confirmed from within the Hoogland Southern Cluster of wind farms. Comprehensive information about the population demographics of Karoo Dwarf Tortoises in this area is not available. Based on the scarcity of historic and recent records, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises. Accordingly, the impacts on Karoo Dwarf Tortoises in the context of the proposed Hoogland Southern Cluster are projected to be LOW after mitigation. As a result, and with the application of the recommended mitigation and avoidance measures, the impacts associated with the Hoogland Southern Cluster of wind farms are considered acceptable. While the Hoogland 3 and 4 Wind Farm sites are within the Riverine Rabbit range and includes habitat that appears is suitable for Riverine Rabbit, the potentially suitable Riverine Rabbit Habitat identified by the specialist has been deemed as No-Go areas and set aside from development of turbines. Although Riverine Rabbits and associated habitat have been confirmed present within the Hoogland 3 Wind Farm, habitat loss within these areas would be minimal and the buffers implemented around these areas are seen to be sufficient to minimise long-term impacts on this species. As a result, long-term impacts associated with the Hoogland 3 Wind Farm on the Riverine Rabbit are likely to be low. Consequently, the development of the Hoogland 3 Wind Farm is considered acceptable with the implementation of the suggested avoidance and monitoring as indicated. Riverine Rabbit was not detected within the Hoogland 4 study area. All sightings are within the typical floodplain environment associated with this species, confirming the high fidelity for specific riparian communities associated with the larger drainage systems of the area. Such areas were not observed within the Hoogland 4 Wind Farm area, and the site is considered low sensitivity for this species A recommendation has been made that a Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. The details of the monitoring programme should be developed in collaboration with the EWT Dryland Programme and should at minimum include certain components and outcomes detailed by the specialist. The findings from the camera trapping have been presented in this BA Report and have indicated forconstruction medium negative impact that can be reduced to low with the proposed mitigation, while operation remains /low negative is with the proposed mitigation. Please refer to *Appendix C: Specialist Reports* for the full study and the summary in Section 7.4). The other ecological aspect relates to avifauna and particularly the presence of raptor species (namely Martial and Verreaux's eagles) which may be susceptible to the harm by wind turbines and to a lesser extent other project infrastructure. Potential nesting sites on and around the site have been identified and buffered with setback distances depending on the bird species in question as well as buffering of other habitat such as watercourses, dams and escarpments. This reduces the magnitude of the impact and its likely significance to medium levels, in the opinion of the avifaunal specialist. In addition, a modelling exercise has been undertaken to inform the risk of collision of the Verreaux’s eagle with the proposed

DESIRABILITY	
CONSIDERATIONS	**RESPONSE / MOTIVATION**
	turbines. The outcomes of the modelling exercise have been incorporated into the layout of the Wind Farms. This, as with any Wind Farm, remains an area where ongoing monitoring is required to manage the impact. In this regard, mortality thresholds will be applied, and an adaptive management approach has been recommended. Refer to the Avifauna specialist report in *Appendix C9: Avifauna.* A summary is included in Section 7.6.

6 BA APPROACH AND PROCESS

6.1 APPROACH AND PROCESS

As the EA process ascribes stringent timeframes once the Application for Environmental Authorisation has been submitted, the approach has been to allow for as much detailed investigation and participation of I&APs upfront as possible. Therefore, a lengthy and detailed Screening and Iterative Design Phase has been provided for in the process (Figure 6-1).

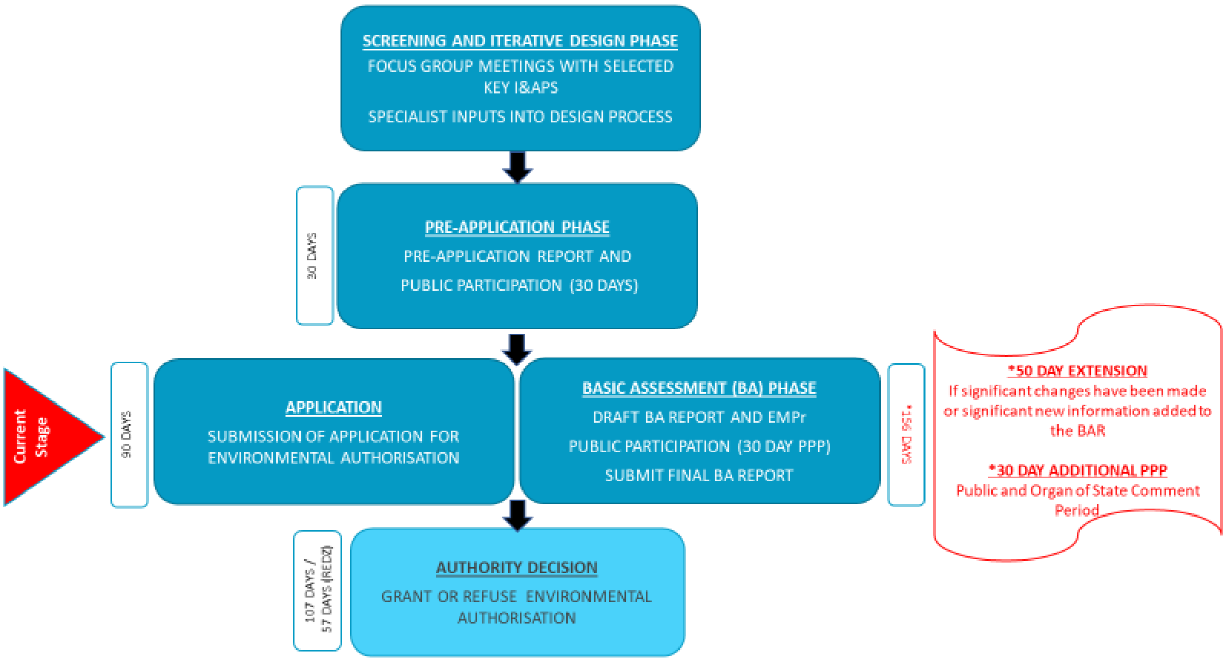


Figure 6-1: Environmental assessment process

6.1.1 Screening and Iterative Design Phase

6.1.1.1 Rationale

A summary of the Screening Phase and Iterative Design Approach and how it forms part of the Environmental Process is provided in this section. Red Cap have proactively sought to identify the best practical environmental option possible for the identified project site through a rigorous, iterative and multi-disciplinary process, that drew on the considerable body of existing knowledge and specialist expertise relating to the study area. This approach aligns with the NEMA principles advocating for sustainable development through the adoption of the mitigation hierarchy as set out in section 2 of NEMA and depicted in Figure 6-2. Through application of this hierarchy, 'avoidance' of environmental impacts was then the basis for the approach to the process.

Figure 6-2: Mitigation hierarchy

6.1.1.2 Process

The detailed screening process for the Hoogland Wind Farms was specifically based on identification and mapping of No-Go areas of the site in order to avoid all environmental, socio-economic and technical sensitive areas, and considered both impacts from turbines and other infrastructure (internal overhead power lines, roads and underground cables and buildings) as separate No-Go layers. This allowed all suitable areas for turbine locations, and associated infrastructure within the site to be identified, which would then be geographically split into four separate potential Wind Farm sites and layouts, two of which comprise the Northern Cluster: Hoogland 1 Wind Farm and Hoogland 2 Wind Farm projects and two of which comprise the Southern Cluster: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm projects. These layouts are the basis for the Wind Farms that are taken forward for environmental assessment.

Through the application of environmental sensitivities and associated developmental No-Go areas that should be avoided by a developer, the screening assessment allows the most environmentally favourable alternative to be identified, in the form of an environmentally preferred site layout. It can also guide selection of mitigation measures in certain areas. Thus, the outcome of the Screening process is the most feasible and reasonable alternative (also known as the preferred alternative) to be considered for detailed assessment in the BA process.

It is the intention that the detailed description of the Screening process presented in this section provides the motivation for not considering alternatives in the environmental assessment process as it documents the process through which environmental sensitivities were avoided at an early stage in the project lifecycle. Through this process the most environmentally and socio-economically favourable site layout was thus identified for assessment in this environmental assessment process.

The approach was as follows:

1. Red Cap undertook preliminary turbine placement on an initial larger site to test viability of the project and 493 potential turbine locations were identified across the consolidated site. Refer toFigure 3-1.
2. A detailed nest survey was then undertaken as well as VERA modelling (November 2020), Red Cap also engaged further with EWT regarding the potential Riverine Rabbit habitat in and around the site.
3. Using this information, the turbine layout was then further revised to **451** potential turbine locations. However, a decision was made to split the site into a Northern and Southern Wind Farm Cluster to avoid a large corridor along the Sak River and the various eagle nests and this layout of **429** potential turbine locations was circulated to specialists prior to their commencing their screening studies in

March 2020. In the interim a Martial Eagle nest was discovered in the north west area eliminating a number of properties and turbines from the Northern Cluster, resulting in **367** potential turbine locations.

4. Selected specialists (aquatic, terrestrial ecology, bird, bat, heritage, palaeontology and visual) undertook a desktop-based study, engaging with the project information provided by Red Cap and documenting the environmental baseline of the study site from available literature and data sources, including environmental assessment work already done in the area such as for the Nuweveld Wind Farms. Some specialists undertook site visits to inform their studies especially aquatic specialist, whose layers were used for reference by other specialists.
5. Specialists identified likely No-Go, high-sensitive, medium-sensitive and low-sensitive areas of the site, for both the turbine layout, and the other associated infrastructure types (internal overhead power lines, roads underground cables and buildings). These were based on the categories defined in Table 6-1 below.
6. SLR undertook initial targeted stakeholder engagement with landowners, adjacent landowners and local authorities who were invited to a focus group meeting to discuss the project and raise potential issues or concerns. The EAP and/or Red Cap further engaged with key stakeholders one-on-one, including DEA&DP, CapeNature, DENC, EWT, Birdlife SA and SANParks.
7. Noise and shadow flicker modelling was also performed to inform the design.
8. A one-week multi-disciplinary site visit including workshops was undertaken in May 2021 with relevant specialists to interrogate and refine the identified impacts and sensitivities, collaborate and build consensus between the specialists. The workshop involved the following:
    a. Each specialist reported on their findings which had been informed by further site visits.
    b. Specialists also reported on the criteria that they used to identify and establish their specialist specific No-Go areas and the high-sensitive, medium-sensitive and low-sensitive developable areas.
    c. The synergies and overlaps between the specialists' sensitive areas/features were presented, discussed and refined in the workshop.
    d. The preliminary turbine and roads layout was presented for discussion specifically where conflicts with sensitive areas may exist. Input was provided by the Wind Farm engineer to describe the site with regards to wind regime and which parts of the site were most suitable for turbine locations.
9. Following the workshop, specialists provided refined spatial datasets showing their revised No-Go, high-sensitive, medium-sensitive and low-sensitive developable areas, for both the turbine layout, and the other associated infrastructure (internal overhead power lines, roads, underground cables and buildings). The Consolidated No-Go Map for each infrastructure type was then revised based on all the updated information.
10. On 25 July 2021, during the third avifauna monitoring site visit, a new Martial Eagle nest was discovered to the east of the Southern Cluster within the associated Grid Connection Corridor. The respective No-Go Maps were revised to take the nest buffers into account. The Martial Eagle nest buffer for turbine positions is 6 km in extent and therefore resulted in the sterilisation of a fairly substantial area of the site.
11. Throughout the process, input was also received from landowners and adjoining landowners and their input regarding constraints was also used to inform the potential turbine locations.
12. The preliminary project turbine layout was iteratively designed as a product of all the steps identified above. Through application of the Consolidated No-Go Maps, 176 potential turbine locations were identified in the Northern Cluster and 172 in the Southern Cluster (total of **348** potential turbine locations) (see Figure 3-3). The optimal turbine layout aimed to maximise the energy outputs after

taking account of the No-Go layers and therefore took into account internal wake effect as well as wind modelling of the site. The turbines were then also arranged into four feasible Wind Farms.

13. The roads design was developed on the basis of the latest turbine positions as well as the Consolidated No-Go Map for roads and was refined iteratively with inputs from certain specialists including ecology, aquatic, heritage, visual.
14. Following this, the internal overhead power lines and buildings Consolidated No-Go Maps were used to identify possible areas for the Wind Farm overhead power lines, as well as substations, battery sites and camps. Collectively the layout of all of this infrastructure formed the basis of the Pre-Application assessment. Refer to Section 6.1.2 for the process undertaken during the Pre-Application Phase, after which the layout was further refined.

Table 6-1: Sensitivity categories used during the screening and constraints process

No-Go	Areas or features that are considered of such sensitivity or importance that any adverse effects upon them may be regarded as a fatal flaw.
High	Areas or features that are considered to have high sensitivity. Development in these areas must be limited and must remain within any acceptable limits of change as determined by the specialist. Development should also comply with any other restrictions or mitigation measures identified by the specialist.
Medium	Medium sensitivity areas are considered to be developable; however, the nature of the effects should remain within any acceptable limits of change as determined by the specialist. Development should also comply with any other restrictions or mitigation measures identified by the specialist.
Low	Low sensitivity areas that are considered to be developable, however, specialists may still wish to define acceptable limits of change should they deem this necessary.

6.1.1.3 Outputs

Resulting from the screening process, as discussed above, was a 348 proposed turbine layout which emerged into 176 potential turbine locations in the Northern Cluster and 172 potential turbine locations in the Southern Cluster. Each cluster has been divided into two separate Wind Farms.

The Southern Cluster layout was divided into two separate Wind Farms namely: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm with potential turbine location numbers to be assessed as follows:

- Hoogland 3 Wind Farm 98 turbines
- Hoogland 4 Wind Farm 74 turbines

The Screening phase Consolidated No-Go maps for each of the infrastructure types, namely: turbines; internal overhead powerlines, roads and underground cables; and buildings were developed. The No-Go layer is a combination of all the No-Go areas as identified by the various specialists, without differentiating between the specialist fields. Every No-Go area, regardless of the discipline that assigned the status, is treated with equal gravitas.

This phase also involved a Pre-Application meeting with the DFFE on 29 July 2021 and subsequent request to combine applications for EA as per Regulation 11 of the EIA Regulations (GN R. 982 2014). Refer to *Appendix D: Public Participation* for the correspondence. This information was used in refining the Terms of Reference (ToR) for the specialist studies presented in the Pre-Application Report.

The outcome of this Screening phase was a proposed site layout for the project which could be assessed by the team of specialists for the inclusion in the Pre-Application Report. The Pre-Application Phase layout is depicted in the layout maps provided in *Appendix B: Maps*.

6.1.2 Pre-Application Phase

The potential turbine location layout for the Hoogland Southern Wind Farm Cluster projects identified through the Screening and Iterative Design Phase formed the basis for the Pre-application Report.

The proposed site layout that was identified during the Screening and Iterative Design Phases as described above, was the basis for the Pre-Application Report. The purpose of the Pre-application Phase was to provide additional opportunity to engage with stakeholders and to receive inputs and comments regarding the proposed developments outside of the formal BA Process. It also allowed time to address, or provide clarifications, relating to any issues or concerns that may arise as a result of the stakeholder engagement (see *Appendix D2: Pre-Application Phase*).

Although the Pre-Application Phase is not considered to be within the official legislated process and timeframes, the exercise and reporting was undertaken to align with the requirements of Appendix 1 of the 2014 EIA Regulations (GN R982 of 2014, as amended).

Further to the above, specialists were requested to assess the impacts of the proposed Pre-application site layout to meet the requirements of Appendix 6 (Contents of Specialist Reports) of GN R982 of 2014 as amended, including specialist protocols outlined in GN 320 (March 2020) and GN 1150 (October 2020). This allowed for a full investigation of potential environmental impacts early in the process and included detailed mitigation measures that could be explored iteratively at an early stage to ensure that where impacts cannot be 'avoided', they can be mitigated to 'minimise' or 'reduce' impacts to acceptable levels.

As mentioned above, the Southern Cluster Wind Farms included the following number of potential turbine locations during the Pre-Application Phase:

- Hoogland 3 Wind Farm – 98 turbines
- Hoogland 4 Wind Farm – 74 turbines

As an outcome of the Pre-Application specialist assessments, the specialists all provided revised sensitivity maps including No-Go areas to avoid which were documented in the Pre-Application Report. Some specialists identified additional features/areas that required avoidance by the development. The recommended changes to avoid such features/areas have been implemented in the design of the layouts for the BA Phase (current phase – see Section 6.1.3) and these are the basis for the Sensitivity maps shown in Section9.

The Pre-Application Phase involved the circulation of a Pre-Application Report for a 30-day public comment period, from 18 March 2022. The intention was to facilitate as much engagement with I&APs as possible (see *Appendix D2: Pre-Application Phase*), so that the layout could be well informed by I&AP's concerns and input before entering the legislated NEMA process.

One of the major outcomes of this Pre-Application consultation was the comments that were received from SANParks and the site visit and engagements that followed between the Applicant and SANParks regarding their concerns about the impacts on the Karoo National Park. These are summarised in Table 6-4 and included in *Appendix D2: Pre-Application Phase.* The Applicant had already intended to reduce the extent of the Southern Wind Farm cluster to exclude the Northern Cape and associated sensitivities, as well as the medium VERA sensitivity areas; however following the consultations with SANParks it was decided to drop a further 21 turbines to ensure the Southern Cluster was setback from the Park by at least 13.5km, over and above other mitigation documented in *Appendix D2: Pre-Application Phase*.

6.1.3 BA Phase

As explained previously, the Southern Wind Farms will qualify for a fast-tracked BA process in terms of GN 142 of 2021, since they are located within a REDZ (Figure 2-3).

The objective of the BA process, as set out in Appendix 1(1) of the 2014 EIA Regulations (GN R982 of 2014, as amended) is summarised as follows:

- Identify the relevant policies and legislation and determine compliance with these;
- Identify the alternatives considered;
- Describe the need and desirability of the proposed alternatives;
- Identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all alternatives;
- Agree on the level of assessment to be undertaken, including the methodology, expertise and consultation to determine the impacts on the preferred site and to inform the location of the development footprint within the site; and
- Identify suitable mitigation measures.

The official BA Phase and circulation of the Draft BA Report (this report) for public comment has commenced simultaneously with the submission of the Application for Environmental Authorisation to the DFFE, as indicated in Figure 6-1. The Draft BA Report is being made available to all registered I&APs, including the public and key stakeholders (including authorities) for a 30-day review and comment period, **from 15 August 2022 – 14 September 2022** (excluding public holidays). See Section 6.2 for more details.

Following the official 30-day public comment period for the Draft BA, the EAP, along with the specialist team will undertake the following tasks related to updating of the report, the outcome of which will be documented in the Final BA Report:

- Specialist reporting, including updates based on new information and/or refinement of the site layout due to PPP inputs during the Draft BA Phase; as well as any new fieldwork, if required.
- EAP reporting including:
    - Updating of the Comments and Responses Table;
    - Updating of any baseline environment information and impacts assessment by specialists; and
    - Preparation of a Final BA Report.

As stipulated in Regulation 19 and 20 of the 2014 EIA Regulations (GN R982, as amended), the Final BA Report will be submitted to DFFE for review within the legislated 90 days after the receipt of the Application Form. Thereafter DFFE must, within 57 days of receipt of the Final BA Report, consider it, and in writing –

(a) grant environmental authorisation in respect of all or part of the activity applied for;or EIA; or

(b) Refuse environmental authorisation if;

6.1.3.1 Environmental Aspects Assessed

This BA Report is based on a number of specialist studies, most of which were identified in the Screening Tool, and which comply with the content requirements for specialist reports applicable as follows:

- **Site Sensitivity Verification Report** in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020 (all projects);
- Assessment Report:
    a. **Specialist Assessment Report / Compliance Statement** as applicable in terms of GN 320 of 20 March 2020 and/or GN 1150 of 30 October 2020 (where applicable the Species Environmental Assessment Guideline may apply[8]); or
    b. Compliance with **Appendix 6** of the EIA Regulations, 2014 (as amended) if no protocols apply to the discipline.

8 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 2.1 2021.

Table 6-2 below is based on the findings of the DFFE Screening Tool (*Appendix E: DFFE Screening Tool Reports*) and indicates the level of specialist inputs required. Noting the following:

- The terrestrial ecologist has prepared a standalone Terrestrial Biodiversity Report (*Appendix C4: Terrestrial Ecology*). The Plant Compliance Statement and SSVR have been prepared and the findings / results also presented in the Terrestrial Ecology section of this BA Report (as part of Section 7.4).
- Riverine Rabbit (*Bunolagus monticularis*) and Karoo dwarf tortoise (*Chersobius boulengeri*) species assessments have been prepared and the findings / results have been presented in this BA Report (as part of Section 7.4).
- The Avifauna theme also includes avifauna species from the Animal theme as identified in the Screening Tool and is included in Section 7.6.
- The Aviation theme is of low sensitivity and according to the protocol there is no requirement for a site with a low sensitivity rating. However, engagements with CAA have been included in the PPP, and the CAA will also undertake their own assessment as part of the REIPPPP bidding process.
- RFI impacts have been addressed through engagement with the respective authority SARAO who has undertaken a preliminary risk assessment in this regard and found that the project presents a medium risk of interference with the SKA telescope. They do not require any further studies and have stipulated "*that if the EA is granted, a detailed EMC Control Plan should be developed by the renewable energy facility developer and that the development will not resume prior to complying with the AGA Act.*" (see *Appendix D2: Pre-Application Phase*). This has been included as a requirement in the EMPr (*Appendix F: Environmental Management Programmes*).
- The Defense theme is rated as low sensitivity and no assessment is required. The South African Army / Department of Defense have, however, been provided with an opportunity to review and comment on the projects as part of the Pre-Application Phase. It should be noted that no comments have been received to date, however, the proposed developments are not expected to impact directly on defense installations and no significant impacts on defense installations are expected (due to their Low Sensitivity, according to environmental screening tool.

Table 6-2: Level of specialist inputs required for Hoogland Southern Wind Farm Cluster

SPECIALISM / THEME	SITE SENSITIVITY VERIFICATION REPORT	LEVEL OF IMPACT ASSESSMENT AND RELEVANT LEGISLATION			
	SSV REPORT IN TERMS OF GN 320 OF 20 MARCH 2020	COMPLIANCE STATEMENT IN TERMS OF GN 320 / GN 1150 OF 20 MARCH 2020	SPECIALIST ASSESSMENT REPORT IN TERMS OF GN 320 MARCH 2020 / GN 1150 OF OCT 2020	APPENDIX 6 OF NEMA 2014	SECTION OF BA REPORT
Climate change				x (*)	7.1
Geotechnical	x			x	7.2
Agriculture	x	x			7.3
Terrestrial – Biodiversity	x		x		7.4
Terrestrial – Animal Species (mammals and reptiles)	x		x		7.4
Terrestrial – Plant Species	x	x			7.4
Bats	x			x	7.5
Avifauna including Animal Species - avifauna)	x		x		7.6
Aquatic ecology	x		x		7.7
Visual (Landscape)	x			x	7.8
Heritage	x			x	7.9
Palaeontology	x			x	7.10
Noise	x			x	7.11
Shadow flicker	x			x	7.12
Traffic	x			x	7.13
Socio-economic	x			x	7.14

*Not identified in Screening Tool, voluntary study

The impacts of the proposed development (during the Construction, Operation and Decommissioning phases) have been assessed by the specialists according to the methodology described in Section 6.2.5 (specifically Table 6-6) which was developed by SLR to align with the requirements of the EIA Regulations. This includes an assessment and rating of potential cumulative impacts. The cumulative impact assessment methodology is described in Section 6.4.

As proposed in the Pre-Application Report, the BA Phase has also included the following additional specialist field work or modelling to support the above-mentioned studies:

- 12 months bird monitoring completed, and results incorporated into the Specialist Report and BA Report (this report) (Section 7.6);
- 12 months bat monitoring completed, and results incorporated into Specialist Report and BA Report (this report) (Section 7.5);
- Ecology camera trapping completed, and results incorporated into the Specialist Report and BA Report (this report) (Section 7.4);
- Plant Compliance Statement completed, and results incorporated into BA Report (this report) (Section 7.4);
- Riverine Rabbit (*Bunolagus monticularis*) and Karoo dwarf tortoise (*Chersobius boulengeri*) species assessments completed, and results incorporated into BA Report (this report); noting that for Hoogland 4, the site verification based on further camera trapping indicated that the Riverine Rabbit is not present in the site and the general lack of habitat within the site indicates that the site can be considered low sensitivity for this species therefore only a compliance statement was necessary (Section 7.4); and
- Remodeling of noise, shadow flicker and visual impacts and results incorporated into BA Report (this report).

6.1.3.2 Layouts Assessed

As detailed in Section 6.1.2, the refined No-Go layers supplied by the specialists were applied by the Applicant to refine and optimise the Pre-Application Phase layout, furthermore, following the consultations with SANParks it was decided to drop a further 21 turbines to ensure the Southern Cluster was setback from the Park by at least 13.5km. The BA Phase layout (current layout) was the outcome and therefore it is the subject of the assessment in this BA Report. The main contributions by specialists were as follows (Noting the turbine numbering is as per the Pre-Application Phase layout, as the remaining turbines were re-numbered for the BA Phase layout):

<u>Hoogland 3 Wind Farm:</u>

1. **Visual** – Visually sensitive areas such as dolerite ridges, koppies, rock outcrops and slopes steeper than 1:10 gradient have been avoided in the layout design. Previously only 1:4 slopes were avoided.
2. **Avifauna** – Layout was revised, based on the Verreaux's Eagle Risk Assessment (VERA) model which was re-run for the overall Hoogland project site due to a nest found near the Northern Cluster, this did not affect any turbines in Hoogland 4. However, in addition, the Applicant decided to remove all of the turbines in the VERA medium sensitivity areas (the high areas were already avoided during Pre-Application Phase). This resulted in the additional loss of three turbines (Turbine numbers 1, 6 and 20) (as numbered in the Pre-Application phase layout). For more information on the VERA model, please refer to the Avifaunal Impact Assessment detailed in Section 7.6 and included in *Appendix C9: Avifauna*.

Therefore, for the **Hoogland 3 Wind Farm**, the layout changes are summarised as follows and shown on Figure 2-5 (with No-Go maps as Figure 9-1, Figure 9-3, Figure 9-5 and Figure 9-7):

1. Turbines reduced from 98 to 58 and some micro-siting of turbines and roads to avoid sensitives based on specialist recommendations and to accommodate additional Karoo NP setback.
2. An additional substation and BESS added, therefore two of each required (although two were assessed during the Pre-Application Phase, originally it was intended only one would be developed).
3. Northern Cape properties have been dropped / excluded.
4. Shared infrastructure with Hoogland 4 added (namely roads). This is where both wind farms (Hoogland 3 and 4) will need to use the same roads, so they need to be included in the assessment for both wind farms.
5. Boundary change to accommodate shared road infrastructure. As above, the boundaries of both wind farms (Hoogland 3 and 4) have been changed to ensure these shared roads are included.

6. Boundary change to accommodate removal of Northern Cape, as well as to take SANParks comments into account and set the wind farm 13.5 km back from the Park.
7. Internal reticulation increased to 'up to 66 kV' from 33 kV, to take account of any future efficiencies in using a higher voltage. Monopoles increased to approximately 22m (from 20m).
8. Reduced sections of internal overhead lines based on sensitivities.

Hoogland 4 Wind Farm:

1. **Visual** – Visually sensitive areas such as dolerite ridges, koppies, rock outcrops and slopes steeper than 1:10 gradient have been avoided in the layout design. Previously only 1:4 slopes were avoided.
2. **Avifauna** – Layout was revised, based on the Verreaux's Eagle Risk Assessment (VERA) model which was re-run for the overall Hoogland project site due to a nest found near the Northern Cluster, this did not affect any turbines in Hoogland 4. However, in addition, the Applicant decided to remove all of the turbines in the VERA medium sensitivity areas (the high areas were already avoided during Pre-Application Phase). This resulted in the additional loss of three turbines (Turbine numbers 165, 166 and 146) (as numbered in the Pre-Application phase layout). For more information on the VERA model, please refer to the Avifaunal Impact Assessment detailed in Section 7.6 and included in *Appendix C9: Avifauna*.

For the **Hoogland 4 Wind Farm** the layout changes are summarised as follows and shown on Figure 2-6 (with No-Go maps as Figure 9-2, Figure 9-4, Figure 9-6 and Figure 9-8):

1. Turbines reduced from 74 to 55 and some micro-siting of turbines and roads to avoid sensitives based on specialist recommendations and to accommodate additional Karoo NP setback.
2. An additional substation and BESS added, therefore two of each required (although two were assessed during the Pre-Application Phase, originally it was intended only one would be developed).
3. Substation and Battery 4A position moved by about 5.5 km to the east.
4. Shared infrastructure with Hoogland 3 added (namely roads). This is where both wind farms (Hoogland 3 and 4) will need to use the same roads, so they need to be included in the assessment for both wind farms.
5. Boundary change to accommodate shared road infrastructure. As above, the boundaries of both wind farms (Hoogland 3 and 4) have been changed to ensure these shared roads are included.
6. Boundary change to accommodate removal of Northern Cape, as well as to take SANParks comments into account and set the wind farm 13.5 km back from the Park; and
7. Internal reticulation increased to 'up to 66 kV' from 33 kV, to take account of any future efficiencies in using a higher voltage. Monopoles increased to approximately 22m (from 20m).
8. Reduced sections of internal overhead lines based on sensitivities.

6.1.3.3 Way Forward

Following the completion of the official 30-day review and comment period of the Draft BA Report (this report), the EAP will convert the Draft BA Report to a Final version (namely a Final BA Report) for submission to the DFFE for approval. The Final BA Report will be submitted to the DFFE up to 90 days after the receipt of the Application Form. The DFFE has a 57-day decision-making period (due to location of the Southern Cluster wind farms in the REDZ and fast-tracked BA process being applicable) once the Final BA Report (inclusive of the EMPr) is submitted for decision-making.

Should the DFFE accept the applications and issue EAs, the EAP would have to notify all registered I&APs and key stakeholders of the decisions and their right to appeal. In this regard, registered I&APs and key stakeholders must be notified within 14 days from the date of the decisions, whereafter I&APs and key stakeholders have a 20-day period from the date of notification to submit an appeal (should this be required).

6.2 PUBLIC PARTICIPATION PROCESS (PPP)

6.2.1 Definition of PPP

Section 1 of NEMA defines public participation in the context of environmental authorisation as follows:

"Public participation process" … "means a process by which potential interested and affected parties are given opportunity to comment on, or raise issues relevant to, the application to ensure compliance with these regulations within the prescribed timeframe".

Public participation is an iterative two-way process between the Applicant and the EAP, and the I&APs, whether these be individuals, organisations, or organs of state. The 2014 EIA Regulations (as amended) prescribe minimum Public Participation Process (PPP) requirements to be adhered to as part of an Environmental Process. The PPP planned as part of the Environmental Process for the proposed Wind Farms will comply with these requirements and include several steps/tasks over and above the minimum requirements. It is also noted that the PPP for the Hoogland Southern Wind Farm Cluster Projects are being undertaken in an integrated manner and therefore the PPP for this Project coincides with the PPP for the Northern Wind Farm Cluster (Hoogland 1 and Hoogland 2), the Northern Grid Connection and the Southern Grid Connection (which form part of separate respective Scoping and EIA and BA applications).

The PPP Report with supporting documentation is included in *Appendix D: Public Participation* and will be updated for each consecutive round of PPP as the project progresses. Section 6.2 summarises and provides the order of events regarding the PPP to date and the proposed activities going forward.

6.2.2 Stakeholder identification

The first steps initiated during the Screening Process, identified key stakeholder groups and sourced and verified their contact information (as best as possible). This included communications with, amongst others:

- Affected and adjacent landowners;
- Relevant district and local municipalities, including ward councillors;
- Relevant national and provincial government departments;
- Relevant national and provincial parastatals and organisations;
- Key stakeholders in renewable energy projects in the area;
- Conservation groups; and
- Other organisations in the area.

This is an ongoing process and registered I&APs will be added to the database after each PPP round (see *Appendix D3: BA Phase* for the latest database).

Also noting that a process of engaging with occupiers of affected and adjacent properties will occur simultaneously with the first round of PPP and is being managed by an independent specialist, Anelle Lötter. The aim is to identify and register any occupiers, explain the project and collect any initial comments. The outcomes of this process have been documented in the subsequent Occupier Engagement Report in *Appendix D2: Pre-Application Phase* (and incorporated in the Pre-Application Phase C&RR - Appendix D2: Pre-Application Phase.

6.2.3 Scope of the PPP

Table 4.1 summarises the PPP to date and the proposed activities going forward as part of the BA Phase. All proofs of notifications and engagements are included in *Appendix D1: Screening Phase*, *Appendix D2: Pre-Application Phase* and *Appendix D3: BA Phase*.

Table 6-3: Scope of Public Participation

PHASE	PURPOSE	METHOD
Screening Phase *(April and May 2021)*	Introduce proposed project to key I&APs and to gather initial comments	Stakeholder Engagement Meetings with Key Stakeholders: • DENC (7 April 2021) • Birdlife (14 April 2021) • DEA&DP (6 May 2021 • CapeNature (7 May 2021) • Landowners and Adjacent Landowners (20 May 2021)
DFFE Pre-Application Meetings *(July 2021 and February 2022)*	To provide the DFFE with information of the proposed projects and get consensus on the approach to the BA process	• A Pre-application meeting was held with DFFE on 29 July 2021. • A second Pre-application meeting was held on 2 March 2022

Pre-Application BA Report
(March – April 2022)
	Allow I&APs 30 days to review and comment on the Pre-Application BA Report	• Key Stakeholder Engagement Meetings:
		  ○ DEA&DP (2 March 2022)
		  ○ SANParks site visit (13 April 2022)[9]
		• Occupier engagements (February 2022 – March 2022)
		• Written Notifications (March 2022)
		• Adverts in Local / Regional Newspapers ("Die Courier and "Die Burger") (18 March 2022)
		• Release of reports for informal 30-day public comment to local venues (Beaufort West Public Library, Klein Karoo Agricultural Cooperative in Beaufort West, Loxton Public Library, Central Karoo District Municipality Offices, Loxton Lekker and Loxton Agricultural Cooperative) (in the form of digital tablets) and website (SLR website & SLR data-free website) (from 18 March 2022)
		• Non-technical Summary (NTS) hardcopies available at the same public venues as the reports above.
		• Virtual presentations on digital tablets available at the same public venues as the reports above, and on the websites above.

[9] It should be noted that SANParks requested a site visit in relation to the Southern Wind Farm Cluster (Hoogland 3 & Hoogland 4). Refer to Pre-Application Phase C&RR in *Appendix D2: Pre-Application Phase* for SANParks comments and responses with regards to the Southern Cluster Wind Farms.

PHASE	PURPOSE	METHOD
		• Site Notices at conspicuous locations at the affected properties[10] (18 March 2022) • Posters in conspicuous locations Beaufort West Public Library, Klein Karoo Agricultural Cooperative in Beaufort West, Loxton Public Library, Central Karoo District Municipality Offices in Beaufort West, Loxton Lekker and Loxton Agricultural Cooperative) (18 March 2022)
Draft BA Report (current phase) (*August– September 2022*)	Allow I&APs 30 days to review and comment on the Draft BA Report (this report)	• Written Notifications • Adverts in Local / Regional Newspapers ("Die Courier and "Die Burger") • Site Notices at conspicuous locations at the affected properties (as per Pre-Application Phase locations) • Posters erected at conspicuous locations (as per Pre-Application Phase locations) • Release of Draft BA report for legislated 30-day public comment to local venues accessible by the public as per Pre-Application Phase locations (in the form of digital tablets) and website (SLR website and SLR data-free website) • Non-technical Summary (NTS) hardcopies available at public venues • Virtual presentations on digital tablets (available at public venues) as well as for download on the SLR websites above.

[10] Rocklands Farm gate (-31.725161°, 22.361817°); farm gate on DR02315 (Molteno gate) (-31.691058°, 22.342520°) and Le Riche Gate along DR02312 (-31.936870°, 22.137912°) – refer to site notice proof provided in Appendix D2.

6.2.4 Summary of Comments from Key Stakeholders

Focus group meetings were held during the screening phase with Key Stakeholder (Table 6-4). The proposed project was introduced along with specialist input gathered at the time. An overview of the process in Section 6.1 was presented to all stakeholders. It should be noted that comments were provided by certain Key Stakeholders following the completion of the 30-day review and comment period for the Pre-Application Report, which were factored into the Pre-Application Phase C&RR and responded to accordingly, where required (*Appendix D2: Pre-Application Phase*).

The following table captures the prevalent comments and recommendations gathered from the stakeholder engagement to date. The meeting minutes, presentations and written comments can be found in the public participation appendices for the respective phases - Appendix D1: Screening Phase*, Appendix D2: Pre-Application Phase* and Appendix D3: BA Phase*.*

Table 6-4: Summary of Comments from Key Stakeholders

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
Department of Environment, Forestry & Fisheries (DFFE)	July 2021 and 03 March 2022 (Pre-Application Meetings - Appendix D2)	• Regulation 11 approval granted to combine Hoogland 1 & 2 (Northern Cluster) (separate EIA process) and Hoogland 3 & 4 (Southern Cluster) (this Application) • Procedural and reporting advice with regards to the combination of the processes • Confirmation of approach to cumulative impact assessment • Confirmation of specialist studies required • Confirmation that a BESS Risk Assessment is required • No objection letter required from the Nuweveld Project • Confirmation that the project is intended for REIPPP as it affects which competent authority has jurisdiction
Department of Environment, Forestry & Fisheries (DFFE) - Directorate: Protected Areas Planning and Management Effectiveness	20 April 2022 (Email comment - Appendix D2)	• Confirmed that the proposed development will not take place within any kind of protected areas in terms of Section 9 of the National Environmental Management: Protected Areas Act (NEMPAA), Act No. 57 of 2003 and that the directorate therefore do not have comments.

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
Northern Cape Department of Environment and Nature Conservation (DENC)	7 April 2021 (Meeting - Appendix D1)	• Indicated that development in CBA areas trigger the need for off-sets • DENC will engage with CapeNature to simultaneously align inputs, especially as the project falls within the Western Cape while only road crossings fall within the Northern Cape. • Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far
Birdlife South Africa	14 April 2021 (Meeting - Appendix D1)	• Recommended avoidance of VERA high and medium buffers • Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far
	21 April 2022 (formal comment letter - Appendix D2)	• Raised issue regarding ambiguity of avifaunal and Pre-Application reports with regards to the duration of data collection, should areas identified as medium sensitivity by VERA not be avoided • Welcomed inclusion of Adaptative Management Plans, thresholds and response strategies to address impacts on birds during the operational phase • Suggested environmental management objective be clearly stated in the EMPr and Adaptative Management Plan • Recommended management actions in the EMPr should be specific, time-bound and measurable and that the duration and nature of post-construction monitoring should be informed by what is required to measure the effectiveness of the Adaptative Management Plan and EMPr (in addition to recommendations of latest version of Best Practice Guidelines)
Western Cape (WC): DEA&DP	6 May 2021 (Meeting - Appendix D1) and 3 March 2022 (Meeting - Appendix D2)	• Requested ample time to comment on various projects • Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far • Subsequent agreement in relation to revised process and timing as proposed in March 2022
	3 March 2022 (Meeting - Appendix D2)	• Subsequent agreement in relation to revised process and timing as proposed in March 2022

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
	10 May 2022 (formal comment letter - Appendix D2)	• Various directorates within the department provided recommendations to be considered by the Applicant and incorporated into the EMPrs, where possible
CapeNature	7 May 2021 (formal comment letter - Appendix D2)	• Indicated that at this stage there are no major concerns and no issues with the approach undertaken by Red Cap thus far
	26 May 2022 (formal comment letter - Appendix D2)	• Provided comments for the Applicant to take into consideration related to avoidance of loss to natural habitat, impact on CBAs and ESAs (which include unknown non-perennial rivers, dams, and wetlands), as well as NFEPA wetlands and also vegetation types that are not threatened • Commented on the importance of a renewable energy development monitoring program to inform future renewable energy developments, especially in the Karoo. • Enquired whether ecological corridors will be allowed and stated that these corridors are important for conserving biodiversity and must be maintained. • Confirmed that the same detailed comments relating to the impact on biodiversity provided for the proposed Hoogland Northern Wind Farm Cluster are applicable for the proposed Hoogland Southern Wind Farm Cluster. This includes: ○ The requirement for permits from CapeNature with regards to endangered or protected species; ○ Provided several recommendations (including the compilation of relevant management plans) to be considered by the Applicant, with certain plans also to be incorporated into the Final EMPrs, where possible; ○ Requirements for borehole exploration, testing and monitoring ○ Toposoil and waste management requirements ○ Stated that infrastructure located in high sensitive areas will not be supported

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
Endangered Wildlife Trust (EWT)	22 April 2022 (formal comment letter – Appendix D2)	• Confirmed support for renewable energy projects as an alternative to generation of electricity through burning of fossil fuels, although acknowledged they have impacts on species, habitat, and society and need to be properly evaluated • Stated there is a strong need for developers to adhere to and initiate environmental best practices • Confirmed support for recommendations made in the terrestrial specialist report and recommended their implementation (should the projects be approved) • Confirmed satisfaction with steps taken to avoid the placement of infrastructure in priority Riverine Rabbit riparian habitat areas (particularly along Sak River and tributaries) • Expressed concerns regarding the impact of this and other developments on the Karoo dwarf tortoises, including the Karoo dwarf tortoise (*Chersobius boulengeri*) and the greater dwarf tortoise (*Homopus femoralis*), and recommended certain measures for post-development monitoring of power lines • Requested to see the specialist report pertaining to reptiles (including the dwarf tortoises) and reserve the right for further comment on this aspect once report has been reviewed • Provided several recommendations related to birds and terrestrial ecology to be considered by the Applicant and incorporated into the EMPrs, where possible and/or required
South African National Parks (SANParks)	23 March 2022 (email – Appendix D2)	• Stated that the Southern Cluster (Hoogland 3 & Hoogland 4) and grid connection is located in the expansion footprint of the Karoo National Park and requested a site visit before prior to issuing comments.
	22 April 2022 (formal comment letter – Appendix D2)	• Confirmed that the Hoogland 3 and 4 Wind Farms (southern cluster) are adjacent to the Karoo National Park expansion footprint, as per the approved Management Plan for the period 2017 – 2027. • SANParks raised the issue of the height of the proposed wind turbines. • Confirmed that SANParks representatives visited the Hoogland southern cluster with Red Cap on 13 April 2022 and noted key issues of concern, which include:

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
		○ Visual impact and loss of sense of place. ○ Protected area expansion compromised and no contribution to biodiversity targets. ○ Spiral turbulence may affect flying operations with small aircraft. ○ The impact of infrasound and noise on rhino populations are poorly understood and a risk-averse precautionary approach is recommended. ○ Heritage resources will be lost, and the cultural landscapes degraded. ○ Loss of raptors and large terrestrial species, many of which are regionally and globally Red Listed. ○ Cumulative impact of wind farms should be recognised. Important areas for conservation and landscape functionality should be 'no go' areas for wind farms. • SANParks objected to the Hoogland southern cluster and related infrastructure below (south of) the DR 02312, as it will have a negative impact on conservation and landscape functionality of the Karoo National Park. • Should the southern cluster be authorised the predominantly wilderness character of the landscape will change to a situation where wind turbines are visible as a constant backdrop, wildlife and birdlife will be negatively affected and protected area expansion compromised. • Stated that in principle, SANParks support wind farm facilities but not in locations where national parks are negatively affected.
Landowners and Adjacent Landowners	21 May 2021 (Meetings - Appendix D1)	• Questions were asked about the REIPPPP process • Confirmed rehabilitation would be undertaken after construction was complete • Confirmed the level of communication required with regards to landowners and adjacent landowners
	22 April 2022 (comment email from Mr Christo Scholtz – Appendix D2)	• Mr Christo Scholtz (adjacent landowner) expressed his concern about the proposed Hoogland projects, with specific mention / reference to visual impacts and impacts on tourism and wildlife

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
Land occupiers	March 2022 (direct engagement – Appendix D2)	Comments were generally positive, however, it should be noted that many occupiers did not have comments as the purpose of the engagement with them was not per se to solicit comments, but to inform them and to provide future opportunities for participation by obtaining their contact details. Land occupiers, especially those on directly adjacent farms, maintain that they should also benefit from the proposed project as opposed to only those living in the formal towns of Beaufort West and Loxton. Other comments include: • Positivity on opportunity for future job creation; • Concerned about potential construction impacts, especially dust and theft; • Concerned about potential socio-economic impacts, e.g., contractors visiting the area and the potential influence that they could have on local labour, potential change in character of people who may receive compensation; and • Proposed project will not assist with provision of electricity on farms.
Municipalities	21 May 2021 and 21 April 2022 (email from Beaufort West Local Municipality – Appendix D2)	• Confirmed that appointed road contractors will be responsible for road construction and the Municipality will be responsible for maintenance once construction is complete • Confirmed that any waste will be formally and appropriately dealt with in compliance with legislation • Confirmed labour will be sourced locally where possible and the developer together with the Contractor will engage the municipalities with regards to the availability of a skills database • District Municipalities are responsible for town planning applications • Beaufort West Local Municipality's Building inspector stated that the Applicant must apply for a consent use to be able to set up a renewable energy structure after the completion of the public participation process
Eskom	11 April 2022 – 21 April 2022 (email from John Geeringh – Appendix D2)	• Provided Eskom requirements for work at or near Eskom servitudes and infrastructure, as well as the Eskom setbacks guideline for renewable energy developments documents for the Developer's attention

KEY STAKEHOLDERS	DATE	KEY COMMENTS FROM STAKEHOLDER
		• Requested KMZ files of the proposed development, layouts and grid connection, which were subsequently forwarded by the EAP
Heritage Western Cape (HWC)	29 April 2022 (formal comment letter – Appendix D2)	• Confirmed that the Impact Assessment Committee (IACom) supports the HIA for the Hoogland 3 and Hoogland 4 Wind Farms dated March 2022 (Appendix C12) and the recommendations within the respective reports • Further confirmed that the Committee has no concerns with the proposals, and do not anticipate any heritage, any significant heritage impacts of concern
	22 July 2022 (email – Appendix D2)	• Acknowledged receipt of the permit application submitted by the heritage specialist for the Hoogland 3 and 4 Wind Farms (southern cluster), which was received on 21 July 2022. • Informed the heritage specialist about the pre-assessment of the application submitted, as per the application guideline of documentation required. •

The key stages of consultation with the competent authority, the DFFE, are set out in the section below.

6.2.5 Consultation with Competent Authority

Key stages of consultation with the DFFE, as the competent authority, are set out in Table 6-5 below:

Table 6-5: Consultation with the DFFE

CONSULTATION PHASE	DESCRIPTION
Pre-application meeting	A Pre-application meeting was held with DFFE on 29 July 2021 to provide the DFFE with information of the proposed project and get consensus on the approach to the BA process. The minutes are contained in *Appendix D1: Screening Phase.*
2nd pre-application meeting	A second pre-application meeting was held on 02 March 2022 with the DFFE prior to the Pre-application Phase to verify and reaffirm the project approach and methodology. The minutes are contained *Appendix D2: Pre-Application Phase.*
Comment on the Pre-Application Report	The DFFE has indicated in the Pre-Application Meeting on 02 March 2022 that they will not comment on any Pre-Application Reports (refer to the aforementioned minutes).
Comment on Draft BA Report (this report)	The DFFE are requested to submit comments on the Draft BA (this report), which has been made available to the public at the same time, for a 30-day comment period (excluding public holidays). The request for comment on the Draft BA Report coincided with the submission of the EA application forms for the respective projects.
Comment and decision on Final BA Report	Where applicable, the Draft BA Report (this report) will be changed as a result of the PPP or results of the additional specialist work undertaken during the BA phase (if required), and will include any new or additional information. It will be converted to a Final BA Report which will be submitted to the DEFF for decision-making. As stipulated in Regulation 19 and 20 of the 2014 EIA Regulations (GN R982, as amended), DFFE must, within 57 days of receipt of the Final BA Report, consider it, and in writing – *(a) grant environmental authorisation in respect of all or part of the activity applied for; or EIA; or* *(b) Refuse environmental authorisation if;*

6.3 ASSESSMENT METHODOLOGY

The impacts of the proposed development (during the Construction, Operation and Decommissioning phases) have been assessed and rated according to the methodology described below and which was developed by SLR to align with the requirements of Appendix 3 of the EIA Regulations (GN 654 of 2010).

The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in Table 6-6. This method complies with the method provided in the EIA guideline document (GN 654 of 2010). Part A provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent and duration). In Part B, a matrix is applied to determine this impact consequence. In Part C, the consequence rating is considered together with the probability of occurrence in order to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in Part D.

Table 6-6: Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA		
Determination of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Determination of SIGNIFICANCE		**Significance is a function of consequence and probability**
Criteria for ranking of the INTENSITY of environmental impacts	**Very High**	Severe change, disturbance or degradation caused to receptors. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required.
	High	Prominent change, or large degree of modification, disturbance or degradation caused to receptors or which may affect a large proportion of receptors, possibly entire species or community.
	Medium	Moderate change, disturbance or discomfort caused to receptors and/or which may affect a moderate proportion of receptors.
	Low	Minor (slight) change, disturbance or nuisance caused to receptors which is easily tolerated without intervention, or which may affect a small proportion of receptors.
	Very Low	Negligible change, disturbance or nuisance caused to receptors which is barely noticeable or may have minimal effect on receptors or affect a limited proportion of the receptors.
Criteria for ranking the DURATION of impacts	**Very Short-term**	The duration of the impact will be < 1 year or may be intermittent.
	Short-term	The duration of the impact will be between 1 - 5 years
	Medium-term	The duration of the impact will be Medium-term between, 5 to 10 years.
	Long-term	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	Permanent	The duration of the impact will be permanent
Criteria for ranking the EXTENT of impacts	**Site**	Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.
	Local	Impact is confined to within the project site / area and its nearby surroundings.
	Regional	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.
	National	Impact may extend beyond district or regional boundaries with national implications.
	International	Impact extends beyond the national scale or may be transboundary.

PART B: DETERMINING CONSEQUENCE						
		EXTENT				
		Site	Local	Regional	National	International
Intensity- Very Low						
DURATION	Permanent	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long-term	**Low**	**Low**	**Low**	**Medium**	**Medium**

	Medium-term	Very Low	Low	Low	Low	Medium
	Short-term	Very low	Very Low	Low	Low	Low
	Very Short-term	Very low	Very Low	Very Low	Low	Low
Intensity -Low						
DURATION	Permanent	Medium	Medium	Medium	High	High
	Long-term	Low	Medium	Medium	Medium	High
	Medium-term	Low	Low	Medium	Medium	Medium
	Short-term	Low	Low	Low	Medium	Medium
	Very Short-term	Very low	Low	Low	Low	Medium
Intensity- Medium						
DURATION	Permanent	Medium	High	High	High	Very High
	Long-term	Medium	Medium	Medium	High	High
	Medium-term	Medium	Medium	Medium	High	High
	Short-term	Low	Medium	Medium	Medium	High
	Very Short-term	Low	Low	Low	Medium	Medium
Intensity -High						
DURATION	Permanent	High	High	High	Very High	Very High
	Long-term	Medium	High	High	High	Very High
	Medium-term	Medium	Medium	High	High	High
	Short-term	Medium	Medium	Medium	High	High
	Very Short-term	Low	Medium	Medium	Medium	High
Intensity - Very High						
DURATION	Permanent	High	High	Very High	Very High	Very High
	Long-term	High	High	High	Very High	Very High
	Medium-term	Medium	High	High	High	Very High
	Short-term	Medium	Medium	High	High	High
	Very Short-term	Low	Medium	Medium	High	High
		Site	Local	Regional	National	International
		EXTENT				

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (to exposure of events)	Definite / Continuous	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible / frequent	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely / improbable	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
		Very Low	Low	Medium	High	Very High
		CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE		
Very High -	Very High +	Represents a key factor in decision-making. In the case of adverse effects, the impact would be considered a fatal flaw unless mitigated to lower significance.
High -	High +	These beneficial or adverse effects are considered to be very important considerations and are likely to be material for the decision-making process. In the case of negative impacts, substantial mitigation will be required.
Medium -	Medium +	These beneficial or adverse effects may be important but are not likely to be key decision-making factors. The cumulative effects of such issues may become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor. In the case of negative impacts, mitigation will be required.
Low -	Low +	These beneficial or adverse effects may be raised as localised issues. They are unlikely to be critical in the decision-making process but could be important in the subsequent design of the project. In the case of negative impacts, some mitigation is likely to be required.
Very Low -	Very Low +	These beneficial or adverse effects will not have an influence on the decision, neither will they need to be taken into account in the design of the project. In the case of negative impacts, mitigation is not necessarily required.
Insignificant		Any effects are beneath the levels of perception and inconsequential, therefore not requiring any consideration.

6.4 CUMULATIVE ASSESSMENT METHODOLOGY

In relation to an activity, cumulative impact 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 be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities*" (NEMA EIA Reg GN R982 of 2014).

Other than the authorised Nuweveld Wind Farms (including grid connection), there are currently no approved renewable energy EA applications within a 30km (or even 50km) radius of the project site Figure 6-3). The nearest operational Wind Farm from the site is the Noblesfontein Wind Farm located approximately 65km to the Northeast. In addition, the latest South African Renewable Energy EIA Application Database (REEA) ("REEA_OR_2022_Q1"), which was released by the DFFE on 31 May 2022, was used during the BA Phase to confirm whether any updates were required to the Cumulative Impact Assessment presented in the Pre-Application Report, due to new information becoming available. No new projects / applications were included in the most-recent version of the database (Q1, 2022), and the database still shows the same renewable energy projects (solar) authorised closed to Beaufort West as presented in the Pre-Application Report. Further research confirmed that none of these projects are going ahead/have a valid EA. The cumulative impact assessed will therefore be the collective impact of the four Hoogland Wind Farms and Grid Connection applications with the three Nuweveld Wind Farm and Gridline applications[11].

The results of the cumulative impact assessment undertaken by each specialist as part of their respective studies are provided in Section 7, with a summary provided in Section 8.

[11] Nuweveld North: 14/12/16/3/3/2/2042, Nuweveld West:14/12/16/3/3/2/2043, Nuweveld East: 14/12/16/3/3/2/2044, Nuweveld Gridline: 14/12/16/3/3/2/2336

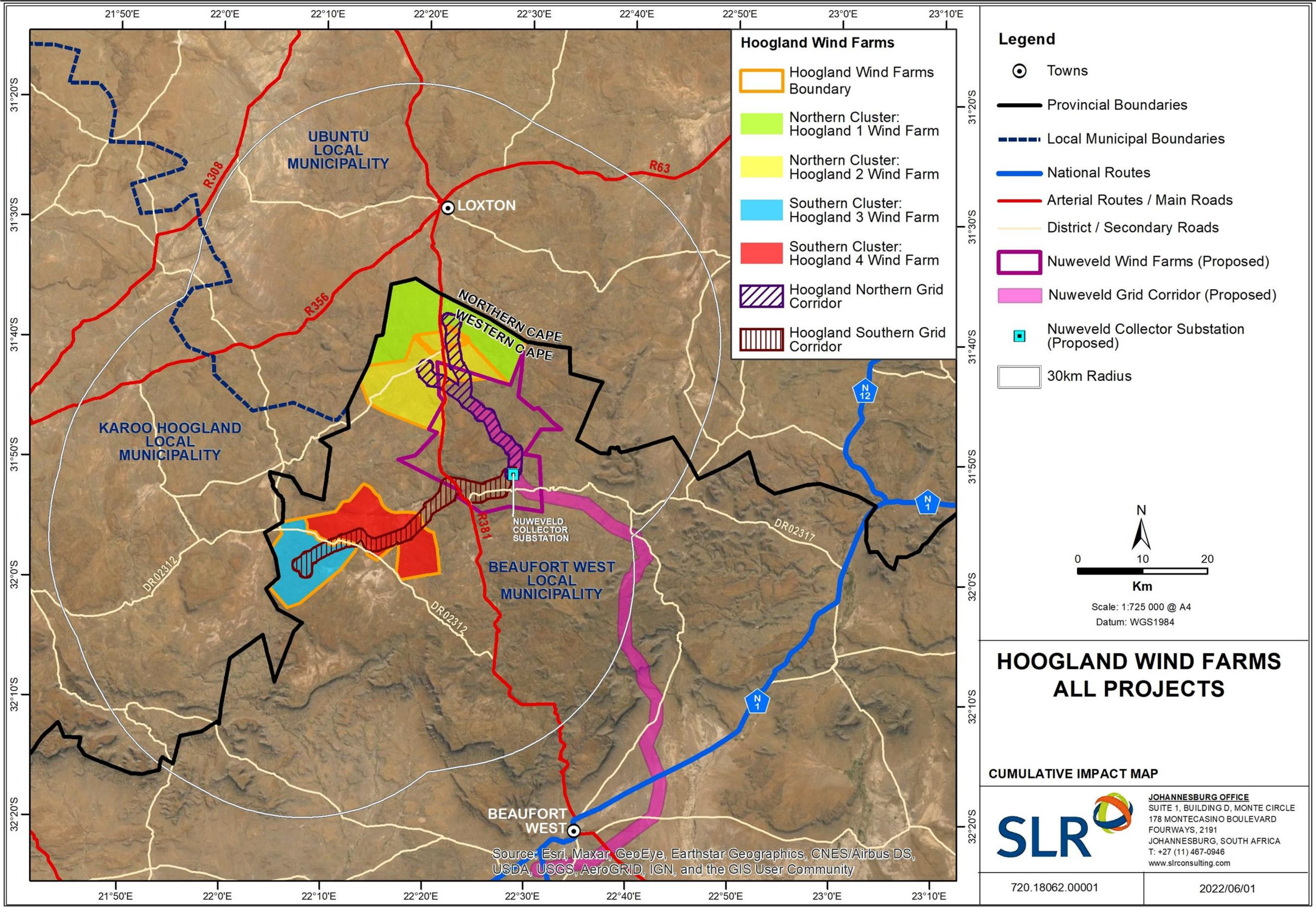


Figure 6-3: Map showing Renewable Energy facilities within 30km of the proposed Hoogland Wind Farms

6.5 ASSUMPTIONS AND LIMITATIONS

In undertaking this investigation and compiling this report, the following assumptions and limitations have been identified:

1. It is assumed that all information provided to the EAP by the applicant was correct and accurate at the time of assessment.
2. Every effort has been made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or organisations will / have conveyed the necessary information to these associations / organisations.
3. It is assumed that the information provided by the various specialists is unbiased and accurate.
4. The degree of the impact that the proposed development will have on the immediate environment has been determined based on specialist input. Actual impacts can only be determined following the commencement of construction and/or operation.
5. All information that could be obtained for the surrounding planned renewable energy developments within 30km) existing or planned (having started their official environmental assessment process) was taken into account as part of the cumulative impact assessment for this project. This includes the latest South African REEA Database ("REEA_OR_2022_Q1"), which was released by the DFFE on 31 May 2022.
6. The exact turbine specifications are not known at this stage and hence the maximum number of turbines to be constructed and the maximum MW of energy to be generated has been clearly defined and a "worst-case scenario" in this regard has been assessed. A 'worst-case scenario rotor swept area envelope' is also assessed as detailed in Section 1.3. This is in line with the precautionary principle.
7. External wake effect from surrounding Wind Farms has not been included in the assessment as the Red Cap Nuweveld Wind Farms (also developed by Red Cap) are the only potentially affected Wind Farms and therefore have no conflict of interest. Nevertheless, for the purpose of reducing any potential wake effect, a 1.6km buffer around the Nuweveld turbines has been used when locating turbines on the Hoogland Northern Wind Farm site.
8. It is intended that these projects would, in the first instance, be bid in a forthcoming round of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) but there is a possibility that they could be considered for business-to-business purposes.
9. Any limitations and gaps in knowledge that have been encountered by the specialists are identified in their respective assessments (*Appendix C: Specialist Reports*).

7 BASELINE ENVIRONMENT AND IMPACT ASSESSMENT

The environmental baseline conditions have been extracted and collated from the specialists' reports. The summary is based on the individual specialist knowledge and experience working in the area especially with regards to the adjacent Nuweveld project, and desk-top investigations as well as field work undertaken as part of the Screening, Pre-Application and BA processes. The baseline information has informed the site constraints and sensitivity categories which in turn has informed the design and layout of the proposed Hoogland Projects. The specialist studies are appended under *Appendix C: Specialist Reports.*

The site sensitivity, potential impacts, likely impact significance, proposed impact mitigations (to reduce negative impacts or enhance positive impacts) and conclusions for the BA Phase are discussed per relevant specialist field. Noting that the key recommendations for each study are reiterated in Section 8.3. The impact assessment methodology used by the specialists to determine the likely impact significance of the impacts identified are detailed in the Impact Assessment Methodology (refer to Section 6.2.5). A consolidated No-Go site sensitivity map (which combines the sensitivities of all specialist fields) and table which outlines the various sensitivities identified on site for each infrastructure type per specialist study is provided in Section 9, and includes inputs from the summary section hereunder. The reader should also be reminded that the assessment considers a worst case in terms of turbines and rotor swept area envelope as described in Section 2.

Importantly, note that this report is the basis for a combined application for the Hoogland 3 and Hoogland 4 Wind Farms and in many cases the baseline descriptions are the same or similar, as with the impact descriptions and ratings. Therefore, to avoid repetition, only where specific features or impacts differ has this been specifically noted in the text, and where necessary separate impact tables have been provided.

7.1 Climate Change

This section provides a short summary of the Climate Change specialist report compiled by Promethium Carbon which is available in *Appendix C1: Climate Change*. The report has provided an assessment of the four Hoogland Wind Farms holistically and is twofold, it considers the impact of climate change on the Project and the impact of the Project on climate change.

7.1.1 Baseline Description

Promethium (2022) undertook an analysis of the historical climate trends in the area to provide the current status quo but also to identify trends that provide the basis for future projections.

7.1.1.1 Regional climate change considerations

The climate change projections for the Project within the Western Cape indicate that annual average ambient temperatures are likely to increase, while overall precipitation is becoming more variable and decreasing, and risk to droughts is likely (Figure 7-1).

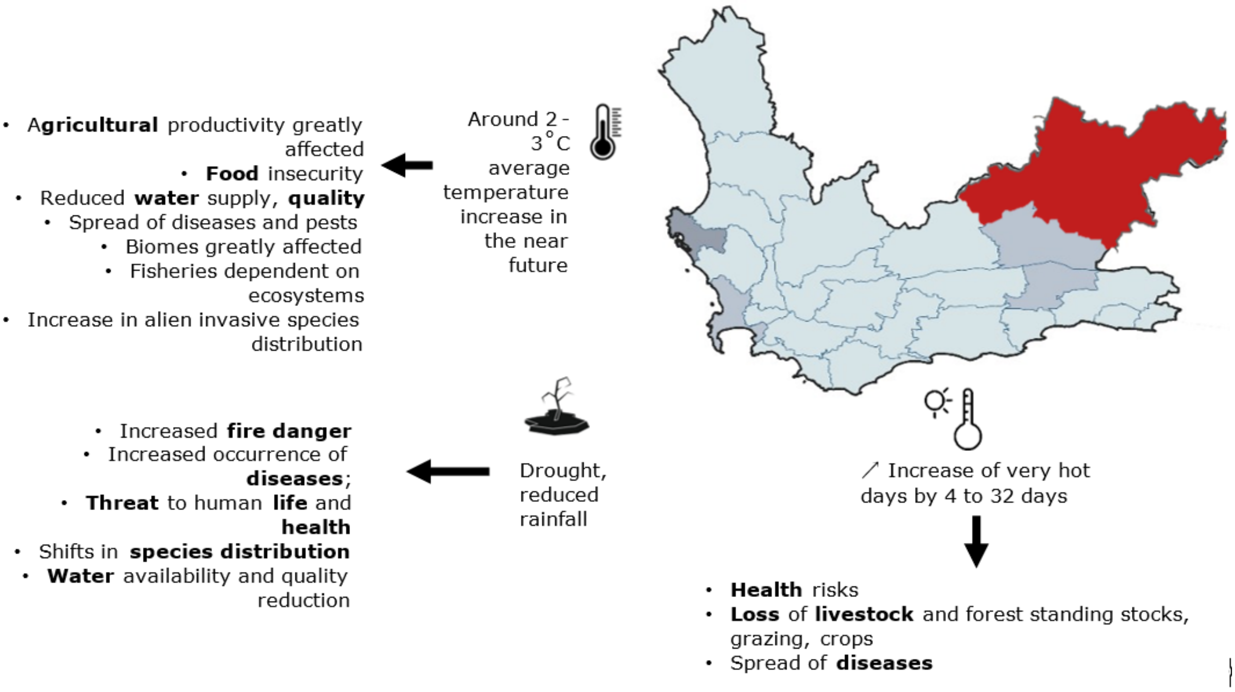


Figure 7-1: Project climatic conditions within the Western Cape Province showing Beaufort West Local Municipality (SSP5) in red

By use of the Greenbook (Le Roux et al, 2019), the current and future change in climate for the Hoogland Wind Farms, being located within the Beaufort West Local Municipality, is summarised in the below table. The future scenarios include an intermediate (SSP 2)[12] and worst-case (SSP 5)[13].

Table 7-1: Current and future temperature and rainfall projections for the Hoogland Wind Farms within the Beaufort West Municipality

CLIMATE CHANGE IMPACT	CURRENT	SSP 2	SSP 5
		The projected change for the period 2021 to 2050, relative to the baseline period (1961 to 1990).	
Temperature	Average annual temperature between 13-17 ˚C.	Average annual temperature increase by approximately 2°C to 3°C	Average annual temperature increase by between 2°C to 3°C
Very Hot Days (>35 degrees Celsius)[14,15]	The region experiences a range from 10 to 35 days per annum.	Potential annual increase in the number of very hot days by between 1 days to 25 days. This will take	Average annual increase in the number of very hot days could increase between

[12] SSP 2:(Previously RCP 4.5) "[T]he Middle of the road" or medium pathway [which] extrapolates the past and current global development into the future. [...] There is a certain cooperation between states, but it is barely expanded. Global population growth is moderate, levelling off in the second half of the century. Environmental systems are facing a certain degradation."

[13] SSP 5:(Previously RCP 8.5) "Fossil-fuelled Development. Global markets are increasingly integrated, leading to innovations and technological progress. The social and economic development, however, is based on an intensified exploitation of fossil fuel resources with a high percentage of coal and an energy-intensive lifestyle worldwide. The world economy is growing and local environmental problems such as air pollution are being tackled successfully."

[14] Very hot days: the number of days (per 8 x 8 km grid point) where the maximum temperature exceeds 35°C.

[15] Heat wave days: where temperature exceeds maximum temperature of the warmest month of the year by 5°C for a period of 3 or more consecutive days.

CLIMATE CHANGE IMPACT	CURRENT	SSP 2	SSP 5
		The projected change for the period 2021 to 2050, relative to the baseline period (1961 to 1990).	
		the annual number of very hot days to between 11 and 60.	4 days to 32 days. This will take the annual number of very hot days to between 14 and 67.
Rainfall	Average annual rainfall within the municipality is between 500 – 700 mm.	Average annual rainfall may decrease by 99 mm or increase by 84 mm	Average annual rainfall may decrease by 97 mm or increase by 87 mm
Extreme Rainfall Days[16]	*Information is not available for the baseline*	The region could experience a change of 2 days fewer extreme rainfall days or up to 1 day more.	The region could experience a change of 3 days fewer extreme rainfall days or up to 2 days more.
Flood Risk[17]	Regions within municipality range from very low to medium-high	*Information is not available for the SSP 2 scenario*	Low risk in the region
Drought Risk,[18]	Increase in drought tendencies in most region of the municipality	*Information is not available for the SSP 2 scenario*	There is an extreme risk in the region
Fire Risk[19]	Very rare	*Information is not available for the SSP 2 scenario*	Medium risk in the region

Climatic projections for the Hoogland Wind Farms suggest that the Beaufort West Local Municipality, could experience an increase in average annual temperatures of at least 2 °C to 3 °C from the baseline period. It is further projected that the number of very hot days will increase between 1 to 25 days, which will increase the annual number of days to between 11 and 60. The change in temperature and increase in very hot days, increases the drought risk and as a result, will impact the fire risk within the region, particularly within the SSP5 projection.

The main climate change impacts at the Beaufort West Local Municipality are **increased temperature**, extreme **heat**, fire risk and high risk of **droughts**. The climate in the area is thus likely to become hotter and drier.

[16] 20mm of rain occurring within 24 hours over the 8 x 8 km grid point

[17] Flood, drought and fire risk data were modelled for the RCP 8.5 scenario only (see greenbook.co.za), therefore no RCP 4.5 data could be included in this analysis. Floods, drought and fires are the most destructive and have the greatest environmental and social impact. RCP 8.5 scenario was selected to give a good indication of how climate change would precipitate as a function of the current conditions under these three aspects. Providing a current and worst case scenario will help to provide a more conservative approach upon which actions can be based.

[18] Number of cases exceeding near-normal per decade for the period 1995-2024 relative to 1986-2005 baseline period, under the low mitigation scenario.

[19] Rainfall Variability: The degree to which rainfall amounts vary across an area or through time.

7.1.1.2 Historical Climate Trends

Both the CustomWeather daily data for the Project area (from 1998 to 2021, based on centrepoints of each site) and the World Resources Institute's (WRI) Aqueduct tool were consulted. Noting that the data was collected and presented for the Northern and Southern Cluster Wind Farm projects as a whole.

7.1.1.2.1 Rainfall data

It was deduced that rainfall has decreased from 1998 to 2020 due to the downward trends present. It is evident from this downward trend that overall precipitation in the Project area has decreased over time.

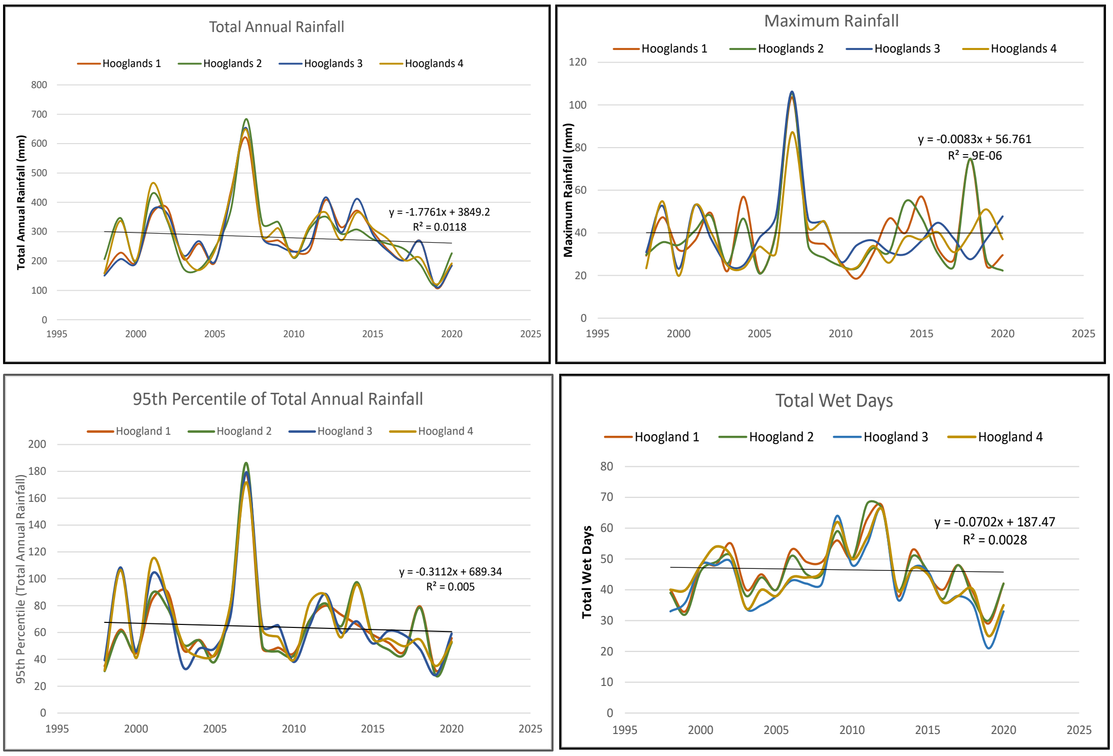


Figure 7-2: Historical rainfall data from 1998 to 2020 for the Project area

An analysis of the variability of annual rainfall[20] implies that the Project being exposed to a combination of erratic rainfall, periods of drought but then also periods of intense rainfall has decreased over time.

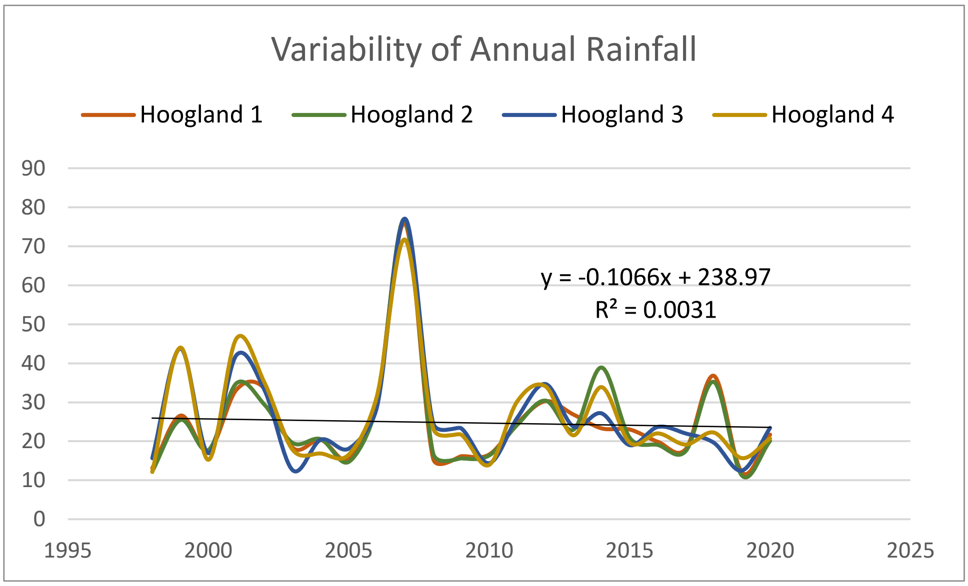


Figure 7-3: Variability of average annual rainfall at the Project area from 1998 to 2020

7.1.1.2.2 Temperature data

It was found that there is an upward trend for the average annual temperature and maximum temperature parameters. It is also noted that the Project area is currently experiencing a drought event. An increase in temperature, in conjunction with the downward trends in rainfall, could be an indication that drought events are likely to become more frequent, as well as more severe over time.

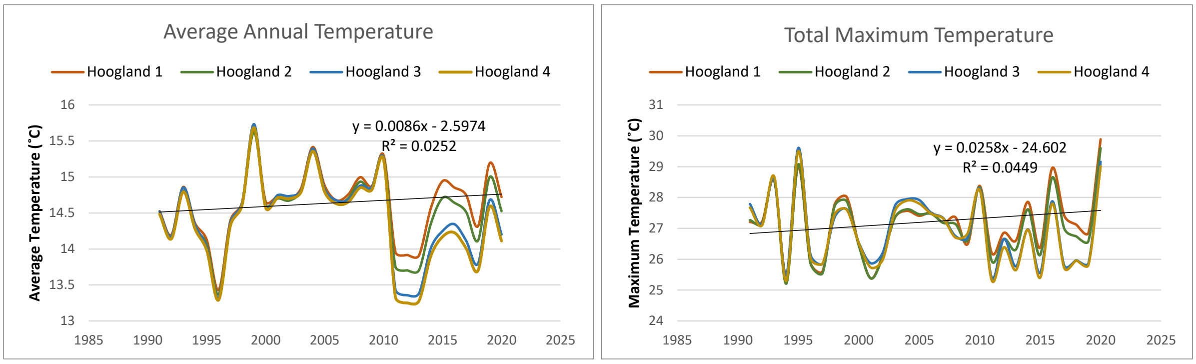


Figure 7-4: Historical temperature data of the Project area from 1991 to 2020

7.1.1.2.3 Wind data

There is a slight upward trend present in the graphs above. It is evident from this upward trend that the average and maximum windspeed at the Project area has increased slightly over time.

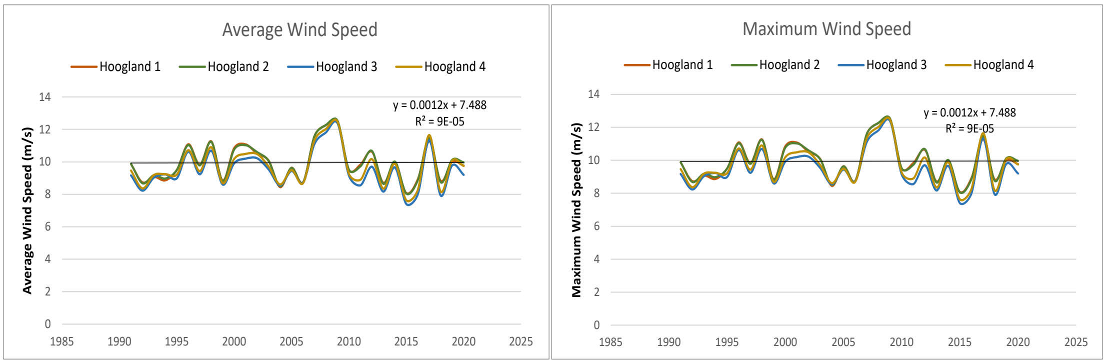


Figure 7-5: Historical wind data for the Project area from 1991 to 2020

7.1.1.3 Projected Climate Change

7.1.1.3.1 Rainfall

Projected annual average rainfall from 1998 to 2035 exhibits a downward trend is present in average annual rainfall. From this projection, it can be deduced that precipitation is forecasted to decrease over time and the Project area will most likely become drier in the future (Figure 7-6).

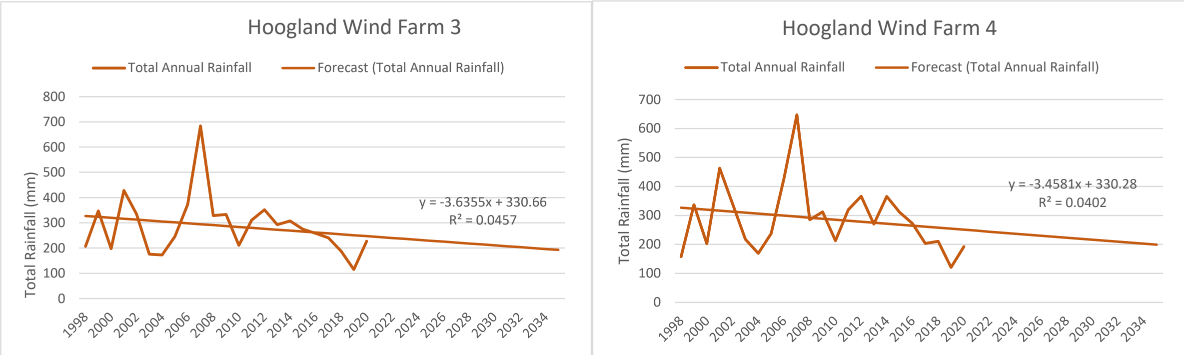


Figure 7-6: Projected total annual rainfall from 1998 to 2035 for the Project area

7.1.1.3.2 Temperature

Projected annual average temperature from 1991 to 2035 is shown in Figure 7-7 below. It is seen that there is a downward trend for Hoogland 3 and 4 therefore from this projection, it can be deduced that average annual temperature is forecasted to decrease over time. However, if we analyse the graph of average annual temperature for all Hoogland Wind Farms, it is likely that the temperature will increase for the overall Hoogland Wind Farm area. This, in conjunction with decreased rainfall, could bring about drier conditions in the future and possibly exacerbate the drought event that is currently occurring in the area

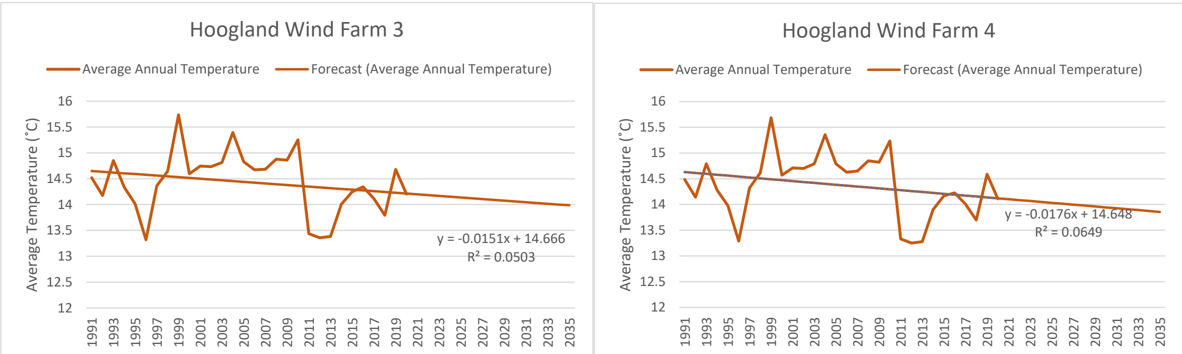


Figure 7-7: Temperature projections of the Project area from 1991 to 2035.

7.1.1.3.3 Windspeed

Projected average annual windspeed from 1991 to 2035 is shown in Figure 7-8 below. It is seen that an upward trend is present for Hoogland 4 with a downward trend for Hoogland 4 Wind Farm. Noting that the other two Northern Cluster Wind Farms are expected to increase. From these projections, it can be deduced that average annual windspeed in the study area as a whole is forecasted to increase over time.

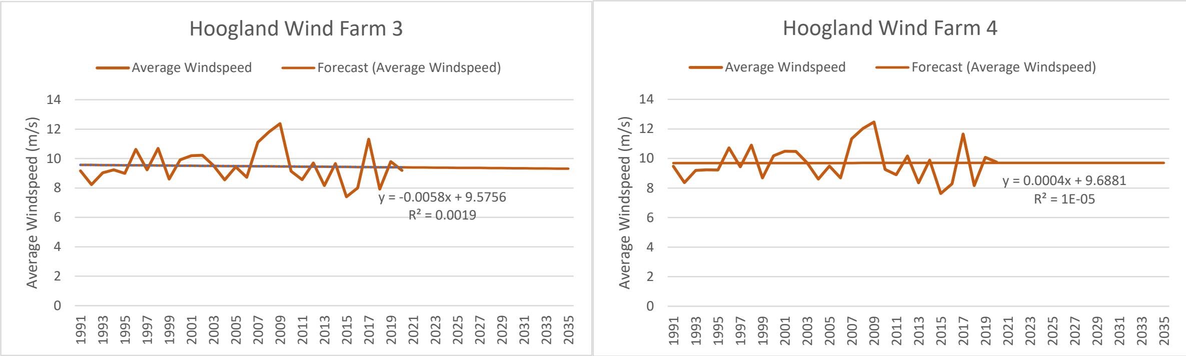


Figure 7-8: Average windspeed projections at the Project area from 1991 to 2035

7.1.1.3.4 Water Risk

By use of the World Resources Institute's (WRI) Aqueduct Tool, the overall water risk for the Hoogland Wind Farms can be analysed. Two aspects are considered in this report: water stress and seasonal variability of water availability.

In terms of projected water stress, the area surrounding the Hoogland Wind Farms is currently considered as an "arid and low water use" region in relation to water stress and will remain arid with low water use in 2030 under a "business-as-usual" scenario. In other words, the baseline water stress for the project area is projected to remain stable in the future.

In terms of the projected change in seasonal variability of water, the WRI Aqueduct Tool indicates that seasonal variability in the Project area is considered "High". Seasonal variability measures the average within-year variability of available water supply, including both renewable surface and groundwater supplies. Higher values indicate wider variations of available water supply within a year. The projected change in seasonal variability of water moves from "High" to "Low-medium" in 2030 under a "business-as-usual" scenario. Lower values indicate narrower variations of available water supply within a year. This indicates that seasonal variability[21] may become less extreme in 2030.

7.1.2 Impact Assessment and Mitigation

7.1.2.1 Impact of Climate Change on the Project

In terms of the impact of climate change on the core operations of the Project, there are two main ways, namely (i) the physical impacts on Wind Farms infrastructure and (ii) the impact on the workforce.

7.1.2.1.1 Physical Risks

Such risks relate to the direct impacts climate change conditions may have on numerous sectors of society and the environment. In conjunction to Hoogland Wind Farms project, the physical risks will consider the impacts temperature and rainfall will have on the project as well as the workforce.

Temperature

It is expected that Beaufort West Municipality will experience an increase in average temperature as well as an increase in the frequency of hot days. The GreenBook tool indicates that by 2050 the average temperature will increase by between 1.73 degrees Celsius to 2.52 degrees Celsius under the SSP 2 (RCP 4.5) scenario and between 2.27 degrees Celsius to 2.86 degrees Celsius under an SSP 5 (RCP 8.5) scenario. The number of very hot

21 Seasonal variability is an indicator of the variability between months of the year. Increasing seasonal variability may indicate wetter wet months and drier dry months, and higher likelihood of droughts or wet periods.

days is also predicted to increase by up to 25 days under SSP2. Typical risks associated with the relationship between increased temperatures and Wind Farms include the following:

- The increased annual temperatures and an increased frequency in the number of hot days/ heatwaves will result in equipment thresholds being exceeded more frequently. Hence, the equipment will reach its limit more often and impact its productivity over time.
- The increased annual temperature will impact the air density, which may lessen the energy output of the wind turbines.
- In addition, the onsite offices will make increased use of air conditioning due to higher temperatures, thus increasing the energy demand and associated costs.

Rainfall

With reference to the climatic data provided by CustomWeather, it is expected that the annual rainfall and rainfall variability will decrease. As for the information provided by the Greenbook, it is identified that the Beaufort West Local Municipality will experience an increase in rainfall variability and drought risk. However, it is important to note that such information is more high level and broad and significant to the municipality in which the project is located in, rather than the actual location of the Wind Farms. Therefore, the information provided by CustomWeather is more significant to the project than the Greenbook. We also acknowledge that the operation of the Hoogland Wind Farms is not water/rainfall dependent. Thus, the information regarding rainfall variability and annual rainfall poses a small risk to direct operations and does not have a significant impact on the project.

7.1.2.1.2 Labour and working conditions

In terms of the Project's workforce, the existing hot and dry environment, coupled with expected increased daytime temperatures, could have a negative impact on the health of employees, particularly for individuals working outside that are exposed to extreme heat. Heat stress is a major occupational health risk and can directly impact workforce productivity and thereby operations at the Hoogland Wind Farm Project. High heat exposure restricts an employee's physical functions, their capabilities and ultimately work productivity and capacity.

7.1.2.2 Impact of the Project on Climate Change

In terms of the Project's impact on climate change, the proposed Hoogland Wind Farm Project will result in some Green House Gas (GHG) emissions being released into the atmosphere during its lifetime. Its impact is quantified by developing a GHG inventory. (See specialist report in *Appendix C1: Climate Change* for calculations).

Two types of design are being considered for the wind turbines, a steel-based and a concrete-based design and the GHG inventory reported below is based on the concrete-based design which is a worst case scenario. The total number of wind turbines to be developed per Wind Farm has also not yet been set and thus a range of 30 to 60 wind turbines per farm has been applied. Table 7-2 and Table 7-3 summarise the direct operational and construction emissions (Category 1)[22] and the upstream operational and construction emissions (Category 3-6) associated with each Wind Farm as well as the four Wind Farms in totality, for a maximum and minimum number of turbines. They also provide the emissions per wind turbine.

[22] Category 1: Direct GHG emissions and removals); Category 2: Indirect GHG emissions from imported energy; Category 3-6: All other indirect GHG emissions.

Table 7-2: Construction- and operation-related emissions for the proposed Hoogland Wind Farm Project (maximum of 60 turbines)

ACTIVITY	CONSTRUCTION EMISSIONS (TCO_2E)	ANNUAL OPERATIONAL GHG EMISSIONS (TCO_2E/A)	EMISSIONS OVER THE LIFE OF PLANT (TCO_2E)
Per Wind Turbine			
Construction Category 1	*		*
Construction Category 3-6	2 100		2 100
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Turbine	2 100	*	2 100
Per Wind Farm			
Construction Category 1	*		*
Construction Category 3-6	128 000		128 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Farm	128 000	*	128 000
Across all 4 Wind Farms			
Construction Category 1	*		*
Construction Category 3-6	512 000		512 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total across all 4 Wind Farms	512 000	*	512 000

* *Data regarding direct emissions during construction and operation (such as onsite fuel combustion in vehicles) as well as indirect emissions during operations were not available at this stage. Based on the specialist's experience, these were assumed to be immaterial relative to the magnitude of the Category 3 - 6 emissions during construction.*

Table 7-3: Construction- and operation-related emissions for the proposed Hoogland Wind Farm Project (maximum of 30 turbines)

ACTIVITY	CONSTRUCTION EMISSIONS (TCO_2E)	ANNUAL OPERATIONAL GHG EMISSIONS (TCO_2E/A)	EMISSIONS OVER THE LIFE OF PLANT (TCO_2E)
Per Wind Turbine			
Construction Category 1	*		*
Construction Category 3-6	2 100		2 100
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Turbine	2 100	*	2 100
Per Wind Farm			
Construction Category 1	*		*
Construction Category 3-6	64 000		64 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total per Wind Farm	64 000	*	64 000
Across all 4 Wind Farms			
Construction Category 1	*		*
Construction Category 3-6	256 000		256 000
Operation Category 1		*	*
Operation Category 3-6		*	*
Total across all 4 Wind Farms	256 000	*	256 000

* *Data regarding direct emissions during construction and operation (such as onsite fuel combustion in vehicles) as well as indirect emissions during operations were not available at this stage. Based on the specialist's experience, these were assumed to be immaterial relative to the magnitude of the Category 3 - 6 emissions during construction.*

Each Wind Farm will only contribute between 64 and 128 ktCO_2e emissions from the construction phase (or 2.1 ktCO_2e per wind turbine), with a total contribution of between 0.25 and 0.5 million tons CO_2e emissions from the construction phase for all four wind farms. Most emissions during the construction phase are associated with the upstream production of construction materials. The emissions that would occur from operating and maintenance activities are negligible.

South Africa's grid is expected to decarbonise in the future. However, it will still rely heavily on GHG intensive technologies, such as coal-fired power stations and gas-to-power technologies. The Hoogland Wind Farm Project will contribute renewable energy onto the grid to replace the use of energy from GHG intensive technologies. This will lead to avoided emissions. Over the lifetime of the project, the avoided emissions are approximately between 5.8 and 11.6 million tonnes CO_2e of emissions per Wind Farm (for a rage of 30 to 60 turbines). This equates to 23.2 to 46.3 million tons CO_2e of emissions for the four Wind Farms (or 41 000 tonnes CO_2e per MW installed).

Overall, the Hoogland Wind Farm Projects (all four) project will lead to between approximately 0.25 and 0.5 million tons CO_2e of emissions associated with the construction of the Wind Farms. These emissions are insignificant relative the potential avoided emissions of between 23.2 and 46.3 million tons CO_2e. This results in net avoided emissions of between 22.9 and 45.8 million tons CO_2e.

Table 7-4: All Phases: Impact of the Project on Climate Change for 30-60 turbines

Issue	**Climate change impacts of the Hoogland Wind Farm Project.**	
Description of Impact		
The Hoogland Wind Farms will have emissions relating to the construction phase of the project. The emissions during the operational phase are negligible. The magnitude of the impact of the Hoogland Wind Farm Project's GHG emissions during construction is determined in Table 7-2 (60 turbines) and Table 7-3 (30 turbines). However, during the operation of the Project, the electricity generated by the Project will displace the use of more emission intensive technologies, such as coal-fired power stations. The magnitude of the impact of the Hoogland Wind Farm Project's avoided GHG emissions during operation is quantified as between 23.2 and 46.3 million tons CO_2e of emissions (the former being based on 30 turbines, the latter being based on 60 turbines per wind farm).		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very High	N/A
Duration	Permanent	N/A
Extent	International	N/A
Consequence	Very High	N/A
Probability	Definite / Continuous	N/A
Significance	Very High +	N/A
Degree to which impact can be reversed	N/A	
Degree to which impact may cause irreplaceable loss of resources	N/A	
Degree to which impact can be mitigated	The Hoogland Wind Farms themselves serve as a mitigation to reduce the current level of exhaustion of South Africa's carbon budget as currently experienced through the existing fossil fuel intensive grid.	
Mitigation actions		
The following measures are recommended:	Mitigation measures to address the impact of the Hoogland Wind Farms on climate change is not required as they are classified as renewable energy and therefore overall have an overall impact of very high positive significance.	
Monitoring		
The following monitoring is recommended:	N/A	

7.1.3 Cumulative Impact

According to Promethium (2022), the cumulative impact of these projects on climate change is considered to be very high (+), as although not quantified, the Nuweveld Projects further increase the opportunity for avoided emissions.

7.1.4 No-Go Alternative

The no-go alternative is less preferred than the Project as it is a lost opportunity to reduce the current level of exhaustion of South Africa's carbon budget as currently experienced through the existing fossil fuel intensive grid.

7.1.5 Conclusion and Recommendations

From a climate change perspective, each of the Wind Farms comprising the Hoogland Wind Farm Project should receive authorisation based on the following key aspects:

1. In accordance with South Africa's Nationally Determined Contribution (NDC) which presents South Africa's commitment to the Paris Agreement, provision has been made in the Integrated Resources Plan (IRP) for the addition of renewable energy onto the national grid as part of the commitment to decarbonise the grid.
2. The Project increases the renewable energy generating capacity in South Africa and can reduce the reliance of the national grid on GHG intensive technologies, such as coal-fired power stations. If all four wind farms are developed, it will have a positive impact on the country's GHG inventory and contribute to the inventory by avoiding emission equivalent to between 0.6 to 1.2% of the country's carbon budget over its lifetime.
3. The Hoogland Wind Farm Project includes the potential for battery storage, which could improve the dispatchability of electricity from the project to the national grid adding to peak generation capacity.

The benefits associated with the Hoogland Wind Farm Project cannot be viewed in isolation. Considering that this is most likely one of the first Climate Change Impact Assessments (CCIA) conducted for a renewable energy project in South Africa, we do not at this time propose any conditions which need to be included in the Environmental Authorisation for the four Hoogland Wind Farms.

7.2 Geotechnical

This section provides a short summary of the desktop geotechnical specialist report compiled by Richard Bradshaw of RABA which is available in *Appendix C2: Geotechnical*.

7.2.1 Baseline description

7.2.1.1 Climate and Soils

RABA (2022) noted that, rock weathering and the formation of residual soils are significantly influenced by the climate. The effect of climate on weathering processes in a particular area can be determined from the climatic N-value as defined by Weinert (1980).

Table 7-5: Border values as proposed by Weinert for different types of weathering

N-value	Types of weathering
N < 2	Wet region, Decomposition of Rock, Montmorillonite (fine) Clay
N>10	Very arid region, Disintegration of Rock
2 < N < 5	Moderate region, Decomposition of Rock, Kaolinite Clay
10>N > 5	Dry region, Disintegration of Rock, Very little clay

According to Weinert, physical weathering (disintegration) will predominate in areas where the N-value is larger than 5 and the residual soils are typically only thinly developed. Chemical weathering (decomposition) will predominate in areas where there is a water surplus and N-values are less than 5. Chemical weathering will result in the formation of secondary minerals such as hydromica, clay minerals and sesquioxides. The type of secondary minerals that will develop will depend on the underlying geology, the time the rock has been exposed to weathering processes and climate. The climatic conditions where N-values are less than 5 are therefore typically favourable for the development of a deep soil profile.

The N-values for Beaufort West and Calvinia are 18.4 and 17.6 respectively and the N-value for the site is therefore approximately 18, implying that a shallow soil profile is developed in the area and very shallow bedrock can be expected unless it is covered by alluvium or other transported soils.

7.2.1.2 Topography and Drainage

Based on the 1:50 000 topographic maps, Hoogland 3 is located in an area where the topography is characterized by two prominent cliff-lines. The first is located in the extreme southwest of the site and generally runs north-south. The difference in elevation across this feature ranges up to approximately 80m. The second cliff-line runs east-southeast and just clips the extreme northeast of this site. Elevation differences of up to approximately 50m occur across this feature. A north-flowing stream with associated alluvial deposits occurs along the western margin of the site and a river occurs along the eastern margin, first passing into a dam then into a local agricultural area. Undulating topography with local ridges and scattered kopjes and irregular ground occurs in other parts of this site.

Two prominent cliff-lines also occur in Hoogland 4. The first is located along the northern boundary and strikes east-west. The elevation difference across it is locally approximately 100m. The second strikes east-southeast across the western central part of the site. The elevation difference across it is 40m to 50m. Several, north-flowing, ephemeral streams and associated areas covered by alluvium occur in the central and northeastern parts of the site. Undulating topography with local ridges and scattered kopjes and irregular ground also occurs in other parts of this site.

7.2.1.3 Geology

The bedrock geology at Hoogland 3 and 4 Wind Farms is illustrated on Figure 7-9 which is a combination of two, 1:250000 geological maps, 3122 Victoria West and 3222 Beaufort West (Council for Geoscience, Pretoria) with short accompanying sheet explanations by Le Roux & Keyser (1988) and Johnson & Keyser (1979) respectively.

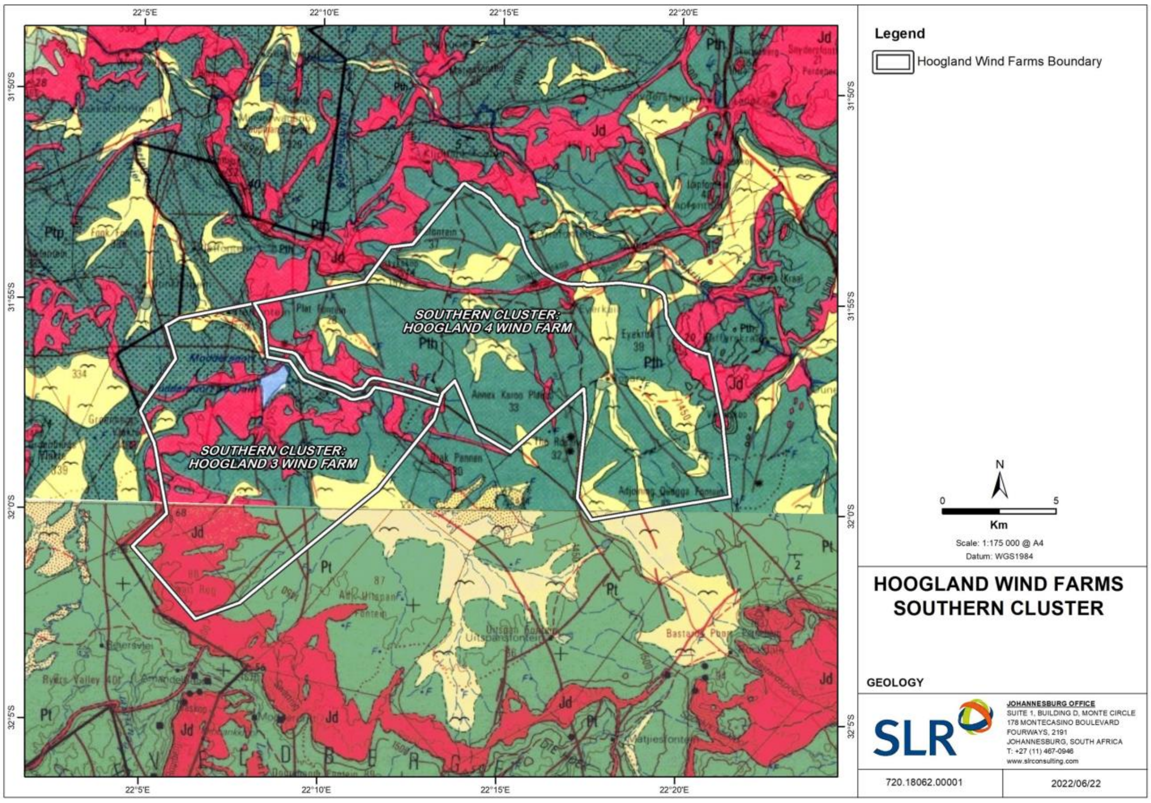


Figure 7-9: Geological Map

The area is situated towards the northern margin of the Main Karoo Basin of South Africa. It is underlain by continental (fluvial, lacustrine) sediments of the Beaufort Group (Karoo Supergroup) of late Middle Permian to early Late Permian age (c. 262-257 Ma). The Beaufort Group in the project area is represented by the Adelaide Subgroup which is sub divided at Hoogland 3 and 4 into the Hoedemaker and Poortjie Members of the Teekloof Formation and by the older Abrahamskraal Formation. The sedimentary rocks are extensively intruded by dolerite of the Karoo Dolerite Suite of Early Jurassic age (c. 183 Ma).

The chronological sequence of formation and the stratigraphic nomenclature of these rocks are as follows:

<table>
<tr><td></td><td colspan="4"></td></tr>
<tr><td>Caenozoic</td><td colspan="4">Soils (alluvium and talus and scree deposits)</td></tr>
<tr><td>Jurassic</td><td colspan="4">Dolerite</td></tr>
<tr><td rowspan="3">}
Permian }
}
}</td><td>Hoedemaker Member }</td><td rowspan="3">Teekloof }
Formation }
Abrahamskraal }
Formation }</td><td rowspan="3">Adelaide }
Subgroup }</td><td rowspan="3">Beaufort
Supergroup</td></tr>
<tr><td>Poortjie Member }</td></tr>
<tr><td></td></tr>
</table>

The mudrock dominated Abrahamskraal Formation (Pa), which is the oldest series of rocks in the area, occurs in the extreme northwestern corner of the map and it thus does not occur in the Southern Cluster. The Poortjie Member (Ptp) comprises mudstones and sandstones generally in a ratio of 3:1 but locally 1:1 as described in the explanation to the Geological Series Map 3122. The Poortjie Member occurs in the northwestern parts of Hoogland 4 and in a very small area in the central west of Hoogland 3.

The younger Hoedemaker Member (Pth) is present in large areas in Hoogland 4. It comprises a higher percentage of red and purple mudstone and thin sandstone bands and it occurs in the eastern and southeastern parts of Hoogland 3.

The Beaufort Group sediments are intensively intruded and often thermally metamorphosed (baked, leached and secondarily mineralized) by an extensive network of dolerite sills and dykes, some of considerable volume.

The dolerite in the project area has mainly intruded as a series of extensive, sub horizontal sills and as subordinate sub vertical dykes. Dolerite outcrop occurs most extensively in the central and southern parts of Hoogland 3 and as sills and dykes in its northern parts. By comparison, relatively little dolerite outcrops in Hoogland 4 with the major outcrops confined to the eastern and northern margins and the western area. The dolerites in the project area are commonly characterised by areas of bouldery outcrop.

No faults are indicated on the geological series map but lineaments probably representing vertical or sub vertical dolerite dykes occur throughout the area. These features are generally orientated either approximately north-south or east-west but north-easterly trending lineaments also occur.

No mining activities have taken place in the project area.

Gravelly to silty Late Caenozoic alluvium is associated with major drainage lines within the combined Hoogland project area (yellow areas in Figure 7-9), and also cover large portions of lower-lying terrain whereas gravelly colluvial deposits (e.g. sandstone and dolerite gravel and boulders) mantle plateau areas and most hill slopes.

7.2.1 Site Sensitivity

Based on the desktop study, the area can be sub divided into three generalized ground or mapping units where similar ground conditions are expected. These units correspond to areas underlain by the sedimentary rocks of the Hoedemaker and Poortjie Members, the dolerite and the more extensively developed alluvium.

All three units are expected to be suitable for the development of the infrastructure for the Wind Farm provided that standard engineering design and construction measures are adopted to mitigate identified geotechnical constraints.

The ground conditions in the sedimentary ground units are considered most suitable for the development due to their relatively geotechnical uniform condition, whereas bouldery and variable conditions might characterize the dolerite. The more extensively developed alluvium will be unconsolidated and potentially loose and the turbine bases must either be founded on bedrock below the alluvium, provided that it is not thickly developed, or supplementary geotechnical measures such as dynamic compaction or construction of a soil raft must be considered to provide suitable foundations.

Areas which display some sensitivity to the development are illustrated on Figure 7-10.

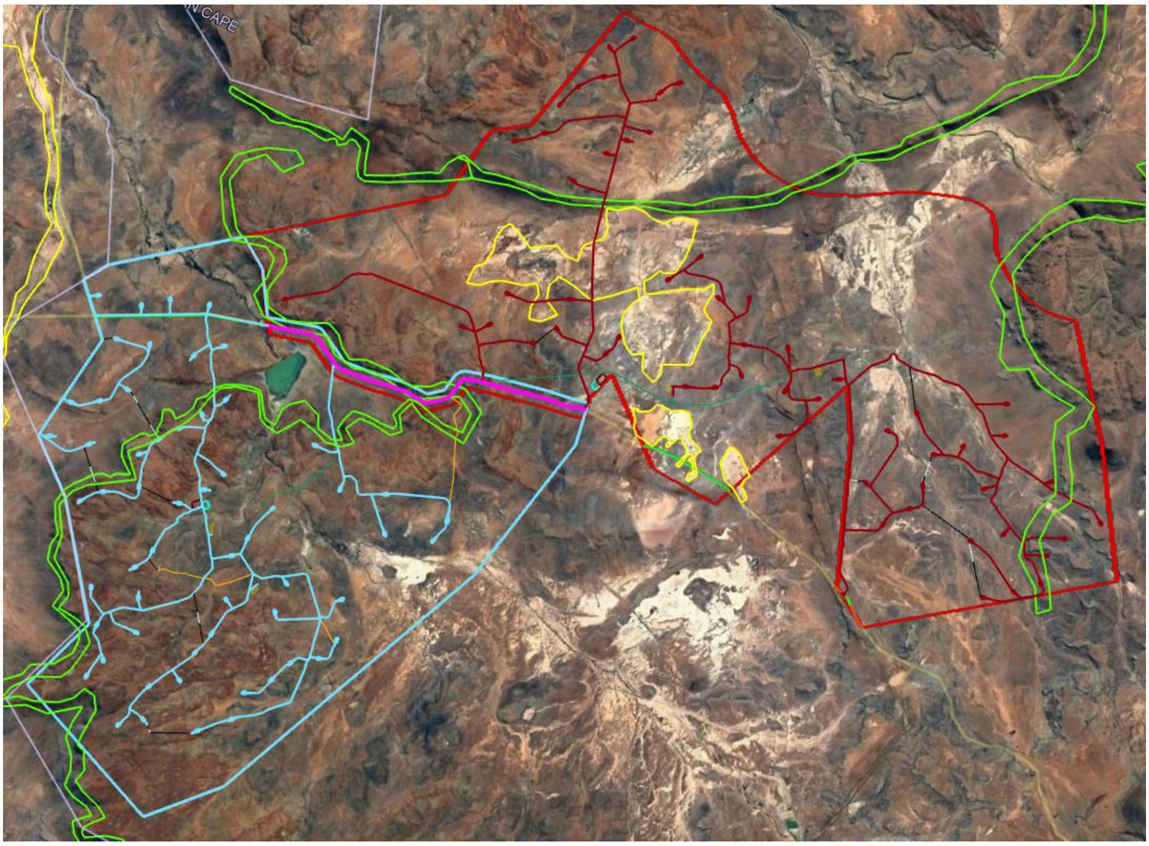


Figure 7-10: Geotechnical Sensitivity Map (yellow: alluvial area: areas of steep ground and green: major changes in elevation)

The alluvial areas variably comprise a series of northerly or northwesterly draining streams with intervening strips and banks of alluvium. In places, the streams coalesce into one defined drainage channel. Only narrow areas in and immediately adjacent to channels are considered highly sensitive from a geotechnical perspective.

The tools available to assess the nature and extent of the alluvium in a desk study are not adequate to enable a detailed assessment of the composition and thickness of the alluvium, but, provided that the turbines are not located within prescribed flood lines to be defined by the Civil Engineer, positioning of turbines in alluvial areas is expected to be acceptable. Detailed topographic survey, hydrological studies and micro siting of turbine positions would be required.

Areas of steep ground and major changes in elevation are indicated in red on Figure 7-10. These areas commonly represent cliff-like features and the associated very steep slopes result from a capping of the areas by rocks less resistant to weathering such as sandstone and mainly dolerite. The impact of this topography is that turbines must not be located within 30m of 1:4 slopes to ensure the tops of the cliff faces are avoided and that access to some turbines would require circuitous routes to avoid slope constraints. It is noted that in the current layout turbines and their platforms have avoided 1:4 slopes.

Defining the exact extent of the steep, cliff-like areas is extremely difficult from the available, large scale data and refinement of the extent of the occurrences will be required when a detailed topographic survey of the project area has been undertaken. The topography of the site is variable with local steep slopes and intervening relatively flat ground and significant earthworks are therefore anticipated in places.

The risk of soil erosion is also increased during construction activities by the removal of vegetation and by possible disturbance to the natural surface drainage environment. These activities may prevent infiltration of rainwater, increase stormwater runoff and cause concentration of surface water flow. Erosion will increase the disturbance and displacement of soils and the impact may extend beyond the infrastructure footprints over time.

7.2.2 Impact Assessment and Mitigation

The following geotechnical impacts have been identified and rated by RABA (2022).

7.2.2.1 Construction Phase

Table 7-6: Construction: Ground disturbance

Issue	Ground disturbance during construction	
Description of Impact		
Ground disturbance during earthworks for turbine bases, access roads, platforms and laydown areas.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	High	High
Probability	Definite / Continuous	Definite / Continuous
Significance	High -	Medium -
Degree to which impact can be reversed	The impact is reversible in respect of the laydown areas where the surfacing can be removed and the ground rehabilitated, but the impact will be irreversible for the access roads, cuttings and platform at the individual turbine locations during the operational phase.	
Degree to which impact may cause irreplaceable loss of resources	The access roads, cuttings, platforms and turbine base areas will be irreplaceably lost during the operational phase.	

Degree to which impact can be mitigated	The impact in the laydown areas can be mitigated and significant mitigation around the turbine bases is possible.
Mitigation actions	
The following measures are recommended:	The surfacing must be removed in the laydown areas and the ground rehabilitated.
Monitoring	
The following monitoring is recommended:	No specific monitoring is required except for the normal weekly check inspections by the Resident Engineer and ECO/ESO.

Table 7-7: Construction: Soil erosion

Issue	Soil erosion during construction	
Description of Impact		
Erosion due to clearing of vegetation and alteration of natural drainage		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Permanent	Short-term
Extent	Site	Site
Consequence	High	Low
Probability	Probable	Unlikely / improbable
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact can be mitigated but noting that loss of topsoil is irreversible in this environment respect of the turbine bases, the laydown areas, platforms and access roads even after the ground has been rehabilitated.	
Degree to which impact may cause irreplaceable loss of resources	Topsoil is very thinly developed or absent in this environment and therefore difficult to replace if extensive erosion occurs.	
Degree to which impact can be mitigated	The impact in the areas described above can be mitigated.	
Mitigation actions		
The following measures are recommended:	Temporary berms and drainage channels to divert water, where required, that rehabilitation of disturbed areas is undertaken timeously, that the designs of the road and site drainage are undertaken correctly, and only designated access routes are used for trafficking around the site.	
Monitoring		
The following monitoring is recommended:	Routine monitoring of the construction of mitigating measures is required by the Resident Engineer and ESO/ECO on the site.	

7.2.2.2 Operational Phase

Table 7-8: Operation: Soil Erosion

Issue	Soil erosion during operational phase
Description of Impact	
Increased erosion due to alteration of natural drainage	
Type of Impact	Direct
Nature of Impact	Negative

Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Permanent	Long-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact is reversible in respect of the laydown areas after the ground has been rehabilitated.	
Degree to which impact may cause irreplaceable loss of resources	This impact will not lead to irreplaceable loss of resources provided that the mitigation actions indicated below are adopted.	
Degree to which impact can be mitigated	The impact in the laydown areas can be mitigated.	
Mitigation actions		
The following measures are recommended:	Maintain drainage channels and other drainage structures such as culverts. Monitor for erosion and remediate and rehabilitate timeously.	
Monitoring		
The following monitoring is recommended:	Routine monitoring by Site Staff during the operational phase. Add the requirement to the standard operating procedures for the site.	

7.2.2.3 Decommissioning Phase

Table 7-9: Decommissioning: Ground disturbance

Issue	Ground disturbance during decommissioning	
Description of Impact		
Ground disturbance during earthworks to remove platforms, turbine bases, road rehabilitation and removal of surface and sub surface structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Medium	High
Probability	Definite / Continuous	Definite / Continuous
Significance	High -	Medium -
Degree to which impact can be reversed	The impact is reversible but the rehabilitation period over the areas in which degradation has occurred will be slow in this arid environment where indigenous vegetation is not extensively developed.	
Degree to which impact may cause irreplaceable loss of resources	In the long-term, resources (the use of land) will not be irreplaceably lost but as indicated above, slow rehabilitation of vegetation is expected.	

Degree to which impact can be mitigated	The impact can be mitigated with the limitation regarding re-growth of vegetation mentioned above.
Mitigation actions	
The following measures are recommended:	The natural site topography must be restored as fully as possible, and landscaping and rehabilitation of disturbed areas must be undertaken timeously.
Monitoring	
The following monitoring is recommended:	Routine monitoring by Site Staff and ESO/ECO during the decommissioning phase.

Table 7-10: Decommissioning: Soil erosion

Issue	Soil erosion during decommissioning stage	
Description of Impact		
Increased erosion due to ground disturbance during rehabilitation activities		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Permanent	Short-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Probable	Possible / frequent
Significance	Medium -	Low -
Degree to which impact can be reversed	The impact is reversible in respect of the laydown and platform areas, roads and turbine bases after the ground has been rehabilitated.	
Degree to which impact may cause irreplaceable loss of resources	This impact will not lead to irreplaceable loss of resources provided that the mitigation actions indicated below are adopted.	
Degree to which impact can be mitigated	The impact can be mitigated as described below.	
Mitigation actions		
The following measures are recommended:	Temporary berms and drainage channels to divert surface water where needed. The natural site topography should be restored wherever possible. Use of designated access routes to minimise the disturbance in surrounding areas.	
Monitoring		
The following monitoring is recommended:	Routine weekly monitoring by Site Staff and Environmental Practitioners during the decommissioning phase and at four monthly intervals thereafter until final sign-off is achieved.	

7.2.3 Cumulative Impact

The following cumulative impacts have been identified and rated by RABA (2022).

Table 7-11: Cumulative impact: ground disturbance during construction

Issue	Ground disturbance during construction	
Nature of cumulative impacts	As indicated in Table 2-2, 105.5Ha of land will be temporarily disturbed in Hoogland 3 and 121Ha permanently impacted. The areas in Hoogland 4 are 112.9Ha (temporary) and 123.3Ha (permanent). Mitigation measures can be successfully undertaken for the temporarily disturbed areas such as the laydown areas but the changes in other areas will be impossible to reverse during the lifetime of the project	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-12: Cumulative impact: soil erosion during construction

Issue	Soil erosion during construction	
Nature of cumulative impacts	Provided that the mitigating measures described in the impact tables above are instituted, the cumulative effect of the project on soil erosion is considered low and issues arising during construction can be mitigated or obviated by the mitigating measures.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-13: Cumulative impact: ground disturbance during the operational phase

Issue	Soil erosion during operational phase	
Nature of cumulative impacts	Provided that the maintenance and monitoring measures described in the impact tables above are instituted, the cumulative effect on the project is considered low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-14: Cumulative impact: ground disturbance during decommissioning

Issue	Ground disturbance during decommissioning	
Nature of cumulative impacts	Provided that the mitigation measures including the rehabilitation described in the impact tables above and the on-site monitoring are undertaken, the cumulative effect on the project is considered low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-15: Cumulative impact: soil erosion during decommissioning

Issue	Soil erosion during decommissioning stage	
Nature of cumulative impacts	Provided that the mitigation measures including the rehabilitation described in the impact tables above and the on-site monitoring are undertaken, the cumulative effect on the project is considered low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.2.4 No-Go Alternative

The 'no-go' alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail. In geological or geotechnical terms, this impact has been assessed as neutral since no changes can be expected.

In terms of the layout, no geologically or geotechnically sensitive areas were identified within the study area. Whereas the areas underlain by the sedimentary rocks are considered geotechnically marginally more suitable for the development than those areas underlain by dolerite and particularly by alluvium, other factors are likely to be more critical in determining the final layout. No preferences for the final layout within the area assist are therefore provided.

7.2.5 Conclusion and Recommendations

From a geotechnical and geological perspective, no fatal flaws, major sensitivities, or areas to be avoided completely have been identified within the area assessed for Hoogland 3 and Hoogland 4 Wind Farms. Sensitive areas have been identified but normal civil engineering and construction best practice and optimisation of the positions of the turbine positions and access roads will address the potential issues in these areas. It is therefore recommended that the proposed activity be authorised subject to adoption of the mitigating and monitoring measures outlined in this report.

7.3 Agriculture

This section provides a short summary of the agricultural specialist report, in the form of a Compliance Statement compiled by Johann Lanz which is available in *Appendix C3: Agriculture*.

7.3.1 Baseline Description

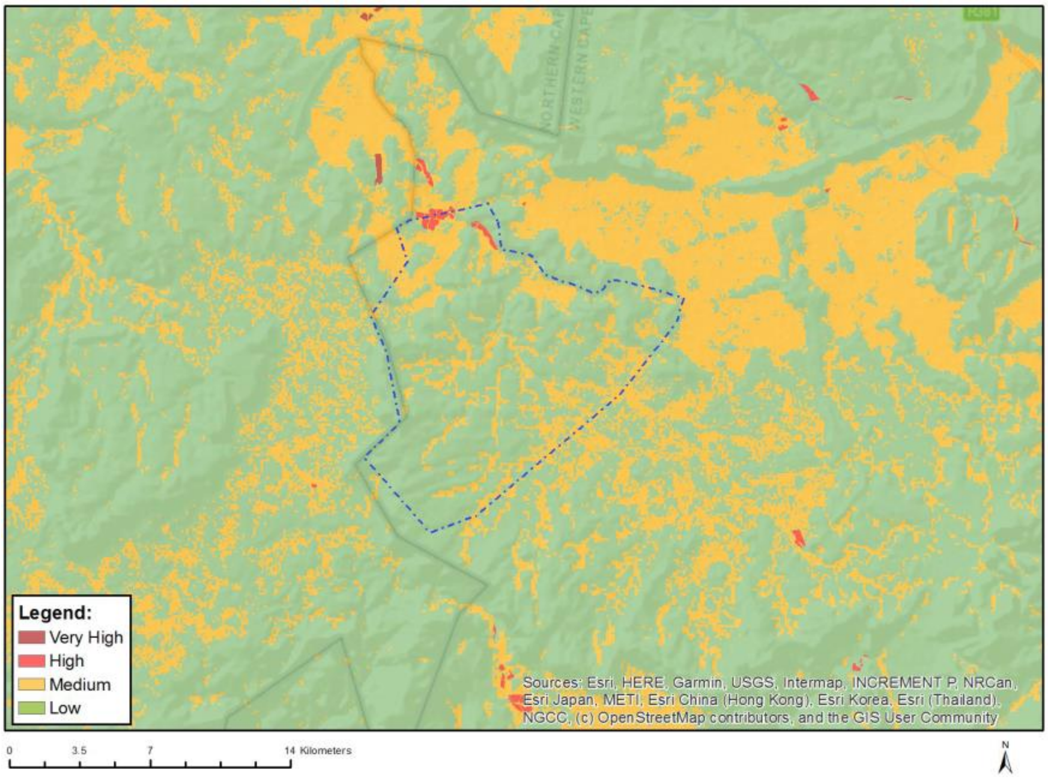
According to Lanz (2022), the aim of the Protocol for the Specialist Assessment and Minimum Report Content Requirements of Environmental Impacts on Agricultural Resources is to preserve valuable agricultural land for agricultural production. Valuable land is considered to be predominantly scarce arable land that is suitable for the viable production of cultivated crops.

Lanz (2022) states that an average rainfall as low as 190mm and high evaporation of between 1,250 and 1,350 mm per annum, proves the area to be arid and the proposed site is significantly constrained in terms of its possible agricultural productivity (including grazing). In addition, the land type data shows the dominant soils to be shallow soils on underlying rock or hard-pan carbonate. A low to medium agricultural sensitivity is entirely appropriate for this land which is unsuitable for crop production.

Agricultural infrastructure of the area includes wind pumps, stock watering points, several small farm dams are located at the Wind Farm sites, fencing, and farm complexes. Grazing of both sheep and game is the dominant agricultural land use in the area. Grazing capacity of the site is fairly low at 26 to 28 hectares per large stock unit. There is almost no cultivation in the area and what there is, is confined to small, isolated patches of pasture or fodder crops around farmsteads.

7.3.2 Site Sensitivity

While the Hoogland Wind Farms have been classified by the DFFE National Screening tool as being sensitive, this classification was on the basis of the presence of crop boundaries Lanz (2022) advised that the avoidance of mapped crop boundaries (cultivated fields) would decrease the sensitivity low and this was taken into consideration in the design of the layouts.



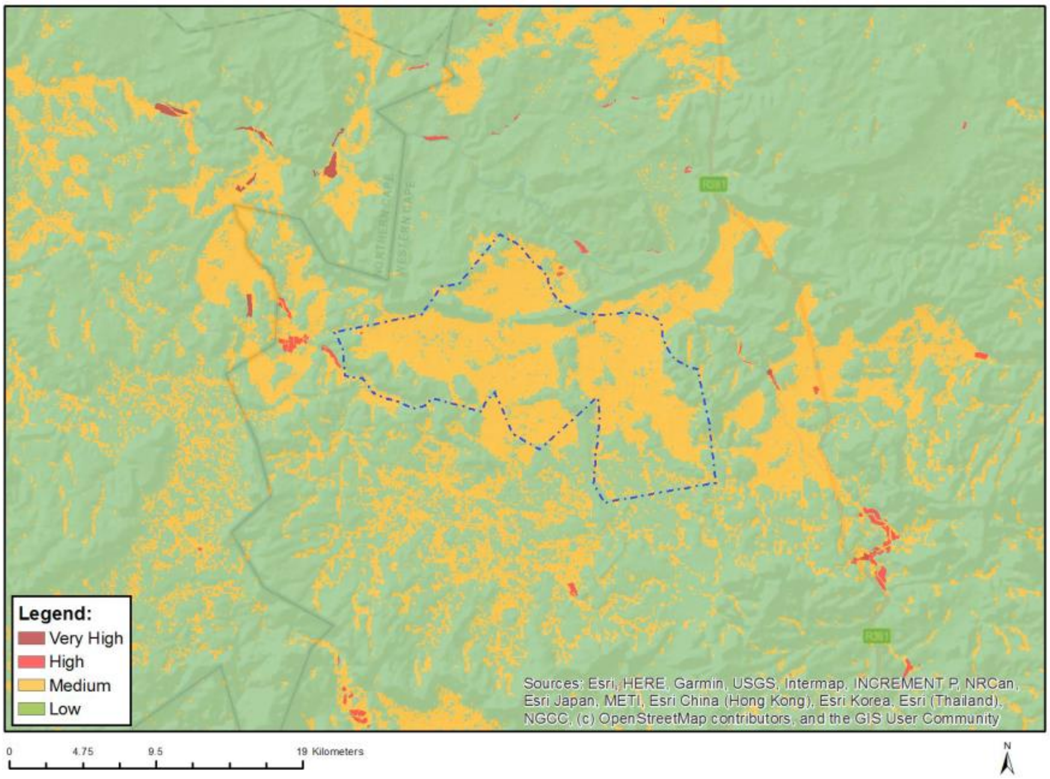


Figure 7-11: Map of relative agriculture theme sensitivity for Hoogland 3 Wind Farm (top) and Hoogland 4 Wind Farm (bottom). High sensitivity shown in red.

Agricultural sensitivity, in terms of environmental impact, and as used in the national web-based environmental screening tool, is a direct function of the capability of the land for agricultural production. This is because a negative impact, or exclusion of agriculture, on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. The general assessment of agricultural sensitivity that is employed in the national web-based environmental screening tool, identifies all arable land that can support viable production of cultivated crops, as high (or very high) sensitivity. This is because there is a scarcity of arable production land in South Africa and its conservation for agricultural use is therefore a priority. Land which cannot support viable production of cultivated crops is much less of a priority to conserve for agricultural use and is rated as medium or low agricultural sensitivity.

The Screening Tool classifies agricultural sensitivity according to only two independent criteria – the land capability rating and whether the land is cultivated or not. All cultivated land is classified as at least high sensitivity, based on the logic that if it is under cultivation, it is indeed suitable for cultivation, irrespective of its land capability rating.

The Screening Tool sensitivity categories in terms of land capability are based upon the Department of Agriculture's updated and refined, country-wide land capability mapping, released in 2016. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rain fed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability values (≥8 to 15) are likely to be suitable as arable land for the production of cultivated crops, while lower values are only likely to be suitable as non-arable, grazing land, or at the lowest extreme, not even suitable for grazing.

A map of the proposed agricultural footprint of the development, which is the total footprint of the facility that actually excludes agricultural land use, overlaid on the screening tool sensitivity is given in Figure 7-12. Within the development area there are small, isolated patches of cultivation around farmsteads that are classified as cultivated land and therefore allocated high agricultural sensitivity because of it (red in Figure 7-12). The Wind Farm footprint entirely avoids all of these areas, and this was purposefully considered in the design. Across the rest of the site, agricultural sensitivity is purely a function of land capability. The land capability of the site on the screening tool is predominantly 5 and 6 but varies from 1 to 7. Values of 1 to 5 translate to a low agricultural sensitivity, and values of 6 to 7 translate to a medium agricultural sensitivity.

Because the environment is unsuited to cultivation, the differences in land capability across the project area are not very significant and are more a function of how the land capability data is generated by modelling, and strongly influenced by terrain in this environment, than actual meaningful differences in agricultural potential on the ground.

The Site Sensitivity Verification by Lanz (2022) verifies the entire agricultural footprint as being of less than high agricultural sensitivity. The required level of agricultural assessment is therefore confirmed as an Agricultural Compliance Statement (refer to *Appendix C3: Agriculture*).

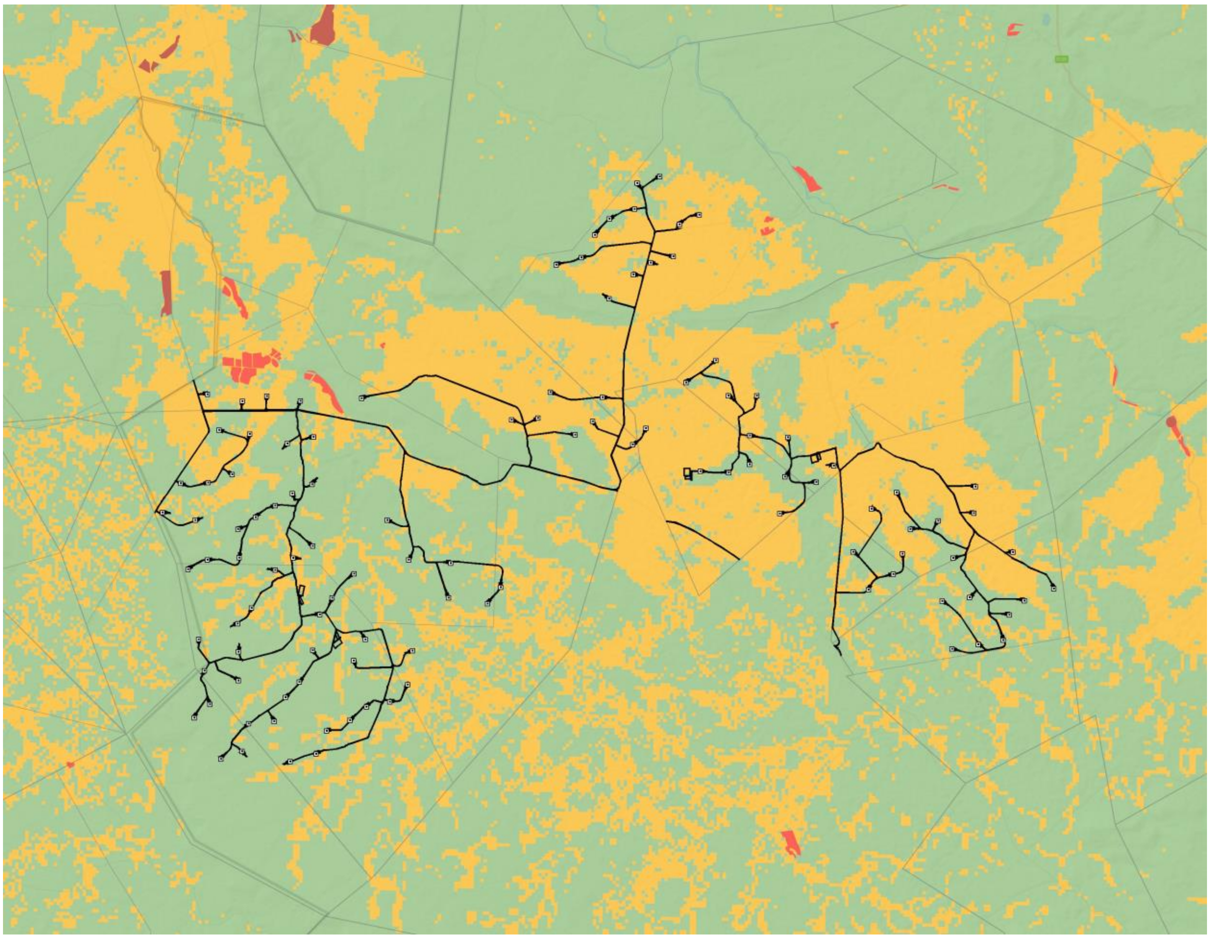


Figure 7-12: The proposed footprint of the facilities, overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high).

7.3.3 Impact Assessment and Mitigation

For reasons explained above a Compliance Statement has been compiled which does not require an assessment in accordance with the NEMA compliant SLR methodology.

7.3.3.1 Impacts

Three potential negative direct agricultural impacts have been identified and described below:

1. 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. Only an insignificant proportion (0.72%) of the available agricultural land is impacted in this way.
2. Loss of agricultural potential by soil degradation – Soil can be degraded by impacts in two different ways: erosion and topsoil loss. 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. Soil degradation will reduce the ability of the soil to support vegetation growth. This impact occurs only during the construction and decommissioning phases. Although the site is susceptibility to soil erosion, it can be completely

managed with an effective erosion management plan. Because the agricultural footprint impacts such a small proportion of the land, it only has the possibility to cause degradation on a very small proportion of the land.

3. Loss of agricultural potential by dust generation – The disturbance of the soil surface, particularly during construction, will generate dust that can negatively impact surrounding veld and farm animals.

One positive agricultural impact has been identified, that is an indirect impact:

1. Enhanced agricultural potential through increased financial security for farming operations - Reliable income will be generated through the lease of the land to the energy facility. This is likely to increase cash flow and financial security of landowners and could improve farming operations and productivity through increased investment into farming.

The extent to which any of these impacts is likely to affect levels of agricultural production is very small and the significance of all agricultural impacts is therefore very low.

7.3.3.2 Mitigation

1. Design an effective system of stormwater run-off 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 run-off water from all accumulation points and it must prevent any potential down slope erosion. This is included in the stormwater management plan.
2. Maintain where possible all vegetation cover and facilitate re-vegetation 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 re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.

7.3.4 Cumulative Impact

According to Lanz (2022), the potential cumulative agricultural impact of importance is a regional loss (including by degradation) of agricultural land, with a consequent decrease in agricultural production.

In quantifying the cumulative impact, the area of land taken out of grazing as a result of all of these projects will amount to a total of 816 hectares. As a proportion of the total area within a 30km radius (approximately 282,700ha), this amounts to only 0.29% of the surface area. That is considered to be within an acceptable limit in terms of loss of agricultural land that is only suitable for grazing, of which there is no scarcity in the country.

The risk of a loss of agricultural potential by soil degradation is low because it can effectively be mitigated for renewable energy developments. If the risk for each individual development is low, then the cumulative risk is also low.

Furthermore, there are no significant other land uses, apart from renewable energy, that are competing for agricultural land in the area, and so the total cumulative loss of agricultural land from all competing land uses is not significantly higher than what has been considered above.

Due to all of the considerations discussed above, the cumulative impact of loss of agricultural land use is assessed as being very low and 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.

7.3.5 No-Go Alternative

Lanz (2022) states that the no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. The one identified potential impact is that due to continued low rainfall in the area, which is likely to be exacerbated by climate change, agriculture in the area will come under increased pressure in terms of economic viability.

The development offers an additional income source to agriculture, without excluding agriculture from the land. Therefore, the negative agricultural impact of the no-go alternative is more significant than that of the development, and so, purely from an agricultural impact perspective, the proposed development is the preferred alternative between the development and the no-go.

7.3.6 Conclusion and Recommendations

All agricultural impacts of the proposed Hoogland 3 and Hoogland 4 Wind Farms are assessed as being of very low significance. However, an Agricultural Compliance Statement is not required to formally rate agricultural impacts. It is only required to indicate whether or not the proposed development will have an unacceptable impact on the agricultural production capability of the site. It must provide a substantiated statement on the acceptability, or not, of the proposed development and a recommendation on the approval, or not of the proposed development.

The conclusion of this assessment is that the proposed development will not have an unacceptable negative impact on the agricultural production capability of the site. The proposed development is therefore acceptable. This is substantiated by the following points:

- The proposed development will occupy land that is of very limited land capability, is only suitable as grazing land, and is unsuitable for the production of cultivated crops. There is not a scarcity of such agricultural land in South Africa and its conservation for agriculture is not therefore a priority.
- The amount of agricultural land loss is well within the allowable development limits prescribed by the agricultural protocol. These limits reflect the national need to conserve valuable agricultural land and therefore to steer, particularly renewable energy developments, onto land with low agricultural production potential.
- The proposed development poses a low risk in terms of causing soil degradation, and only to a very small proportion of the land. Degradation can be adequately and easily managed by mitigation management actions. In addition, the degradation risk is only to land of low agricultural value, and the significance of the impact is therefore low.
- The proposed development offers some positive impact on agriculture by way of improved financial security for farming operations, as well as wider, societal benefits.

Therefore, from an agricultural impact point of view, it is recommended that the Hoogland 3 and Hoogland 4 Wind Farms be approved.

7.4 Terrestrial Ecology

This section provides a short summary of the suite of terrestrial ecology reports compiled largely by Simon Todd of 3Foxes Biodiversity Solutions and supplemented by Marius Burger of Sungazer Faunal Surveys.

Terrestrial ecology includes high level floral and faunal (reptile, mammal and amphibians) components of the environment and the study has been guided by the requirements of the DFFE Screening Tool outputs. This section therefore includes the findings of a Terrestrial Biodiversity Impact Assessment (*Appendix C4: Terrestrial Ecology*), a detailed standalone Plant species compliance statement (*Appendix C5: Flora*), a Riverine Rabbit species assessment report (*Appendix C6: Riverine Rabbit)* all compiled by 3Foxes Biodiversity Solutions as well as a Karoo Dwarf tortoise species assessment report (*Appendix C7: Karoo Dwarf Tortoise*) compiled by Marius Burger of Sungazer Faunal Surveys. The findings of these reports have been considered in Sections 7.4.1.3, 7.4.1.3.1and 7.4.1.3.2 respectively, to provide a comprehensive holistic representation of the various terrestrial ecological findings.

Bats (refer to Section 7.5) and Avifauna (refer to Section 7.6) findings have been excluded from this section and are dealt with separately since this is a different specialist field of expertise. Aquatic ecology has also been considered separately in Section 7.7.

7.4.1 Baseline Description

Simon Todd of 3Foxes visited the site in April 2021, September 2021, February 2022, March 2022 and June 2022, spending 10 days on site, furthermore the Nuweveld component was visited on four occasions between June 2019 and February 2020. Herpetological specialist Marius Burger of Sungazer Faunal Surveys visited the site between 21 to 27 September 2021. During these visits, various sensitive areas (identified via aerial imagery) were investigated and ground-truthed. Activities also included installation of 29 camera traps placed to monitor Riverine Rabbit and other mammal activity in the field in June 2021 and retrieved in- June 2022 giving rise to 12 months of camera trapping to inform the study.

7.4.1.1 Vegetation Types

The National Vegetation Map (Mucina & Rutherford 2006 & SANBI 2018 update) for the study area is depicted below in Figure 7-13. There are several vegetation types within the Hoogland Southern Cluster including Eastern Upper Karoo which predominates in the north of the site, Western Upper Karoo which predominates in the central and eastern parts of Hoogland 3, and the south of Hoogland 4; Upper Karoo Hardeveld which occupies the major ridge systems of both sites, especially in the southwest. Although it has not been mapped as falling within the site, there is also some Bushmanland Vloere present in parts of the site, namely Hoogland 4. In Hoogland 3, although not all areas associated with the Southern Karoo Riviere vegetation type have been mapped in the VegMap, the vegetation along the major rivers within the site corresponds with the Southern Karoo Riviere vegetation type. These vegetation types are described and illustrated briefly below as observed at the site.

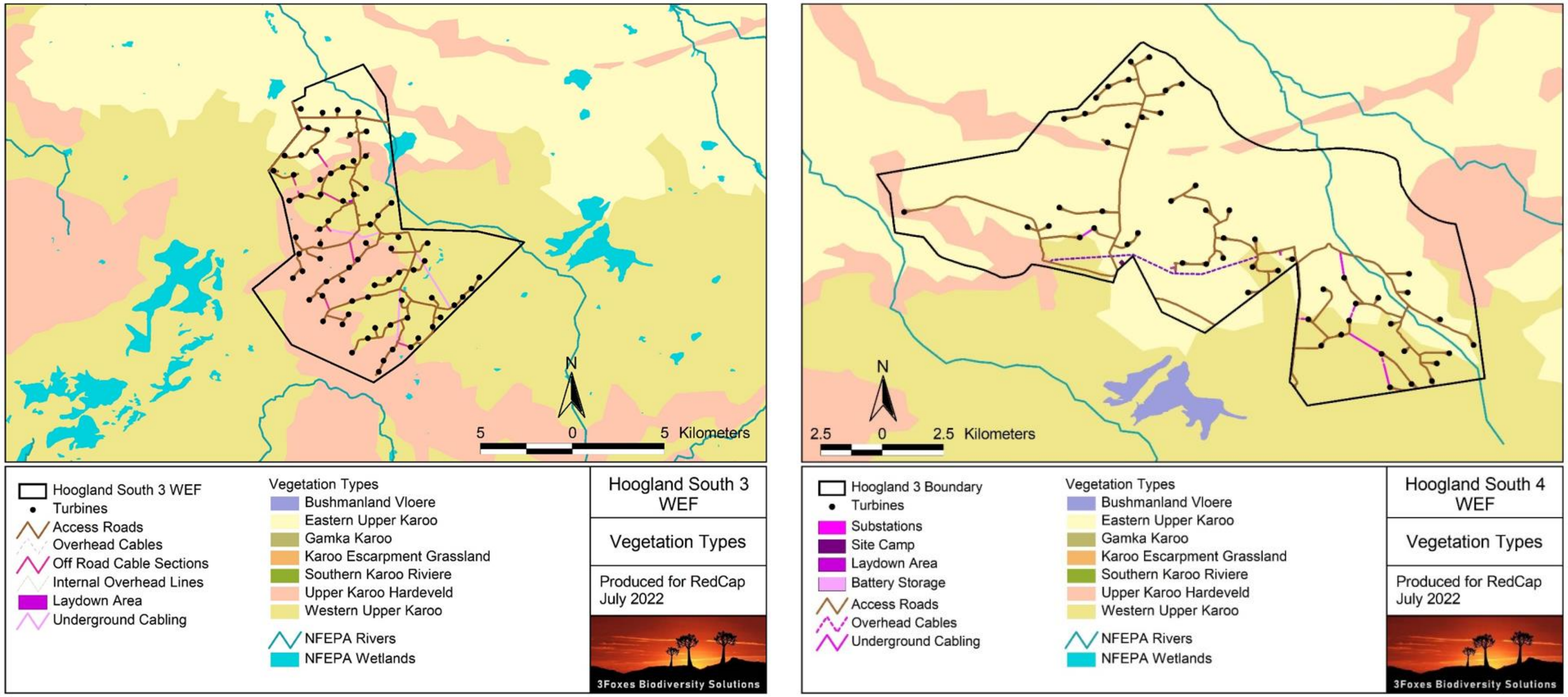


Figure 7-13: The National Vegetation Map (SANBI 2018 Update) for the Southern Cluster Wind Farms and surrounding area (Hoogland 3 left and Hoogland 4 right)

7.4.1.1.1 Eastern Upper Karoo

Eastern Upper Karoo dominates the northern section of the Hoogland 3 and Hoogland 4 study areas and is the predominant vegetation type within the Hoogland 4 site. Eastern Upper Karoo has an extent of 49 821 km^2 and is the most extensive vegetation type in South Africa and forms a large proportion of the central and eastern Nama Karoo Biome. This vegetation type is classified as Least Threatened, and about 2% of the original extent has been transformed largely for intensive agriculture. Eastern Upper Karoo is however poorly protected and less than 1% of the 21% target has been formally conserved. Mucina & Rutherford (2006) list eight endemic species for this vegetation type, which considering that it is the most extensive unit in the country, is not very high. As a result, this is not considered to represent a sensitive vegetation type.

Within the study area, this is dominant vegetation type and forms the matrix in which the other vegetation units are embedded. There is however a fairly large degree of variation in the structure and composition of Eastern Upper Karoo within the site, driven largely by the substrate conditions, with the main differences being associated with dolerite-derived soils vs. shale and mudstone- derived soils. Overall, these tend to be represented by large tracts of fairly homogenous landscapes of low plant diversity. Dominant and characteristic species include low woody shrubs such as *Pentzia globosa*, *Rosenia humulis*, *Asparagus capensis*, *Eriocephalus ericoides*, *Pteronia sordida*, *Pteronia incana*, *Plinthus karooicus*, *Helichrysum luciloides*, *Felicia muricata*, with a varying density of low succulent shrubs such as *Roepera lichtensteinii*, *Aridaria noctiflora* and *Ruschia spinosa*, with a variable grass layer dominated by *Aristida adscenionis*, *Stipagrostis ciliata*, *Stipagrostis obtusa*, *Enneapogon desvauxii* and *Tragus berteronianus.*

Figure 7-14: Typical open plains present in the north of the Hoogland South 3 study area, corresponding with the Eastern Upper Karoo vegetation type. The typical plains of the study area are considered low sensitivity and considered suitable for wind farm development.

Figure 7-15: Typical open plains present in the north of the Hoogland South 4 study area, corresponding with the Eastern Upper Karoo vegetation type. The typical plains of the study area are considered low sensitivity and considered suitable for wind farm development.

7.4.1.1.2 Western Upper Karoo

The Western Upper Karoo vegetation type occurs in the Northern Cape Province and a small part in the Western Cape and occurs on plains from the Fish River and upper reaches of the Renoster River in the west as far as Fraserburg and Carnarvon in the east, sandwiched between the Bushmanland Basin in the north and the Roggeveld Karoo and edges of the Great Escarpment in the south. In the southwest the dissected landscape is associated with the tributaries of the upper catchment of the Sak River (e.g. Renoster River, Riet River, Klein Sak River) and is often rocky. It is a mixture of small-leaved shrubs and shrubby succulents (*Brownanthus*, *Drosanthemum*, *Ruschia* etc.) with drought-resistant (mostly 'white') grasses a determinant feature of the vegetation structure.

Within the Hoogland Southern Cluster, there is not a lot of difference between Western Upper Karoo and Eastern Upper Karoo and there are not usually clear boundaries between these vegetation types. However, in general, the lower elevation and southern, warmer areas consist of Western Upper Karoo, while the northern and colder areas consist of Eastern Upper Karoo. Common and dominant shrub species include *Lycium cinereum*, *Tripteris sinuata, Chrysocoma ciliata, Eriocephalus ericoides subsp. ericoides, Helichrysum lucilioides, Pentzia globosa, Tetragonia arbuscula, Asparagus capensis var. capensis, Berkheya annectens, Eriocephalus decussatus, Euryops multifidus, Felicia muricata, Hermannia cuneifolia, H. spinosa, Melolobium candicans, Pegolettia retrofracta, Pentzia incana, Pteronia adenocarpa, P. glauca, P. mucronata, P. sordida, Rosenia glandulosa, Selago albida* and *Zygophyllum microphyllum*. Succulent shrubs include *Ruschia intricata, Aridaria noctiflora subsp. straminea, Brownanthus ciliata subsp. ciliatus, Drosanthemum lique, Euphorbia rectirama, Galenia sarcophylla, Salsola calluna, S. glabrescens, S. rabieana, S. tuberculata, Sarcocaulon patersonii* and *Psilocaulon coriarium*. Grasses include *Aristida congesta, Enneapogon desvauxii, Stipagrostis ciliata, S. obtusa, Aristida adscensionis, A. diffusa, Eragrostis obtusa, Fingerhuthia africana, Tragus berteronianus* and *T. koelerioides*. In general, this is not considered to represent a sensitive vegetation type Figure 7-17 and Figure 7 18

Figure 7-16: Western Upper Karoo from within Hoogland South 3 Wind Farm, with a large amount of annual grass present as a result of heavy rains experienced in the summer of 2021/2022.

Figure 7-17: Western Upper Karoo from within Hoogland South 4 Wind Farm, which is usually similar in structure and composition to the areas of Eastern Upper Karoo, but usually has a higher proportion of grass.

7.4.1.1.3 Upper Karoo Hardeveld

The Upper Karoo Hardeveld vegetation type is associated with 11 734 km^2 of the steep slopes of koppies, buttes mesas and parts of the Great Escarpment covered with large boulders and stones. The vegetation type occurs as discrete areas associated with slopes and ridges from Middelpos in the west and Strydenburg, Richmond and Nieu-Bethesda in the east, as well as most south-facing slopes and crests of the Great Escarpment between Teekloofpas and eastwards to Graaff-Reinet. Altitude varies from 1000-1900m. Mucina & Rutherford (2006) list 17 species known to be endemic to the vegetation type. This is a high number given the wide distribution of most karoo species and illustrates the relative sensitivity of this vegetation type compared to the surrounding Eastern Upper Karoo.

Most of the hills, outcrops and steep slopes within the Hoogland South site consist of Upper Karoo Hardeveld. This vegetation type usually consists of very rocky ground and is often associated with steep slopes, with the result that it is considered vulnerable to disturbance but is also an important habitat for fauna. Although it contains a higher diversity of plant species than the adjacent areas of Eastern Upper Karoo, no red-listed plant species were observed within these areas. Thus, while the rocky hills are considered sensitive from an overall ecological perspective, they are considered low sensitivity for plant species.

Figure 7-18: Dolerite ridge within the Hoogland South 3 site, with the Upper Karoo Hardeveld vegetation type.

Figure 7-19: Dolerite ridge within the Hoogland South 4 site, with the Upper Karoo Hardeveld vegetation type.

7.4.1.1.4 Southern Karoo Riviere (Hoogland 3)

Although not all areas associated with this vegetation type have been mapped in the VegMap, the vegetation along the major rivers within the site corresponds with the Southern Karoo Riviere vegetation type. In the area, the riparian areas are mapped as Bushmanland Vloere in the VegMap, but this is not an appropriate designation for these areas and the riparian areas within the site and within the upper Sak and Krom rivers more generally, corresponds better with the Southern Karoo Riviere vegetation type. The Southern Karoo Riviere vegetation type is associated with the rivers of the central karoo such as the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega and Sundays Rivers. About 12% has been transformed as a result of intensive agriculture and the construction of dams. Although it is classified as Least Threatened, it is associated with rivers and drainage lines and as such represents areas that are considered ecologically significant. Common and dominant species in the drainage lines and within the adjacent floodplain vegetation include *Sporobolus ioclados*, *Helichrysum pentzioides*, *Drosanthemum lique*, *Pentzia globosa*, *Salsola aphylla*, *Tribulis terrestris*, *Felicia muricata*, *Atriplex vestita, Roepera retrofractum*, *Cynodon dactylon*, *Chrysocoma ciliata*, *Stipagostis namaquensis*, *Lycium pumilum*, *Lycium cinereum*, *Artemisia africana*, *Tripteris spinescens*, *Exomis microphylla* and *Derverra denudata*. These areas are considered important for ecological processes and the provision of ecosystem services.

Figure 7-20: Typical drainage line within the Hoogland 3 Wind Farm, with standing water as a result of recent rains.

7.4.1.1.1 Bushmanland Vloere (Hoogland 4)

The Bushmanland Vloere vegetation type is restricted largely to the Bushmanland and the Northern Cape, but occurs marginally into the Western Cape in places. It occupies the vloere (salt pans) of the central Bushmanland Basin as well as the broad riverbeds of the intermittent Sak River as well as its numerous ancient tributaries. This is not a well investigated vegetation type and it has not been well studied or characterised. Common and dominant species include *Parkinsonia africana, Xerocladia viridiramis, Rhigozum trichotomum, Aizoon schellenbergii, Asparagus glaucus, Eriocephalus decussatus, Eriocephalus spinescens, Pegolettia retrofracta, Salsola aphylla, Salsola glabrescens, Salsola rabieana, Lycium pumilum, Amaranthus dinteri, Lotononis minima, Stipagristis ciliata, Stipagrostis obtusa* and *Sporobolus nervosus*. Although there aren't any plant species of concern associated with the pans, they are considered sensitive from a general ecological perspective and have been excluded from the development footprint.

Figure 7-21: Example of one of the pans within the Hoogland 4 Wind Farm, corresponding with the Bushmanland Vloere vegetation type.

7.4.1.2 Listed Plant Species

The DFFE screening tool lists four sensitive plant species potentially present within Hoogland 3, and four potentially present within Hoogland 4, site being rates as medium sensitivity for these species, these are shown in Table 7-16. None of these species were observed within the site and as a result, the site is considered low sensitivity for these species. Some of these species are however cryptic and it is possible that given the large extent of the Hoogland Southern Cluster site, that some of these species may have been missed. However, a preconstruction walk-through of the final development footprint would enable any affected individuals of these species to be avoided. The cryptic species are associated with specialised habitats with the result that they tend to be highly localised and hence can be effectively avoided through micrositing of turbines and access roads.

Table 7-16: Listed plant species known from the broad area around the Hoogland Southern Cluster site. None of these species were observed at the site.

DFFE Site Status	Name	IUCN Status	Possible presence within the Hoogland South Cluster
Medium	*Isolepis expallescens*	Vulnerable	Hoogland 4: Nuweveld Mountains between Fraserburg and Victoria West. This species is known from only three collections, but its distribution range is botanically very poorly explored. This species was not observed within the site. However, if present it would be associated with mesic areas which would be avoided by the development.
Medium	Sensitive species 484	Rare	Hoogland 3: This small cryptic succulent occurs from the Roggeveld Escarpment to the Nuweveld Mountains. As this species is localised habitat specialist it is possible that it was overlooked within the site.

DFFE Site Status	Name	IUCN Status	Possible presence within the Hoogland South Cluster
			However, as it was not observed despite searching within suitable habitat, it is assumed absent from the site.
Medium	Sensitive species 945	Rare	Hoogland 3 and 4: This seasonal geophyte species is associated with dolerite outcrops in high-lying areas of the Sneeuberg, Agter-Sneeuberg and Nuweveld Mountains. It was not observed within the Hoogland South site. As a result, this species is considered absent from the site and hence the site is considered low sensitivity for this species.
Medium	Sensitive species 886	Rare	Hoogland 3: This asteraceous shrub grows on the Roggeveld and Hantamsberg Mountains. The habitat is considered to represent steep or gentle slopes of a mainly southern aspect in low karroid scrub. This species was not observed within the site and it is assumed to be absent from the site.
Medium	*Cliffortia arborea*	Vulnerable	Hoogland 3 and 4: This is a conspicuous species that grows on cliffs from the Hantamsberg Mountain to the Nuweveld Mountains. There is little suitable habitat for this species at the site and it is confirmed as not present within the Hoogland Southern Cluster site.

7.4.1.3 Faunal Communities

7.4.1.3.1 Mammals

As many as 70 mammals are listed for the wider study area in the MammalMap database, but many of these are introduced or conservation dependent and approximately 48 can be considered to be free-roaming and potentially impacted by the development. This includes several red-listed species including the Riverine Rabbit *Bunolagus monticularis* (CR), Black-footed Cat *Felis nigripes* (VU), Grey Rhebok *Pelea capreolus* (NT), Mountain Reedbuck *Redunca fulvorufula* (EN) and Brown Hyena *Hyaena brunnea* (NT). Based on the camera trapping conducted on the site, only the Riverine Rabbit can be confirmed present within Hoogland Wind Farm 3. Hoogland 4 Wind Farm lacks suitable habitat, specifically relatively large intact and contiguous patches of riparian vegetation. An analysis of the potential presence and the possible impact of the development on these species is provided below in Table **7**-**16**.

Table 7-17: Red-listed mammals known from the broad area and their likely presence in the Hoogland Southern Cluster sites and the likely consequence thereof.

Species	Status	Likely Presence & Consequence		
		Wider Hoogland Southern Area	Hoogland 3 Wind Farm	Hoogland 4 Wind Farm
Riverine Rabbit Bunolagus monticularis	CR	Confirmed present within the Hoogland 3 Wind Farm, and more widely within the Riet and Sak River.	Confirmed present within the Hoogland South 3 site. Common locally within suitable habitat. Significant avoidance and mitigation has been implemented to reduce the impact of the development on this species. Please refer to the Riverine Rabbit Species Assessment for further details.	There are no major drainage lines within the site that contain extensive tracts of riparian vegetation and the camera trapping failed to confirm the presence of this species within the Hoogland 4 site, with the result that the site is considered low sensitivity for this species.
Black-footed Cat Felis nigripes (VU)	VU	There are historical records from the Hoogland area and it is considered to be possibly present within the Karoo National Park but not confirmed.	This is a secretive species and while it may be present in the area, this species has not been detected by any of the camera trapping conducted by the consultant in the Nuweveld area to date. This species is likely either not present within the site or only rarely present.	
Grey Rhebok Pelea capreolus	NT	This species is confirmed present in the broader area and can commonly be seen in most areas of high-lying ground in the Karoo and along the Great escarpment.	This species was not been detected by the camera traps on the Hoogland South site or on the nearby Hoogland North and Nuweveld WEFs, suggesting that it does not occur within the study area despite being present along the Nuweveld Escarpment to the south and east of the current site. This species has a wide distribution in the country and the wind farm is not likely to generate a significant impact on the local population of this species.	
Mountain Reedbuck Redunca fulvorufula	EN	This species is confirmed present in the area, both within the Karoo National Park and more generally in the area, in high-lying areas with good grass cover.	This species has been confirmed present within the nearby Nuweveld WEF but has not been detected on Hoogland South. This suggests that this species is not present within the Hoogland South site as it is frequently picked up by camera traps within suitable habitat. As with the Grey Rhebok, this species has a large range and it is not likely that the development would generate a large impact on this species.	

Brown Hyena *Hyaena brunnea*	NT	This species occurs at a naturally low density within the Karoo and is known from a few records from the Karoo National Park but may also roam freely on farmland.	Although this species may pass through the area on occasion, it is considered unlikely to be present on the site on a regular basis and has not been detected by any of the camera trapping conducted in the broad area to date.

In terms of sensitivity mapping relating more generally to mammals, the riparian areas have been classified as Very High sensitivity based on their value as Riverine Rabbit habitat but also as a result of their general ecological significance (see Section 7.4.1.3.1.1). The rocky hills and steep slopes have been classified as High and Very High sensitivity on account of the value of these areas as habitat for mammals associated with rocky areas and the more general ecological value of these areas.

7.4.1.3.1.1 Riverine Rabbit Species Assessment

A Riverine Rabbit Species Specialist Assessment was compiled Hoogland 3 Wind Farm and Compliance Statement was compiled for Hoogland Wind Farm 4, the findings of which are detailed below.

The Riverine Rabbit was detected only within the Hoogland 3 Wind Farm of the Southern Cluster and is associated largely with the Rietfontein River (Figure 7-22). All of the sightings are within the typical floodplain environment associated with this species, confirming the high fidelity for specific riparian communities associated with the larger drainage systems of the area. No rabbits were detected along the minor drainage features of the Southern site, supporting the high fidelity of this species for specific riparian communities. One of the five camera locations. Voucher images from all cameras with Riverine Rabbit observations have been uploaded onto the iNaturalist platform (https://www.inaturalist.org/, Figure 7-23 and Table 7-18).

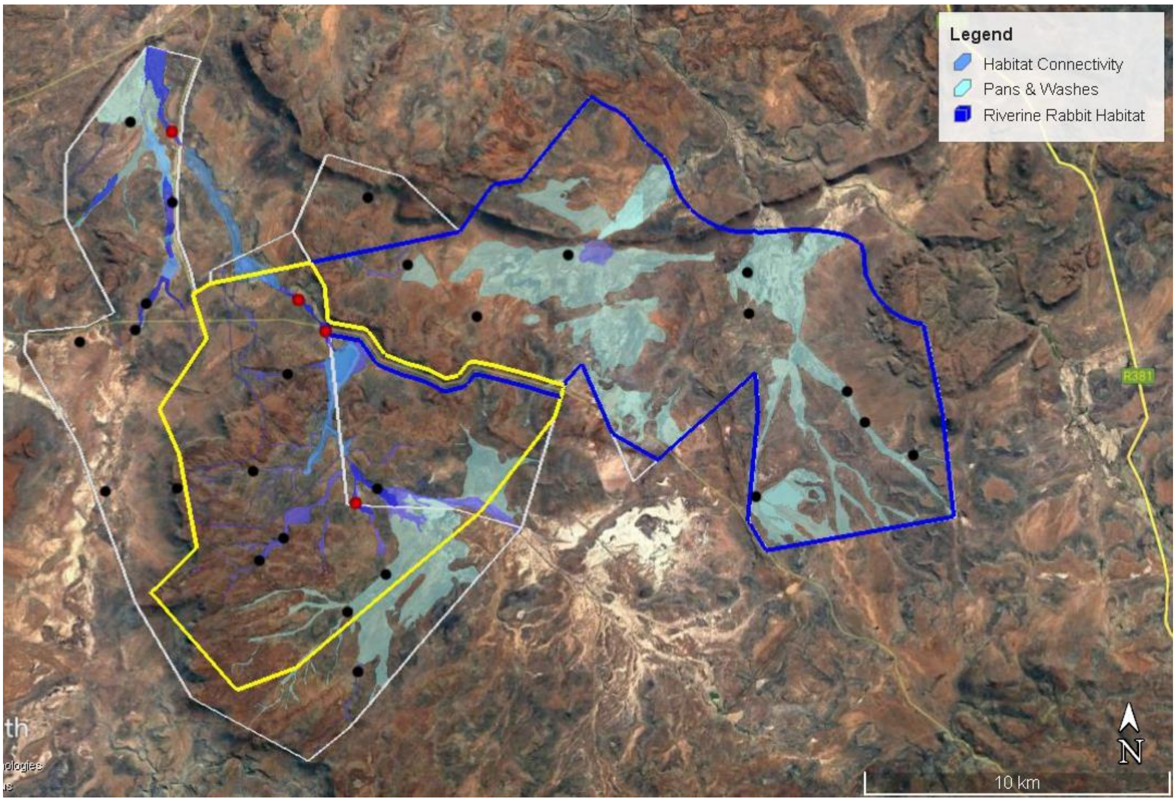


Figure 7-22: Map showing the location of camera traps within the Hoogland South Cluster site showing camera locations with confirmed Riverine Rabbit observations in red.

Figure 7-23: Riverine Rabbit images captured at different localities by camera traps within the Hoogland South site.

Table 7-18: Camera trap numbers and associated iNaturalist observations of Riverine Rabbits

Camera Trap Number	iNaturalist Link	Observations
SC17	https://inaturalist.ca/observations/128340444	11
SC1	https://inaturalist.ca/observations/120740040	8
SC20	https://inaturalist.ca/observations/120734541	97
SC9	https://inaturalist.ca/observations/120733364	17

The Riverine Rabbit is endemic to the semi-arid central Karoo region of South Africa. It is associated with dense riparian scrub fringing the seasonal rivers of the region (Figure 7-24). This habitat specificity is assumed to be related to a dependence on soft and deep alluvial soils along the river courses for constructing stable breeding stops. Home range has been estimated as approximately 12 ha (Duthie 1989). Riverine Rabbits are nocturnal, spending daylight hours in a scrape beneath riparian vegetation. They are solitary and will only be found in breeding pairs for short periods, or in female-juvenile pairs for rearing purposes (Duthie 1989). Results of the current camera trapping exercise indicate that they only come out to forage after dark, but may still be active in the early morning after sunrise.

Figure 7-24: Example of riparian vegetation present within the Hoogland 3 Wind Farm, with good vegetation cover and plant species indicative of favourable habitat for Riverine Rabbits.

Geographically, Riverine Rabbits occur in two separate populations, with a population centred on the Upper Karoo (the northern population) and a second more-recently discovered population in the Little Karoo (the southern population). Population estimates vary widely and it clear that a reliable estimate of the overall population size has yet to be made. Duthie et al. (1989) speculated that the remaining habitat might potentially support around 1,435 individuals. This is in contrast to Collins & Du Toit (2016) who estimated an adult population of between 157 and 207 individuals. This latter estimate was however based on an extrapolation from actual observations of rabbits obtained during monitoring transects, which is not a reliable manner of obtaining density estimates as Rabbits are not easily flushed from their scrapes. In addition, there have been some recent range extensions based on observations of Riverine Rabbits from novel areas including from near to the Baviaanskloof in the Eastern Cape (EWT pers. comm.). The 2016 red list assessment indicates that at the time, there were an estimated 12 subpopulations, three in the southern population and nine in the northern population.

Threats to this species include ongoing habitat degradation and fragmentation due to detrimental land-use practices (largely overgrazing and transformation for intensive agriculture), climate change and renewable energy development. It is estimated that 40–60% of the riparian habitat has been lost as a result of cultivation over the past century.

Due to the presence of the Riverine Rabbit at the Hoogland 3 Wind Farm site and the condition and extent of habitat, the areas of habitat within the site are considered to have a High Site Ecological Importance (SEI). Within the study area, areas of habitat are restricted to the major drainage lines and in particular the Rietfontein River and the Sak Rivier. Apart from areas deemed to be potentially suitable Riverine Rabbit habitat all major and minor drainage features of the site were mapped and included into the overall sensitivity mapping of the site (Figure 7-25). These buffers and corridor linkages between the major habitat patches have been integrated into the turbine no-go layer and this explicitly informs the location of turbines at the site. Based on the turbine layout provided for the current assessment, there are no turbines within Riverine Rabbit habitat buffers. All planned roads through the identified areas of habitat have been located along existing major farm access roads, thereby limiting habitat loss to less than 0.5ha. With the implementation of the above avoidance as well as the other recommended mitigation measures, the overall long-term impact of the development on Riverine Rabbits and their associated habitat is likely to be acceptable and would not be likely to compromise the local or regional population of this species.

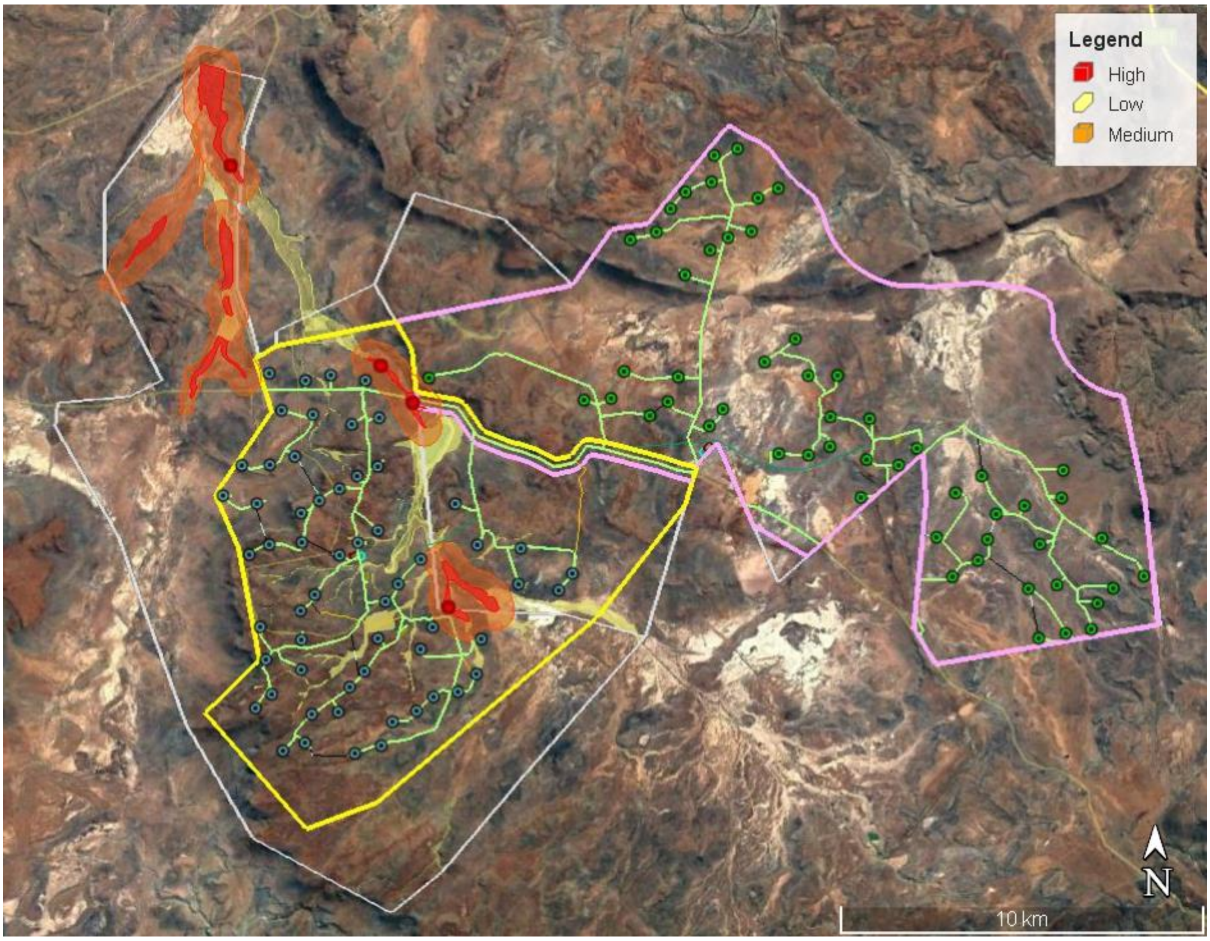


Figure 7-25. Sensitive areas for the Riverine Rabbit within the greater Southern Cluster study area

7.4.1.3.2 Reptiles

Reptile diversity in the wider area is relatively high which can be ascribed to the diversity of habitats present, especially along the Nuweveld escarpment south of the site. Based on the results of the adjacent Nuweveld Wind Farms study, which includes the contribution of the Sungazer (2020) study, approximately 63 reptile species are known from the general region and may potentially occur within the study area, with 14 being of confirmed occurrence, 45 of probable occurrence and four of possible occurrence. Species of potential concern include the local endemic, Braack's Pygmy Gecko and the Karoo Dwarf Tortoise. Braack's Pygmy Gecko *Goggia braacki* is a Western Cape endemic with an extremely restricted distribution range. Most of its distribution is associated with a section of the Hoogland Mountains range within the Karoo National Park. It is however not currently red-listed, but it can perhaps be regarded as the reptile icon for the Hoogland/Beaufort West region. It has thus far, not been recorded in the Hoogland Wind Farms study area, but it may possibly (not probably) be present within the study area.

The only threatened (Red Listed) reptile species in this region is the Karoo Dwarf Tortoise (EN) and it is addressed below.

7.4.1.3.2.1 Karoo Dwarf Tortoise Species Assessment

According to Sungazer Faunal Surveys (2022), this small tortoise (max. 110 mm in length) is cryptically coloured seldom observed, and it is often difficult to detect specimens in stony habitat. The Karoo Dwarf Tortoise is a South African endemic that is distributed throughout much of the south-western Great Karoo and along the region of the Great Escarpment, eastwards to Cradock in the Eastern Cape Province. The Karoo Dwarf Tortoise occurs mainly in the southern regions of the Succulent and Nama Karoo biomes and peripherally in the Albany Thicket biome in the southeast of its range, at elevations of approximately 800–1,500 meters above sea level. This species is generally associated with dolerite ridges, but it also inhabits various other rocky outcrops such as sandstone and shale formations. The rocky components serve as shelter for this small tortoise (Figure 7-26).

Figure 7-26: A pair of Karoo Dwarf Tortoises emerging from the shelter of a large rock, photographed by Courtney Hundermark at a DTC research site in the Williston region.

The current IUCN conservation status of the Karoo Dwarf Tortoise is Endangered (A4ace). This is because most localities (30 of 35) no longer harbour viable populations and nearly 50% of the species' range is moderately or severely degraded with changes from a shrubby to a grassy landscape (Stevens *et al.* 2015). The species is thought to be in decline based on an estimate of a reduction in population size of approximately 30% over the past 25 years (one generation) and a projected reduction of at least another 30% over the next 50 years (two generations), for a total reduction over three generations of approximately 60% (Hofmeyr *et al.* 2018, Tolley *et al.* in press).

Threats to this species include habitat degradation due to agricultural activities and overgrazing, climate change, and predation by the Pied Crows which in recent decades have expanded in distribution range.

The vegetation type of the Hoogland Southern Cluster is comprised of Eastern Upper Karoo vegetation type (Mucina and Rutherford 2006 and SANBI 2018 update). However, there are extensive tracts of Upper Karoo

Hardeveld at the site, and areas of riparian vegetation which are allied to the Southern Karoo Riviere vegetation type (3 Foxes, 2022).

According to Sungazer Faunal Surveys (2022), the three Karoo Dwarf Tortoise observations that were made during 2021/22 (Table 7-19) are the only known records of this species from within the Hoogland Project site. One Karoo Dwarf Tortoise observation that was made in March 2022 is the only known record of this species from within the Hoogland Southern Cluster. It is not realistically possible to make definite statements about the population size of this SCC within this study area, but the general impression is that it is extremely rare within this region. This conclusion is based on the fact that:

- In spite of several weeks of field studies that were conducted by the appointed faunal specialist (3 Foxes Biodiversity Solutions) and herpetologist within the study area, only one observation (i.e., shell-remains of a dead specimen; Figure 7-27) of this species was made.
- There are no known historical records of this species from within the study area.
- Interviewed landowners and their staff are unfamiliar with this species, i.e., they do not encounter specimens during farming activities.

Figure 7-27. The remains of an adult Karoo Dwarf Tortoise from Hoogland 4 (Photos by Simon Todd, 3FBS). It appears as though this specimen was predated upon, presumably by a corvid (crow or raven).

Table 7-19: A list of 20 observation records of Karoo Dwarf Tortoise at the localities nearest to the Hoogland Southern Cluster.

Institution	Year	URL/source
EWT	2022	https://www.inaturalist.org/observations/118892553
3FBS	2022	https://www.inaturalist.org/observations/119719245
3FBS	2021	https://www.inaturalist.org/observations/119741090
SANBI	2016	BioGaps Project (Telford *et al.* 2022)
SANBI	2016	BioGaps Project (Telford *et al.* 2022)
PEM	1975	http://vmus.adu.org.za/?vm=ReptileMAP-50265
PEM	1975	http://vmus.adu.org.za/?vm=ReptileMAP-50263
PEM	1975	http://vmus.adu.org.za/?vm=ReptileMAP-50264
TM	1969	http://vmus.adu.org.za/?vm=ReptileMAP-45709
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112328
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112362
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112391
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112400
TM	1969	http://vmus.adu.org.za/?vm=ReptileMAP-45056

Institution	Year	URL/source
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112356
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112336
PEM	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-50275
PEM	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-50276
CapeNature	Undated	http://vmus.adu.org.za/?vm=ReptileMAP-112339
PEM	1969	http://vmus.adu.org.za/?vm=ReptileMAP-50280

The occurrence of Karoo Dwarf Tortoise has therefore been confirmed from within the Hoogland Southern Cluster of wind farms. Comprehensive information about the population demographics of Karoo Dwarf Tortoises in this area is not available. Based on the scarcity of historic and recent records, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises.

7.4.1.3.3 Amphibians

The diversity of amphibians in the study area is relatively low with only 11 species having being recorded in the area. Species observed at the vicinity of the Hoogland site include the Karoo Toad, Clawed Toad and Poynton's River Frog. There are no listed amphibian species known from the area although the Giant Bull Frog *Pyxicephalus adspersus* was previously listed as Near Threatened but has revised to Least Concern. This species is associated with temporary pans in the Karoo, Grassland and Savannah Biomes, but is not commonly recorded in the study area and its presence at the site is considered unlikely. Within the site, there are several drainage lines that would have temporary pools that can be used by toads and frogs for seasonal breeding purposes. But given that these areas are considered important for Riverine Rabbits and other ecological considerations, areas important for amphibians are captured through other sensitivities and there are no areas that would need to be avoided on specific account of amphibians. Given the localised nature of important amphibian habitats at the site as well as the generally arid nature of the site and the low overall abundance of amphibians, a significant long-term impact on amphibians is unlikely.

7.4.1.4 Critical Biodiversity Areas and Broad-Scale Processes

There are several CBAs within the Hoogland Southern Cluster study area (Figure 7-28). There is a single extended CBA within the south of the Hoogland 3 site and three extended CBAs within the Hoogland 4 site as well as a few smaller isolated CBAs within the Southern Cluster.

All of the minor drainage systems and washes (minor drainage features without well-developed riparian vegetation) of the site are mapped as ESAs and as it is not possible to avoid all of these features, there would be some impact on these minor features, largely through habitat loss and disturbance associated with the access road that would need to be constructed in order to construct and maintain the power line. The ESAs are small and represent buffers along the minor drainage features of the site and as such do not represent broad-scale corridors or ecological gradients that would potentially be disrupted by the development.

The majority of the CBAs are driven by the selection of areas of Eastern Upper Karoo, with lesser significance or frequency for water resource protection, areas identified as Very High Sensitivity under the Shale Gas SEA, Ecological processes, FEPA River Corridors and River Type. As none of the areas selected on the basis of vegetation type are seen as being unique or of specific significance to the study area, the affected CBAs are all seen as being of low irreplaceability with regards to vegetation type. In terms of the water resource protection and ecological process features, the development footprint within these areas is very low and is highly unlikely to compromise the ecological functioning of the study area or the future ability to meet conservation targets in the Upper Karoo. As the development footprint would be relatively low within the CBAs and there would be specific mitigation and avoidance aimed at reducing negative hydrological impacts, the impacts on water quality and degradation within the FEPA River Corridors would be low and the development would not compromise watercourse protection goals within the area. Given the low footprint within the CBAs, the overall impact of the development on CBAs would be very low and is considered acceptable.

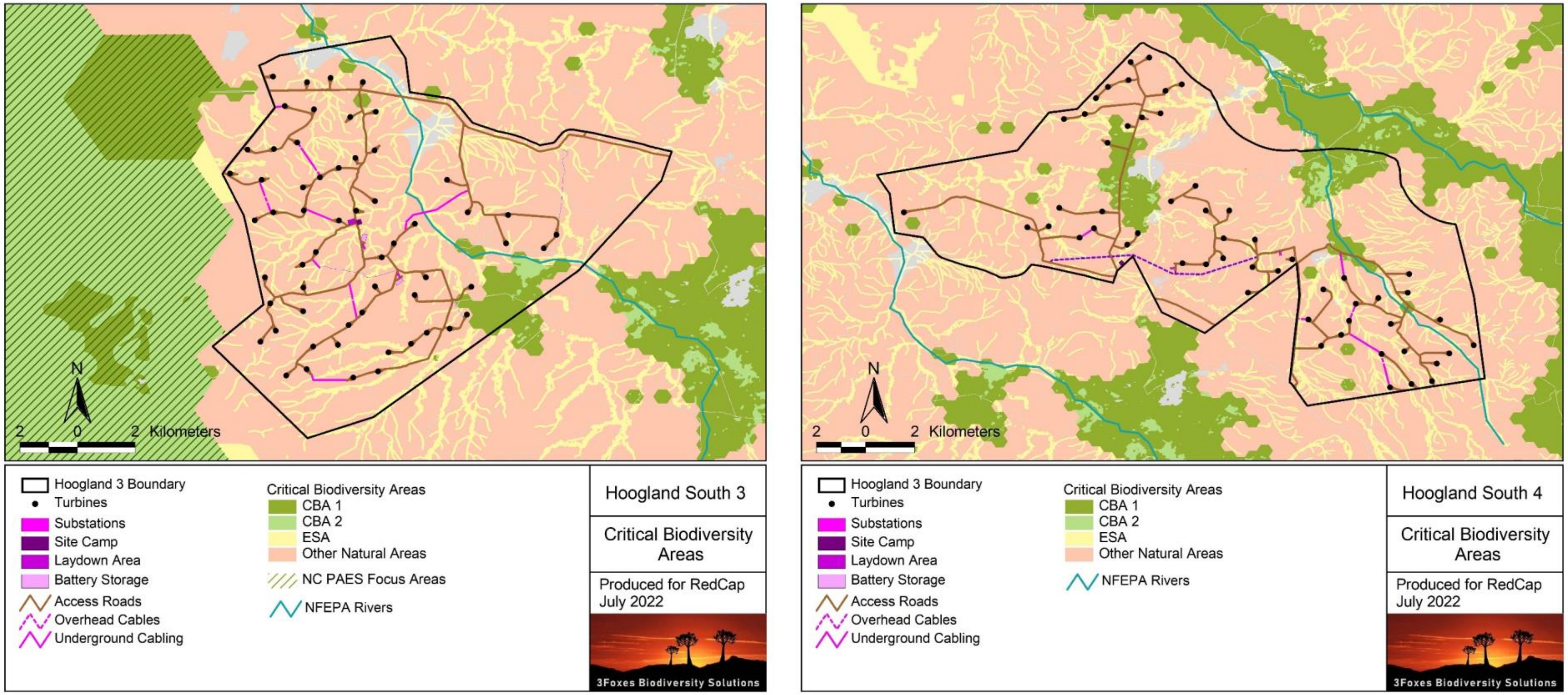


Figure 7-28: Extract of the Western Cape Biodiversity Spatial Plan and Northern Cape CBA map for the Hoogland Southern Cluster Wind Farms, showing that there are a few extensive CBAs within the sites (Hoogland 3, left and Hoogland 4 right).

7.4.2 Site Sensitivity

The terrestrial biodiversity within the Hoogland Southern Wind Farms have been classified by the DFFE National Screening Tool as being sensitive (Figure 7-29). Note the Animal and Plant specific sensitivities are discussed in *Appendix C5: Flora, Appendix C6: Riverine Rabbit, and Appendix C7: Karoo Dwarf Tortoise.*

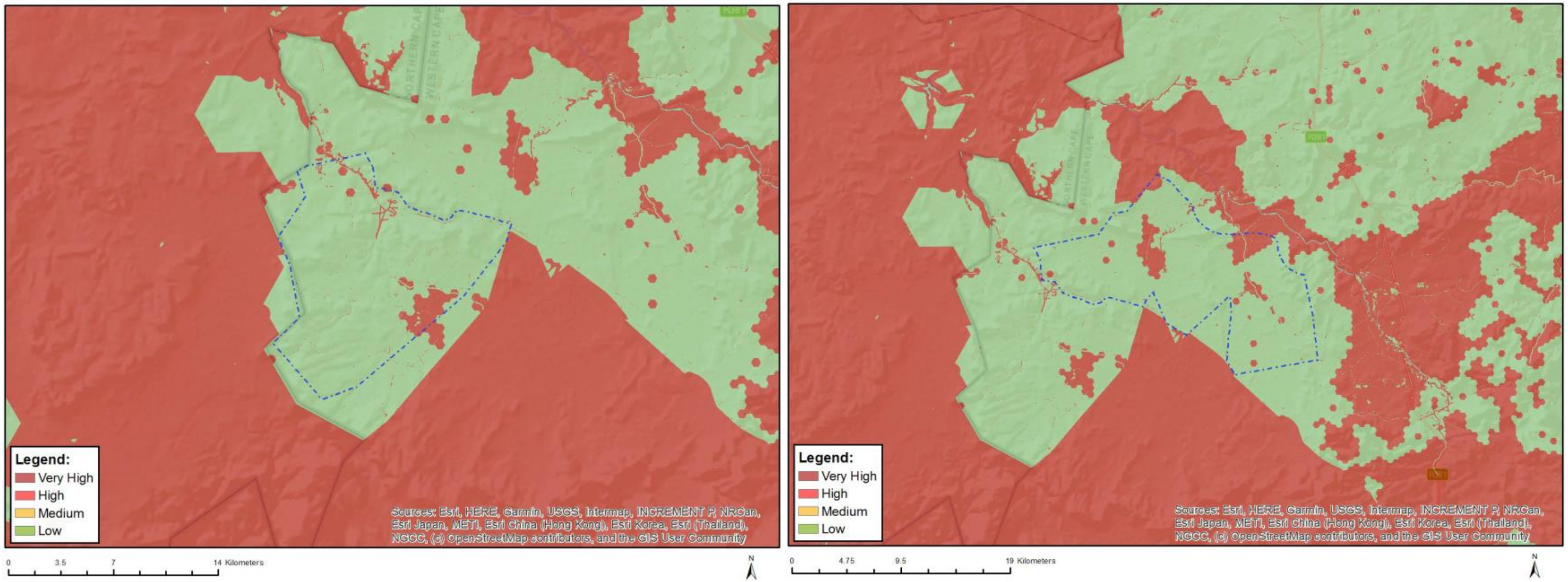


Figure 7-29: Map of relative terrestrial biodiversity theme sensitivity for Hoogland 3 Wind Farm (left) and Hoogland 4 Wind Farm (right). High sensitivity shown in red.

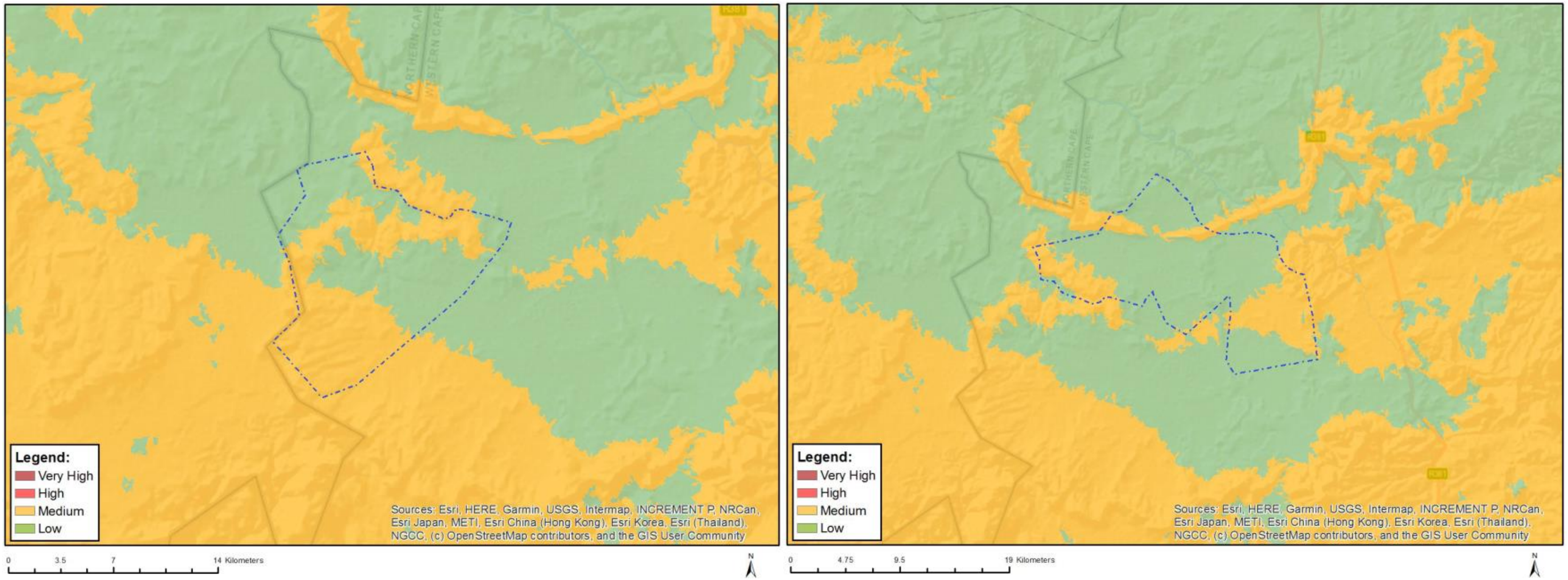


Figure 7-30: Map of relative plant species theme sensitivity for Hoogland 3 Wind Farm (left) and Hoogland 4 Wind Farm (right), medium sensitivity shown in orange and low sensitivity in green.

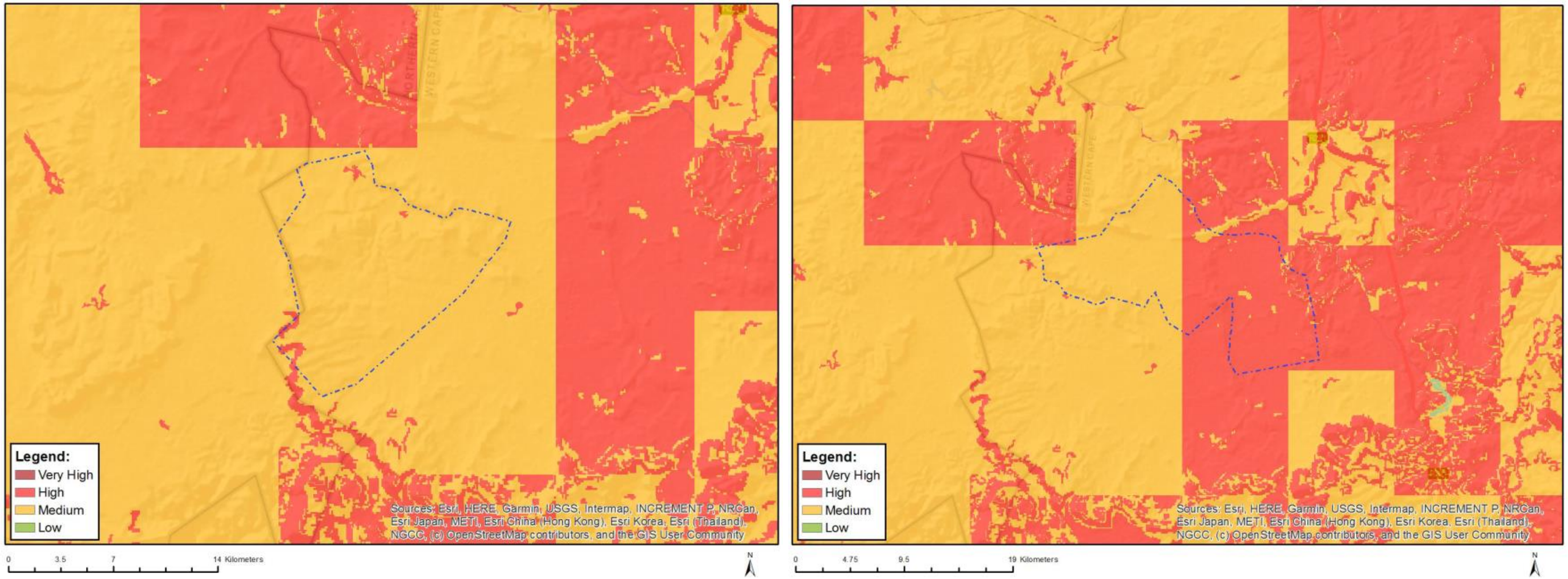


Figure 7-31: Map of relative animal species theme sensitivity for Hoogland 3 Wind Farm (left) and Hoogland 4 Wind Farm (right), high sensitivity shown in red and medium sensitivity shown in orange.

Sensitivity maps were produced by integrating the results of the site visits with the available ecological and biodiversity information in the literature and various spatial databases as described above. Sensitive features such as wetlands, drainage lines, rocky hills and pans were collated, mapped, and buffered where appropriate to comply with legislative requirements or ecological considerations. Additional sensitive areas were then identified from the satellite imagery of the site and delineated. All created layers were merged to create a single coverage. The ecological sensitivity of the different units identified in the mapping procedure was rated to the scale below.

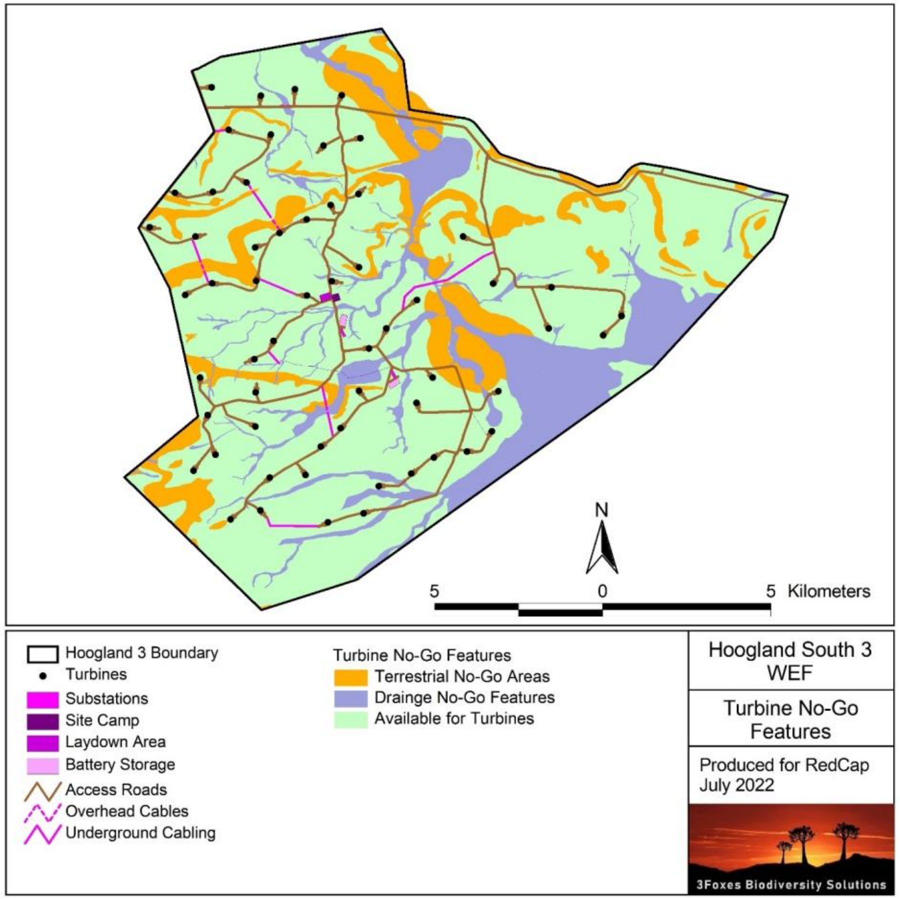
- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high potential impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution (such as specific consideration of the footprint within these areas and field verification of the acceptability of development within these potentially sensitive areas) as it may not be possible to mitigate all impacts appropriately.
- **Very High/No-Go** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are usually no-go areas from a developmental perspective and must be avoided.

In order to ensure the maintenance of ecological processes within the wind farm and the minimisation of impacts on terrestrial biodiversity, a constraints map for the site was produced. This has been used to inform the development layout and ensure that impacts on the sensitive features of the site are maintained within acceptable limits. Since they have differing impacts, turbines were separated from roads and other infrastructure in this regard.

The constraints/sensitivity map (for turbines) for the Hoogland South 3 Wind Farm area is depicted below in Figure 7-32. There are numerous constraints operating across the site, associated largely with the drainage features of the area, Riverine Rabbit habitat and their associated applied buffers and also the steep slopes and dolerite outcrops of the site. Although these occupy a significant proportion of the site, there are also extensive open plains and low hills present across the site that are considered low to moderate sensitivity and which are suitable for wind energy development. Under the assessed layout, there are no turbines located within areas considered unsuitable for turbine placement.

Similarly for Hoogland 4, there are numerous constraints operating across the site, associated largely with the pans and drainage features of the area as well as the steep slopes and dolerite outcrops of the site. Although these features which are considered unsuitable for development occupy a significant proportion of the site, there are also extensive open plains and low hills present across the site that are considered low to moderate sensitivity and which are suitable for wind energy development. Under the assessed layout, there are no turbines located within areas considered unsuitable for turbine placement.

In terms of the roads and other infrastructure no-go layer for both Hoogland 3 and Hoogland 4 (Figure 7-33), these are largely similar to the turbine no-go layer but somewhat less constrained in terms of the drainage lines and somewhat more constrained in terms of slopes. Ultimately, it is the roads that generate the largest proportion of habitat loss associated with wind farms and as such, are the primary drivers of habitat loss within the affected area and the sensitivity mapping takes specific account of sensitive areas associated with the Karoo Dwarf Tortoise as well as avoiding areas of rugged terrain and steep slopes where the construction of the roads would generate a lot of cut and fill or increase erosion potential of disturbance within sensitive habitats. In terms of the assessed layout, there are no roads within areas that are considered no-go areas. The scale of the sensitivity map as depicted below does not allow for clear interrogation of the roads and observation of the extent to which these avoid the no-go areas, however, these have been checked at a fine scale and observed to avoid all no-go areas. Overall, the road layer is considered acceptable and would generate low to moderate impacts on fauna and flora.



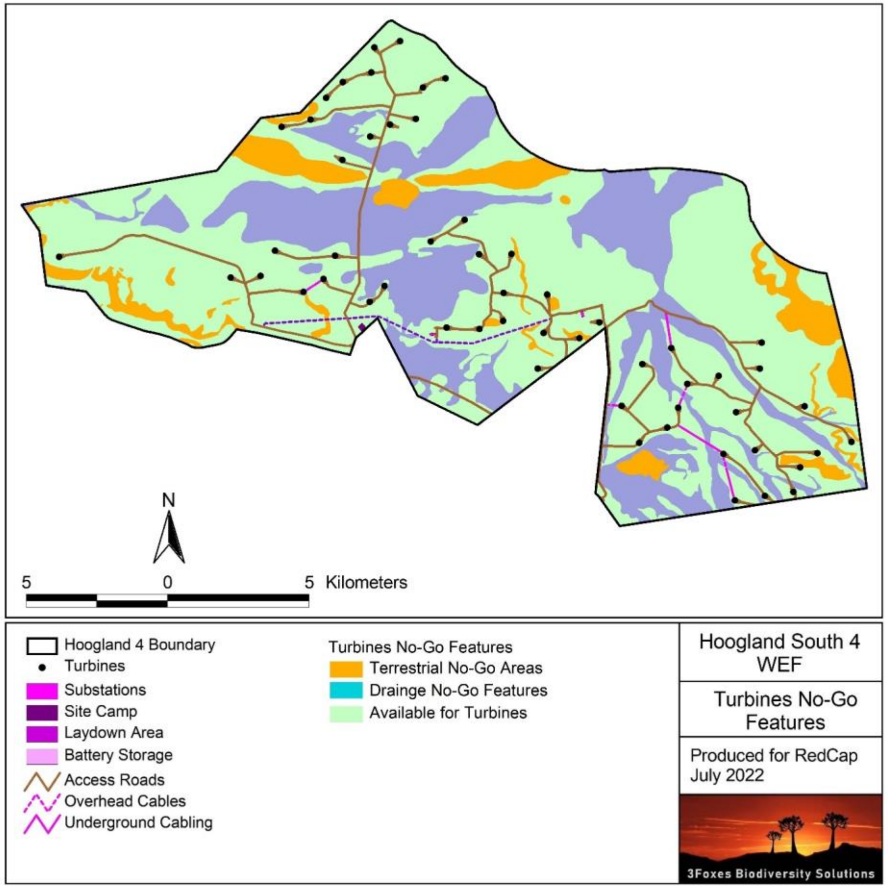


Figure 7-32. Ecological constraints map for turbines, substations, the BESS and other built infrastructure on the Hoogland 3 Wind Farm (left) and Hoogland 4 Wind Farm (right).

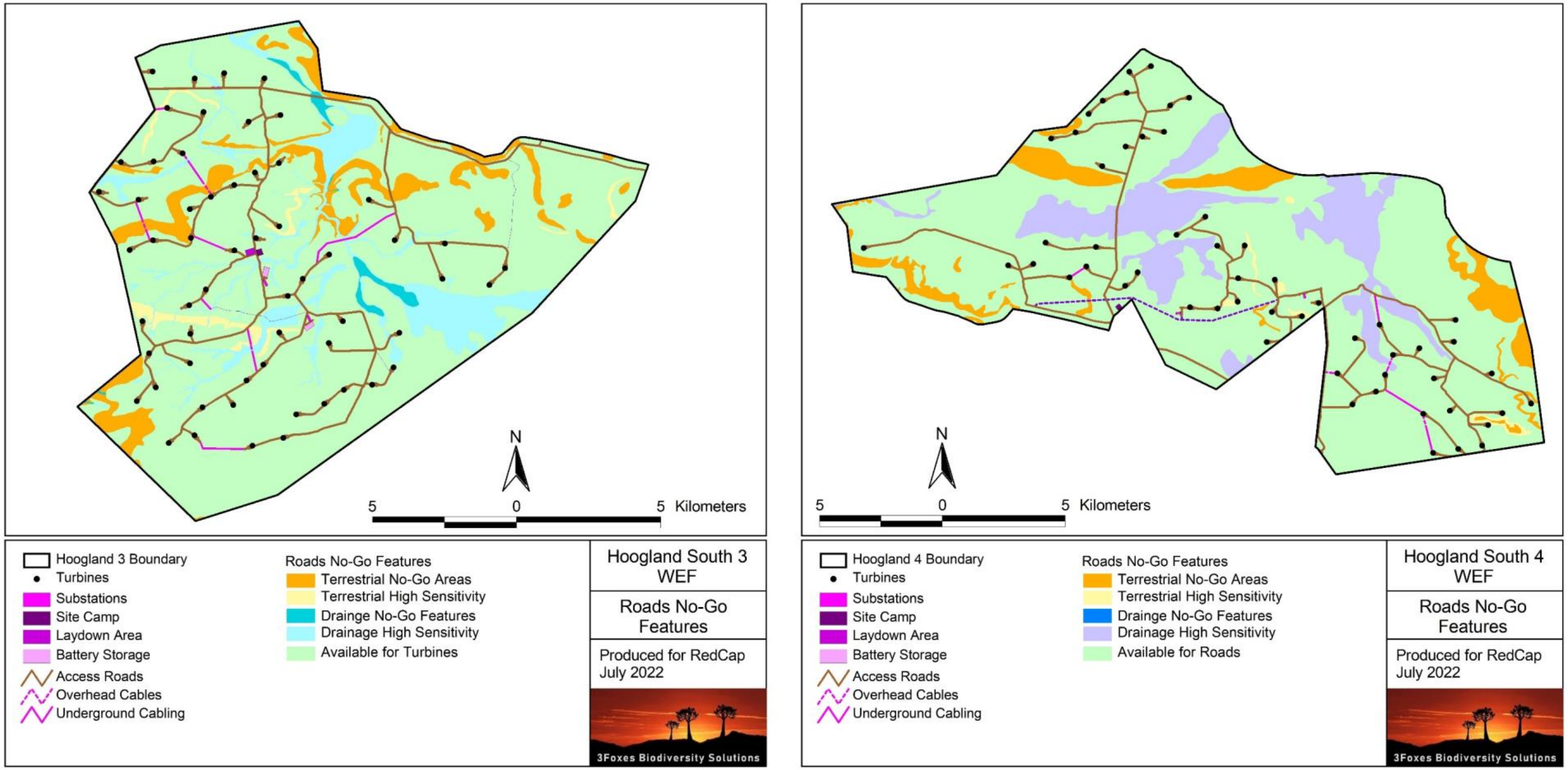


Figure 7-33. Ecological constraints map for roads and underground cabling on the Hoogland 3 Wind Farm (left) and the Hoogland 4 Wind Farm (right).

7.4.3 Impact Assessment and Mitigation

The following Terrestrial Biodiversity impacts and Riverine Rabbit impacts have been identified and rated by 3 Foxes (2022), while the Karoo Dwarf Tortoise impacts have been rated by Sungazer Faunal Surveys (2022).

7.4.3.1 Construction Phase: Hoogland 3 and 4

Table 7-20: Construction: Impact on the Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Description of Impact		
Construction phase impact on CBAs, ESAs and ecological processes within the site.		
Type of Impact	Direct/Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts. The footprint within CBAs is low and considered acceptable. The Low intensity pre-mitigation impacts are the result of avoidance of these features at the planning stage.	
Mitigation actions		
The following measures are recommended:	• There are no turbines located in CBAs however CBAs should be avoided for roads as far as possible. The use of existing roads through these areas is considered acceptable. Therefore the current layout is suitable in this regard. • Should access roads, internal cables and overhead lines traverse drainage lines and riparian areas mapped as CBAs these should be microsited by a suitably qualified ecological and aquatic specialist before construction in that area starts to ensure any potential impacts are minimised • Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in low sensitivity or previously disturbed areas. The current layout depicts that the substations, camps and lay-down areas are in low sensivity areas, and this is therefore acceptable. • Avoid impact to restricted and specialised habitats such as pans, wetlands and rock pavements. The final development footprint to be authorised should be checked for such sensitive features in the field, such that there is a high degree of confidence that the final layout avoids such features so that significant changes to turbines or roads are not required at the preconstruction phase.	

	• Minimise the development footprint near watercourses and other ecologically significant features.
Monitoring	
The following monitoring is recommended:	• Monitoring of construction activities to ensure that the development footprint within CBAs is restricted to the authorised development footprint.

Table 7-21: Construction: Habitat loss and degradation impact on the Karoo Dwarf Tortoise

Issue	**Construction phase impacts on the Karoo Dwarf Tortoise.**	
Description of Impact		
Habitat loss and habitat degradation may impact the Karoo Dwarf Tortoise during construction phase activities in the following three ways: 1) loss/degradation of rocky habitat, i.e. reduced shelter opportunities; 2) loss/degradation of vegetation, i.e. reduced food sources; and 3) new roads and turbine platforms adding to the fragmentation of the landscape.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Mitigation exists and will notably reduce significance of impacts.	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention.	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA phase. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high sensitivity (very high = no go areas). • Access to areas outside of the construction footprint during construction must be limited to minimise habitat degradation.	
Monitoring		
The following monitoring is recommended:	• Construction activities must be monitored by ECO with the aim to guard against potential impacts on Karoo Dwarf Tortoises where feasible.	

Table 7-22: Construction: Karoo Dwarf Tortoise mortalities due to earthworks and roadkill

Issue	**Construction phase impact on the Karoo Dwarf Tortoise**
Description of Impact	
Karoo Dwarf Tortoises may inadvertently be killed during earthworks activities when clearing habitat for new roads, turbine platforms and other associated infrastructure. Additionally, tortoises may be killed on roads by construction/support vehicles.	
Type of Impact	Direct
Nature of Impact	Negative
Phases	Construction

Criteria	Without Mitigation	With Mitigation
Intensity	High	Medium
Duration	Short-term	Short-term
Extent	Local	Local
	Medium	Medium
Probability	Probable	Conceivable
Significance	**Medium -**	**Low -**
Degree to which impact can be reversed	Mitigation exists and will notably reduce significance of impacts	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are applied, it is plausible that the Karoo Dwarf Tortoise population within the PAOI can overtime recover from the tortoise mortalities incurred during the construction phase, and thus no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	• The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA phase. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high sensitivity (very high = no go areas). • Limit construction activities within the defined development footprints to minimise the chances of killing tortoise inadvertently. • All vehicles must adhere to a low-speed limit, i.e. 30 km/h on site and 40 km/h in areas where Karoo Dwarf Tortoises are likely to be present, both within the wind farm as well as on the public roads to the site.	
Monitoring		
The following monitoring is recommended:	• Construction activities must be monitored by ECO with the aim to guard against potential impacts on Karoo Dwarf Tortoises where feasible.	

7.4.3.2 Construction Phase: Hoogland 3 only

Table 7-23: Construction: Impact on the Riverine Rabbit within the Hoogland 3 site

Issue	Construction phase impact on the Riverine Rabbit	
Description of Impact		
Impacts on Riverine Rabbit as a result of construction phase activities, including vehicle collisions, disturbance and habitat loss.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Medium-term	Short-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	

Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.
Mitigation actions	
The following measures are recommended:	• All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. • During construction, driving between sunset and sunrise should be reduced as far possible as this is when Riverine Rabbits are most active and the risk of collisions is highest. • No dogs should be allowed on site and precautions to ensure that there is poaching or other direct faunal disturbance on site should be implemented. • Where any new roads, cabling and/or overhead lines traverse areas mapped as High Riverine Rabbit habitat sensitivity, the route should be microsited by a suitably qualified ecological specialist before construction commences to ensure any potential impacts are minimised. Existing tracks through these areas should be used where present.
Monitoring	
The following monitoring is recommended:	• There should be a monitoring programme for Riverine Rabbit roadkill during construction that should be used to inform any additional mitigation and avoidance that should be implemented. Should rabbits be killed by traffic, then the traffic management to and from the site should be reviewed in collaboration with the EWT Drylands Programme, to identify additional mitigation and avoidance that should be implemented to further reduce roadkill. • Ensure that riparian areas near to the development footprint are clearly demarcated as no-go areas with appropriate signage and barriers.

7.4.3.3 Operational Phase: Hoogland 3 and 4

Table 7-24: Operation: Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Description of Impact		
Operational phase impact on CBAs and ESAs		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Conceivable
Significance	**Medium -**	**Low -**
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The affected environment will only recover from the impact with significant intervention	

Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts. The footprint within CBAs is low and considered acceptable. The Low intensity pre-mitigation impacts are the result of avoidance of these features at the planning stage.
Mitigation actions	
The following measures are recommended:	• A Fauna Monitoring Pogramme as detailed in the Riverine Rabbit Species Assessment should be implemented at the site before and after construction so as to monitor the impact of the development on faunal presence within the facility. • Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • Appropriate design of roads and other infrastructure to minimise faunal impacts and allow fauna to pass over, through or underneath these features as appropriate. • A log should be kept detailing and fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. These should be reviewed annually and used to inform operational management and mitigation measures.
Monitoring	
The following monitoring is recommended:	• Monitoring of construction activities to ensure that the development footprint within CBAs is restricted to the authorised development footprint.

Table 7-25: Operation: Impact on the Karoo Dwarf Tortoise: Tortoise mortalities due to roadkill

Issue	Operation phase impact on the Karoo Dwarf Tortoise.	
Description of Impact		
Karoo Dwarf Tortoises may inadvertently be killed by vehicular traffic on the new roads.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Tortoise populations are generally able to recover from limited mortalities, and thus no irreplaceable losses are anticipated.	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are applied, it is plausible that the Karoo Dwarf Tortoise population within the PAOI can overtime recover from the tortoise mortalities incurred during the operation phase, and thus no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and can partially reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• The development is to avoid areas identified as prime Karoo Dwarf Tortoise habitat, as per the layouts produced during the planning and design phase and presented in this report as the EIA phase. This has been implemented via the sensitivity mapping and identification of the PAOI which has included areas of habitat that were rated as high or very high sensitivity (very high = no go areas).	

	• Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • Incorporate special design features to roads to provide safer options for tortoises to minimise the potential of roadkill mortalities. • Keep a log of tortoise roadkill mortalities. This log must be reviewed annually to inform operational management and mitigation measures. • Adhere to speed limits and exercise vigilance of tortoises crossing the roads.
Monitoring	
The following monitoring is recommended:	• Monitor (keep log of) tortoise roadkill mortalities.

Table 7-26: Operation: Impact on the Tortoise mortalities due to predation by corvids

Issue	**Operation phase impact on the Karoo Dwarf Tortoise.**	
Description of Impact		
The addition of powerline pylons to the landscape offers additional perching and nesting structures/opportunities for crows. This may potentially result in an increase of the local crow population, which in turn may cause an increase of corvids predating on Karoo Dwarf Tortoises during the operation phase and beyond.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Probable	Possible/frequent
Significance	High -	Low -
Degree to which impact can be reversed	Mitigation exists and may notably reduce significance of impacts.	
Degree to which impact may cause irreplaceable loss of resources	If the proposed mitigations are rigidly applied during the operation phase, it is plausible that the Karoo Dwarf Tortoise population within the PAOI will be able to sustain viably in spite of corvid predation. Thus, no irreplaceable losses are anticipated.	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• A monopole-type structure was selected for almost all of the internal overhead lines as well as the main grid connection lines. This is reputedly the best type of structure to deter nesting since it does not provide good nesting substrate compared to lattice towers for example. • Adhere to the open space management plan which makes provision for the favourable management of the facility and the surrounding area for fauna. • Conduct annual inspections along powerlines to monitor the extent of corvids nesting on these structures, and to check for tortoise carcases below these nesting sites. • Based on the findings of the annual inspections, reactive measures such as crow culling and/or removal of nests may have to be implemented.	

	• Keep a log of tortoise roadkill mortalities. This log must be reviewed annually to inform operational management and mitigation measures.
Monitoring	
The following monitoring is recommended:	• Conduct annual surveys along the powerlines to 1) census crow numbers, 2) log crow nesting sites, and 3) log tortoise carcases observed along the powerlines.

7.4.3.4 Operational Phase: Hoogland 3

Table 7-27: Operation: Impact on the Riverine Rabbit within the Hoogland 3 site

Issue	Operational Phase impact on the Riverine Rabbit	
Description of Impact		
There would potentially be impact on Riverine Rabbits at the site during operation due to operational activities (vehicles/disturbance) as well as turbine noise.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Probable	Possible / frequent
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will be able to recover from the impact	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts.	
Mitigation actions		
The following measures are recommended:	• Adherence to a Riverine Rabbit Monitoring Plan	
Monitoring		
The following monitoring is recommended:	• A Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. As there is some potential for noise and disturbance-related impacts on Riverine Rabbits, the development presents a clear opportunity to evaluate the degree to which wind farms are compatible with the maintenance and conservation of Riverine Rabbit populations within their boundaries. The monitoring programme should be conducted with input from EWT and should include preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site. This should be followed by matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. The exact duration and frequency of monitoring would need to be determined based on the number of cameras to be used and the desired precision and statistical power to be obtained.	

	• The monitoring should include a feedback mechanism to use these findings to improve future wind energy development in Riverine Rabbit areas should be developed. • All incidents involving Riverine Rabbits should be documented and reported to the local EWT field office in Loxton. If Rabbits are killed, the carcases should be collected and provided to EWT for the collection of DNA and other samples. • For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population.

7.4.3.5 Decommissioning Phase: Hoogland 3

Table 7-28: Decommissioning: Impact on the Riverine Rabbit within the Hoogland 3 site

Issue	**Decommissioning phase impact on the Riverine Rabbit**	
Description of Impact		
Impacts on Riverine Rabbit as a result of decommissioning phase activities, including vehicle collisions, disturbance and habitat loss.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Medium-term	Short-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will only recover from the impact with significant intervention	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts.	
Mitigation actions		
The following measures are recommended:	• All vehicles should adhere to a low speed limit on site. Heavy vehicles should be restricted to 30km/h and light vehicles to 40km/h. • During decommissioning, driving between sunset and sunrise should be reduced as far possible as this is when Riverine Rabbits are most active and the risk of collisions is highest. • No dogs should be allowed on site and precautions to ensure that there is poaching or other direct faunal disturbance on site should be implemented. • Where any roads, cabling and/or overhead lines traverse areas mapped as High Riverine Rabbit habitat sensitivity, any remaining open and disturbed areas after decommissioning should be rehabilitated with local plant species appropriate for the affected habitat.	

Monitoring	
The following monitoring is recommended:	• Should rabbits be killed by traffic, then the traffic management to and from the site should be reviewed in collaboration with the EWT Drylands Programme, to identify additional mitigation and avoidance that should be implemented to further reduce roadkill. • Ensure that riparian areas near to the development footprint are clearly demarcated as no-go areas with appropriate signage and barriers.

7.4.4 Cumulative Impact

The following cumulative impacts have been identified and rated by 3 Foxes and Sungazer (2022).

7.4.4.1 Construction Phase: Hoogland 3 and 4

Table 7-29: Cumulative impact: Construction Phase Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Nature of cumulative impacts	As the total extent of habitat loss within CBAs within the site is very low, the potential for the Hoogland 3 Wind Farm, or Hoogland 4 Wind farm respectively, to contribute to cumulative impacts on CBAs is also seen as being low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Low -

Table 7-30: Cumulative impact: Construction phase impact Karoo Dwarf Tortoise: Habitat loss and degradation

Issue	Construction phase impacts on the Karoo Dwarf Tortoise from 1) loss/degradation of rocky habitat, i.e. reduced shelter opportunities; 2) loss/degradation of vegetation, i.e. reduced food sources; and 3) new roads and turbine platforms adding to the fragmentation of the landscape	
Nature of cumulative impacts	Cumulative impacts of habitat loss and degradation on the Karoo Dwarf Tortoise are predicted to be low with mitigation because habitat loss in general would be low, and project roads have mostly avoided sensitive habitat.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.4.4.2 Construction Phase: Hoogland 3 only

Table 7-31: Cumulative impact: Construction phase impact on the Riverine Rabbit within the Hoogland 3 site

Issue	Construction phase impact on the Riverine Rabbit	
Nature of cumulative impacts	The development would contribute to cumulative impacts on Riverine Rabbits especially due to vehicle collisions, but this would be transient and the overall contribution to cumulative impact would be low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.4.4.3 Operational Phase: Hoogland 3 and 4

Table 7-32: Cumulative impact: Operational Phase Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes

Issue	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes within the site	
Nature of cumulative impacts	As the total extent of habitat loss within CBAs within the site is very low, the potential for the Hoogland 3 Wind Farm, or Hoogland 4 Wind Farm respectively, to contribute to cumulative impacts on CBAs is also seen as being low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Low -

7.4.4.4 Operational Phase: Hoogland 3 only

Table 7-33: Cumulative impact: Operational Phase impact on the Riverine Rabbit within the Hoogland 3 site

Issue	Operation phase impact on the Riverine Rabbit	
Nature of cumulative impacts	The development would contribute to cumulative impacts on Riverine Rabbits especially due to vehicle collisions, but this would be transient and the overall contribution to cumulative impact would be low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.4.4.5 Decommissioning Phase: Hoogland 3 only

Table 7-34: Cumulative impact: Decommissioning Phase impact on the Riverine Rabbit within the Hoogland 3 site

Issue	Decommissioning phase impact on the Riverine Rabbit	
Nature of cumulative impacts	The development would contribute to cumulative impacts on Riverine Rabbits especially due to vehicle collisions, but this would be transient and the overall contribution to cumulative impact would be low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.4.4.6 All Phases

Table 7-35: Cumulative impact: All phases: Impact on Karoo Dwarf Tortoise: Mortalities due to earthworks, roadkill and predation by corvids.

Issue	Impacts on the Karoo Dwarf Tortoise. Mortalities due to earthworks, roadkill and predation by corvids.	
Nature of cumulative impacts	Karoo Dwarf Tortoises may inadvertently be killed during earthworks activities when clearing habitat for new roads, turbine platforms and other associated infrastructure. Additionally, tortoises may be killed on roads by construction/support vehicles during the construction phase, and by vehicular traffic on the new roads during the operation and decommissioning phases. Also, the addition of powerline pylons to the landscape offers additional perching and nesting structures/opportunities for crows. This may potentially result in an increase of the local crow population, which in turn may cause an increase of corvids predating on Karoo Dwarf Tortoises during the operation phase and beyond. The development would contribute to cumulative impacts on the Karoo Dwarf Tortoise, but this would be transient and the overall long-term contribution to cumulative impacts on this species would be low.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.4.5 No-Go Alternative

Under the 'no-go' alternative, the current land use, consisting of extensive livestock grazing, would continue. When applied correctly, such livestock grazing is considered to be largely compatible with long-term biodiversity conservation, although in practice there are some negative effects associated with such land use, such as predator control and negative impacts on habitat availability for the larger ungulates that would historically have utilised the area. Under the current circumstances, the 'no-go' alternative is considered to represent a low long-term negative impact on the environment. The current development is however not an alternative land use for the site, but rather represents an additional stressor that would additively and cumulatively contribute to ecological impacts on the site.

7.4.6 Conclusion and Recommendations

The Hoogland Southern Cluster is mapped as falling primarily within the Eastern Upper Karoo vegetation type with lesser extents of Western Upper Karoo, Upper Karoo Hardeveld and Bushmanland Vloere. All of these vegetation types have been little impacted by transformation and are classified as Least Threatened. In terms of fauna, there are several listed mammals which occur in the area and which would potentially be impacted by the development. This includes the Riverine Rabbit, Black-footed Cat, Brown Hyena, Grey Rhebok, Mountain Reedbuck.

The Riverine Rabbit is of greatest potential concern as it has the highest threat status and has also been confirmed present only within the Hoogland 3 Wind Farm site through extensive camera trapping. The extent of habitat loss within the areas of Riverine Rabbit habitat would however be minimal and would not compromise the local population of this species.

Although there are several CBAs within the site, there are no turbines within any of the CBAs under the assessed layout. There are however two access roads that traverse CBAs on Hoogland 3 Wind Farm and three access roads that traverse CBAs on Hoogland 4 Wind Farm. The footprint within the CBAs would be minimal and many on Hoogland 4 are along existing roads and would therefore not compromise the functioning of the CBAs or destroy the underlying biodiversity features present these areas. All of the minor drainage systems and washes of the site are mapped as ESAs and it is not possible for the development to entirely avoid these features. As a result, there would be some impact on these minor features, largely through habitat loss and disturbance associated with the access roads of the development. The ESAs are however small and represent buffers along the minor drainage features of the site and as such, do not represent broad-scale corridors or ecological gradients that would potentially be disrupted by the development. The impact of the development on CBAs and ESAs is therefore considered acceptable.

In terms of potential cumulative impacts in and around the Hoogland South 3 and 4 site respectively, these currently amount to approximately 760ha of planned wind farm projects. The Hoogland Southern Cluster would contribute an additional 220ha of long-term habitat loss to this total. Although cumulative impacts on the Riverine Rabbit are a significant potential concern, significant habitat avoidance and buffering has been implemented on both the Hoogland South 3 and 4 sites with the result that the impact on this species is likely to be low. As the Riverine Rabbit has been detected only from the Hoogland 3 Wind Farm and the Hoogland 1 Wind Farm, it is only these two projects that would contribute to the cumulative impacts on the Riverine Rabbit. As the broader area is still largely intact with no existing renewable energy facilities present, cumulative impacts associated with the current project are considered acceptable.

Potential impacts on the Riverine Rabbit have been specifically assessed through the Species Assessment for this species and are considered acceptable with the implementation of the buffers and avoidance as detailed in that report. The avoidance implemented for the Riverine Rabbit would also serve to protect other species associated with the major drainage features of the area and this would also ensure the maintenance of general ecological processes such as faunal dispersal which is likely to be associated with the major drainage systems of the area.

In terms of development recommendations, the following avoidance was implemented:

- Areas of River Rabbit habitat are considered to represent No-Go areas for turbines.
- Wind farm roads may only traverse areas of Riverine Rabbit habitat along existing major farm access roads.
- Riverine Rabbit habitat buffers are considered to be No-Go areas for turbines.
- Riverine Rabbit habitat buffers are considered to be high sensitivity for wind farm access roads and subject to individual evaluation.

Although the actual occurrence of Karoo Dwarf Tortoise was not confirmed from within the Hoogland Southern Cluster Wind Farms (apart from a dead predated specimen), the species has a high probability of being present here. Comprehensive information about the population demographics of Karoo Dwarf Tortoises in this area is not available. Based on the scarcity of historic and recent records, and the fact that landowners are generally not familiar with this species, the area is presumably not a stronghold for Karoo Dwarf Tortoises.

The sensitivity analysis for the Karoo Dwarf Tortoise was factored into Hoogland Southern Cluster design and included avoidance of dolerite outcrops as no-go areas turbines and roads, and avoidance of rocky ridges on steeper slopes where possible. The integration of the sensitivity components into the layout design is deemed to be an appropriate buffering scheme that will adequately safeguard Karoo Dwarf Tortoises within the Hoogland Southern Cluster. Accordingly, the impacts on Karoo Dwarf Tortoises in the context of the proposed development is projected to be low after mitigation. As a result, and with the application of the recommended mitigation and avoidance measures, the impacts associated with the Hoogland Southern Cluster are considered acceptable.

Potential impacts on the both the Karoo Dwarf Tortoise and Riverine Rabbit have been specifically assessed through the Species Assessment for each species and are considered acceptable with the implementation of the buffers and avoidance as detailed in their respective reports.

There are no terrestrial biodiversity, Riverine Rabbit related or Karoo Dwarf Tortoise related fatal flaws associated with the assessed Hoogland Southern Cluster. Although there are a variety of no-go areas within the cluster, these features have been avoided. As such, there are no terrestrial ecological reasons to oppose the development of the Hoogland Southern Cluster. Consequently, it is the reasoned opinion of the specialists that the Southern Cluster Wind Farms can be developed, provided that all mitigation and avoidance measures are implemented.

7.5 Bats

This section provides a short summary of the bat specialist report compiled by Werner Marais of Animalia which is available in *Appendix C8: Bats*. The information presented here draws from the pre-construction bat monitoring undertaken for the project, the results of which informed the identification of impacts and preliminary impact assessment.

7.5.1 Baseline Description

According to Animalia (2022), three factors need to be present for most South African bats to be prevalent in an area: availability of roosting space, food (insects/arthropods or fruit), and accessible open water sources. However, the dependence of a bat on each of these factors depends on the species, its behaviour and ecology. Nevertheless, bat activity, abundance and diversity are likely to be higher in areas supporting all three above mentioned factors.

The site is evaluated by comparing the amount of surface rock (possible roosting space), topography (influencing surface rock in most cases), vegetation (possible roosting spaces and foraging sites), climate (can influence insect numbers and availability of fruit), and presence of surface water (influences insects and acts as a source of drinking water) to identify bat species that may be impacted by wind turbines. These comparisons are done chiefly by briefly studying the geographic literature of each site and available satellite imagery. Species probability of occurrence based on the above-mentioned factors are estimated for the site and the surrounding larger area. Pre-construction and operational bat monitoring data from surrounding and nearby Wind Farms have also been consulted during this screening phase study.

Several site visits were carried out from March 2021 – June 2022, including a helicopter flight, to groundtruth bat sensitivity features and habitats delineated in the bat sensitivity constraints map. In May 2021, passive bat detection systems were set up on the 2 Meteorological (Met) Masts with microphones at 10m, 60m and 120m. Additionally, in July 2021 three Short Mast bat detection systems have also been set up, with microphones at 7m (referred to ShM1S – ShM3S, (see Figure 7-34). These systems were set to gather bat activity data every night for 12 months to form part of the long-term pre-construction monitoring.

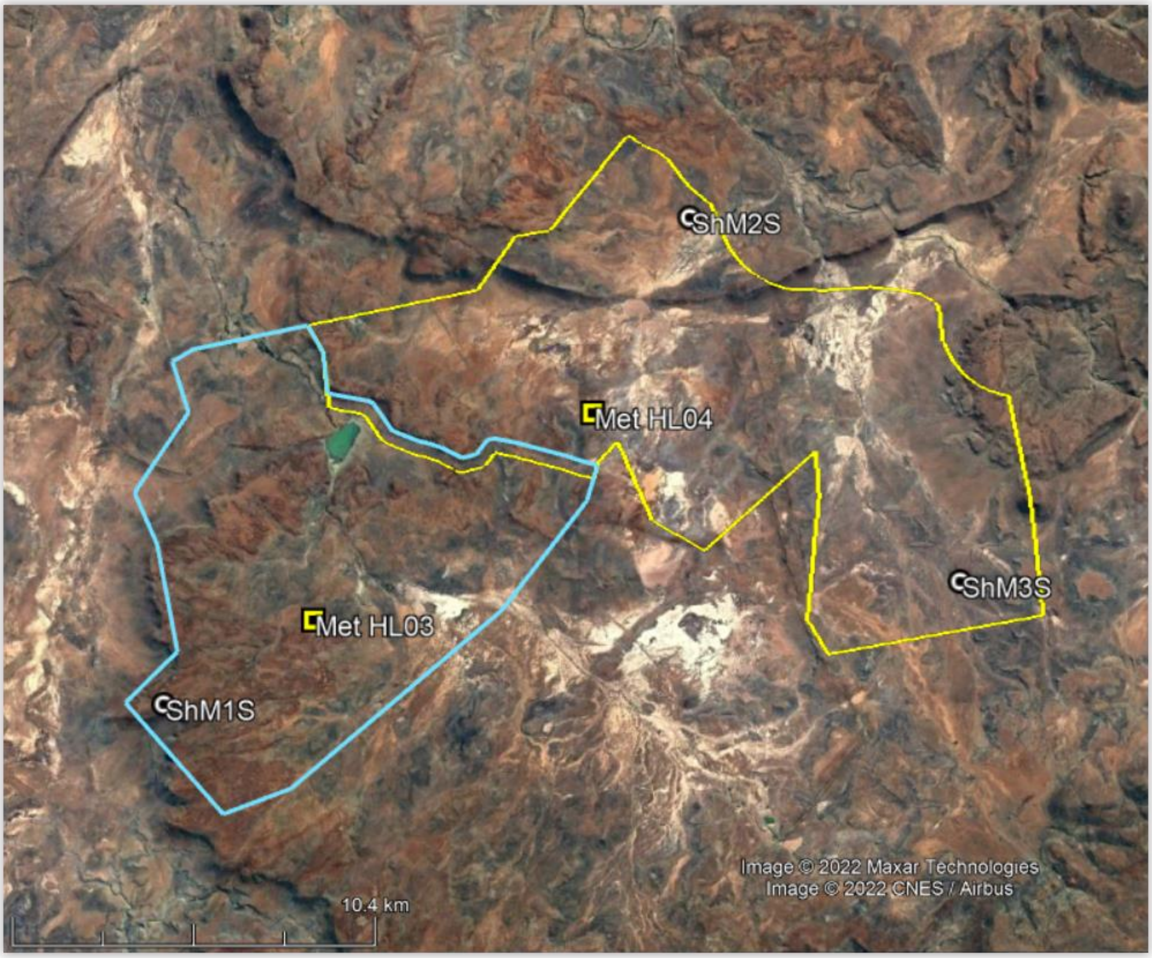


Figure 7-34: Passive bat detection systems set up on the Hoogland Southern cluster.

7.5.1.1 Land Use, Vegetation, Climate and Topography

According to Mucina and Rutherford (2012, 2018), the Hoogland Southern cluster comprising mostly of the Eastern Upper Karoo and Western Upper Karoo, with sections of Upper Karoo Hardeveld along dolerite ridges. Some patches of Bushmanland Vloere are located near the site (Figure 7-13).

The Eastern Upper Karoo vegetation unit on the Southern cluster is mostly flats and gently sloping plains with occasional washes, interspersed with some Upper Karoo Hardeveld (refer to Figure 7-13 in Section 7.4.1.1 above for the vegetation map). The Upper Karoo Hardeveld regions on the sites are characterised by dolerite rock tors (abrupt small koppies) and dolerite cliffs edges. The Eastern Upper Karoo vegetation are mostly dwarf shrubs with some white grasses, last mentioned occurring in a lesser extent. The geology of the Eastern Upper Karoo are mudstones and sandstones. And rainfall is mostly in autumn and summer, peaking in March, with annual averages of 180mm – 200mm. Snowfall can occur in winter months and mean maximum and minimum temperature ranges from -8°C – 37°C.

The Western Upper Karoo vegetation unit comprises a mixture of shrubby succulents and drought resistant grasses. Geology consists of Karoo sediments and intrusive dolerites. On the Southern cluster some washes are present forming part of the hydrology. The highest precipitation occurs in March at about 220mm with average temperature ranges almost similar to the Eastern Upper Karoo.

Rocky boulder stacks exposed by erosion, in the form of tors and cliff edges, are prevalent in the Upper Karoo Hardeveld on the site. Providing possible roosting space for crevice dwelling bats, as well as feeding spots sheltered from wind.

Vegetation units and geology are of great importance as these may serve as suitable sites for the roosting of bats and support of their foraging habits (Monadjem *et al.* 2020). Houses and buildings may also serve as suitable roosting spaces (Taylor 2000; Monadjem *et al.* 2020). The importance of the vegetation units and associated geomorphology serving as potential roosting and foraging sites have been described in Table 7-36.

Table 7-36: Potential of the vegetation units to serve as suitable roosting and foraging spaces for bats

VEGETATION UNIT	FORAGING POTENTIAL	ROOSTING POTENTIAL	COMMENTS
Eastern Upper Karoo	Moderate – High (seasonal)	Low - Moderate	These areas are classified as part of the Eastern Upper Karoo but in some areas displays characteristics closer to that of the Karoo Upper Hardeveld. Foraging potential can be high in drainage areas and seasonally in washes.
Western Upper Karoo	Moderate – High (seasonal)	Low	Foraging potential can be high in drainage areas and seasonally in washes.
Upper Karoo Hardeveld	Moderate - High	High	The exposed rocky cliffs and tors can provide roosting space for crevice dwelling bats and feeding spots sheltered from wind.

7.5.1.2 Protected areas, known sensitivities and caves/roosts within 100km from the site

The Karoo National Park and Steenbokkie Private Nature Reserve are the closest protected areas to the site, approximately 10km to the South (Figure 7-35). None of the nature reserves are well known hotspots for bat activity or bat roosts that may influence the site, although the presence of natural vegetation may promote bat diversity and activity levels.

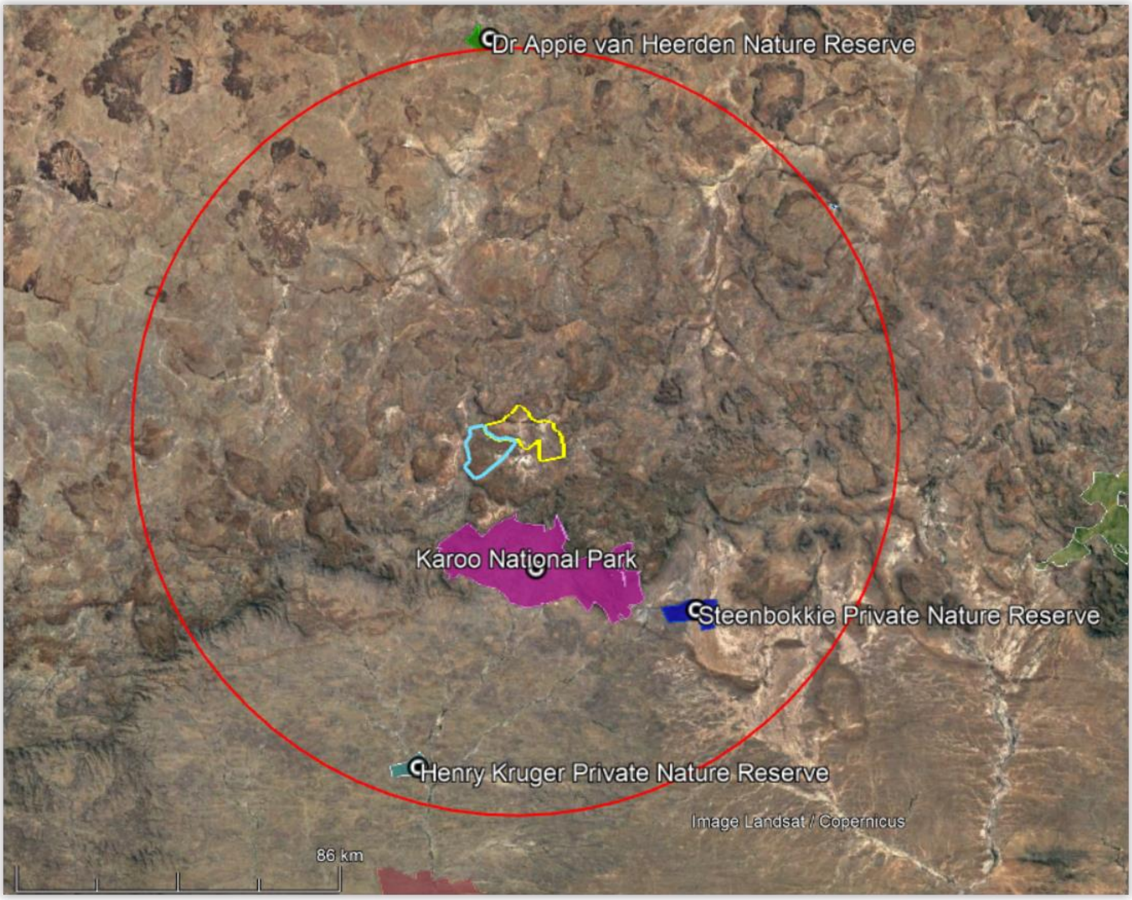


Figure 7-35: Protected areas within a radius of 100km (red line) around the site (DFFE, October 2021)

The Strategic Impact Assessment (SEA) assigns 50km buffers to large bat roosts for wind energy and 5km for PV energy, therefore any of the unconfirmed or possible cave/roost locations may be assigned a buffer up to 50km if they are found to be supporting large enough bat colonies. This location in Figure 7-36 is further than 50km from the site.

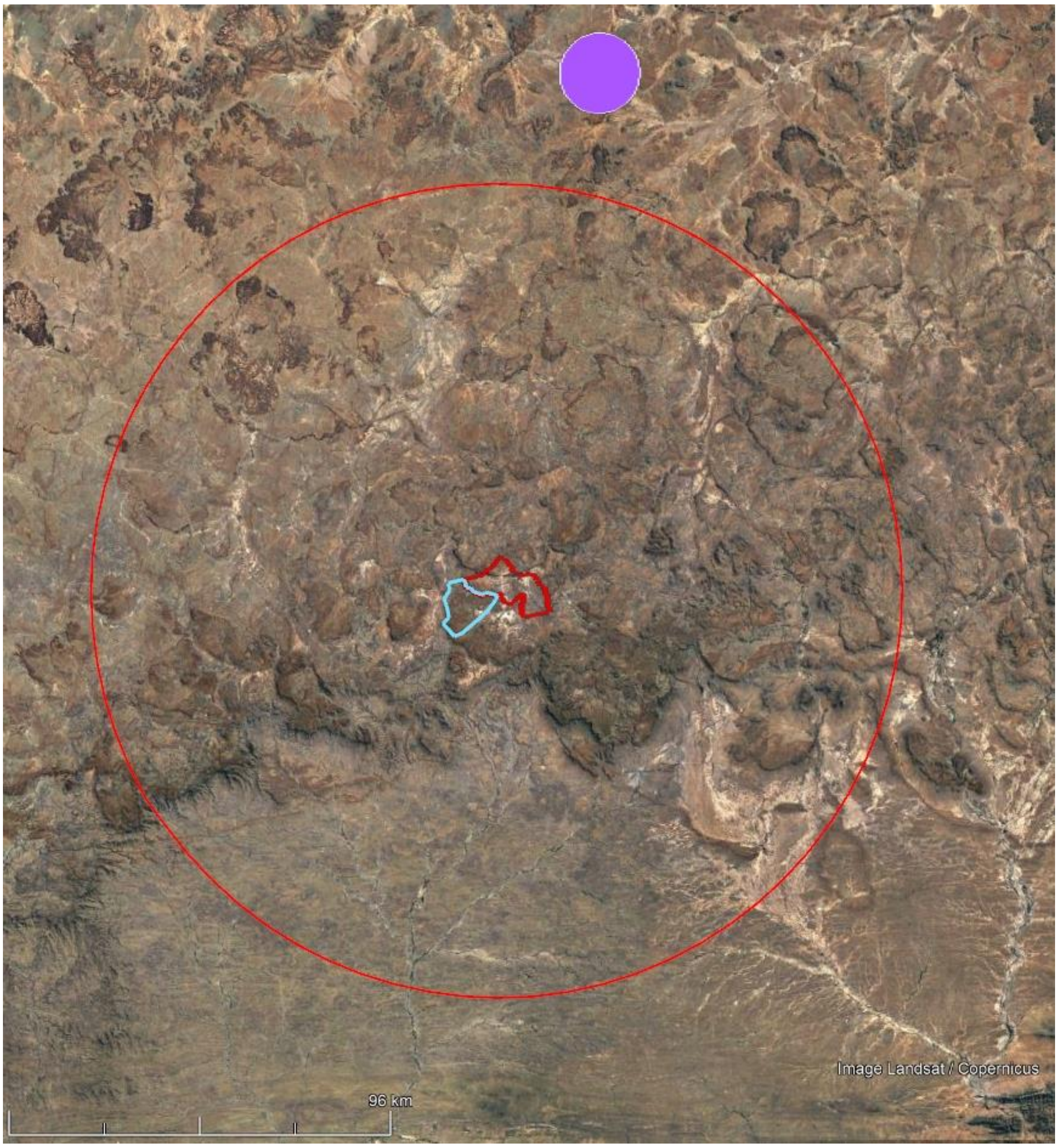


Figure 7-36: An unconfirmed bat roost just outside 100km (red radius line) from the site. The purple circle is classified by the SEA as an unconfirmed roost and has been assigned a 10km buffer by the SEA

In Figure 7-36 the red areas indicate high bat sensitivity hydrology features, the remaining areas are assigned a medium sensitivity by the Screening Tool. The sensitivities of the National Screening Tool have been considered, however the sensitivity map produced with this Pre-Application study deviates from these sensitivities. The deviations are based on detailed site visits and assessments and the sensitivities applied are depicted in Section 7.5.1.5.

7.5.1.3 Bat species

There are several bat species in the vicinity of the site that occur commonly in the area. Some of these species are of special importance based on their likelihood of being impacted by the proposed Wind Farm, due to high abundances and certain behavioural traits. They have also been dominating records of fatalities at nearby wind farms. The relevant species are in Table 7-37 below.

7.5.1.4 Ecology of bat species that may be impacted the most by the Wind Farm

There are several bat species in the vicinity of the site that occur commonly in the area. Some of these species are of special importance based on their likelihood of being impacted by the proposed Wind Farm, due to high abundances and certain behavioural traits. They have also been dominating records of fatalities at nearby Wind Farms. The relevant species are discussed below.

7.5.1.4.1 Tadarida aegyptiaca

The Egyptian Free-tailed Bat, *Tadarida aegyptiaca*, is a Least Concern species (IUCN Red List 2016) as it has a wide distribution and high abundance throughout South Africa and is part of the Free-tailed bat family (Molossidae). It occurs from the Western Cape of South Africa, north through to Namibia and southern Angola; and through Zimbabwe to central and northern Mozambique (Monadjem *et al*. 2020). This species is protected by national legislation in South Africa (ACR 2018).

They roost communally in small (dozens) to medium-sized (hundreds) groups in rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. *Tadarida aegyptiaca* has also adapted to roosting in buildings, in particular roofs of houses (Monadjem *et al*. 2020). Thus, the rocky boulder crevices and man-made structures on the site would be important roosts for this species.

Tadarida aegyptiaca forages over a wide range of habitats, flying above the vegetation canopy. It appears that the vegetation has little influence on foraging behaviour as the species forages over desert, semi-arid scrub, savannah, grassland and agricultural lands. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey (Monadjem *et al*. 2020).

After a gestation of four months, a single young is born, usually in November or December, when females give birth once a year. In males, spermatogenesis occurs from February to July and mating occurs in August. Maternity colonies are apparently established by females in November.

The Egyptian Free-tailed bat is considered to have a high likelihood of risk of fatality due to wind turbines (MacEwan *et al.* 2020) and are displaying moderate to high numbers of mortalities at operating Wind Farms in South Africa. Due to the high abundance and widespread distribution of this species, high mortality rates due to wind turbines would be a cause of concern as these species have more significant ecological roles than the rarer bat species.

7.5.1.4.2 Neoromicia capensis

Neoromicia capensis (Cape serotine bat) has a conservation status of Least Concern (IUCN Red List 2016) as it is ***fo***und in high numbers and is widespread over much of Sub-Saharan Africa.
High mortality rates of this species due to wind turbines would be a cause of concern as *N. capensis* is abundant and widespread and as such has a more significant role to play within the local ecosystem than the rarer bat species. They do not undertake migrations and thus are considered residents of the site.

It roosts individually or in small groups of two to three bats in a variety of shelters, such as under the bark of trees, and inside the roofs of houses. They will use most man-made structures as day roosts which can be found on the site and surrounding areas (Monadjem *et al*. 2020).

Mating takes place from the end of March until the beginning of April. Spermatozoa are stored in the uterine horns of the female from April until August, when ovulation and fertilisation occurs. They give birth to twins during late October and November, but single pups, triplets and quadruplets have also been recorded (van der Merwe 1994 and Lynch 1989).

They are tolerant of a wide range of environmental conditions as they survive and prosper within arid semi-desert areas to montane grasslands, forests, and savannas; indicating that they may occupy several habitat types across the site and are amenable towards habitat changes. They are however clutter-edge foragers, meaning they prefer to hunt on the edge of vegetation clutter mostly, but can occasionally forage in open spaces. They are thought to have a Medium-High likelihood of risk of fatality due to wind turbines (MacEwan *et al.* 2020). And are displaying moderate to high numbers of mortalities at operating Wind Farms in South Africa.

7.5.1.4.3 Miniopterus natalensis

Miniopterus natalensis (Natal long-fingered bat), occurs widely across the country but mostly within the southern and eastern regions and is listed as Near Threatened (Monadjem *et al*. 2020). This bat is a cave-dependent species and identification of suitable roosting sites may be more important in determining its presence in an area than the presence of surrounding vegetation. It occurs in large numbers when roosting in caves with approximately 260 000 bats observed making seasonal use of the De Hoop Guano Cave in the Western Cape, South Africa. Culverts and mines have also been observed as roosting sites for either single bats or small colonies in South Africa. Separate roosting sites are used for winter hibernation activities and summer maternity behaviour, with the winter hibernacula generally occurring at higher altitudes in more temperate areas and the summer hibernacula occurring at lower altitudes in warmer areas of the country (Monadjem *et al*. 2020).

Mating and fertilisation usually occur during March and April and is followed by a period of delayed implantation until July/August. Birth of a single pup usually occurs between October and December as the females congregate at maternity roosts (Monadjem et al. 2020 & van der Merwe 1979).

The Natal long-fingered bat undertakes short migratory journeys between hibernaculum and maternity roosts. Due to this migratory behaviour, they are considered to be at high risk of fatality from wind turbines if a Wind Farm is placed within a migratory path (MacEwan *et al*. 2020). The mass movement of bats during migratory periods could result in mass casualties if wind turbines are positioned over a mass migratory route and such turbines are not effectively mitigated. Very little is known about the migratory behaviour and paths of M. natalensis in South Africa with migration distances exceeding 150 kilometres. If the site is located within a migratory path the bat detection systems should detect high numbers and activity of the Natal long-fingered bat, this will be examined over the course of the 12-month monitoring survey. However, it should be noted that no migration routes are known to occur on site or in the surrounding area. Also, no known caves are present in the area of the site and the geology are not prone to cave formation. However, from personal observations it has been noted that they can occur individually or in small groups in rock hollows or man-made structures such as culverts.

MacEwan *et al*. (2020) advise that *M. natalensis* faces a medium to high risk of fatality due to wind turbines. This evaluation was based on broad ecological features and excluded migratory information. And are displaying low to moderate numbers of mortalities at operating Wind Farms in South Africa.

7.5.1.4.4 Cistugo lesueuri

Cistugo lesueuri (Lesueur's Wing-gland bat) and has a conservation status of Least Concern (IUCN Red List 2016) and Near Threatened in the 2004 International Union for Conservation of Nature (IUCN) Red List, it has a limited distribution and is endemic to South Africa and Lesotho with only a few museum records. It appears to be associated with high altitude montane grasslands where open drinking water and rock crevices are present (Monadjem *et al.* 2020). A specimen has been collected in 1979 just outside the town of Beaufort West, indicating that the habitat of the larger area can be suitable for this species.

It has relatively short and broad wings with an intermediate wing loading and low aspect ratio, indicating it's a clutter edge forager. It may arguably therefore be placed in the same risk category as *Neoromicia capensis* at Medium-High likelihood of risk of fatality due to wind turbines.

Table 7-37: Table of species that are currently confirmed on site, and/or have been previously recorded in the area and may be occurring based on literature. Included is roosting or foraging in the study area, the possible site-specific roosts, and their probability of occurrence based on literature as well as recordings and observations in the surrounding area (Monadjem *et al.* 2020).

SPECIES	COMMON NAME	PROBABILITY OF OCCURRENCE (%)	CONSERVATION STATUS (2016 REGIONAL LISTING)	POSSIBLE ROOSTING HABITAT ON SITE	POSSIBLE FORAGING HABITAT UTILISED ON SITE	LIKELIHOOD OF RISK OF FATALITY (MACEWAN *ET AL.* 2020)
Tadarida aegyptiaca	Egyptian free-tailed bat	Confirmed on site	Least Concern	Roosts in rock crevices, hollows in trees, and behind the bark of dead trees. Exposed rocky cliffs and tors. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types of natural and urbanised habitats.	High
Neoromicia capensis	Cape serotine	Confirmed on site	Least Concern	Roosts in the roofs of houses and buildings, and also under the bark of trees.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannahs. But is predominantly a medium height clutter edge forager.	Medium - High
Miniopterus natalensis	Natal long-fingered bat	Confirmed on site	Near Threatened (2004 National Listing)	Cave and hollow dependent, no known caves nearby. Will also roost in small groups or individually in culverts and other hollows.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium - High
Sauromys petrophilus	Roberts's flat-headed bat	Confirmed on site	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs and tors.	Open air forager.	High
Eptesicus hottentotus	Long-tailed serotine	Confirmed on site	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs and tors.	It generally seems to prefer foraging on the clutter edge of vegetation, such as the vegetated drainage areas and also over open water sources such as farm dams.	Medium
Rhinolophus clivosus	Geoffroy's horseshoe bat	Confirmed on site	Near Threatened (2004 National Listing)	Roosts in caves and mine adits, no known caves in the area. May utilise man made	It is associated with a variety of habitats including thickets that may be found in the vegetated drainage areas.	Low

				hollows, Aardvark burrows or hollows formed by rocky boulder tors.		
Nycteris thebaica	Egyptian slit-faced bat	30 - 40	Least Concern	Roosts in rocky hollows, aardvark burrows, culverts under roads and the trunks of dead trees.	It appears to occur throughout the savannah and karoo biomes, but avoids open grasslands. May occur in the thickets that may be found in the vegetated drainage areas.	Low
Myotis tricolor	Temmink's myotis	Confirmed on site	Near Threatened (2004 National Listing)	Usually roosts gregariously in caves, and sometimes culverts or other hollows. No known caves or mine adits close to site.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium - High
Cistugo lesueuri	Lesueur's wing-gland bat	Museum records within larger area around site.	Near Threatened (2004 National Listing)	It is a crevice dweller roosting in rock crevices. Exposed rocky cliffs and tors.	Areas with available drinking water. Clutter edge forager. May forage in more open terrain during suitable weather.	Medium – High

7.5.1.5 Passive Bat Activity

Passive bat data was collected at the Hoogland 3 and 4 Wind Farms between the period of May 2021 (Met Masts) and July (Short Masts) to June 2022, representing four seasons of passive bat activity monitoring. Figure 7-37 to Figure 7-44 graphically display the data collected thus far, pertaining to the total bat passes recorded at each of the Met Masts (10m, 60m and 120m) and the Short Mast systems (7m), as well as the average hourly bat passes per system. The temporal distribution of bat activity is displayed, per night, in Figure 7-45 to Figure 7-48.

Bat activity was divided into categories (Table 7-38) according to the risk of being impacted on by wind turbines, as well as other important ecological significance (as is the case with cave bats).

Table 7-38: The categories used for grouping and presenting bat activity in the passive bat activity graphs.

Graph category and abbreviation	Motivation of graph category	Species detected in graph category
High risk (H)	• Open-air foragers • High flying in rotor swept zone	*Tadarida aegyptiaca* *Sauromys petrophilus*
High - Medium risk (HM)	• Migrant bats, can influence multiple ecologies • Cave bats, may possibly indicate presence of undiscovered bat cave roosts • Can also roost in non-cave hollows • Forages on the edges of vegetation clutter (clutter-edge foragers) • Medium height foraging, overlapping with lower rotor swept zone	*Miniopterus natalensis* *Miniopterus* spp. *Myotis tricolor*
Medium risk (M)	• Forages on the edges of vegetation clutter (clutter-edge foragers) • Medium height foraging, overlapping with lower rotor swept zone	*Laephotis capensis* *Eptesicus hottentotus* *Cistugo lesueuri* Other members of Vespertilionidae family
Low risk (L)	• Non-migrant cave and hollow dwelling bats, but may possibly indicate presence of caves, therefore presented in graphs • Forages in dense vegetation clutter (clutter foragers) • Low height foraging outside rotor swept zone	*Rhinolophus* spp.

*Echolocation call overlap with *Laephotis capensis*, presence could not be determined by echolocation data.

The six bat species detected on site were: *Eptesicus hottentotus, Tadarida aegyptiaca, Sauromys petrophilus, Laephotis capensis, Myotis tricolor* and *Miniopterus natalensis*. Additionally, other members of the genera *Miniopterus* spp. and *Rhinolophus* were also detected. Even though the presence of *Cistugo lesueuri* could not be confirmed or disproved, it's included into the above table since it's endemic to South Africa and Lesotho and is represented in museum records from the larger area around site.

When considering total bat passes (Figure 7-37– Figure 7-40), the High risk category (H) dominated at all systems and at all heights, with the Medium risk category (M) displaying the second highest activity levels at all microphones. Bat activity for the High risk category was highest at 60m on the met masts, due to the open air and higher flying foraging habits of *T. aegyptiaca* and *S. petrophilus* constituting this category. Bat activity was greater at 7m on the Met Masts than at the 120m height. Total bat passes can be used to compare activities between microphone heights, but results may be skewed by data gaps where the bat detector/microphone did not function. Some bat detectors experienced technical issues that resulted in gaps in their bat activity data. However, the other bat detectors on site gathered complete data during such periods to collectively inform the impact assessment sufficiently.

Average hourly activity (Figure 7-41– Figure 7-44) is more accurate for bat activity comparisons between different sample points since it considers only the nights on which the systems recorded successfully, and are therefore a true indication of activity levels. On the met masts, the average hourly activity levels did not display a similar pattern as seen in the total bat passes graphs, the bat activity and the High risk category dominated at the 7m microphones with second highest activity at 60m. Met Mast HL04 showed higher peak average hourly activity than Met Mast HL03. This may be due to the overall wetter terrain around the location of HL04. ShM1S and ShM2S combined had a higher average hourly activity than ShM3S.

The warmer months of September to March had the highest average activity levels in general, with the month of February displaying the overall highest activity across all systems on site. These months with higher activity in the High risk category are important to consider in case mitigation may be required during the operational phase. The pattern of higher bat activity during summer nights is to be expected when taking insect activity into consideration. The high elevation of the site lends to frequent frosts during colder nights and there is a distinct correlation between temperature, insect activity and thus bat activity. The area also received very good rainfall over the summer of 2021/2022, thus breaking the prolonged drought over the past decade.

The yearly median of average hourly bat passes, at 120m considering both met masts, are 0.8bp/h. At 60m the median for both met masts is 3.22bp/h. According to MacEwan *et al.* (2020), for the Nama Karoo ecoregion it's considered to be high bat activity levels indicating a high risk of bat mortalities. Therefore, the probability of active mitigations being required during operation is high and the exact mitigation measure will be based on results of the operational mortality monitoring.

Miniopterus natalensis and *Myotis tricolor* (part of the HM graph category) are cave dwelling species but may also take residence in smaller numbers in culverts and other suitable man-made hollows, these species did not show any abrupt peaks of activity that may indicate that the site is on any migration route. The species was not particularly frequently recorded on the systems, although it was present in the data from each system.

The temporal data displays the spread of bat activity over each night and season and did not indicate any abrupt peaks in activity.

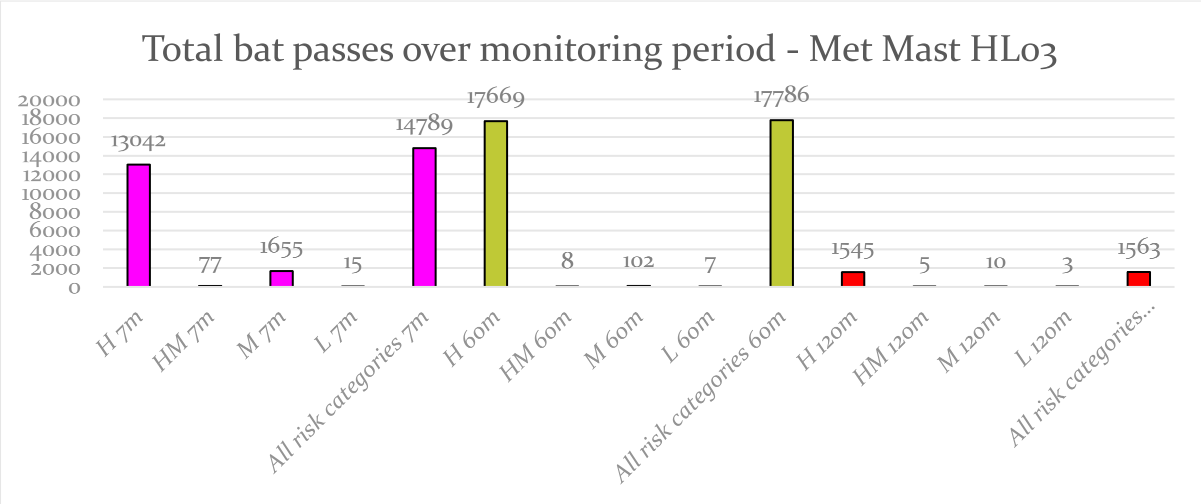


Figure 7-37: Total number of bat passes recorded over the monitoring period by Met Mast HL03.

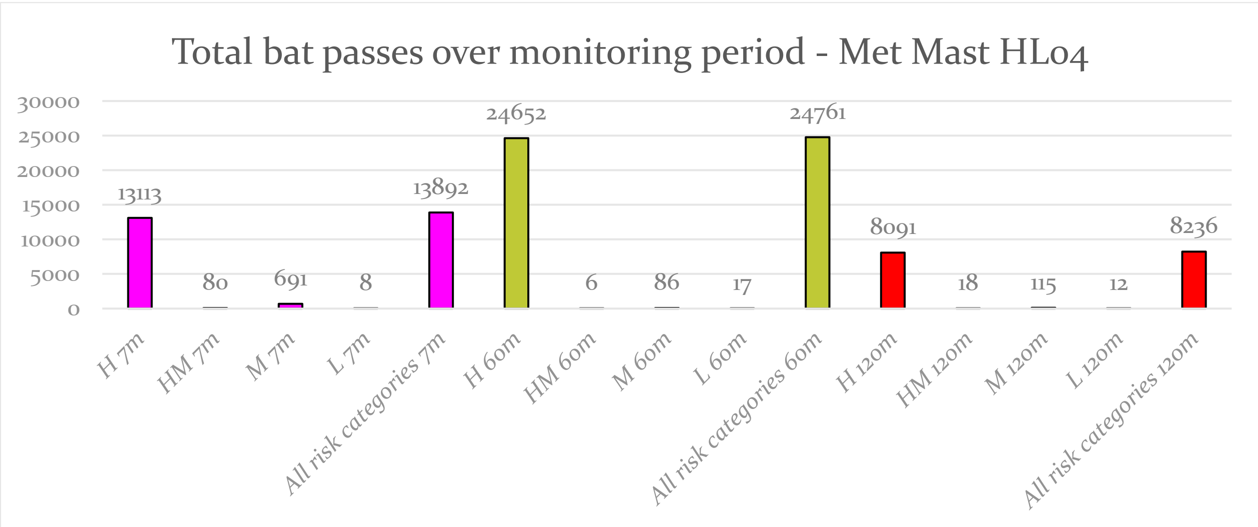


Figure 7-38: Total number of bat passes recorded over the monitoring period by Met Mast HL04.

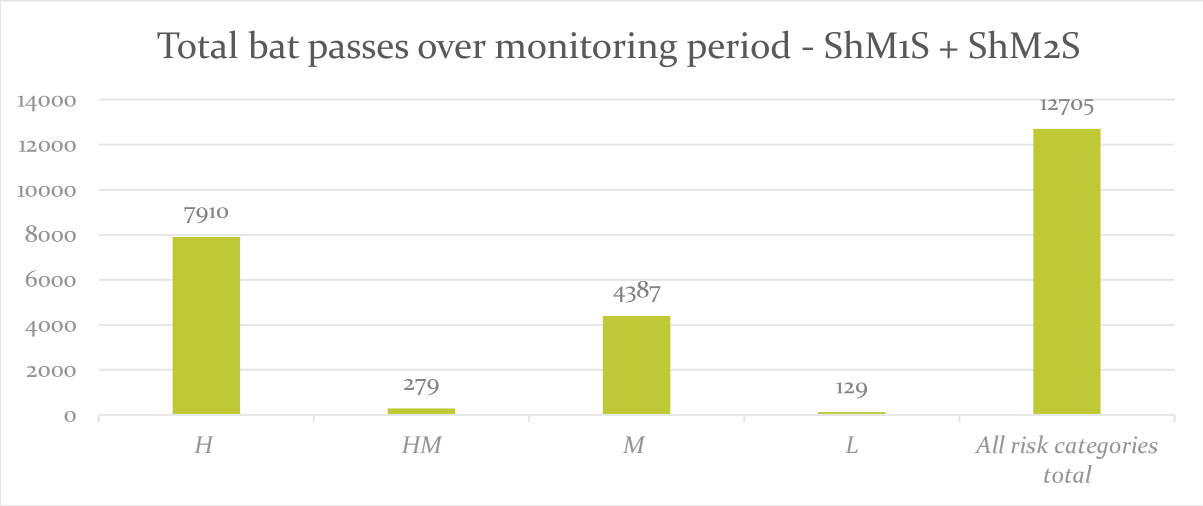


Figure 7-39: Total number of bat passes recorded over monitoring period by short mast ShM1S and ShM2S combined.

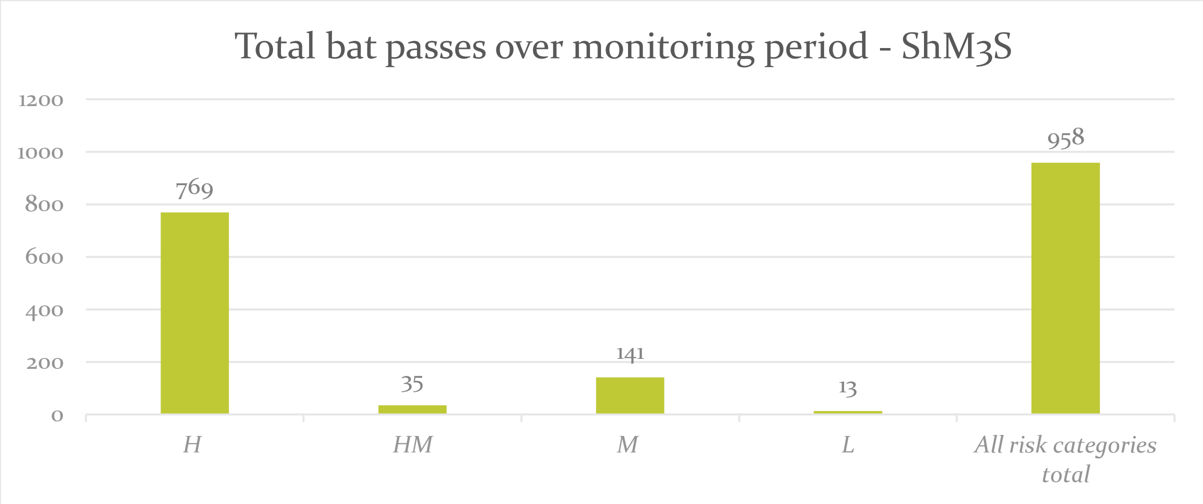


Figure 7-40: Total number of bat passes recorded over the monitoring period by short mast ShM3S.

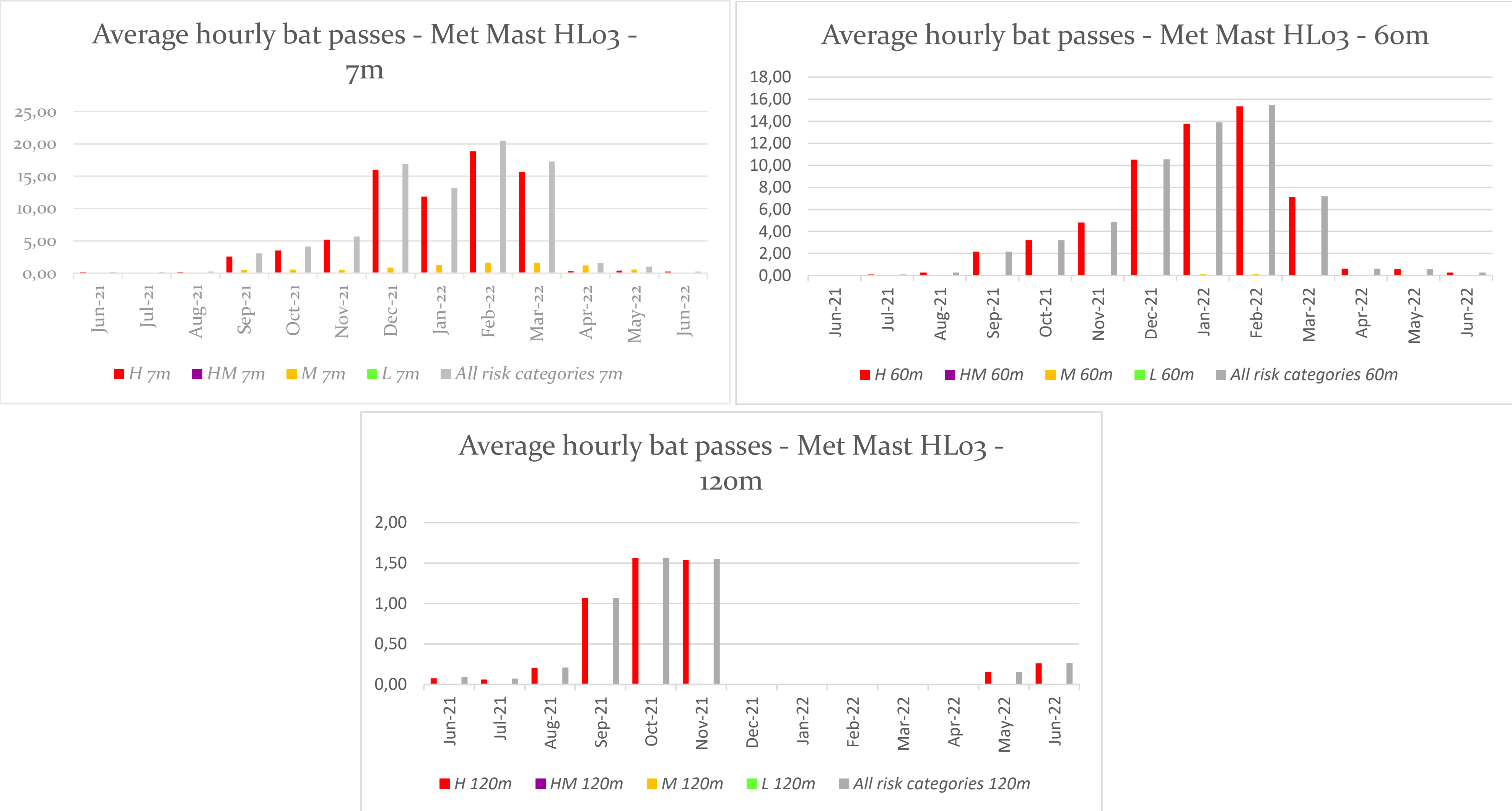
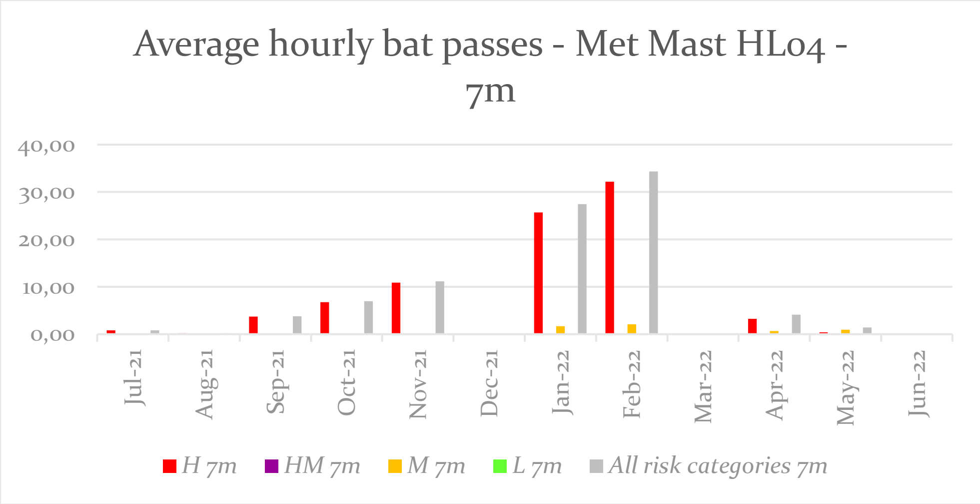
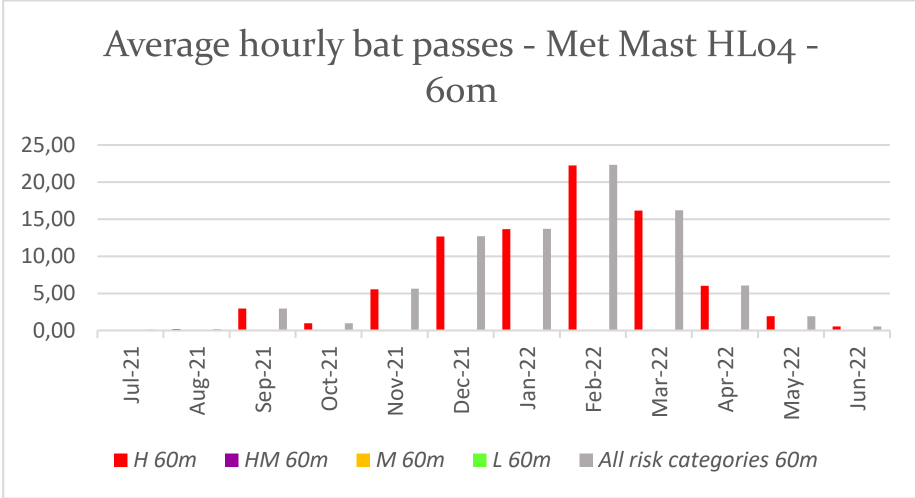


Figure 7-41: Average hourly bat passes recorded per month by Met Mast HL03 – 10m, 60m and 120m.





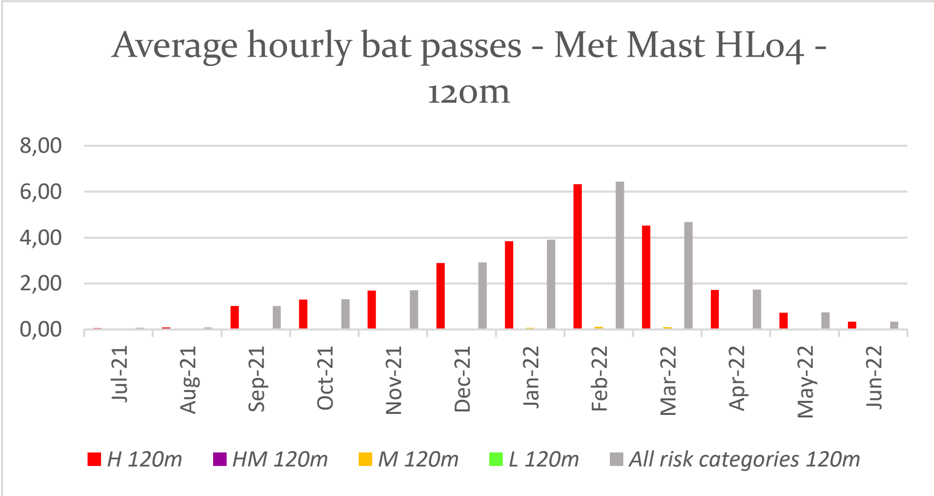


Figure 7-42: Average hourly bat passes recorded per month by Met Mast HL04 – 10m, 60m, 120m.

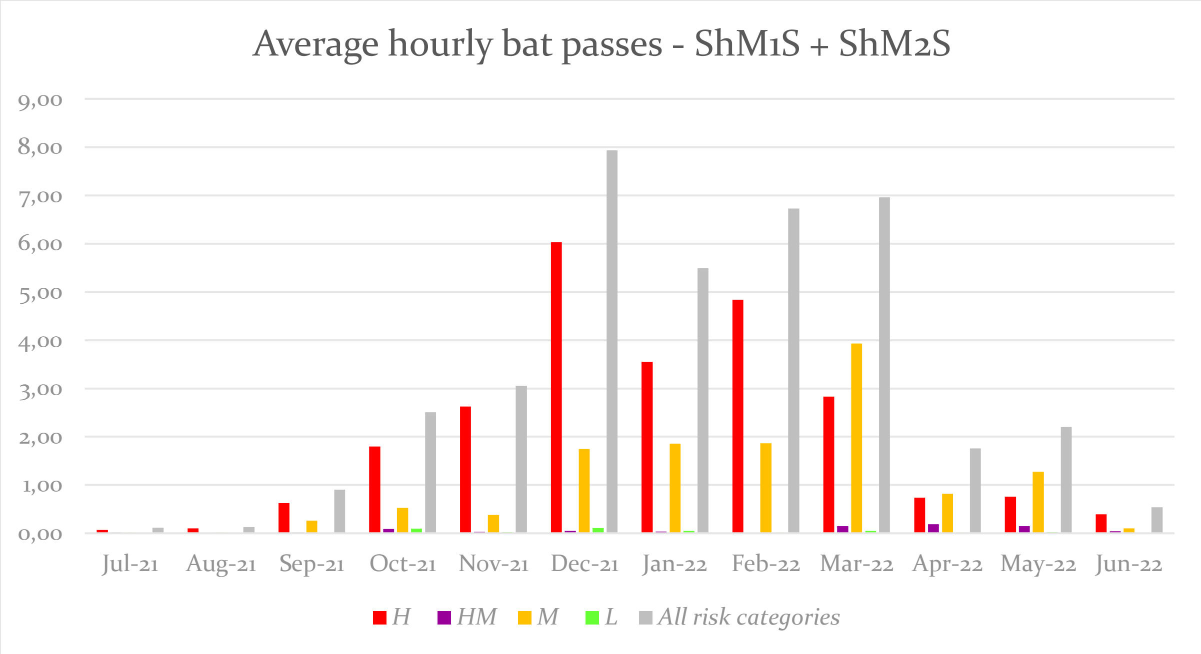


Figure 7-43: Average hourly bat passes recorded per month by short mast ShM1S and ShM2S combined.

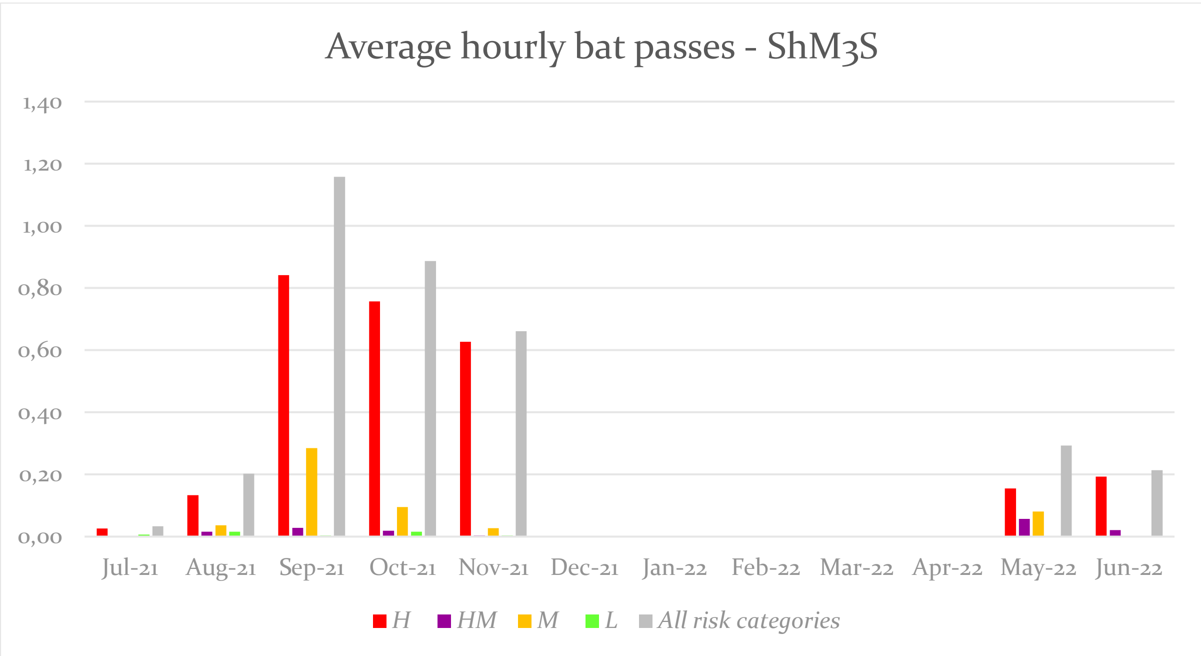


Figure 7-44: Average hourly bat passes recorded per month by short mast ShM3S.

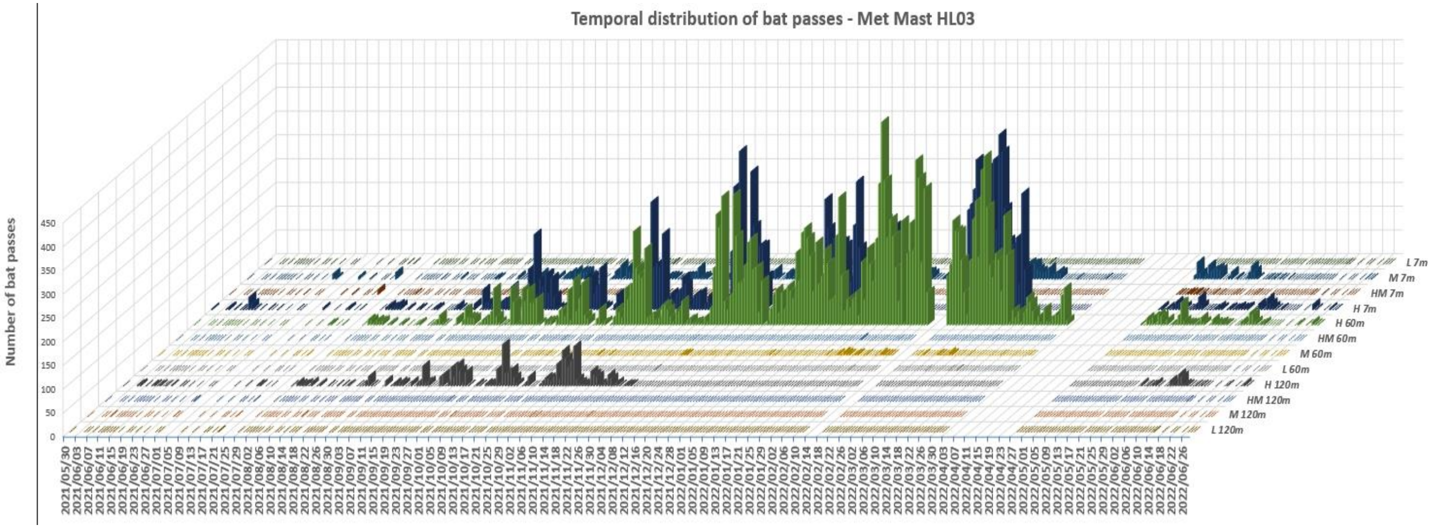


Figure 7-45: Temporal distribution of bat passes detected over the monitoring period by Met Mast HL03.

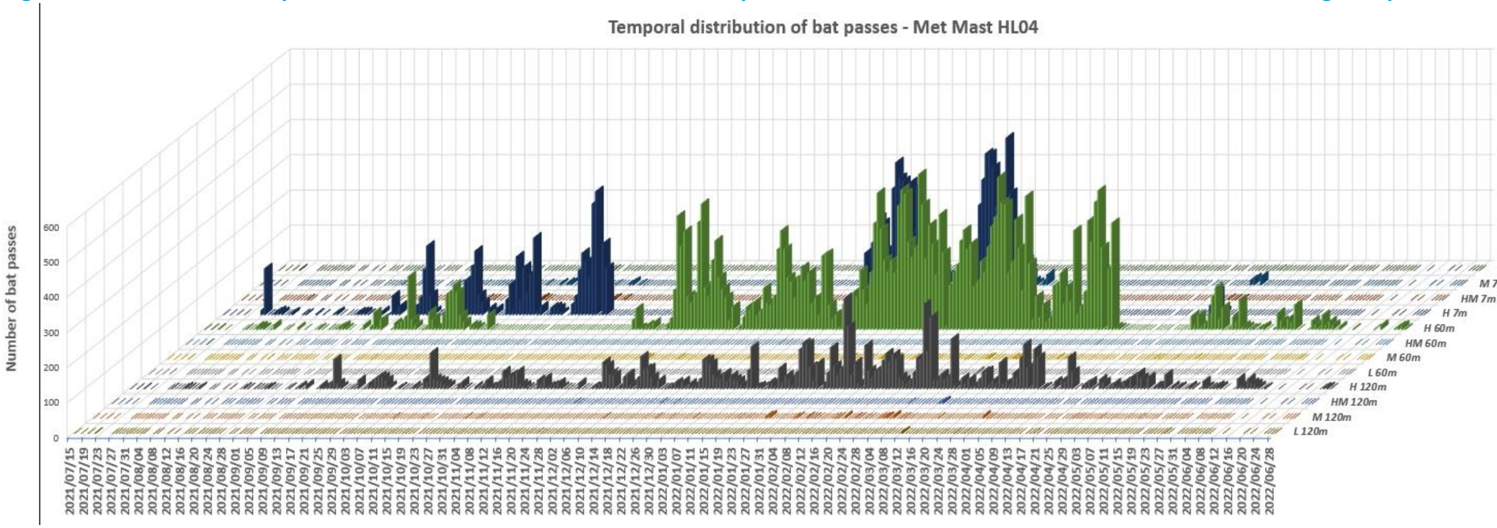


Figure 7-46: Temporal distribution of bat passes detected over the monitoring period by Met Mast HL04.

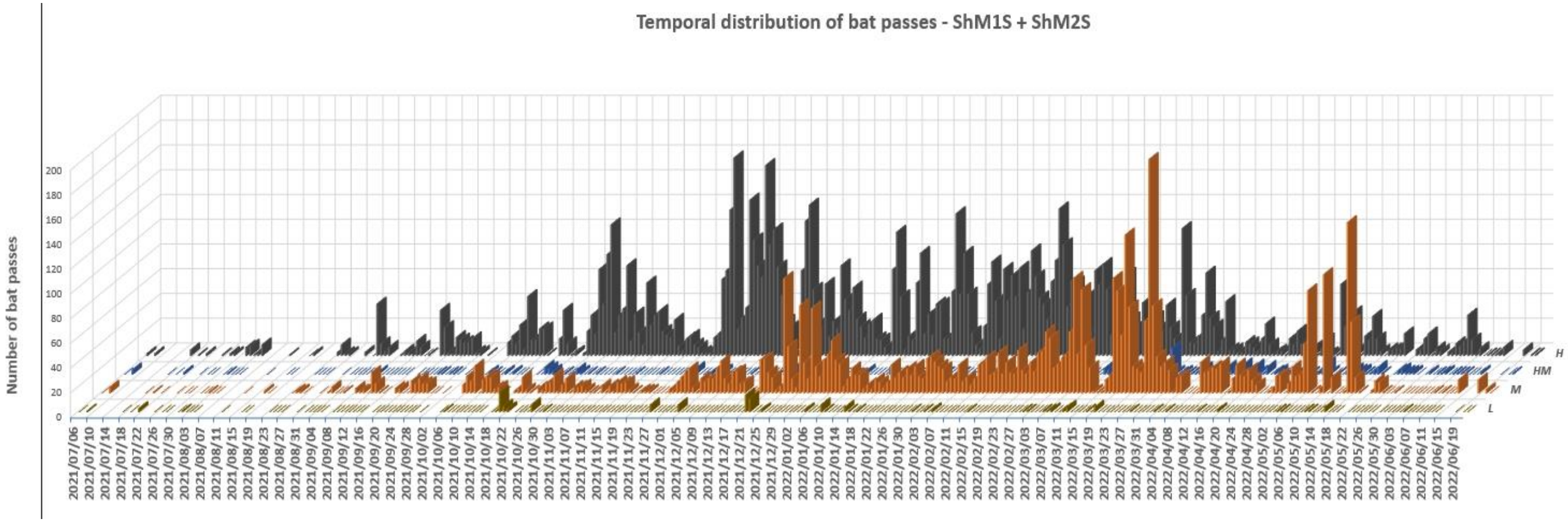


Figure 7-47: Temporal distribution of bat passes detected over the monitoring period by ShM1S and ShM2S combined.

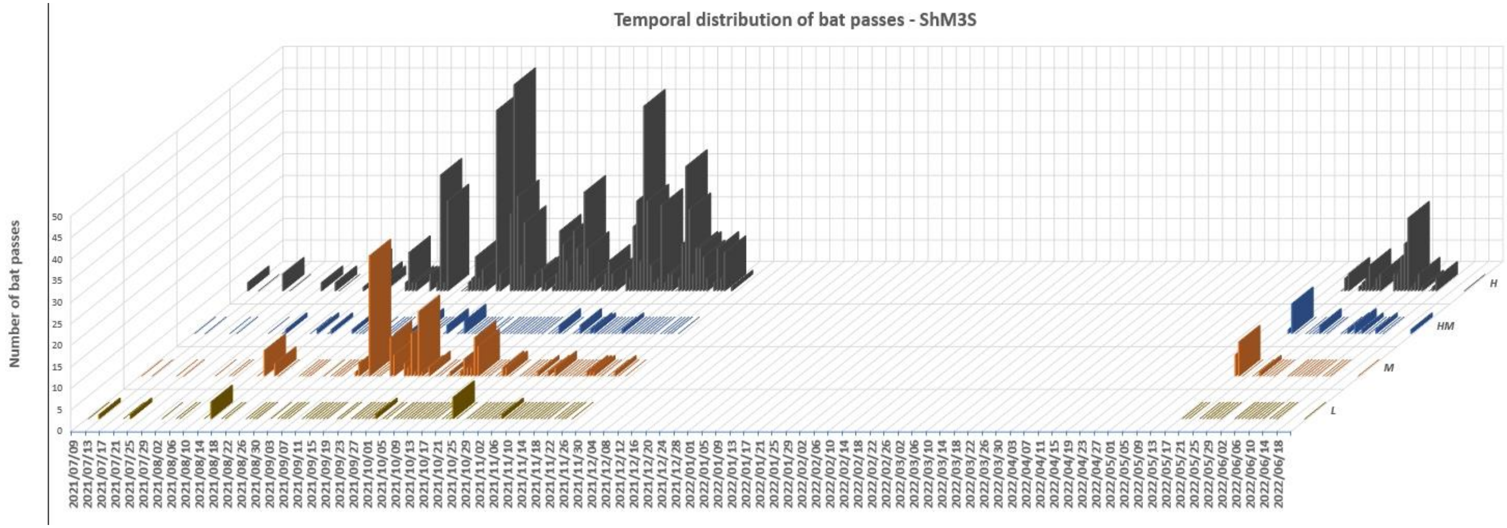


Figure 7-48: Temporal distribution of bat passes detected over the monitoring period by ShM3S.

7.5.2 Site Sensitivity

The sensitivities of the National Screening Tool have been considered, however the sensitivity map produced with this study deviates from these sensitivities. The deviations are based on detailed site visits and assessments and the sensitivities applied are depicted in Section 7.5.1.5.

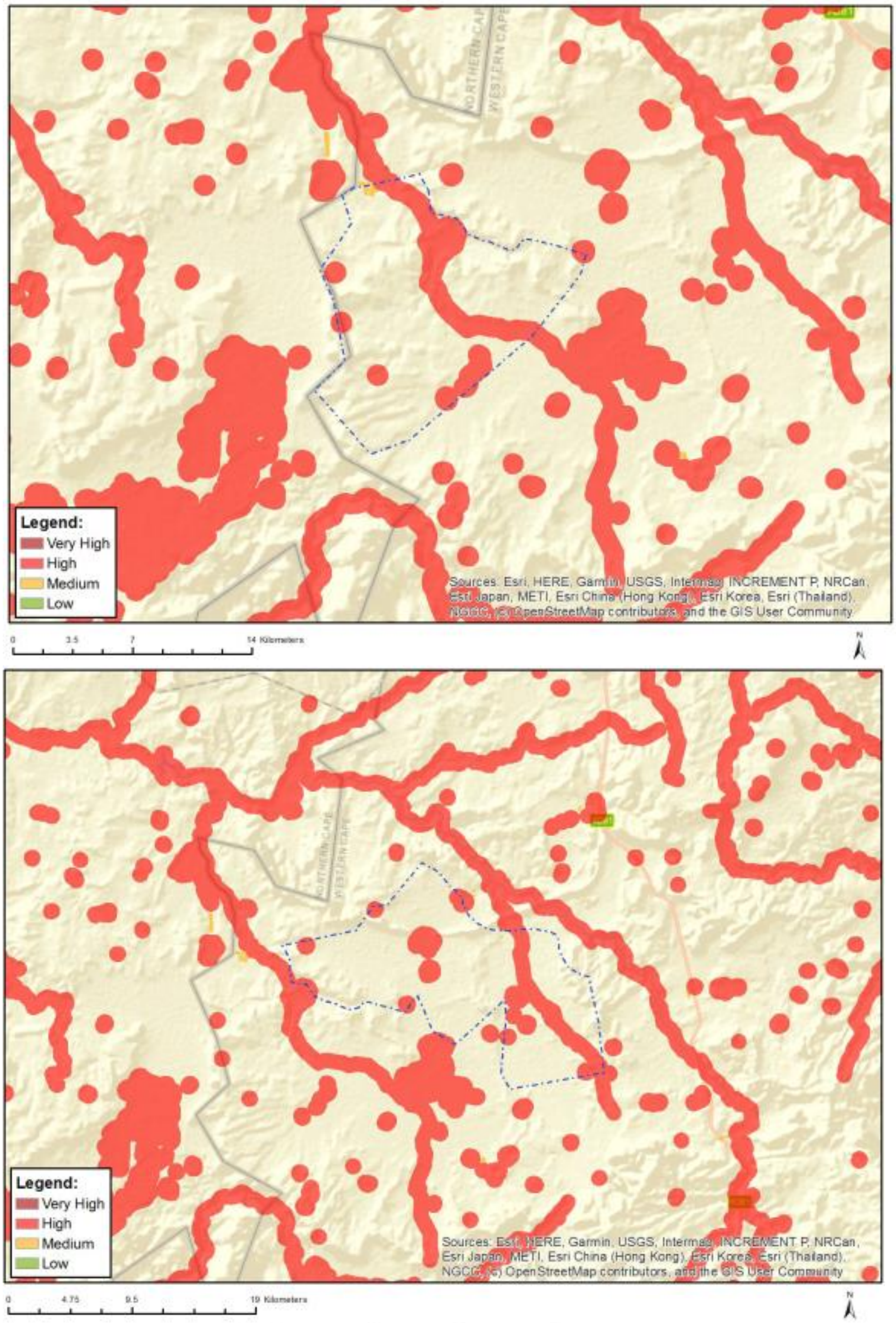


Figure 7-49: Possible bat sensitivity features and areas wind energy for HL3 (top) and HL4 (bottom) according to the National Environmental Screening Tool (May 2022)

Table 7-39 depicts the sensitive areas of the Southern Cluster site, based on features identified to be important for foraging and roosting of the species that most commonly occur on site (which are described in Table 7-37). Thus, the sensitivity map for Hoogland 3 Wind Farm (Figure 7-50) and Hoogland 4 Wind Farm (Figure 7-51) is based on species ecology and habitat preferences. This map has already been used as a pre-construction mitigation in terms of improving turbine placement with regards to bat preferred habitats on site, since the applicant amended the turbine layout considering the sensitivity map. It has also been applied to the other infrastructure types where relevant as detailed in Section 9.

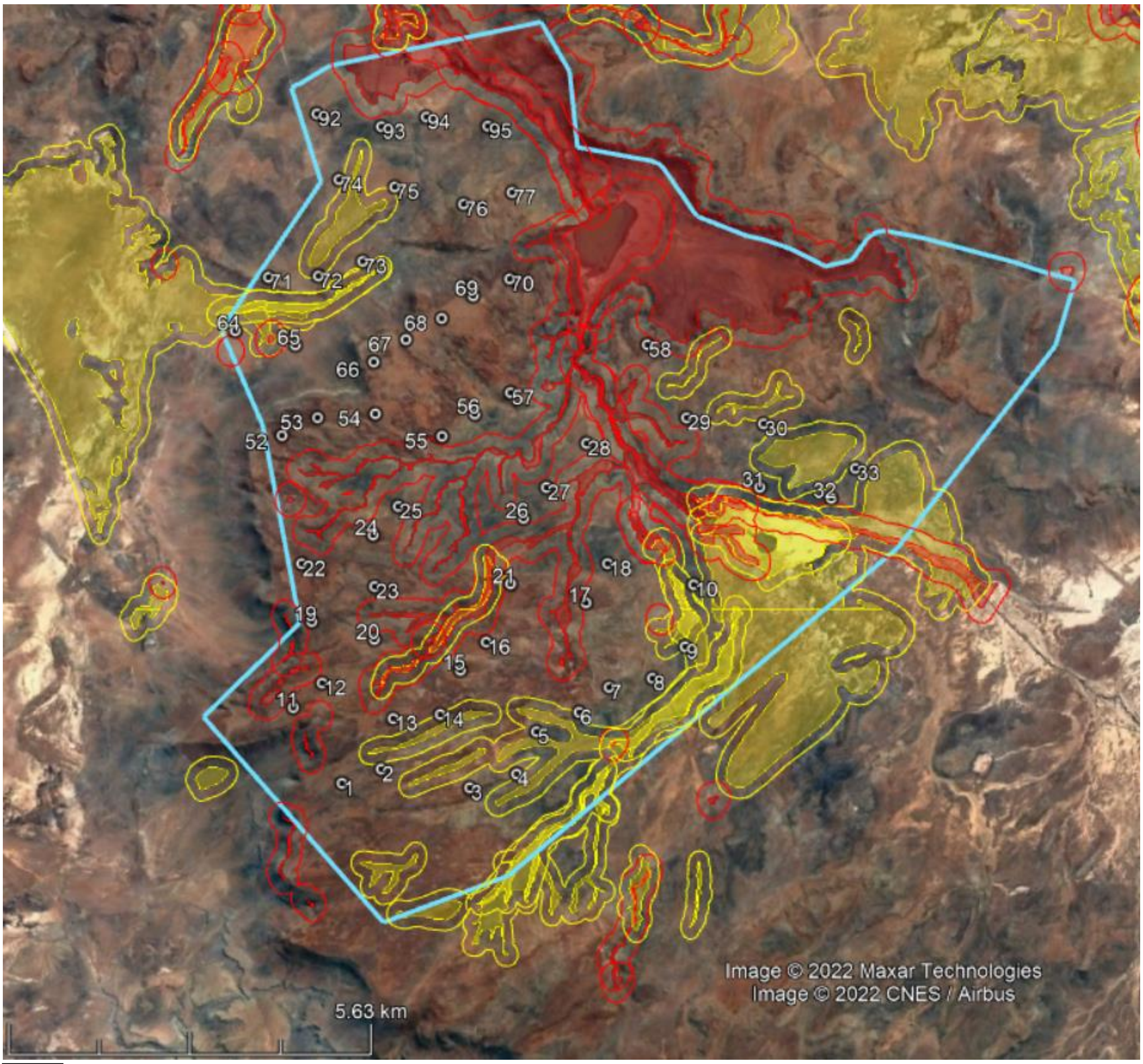
Note that for the turbine sensitivity maps, the buffers provided exclude for blade overhang and a worst-case turbine blade length of 97.5 m has been applied by the Applicant to take this into account as shown in the Consolidated Turbine No-Go map in Section 9.

Table 7-39: Description of parameters used in the construction of the sensitivity map

CLASSIFICATION	FEATURE
High sensitivities and 200m buffers	Valley bottom wetlands.
	Pans and depressions.
	Dams.
	Rocky boulder koppies (tors).
	Exposed rocky cliff edges.
	Drainage lines capable of supporting riparian vegetation.
	Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds.
Moderate sensitivities and 150m buffers	Alluvial plains and washes.
	Seasonal drainage lines.
	Small and low exposed rocky cliffs and edges.

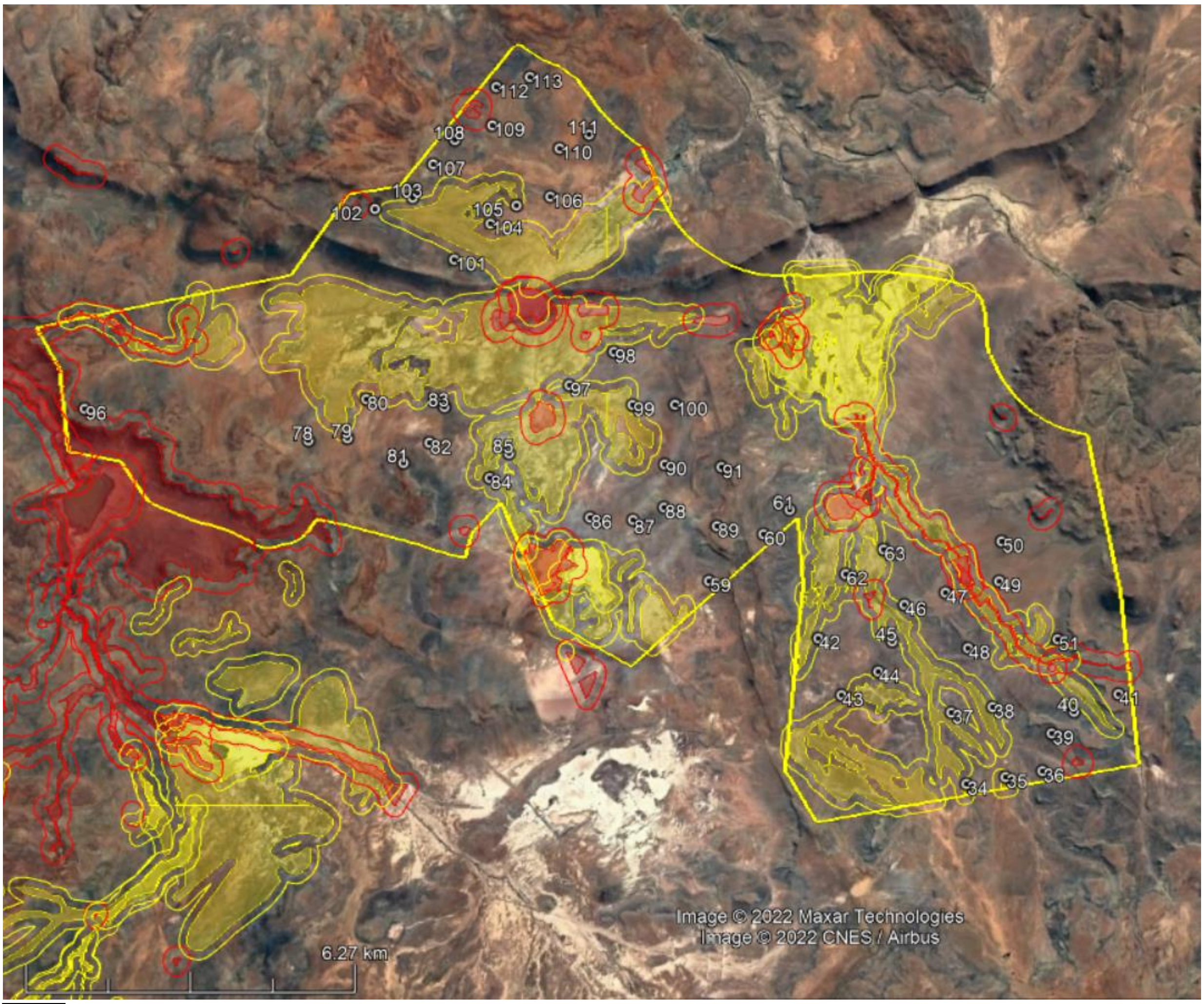
Table 7-40: Turbines located within bat sensitive areas and buffers (including 97.5m turbine blades)

Bat sensitive area	Hoogland 3 Turbines	Hoogland 4 Turbines
High bat sensitivity area (no-go areas)	None	None
High bat sensitivity buffer (no-go areas)	None	None
Moderate bat sensitivity area	9	35, 38, 62, 85, 99, 105
Moderate bat sensitivity buffer	2, 4, 5, 6, 10, 14, 30, 64, 72, 73, 74	34, 37, 42, 43, 44, 45, 46, 63, 79, 84, 97, 101, 102, 103, 104



	High bat sensitivity area		High bat sensitivity buffer 200m
	Moderate bat sensitivity area		Moderate bat sensitivity buffer 150m

Figure 7-50: Bat sensitivity map of the proposed Hoogland 3 Wind Farm site, showing moderate and high sensitivity zones and their buffers, in relation to turbine positions



High bat sensitivity area — High bat sensitivity buffer 200m

Moderate bat sensitivity area — Moderate bat sensitivity buffer 150m

Figure 7-51: Bat sensitivity map of the proposed Hoogland 4 Wind Farm site, showing moderate and high sensitivity zones and their buffers in relation to turbine positions

7.5.3 Impact Assessment and Mitigation

The following bat impacts have been identified and rated by Animalia (2022). Nothing that decommissioning impacts are considered insignificant and have been scoped out of this assessment.

7.5.3.1 Construction Phase

Table 7-41: Construction: Loss of foraging habitat by clearing of vegetation

Issue	Loss of foraging habitat by clearing of vegetation.
Description of Impact	
Bat foraging habitat will be destroyed during construction, however the relative footprint is small.	
Type of Impact	Direct
Nature of Impact	Negative

Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Low	Very Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Very Low
Probability	Definite / Continuous	Probable
Significance	Low -	Very Low -
Degree to which impact can be reversed	Reversable in areas of temporary construction clearing, not reversable in areas of permanent construction.	
Degree to which impact may cause irreplaceable loss of resources	Irreplaceable loss of resources will occur in areas of permanent construction but are limited to a small footprint.	
Degree to which impact can be mitigated	Avoid No-go areas by adhering to the sensitivity map (this has been applied in the current layout to date). Rehabilitating temporary construction clearings.	
Mitigation actions		
The following measures are recommended:	Adhere to the sensitivity map criteria. Rehabilitate cleared vegetation where possible at areas such as laydown yards.	
Monitoring		
The following monitoring is recommended:	The ECO on site during construction must ensure that the sensitivity map is adhered to during construction.	

Table 7-42: Construction: Roost destruction during earthworks

Issue	Roost destruction during earthworks.	
Description of Impact		
Bat roosts in rock crevices may be destroyed during construction, this can cause bat mortalities or permanent disturbances to roosts.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Conceivable	Unlikely / improbable
Significance	Low -	Insignificant
Degree to which impact can be reversed	If the impact occurs, it cannot be reversed. Unlikely to occur.	
Degree to which impact may cause irreplaceable loss of resources	If the impact occurs it will cause irreplaceable loss of resources. Unlikely to occur.	
Degree to which impact can be mitigated	Can be mitigated by adhering to the sensitivity map criteria.	
Mitigation actions		

The following measures are recommended:	Avoid No-go areas by adhering to the sensitivity map (this has been applied in the current layout to date)
Monitoring	
The following monitoring is recommended:	The ECO on site during construction must ensure that the sensitivity map is adhered to during construction.

7.5.3.2 Operational Phase

Table 7-43: Operation: Bat mortalities during foraging

Issue	Bat mortalities during foraging.	
Description of Impact		
Foraging bats can be killed by colliding with turbine blades, or by suffering barotrauma.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Very High	Medium
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Probable	Possible / frequent
Significance	High -	Low -
Degree to which impact can be reversed	Bat mortalities cannot be reversed, however impacted populations may recover over long time periods.	
Degree to which impact may cause irreplaceable loss of resources	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population.	
Degree to which impact can be mitigated	Can be mitigated by correct turbine placement and active mitigations, when required.	
Mitigation actions		
The following measures are recommended:	Avoid No-go areas by adhering to the sensitivity map (already implemented in this layout). Where needed, if indicated through operational monitoring, reducing blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialled and may be recommended during operational monitoring. Refer to the Bat Mitigation Plan as included in the specialist report and also the EMPr.	
Monitoring		
The following monitoring is recommended:	A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility.	

Table 7-44: Operation: Bat mortalities during migration

Issue	Bat mortalities during migration.	
Description of Impact		
Migrating bats influence several ecosystems since they are cave dwelling species, also over a larger area due to the distances that may be travelled. If turbines are placed within a migration path, a larger area and higher diversity of ecosystems may be impacted.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Very High	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	Bat mortalities cannot be reversed, however impacted populations may recover over long time periods.	
Degree to which impact may cause irreplaceable loss of resources	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population.	
Degree to which impact can be mitigated	Can be mitigated by correct turbine placement and active mitigations, when required. Each WEF in a migration path should apply their appropriate mitigation measures.	
Mitigation actions		
The following measures are recommended:	Avoid No-go areas by adhering to the sensitivity map (already implemented in this layout). Where needed, if indicated through operational monitoring, reducing blade movement at selected turbines and high-risk bat activity times/weather conditions. Acoustic deterrents are developed well enough to be trialled and may be recommended during operational monitoring. Each WEF in a migration path should apply appropriate mitigation measures to ensure that each facility's bat mortalities are below a sustainable threshold. Refer to the Bat Mitigation Plan as included in the specialist report and also the EMPr.	
Monitoring		
The following monitoring is recommended:	A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility.	

Table 7-45: Operation: Increased bat mortalities due to light attraction and habitat creation

Issue	Increased bat mortalities due to light attraction and habitat creation.	
Description of Impact		
Floodlights and other lights at turbine bases or nearby buildings, will attract insect eating bats and therefore significantly increase the likelihood of these bats being impacted on by moving turbine blades. Habitat creation in the roofs of nearby buildings can cause a similar increased risk factor.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	Without Mitigation	With Mitigation
Intensity	Very High	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Medium
Probability	Definite / Continuous	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Bat mortalities cannot be reversed, however impacted populations may recover over long time periods.	
Degree to which impact may cause irreplaceable loss of resources	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population.	
Degree to which impact can be mitigated	Can be very efficiently mitigated with low input costs.	
Mitigation actions		
The following measures are recommended:	Avoid No-go areas by adhering to the sensitivity map when siting buildings (this has been applied in the current layout to date). Only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools. This will be at turbine bases (if applicable) and other infrastructure buildings. For buildings, ensure the design does not allow for any entrance holes into the roof cavity. Refer to the Bat Mitigation Plan as included in the specialist report and also the EMPr.	
Monitoring		
The following monitoring is recommended:	During the operational bat mortality monitoring, the bat specialist should visit and make observations on the operational wind farm to determine that no outside lights are installed and positioned in a way where it can increase the probability of bat mortalities from turbines.	

7.5.4 Cumulative Impact

The following cumulative impacts have been identified and rated by Animalia (2022).

7.5.4.1 Construction Phase

Table 7-46: Cumulative impact: Loss of foraging habitat by clearing of vegetation

Issue	Loss of foraging habitat by clearing of vegetation.	
Nature of cumulative impacts	Several wind energy facilities will cumulatively amount to more foraging habitat loss, however these impacts are fragmented and covers a relatively small footprint area.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

Table 7-47: Cumulative impact: Roost destruction during earthworks

Issue	Roost destruction during earthworks.	
Nature of cumulative impacts	Several roosts being destroyed can impact bat populations of affected species over a larger area, however the impact is unlikely to occur.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	Low -	Very Low -

7.5.4.2 Operational Phase

Table 7-48: Cumulative impact: Bat mortalities during foraging

Issue	Bat mortalities during foraging.	
Nature of cumulative impacts	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population. If this occurs over a larger area of several Wind Farms, it decreases the chances of bat populations recovering to a prior state. Bats play an important role in controlling insect numbers, certain species of insects may increase in numbers over a larger area if bats are negatively impacted.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

Table 7-49: Cumulative impact: Bat mortalities during migration

Issue	Bat mortalities during migration.	
Nature of cumulative impacts	Bat mortalities over long periods of time can negatively impact species genetic diversity in a population. If this occurs over a larger area of several Wind Farms, it decreases the chances of bat populations recovering to a prior state. Bats play an important role in controlling insect numbers, certain species of insects may increase in numbers over a larger area if bats are negatively impacted. For migrating bats the area of influence are dependent on the migration routes, and may therefore involve Wind Farms not in the immediate larger area.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

Table 7-50: Cumulative impact: Increased bat mortalities due to light attraction and habitat creation

Issue	Increased bat mortalities due to light attraction and habitat creation.	
Nature of cumulative impacts	Floodlights and other lights at turbine bases or nearby buildings, will attract insect eating bats and therefore significantly increase the likelihood of these bats being impacted on by moving turbine blades. Habitat creation in the roofs of nearby buildings can cause a similar increased risk factor. Considering several Wind Farms, the overall mortality rate will be significantly higher with an increased likelihood of impact.	
Rating of cumulative impacts	Without Mitigation	With Mitigation
	High -	Medium -

7.5.5 No-Go Alternative

Due to the comprehensive iterative design process which has been undertaken for the Hoogland Wind Farms and Grid Connection, no other alternatives are being considered. The preferred layout is therefore only being assessed against the 'no-go' alternative. The 'no-go' alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail.

Therefore, the specialist rates the No-Alternative as neutral and have no objection with further investigating the option of constructing the project

7.5.6 Conclusion and Recommendations

The bat study considered information from several site visits were carried out from March 2021 – June 2022, including a helicopter flight, to groundtruth bat sensitivity features and habitats delineated in the bat sensitivity map. Information from literature as well as available bat activity data from site and in the surrounding area, confirms six bat species to occur in the area and another three species likely to occur. Out of this total of nine species, six of these have a medium – high or high likelihood to be impacted by wind energy due to their foraging and behavioural patterns.

Considering hydrology, the available open surface water is medium and foraging activity trends and ranges were therefore strongly dependent on and fluctuated according to seasonal climatic conditions.

A bat sensitivity map has been compiled to include probable roosting and foraging habitats and has already been considered by the developer with regards to initial turbine layout adjustments. Therefore, mitigation through avoidance has been applied as far as possible with current knowledge of the site.

The preconstruction bat monitoring is completed and gathered four seasons of passive bat activity, which provided comparative bat activity and species assemblages across all seasons as well as various habitats, terrain and/or areas of the site. If the proposed wind farm is approved, a minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. And if indicated by the operational monitoring data, the recommended mitigation measures must be followed for the operational phase.

According to available information consulted during this study and up to date, there are no fatal flaws from a bat sensitivity perspective which should prevent the Wind Farms from being approved. Additionally, no known bat caves or large roosts occur in the vicinity of the site. No reasons have been identified for the Hoogland 3 and 4Wind Farms not to proceed to receive Environmental Authorisation.

7.6 Avifauna

This section provides a short summary of the avifauna specialist report, compiled by Jon Smallie of Wildskies Ecological Service (Pty) Ltd which is available as *Appendix C9: Avifauna*. The information presented here draws from part of the consists of 12-month pre-construction avifaunal monitoring undertaken by the specialist to date.

7.6.1 Baseline Description

It must be noted that pre-construction bird monitoring and all specialist field assessments have been designed to assess the full Hoogland Southern site (i.e., Hoogland 3 Wind Farm and Hoogland 4 Wind Farm). This is an advantage when it comes to the assessment of each site on its own, as data has been collected for a larger area. Since birds are mobile this presents a far stronger assessment than would otherwise be the case. Furthermore, the Hoogland Northern Wind Farm Cluster has been assessed at the same time and presents an additional data set for the avifaunal community in the broader area.

Data for the consolidated Hoogland Southern Cluster Wind Farm Projects site is presented throughout the summary but focuses on individual Wind Farm site specific findings, where relevant.

The baseline description of the study area, prior to pre-construction bird monitoring data (discussed separately below), took into account the following available data:

- Vegetation and Habitat
- Southern African Bird Atlas Project data
- Important Bird & Biodiversity Area (IBA) data
- Co-ordinated Waterbird Count (CWAC) data

7.6.1.1 Data Collection

Pre-construction bird monitoring was initiated in March 2021, and all six seasons site visits have been completed (March, May, July, September/October, November/December 2021 and February 2022). See Figure 7-52 for the location of the monitoring activities. Each site visit consists of approximately 15 consecutive days on site by four teams of two skilled observers (total of 8 observers), to record data on bird species and abundance on and near site. The site visits covered summer (when summer migrants are present); winter (when raptors breed and Blue Cranes flock); spring (when summer migrants are arriving on site and many species start to breed); and autumn (when summer migrants are leaving, and many raptors are preparing to breed). This sampling is sufficient to capture data representative of conditions on site. Pre-construction bird monitoring complied with both the general and Verreaux's Eagle best practice guidelines.

Baseline data was collected using the following methods:

- Sample counts of small terrestrial species
- Count of large terrestrial species and raptors
- Focal site survey and monitoring
- Incidental observations
- Direct observation of bird flight on site
- Control site[23]

[23] A control site is monitored to the south-west of the Hoogland Wind Farms site. Monitoring at this site consists of three Vantage Points; six Walked Transects; one Drive Transect; and two Focal Sites. Results from this control site are not reported in this study but serve rather as a baseline information set against which impacts can be measured if the wind farm is built.

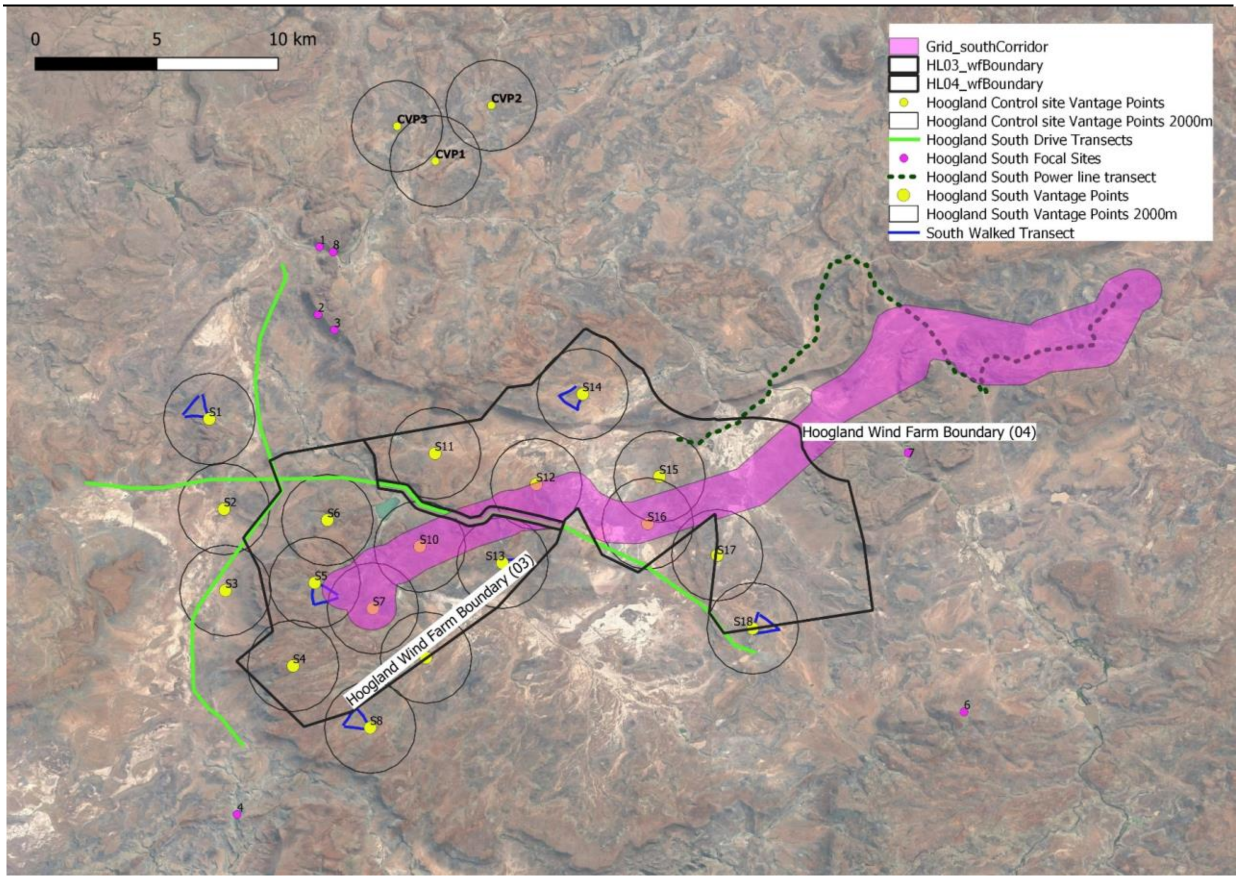


Figure 7-52: The layout of the pre-construction bird monitoring activities on the site

7.6.1.2 Priority Bird Species

For this study, it was necessary to focus on which species are most important or vulnerable as it is not possible to effectively assess the risk to all species observed on site in detail. These have been termed 'Priority species'.

Table 7-51 below lists the final priority bird species as identified by the specialist, together with seasonal presence and a qualitative assessment of risk to each species.

Table 7-51: Priority species for the site

Common name	Regional, Global, Endemic	SAB AP1	SAB AP2	Retief *et al.* 2014	N S1	N S2	N S3	N S4	N S5	N S6	Overall Risk	Likely impacts
Black Harrier	EN, EN, NE	1		6	1	1	1	1			Low	Collision with turbines
Ludwig's Bustard	EN, EN	1	1	13	1	1	1	1	1	1	High	Collision with turbines
Martial Eagle	EN, VU	1	1	4	1	1	1	1		1	Medium	Collision with turbines
African Rock Pipit	NT, LC, SLS	1	1	77	1	1	1	1	1	1	Medium	Collision with turbines, Disturbance, displacement

Common name	Regional, Global, Endemic	SAB AP1	SAB AP2	Retief *et al.* 2014	N S1	N S2	N S3	N S4	N S5	N S6	Overall Risk	Likely impacts
Flamingo, Greater	NT, LC	1	1	27		1			1		Low	Collision with turbines
Karoo Korhaan	NT, LC	1	1	51	1	1	1	1	1	1	High	Collision with turbines, disturbance, displacement
Flamingo, Lesser*	NT, NT		1	28							Low	Collision with turbines
Bustard, Kori	NT, NT	1		39	1	1		1			Low	Collision with turbines
Crane, Blue	NT, VU	1	1	11	1	1		1	1	1	Low	Collision with turbines, disturbance, displacement
Duck, Maccoa	NT, VU		1						1	1	Low	Collision with turbines
Verreaux's Eagle	VU, LC	1	1	3	1	1	1	1	1	1	Medium	Collision with turbines
Stork, Black	VU, LC	1		8				1			Low	Collision with turbines
Falcon, Lanner	VU, LC	1		23	1	1	1	1		1	Low	Collision with turbines
Secretarybird	VU, VU		1	12	1	1	1	1			Low	Collision with turbines, disturbance, displacement
Jackal Buzzard	NE	1	1	44	1	1	1	1	1	1	High	Collision with turbines

*Lesser Flamingo was not encountered on site during the year's monitoring, although they are likely to occur, given the positive SABAP 2 reporting result; thus it remains included in this table.

EN=Endangered; VU=Vulnerable; NT=Near-threatened; LC=Least Concern; E=Endemic; NE=Near-endemic; SLS=endemic to SA, Lesotho, Swaziland.

7.6.1.3 Pre-Construction Bird Monitoring Data

The pre-construction bird monitoring data is summarised below. Detailed information relating to the data and each data collection method is included in the specialist report.

Table 7-52: Pre-construction bird monitoring provisional results.

Small terrestrial bird species	A total of 67 small bird species were recorded on the 18 Walked Transects conducted on the site. This includes 4 259 individual birds from 1 529 records. The first site visit (S1) recorded 45 species, S2 recorded 30, S3 recorded 34, S4 recorded 34, S5 recorded 38 and S6 recorded 43 species. Eleven of the 67 species are endemic or near-endemic to South Africa. The most abundant species on the site were not surprisingly all species already known to be common in the area, such as: Lark-like Bunting *Emberiza impetuani*, Cape Sparrow *Passer melanurus*, and Black-eared Sparrow-lark *Eremopterix australis*. Large-billed Lark *Galerida magnirostris,* Rufous-eared Warbler *Malcorus pectoralis,* and Common Waxbill *Estrilda astrild* were also frequently recorded.

	The endemic and near-endemic species recorded were: Black-eared Sparrowlark; Large-billed Lark *Galerida magnirostris,* Pied Starling *Lamprotornis bicolor,* Sickle-winged Chat *Emarginata sinuata,* Cape Clapper Lark *Mirafra apiata*, Black-headed Canary *Serinus alario*, Karoo Eremomela *Eremomela gregalis*; Karoo Prinia *Prinia maculosa*; Karoo Lark *Calendulauda albescens* and Grey Tit *Parus afer*. Overall, the small passerine bird community is as expected for this area, with no particularly sensitive species present. African Rock Pipit does occur on site (we recorded it incidentally), although it has not been recorded by walked transects.
Large terrestrial species & raptors	A total of 10 large terrestrial and raptor species were recorded across the 5 drive transects totalling 55.7 kilometres per season on the site. This included 106 individual birds from 67 records. These data are shown in Table 6-3. In each case the species' regional and global Red List status and endemism is shown. Five of the 10 species are regionally Red Listed: Ludwig's Bustard and Black Harrier (Endangered); Verreaux's Eagle (Vulnerable); and Karoo Korhaan and Blue Crane (Near-threatened). Three species are near-endemic to the region: Jackal Buzzard; Blue Crane; and Black Harrier. The most abundant species recorded by this method to date is the Karoo Korhaan, followed by Blue Crane and Pale Chanting Goshawk. The general abundance of large terrestrials such as cranes, bustards and korhaans is low on site, perhaps reflecting the dry conditions in the environment at the tail-end of a prolonged drought (although the final seasonal survey was after significant rainfall).
Focal Site surveys	The results of the Focal Site surveys relate to the breeding status at the large eagle nests within the broader area. These territories are all occupied and in various breeding states.
Incidental Observations of target bird species	A total of 28 target bird species were recorded on the site as Incidental Observations. The first site visit (S1) recorded 18 species, S2 recorded 14, S3 recorded 10, S4 recorded 18 and S5 & S6 each recorded 13 species. The most abundant species recorded by this method by far was Karoo Korhaan, due mostly to being recorded frequently in pairs or groups. Blue Crane was the next most frequently encountered species, also with larger group sizes, as were Grey-winged Francolin coveys (mostly detected by their calls). Jackal Buzzard was also recorded frequently, but predominantly as single birds. Since these data are not the product of systematic data collection methods, they should be used cautiously and we do not discuss this any further here. As far as possible, field teams attempted to avoid recording resident species in the same location, however some replication is probable. We have recorded a total of 217 bird species on site to date (considering all data collection methods), 106 in S1, 111 in S2, and 94 in S3, 112 in S4, 110 in S5 and 127 in S6. Included in the 217 species are: 3 regionally Endangered species; 5 Vulnerable species; 7 Near-threatened species; and 25 endemic or near-endemic species
Bird flight activity on site	A total of 324 sessions (4hrs duration each) of bird flight observation were completed over the year of monitoring, totalling 1 296 hours of observation at Vantage Points across the site in the six site visits. In total, 20 target bird species were recorded flying on the site during this observation period. These data are shown in Table 6-6. Nine of these 20 species are regionally Red Listed (Taylor et al, 2015): Black Harrier, Ludwig's Bustard & Martial Eagle (Endangered); Secretarybird, Verreaux's Eagle and Lanner

	Falcon (Vulnerable); and Karoo Korhaan, Kori Bustard and Blue Crane (Near-threatened). Jackal Buzzard, Blue Crane, Karoo Korhaan and Black Harrier are near-endemic. The most frequently recorded flying species was Jackal Buzzard with 244 individual birds recorded across 217 records. Karoo Korhaan was the second most frequent flier, with 159 birds recorded across 88 records. Pale Chanting Goshawk was the third most frequent flier, recorded 96 times, for 114 individual birds. Black Harrier was recorded flying only 12 times (single birds). Overall, across all species, flight activity decreased throughout the year during monitoring. There is thus no seasonal correlation, but this does not take the trends for individual species into consideration, some of which showed different patterns in abundance.

7.6.1.4 Estimating turbine collision fatality rates

Crude turbine collision fatality rates were calculated for each species to estimate how many birds each of the proposed two Wind Farms could kill once operational. This was based on the species' passage rates (number of birds recorded flying per hour) recorded on site. Generally speaking, it is expected that those species which fly more often are more susceptible to turbine collision. The method of calculation and associated assumptions are described in the specialist report in detail.

Wildskies (2022) believes that the estimated fatality rates calculated represent a worst case scenario, for the following reasons: flights of all heights above ground were included, whereas in reality some flights would be below or above rotor zone; no consideration is given to actual turbine locations relative to actual flight path positions (and extensive avoidance of collision risk has been applied in turbine siting already); and a relatively conservative avoidance rate of 98% was used.

The specialist notes a low confidence in the estimates (refer to specialist reports for assumptions and motivations in this regard), but the exercise is worthwhile, nonetheless. It is estimated that approximately 9.23 and 8.75 bird fatalities could be recorded at each wind farm respectively (Hoogland 3 & Hoogland 4) per year across the 20 target bird species recorded flying on site to date. This includes the following priority species (HL03/HL04): 2.27/2.16 Jackal Buzzard; 1.48/1.40 Karoo Korhaan; 1.02/0.96 Blue Crane; 0.65/0.62 Verreaux's Eagle; 0.51/0.49 Ludwig's Bustard; 0.16/0.15 Martial Eagle; 0.11/0.11 Black Harrier; 0.07/0.06 Secretarybird; 0.05/0.04 Lanner Falcon and 0.03/0.03 Kori Bustard.

Human caused fatalities of Red listed or otherwise threatened bird species are always cause for concern and should be avoided as far as possible. There are currently no established thresholds for acceptable impacts on bird species in South Africa. To establish these thresholds would require complex population modelling incorporating accurate information on many factors for each species (including population size, age specific fatality rates, breeding productivity etc). Such modelling and information are not available in South Africa at present. In the absence of this information, we are forced to make a subjective finding as to the acceptability of the above estimated estimates. In terms of the impacts of unnatural sources of mortality (such as wind turbine collisions) on birds, the large, slow breeding, and long-lived bird species are most susceptible. This is because the effect of a mortality is greater than just that one bird. If it is an adult bird, there could be secondary effects of lost breeding opportunity and recruitment of young birds to the population, in addition to the single mortality. This means that of the priority bird species, it is the raptors, cranes and bustards which are probably most likely of any species to experience population level impacts.

The specialist is not aware of any published studies demonstrating population level impacts of Wind Farms on such species in South Africa. Although several international authors have suggested that population level impacts on certain species are likely or predicted such impacts on prioritised species according to their vulnerability (e.g., Loss *et al*, 2013; *Beston et al,* 2016, Watson *et al*, 2018, Carrete *et al*, 2009) we are not aware of actual evidence of such effects.

Wildskies (2022) views the above fatality rates as being of medium to high significance for these species (the raptors, cranes and bustards). It is essential that all mitigation measures recommended in Section 7.6.3 be accepted to ensure that these fatality rates are reduced where possible including an adaptive management approach as explained below.

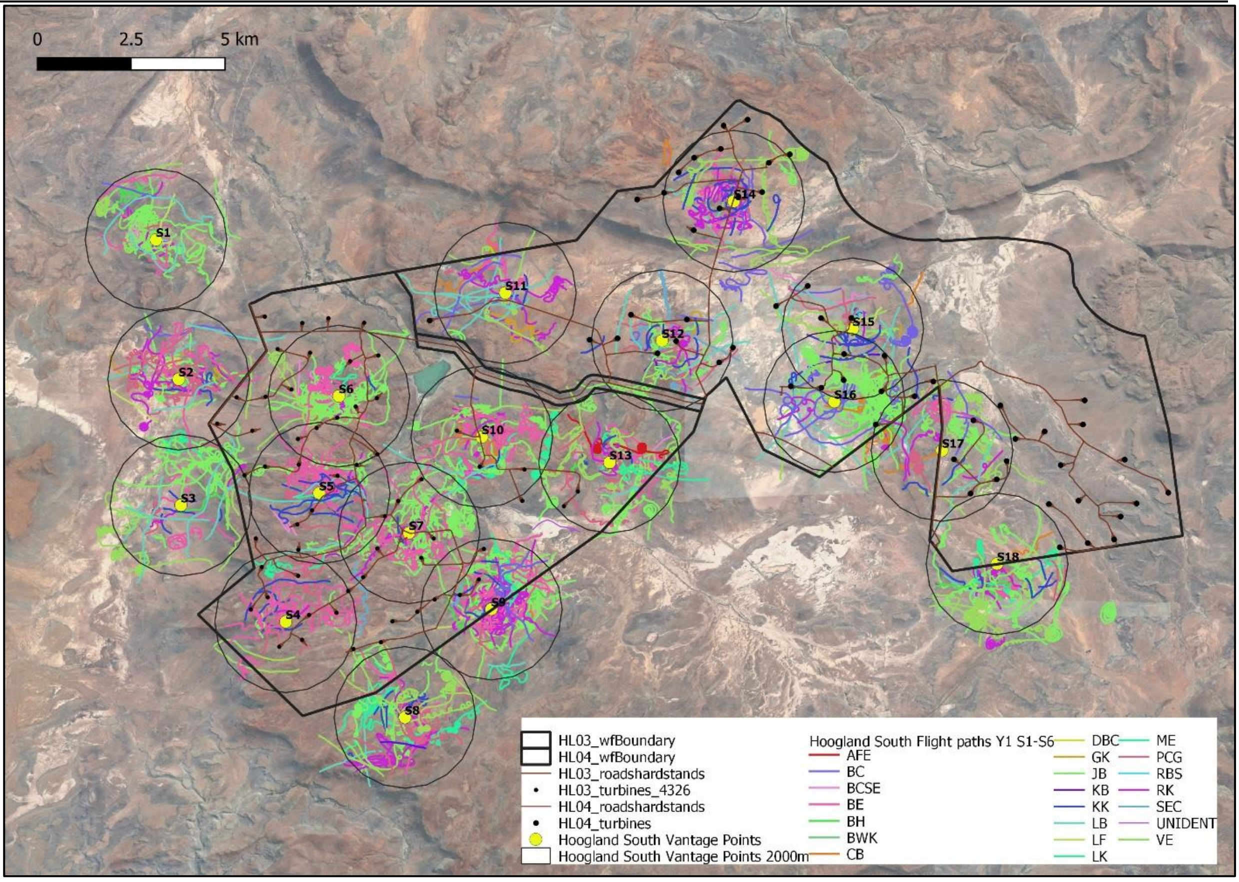
7.6.1.5 Spatial location of flight records

The spatial location of all target bird species flight records for the site, for the three site visits to date, can be seen below in Figure 7-53 and Figure 7-54. When considering all target species, there appears to be an even spread of flight activity across the landscape, with a relatively equal coverage of mapped flight paths recorded for each Vantage Point, but particularly around VP 9. It should be noted that the proposed turbine layout has recently been adjusted and that it now excludes the viewshed areas of VPs 1, 3, 8, and 11 and much of VPs 2, 9, 13 and 18. The flight activity recorded throughout the year is still displayed for these areas, however.

Considering non-Red Listed species first, most of these species were seldom encountered flying on site, namely: Black-chested Snake-eagle, Black-winged Kite, Common Buzzard, Double-banded Courser, Lesser and Greater Kestrels, Rufous-breasted Sparrowhawk and African Fish Eagle. Due to the sparse nature of their flights, no true patterns in their movements could be deduced. Interestingly, there was no mass influx of Lesser Kestrel to the Southern Cluster during the summer monitoring period such as there was for the Hoogland Northern wind farms area, and few records of the species were made on site.

Booted Eagle, Pale Chanting Goshawk and Rock Kestrel were relatively frequently recorded target species. Rock Kestrel were especially frequent fliers at VPs 2, 9 and 14. Booted Eagle and Pale Chanting Goshawk were amongst the common fliers, with activity higher at HL03 than at HL04 (only four flights of the former were observed on HL04).

Jackal Buzzard were very frequent fliers across most of the Southern Cluster. Particularly high-use areas were ridges surrounding VPs 1, 6, 7, 9, 10 and just east of VP 16. While this species is still considered to be common, turbine collisions at operational wind farms are killing many individuals in the country, and this does appear to be a cause for concern (Ralston-Paton et al. 2017). “Buteo” as a genus has high fatality rates globally, and although Jackal Buzzards are widely distributed across the country, territories of this near endemic species are likely to overlap more and more with that of wind farm development in the future. The role that common raptors play in the ecosystem is an important one, and the implications of losing resident predators such as the Jackal Buzzard can be difficult to predict.



AHH=African Harrier-Hawk; BH=Black Harrier; DBC=Double-banded Courser; GK=Greater Kestrel; GWF=Grey-winged Francolin; H=Hamerkop; JB=Jackal Buzzard; KK=Karoo Korhaan; LB=Ludwig's Bustard; LK=Lesser Kestrel; ME=Martial Eagle; PCG=Pale Chanting Goshawk; RK=Rock Kestrel; SB=Secretarybird; VE=Verreaux's Eagle.

Figure 7-53. Recorded target bird species flight paths at the site (all species, 6 site visits)

Considering the Red Listed species (presented in Figure 7-54), the following species were infrequently noted on site and no real comment can be made regarding spatial trends in flight patterns: Black Harrier, Kori Bustard and Lanner Falcon. Secretarybird were also seldom recorded, however birds were recorded flying at VP 12 (in relative proximity to a known nest) and twice between VPs 4, 7 and 9.

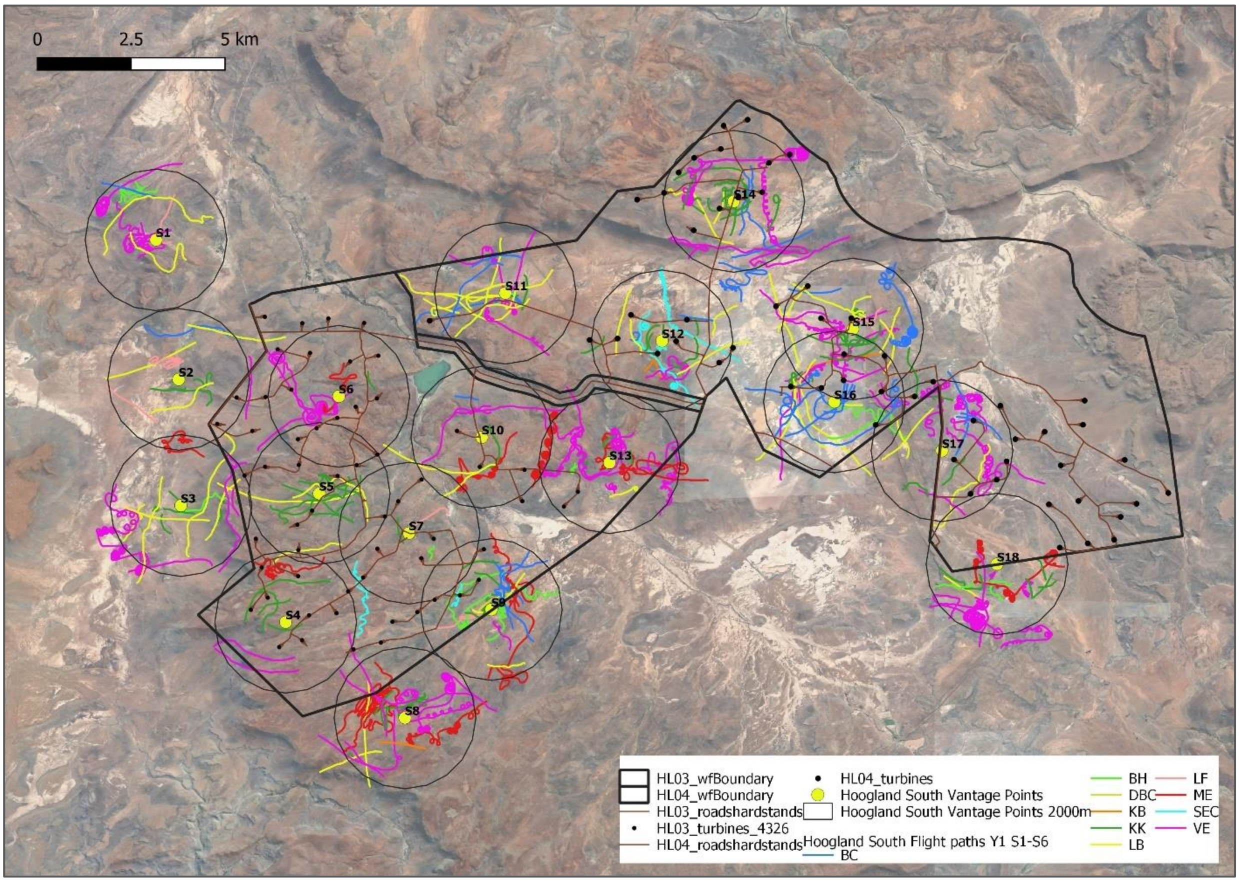
Blue Crane were not particularly frequently recorded flying on site, however HL04 recorded more flights for this species, perhaps due to the flatter, more open nature of much of the habitat in conjunction with the proximity to nearby water bodies. (The area surrounding VPs 14, 15 and 16 predominantly).

Karoo Korhaan were also relatively commonly recorded fliers, although these birds tend to fly short distances at a height below the typical rotor-swept zone, thus their flight behaviour suggests that they may not be as high-risk fliers as certain other species. However, as judged from the Incidental Observations, they are very common birds on site and we cannot say for sure how their flight patterns may change once there are turbines in the environment.

The Ludwig's Bustard flights that were recorded throughout the year do not appear to be close to the new turbine layout, as the areas where much flight activity was recorded around VPs 1, 2, 3, 8 and 11 are now not within the proposed development area. There was greater flight activity for this species across the turbine footprint for HL04 compared to HL03.

Martial Eagle activity was almost exclusively recorded across HL03, with some activity in the extreme south of HL04. Observers recorded their flights in the areas surrounding VPs 8, 9, 10 and 13 in particular. This species would often gain height by soaring in thermals and then glide vast distances until out of sight. Much of their flight (and foraging) behaviour makes use of the rotor-swept zone and places them at high risk of collision with turbines.

Verreaux's Eagle flights largely avoided the newly redesigned HL03 layout (except around VP 6), but this was not the case for the new HL04 layout. Flights for this species were frequently recorded by observers. As for the Martial Eagle, their flights included much time at rotor height while foraging, courting and commuting.

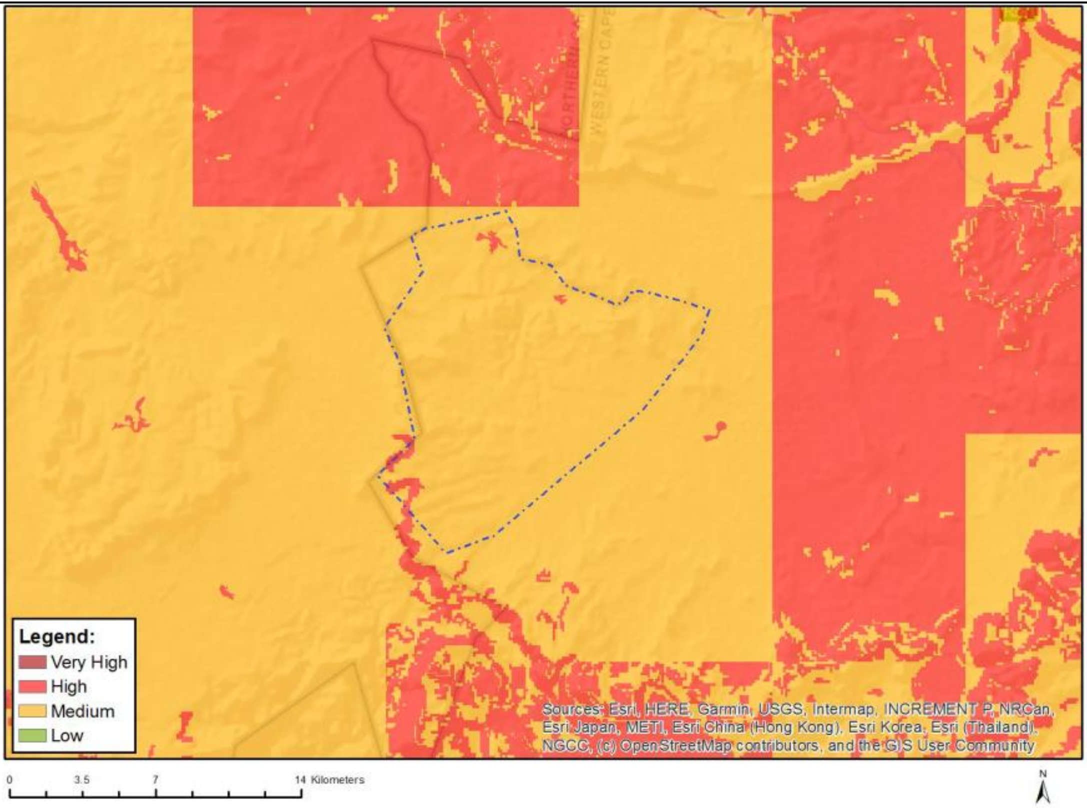


AFE=African Fish Eagle; BC=Blue Crane; BCSE=Black-chested Snake-Eagle; BE=Booted Eagle; BH=Black Harrier; BWK=Black-winged Kite; CB=Common Buzzard; DBC=Double-banded Courser; GK=Greater Kestrel; JB=Jackal Buzzard; KB=Kori Bustard; KK=Karoo Korhaan; LB=Ludwig's Bustard; LF=Lanner Falcon; LK=Lesser Kestrel; ME=Martial Eagle; PCG=Pale Chanting Goshawk; RBS=Rufous-breasted Sparrowhawk; RK=Rock Kestrel; SB=Secretarybird; VE=Verreaux's Eagle.

Figure 7-54. Recorded Red Listed species flight paths at the site (6 site visits)

7.6.2 Site Sensitivity

Reporting was further informed by the high sensitivity output of the Animal theme in the National Screening Tool. While the Avian theme (see *Appendix E: DFFE Screening Tool Reports* for full reports) was considered Low Sensitivity, the Animal theme classifies the site as 'High sensitivity' and identifies High and Medium sensitivity portions of the site based on Ludwig's Bustard, Southern Black Korhaan, and Verreaux's Eagle presence.



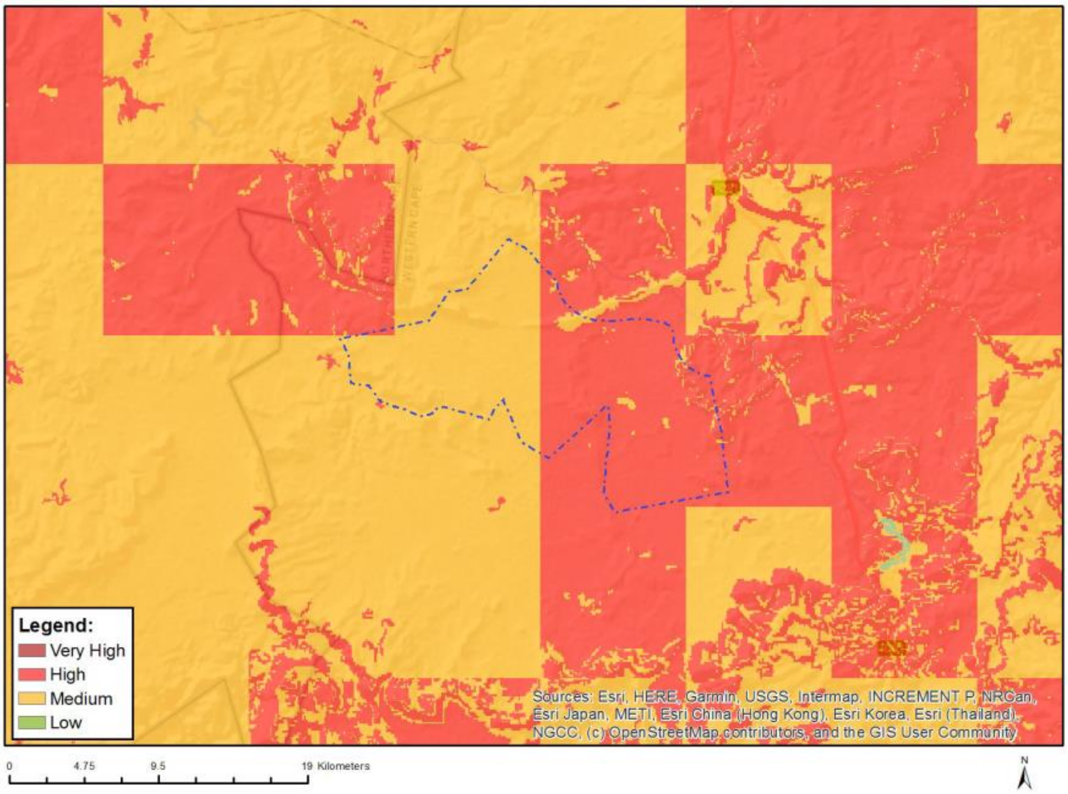


Figure 7-55: Map of relative Animal theme sensitivity for Hoogland 3 Wind Farm (top) and Hoogland 4 Wind Farm (bottom). High sensitivity shown in red

7.6.2.1 Landscape level sensitivity

The "Avian Wind Farm Sensitivity map for South Africa" (Retief *et al,* 2011) and the Important Bird & Biodiversity Areas programme data (IBBA - Marnewick *et al*, 2015) were consulted to determine the sensitivity of the site in national terms. Figure 7-56 shows that the site falls mostly in the lowest two sensitivity categories in terms of avifauna (darker colours indicate higher risk), although some areas are in medium and medium-high categories. For a full discussion on the methods used in producing this map see Retief *et al* (2011, 2014). The site does not fall within any IBAs (Marnewick *et al*, 2015). The closest IBA is approximately 13km south (Karoo National Park).

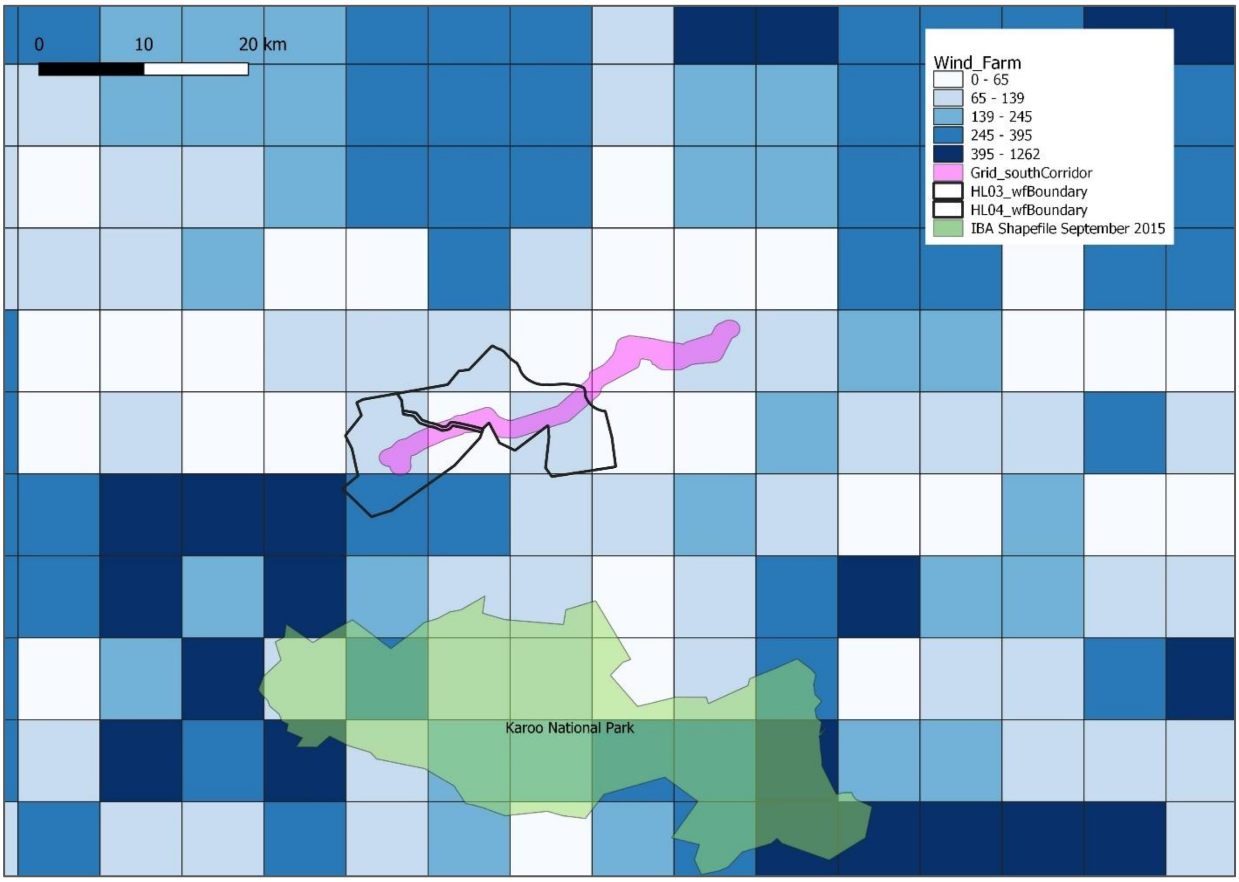


Figure 7-56. The position of the site relative to the Avian Wind Farm sensitivity map (Retief *et al*, 2011) & Important Bird Areas (Marnewick *et al* 2015) (Darker colours indicate higher avifaunal sensitivity)

The proposed site falls within the REDZ and the Transmission Grid corridors identified (Figure 2-3). The REDZ are areas that are being strategically identified for potential wind energy development in future (Section 4.3.5).

7.6.2.2 On site sensitivity

The study area was classified into the following classes: No-Go, High, Medium, Low and Neutral sensitivity areas. The distinction was also made between turbines; roads & cables (underground); buildings; internal overhead lines. This is a particularly appropriate distinction for avifauna as there is a collision risk with vertical turbines and overhead power lines, but not with surface level infrastructure such as roads. In the case of overhead power lines the relevant aspect for avifauna in terms of spatial constraints is the cables themselves[24].

[24] See separate Hoogland North Grid reports for powerline related impacts.

One both Wind Farm sites the large eagle nests are the key spatial issue determining sensitivity on the sites, with several confirmed nests as already described. For turbines, the no-go buffer size around Verreaux's Eagle nests is prescribed by the Verreaux's Eagle Risk Assessment (VERA) output (Appendix 4 of the Specialist report in *Appendix C9: Avifauna* of this report). The Verreaux's Eagle best practice guidelines also prescribe a 1km buffer for the construction of other Wind Farm infrastructure during breeding season. No buffer size is stipulated for power lines though, so a subjective judgement is made in this regard.

For Martial Eagle, no guidelines exist yet and Wildskies (2022) has determined the buffer size using the best possible available literature on the species home range. A 6km radius circular buffer was placed around the Martial Eagle nesting sites – classified as No-Go for turbines.

The site sensitivity maps for the various infrastructure types of the Hoogland Southern Cluster are shown spatially in the figures below and largely avoid the No-go and High sensitivity areas.

Since this information was already available during the pre-feasibility, screening and draft BA phases of the project, the proposed layouts largely avoid the No-go and High sensitivity areas already. More specifically:

- No turbines are placed in No-Go or High areas (Figure 7-57)
- No roads and cables are placed in No-Go or High areas (Figure 7-58)
- No buildings are placed in No-Go or High areas (Figure 7-59)
- No WEF Internal overhead lines are placed in No-Go areas (Figure 7-60).
- On Hoogland 3, one short piece of WEF Internal overhead line (approximately 620m long) traverses a High sensitivity area (due to crossing of a river/drainage line) (Figure 7-60). This exception has been agreed to by the avifaunal specialist. This exception is acceptable because it will be adjacent to the larger grid connection power line which will improve its visibility and therefore reduce the risk.

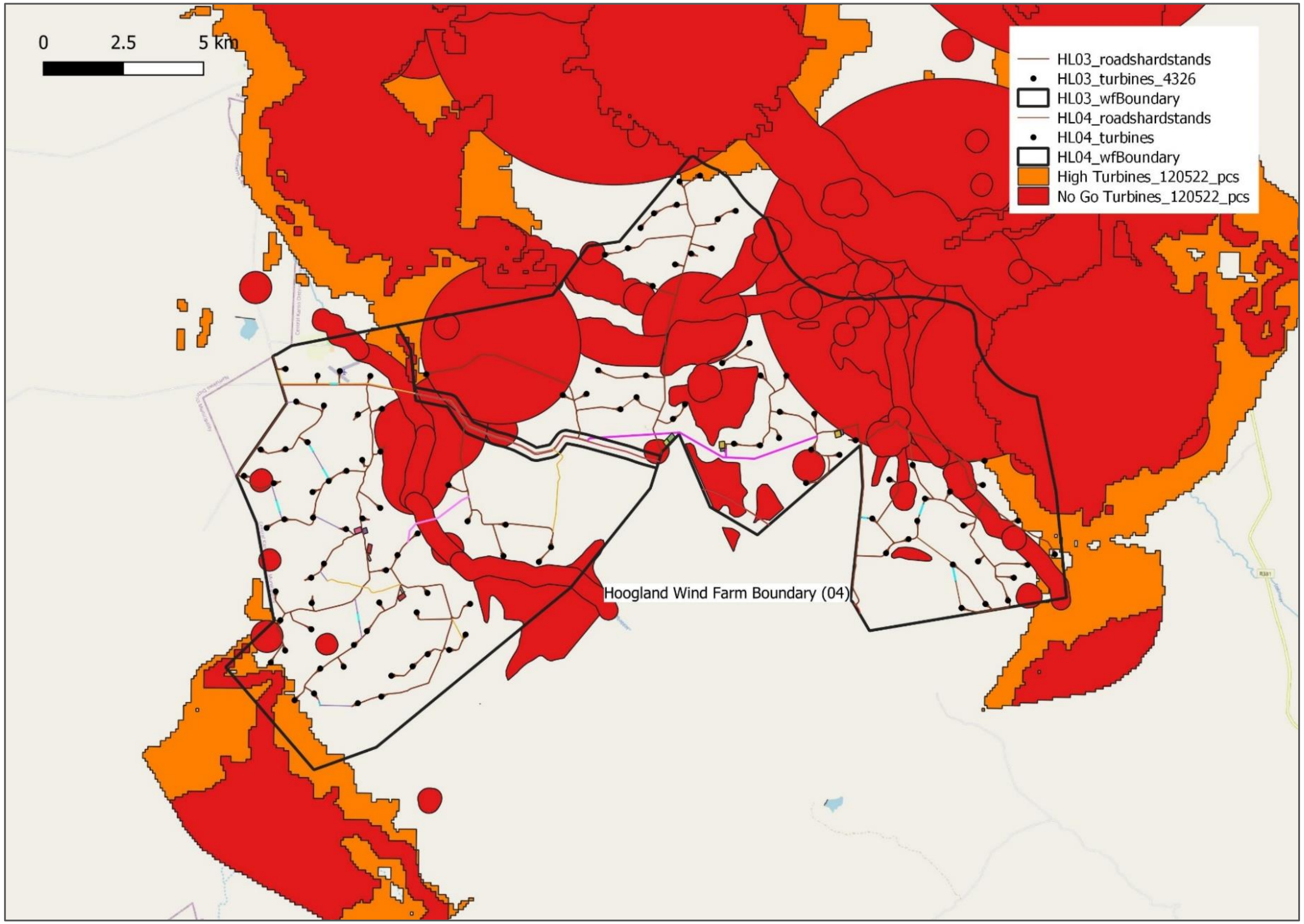


Figure 7-57: Turbine avifauna sensitivity map

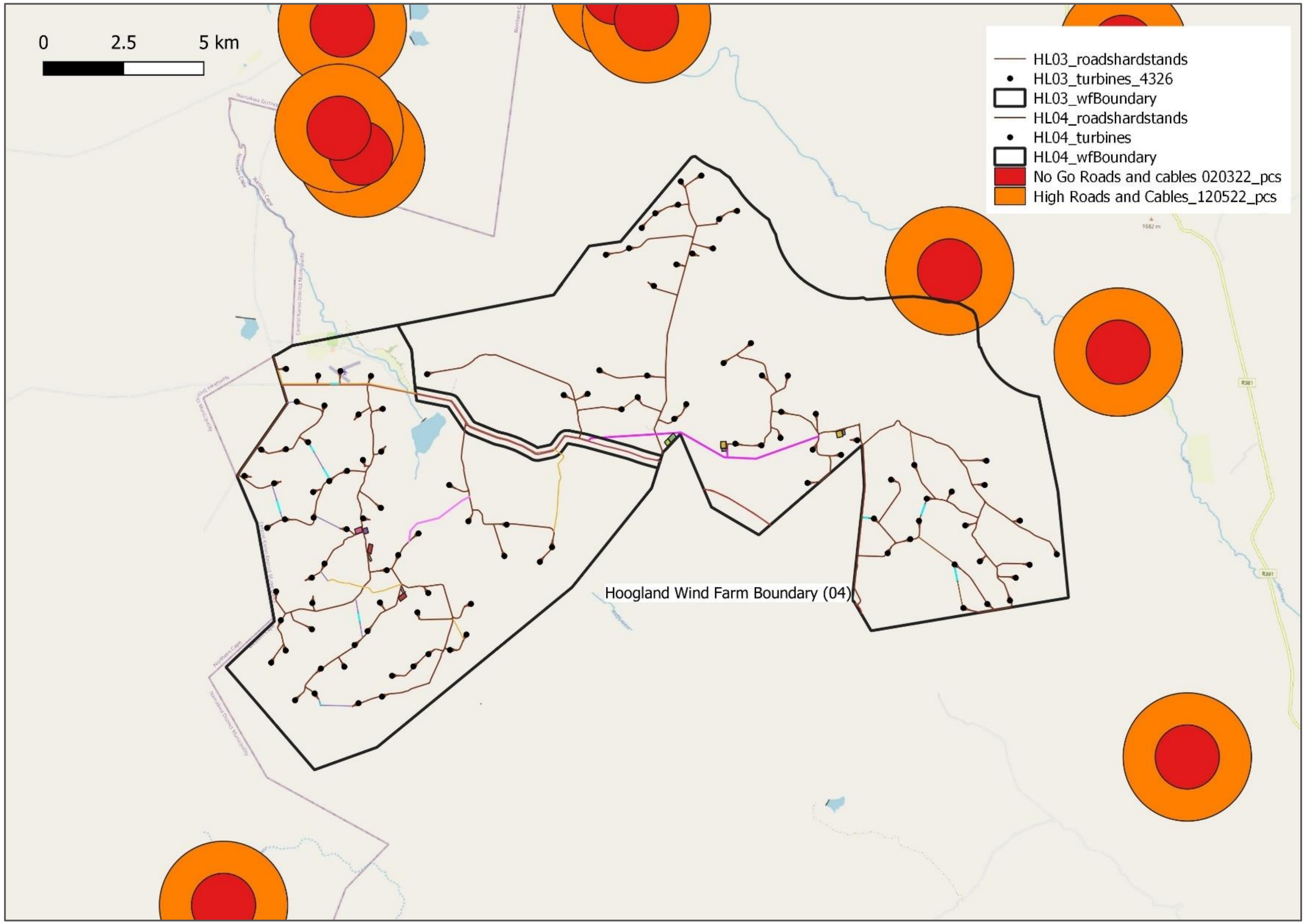


Figure 7-58: Roads and cables (underground) avifauna sensitivity map

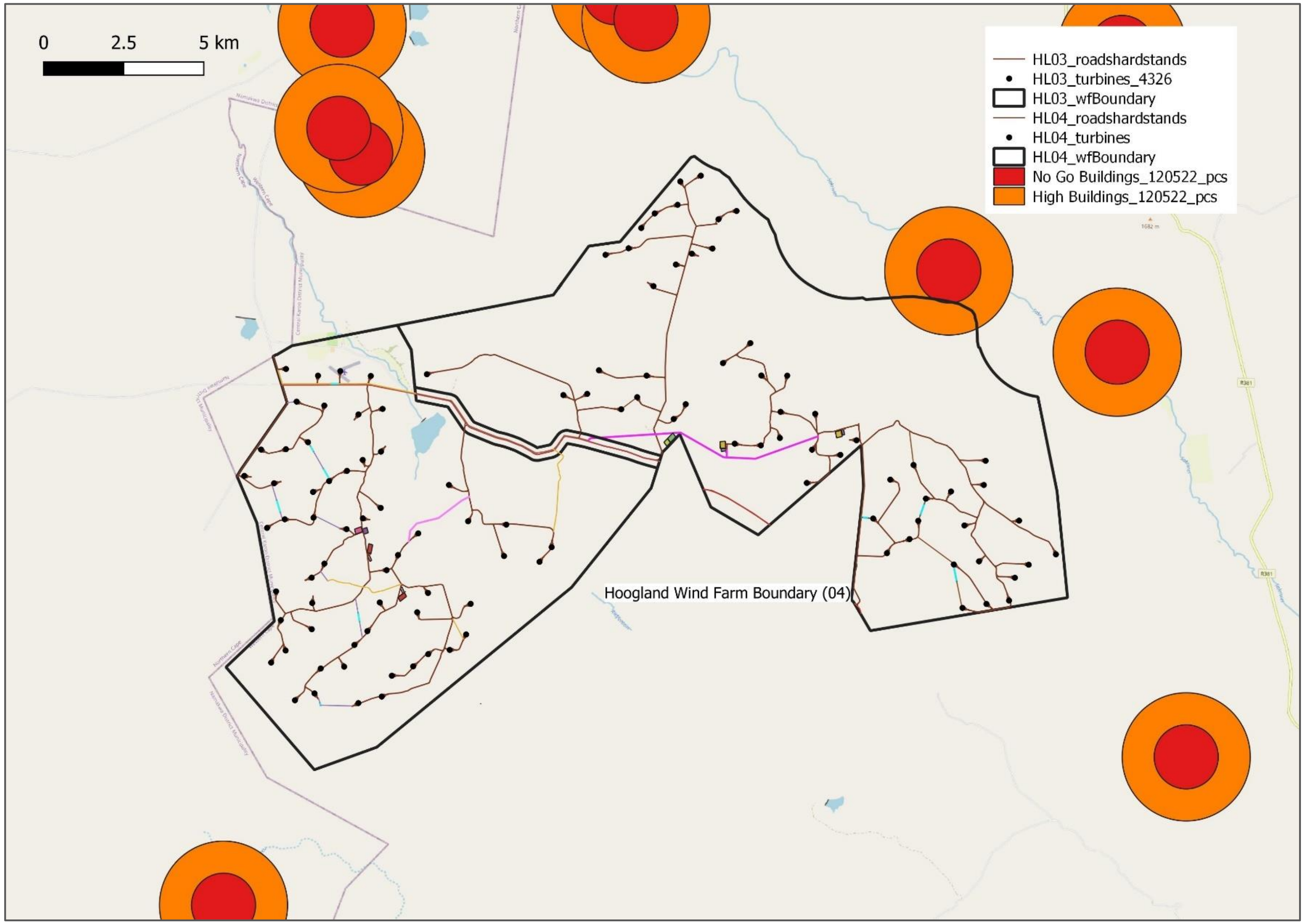


Figure 7-59: Buildings (including substation, battery storage, construction camps) avifauna sensitivity map

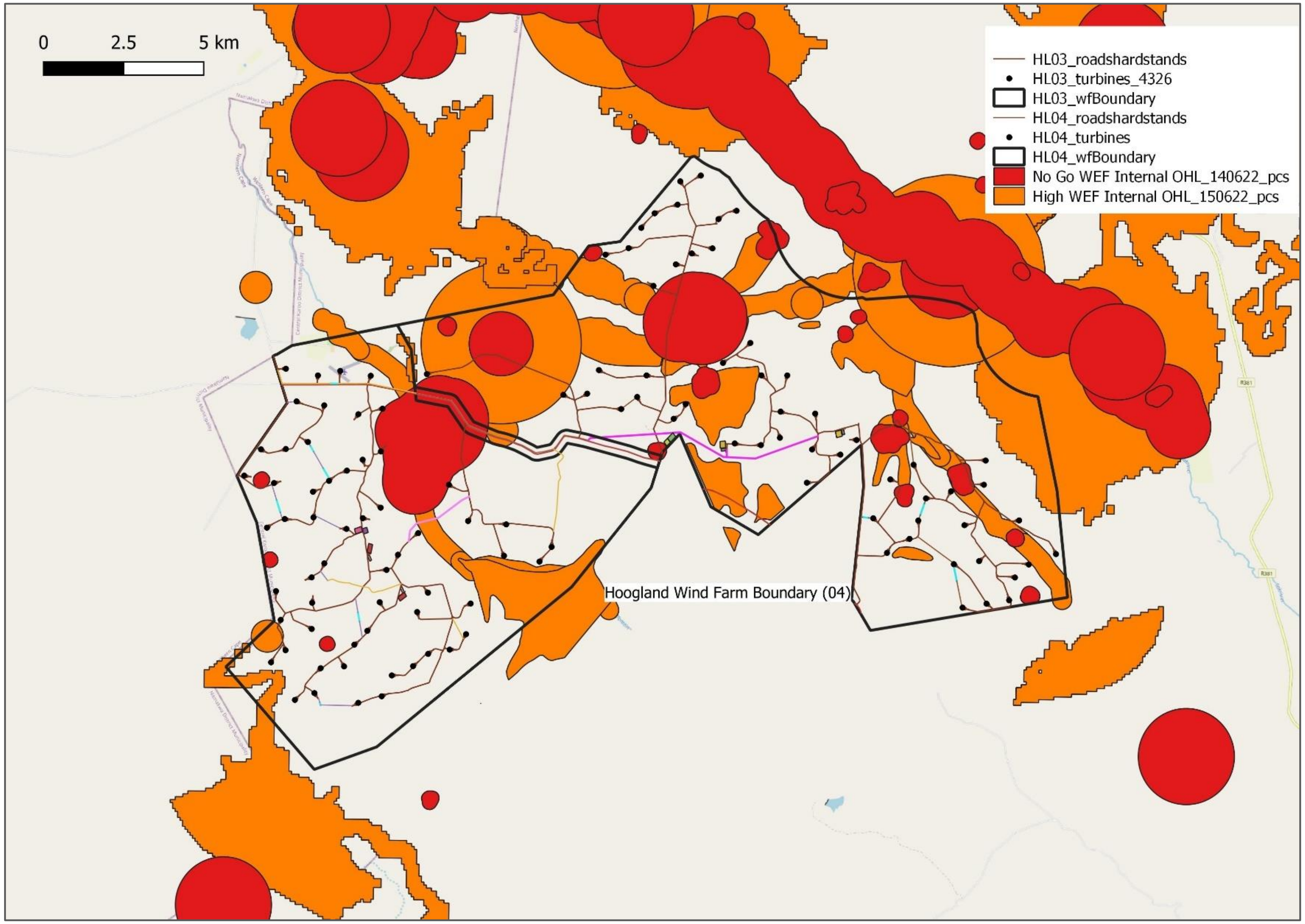


Figure 7-60: Wind Farm Internal Overhead lines avifauna sensitivity map

7.6.3 Impact Assessment and Mitigation

7.6.3.1 Impact assessment

The following avifauna impacts have been identified and rated by Wildskies (2022).

7.6.3.1.1 Construction Phase

Table 7-53: Construction: Bird habitat destruction

Issue	Habitat destruction during construction	
Description of Impact		
Table 2-2 described the amount of natural habitat that will be altered and destroyed on the proposed wind farm. We include temporary areas in our calculation of habitat destruction, since in our experience these are not normally rehabilitated to their former functional state by contractors, and in order to consider the worst-case scenario. At the proposed site, a total of approximately 226.5ha (121ha temporary & 105.5ha permanent) and 236.2ha (123.3ha temporary & 112.9ha permanent) would be affected at Hoogland 3 and Hoogland 4 respectively. The temporary road bypass around Beaufort West is almost all on an existing road, and the new portion is in quite disturbed habitat, so we did not include it in the calculation of area lost as it is already severely degraded. Of course, the effect on the avifaunal community is not as simple as the surface area affected. In addition to surface area alteration, the effect of large, dispersed infrastructure projects such as wind farms on birds is likely to be far more complex through factors such as habitat fragmentation, disruption of territories and other factors. These effects have however proven extremely difficult to measure. In order to apply a cautious approach, we conclude that the overall significance of habitat destruction is Medium (-) significance both pre and post mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
	Without Mitigation	**With Mitigation**
Intensity	Medium	Medium
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	Low - natural habitat will be transformed	
Degree to which impact may cause irreplaceable loss of resources	High - habitat will not easily be restored to original state	
Degree to which impact can be mitigated	Low - certain amount of habitat transformation is inevitable	

Issue	Habitat destruction during construction
Mitigation actions	
The following measures are recommended:	• The No-Go areas identified by this study (which build on those identified in the screening phase) should all be adhered to (the current layout adheres to this). All other facility infrastructure also avoids the No-Go and High sensitivity areas. One exception is a short piece of WEF Internal overhead line (approximately 620m long) is placed in a High sensitivity area (due to a river/drainage line). This exception has been agreed to by the avifaunal specialist. This exception is acceptable because it will be adjacent to the larger grid connection power line. • A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. • All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of *Appendix C9: Avifauna*

Table 7-54: Construction: Disturbance of birds

Issue	Disturbance of birds during construction	
Description of Impact		
Activities associated with construction of a Wind Farm (including: heavy machinery, earth moving, vehicle and staff traffic) can disturb birds in the receiving environment. Effects of disturbance during breeding could include loss of breeding productivity; temporary or permanent abandonment of breeding; or even abandonment of a nest site. Avoidance measures taken for Martial and Verreaux's Eagle and other nests reduce the significance of this impact. Pre-mitigation this impact is Low (-) significance and will remain at Low significance post the application of mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Highly reversible, as soon as construction stops impact will cease	
Degree to which impact may cause irreplaceable loss of resources	Low - any impacts are reversible and no irreplaceable loss	

Issue	Disturbance of birds during construction
Degree to which impact can be mitigated	Low - certain amount of disturbance during construction is inevitable
Mitigation actions	
The following measures are recommended:	• An avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. • Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline). • All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of *Appendix C9: Avifauna*

7.6.3.1.2 Operational Phase

Table 7-55: Operation: Disturbance of birds

Issue	Disturbance of birds during operations	
Description of Impact		
Activities associated with operation of a Wind Farm (including: heavy machinery for maintenance, vehicle and staff traffic) can disturb birds in the receiving environment. Effects of disturbance during breeding could include loss of breeding productivity; temporary or permanent abandonment of breeding; or even abandonment of a nest site. The indications from operational Wind Farms are that this impact is of fairly low importance. For Hoogland 3 and 4 we consider this impact to be of Low (-) significance both pre and post mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long term	Long term
Extent	Local	Local
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Highly reversible, as soon as maintenance or operational activity stops impact will cease	
Degree to which impact may cause irreplaceable loss of resources	Low - any impacts are reversible and no irreplaceable loss	

Issue	Disturbance of birds during operations
Degree to which impact can be mitigated	Low - certain amount of disturbance during operation is inevitable
Mitigation actions	
The following measures are recommended:	None required
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of *Appendix C9: Avifauna*

Table 7-56: Operation: Displacement of birds

Issue	Displacement of birds during operations	
Description of Impact		
Operational activities can cause displacement which occurs when a facility may have a barrier effect or serve as an obstacle for birds which need to fly around or avoid it. As for disturbance above, the indications from operational Wind Farms are that this impact may be of low importance. For Hoogland 3 and 4 we consider this impact to be of Low (-) significance with the avoidance measures already implemented, both pre and post mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	High - if operations cease the effect would cease	
Degree to which impact may cause irreplaceable loss of resources	Low - no birds are killed	
Degree to which impact can be mitigated	Low	
Mitigation actions		
The following measures are recommended:	Monitoring of breeding status of Verreaux's and Martial Eagles should be conducted in all breeding seasons as per the avifaunal operational monitoring programme.	
Monitoring		
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of *Appendix C9: Avifauna*	

Table 7-57: Operation: Collision of birds with turbines

Issue	Collision of birds with turbines once operational	
Description of Impact		
There is a risk of collision with wind turbines when birds fly through an operational Wind Farm at rotor height. We have made our bird fatality estimates as transparent as possible so that our assumptions are clear. Table 8 summarises this information for the priority bird species We conclude that overall, this impact will be of High (-) significance before mitigation. This is mostly a precautionary finding as the estimated fatality rates based on data collected on site are very low. Mitigation measures detailed below can be expected to reduce the significance to Medium (-) significance. Due to the uncertainty around the effectiveness of some of the measures, the significance cannot be reduced further.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	High	Medium
Probability	Probable	Probable
Significance	High -	Medium -
Degree to which impact can be reversed	Low - birds are killed	
Degree to which impact may cause irreplaceable loss of resources	High - birds are killed	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• During construction, all road and hard stand verges and other disturbed areas must be fully compacted to as hard as they were prior to construction, to ensure that these areas do not attract ground burrowing mammals in artificially high abundance and closer to turbines. These species represent prey for raptors and such situations would increase raptor-turbine collision risk. Piles of spoil material close to turbines should be avoided as far as possible as these also attract prey species. It is essential that the new Wind Farm does not create favourable conditions for such mammals in high risk areas. If such conditions are created, this will require reactive management during the operational phase. • The bird-turbine collision risk pre-mitigation has been rated as High significance and must be mitigated to Medium through the implementation of effective mitigation measures from COD onwards. Two potential options exist to our knowledge: blade painting; and shutdown on demand (either observer or technology	

	led). Since it will be several years before the proposed Wind Farm is constructed, there is an opportunity to learn more about these two measures in the interim and make a decision on which option is implemented at that time. Several operational Wind Farms have just begun observer led shutdown on demand programmes in SA, and two Wind Farms are about to trial blade painting. There is therefore a high likelihood of having more experience on the effectiveness of such measures a year or two from now. We recommend that either of these options be implemented across the full facility, and that a decision on which be taken within 6 months of the project achieving preferred bidder status. Any alternative that is identified in the interim that is approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. In the meantime all necessary financial and technical provisions must be made by the developer. • The Adaptive Management Plan developed and presented in Appendix 3 of the specialist report (*Appendix C9: Avifauna*) must be included in the EMPr and implemented by each Wind Farm once operational.
Monitoring	
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of *Appendix C9: Avifauna.*

Table 7-58: Operation: Collision and electrocution of birds on overhead power lines

Issue	Collision and electrocution of birds on overhead power lines	
Description of Impact		
Overhead power lines pose a collision and possible electrocution threat to certain bird species. The majority of internal power lines will be placed underground as buried cables. Some minor sections may be required to be built above ground for technical reasons. This above ground power line results in this impact being of High (-) significance pre-mitigation as many of the Red Listed species present on site are known to be highly susceptible to collision with and/or electrocution on overhead power lines. Overhead power lines pose a collision risk to large terrestrial species such as bustards and korhaans in particular. Large eagles such as Verreaux's and Martial Eagle are very susceptible to electrocution on pylons, particularly in a treeless landscape such as the proposed site where they will certainly perch on pylons if available and may also nest on them. The significance of both these impacts can be reduced to Low (-) significance through the application of the mitigation below.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Long-term	Short-term

Extent	Regional	Regional
Consequence	High	Medium
Probability	Probable	Conceivable
Significance	High -	Low -
Degree to which impact can be reversed	Low - birds are killed	
Degree to which impact may cause irreplaceable loss of resources	High - birds are killed	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	• Internal power lines must be placed underground except where absolutely necessary such as to cross drainage lines or get up steep/ extremely rocky slopes. • Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these. • The pole design currently proposed, i.e. monopole double circuit built to 88/132kV dimensions is significantly safer from an electrocution point of view than a standard 33kV structure that the Applicant could have opted to use but decided not to so as to reduce this potential impact. However, the safety should be improved by using a bird perch at the very top of the pole.	
Monitoring		
The following monitoring is recommended:	See framework for operational phase monitoring – Appendix 3 of *Appendix C9: Avifauna.*	

Table 7-59: Decommissioning: Disturbance of birds

Issue	Disturbance of birds during decommissioning	
Description of Impact		
Activities associated with decommissioning of a Wind Farm (including: heavy machinery, earth moving, vehicle and staff traffic) can disturb birds in the receiving environment. Effects of disturbance during breeding could include loss of breeding productivity; temporary or permanent abandonment of breeding; or even abandonment of a nest site. This impact is of Low (-) significance pre and post -mitigation.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low

Issue	Disturbance of birds during decommissioning	
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Highly reversible, as soon as decommissioning stops impact will cease	
Degree to which impact may cause irreplaceable loss of resources	Low - any impacts are reversible and no irreplaceable loss	
Degree to which impact can be mitigated	Low - certain amount of disturbance during decommissioning is inevitable	
Mitigation actions		
The following measures are recommended:	• Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in the operations phase. This will allow us to judge the risk of decommissioning to birds when the time comes. • All decommissioning activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.	
Monitoring		
The following monitoring is recommended:	See framework for operational phase monitoring – Table 7-53 above	

7.6.3.2 During & post construction bird monitoring framework

The work to date on the proposed site has established a baseline understanding of the distribution, abundance and movement of key bird species on and near the site. However, this is purely the 'before' baseline and aside from providing input into turbine micro-siting, it is not very informative until compared to post construction data. Bird fatality estimates are a key component of operational monitoring; and fatality thresholds have been set for the high-risk bird species whereby adaptive management will be triggered when these thresholds are exceeded. Appendix 3 of the Avifauna Report (*Appendix C9: Avifauna*) sets out the monitoring framework for the construction and operational phases of the project, as well as specifics of an Adaptive Management Plan.

7.6.4 Cumulative Impact

The following cumulative impacts have been identified and rated by Wildskies (2022).

7.6.4.1 Construction Phase

Table 7-60: Cumulative impact: Destruction & alteration of habitat

Issue	Habitat destruction during construction
Nature of cumulative impacts	Approximately 226.5ha and 236.2ha of habitat will be transformed by the Hoogland 3 and 4 Wind Farms respectively. In our view this is relatively small amount of habitat transformation given the scale of the projects and amount of energy production. We recognise however that the effect on avifauna is more complex than surface area as the area is also fragmented, and aerial space is also taken up

	by turbines. We concluded in Section 9.1.1. that habitat destruction at each wind farm is of Medium (-) significance. The estimated surface areas for all proposed projects are shown below: • Hoogland 1 – 306.7ha • Hoogland 2 – 300.9ha • Hoogland 3 – 226.5ha • Hoogland 4 – 236.2ha • Nuweveld East – 161ha • Nuweveld West – 161ha • Nuweveld North – 159ha The cumulative effect of this amount of habitat destruction is now rated as High (-) significance pre and Medium (-) post mitigation. The contribution of each of Hoogland 3 and 4 to this is Medium.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Medium -

Table 7-61: Cumulative impact: Disturbance of birds during construction

Issue	Disturbance of birds during construction	
Nature of cumulative impacts	The avoidance of this risk is already applied through implementation of the eagle nest buffers. The cumulative impact of disturbance of birds across all proposed projects is Low (-) both pre and post mitigation due to similar avoidance measures applied on all projects.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Low -

7.6.4.2 Operational Phase

Table 7-62: Cumulative impact: Disturbance of birds during operation

Issue	Disturbance of birds during operations	
Nature of cumulative impacts	The avoidance of this risk is already applied through implementation of the eagle nest buffers. The cumulative impact of disturbance of birds across all proposed projects is Low (-) both pre and post mitigation due to similar avoidance measures applied on all projects.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Low -

Table 7-63: Cumulative impact: Displacement of birds from the site.

Issue	Displacement of birds during operations
Nature of cumulative impacts	The avoidance of this risk is already applied through the application of no-go nest buffers for sensitive species. The cumulative impact of disturbance of birds across all proposed projects is Low (-) both pre

	and post mitigation due to similar avoidance measures applied on all projects.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Low -

Table 7-64: Cumulative impact: Direct mortality of birds through collision with turbines.

Issue	Collision of birds with turbines once operational	
Nature of cumulative impacts	Key species estimated annual fatality rates across all 7 Wind Farms include: Jackal Buzzard 8.86; Karoo Korhaan 5.45; Ludwig's Bustard 2.88; Martial Eagle 0.64; and Verreaux's Eagle 3.51. Based on these figures we conclude that the cumulative turbine collision impact of wind farms on the priority bird species in the area before mitigation is High (-), and post mitigation is Medium (-). The contribution by each of Hoogland 3 and 4 is High. If each of the proposed wind farms implements the required mitigation measures this cumulative impact can be reduced to Medium (-).	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Medium -

7.6.5 No-Go Alternative

Due to the comprehensive iterative design process that has been undertaken to inform the respective Wind Farm layouts and associated infrastructure for the Hoogland Projects, no site or layout alternatives will be assessed.

However, the preferred layouts of the Hoogland Wind Farms, and respective Grid Corridors, will each be assessed against the 'no-go' alternative. The 'no-go' alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail.

The No-go alternative will in each case result in no impact on avifauna and is therefore of neutral significance.

7.6.6 Conclusion and Recommendations

Wildskies (2022) state that overall, their impression of the Hoogland 3 Wind Farm and Hoogland 4 Wind Farm avifaunal communities is that the most sensitive features are the identified eagle nests. Given that these nests have been afforded a significant amount of spatial protection (in line with current best practice), they believe that the most significant risks to avifauna have partially been avoided. The remaining risk will still need to be mitigated carefully. Provided that the mitigation measures identified in the sections above as well as the specialist report (*Appendix C9: Avifauna*) are implemented, they recommend that the projects each be allowed to proceed.

7.7 Aquatic Ecology

This section provides a short summary of the aquatic specialist report, the full Aquatic Impact Assessment compiled by Brian Colloty of EnviroSci (Pty) Ltd and is available in *Appendix C10: Aquatic Ecology*.

7.7.1 Baseline Description

The specialist visited the site several times between February 2021 and May 2021, to refine feature mapping, improve confidence of the desktop mapping exercise and collect additional information to assess the Present

Ecological State (PES) and Ecological Importance (EI) and Ecological Sensitivity (ES) ratings that will be used in the BA reports as well as the Water Use License Applications in future.

7.7.1.1 Aquatic Features and Catchments

According to of EnviroSci (2022), the study area is comprised of various aquatic features associated with catchments and rivers including alluvial areas, watercourses with vegetated riparian zones, head water areas with instream vegetation and valley bottom wetlands (Figure 7-61). Several artificial systems such as berms and dams are also prevalent in the area.

Figure 7-61: (Top left) Pan/Depression in low lying areas associated with alluvial floodplain, (Top right) Dry alluvial river bed with no aquatic features intersected by existing road, (Bottom left) Upper catchment watercourses with limited instream vegetation, (Bottom right) Watercourse with narrow riparian zones, representing the lower valley zones

This information collected during the site visit was then compared to current wetland inventories (Figure 7-62) (van Deventer *et al.,* 2018) and 1: 50 000 topocadastral surveys mapping. A baseline map was developed to delineate the respective aquatic systems listed above for Hoogland 3 and Hoogland 4 and shown on Figure 7-62 and Figure 7-63 repsectively.

.

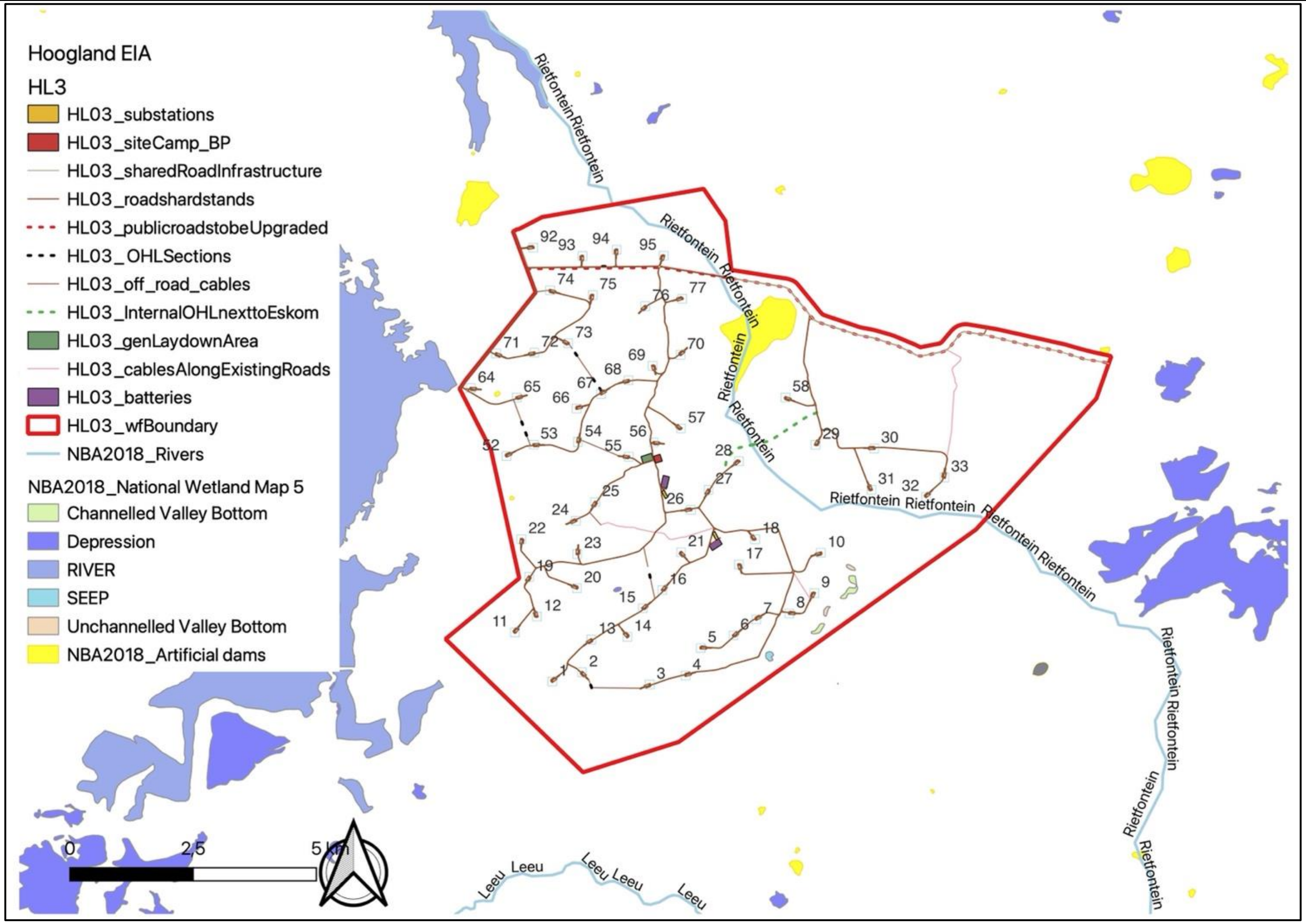


Figure 7-62: National Wetland Inventory wetlands and waterbodies (van Deventer *et al.,* 2018) for the Hoogland 3 Wind Farm area

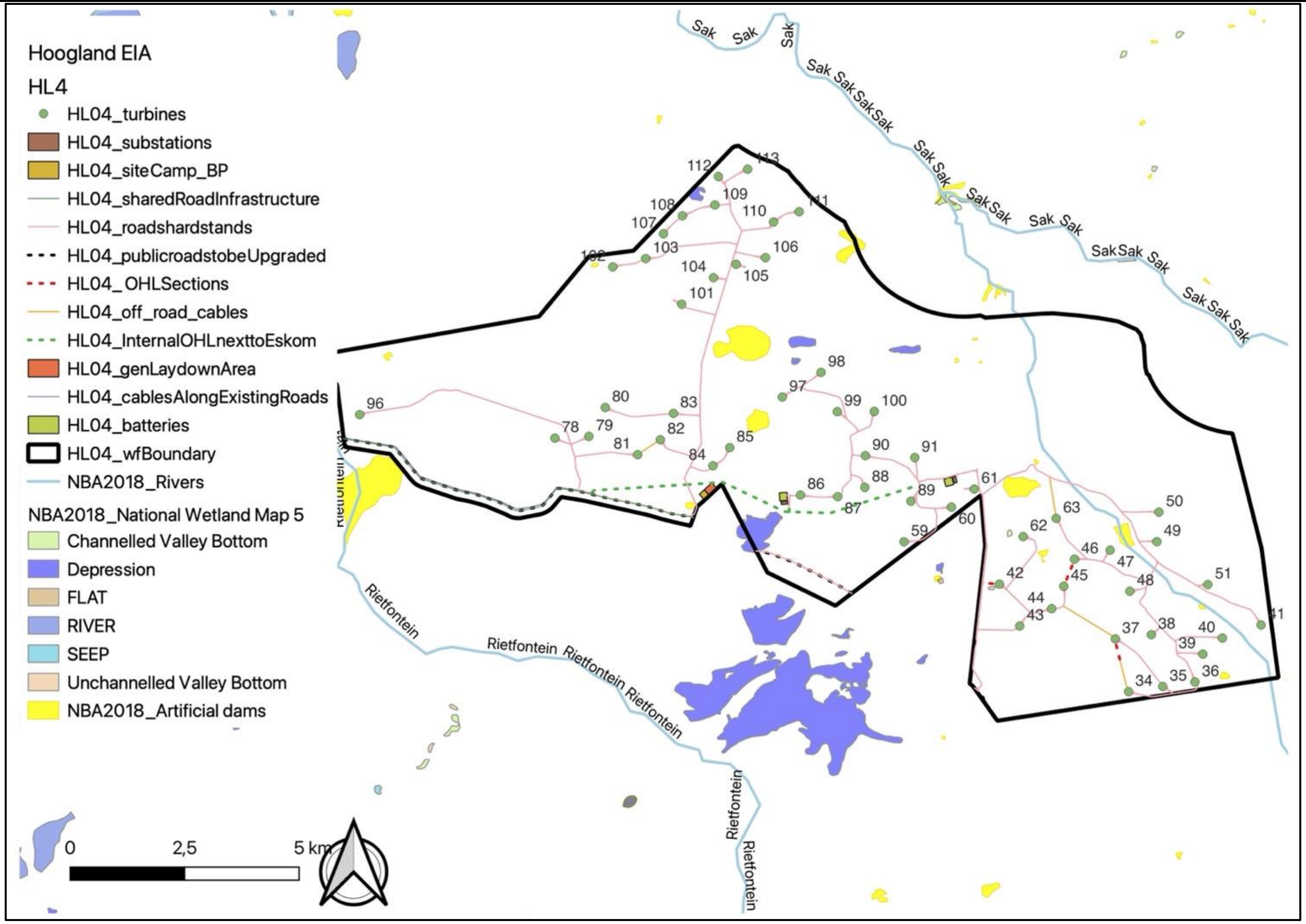


Figure 7-63: National Wetland Inventory wetlands and waterbodies (van Deventer *et al.,* 2018) for the Hoogland 4 Wind Farm area

Notably most of the aquatic features within the study area are located within the riverine valleys and alluvial floodplains, of the following catchments within the Nama Karoo Ecoregion (Table 7-65):

Table 7-65: Catchments and Water Management Areas within the Nama Karoo Ecoregion

WATER MANAGEMENT AREAS	QUATERNARY CATCHMENTS	RIVER
Orange Water Management Area	D55A	Elandsfontein se Leegte, Rietfontein and Sak rivers

7.7.1.2 Present Ecological State (PES) and Conservation Importance

The PE of a river, watercourse or wetland represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system also incorporates Ecological Importance (EI) and Ecological Sensitivity (ES) separately as opposed to Ecological Importance and Sensitivity (EIS) in the old model, although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters are assessed or the overall PES is rated between a C or D.

With the exception of portions of the Sak River (PES = B or Largely natural), the remainder of the systems assessed by DWS were rated as PES = C or Moderately Modified. While all the rivers were rated as Moderate / Medium in terms of Ecological Sensitivity and Ecological Importance. For now these ratings have been used in the sensitivity / constraints assessment, but may be adjusted once the design has been finalised during the EA process, and specific impacts such as crossings are identified and need more detailed assessment during the walk down post EA.

The importance of these systems is however substantiated by the fact that the mains stem systems within the study area (incl of alluvial systems and wetlands) are included in the Western Cape Biodiversity Spatial Plan (2017) as Critical Biodiversity Area (CBA) and Ecological Support Areas (ESA) (mapped by 3 Foxes in Figure 7-28). However for the most part the layout has avoided these areas, due to the fact that the with the exception of a few crossings, the aquatic environment will be avoided.

Overall, these catchment and subsequent rivers / watercourses are largely in a natural state. But present day impacts occur in localised areas and included the following:

- Erosion because of road crossings;
- Several farm dams; and
- Undersized culverts within present day road crossings.

7.7.1.3 Ground water

The potential water sources, which will be focused mainly on groundwater resources must be assessed in greater detail should the project proceed. As this is a significant factor in Wind Farm construction, a detailed ground water investigation will be conducted as part of the Water Use License Application. Estimates for Wind Farm construction projects have been around 50 – 60 000m^3 per year, but actual figures from Wind Farm monitoring data indicate that between 80 – 90 000m^3 of water is required per year over the 24-month construction period, particularly if concrete towers for the turbines are used. The high-level assessment attached to the aquatic specialist report has indicated that water is available and in sufficient quantities (*Appendix C10: Aquatic Ecology*).

7.7.1.4 Aquatic Flora and Fauna

Coupled with the aquatic delineations, information was collected on potential species that could occur within the wetlands and water courses, especially any areas that would contain open water for long periods and or conservation worthy species (Listed or Protected). None of the dominant riparian / wetland associated plant species observed are listed or protected under any form of legislation.

Similarly, amphibian species are known to occur within the region (Beaufort West and Karoo National Park), but little is known of the actual distribution of frogs within the study area based on mapping data contained in Minter *et al.* (2004) and the FrogMAP spatial database. The potential frogs known to occur in the area and their preferred habitat, with two frog species being observed during this assessment. None of these species are listed by the IUCN, but a special note is made by Minter et al. (2004), that detailed assessment of *Vandijkophrynus gariepensis gariepensis* (Karoo toad) is needed within the Nuweveld mountains. Two ectomorphic variations were collected (Karoo National Park - 3222BC), which possibly warrants subdivision into *Vandijkophrynus gariepensi*s, a larger and duller in colour variation found on the lower plains and is different from the smaller and more brightly coloured specimens found only in isolated high lying mountain areas and should be raised to species status, namely, *Vandijkophrynus gariepensis nubicolus*.

No fish species were observed or have been recorded within the study area, although fish distributions in downstream areas, such as the Sak River, beyond the site boundaries (ca. 4km), indicate the following species, none of which are listed with conservation concern could occur: Chubbyhead Barb - *Enteromius anoplus*; and Vaal-orange Smallmouth Yellowfish - *Labeobarbus aeneus.*

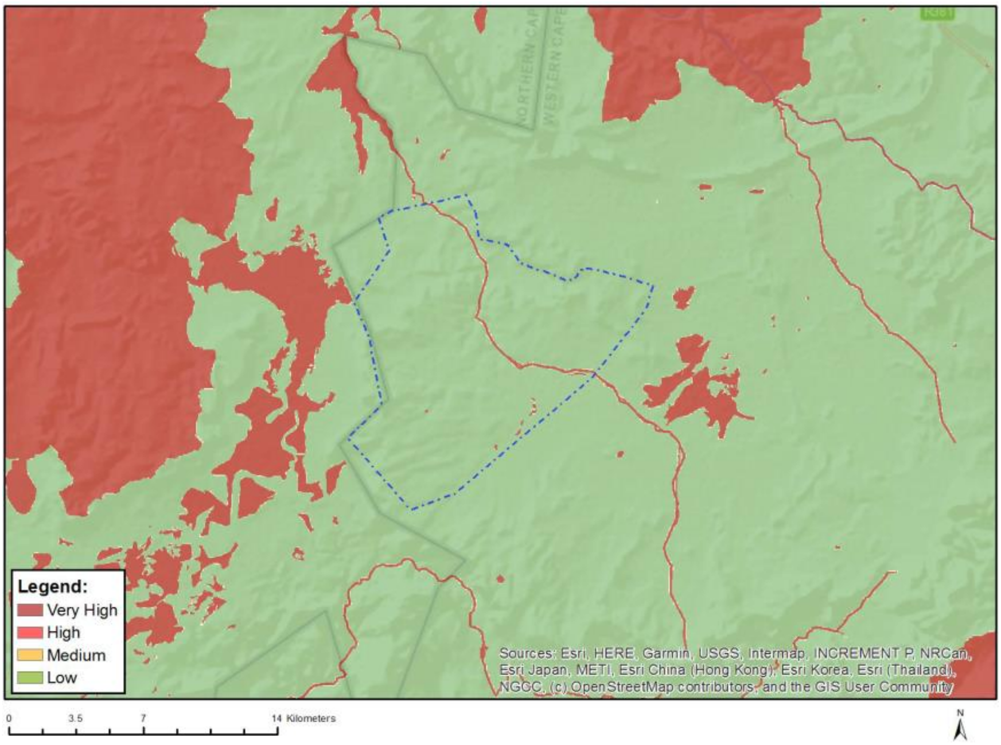
7.7.2 Site Sensitivity

The Hoogland Wind Farms have been classified by the DFFE National Screening tool as being sensitive due to the presence of CBAs and rivers (Figure 7-66). However, although the specialist agrees with the environmental sensitivities as identified on site, the exact extent of the systems is disputed, as the Screening Tool shows an under representation of the aquatic waterbodies that were rated as sensitive.

To inform the site layout, various buffers have been placed around the sensitive aquatic features of the site as follows:

- Riverine (mainstems): Floodplain and riparian dominated systems (45 m)
- Riverine (minor drainage lines): Incised channels with limited riparian vegetation or part of an alluvial valley (45 m)
- Wetland: Valley bottom wetland some with seepage zones (50 m)
- Pan (wetland): Endorheic Pan/Depressions (50 m)

These are shown on Figure 7-65 and the restrictions for different infrastructure types are detailed in Table 9-1.



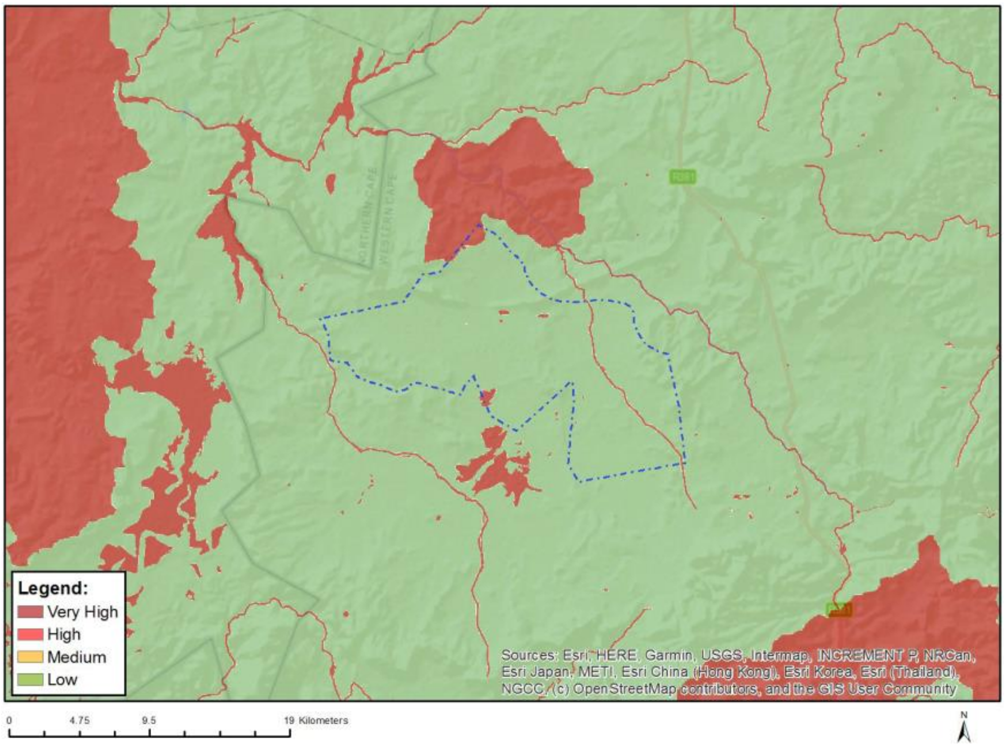


Figure 7-64: Map of relative Aquatic ecology theme sensitivity for Hoogland 3 Wind Farm (top) and Hoogland 4 Wind Farm (bottom). High sensitivity shown in red

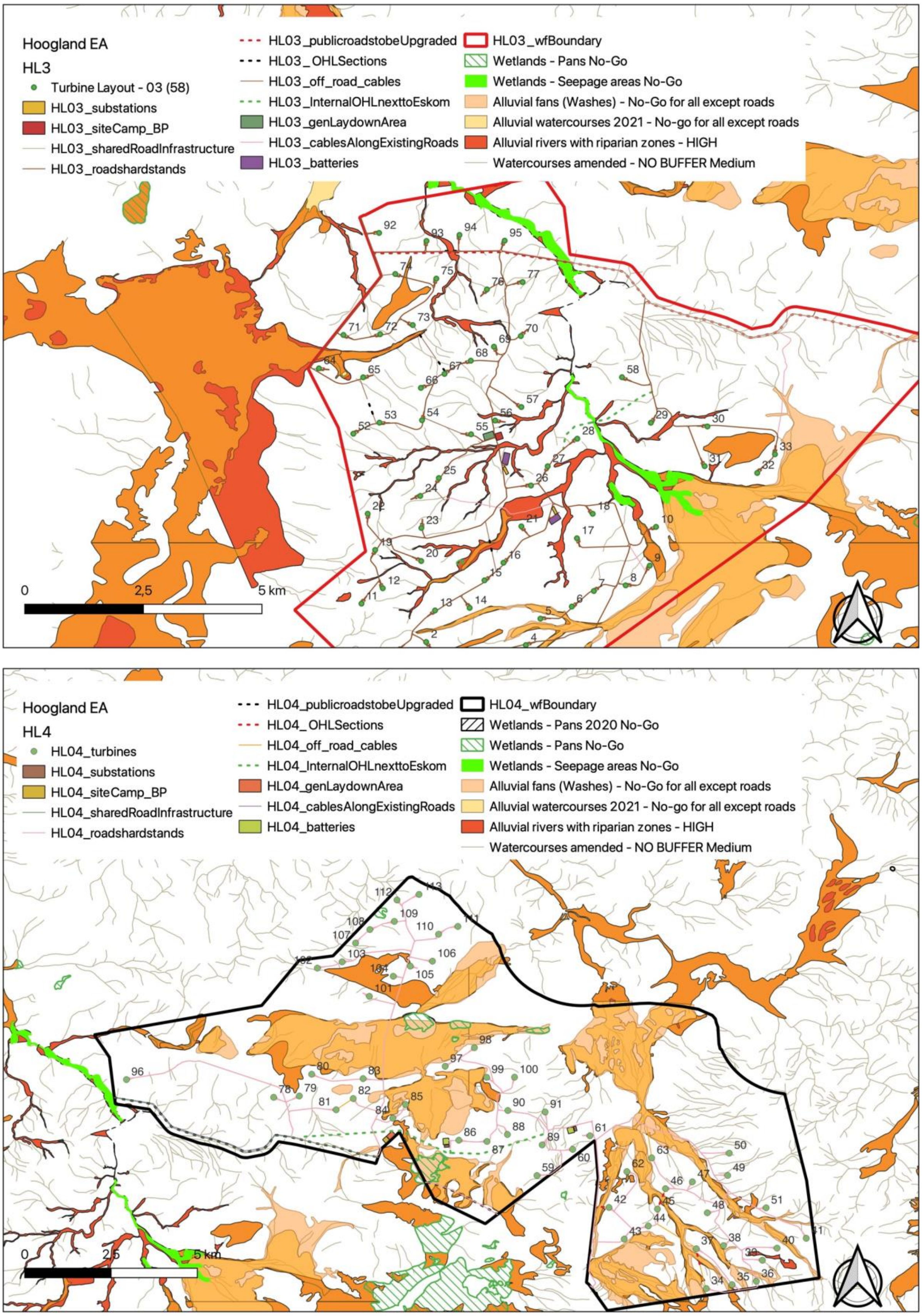


Figure 7-65: The delineated waterbodies for the Hoogland Wind Farm 3 (top) and Hoogland Wind Farm 4 (bottom), natural and artificial, inclusive of the respective sensitivity ratings against the roads and hardstand / turbine footprints

7.7.3 Impact Assessment and Mitigation

The following direct impacts of the wind farms have been assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and included in Table 7-66 below.

Table 7-66: Aquatic impacts with reference to the Biodiversity Assessment Protocol

BIODIVERSITY ASSESSMENT PROTOCOL IMPACTS FOUND APPLICABLE TO THIS PROJECT	IMPACTS ASSESSED IN THIS REPORT BELOW
Faunal and vegetation communities inhabiting the site	Impact 1 and 2 (Table 7-67 and Table 7-68)
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1 and 2 (Table 7-67 and Table 7-68)
Changes in numbers and density of species	Impact 1 and 2 (Table 7-67 and Table 7-68)
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication	Impact 3 and 4 (Table 7-69 and Table 7-70
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 2 & 5 (Table 7-68 and Table 7-71)
Streamflow regulation	Impact 3 (Table 7-69)
Erosion control	Impact 3 (Table 7-69)
Cumulative Impacts	Impact 6 (Table 7-72 - Table 7-76)

The potential impact of groundwater abstraction on the region has been addressed and forms part of a more detailed groundwater assessment (Available in *Appendix C18: Geohydrology*). For the purposes of this report, the impacts are shown in Impact 5, Table 7-71 below.

Note that most of the impacts refer to multiple project phases and have not been grouped under the respective sub-headings to avoid repetition, i.e. Construction, Operation and Decommissioning.

Table 7-67: Construction and Decommissioning: Damage or loss of riparian systems and disturbance of waterbodies

Issue	Construction & decommissioning could result in the loss of drainage systems that are fully functional and provide ecosystem services within the site especially where new crossing are made (including their proposed buffers) Loss can also include a functional loss, through change in vegetation type.	
Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Short-term
Extent	Local	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	Yes with a significant amount of rehabilitation	

Degree to which impact may cause irreplaceable loss of resources	Medium
Degree to which impact can be mitigated	High
Mitigation actions	
The following measures are recommended:	A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the stormwater management plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc). Furthermore, the following applies to watercourse crossing upgrades: • All pipe culverts must be removed and replaced with suitable sized box culverts, where road levels are raised. • River levels, regardless of the current state of the river / water course will be reinstated thus preventing any impoundments from being formed. The related designs must be assessed by an aquatic specialist during a pre-construction walkdown. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Suitable stormwater management systems must be installed along roads and other areas and monitored during the first few months of use. Any erosion / sedimentation must be resolved through whatever additional interventions maybe necessary (i.e., extension, energy dissipaters, spreaders, etc.). • A detailed monitoring plan must be developed in the pre-construction phase by an aquatic specialist, where any delineated wetlands occur within 50 m of existing crossings.
Monitoring	
The following monitoring is recommended:	All alien plant re-growth, which is currently low within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed crossings. Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.

Table 7-68: Construction, Operation and Decommissioning: Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function during the construction and into the operational phase, i.e. changes to the hydrological regime

Issue	Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.
Description of Impact	
Type of Impact	Indirect
Nature of Impact	Negative

Phases	Construction, into the Operational phase / Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	High with rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil.	
Monitoring		
The following monitoring is recommended:	This stormwater control systems must be inspected on an annual basis to ensure these are functional	

Table 7-69: Construction and Operation: Changes to hydrological regimes that could also lead to sedimentation and erosion

Issue	Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.	
Description of Impact		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction into the Operational phase	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	High with rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	

Mitigation actions	
The following measures are recommended:	A stormwater management plan must be developed in the preconstruction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil.
Monitoring	
The following monitoring is recommended:	This stormwater control systems must be inspected on an annual basis to ensure these are functional

Table 7-70: Construction and Decommissioning: Potential impacts on localised surface water quality

Issue	During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the fuel storage facility must be given. Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), if the Redox Flow technology is selected, namely with regard to safe handling during the construction phase. This is to avoid any spills or leaks from this system.	
Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction / Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Short-term
Extent	Local	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	Yes with a significant amount of rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	• All liquid chemicals including fuels and oil, including for the BESS, must be stored in with secondary containment (bunds or containers or berms) that can contain a leak or spill. Such facilities must be inspected routinely and must have the suitable PPE and spill kits needed to contain likely worst-case scenario leak or spill in that facility, safely. • Washing and cleaning of equipment must be done in designated wash bays, where rinse water is contained in evaporation/sedimentation ponds (to capture oils, grease cement and sediment).	

	Mechanical plant and bowsers must not be refueled or serviced within 100m of a river channel. • All construction camps, lay down areas, wash bays, batching plants or areas and any stores should be more than 50 m from any demarcated water courses. • Littering and contamination associated with construction activity must be avoided through effective construction camp management. • No stockpiling should take place within or near a water course. • All stockpiles must be protected and located in flat areas where run-off will be minimised and sediment recoverable.
Monitoring	
The following monitoring is recommended:	ESO monitors the site on a daily basis to ensure plant is in working order (minimise leaks), spills are prevented and if they do occur, are quickly rectified.

Table 7-71: Construction and Operation: Groundwater abstraction

Issue	The proposed project will require water for the construction and operations of the proposed Wind Farms, with anticipated demands being met by the local groundwater resources, but would not exceed the General Authorisation limits per farm portion of 40 000m^3 Per Annum per farm portion (assuming that farm portions selected meet the thresholds listed in the GA).	
Description of Impact		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction & Operations	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Short-term
Extent	Site	Site
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	High with rehabilitation	
Degree to which impact may cause irreplaceable loss of resources	Medium	
Degree to which impact can be mitigated	High	
Mitigation actions		
The following measures are recommended:	• The legal status of groundwater use at each property should be confirmed. This will inform the need for future water use authorisations. • Every effort should be made to visit all boreholes and undertake yield and quality tests at boreholes that could be considered for future supply (based on their relative proximity to Wind Farm infrastructure). The information obtained from the NGA database would be a useful starting point in determining which of the boreholes should be tested for their yields. Further, the relative sizes, GA volumes (and	

	cap volumes) of the respective farm portions should also be considered when planning scientific yield testing. • Groundwater exploration via geological and geophysical methods is recommended for Wind Farms, should existing boreholes not be sufficient. • All boreholes planned for use will require scientific yield and quality testing and analysis. • Water abstracted will be used for, *inter alia*, dust suppression on the wearing course of the proposed gravel roads that are to service the Wind Farms. In an effort to limit the groundwater abstraction volumes, consideration should be given to the application of a stabilization compound to the *in-situ* materials. A series of basic laboratory tests on natural material can determine the appropriate dosage to that is to be applied to *in-situ* materials. Further, these tests would also aid in the determination of the feasibility of adopting such an approach. This method of road construction would limit the evaporative losses of groundwater on surface. This is of significance as the proposed wind energy facility is located in a water-stressed area.
Monitoring	
The following monitoring is recommended:	Monitoring of groundwater (abstraction volumes and water levels) will be required, but the exact requirements will be determined during the physical surveys of the boreholes

7.7.4 Cumulative Impact

The following cumulative impacts have been identified and rated by EnviroSci (2022).

Table 7-72: Cumulative impact: Damage or loss of riparian systems and disturbance of waterbodies

Issue	Construction and decommissioning could result in the loss of drainage systems that are fully functional and provide ecosystem services within the site especially where new crossing are made or large hard engineered surfaces are placed within these systems (including their proposed buffers). Loss can also include a functional loss, through change in vegetation type.	
Nature of cumulative impacts	The cumulative assessment considers the various proposed renewable projects that occur within a 30km radius of this site, namely the proposed Hoogland Northern Wind Farm Cluster and adjacent Nuweveld Wind Farms. The rating below is based on the premised that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Very Low -

Table 7-73: Cumulative impact: Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function

Issue	Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.

Nature of cumulative impacts	The rating below is based on the premised that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-74: Cumulative impact: Changes to hydrological regimes that could also lead to sedimentation and erosion

Issue	Increase in hard surface areas, and roads that require stormwater management will increase through the concentration of surface water flows that could result in localised changes to flows (volume) that would result in form and function changes within aquatic systems, which are currently ephemeral. This then increases the rate of erosion and sedimentation of downstream areas.	
Nature of cumulative impacts	The rating below is based on the premised that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-75: Cumulative impact: Potential impacts on localised surface water quality

Issue	During construction or decommissioning, earthworks will expose and mobilise earth materials, and a number of materials as well as chemicals will be imported and used on site and may end up in the surface water, including soaps, oils, grease and fuels, human wastes, cementitious wastes, paints and solvents, etc. Any spills during transport or while works area conducted in proximity to a watercourse has the potential to affect the surrounding biota. Leaks or spills from storage facilities also pose a risk and due consideration to the safe design and management of the fuel storage facility must be given. Although unlikely, consideration must also be provided for the proposed Battery Energy Storage System (BESS), if the Redox Flow technology is selected, namely with regard to safe handling during the construction phase. This is to avoid any spills or leaks from this system.	
Nature of cumulative impacts	Although most of the project components are linear in fashion, while being spread over a wide area, most of the projects are spread over various catchments. However, spills and water quality issues remain localised due to the ephemeral nature of the aquatic systems	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Very Low -

Table 7-76: Cumulative impact: Groundwater abstraction

Issue	The proposed project will require water for the construction and operations of the proposed Wind Farms, with anticipated demands being met by the local groundwater resources, but would not exceed the General Authorisation limits per farm portion of 40 000m^3 Per Annum per farm portion (assuming that farm portions selected meet the thresholds listed in the GA).	
Nature of cumulative impacts	This can only be assessed in detail prior to construction when modelling, pump and yield testing is undertaken.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Very Low -

7.7.5 No-Go Alternative

The overall impact of the status quo activities would be Very Low (-) over time mostly related to road and track access within the aquatic environment and does have a marginal impact on the landscape. However, the intensity, which is Low, limits any significant degradation these systems.

7.7.6 Conclusion and Recommendations

To summarise, various aquatic features, mostly ephemeral in nature were observed within the study area for Hoogland 3 and Hoogland 4 Wind Farms respectively, and with adherence to the constraints, the overall impact on the aquatic environment would be Low (-).

Specific areas that should be avoided are the valley bottom wetlands and the endorheic pans, which have been avoided by all infrastructure in the layouts assessed. The valley bottom wetlands have been mapped and it is recommended that only existing crossings be used or upgraded, and these have also been avoided by all infrastructure in the layout except in the case of existing crossings. These together with some of the mainstem alluvial systems were rated Very High in the DFFE screening tool results and thus must behave been avoided by the larger structures (turbines, O&M buildings etc.) as shown in the sensitivity rating table. These too have been also avoided by all infrastructure in the layout except in the case of roads.

Furthermore, the potential water sources for the project, will focus mainly on groundwater resources. The desktop assessment attached to the aquatic report (refer to *Appendix C18: Geohydrology*of the BA) has indicated that water is available and in sufficient quantities, but this will be supported at later stage with pump/yield tests. As this is a significant factor in wind farm construction, a detailed ground water investigation will be conducted as part of the Water Use License Application. Estimates for wind farm construction projects have been around 50 – 60 000m^3 per year, but actual figures from wind farm monitoring data indicate that between 80 – 90 000m^3 of water is required per year over the 24-month construction period, particularly if concrete towers for the turbines are used.

In summary the current layout has, avoided key sensitive features and buffer areas, greatly reducing the potential overall impact and risk to Aquatic resources, which includes any Critical Biodiversity Areas and Ecological Support Areas. The overall and cumulative impacts, as assessed, are linked to instances where complete avoidance was not possible, or the nature of the activities involve a potential risk to aquatic resources even at great distance. Overall, it is expected that the impact on the aquatic environment would be Low (-).

Based on the findings of this study, the specialist finds no reason to withhold to an authorisation of any of the proposed activities, assuming that key mitigations measures are implemented

7.8 Visual

This section provides a short summary of the visual specialist report compiled by Quinton Lawson and Bernard Oberholzer (2022) which is available in *Appendix C10: Aquatic Ecology*.

7.8.1 Baseline Description

The proposed Hoogland Southern Wind Farms (Hoogland 3 Wind Farm, HL03 and Hoogland 4 Wind Farm HL04) are located on the Nuweveld plateau in the Great Karoo. The Karoo National Park boundary is about 13 km to the south of the proposed wind farms.

According to Lawson and Oberholzer (2022), it is an expansive semi-arid landscape, with widely scattered farmsteads nestled among tree copses, usually near sources of water or boreholes, many of the farm names ending with the term ‘fontein’. The large farms support mainly merino sheep, and occasionally dorper sheep and cattle, as well as game, such as springbok and other small antelope. The Nuweveld escarpment and plateau is characterised by horizontal sills of erosion-resistant dolerite forming steep cliffs in places, boulder-strewn mesas or plateaus and flat-topped koppies while the gentler, lower hillslopes and plains consist of more easily weathered mudstone, with occasional narrow ledges of harder sandstone. The flattish plains are at around 1400m elevation, and the dolerite ridges and mesas are 1500-1600m elevation.

The landscape and scenic features of the site and surrounding area are made up of landscape setting, geology and landforms, vegetation cover, land use and sense of place (Figure 7-66).

Figure 7-66: The expansive Karoo landscape (top), dolerite koppies are a characteristic feature of the geology (bottom)

Landscape features of visual or scenic value, along with potential sensitive receptors in the surroundings, are described in below. These provide a visual baseline for the study area.

Table 7-77: Landscape features within or adjacent the proposed site

SCENIC RESOURCE	LANDSCAPE FEATURES WITHIN OR ADJACENT TO THE DEVELOPMENT SITE
Topographic features	Characteristic landforms include the *mesas* and *koppies* formed from horizontal dolerite sills. Vertical dolerite dykes form long knobbly ridges and rock outcrops. Landscape features in the area contribute to scenic and natural heritage value, providing visual interest or contrast in the open Karoo landscape.
Water Features	In the dry landscape, drainage features and the larger dams provide scenic and amenity value.
Cultural landscapes	Green patches of cultivated land and tree copses in alluvial valleys form part of the cultural landscape. The Heritage Assessment includes archaeological and historical features, which have visual implications.
SCENIC RESOURCE	RECEPTORS ADJACENT TO THE SITE OR IN THE LOCAL SURROUNDINGS
Protected Areas	The Karoo National Park, about 13kmfrom the site, has wilderness and scenic value in addition to its biological conservation role, serving as an important visitor / tourist destination (Figure 1-1). Visual significance is increased by its protection status.
Game farms	Private game farms and guest accommodation in the area are important for the local tourism economy and tend to be sensitive to loss or degradation of scenic quality.
Human settlements, farmsteads	. Surrounding farmsteads, particularly those within 10km of the project, could be sensitive to the visual intrusion of wind turbines in the landscape. It is assumed that farms that form part of the development are less visually sensitive.
Scenic routes and arterial roads	Primary district roads, used by residents and visitors to the area, are visually sensitive.

7.8.2 Site Sensitivity

The Hoogland Southern Cluster Wind Farms have been classified by the DFFE National Screening tool as being sensitive due landscape features of visual or scenic value, along with potential sensitive receptors in the surroundings, as described in Table 7-77 above and shown in Figure 7-67.

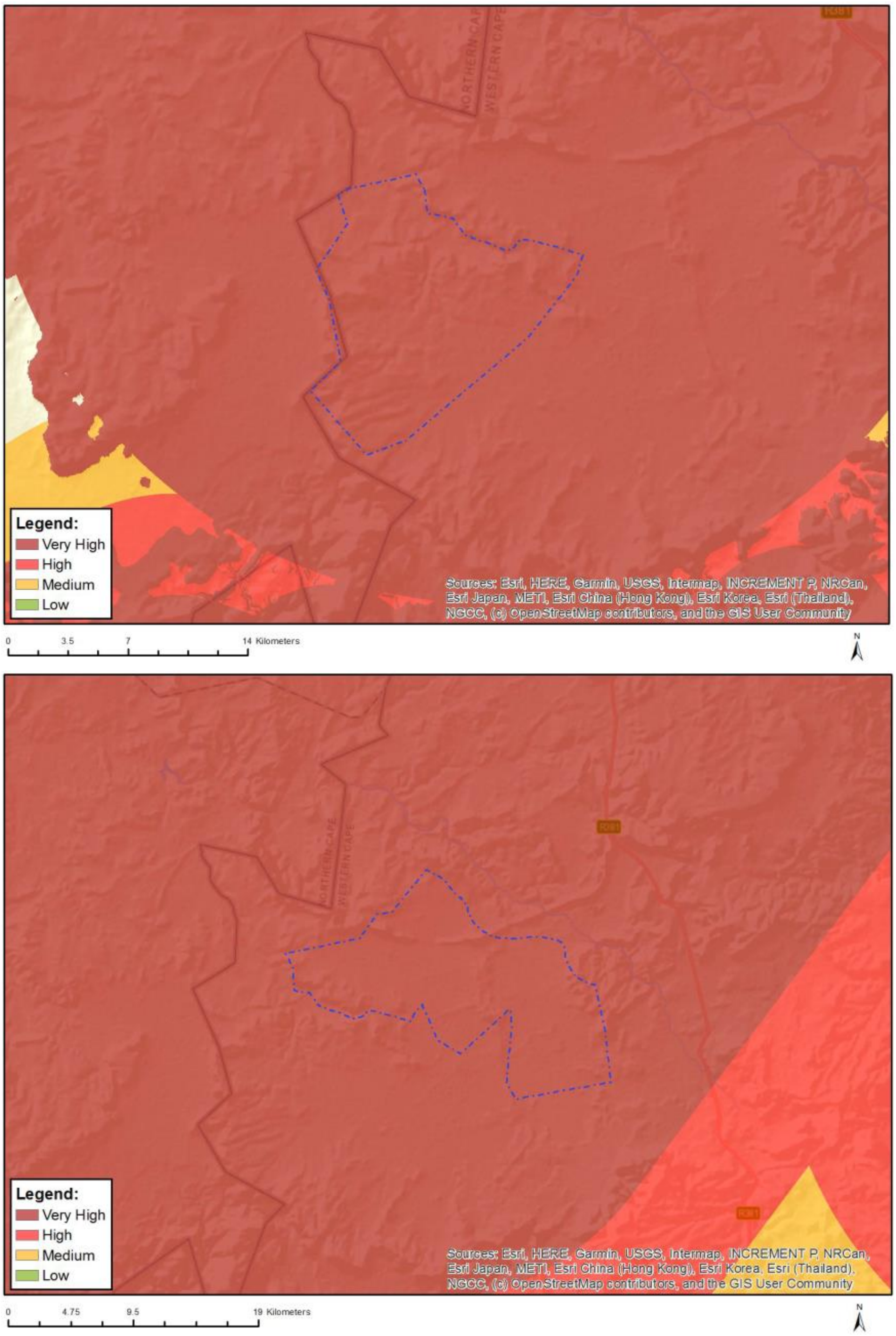


Figure 7-67: Map of relative landscape theme sensitivity for Hoogland 3 Wind Farm (top) and Hoogland 4 Wind Farm (bottom). High sensitivity shown in red.

7.8.2.1 Viewsheds and Viewpoints

During the site assessment the specialist identified viewpoints based on selected potentially sensitive receptors, mainly surrounding farmsteads (some of which are guest accommodation), as well as road corridors, particularly where these have scenic attributes, such the small passes and *poorts.* Viewpoints were selected to represent a range of distances to give an idea of their relative visibility.

It is important to note that for the purposes of this report, the term 'visibility' relates to geographic distance from the proposed wind turbines, while the term 'sensitivity' involves a range of additional visual criteria.

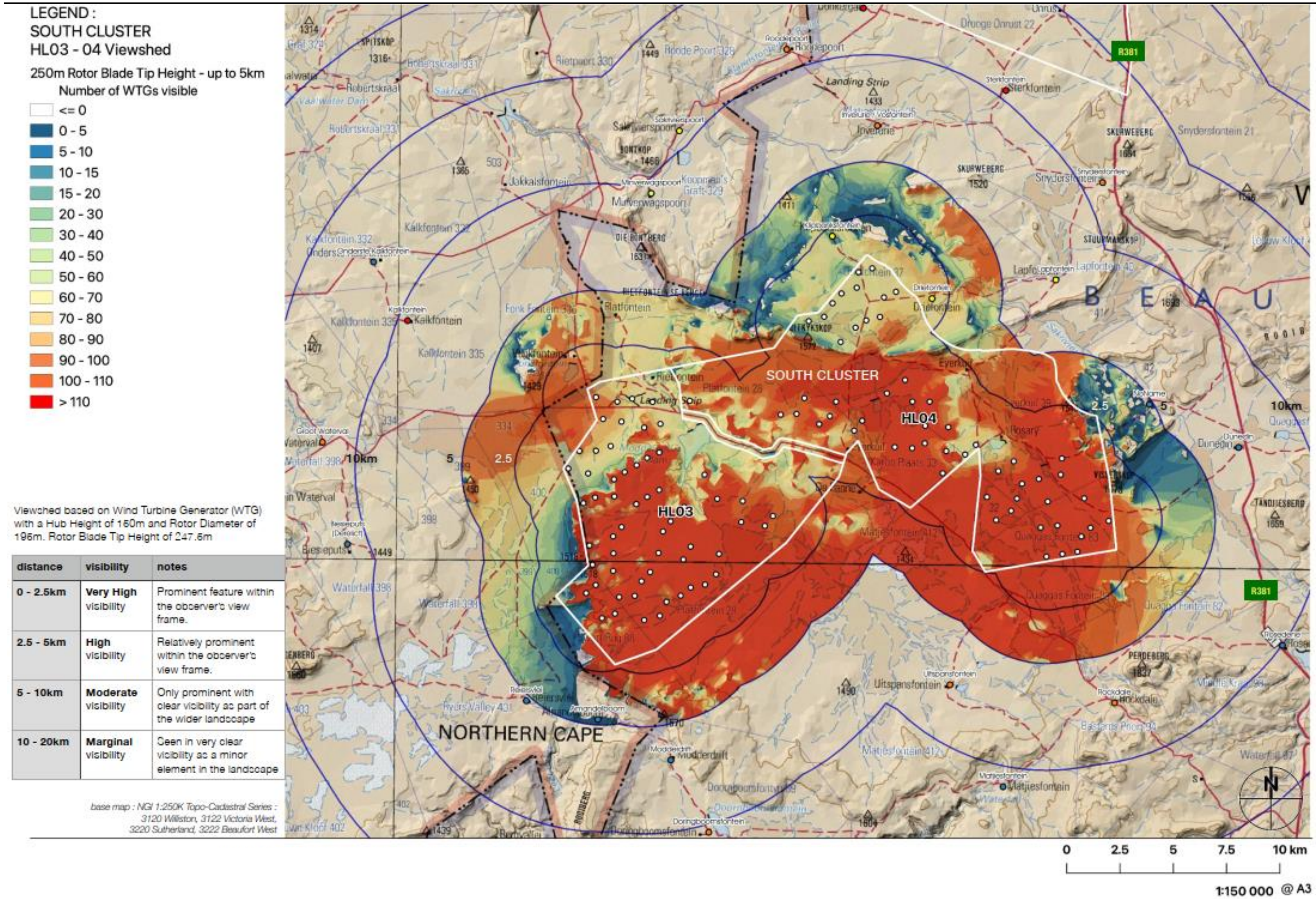
Viewsheds of the wind turbine layouts are indicated on Figure 7-68 and Figure 7-69, being the zone of visual influence of the both Hoogland Northern Wind Farms[25]. Figure 7-68 indicates the number of turbines that would be visible within 5km, based on the tip height of the turbines. Figure 7-69 indicates the number of turbines that would be visible from 5 to 25km, based on the hub height of the turbines. The colours denote how many turbines are visible from each location, while the 'clear' areas are in a view shadow and therefore not visually affected. These maps show that in some cases only a few turbines would be visible, even from nearby receptors. Table 7-78 below defines visibility in terms of distance.

Table 7-78: Definitions of visibility

Distance	Visibility	Notes
0-2.5km	Very high visibility	Prominent feature within the observer's frame
2.5-5km	High visibility	Relatively prominent feature within the observer's frame
5-10km	Moderate visibility	Only prominent with clear visibility as part of the wider landscape
10-20km	Marginal visibility	Seen in very clear visibility as a minor element in the landscape

It is important to note that for the purposes of this report, the term 'visibility' relates to geographic distance from the proposed wind turbines, while the term 'sensitivity' involves a range of additional visual criteria.

[25] The Southern Cluster Wind Farms have been assessed cumulatively so as to represent a worst-case scenario for the purpose of the BA report.



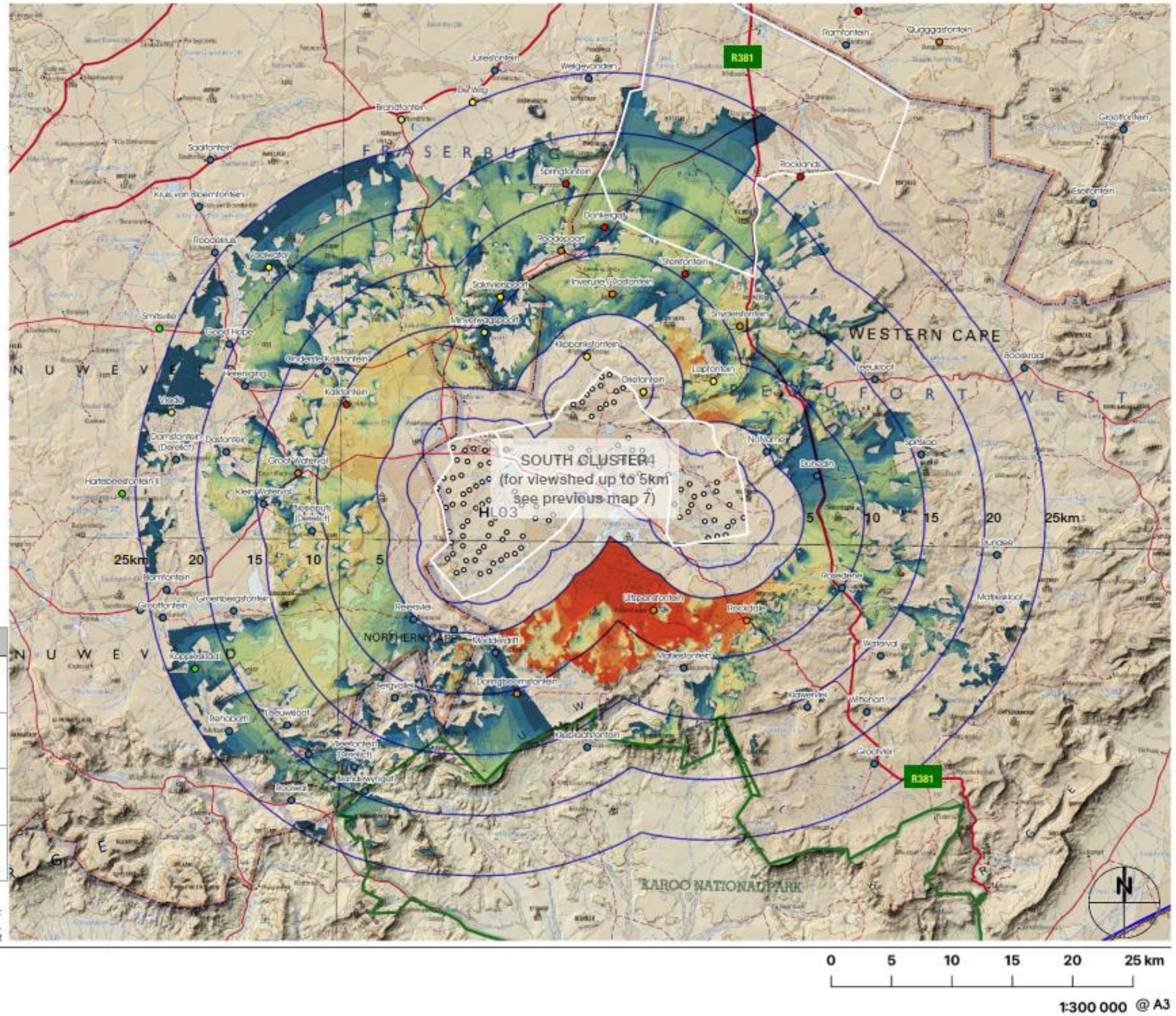
distance	visibility	notes
0 - 2.5km	Very High visibility	Prominent feature within the observer's view frame.
2.5 - 5km	High visibility	Relatively prominent within the observer's view frame.
5 - 10km	Moderate visibility	Only prominent with clear visibility as part of the wider landscape
10 - 20km	Marginal visibility	Seen in very clear visibility as a minor element in the landscape

Figure 7-68: Viewshed indicates the number of turbines that would be visible within 5km, based on the tip height of the turbines of the current wind turbine layouts for both Hoogland 3 and Hoogland 4 Wind Farms clear areas are in a view shadow.

LEGEND :
SOUTH CLUSTER
HL03 - 04 Viewshed

150m Hub Height for 5-25km
Number of WTGs visible

- <= 0
- 0 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- 90 - 100
- 100 - 110
- > 110



Viewshed based on Wind Turbine Generator (WTG) with a Hub Height of 150m

distance	visibility	notes
0 - 2.5km	Very High visibility	Prominent feature within the observer's view frame.
2.5 - 5km	High visibility	Relatively prominent within the observer's view frame.
5 - 10km	Moderate visibility	Only prominent with clear visibility as part of the wider landscape
10 - 20km	Marginal visibility	Seen in very clear visibility as a minor element in the landscape

base map : NGI 1:250K Topo-Cadastral Series : 3120 Williston, 3122 Victoria West, 3220 Sutherland, 3222 Beaufort West

Figure 7-69: Viewshed indicates the number of turbines that would be visible from 5 to 25km, based on the hub height of the turbines. The colours denote how many turbines are visible from each location, while the 'clear' areas are in a view shadow and therefore not visually affected.

7.8.2.2 Visual sensitivity mapping criteria

The visual assessments of the proposed Hoogland Southern Wind Farms are based on several quantitative and qualitative criteria to determine potential visual impacts, as well as their relative significance, including the considerations described below.

7.8.2.2.1 *Visual Exposure*

As described above, viewsheds of the proposed Wind Farms are indicated on Figure 7-68 and Figure 7-69, being the potential zone of visual influence of the Southern Cluster development based on the current layout of wind turbines (representing a theoretical 'worst case scenario'). Figure 7-68 indicates the number of turbines that would be visible within 5km, based on the tip height of the turbines. Figure 7-69 indicates the number of turbines that would be visible from 5 to 25km, based on the hub height of the turbines. These maps show that in some cases only a few turbines would be visible, even from nearby receptors.

7.8.2.2.2 Visibility

A number of significant viewpoints have been identified, together with their relative distances and anticipated visibility of the proposed Wind Farms (shown on Figure 7-68 and Figure 7-69 and listed in the VIA). The viewpoints were selected based on proximity to the Wind Farms and the potential sensitivity of identified receptors, including users of arterial routes along with guest farms and farmsteads.

Degrees of visibility would depend on the number of turbines in the view field and their position in the landscape (e.g., on ridgelines), as well as on foreground screening provided by topography or trees.

It should be noted that once a wind farm is over 10km away, the visibility of the wind farm becomes marginal and if visible (and not blocked by the terrain) it will only be seen as a minor element in the landscape. This implies that beyond 10km the wind farm will not have a major visual impact as it is not a major element in the landscape.

With regards to the Karoo National Park as a potential receptor, it should be noted that the nearest turbine is approximately 13.5 km from the Park boundary. In addition, there is a very high escarpment which buffers the park from views of the wind farm. Therefore, as shown in the viewshed (Figure 7-69) only a few turbines may be visible from some isolated high lying areas of the park and their visibility would be marginal because of the distance. The impact on the Park is therefore considered to be negligible and viewpoints have therefore not been included for this reason.

7.8.2.2.3 Visual Absorption Capacity (VAC)

This relates to the potential of the landscape to screen the proposed Wind Farms from view. Wind turbines tend to be more obscured from view in broken mountainous topography and more exposed in the open plains. Turbines located on ridgelines or *koppies* tend to be more visible in the landscape, particularly when seen in silhouette. The sparse Karoo vegetation provides little screening effect. However dense clumps of trees around farmsteads tend to reduce visibility by receptors.

7.8.2.2.4 Landscape Integrity

Landscape integrity tends to be enhanced by scenic or rural quality and intactness of the landscape, as well as absence of other visual intrusions. Natural or pristine landscapes tend to have higher visual quality and therefore higher value. Cultural landscapes, such as rural or farming scenes also have visual or scenic value. On the other hand, industrial activity and visual 'clutter', including substations and power lines, detract from these scenes.

Most of the site for the proposed Wind Farms has an uncluttered, expansive landscape with pastoral scenes, for which the Karoo is renowned.

7.8.2.2.5 Visually Sensitive Resources

Natural and cultural landscapes, or scenic resources, form part of the 'National Estate' and may have local, regional or even national significance, usually, but not only, of tourism importance. Within the study area, the dolerite dykes, koppies and other outcrops tend to be the main features of scenic and geological interest.

7.8.2.2.6 Visual Impact Intensity

The overall potential visual impact intensity is determined in Table 7-79 below by combining all the factors above, namely visual exposure, visibility, visual absorption capacity, landscape integrity and visually sensitive resources. Visual impact intensity is in turn used to assess visual impact consequence of the two proposed Wind Farms and related infrastructure, such as the substations (including associated battery facilities), buildings, internal overhead powerlines and access roads.

Table 7-79: Visual Impact Intensity

VISUAL CRITERIA	COMMENTS	WIND TURBINES	RELATED INFRASTRUCTURE
Visual exposure	Extensive viewshed relating to large scale and number of wind turbines.	High	Low
Visibility	Visible from parts of the R381 Route, main district roads, and a number of farmsteads and guest farms.	High	Low
Visual absorption capacity (VAC)	Visually exposed plain and ridges (in places), and therefore low VAC.	High	Medium
Landscape integrity / intactness	Effect on rural farming character and Karoo landscape.	High	Medium
Landscape / scenic sensitivity	Effect on scenic resources / dolerite outcrops.	High	Low
Impact intensity	Summary	**High**	**Medium**

Scenic resources and sensitive receptors within the study area have been identified and categorised into no-go, high sensitivity, medium sensitivity and low visual sensitivity zones at a more detailed local scale. Visual sensitivity maps have been created for turbines, buildings and substations (including associated battery storage facility), internal roads and cables and internal overhead powerlines. The sensitivity mapping provides some indication of the level of acceptable change in visual terms and, have previously and will continue to inform the project layout. The sensitivity maps are included in the figures below (Figure 7 62 and Figure 7 67) and the criteria are included in Table 9 1.

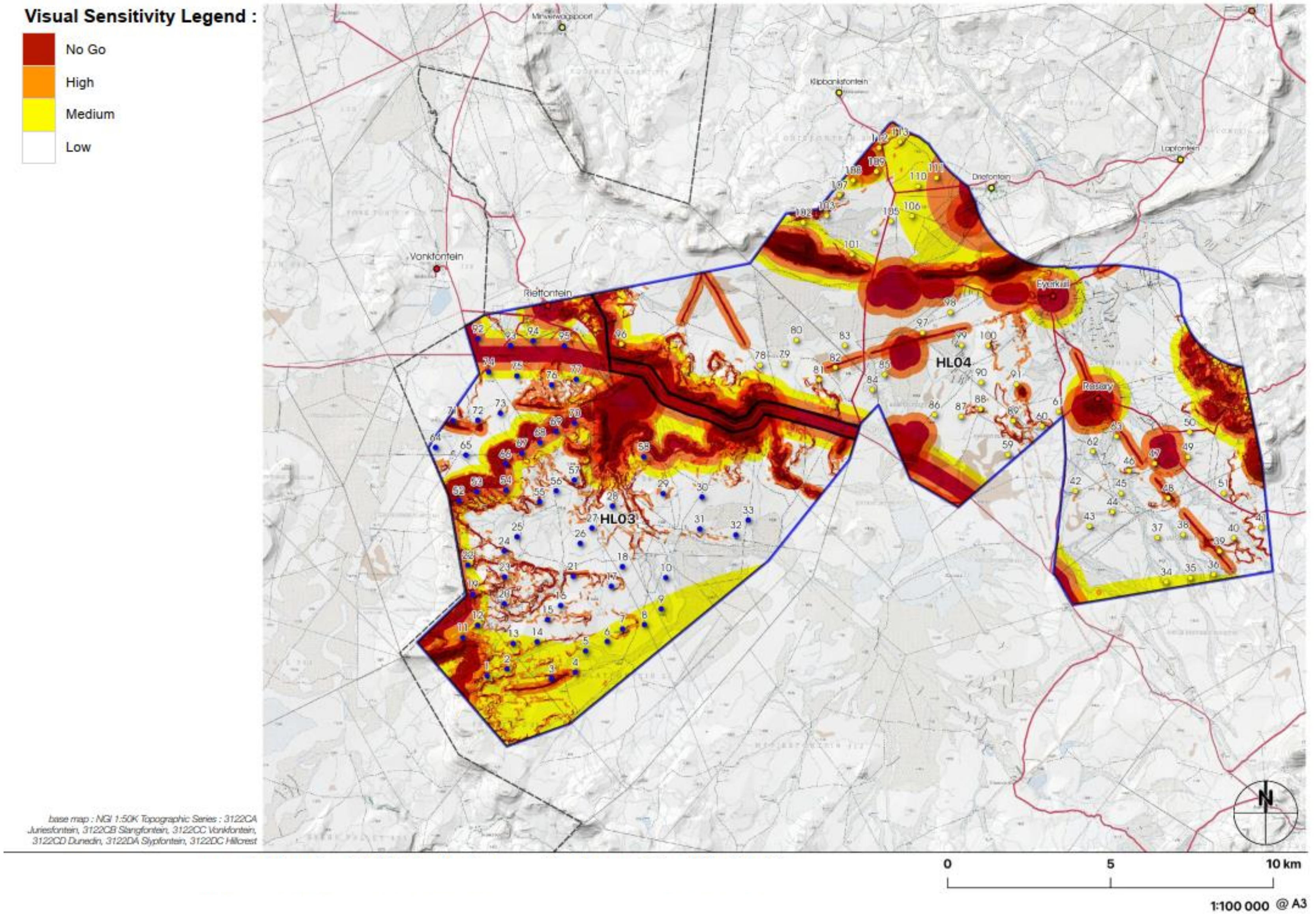


Figure 7-70: Wind turbine visual sensitivity map

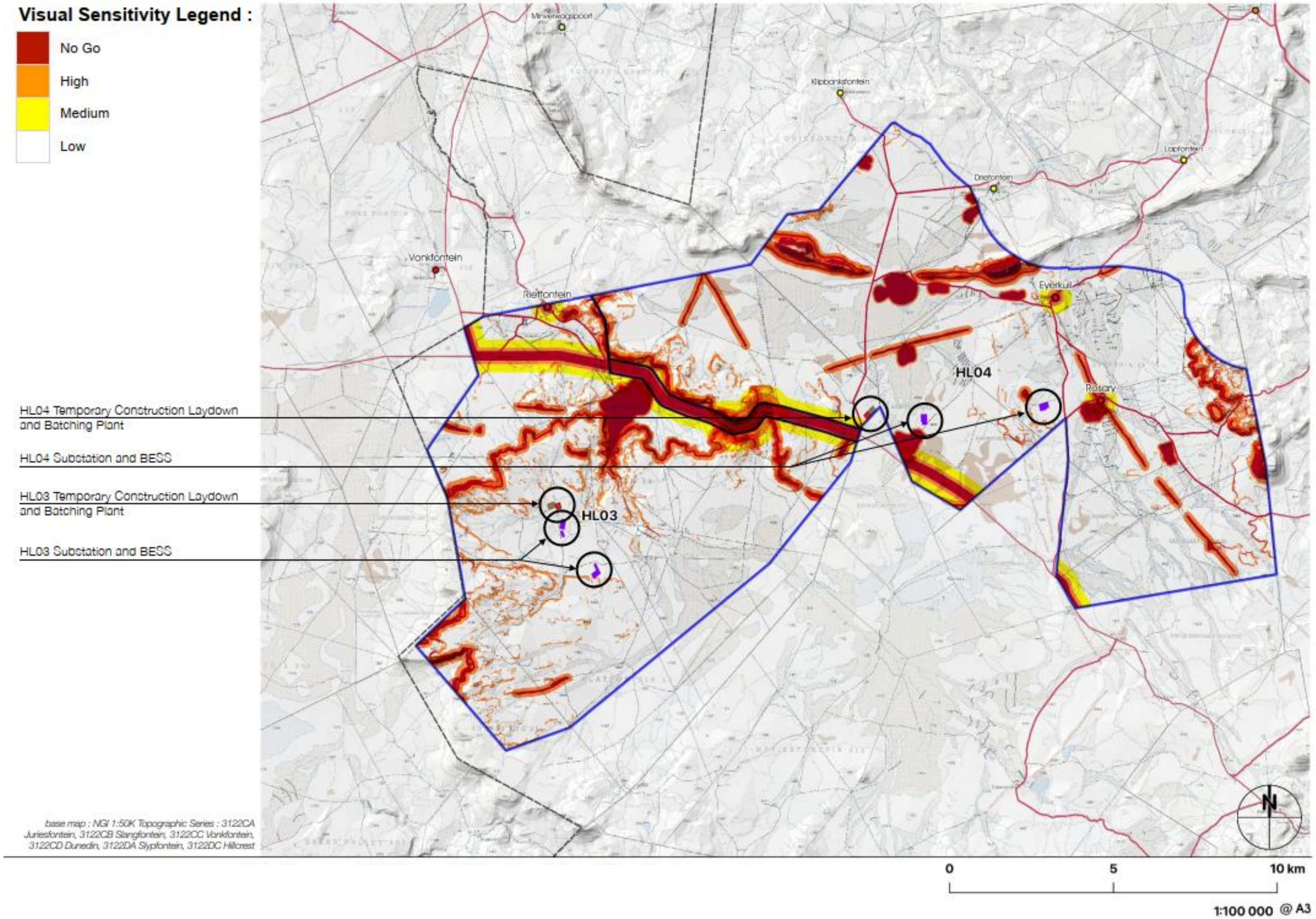


Figure 7-71: Buildings, substation and BESS visual sensitivity map

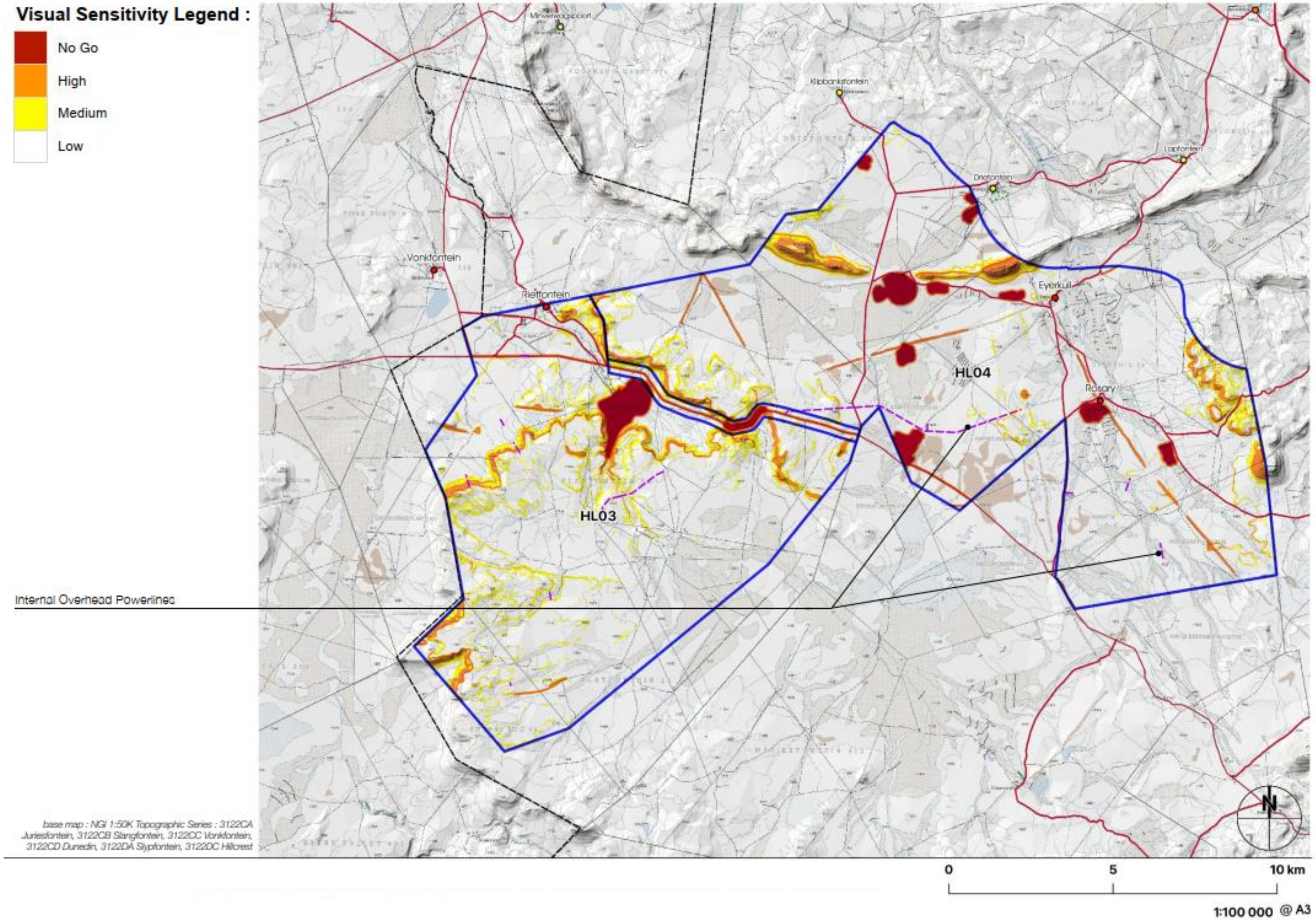


Figure 7-72: Overhead powerline visual sensitivity map

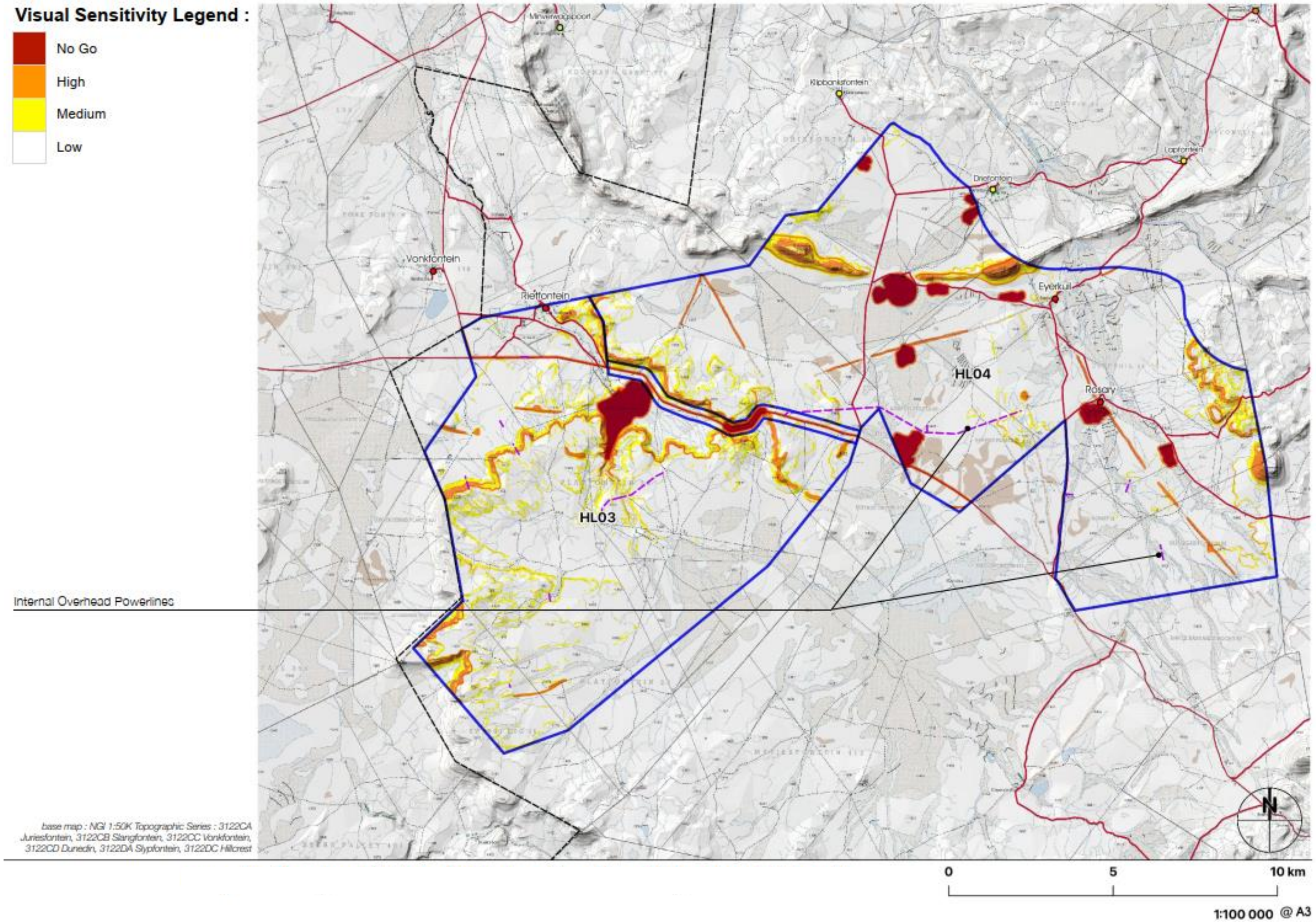


Figure 7-73: Internal roads visual sensitivity map

7.8.3 Impact Assessment and Mitigation

The following visual impacts have been identified and rated by Lawson and Oberholzer (2022).

Potential visual impacts associated with the proposed Wind Farms will occur where turbine positions and associated infrastructure types conflict with identified scenic resources and sensitive receptors, as indicated in the sensitivity mapping. Scenic resources at the site are mainly prominent topographic and water features. Sensitive receptors include game farms, especially those with tourism facilities, as well as individual farmsteads within the site and in the surroundings.

A number of quantitative and qualitative criteria may affect the potential visual impacts, as well as their relative significance, including: visual exposure, visibility, visual absorption capacity, landscape integrity, visually sensitive resources and visual impact intensity (as outlined in the previous section).

7.8.3.1 Construction Phase

Table 7-80: Construction: Visual intrusion of construction activities

Issue: Visual intrusion of construction activities on the Karoo landscape.		
Description of Impact		
• Visual intrusion of cranes, heavy vehicles and construction activities required for the erection of wind turbines, and related infrastructure. • Temporary construction areas eg camps and batching plants Visual scarring from earthworks for assembly platforms. Soil/ rubble stockpiles from earthworks. • Litter generated from construction site. • Noise and dust from construction activity affecting the Karoo's sense of place.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Probable
Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact is reversible by means of site rehabilitation after construction and removal of construction equipment.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	• There is some scope for mitigation as per the recommended mitigation measures below: • Visually sensitive skylines, such as dolerite ridges, koppies, rock outcrops and slopes steeper than 1:4 or 1:10 gradient, avoided in the layout design. The revised layout largely meets these requirements.	

	• Disturbed areas rehabilitated / revegetated as soon as possible during the construction phase. • Temporary laydown and areas and batching plants to be located away from arterial or district roads unless approved by the visual specialists. This current layout is acceptable in this regard, where a visual buffer of 50m would be provided. • Stockpiles to be demarcated and located within approved construction footprints. • Recycling and refuse bins to be provided to eliminate litter from the site.

7.8.3.2 Operational Phase

Table 7-81: Operation: Visual intrusion of wind turbines

Issue: Visual intrusion of wind turbines on the Karoo landscape.		
Description of Impact		
Potential visual intrusion of the tall wind turbines on the rural landscape, scenic resources and sensitive receptors. Change in the pastoral Karoo character and sense of place of the local area.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	High
Probability	Definite/ Continuous	Definite/ Continuous
Significance	High -	High -
Mitigation actions		
Degree to which impact can be reversed	The impact could be reversible at the decommissioning phase by means of dismantling the turbines and site rehabilitation.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	Mitigation only achievable by means of avoidance in the siting of turbines. No potential for screening of the tall turbines. Further potential design recommendations in relation to cumulative impacts are shown in Section 7.8.4.	

Table 7-82: Operation: Visual intrusion of associated infrastructure

Issue: Visual intrusion of infrastructure on the Karoo landscape.	
Description of Impact	
• Visual effect of industrial-type substations and BESS on the rural Karoo landscape. • Visual intrusion of internal overhead powerlines, including silhouette effect on skylines of ridges/ koppies. • Visual intrusion of internal access roads and hardstands in the local area.	
Type of Impact	Direct
Nature of Impact	Negative
Phases	Operational

Criteria	Without Mitigation	With Mitigation
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Definite/ Continuous
Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact could be reversible at the decommissioning phase by means of dismantling the infrastructure and implementing site rehabilitation.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	Some mitigation is achievable through careful siting and screening of infrastructure. These are as follows: • Substations and O&M Buildings to be located in unobtrusive low-lying areas away from provincial and district roads where possible. The current locations meet these requirements. • On-site signage to be discrete, and billboards prohibited. Signage to be fixed as low as possible, preferably against a backdrop to avoid intrusion on the skyline. • Security and other outdoor lighting to be fitted with reflectors to conceal the light source.	

Table 7-83: Operation: Visual intrusion of lighting at night

Issue: Visual intrusion of lighting at night.		
Description of Impact		
Visual effect on the dark skies of the Karoo created by lights on turbines for aircraft navigation. Visual intrusion of area and security lighting around the substations and O&M buildings.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operational	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Definite/ Continuous
Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact could be reversible at the decommissioning phase by means of dismantling the turbines and other infrastructure and site rehabilitation.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	

Degree to which impact can be mitigated	Some mitigation achievable for navigation lights by means of technological advances. Security and other outdoor lighting can be fitted with reflectors. These are as follows: • Use of available technology to minimise the visual effect of navigation lights, conforming with CAA requirements. • Use of reflectors on area and security lighting to conceal light sources.

7.8.3.3 Decommissioning Phase

Table 7-84: Decommissioning: Visual intrusion of decommissioning activities

Issue: Visual intrusion of activities to remove infrastructure.		
Description of Impact		
Visual effect of construction activities to remove infrastructure at the end of the life of the project, including wind turbines, substation, buildings, internal overhead powerlines and access roads.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Very short-term	Very short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite/ Continuous	Probable
Significance	Medium -	Medium -
Mitigation actions		
Degree to which impact can be reversed	The impact is reversible by means of site rehabilitation after construction and removal of construction equipment.	
Degree to which impact may cause irreplaceable loss of resources	Scenic resources are not damaged irreparably.	
Degree to which impact can be mitigated	There is some scope for mitigation as per the recommended mitigation measures below: • Disturbed areas rehabilitated / revegetated as soon as possible after the decommissioning phase. • Wind turbines and building structures removed at the end of the life of the project. • Hardstands and access roads no longer required to be ripped and regraded. • Exposed or disturbed areas revegetated and returned to grazing pasture or natural veld to blend with the surroundings.	

7.8.4 Cumulative Impact

There will be cumulative visual impacts arising from the combination of the Hoogland Northern and Hoogland Southern Wind Farms, as well as the proposed three Nuweveld wind farms once all wind farms are developed and there would be a change to the largely rural character and sense of place of the area.

However, the nature of the topography would result in some screening between the above-mentioned wind farms, and these would therefore seldom be seen fully in combination. The Hoogland Northern and Southern Clusters are also spaced more than 10km apart from each other which ensures a visual separation of the two clusters. Similarly, the Hoogland Wind Farms have a number of smaller natural gaps, derived from the various specialist sensitivity mapping, which helps to provide a clustering effect.

Potential cumulative visual impacts of the combination of the above Wind Farms would be high (-). In terms of mitigation, it is proposed that where a choice exists between turbines to be dropped and all other factors being equal, priority should be given to removing or relocating 'outlier' turbines, as well as widening any gaps to improve the visual clustering effect. Removing turbines in the “high” visual sensitivity category could also be considered.

Table 7-85: Cumulative impact: Visual impact of turbines

Issue: Cumulative visual intrusion of wind turbines on the Karoo landscape.		
Nature of cumulative impacts	The cumulative assessment considers the various proposed renewable projects that occur within a 30km radius of this site, namely the proposed Hoogland Southern Wind Farm Cluster, Hoogland Northern Wind Farm Cluster and adjacent Nuweveld Wind Farms. The rating below is based on the premised that important or sensitive features will be avoided by the various projects, while the mitigations proposed will ensure that the form and or function of downstream areas remain intact.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	High -

7.8.5 No-Go Alternative

The no-go alternative would mean that there would be no additional visual intrusion on the rural landscape and on farmsteads in the area by wind turbines and related infrastructure. Scenic features and the overall sense of place would therefore remain intact.

It is envisaged that the potential visual impact significance of the no-go alternative would be neutral as the status quo would likely continue and there would be no further visual impacts.

7.8.6 Conclusion and Recommendations

The layouts of the Hoogland Southern Wind Farms have followed an iterative planning process during the Screening Phase, based on the various specialist findings, including the mapping of scenic resources and sensitive receptors. The proposed layout for construction and operational infrastructure largely succeeds in avoiding most visual 'no-go' areas indicated on the visual sensitivity maps and is acceptable.

Given the relatively large number and large scale of the wind turbines, the potential visual impact of the Wind Farm was calculated to be high (-) before mitigation. The VIA considered the visual impact of 58 and 55 turbines for each of the Wind Farms respectively, while acknowledging that a maximum of 60 turbines for each could be developed (as per the application), potentially reducing the visual impact. This assessment, however, considers the worst-case scenario in terms of the visual impacts associated with the two proposed Hoogland Southern Cluster Wind Farms.

To reduce the impacts, further refinement of the layout has been recommended where a choice exists between turbines to be dropped to reach the final turbine positions, and all other factors are equal. This includes outlier turbines (that extend the zone of visual influence and detract from the visual cohesion of the proposed wind farms); those in the 'high' visual sensitivity areas; and those when removed widen gaps that could improve the clustering effect.

It is the opinion of the Visual Specialists that while the Hoogland 3 Wind Farm and Hoogland 4 Wind Farm layouts would each respectively have a significant visual impact, the layouts have avoided most of the scenic resources and visual receptors of the area and provided the recommended mitigation measures are implemented (specifically the removal of turbines in identified no-go areas as discussed above), would not present a potential fatal flaw in visual terms. The project, with mitigations, may therefore be authorised from a visual perspective.

7.9 Heritage

This section provides a short summary of the heritage specialist report compiled by Jayson Orton of Asha Consulting which is available in *Appendix C12: Heritage*.

7.9.1 Baseline Description

The baseline description is based on available literature, mapping and field work undertaken between March 2021 and September 2021 the aim of which was to record as many heritage resources in the study area as possible.

The Wind Farm sites are in a rural/natural context used for livestock (sheep and cattle) and game rearing. All local roads are gravel and farm complexes are few and far between. Human modification of the environment, aside from roads and occasional farm complexes, some of which have associated agricultural lands, is limited to wind pumps, reservoirs, dams and farm fences.

Large parts of the overall study area lie on extensive flat, silty plains and these are bounded variably by dolerite dykes that form small or large ridges or hills and low sandstone scarps. In places shale is visible on the surface but this is largely limited to riverbeds. It is generally very hilly and rocky, although the majority of the rocks do not form cliffs but break into pieces through erosion and weathering. The exception is the bands of sandstone that occur in places and are more resistant to weathering. These create low cliffs (in the order to 1 to 5 m high and sometimes result in the formation of rock shelters. Narrow, incised valleys with well-defined rivers are rare. Vegetation tends to be relatively sparse due variably to the elevation and exposure, limited rainfall and sometimes very rocky substrates (Figure 7-74).


Figure 7-74: Looking south along a dolerite ridge in the centre of the HL03 site (left), Looking east along a sandstone scarp in the far western part of the HL04 site (right)

Heritage resources at the site can be divided into five main categories namely: Palaeontology, archaeology, graves, built environment and cultural landscape. This section provides a summary of the baseline heritage resources associated with these five categories.

Note: Visual and palaeontology resources are not included in this baseline description as they are covered in more detail Section 7.8 and Section 7.10 respectively.

7.9.1.1 Archaeology

According to ASHA (2022), the study area has been found to be rich in archaeology but with sites being in clusters that are often quite far apart. The vast majority of the recorded archaeology dates to the colonial period but Stone Age sites were also present.

The vast majority of the Stone Age finds were from the Late Stone Age (LSA), although occasional finds of older stone artefacts were also noted. One such scatter in HL04 was at the base of a sandstone scarp with the heavy patination on the artefacts indicating their relatively great age – the artefacts no doubt include MSA pieces, but some of the larger flakes could well indicate an ESA origin (waypoint 1550; Figure 7-75). Background scatter artefacts (essentially precolonial litter) were generally uncommon, but when such artefacts were found they tended to be in areas with a light gravel covering and were very ephemeral. These materials are all likely to be of Pleistocene age and, because of their small numbers, are of no consequence. No Early Stone Age (ESA) material was seen. One such ephemeral scatter was found on a flat, silty area in HL04 at waypoint 1796 and included a clear handaxe which dates from the ESA (waypoint 1796; Figure 7-75).

Figure 7-75: Collection of very well-patinated hornfels flaked stone artefacts dating to the MSA. The central artefact in the right picture, in the bottom row is a handaxe (waypoint 1796 in HL04). Scale = 5 cm.

A few proper LSA occupation sites were found, but most were surface scatters. Artefacts were found from a dense scatter located at a gap in a dolerite dyke in HL04 (waypoint 1613; Figure 7-76). A dam has been built behind the dyke now, but presumably in the past an ephemeral stream flowed through the gap making this location attractive for settlement. Another very dense scatter was found on the bank of a larger stream in HL04 but, due to it being very late in the day, it could not be properly examined (waypoint 1675; Figure 7-76).

A large boulder at the foot of a larger-than-usual sandstone scarp in HL04 had some historical stone walling (waypoint 1675; Figure 7-76) but more importantly there was a large scatter of LSA material (waypoint 1549; Figure 7-77). Most artefacts were of hornfels and a very dense scatter of ostrich eggshell was seen in one place. The third site highlighted here was a large, dense scatter some 25 m across. It was located on the edge of a river floodplain, but about 170 m away from the riverbed itself. The scatter included many stone artefacts, mostly in hornfels, a potsherd, some ostrich eggshell beads (waypoint 211; Figure 7-77) and a lower grindstone with a light groove in it (waypoint 211; Figure 7-77).

Figure 7-76: LSA artefact scatter located at a gap in a dolerite dyke at waypoint 1613 HL04. (left), very dense scatter was found on the bank of a larger stream at waypoint 1675 (middle) and large sandstone with LSA artefacts at waypoint 1549 in HL03 and HL04 (right). Scale in cm.

Figure 7-77: Large scatter of LSA material at waypoint 1549 in HL04 (left) Stone artefacts, mostly in hornfels, a potsherd, some ostrich eggshell beads waypoint 211 in HL04. Scale in 1 cm intervals (middle) and Lower grindstone with a light groove in it at waypoint 211 in HL04. Scale in 1 and 5 cm intervals (right).

A rock shelter was located at waypoint 1652 in the scarp above the boulder site at waypoint 1549 in HL04. It too had some stone walling in it which was likely historical (waypoint 1652; Figure 7-78). However, within the shelter there was some pottery, including a large fibre-tempered sherd (waypoint 1549; Figure 7-78), and ostrich eggshell along with rare stone artefacts. An ostrich eggshell fragment had cross-hatched engraving on its inner surface (waypoint 1549; Figure 7-78). The talus slope, however, was littered with many thousands of ostrich eggshell fragments (waypoint 1549; Figure 7-78).

Figure 7-78: A rock shelter was located at waypoint 1652 in HL04 (top left), large fibre-tempered sherd at waypoint 1652 in HL04. Scale in cm (top right), Ostrich eggshell with cross-hatching on its inner surface at waypoint 1652 in HL04 (bottom left) and Abundant ostrich eggshell on the talus slope at waypoint 1652 in HL04. Scale in cm (bottom right).

A number of engravings deemed to be from the LSA have also been located. Many are poorly preserved and difficult to photograph adequately. Figure 7-79 shows a dolerite slab at waypoint 1574 from HL03 with many engravings on it. The majority are historical but a very clear scraped eland engraving dating to the LSA is clearly visible. It is overprinted by the later historical scratched images. Figure 7-80 shows three further LSA engravings, all of the from HL03.

Figure 7-79: Dolerite boulder with many engraved animals on it (waypoint 1574 in HL03). The majority are historical scratchings and depict horses, but a scraped eland occurs in the centre. Scale in cm.

Figure 7-80: An enigmatic scraped animal engraving with head to the left and a bifurcated tail from waypoint 1859 in HL03. Scale in cm (left); A scraped eland engraving with a very recently scratched scorpion overprinted from waypoint 1860 in HL03. Scale in cm (middle) and a scraped eland engraving with its back arched downwards from waypoint 1862 in HL03. Scale in cm.

The colonial period archaeological sites would have been made by the trekboers who colonised this area during the 18th and 19th centuries but evidence of occupation of these sites into the early 20th century was also found in a few instances. These sites are stone-built farm complexes with livestock enclosures (kraals), houses, cooking shelters (kookskerms), rare threshing floors (trapvloere), various other unidentifiable stone structures and graves. Importantly, they sometimes have associated ash and rubbish dumps which contain extensive material evidence relating to day-to-day life during occupation of these sites. These sites are invariably located along rivers and, for this reason, should largely be protected from harm. Figure 7-81 shows an example of a stone-built house photographed in the early 20th century while still in use. The roof would have been of poles, branches, sacking, sheepskins, or other suitable materials. This is probably what many of the less formal stone houses in the area looked like. More formal rectangular houses would have had flat roofs, brakdak during earlier times with corrugated iron coming later.

Figure 7-81: A shepherd's hut photographed near Beaufort West in the early 20th century. Note the low, narrow doorway and informal roof structure. Source: Schoeman (2013:48)

One such complex lies in the far south of Platfontein 28 and is recorded as waypoints 182 to 187 (just outside HL03). Several ruined structures were present (waypoint 112 in HL03; Figure 7-82). Some internal architectural detailing such as a muurkas and a corner shelf were present (waypoint 185 in HL03; Figure 7-83). No dump was found but a light scattering of glass, ceramics and metal was noted (waypoint 183 in HL03; Figure 7-83).

No highly significant ash and rubbish dumps were found in the study area with most being relatively ephemeral examples with few artefacts (e.g. waypoint 1792 in HL04; Figure 7-84). In one case, however, a large dump was found but it had almost no artefacts (waypoint 157 in HL03; Figure 7-84).

Figure 7-82: Stone-walled structures at a ruined farm werf at waypoint 182 outside HL03 (left) and Stone-walled structures at a ruined farm werf at waypoint 183 outside HL03 (right)

Figure 7-83: Architectural details in the ruin at waypoint 185 outside HL03 (left) and Artefacts from an ephemeral ash dump at waypoint 183 outside HL03. Scale in 1 and 5 cm intervals (right)


Figure 7-84: Artefacts from an ephemeral dump at waypoint 1792 in HL04. Scale in cm (left); The large ash dump with minimal artefacts at waypoint 157 in HL03 (right)

Elsewhere, in HL03, a walled valley was noted (Figure 7-85). The site was not examined in detail due to time constraints but a threshing floor with an associated square stone structure and a kraal (Figure 7-86) were noted amongst other features.

Figure 7-85: A walled valley in the southwestern corner of HL04. Yellow arrows mark two ends and two corners of the main wall system.


Figure 7-86: A threshing floor and associated structure at waypoint 1673 in HL04 (top) and A stone kraal at waypoint 1671 in HL04 (bottom)

A very interesting small ruined house lay in an isolated position well away from any other historical remains outside the boundary of HL03. This house has end gables containing a door and window respectively (waypoint 1585; Figure 7-87) with the roof having been created in a corbelled manner with overlapping rock slabs gradually closing the gap. There is still a space in the middle and it is unclear how this last piece would have been closed (waypoint 1585; Figure 7-87). A small number of artefacts were associated.

Figure 7-87: Gable with low entrance door in the house at waypoint 1585 outside HL03. The figure is on her knees (top left) The opposite end gable with a small window at waypoint 1585 outside HL03 (top right), The interior of the house at waypoint 1585 outside HL03. (bottom left), Artefacts associated with the house at waypoint 1585 outside HL03, including a small dolerite upper grindstone (bottom right)

Some historical stone-walled sites are far smaller and less obvious on the landscape. These smaller sites are perhaps small herder camps where a low circle of stones was built up and covered by, sticks and skins. Some of these structures occurred in very remote areas, while others were close to ruined farm complexes (e.g., that at waypoint 1663 in HL03) (Figure 7-88). Other even smaller features include small cairns and stone clusters such as that at waypoint 1659 which lay in the middle of a small, ephemeral pan in HL03 and was thus certainly not a grave (Figure 7-88).

Figure 7-88: A small stone feature some 2 m in diameter at waypoint 1663 in HL03 (left) and A stone feature in an ephemeral pan at waypoint 1659 in HL03 (right)

Another aspect of historical archaeology is the many scratched engravings found in clusters in various places on dolerite ridges. The main subject matter is horses. This is not unexpected; Morris (1988:116) notes that "recently incised engravings, including distinctive horse motifs, are found in great numbers in the Karoo and areas just north of the Orange River." Figure 7-89 shows two typically stylised horses, one with a rider and another hitched to a wagon that seems not to be complete (waypoint 1576 in HL03). Figure 7-90 show a selection of the many other historical engravings, with the last two showing some text. The majority were within the HL03 study area but some were in HL04 and a cluster was recorded just outside the northern edge of HL04.

Figure 7-89: Historical scratched engraving of a horse and chariot and a horse and rider at waypoint 1576 in HL03. The chariot looks incomplete. Scale in cm.

Figure 7-90: Historical scratched engraving of what appear to be plants at waypoint 1573 in HL03. Scale in cm (left), Historical scratched engraving of a bird and some antelope at waypoint 1646 in HL04. Scale in cm (middle) and A historical scratched engraving of a Cape Cart at waypoint 1857 in HL03. Scale in cm (right)

7.9.1.2 Graves

Graves seemed to be remarkably rare in the study area with just two possible grave cairns (waypoints 139, on the boundary of HL03, and 196,just outside HL03) and two clear graves (waypoint 188, just outside HL03) having been recorded (Figure 7-91). A farm graveyard appears to be visible on aerial photography at the Rietfontein homestead on Platfontein 28, while another is very clear at the Eyerkuil farmstead on Eyerkuil 39. Neither of these sites were visited.

Figure 7-91: A likely grave cairn at waypoint 139 on boundary of HL03 (left), Two graves at waypoint 188 just outside HL03 (right)

7.9.1.3 Historical aspects and the Built environment

Relatively few farmsteads occur in the study area which means that historical buildings are few in number. Some are occupied and others are not. A few examples are presented here with all being unoccupied since the three farmsteads in the study area known to be occupied were not specifically visited. Another occurs just outside the northern edge of the study area. At waypoint 1552 in HL03 there is a horse stable complex said to have been built soon after 1954, but not present on the 1960 aerial photograph (see below) and which thus may or may not be a heritage resource. They are built in a Cape Dutch Revivalist style with many gables, and a stable manager's cottage lies adjacent (Figure 7-92 to Figure 7-94). The farm (Rietfontein) was once used as a stud farm but the stables now stand empty.

Figure 7-92: View of the stable complex at waypoint 1552 in HL03.

Figure 7-93: The mid-20th century stables at waypoint 1552 in HL03.

Figure 7-94: The stable manager's house at waypoint 1552 in HL03.

A homestead called 'Rosary' has a derelict house at waypoint 1791 in HL04 and likely dating to the very early 20th century. Although a crack has formed through one of its front gables, the rest of the house is largely structurally sound but in poor condition with broken windows in places and at least one room missing its floor. A very beautiful wooden ceiling is present though. Figure 7-95 to Figure 7-97 show features of the house. There were many other structures in the homestead area but most are now ruined. Figure 7-98 shows a large outbuilding that is still intact enough to be considered a structure.

Figure 7-95: The front of the main house at waypoint 1791 in HL04.

Figure 7-96: The back of the main house at waypoint 1791 in HL04.

Figure 7-97: Porch and front door details at the front of the main house at waypoint 1791 in HL04.

Figure 7-98: A derelict outbuilding alongside the main house at waypoint 1791 in HL04.

7.9.1.4 Cultural landscapes and scenic routes

Cultural landscapes are the product of the interactions between humans and nature in a particular area. The site is characterised as a relatively undisturbed wilderness with a sense of wide-open space. The three aspects that make up the cultural landscape of the site are summarised in Table 7-86.

Table 7-86: Summary of the aspects of the cultural landscape of the Hoogland Southern Wind Farms site

CULTURAL LANDSCAPE	DESCRIPTION
Natural/Primeval Landscape	Inhabited by the indigenous Bushmen hunter-gatherers who left little trace of their passing but did mark the landscape with engravings and rock gongs.
Trekboer Landscape	Characterised by more permanent traces in the form of stone-built residential and farming structures (now in ruin), graves and threshing floors. The earliest trekboers left very little trace at all since they would have lived in their ox wagons before eventually settling down and building the stone structures that characterise this aspect of the cultural landscape. Grey poplar (*Populus x canescens*) is typical of trekboer farm structures who grew these fast-growing trees for construction purposes.
Modern Landscape	Characterised by livestock and game farming, widely spaced farm complexes, farm fences and tracks. Farm complexes are generally marked by the presence of many trees. They often contain different layers of heritage and can be thought of as areas of higher density of heritage resources. An Example includes Rosary on HL04 and Rietfontein werf on HL03.

Part of all the above is the relatively undisturbed wilderness atmosphere that pervades the region – this includes the darkness of the night-time sky. Driving its main roads, in this case the R381 which passes through the wider study area, leaves one marvelling at the tremendous sense of wide open space and, away from the hills of the escarpment, the endless Karoo plains. Winter and Oberholzer (2013) have rated the Molteno Pass section of the R381 which goes up the escarpment as being a locally significant route. This rating can certainly be extended to the rest of this road for its scenic value, although it must be noted that parts of the R381 pass through the Beaufort West REDZ and three other wind farms have been approved by HWC in the area. The Karoo National Park lies some approximately 13km south of

HL03 and HL04 respectively. It is a significant landscape and offers formal protection to a section of the highly scenic escarpment. Although the wind farms might be visible in the distance, the Park and escarpment are both too far south to be significantly affected by the proposed wind farms. In addition, a ridge forms much of the northern boundary of the Park offering screening.

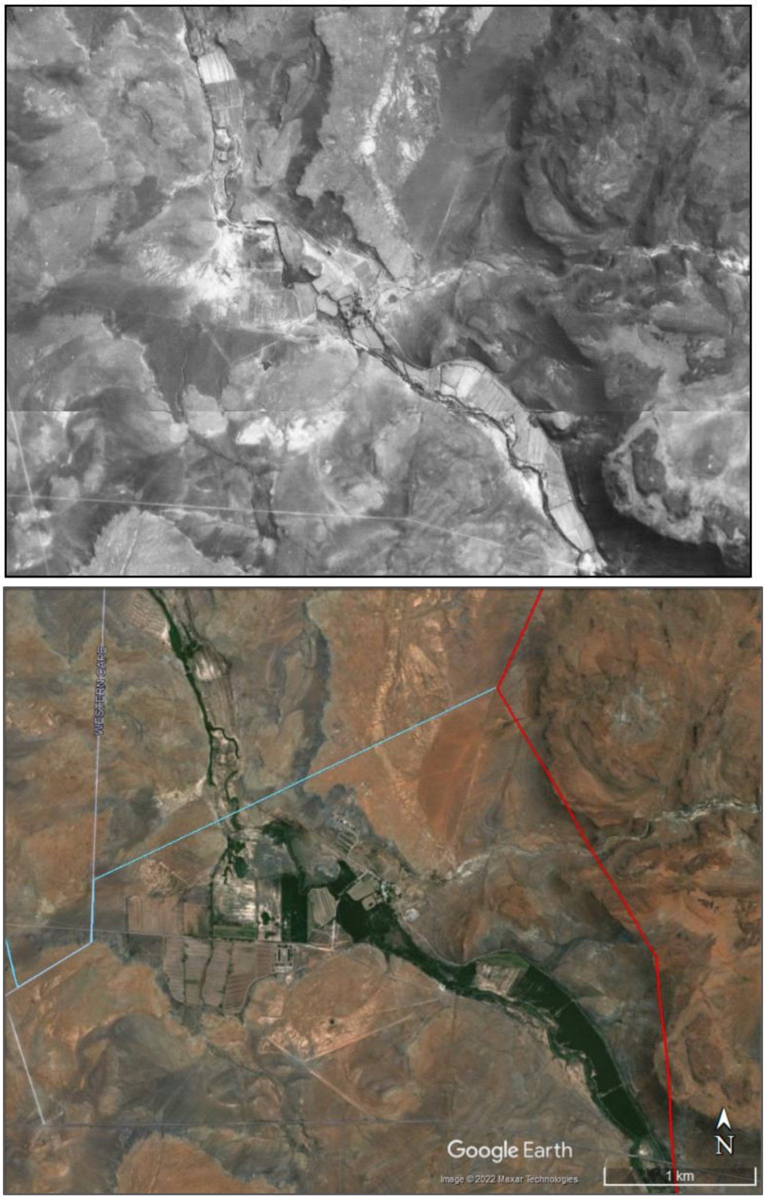


Figure 7-99: Historical aerial view of the Rietfontein werf on HL03 and associated agricultural landscape from 1960 showing the landscape at that time. The inset shows the location of the stable complex with no buildings evident. (left) and Modern aerial view of the Rietfontein werf on HL03 showing agricultural landscape along the Sak River (right)

7.9.1.5 Places associated with living heritage

As noted above, the historical engravings of the area demonstrate continuity in the tradition of engraving. This signature is very strongly present in the study area, and especially in HL03. What is perhaps of greatest interest is that the engraving tradition appears to have continued even longer than expected as evidenced by the clearly very recent scorpion engraving described above. Another recorded location only represents a lunch stop for recent farm workers and is not significant but the use of bushes to create a windbreak or kookskerm is a practice rooted in the past.

7.9.1.6 Visual impact assessment

Lawson and Oberholzer (2022) summarised in Section 7.8, note the project setting to be an expansive semi-arid landscape. Flat-topped hills are seen as a characteristic feature of what is an otherwise fairly featureless landscape. Refer to Figure 7-68 and Figure 7-69 for a viewshed map for HL03 and HL04 Wind Farms together. With the mixture of hills and open plains around the study area the visual exposure is relatively similar in all directions but, notably, it is truncated along the boundary of the Karoo National Park by a line of hills along the latter's northern boundary.

7.9.2 Site Sensitivity

The DFFE National Screening tool indicates that the Archeological and Cultural Heritage theme for the Hoogland Southern Cluster Wind Farms is classified as not being sensitive (Figure 7-100).

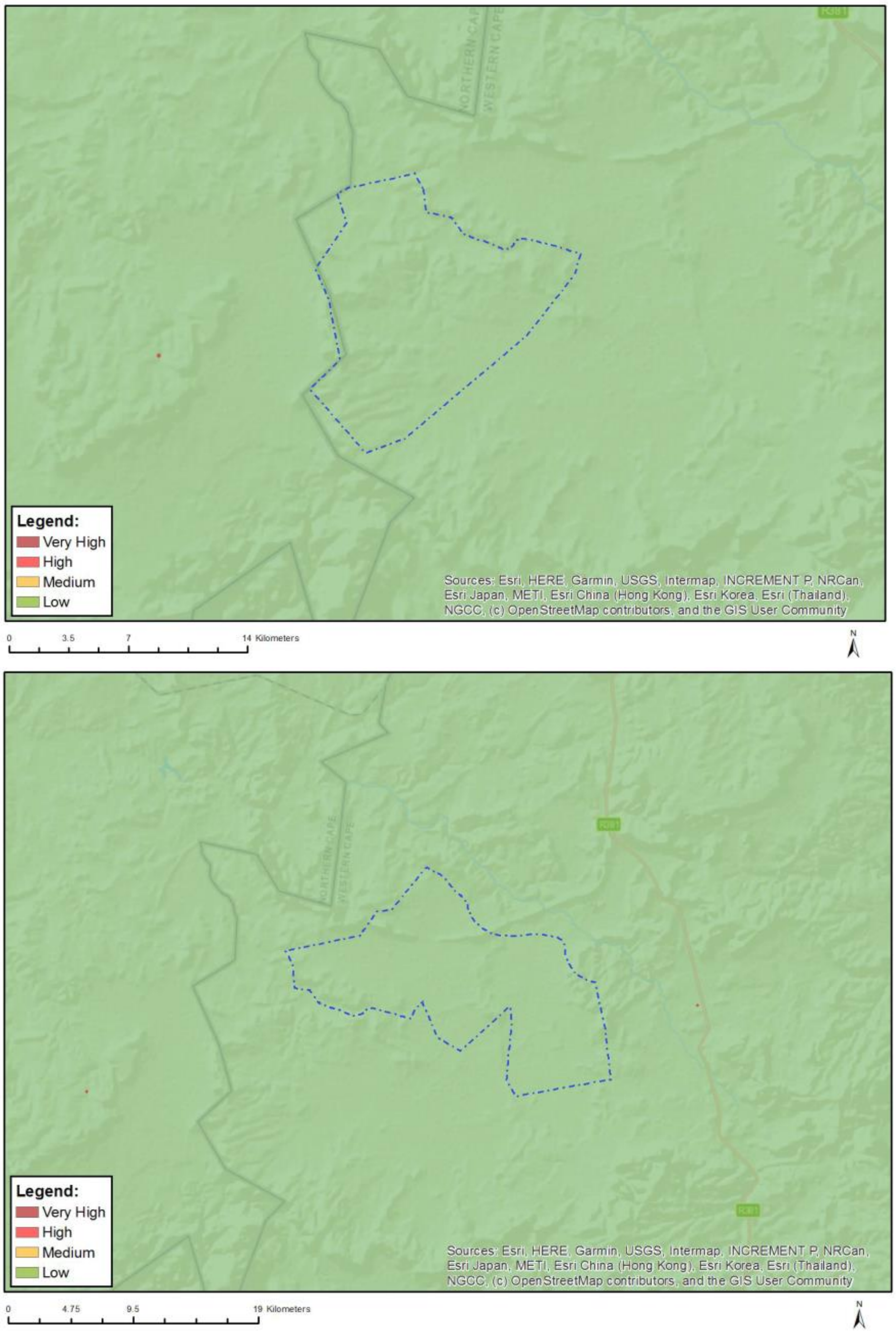


Figure 7-100: Map of relative Archaeological and Cultural Heritage theme sensitivity for Hoogland 3 Wind Farm (top) and Hoogland 4 Wind Farm (bottom)

7.9.2.1 Sensitive features and buffers

The development footprint contains various sensitivities that were identified following the undertaking of several site visits and spatial input considerations. A detailed list of inventory finds, their locations and associated heritage grading are included in Appendix 3 of the Heritage report (included in *Appendix C12: Heritage* of this report).

The sensitivity of these findings and the respective buffers was classified according to their grading, which differed for the various infrastructure types. Refer to Table 7-87. They are shown graphically in Figure 7-101 and more detailed maps can be found in the Heritage report (*Appendix C12: Heritage*).

Table 7-87: Relationship between heritage grades, sensitivity ratings and project components as developed during the early part of the project

PROJECT COMPONENT	IIIA		IIIB		IIIC		NCW
	FEATURE	BUFFER	FEATURE	BUFFER	FEATURE	BUFFER	FEATURE
Turbines	No-go	No-go	High	Medium	Medium	Low	Neutral
Substations, buildings	No-go	No-go	High	Medium	Medium	Low	Neutral
New roads and jeep tracks for upgrade	No-go	No-go	High	Medium	Medium	Low	Neutral
Existing proper gravel roads (not jeep tracks) for upgrade	No-go	High	Medium	Low	Low	Low	Neutral
Pylons	No-go	No-go	High	Medium	Medium	Low	Neutral
Overhead lines (spanning)	No-go	High	Medium	Low	Low	Low	Neutral

- Sensitivity classes are designed to be in line with the HWC grading scheme, since the gradings MUST be used in all HIAs. Although NCW is low sensitivity (the lowest rating in the Red Cap scheme), they are coloured black and called 'neutral' to distinguish low heritage sensitivity from NCW.
- Note that existing roads would obviously not go over point sites but they may pass through larger multi-component sites.
    - Existing roads to be widened/upgraded get a lower level of sensitivity as they are already present and it is more desirable to upgrade than to build a second road nearby.
    - Occasionally very small 'twee-spoor' jeep tracks can pass very close to heritage sites and create minimal existing impacts. For this reason, their upgrades are best treated like building new roads.

Overhead lines spanning over sites also get lower ratings because there would be no physical damage. BUT there is still a chance of damage during construction so spanning lines are only one sensitivity level lower.

Allocation of protective buffers is as follows:

- Scenic passes, roads and cultural landscapes
    - Buffer to be determined by visual specialist for Grade IIIB linear features.
    - Buffer 50 m around Grades IIIA and IIIB cultural landscapes. Agricultural landscapes were delineated by including all arable lands clearly visible on aerial photography. Note that these are really visual issues and hence different buffers may be proposed by the visual practitioners. The 50 m buffer suggested here should be treated as a minimum.
- Archaeology, Built environment, Graves
    - Buffer 50 m around waypoints for small, single component sites (Grades IIIA to IIIC)
    - Buffer 50 m around outer edge of larger, multi-component sites (Grades IIIA to IIIC)
    - Note that, in line with the relevant heritage indicator and although it may not always be possible due to the multitude of other limitations on turbine layout, buffers of up to 200 m are encouraged for IIIA rock art sites

Note that, in line with the relevant heritage indicator and although it may not always be possible due to the multitude of other limitations on turbine layout, buffers of up to 200 m are encouraged for IIIA rock art sites

The implications of the mapped sensitivities are discussed in the conclusions. There are no highly significant concerns requiring major adjustment to the layout as these have mostly been addressed through avoidance.

The entire area is regarded as a cultural landscape, although the Karoo National Park[26] and escarpment are the most important parts. These are too far from the study area to require mapping in relation to the potential impacts. The R381 in this area is a local route with lesser significance due to being away from the major topographic landscape features.

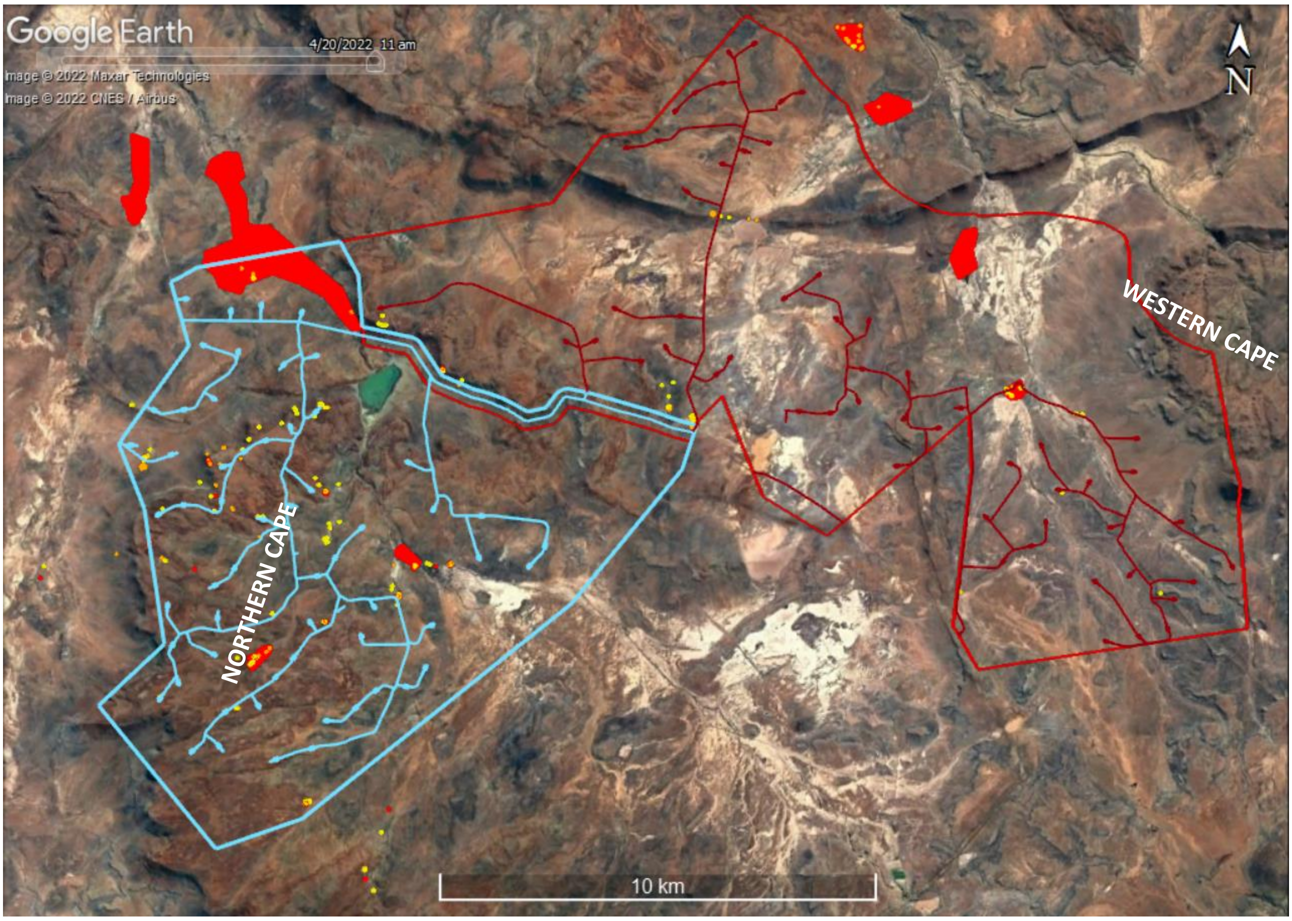


Figure 7-101: Sensitivity map for the entire HL03 (blue layout) and HL04 (red layout) area. Red, orange and yellow shaded areas are high, medium and low sensitivity respectively

[26] Noting that the project infrastructure is located outside the Karoo National Park and its respective buffer and expansion areas.

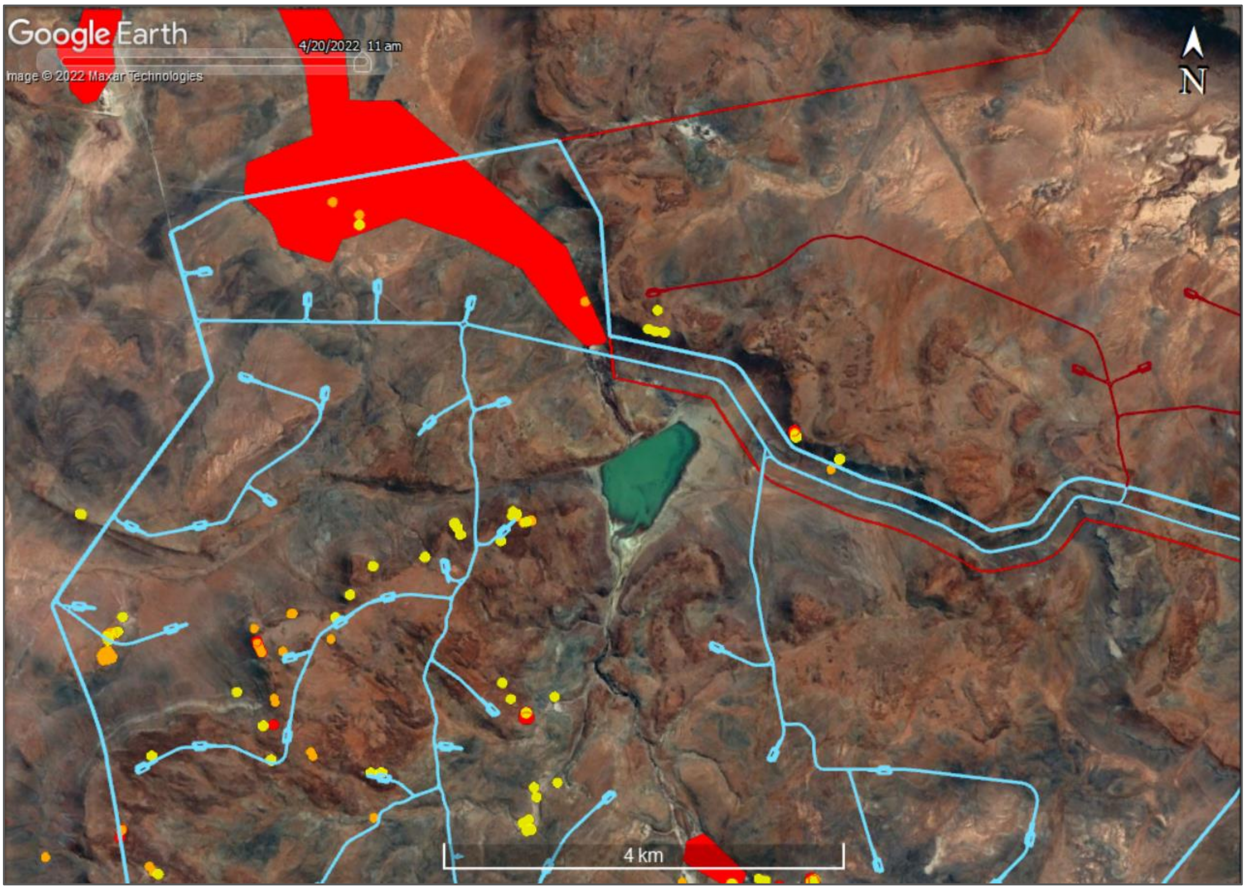


Figure 7-102: Enlarged sensitivity map showing the north-western part of Figure 7-101. Key as per Figure 7-101.

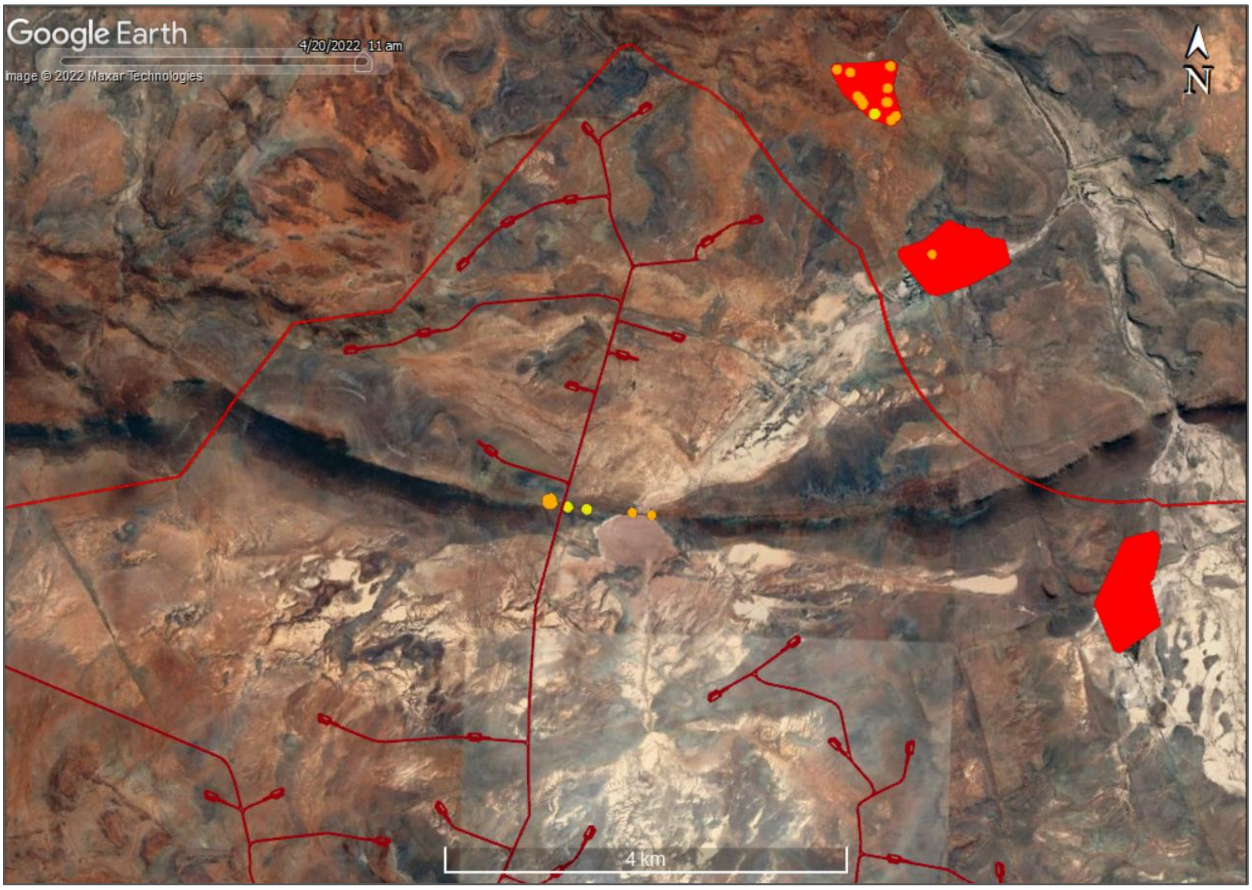


Figure 7-103: Enlarged sensitivity map showing the north-eastern part of Figure 7-101. Key as per Figure 7-101

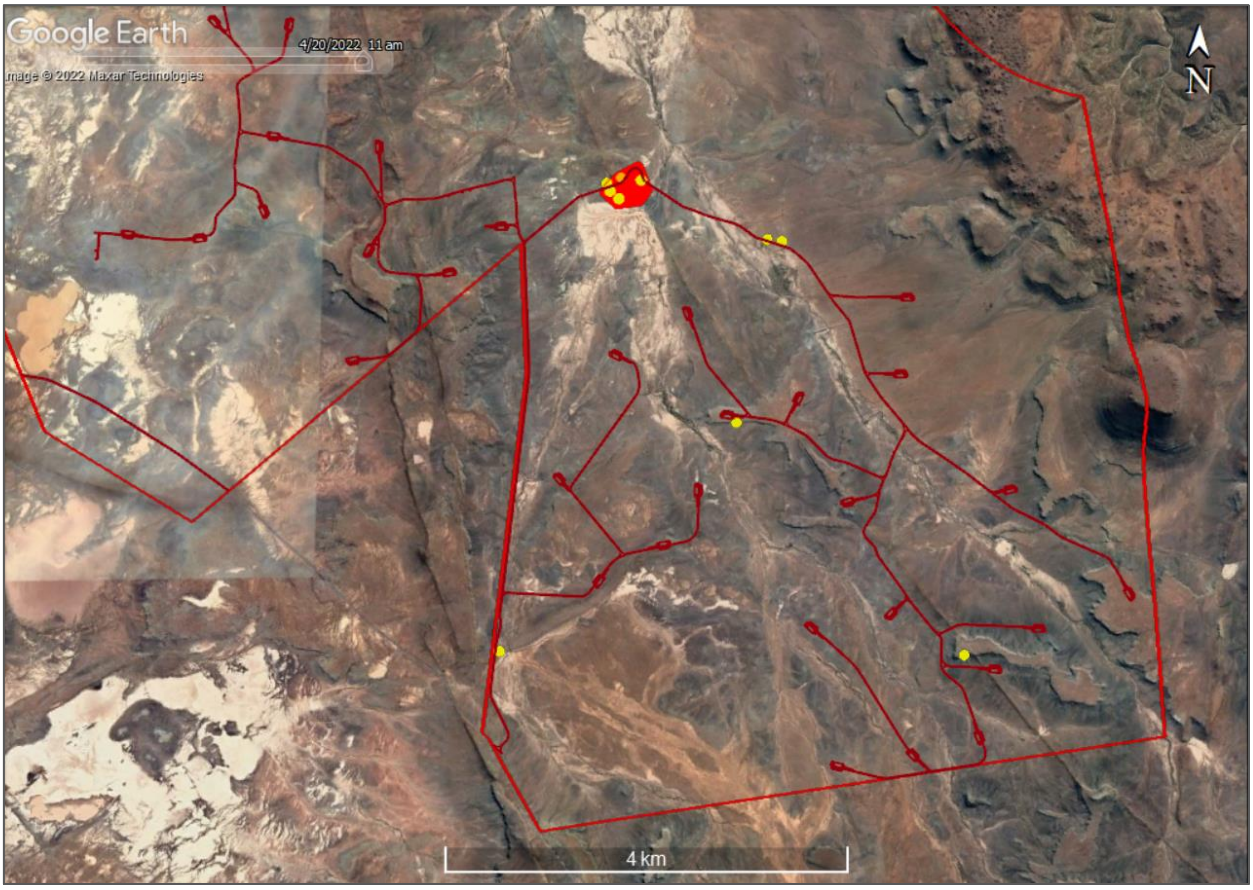


Figure 7-104: Enlarged sensitivity map showing the south-eastern part of Figure 7-101. Key as per Figure 7-101

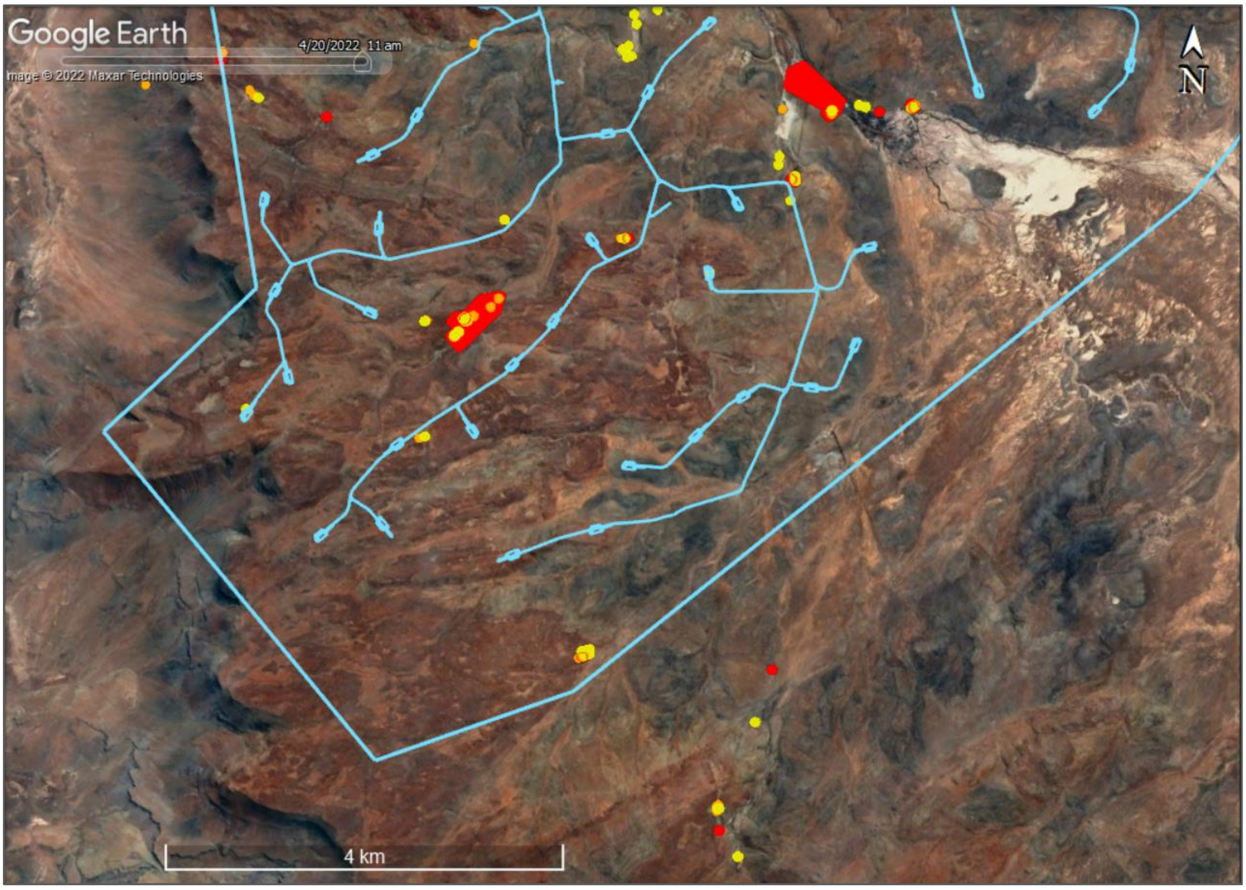


Figure 7-105: Enlarged sensitivity map showing the south-western part of Figure 7-101. Key as per Figure 7-101.

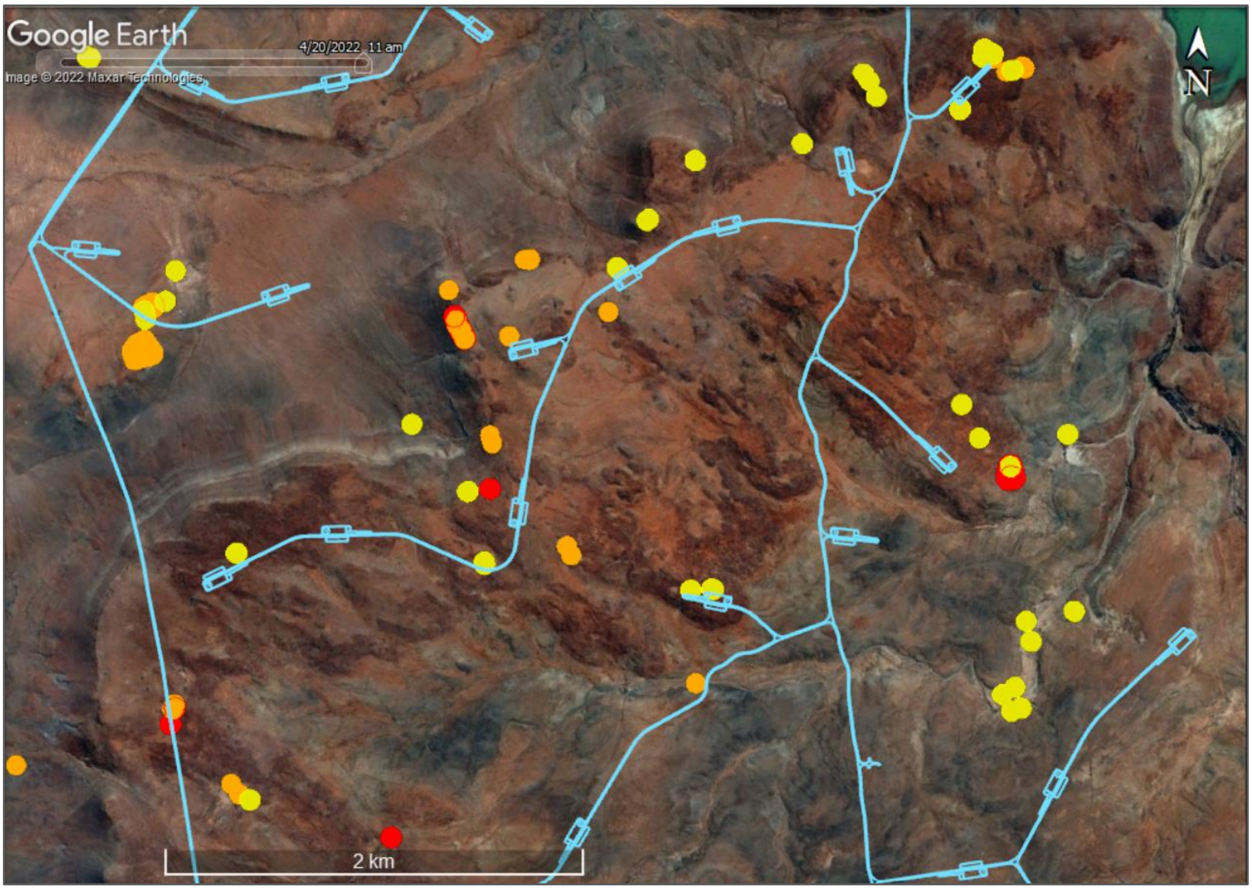


Figure 7-106: Enlarged sensitivity map showing the central part of HL03 where the ridge containing the main cluster of rock engravings lies (diagonally from southwest to northeast in this map). Key as per Figure 7-101.

7.9.2.2 Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Any uncontrolled impacts to standing heritage structures are unacceptable. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many publicly accessible vantage points is undesirable.

7.9.3 Impact Assessment and Mitigation

In summary, heritage resources are highly likely to be impacted by the proposed Wind Farms, as is the cultural landscape. All will be impacted during the construction phase but impacts to the cultural landscape will continue throughout the lifetime of the project.

These impacts have been identified and rated by ASHA (2022) in the following tables, per phase, noting that the construction phase impacts differ between Hoogland 3 and Hoogland 4.

7.9.3.1 Construction Phase: Hoogland 3

Table 7-88: Construction: Hoogland 3 - Impacts to archaeological resources

Issue	Impacts to archaeological resources
Description of Impact	
Archaeological materials can be damaged or destroyed during grubbing and excavation of foundations and trenches.	
Type of Impact	Direct

Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Low
Duration	Permanent	Permanent
Extent	Local	Site
Consequence	High	Low
Probability	Definite / Continuous	Definite / Continuous
Significance	High -	Low -
Degree to which impact can be reversed	Low. Heritage resources cannot be replaced or recreated.	
Degree to which impact may cause irreplaceable loss of resources	High. Heritage resources are unique and irreplaceable.	
Degree to which impact can be mitigated	High. Archaeological heritage can very easily be sampled and/or mapped as needed, although in the case of historical sites this can be more time-consuming.	
Mitigation actions		
The following measures are recommended:	• Pre-construction survey of the layout followed by micrositing or mitigation as appropriate or possible. • Temporary protective fencing or No-Go signs where buffers are transgressed.	
Monitoring		
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint.	

Table 7-89: Construction: Hoogland 3 - Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial equipment and structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Permanent	Medium-term
Extent	Local	Local
Consequence	High	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	High -	Medium -
Degree to which impact can be reversed	Medium. In terms of the landscape, once construction is complete all the equipment would be removed but the turbines and related structures would remain present. However, almost all noise and activity would cease. In terms of the rock art landscape, some sites may be missing (although mitigated) and cannot be replaced.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa.	
Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.	

Mitigation actions	
The following measures are recommended:	• Keep construction duration as short as possible. • Minimise landscape scarring. • Rehabilitate any areas not required during operation. • Where road surfacing is required use low contrast materials where possible. • Microsite to reduce impacts to the rock art landscape.
Monitoring	
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint and that engravings to be retained are not impacted.

7.9.3.2 Construction Phase: Hoogland 4

Table 7-90: Construction: Hoogland 4 - Impacts to archaeological resources

Issue	Impacts to archaeological resources	
Description of Impact		
Archaeological materials can be damaged or destroyed during grubbing and excavation of foundations and trenches.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Medium	Low
Probability	Definite / Continuous	Conceivable
Significance	Medium -	Very Low -
Degree to which impact can be reversed	Low. Heritage resources cannot be replaced or recreated.	
Degree to which impact may cause irreplaceable loss of resources	High. Heritage resources are unique and irreplaceable.	
Degree to which impact can be mitigated	High. Archaeological heritage can very easily be sampled and/or mapped as needed, although in the case of historical sites and rock engravings this can be more time-consuming and/or expensive.	
Mitigation actions		
The following measures are recommended:	• Pre-construction survey of the layout followed by micrositing or mitigation as appropriate or possible. • Temporary protective fencing of sites whose buffers are transgressed.	
Monitoring		
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint and that all required mitigation has been completed.	

Table 7-91: Construction: Hoogland 4 - Impacts to built heritage

Issue	Damage to or destruction of built heritage resources
Description of Impact	

Built heritage resources can be physically harmed during construction, either to make way for development or accidentally.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Medium	Low
Probability	Conceivable	Unlikely / improbable
Significance	Low -	Insignificant
Degree to which impact can be reversed	Low. Heritage resources are unique and cannot be replaced, although repairs can be made in the event of minor damage.	
Degree to which impact may cause irreplaceable loss of resources	High. Heritage resources are unique and cannot be replaced.	
Degree to which impact can be mitigated	High. Road footprints can be adjusted to avoid sensitive features.	
Mitigation actions		
The following measures are recommended:	Ensure that the existing road between the structures is followed and that necessary upgrades do not put the structures at risk of damage.	
Monitoring		
The following monitoring is recommended:	ECO to ensure that enough space exists between roads and built structures and monitor earthmoving at Waypoints 1781-1791.	

Table 7-92: Construction: Hoogland 4 - Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial equipment and structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	Medium. Once construction is complete all the equipment would be removed but the turbines and related structures would remain present. However, almost all noise and activity would cease.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa.	

Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.
Mitigation actions	
The following measures are recommended:	• Keep construction duration as short as possible. • Minimise landscape scarring. • Rehabilitate any areas not required during operation. • Where road surfacing is required use low contrast materials where possible.
Monitoring	
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint.

7.9.3.3 Operational Phase: Hoogland 3 and 4

Table 7-93: Operation: Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	High. Once the facility is decommissioned and the land rehabilitated, the impacts would be almost entirely gone.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa. With decommissioning the landscape could be restored.	
Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.	
Mitigation actions		
The following measures are recommended:	• No maintenance activities to take place outside of the authorised footprint and all vehicles to remain on authorised roads and tracks. • If approved by the CAA at the time, make use of a warning system in which the lights stay off at night until needed. If not yet approved, then investigate such a system and retrofit if/when approval is gained.	
Monitoring		

The following monitoring is recommended:	No specific monitoring other than to ensure the above measure is complied with.

7.9.3.4 Decommissioning Phase: Hoogland 3 and 4

Table 7-94: Decommissioning: Impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Description of Impact		
Intrusion into the rural landscape of industrial equipment and structures.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	Medium. Once decommissioning is complete all the equipment would be removed and the site would be rehabilitated. Although it would likely take hundreds of years for the landscape to fully recover, the general pre-construction sense of place would be restored.	
Degree to which impact may cause irreplaceable loss of resources	Medium. Every landscape setting is unique but similar landscapes do occur widely in the central interior of South Africa.	
Degree to which impact can be mitigated	Low, since concealing the activity and structures is not feasible.	
Mitigation actions		
The following measures are recommended:	• Keep decommissioning duration as short as possible. • Ensure effective rehabilitation of all areas.	
Monitoring		
The following monitoring is recommended:	ECO to ensure that construction activities remain in approved footprint.	

7.9.4 Cumulative Impact

The following cumulative impacts have been identified and rated by ASHA (2022).

7.9.4.1 Construction Phase: Hoogland 3

Table 7-95: Cumulative impact: Hoogland 3 - Construction phase Impacts to archaeological resources

Issue	Impacts to archaeological resources	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Very Low -

Table 7-96: Cumulative impact: Hoogland 3 - Construction phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.

Nature of cumulative impacts	Negative	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

7.9.4.2 Construction Phase: Hoogland 4

Table 7-97: Cumulative impact: Hoogland 4 - Construction phase Impacts to archaeological resources

Issue	Impacts to archaeological resources	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Very Low -

Table 7-98: Cumulative impact: Hoogland 4 - Construction phase impacts to built heritage

Issue	Damage to or destruction of built heritage resources	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Very Low -

Cumulative impact: Hoogland 4 - Construction phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

7.9.4.3 Operational Phase: Hoogland 3 and 4

Table 7-99: Cumulative impact: Operational phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

7.9.4.4 Decommissioning Phase: Hoogland 3 and 4

Table 7-100: Cumulative impact: Decommissioning phase impacts to the cultural landscape

Issue	Visual intrusion into the cultural landscape and disturbance of the setting and context of heritage resources.	
Nature of cumulative impacts	Negative	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

7.9.5 No-Go Alternative

Due to the comprehensive iterative design process that has been undertaken to inform the Hoogland 3 and Hoogland 4 wind farm layouts and their associated infrastructure, no site or layout alternatives will be assessed. However, it is required that the 'no-go' alternative be assessed. The 'no-go' alternative is the option of not constructing the project where the status quo of the current farming activities on the site would prevail.

Not constructing the facilities means that the study area would remain undeveloped and the status quo would be retained. The impacts that would occur would be as per the existing impacts described above in the paragraph above. Importantly, electricity generation would not take place, which means that this benefit would be lost to society. Although the heritage impacts with implementation would be greater than the existing impacts, the loss of socio-economic benefits is more significant and suggests that the No-Go option is less desirable.

7.9.6 Conclusion and Recommendations

The Hoogland Find Farm Projects study area contains many heritage resources, the vast majority of which are archaeological. In general, the iterative process followed in the development of the Hoogland 3 and Hoogland 4 Wind Farm layouts has meant that, aside from the unavoidable impacts to the wider cultural landscape, impacts to heritage resources are minimal. For Hoogland 3, however, there are still a number of impacts that will require further consideration and key recommendations in this regard are included in Section 8.3. It is also notable that Hoogland 3 has a greater chance of further sites being discovered within the layout at a later stage.

Given that the Southern Cluster Wind Farms lie wholly in within a REDZ and that other wind farms have been approved in the area, the proposed land use is deemed acceptable because renewable energy facilities are to be expected in the future. The various other individual impacts highlighted in Section 7.9.3 above can easily be dealt with through micrositing or archaeological mitigation as appropriate. It is therefore the opinion of the heritage specialist that the proposed Hoogland 3 Wind Farm and Hoogland 4 Wind Farm should both be authorised in full, but subject to the mitigation recommendations in Section 8.3.

7.10 Palaeontology

This section provides a short summary of the palaeontology specialist report compiled by John Almond of Natura Viva which is available in *Appendix C13: Palaeontology*.

7.10.1 Baseline Description

As reported by Natura Viva (2022), the country here is semi-arid with sparse *bossieveld* vegetation and few trees, except along larger water courses (Figure 7-107). Rugged, rocky upland areas, notably in the central and southern Hoogland 3 Wind Farm, western Hoogland 4 Wind Farm project areas, are largely centered on major dolerite intrusions and associated resistant-weathering, baked country rocks within their extensive metamorphic aureoles. Examples include the major, west-east trending dolerite ridge rising up to 1600 m amsl., including Uitkykskop and Rooirant, that runs across the northern sector of the Hoogland 4 Wind Farm project area, the undulating Platfontein – Swartrug plateau of dolerite and metasediments in the southern portion of the Hoogland 3 Wind Farm project area whose south-western rim rises up to 1570 m amsl. Extensive, low-lying, sandy to gravelly *vlaktes* at around 1360 to 1400 m with very little bedrock exposure make up most of the remainder of the project area (e.g. Karoo Plaats, Groenbergs Vlakte). The wider Southern project area is largely drained to the north via the Sakrivier and its various tributaries (e.g. Rietfontein se Rivier).

Figure 7-107: Extensive gravel-strewn vlaktes in the northern sector of the HL04 project area (Farm RE/37) with low doleritic hills to the west in the background (left), Undulating, low-relief terrain in the south-western sector of the WEF project area (Farm 4/28) with pervasive cover by sandy to gravelly soils and grassy karroid bossieveld vegetation (right)

The geology of the combined Hoogland 3 Wind Farm, Hoogland 4 Wind Farm and Hoogland Southern Grid Connection project area is covered by 1: 250 000 geology sheets 3122 Victoria West and 3222 Beaufort West (Council for Geoscience, Pretoria), with short sheet explanations by Le Roux & Keyser (1988) and Johnson & Keyser (1979) respectively (Figure 7-108).

(N.B. The geological context for the eastern sector of the Hoogland Southern Grid Connection project area which overlaps with the Red Cap Nuweveld WEF and grid connection project areas has already been covered by Almond (2020a-c, 2021 and will not be repeated here).

The majority of the combined Wind Farm and Grid Connection project area is underlain by continental (fluvial, lacustrine) sediments of the Lower Beaufort Group (Karoo Supergroup) of late Middle Permian to early Late Permian age (c. 262-257 Ma = million years ago (Johnson et al. 2006) that are assigned to the Teekloof Formation (Figure 5-37). The basal, sandstone-rich Poortjie Member is largely restricted to the northern half of the Hoogland 3 Wind Farm project area which features stepped terrain with low kranzes of yellowish-weathering channel sandstones displaying erosive, gullied bases and well-developed intraformational breccia-conglomerates. The overlying Hoedemaker Member of the Teekloof Formation is dominated by readily-weathered mudrocks with only a few, thin channel sandstone units and therefore generally underlies low-relief terrain, as mapped in the southern portion of the Hoogland 3 Wind Farm project area as well as most of the Hoogland 4 Wind Farm and Grid Connection project areas towards the east. Regional Early Jurassic igneous intrusion seems to have occurred preferentially into the Hoedemaker Member bedrocks and has generated an extensive network of dolerite sills and dykes, some of considerable volume, assigned to the Karoo Dolerite Suite of Early Jurassic age (c. 183 Ma) (McCarthy & Rubidge 2005, Johnson et al. 2006, Duncan & Marsh 2006). A large portion of the Hoedemaker Member country rocks have been intensely baked to vuggy (i.e. containing rounded hollows or vugs) hornfels and quartzite and otherwise altered by Karoo-age magmatism and associated metasomatism. It should be emphasized that the mapping of the various members within the Teekloof Formation in the region to the south of Loxton is often ambiguous and in need of revision.

Substantial thicknesses of gravelly and sandy to silty Late Caenozoic alluvium are associated with major drainage lines within the combined Hoogland Wind Farm project area (pale yellow areas in Figure 7-108) and also cover large portions of lower-lying terrain here. Older alluvial deposits, especially in areas overlying dolerite, have often been partially calcretised. In turn, gravelly colluvial and eluvial deposits dominated by sandstone, hornfels, quartzite and dolerite rubble mantle plateau areas and most hillslopes. In general, topographic relief is subdued within most of the project area and exposure levels of potentially-fossiliferous Beaufort Group sediments, with few local exceptions, are correspondingly low to very low.

Representative exposures of the main rock units occurring within the site can be found in the specialist report in *Appendix C13: Palaeontology*.

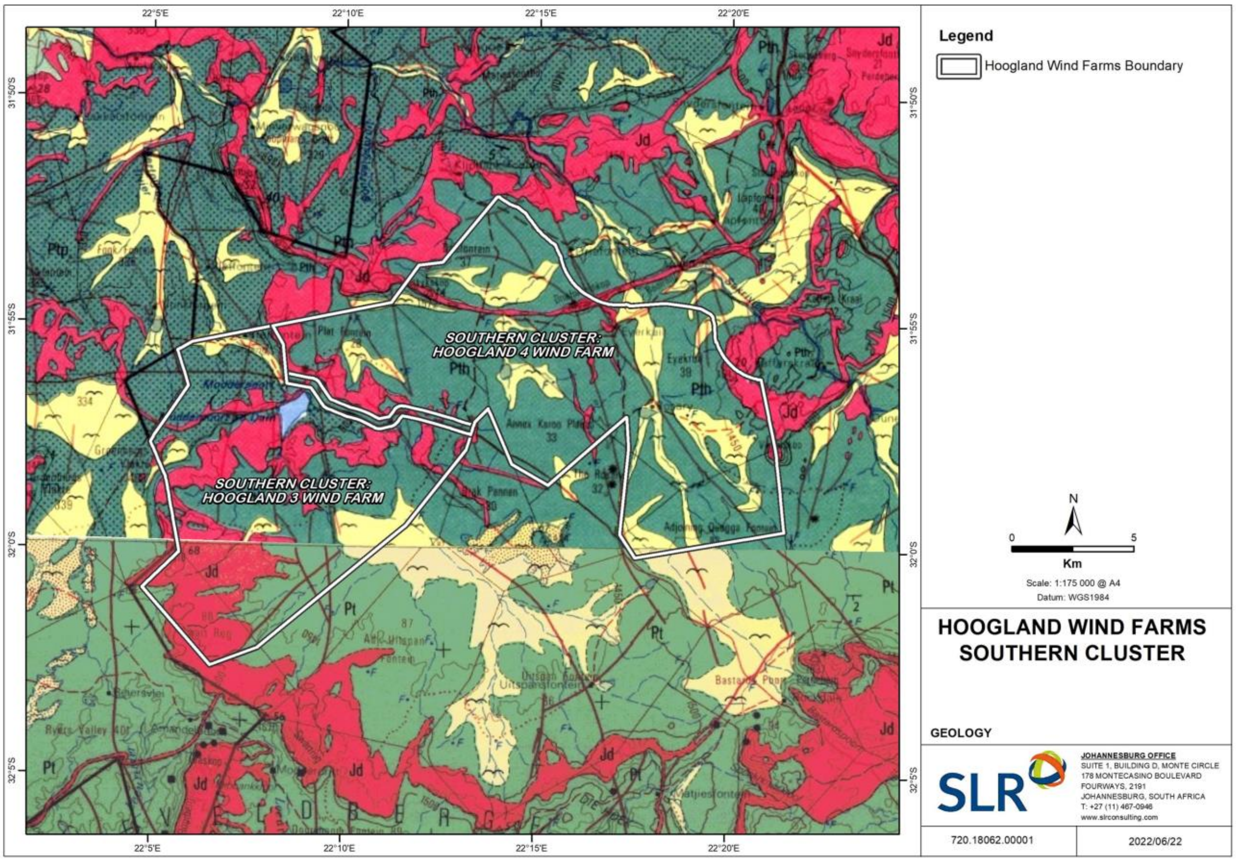


Figure 7-108: Extract from adjoining 1: 250 000 geology sheets 3122 Victoria West (above) and 3222 Beaufort West (below) (Council for Geoscience, Pretoria) showing the location of the Hoogland 3 and 4 WEF project areas (white polygons). Scale bar = 5 km.

The main geological units represented on the geological map include:

- Middle Permian Abrahamskraal Formation (Lower Beaufort Group) – pale blue (Pa).
- Middle to Late Permian Teekloof Formation (Lower Beaufort Group) – green / blue-green. On the Victoria West sheet this formation (Pt) is differentiated into the Ptp = Poortjie Member (Pt, stippled), Hoedmaker Member (Pth) and Oukloof Member (Pto, dark green) (Note the outcrop areas of these members are probably in need of revision). Small black symbols refer to historical fossil sites, very few of which are recorded within the Hoogland project areas.
- Early Jurassic Karoo Dolerite Suite – red (Jd)
- Late Caenozoic alluvium – yellow with "flying bird" symbol
- *N.B.* Most younger superficial deposits are not mapped at 1: 250 000 scale but these obscure the older bedrocks over most of the WEF and grid project area.

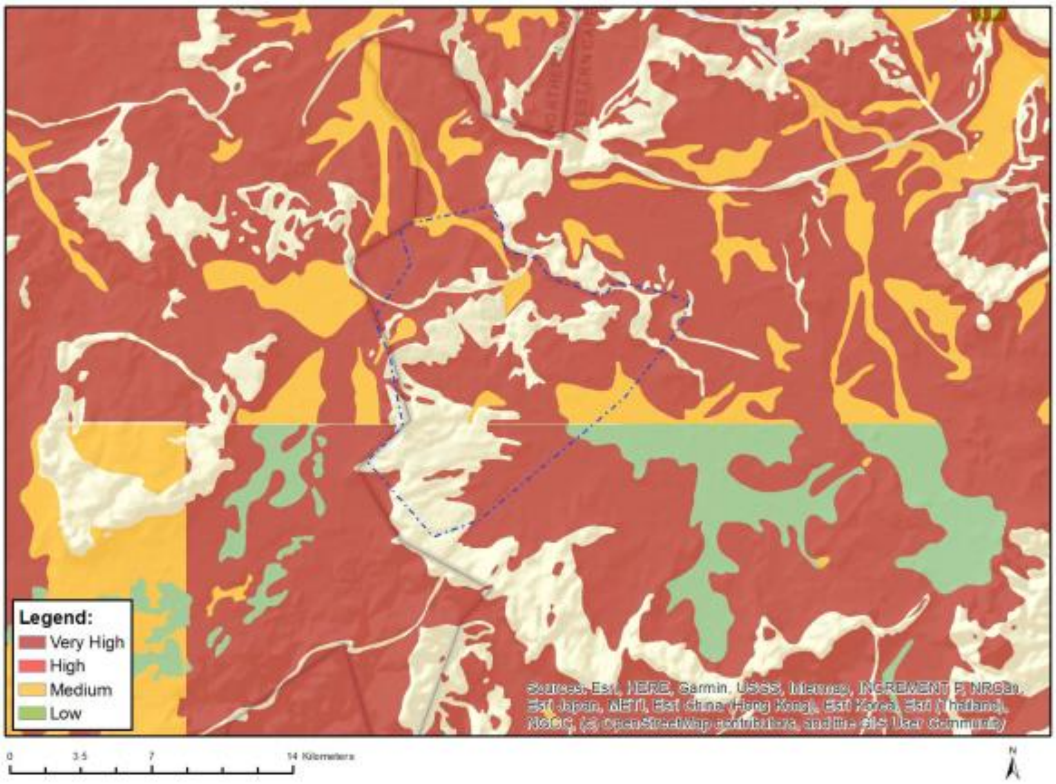
7.10.2 Site Sensitivity

The project is provisionally rated as of Very High Palaeosensitivity (SAHRIS website, DFFE Screening Tool) due to the rich Permian fossil assemblages recorded from the Lower Beaufort Group in the Main Karoo Basin (Figure 7-109). However, a three-week reconnaissance-level palaeontological heritage survey by Dr John Almond from NaturaViva between April and May 2021, showed few well-preserved fossils of scientific and conservation interest. This is due to:

a) poor levels of bedrock exposure associated with generally low relief and pervasive cover by largely unfossiliferous superficial sediments;

b) a high intensity of dolerite intrusion which has “sterilized” large volumes of potentially fossiliferous bedrocks through thermal metamorphism, leaching and secondary mineralisation, while the large dolerite outcrop areas in the uplands are completely fossil-free; and

c) highly impoverished fossil biotas associated with the catastrophic end Middle Permian Mass Extinction Event of 260 million years ago.



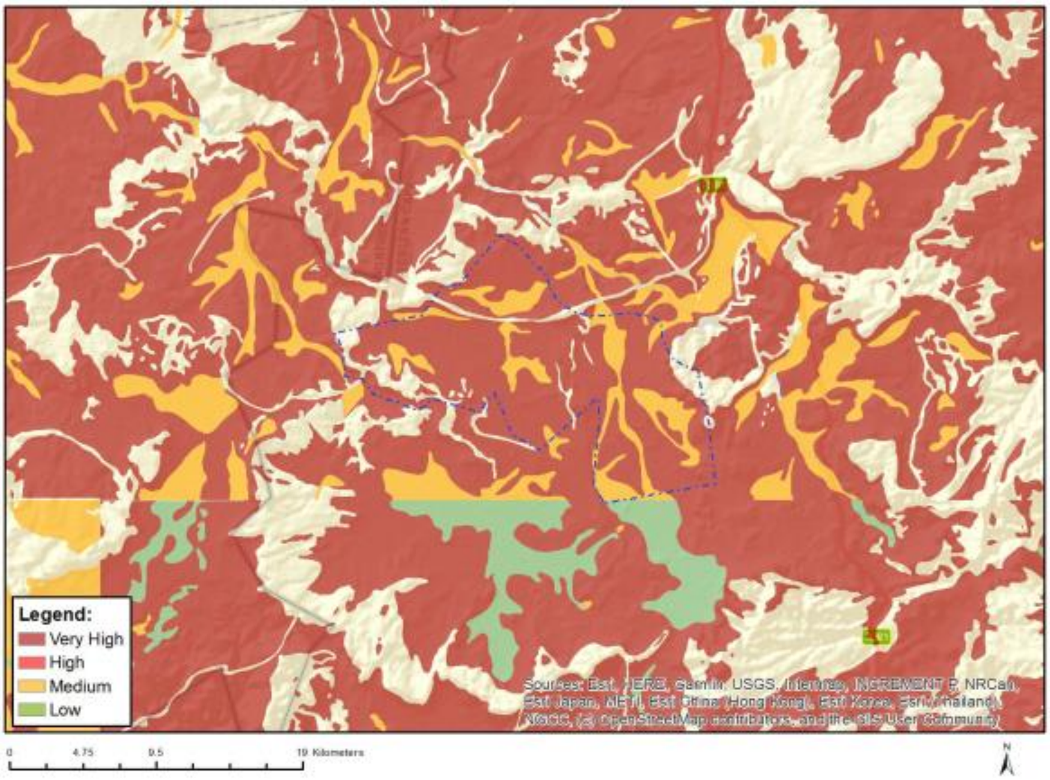


Figure 7-109: Map of relative Palaeontological theme sensitivity for Hoogland 3 Wind Farm (top) and Hoogland 4 Wind Farm (bottom). High sensitivity shown in red.

The majority of fossil sites recorded within the project area are (1) of low scientific or conservation value and (2) lie well outside (> 20 m) the project footprint and therefore do not warrant mitigation (see data table in Appendix 2 of the Specialist Report, *Appendix C13: Palaeontology* of this report).

With the minor exceptions of fossil site numbers 209, 210 and 212, all of which can be readily mitigated in the pre-construction phase if necessary, the proposed layouts of the Hoogland 3 Wind Farm and Hoogland 4 Wind Farm do not directly or indirectly threaten any of the known fossil sites here. Two concentrations of fossil sites were identified within the Hoogland Southern Wind Farm Cluster project area:

- The **Hoogland Fossil Site 1** on Farm 1/39 (Hoogland 4 Wind Farm and Hoogland Southern Grid Connection project areas) contains numerous examples of small tetrapod burrow casts, a few containing poorly-preserved skeletal remains, as well as occasional better preserved isolated skulls and semi-articulated post-cranial material of medium-sized dicynodonts. The great majority of the site lies well outside the project infrastructure footprint and should be protected within the standard riverine ecological buffer zone (Figure 7-110). A few sites of fairly low scientific interest (*viz*. sites 209, 210, 212) lie close to the proposed access road footprint (pale blue line) and should be considered for professional mitigation (recording / sampling) in the pre-construction phase.

- The **Hoogland Fossil Site 2** comprises a high concentration of articulated and semi-articulated skeletal fossils and associated burrow casts of small-bodied tetrapods along the bed and banks of a shallow stream on the northern portion of Farm 4/28 (Hoogland 3 Wind Farm and Hoogland Southern Grid Connection project areas). The site should be protected within the standard riverine ecological buffer zone (Figure 7-111). A proposed access road crossing the stream will not directly impact the known fossil sites here, all of which lie ≥20m from the project footprint (Figure 7-112), and so no specific palaeontological mitigation is recommended for this site.

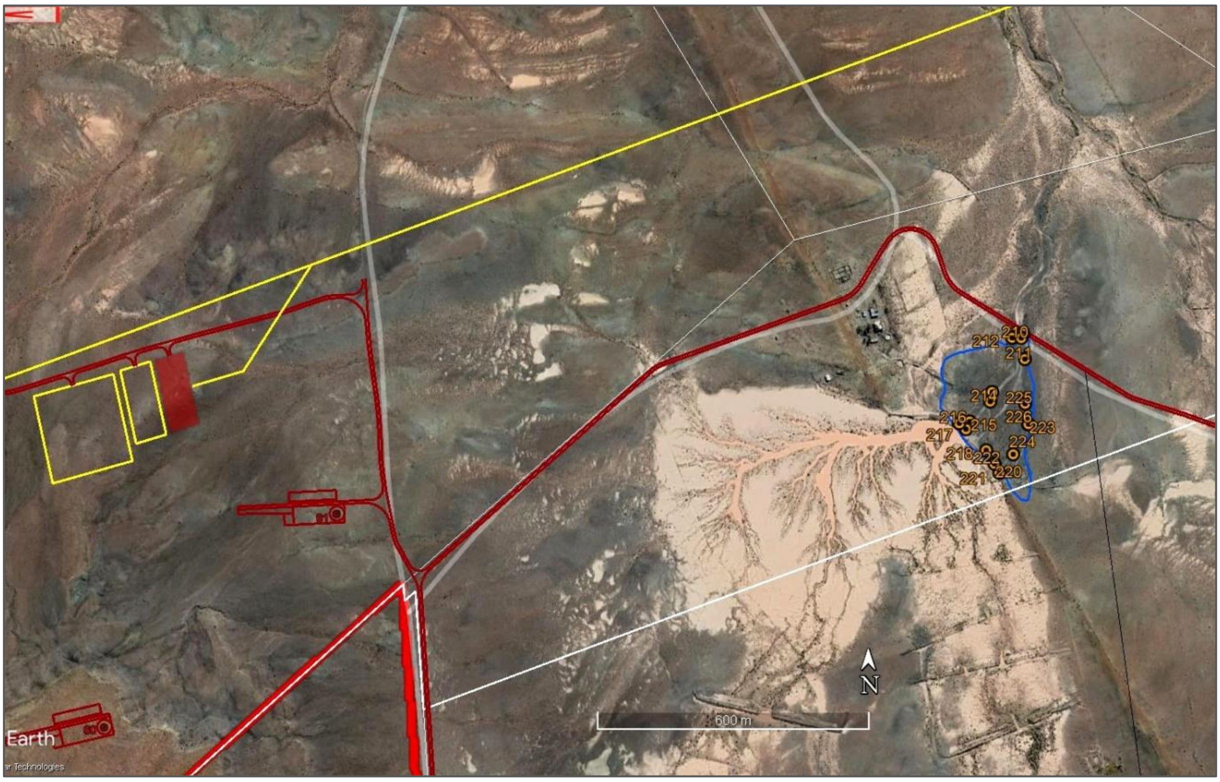


Figure 7-110: Hoogland Fossil Site 1 (dark blue polygon) on Farm 1/39 (Hoogland 4 Wind Farm project area) includes numerous skeletal remains and burrow casts of small tetrapods in an extensive gullied exposure of Hoedemaker Member mudrocks in a dam overflow area close to Rosary farmstead. The majority of the fossil sites lie >20 from the project infrastructure footprint. A few sites of fairly low scientific interest (209, 210, 212) lie close to the proposed access road footprint (dark red line) and should be considered for professional mitigation (recording / sampling) in the pre-construction phase.

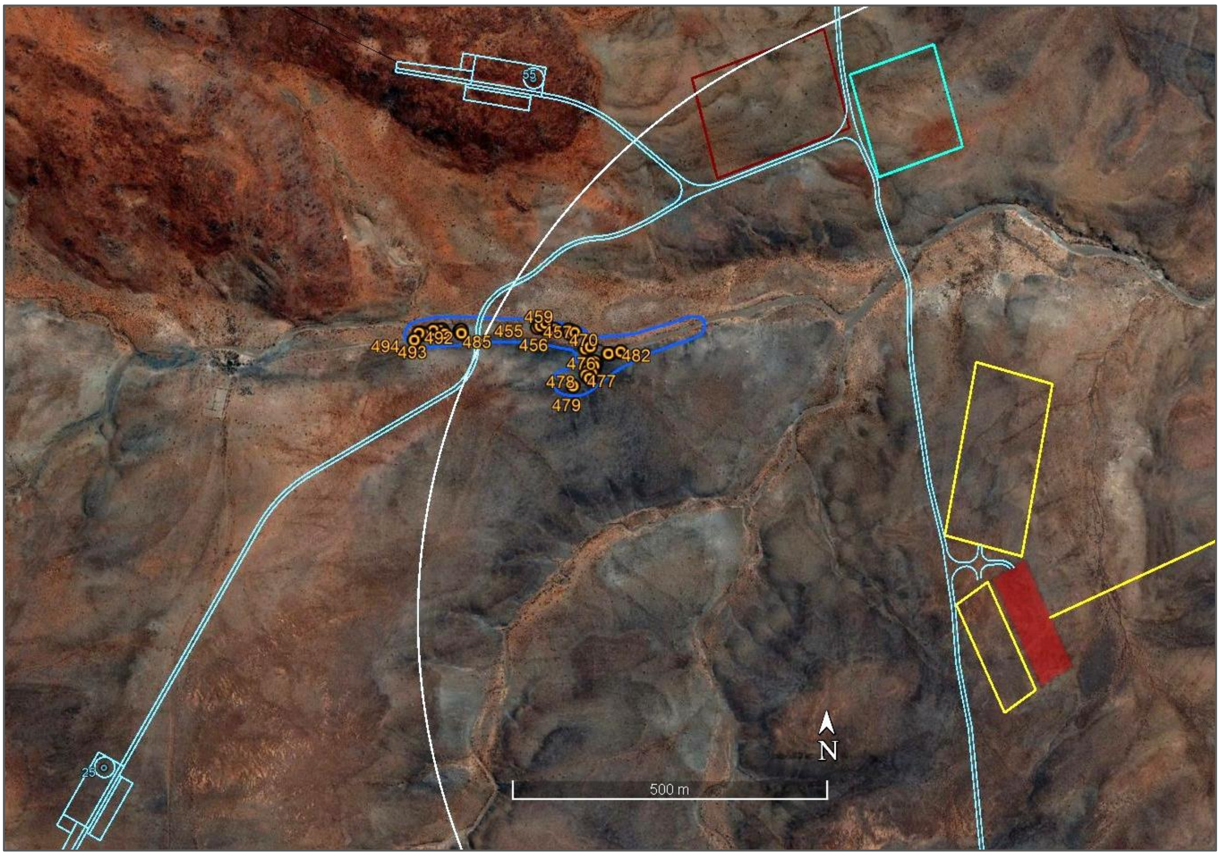


Figure 7-111: Hoogland Fossil Site 2 (dark blue polygon) on the northern portion of Farm 4/28 (Hoogland 3 Wind Farm project area) includes numerous poorly-preserved skulls, skeletons and burrow casts of small-bodied tetrapods within baked mudrocks of the Hoedemaker Member exposed along a shallow stream. The site is therefore of palaeoecological and palaeoethological interest. However, none of the recorded fossils lies < 20 m from the WEF project footprint (proposed road shown as pale blue line) and so no mitigation is required here.

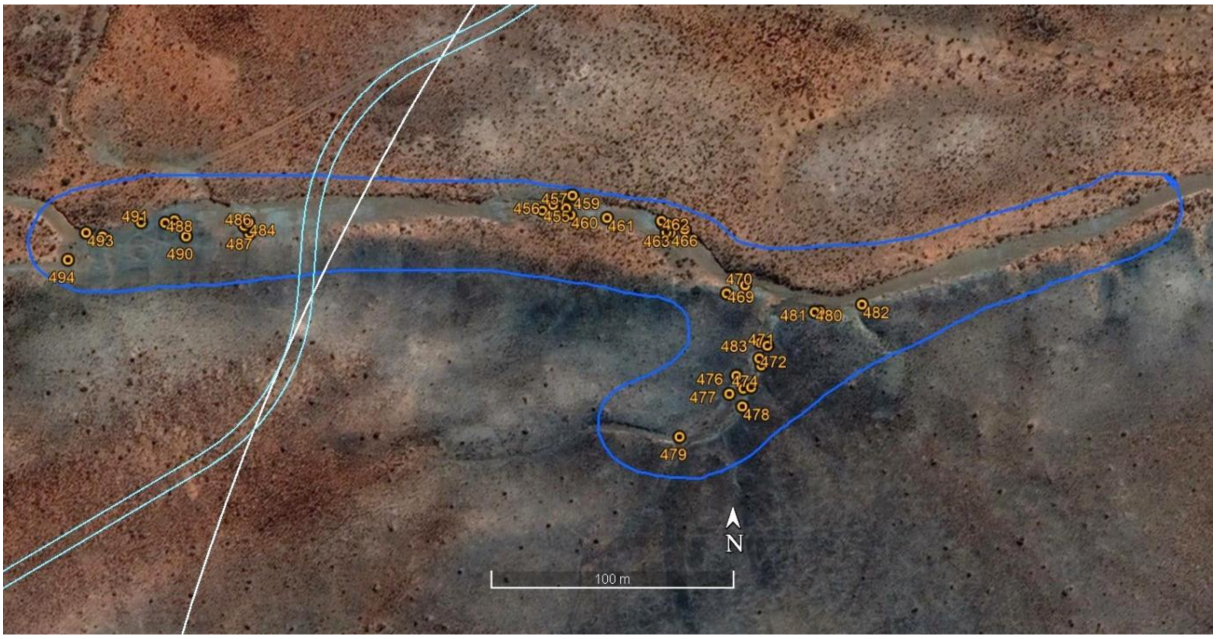


Figure 7-112: More detailed view of Fossil Site 2, none of the recorded fossils lies < 20 m from the WEF project footprint (proposed road shown as pale blue line) and so no mitigation is required here.

7.10.3 Impact Assessment and Mitigation

The following palaeontological impacts have been identified and rated by Natura Viva (2022).

Given the similar geological (and hence palaeontological) setting for both developments, the results of their separate impact assessments are also very similar. Fossils of some sort occur widely within almost all sedimentary rocks, but most of them are low scientific or conservation value or are very widely distributed (e.g. many microfossils, trace fossils). This assessment therefore focuses on fossil heritage that is of potentially high scientific and / or conservation interest and on the construction phase of the developments where impacts are potentially most damaging.

7.10.3.1 Construction Phase

Table 7-101: Construction: Loss or degradation of local palaeontological heritage resources of scientific and / or conservation value

Issue: Loss or degradation of local palaeontological heritage resources of scientific and / or conservation value		
Description of Impact		
Damage, disturbance, destruction or sealing-in of legally protected, scientifically valuable fossil heritage at or beneath the ground surface within the Wind Farm project footprint, mainly due to ground clearance and excavations for wind turbines, hard standing areas, access / service roads, underground cabling and pylon footings.		
Type of Impact	Type of Impact	
Nature of Impact	Nature of Impact	
Phases	Phases	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very Low
Duration	Permanent	Permanent
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Possible
Significance	Low -	Very Low -
Mitigation actions		
Degree to which impact can be reversed	Impacts to palaeontological heritage are generally irreversible.	
Degree to which impact may cause irreplaceable loss of resources	Low. Most fossils recorded from the project area are of widely occurring forms within the outcrop areas of the formations concerned.	
Degree to which impact can be mitigated	Moderate. Most recorded fossil sites can be effectively mitigated by a professional palaeontologist in the pre-construction phase (recording / collection). Newly exposed fossils can be mitigated through a Chance Fossil Finds Procedure. However, residual impacts following mitigation may be locally high, given the unavoidable difficulties of identifying and sampling fossils from on-going construction phase excavations and site clearance.	
Monitoring		
The following monitoring is recommended:	The Environmental Control Officer (ECO) / Environmental Site Officer (ESO) responsible for the development should be made aware of the possibility of important fossil remains (vertebrate bones, teeth, burrows, petrified wood, plant-rich horizons etc., such as those illustrated in this report) being found or unearthed during the construction phase of the development. Monitoring for fossil material of all major surface clearance and deeper (>1m) excavations	

	by the ECO/ESO on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded and reported at the earliest opportunity to Heritage Western Cape for recording and sampling by a professional palaeontologist (Contact details: Heritage Western Cape. 3rd Floor Protea Assurance Building, 142 Longmarket Street, Green Market Square, Cape Town 8000. Private Bag X9067, Cape Town 8001. Tel: 021 483 5959 Email: ceoheritage@westerncape.gov.za). An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work. Minimum Standards for palaeontological heritage reports and fieldwork have been specified by SAHRA (2013) and Heritage Western Cape (2021).

7.10.4 Cumulative Impacts

The following cumulative impact has been identified and rated by Natura Viva (2022).

Table 7-102: Cumulative impact: Loss or degradation of local palaeontological heritage resources of scientific and / or conservation value

Issue: Loss or degradation of local palaeontological heritage resources of scientific and / or conservation value		
Nature of cumulative impacts	Potential loss of a significant fraction of scientifically important, rare or unique, fossil heritage within the Palaeozoic bedrocks and Late Caenozoic superficial sediments in the Upper Karoo south of Loxton.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.10.5 No-Go Alternative

The impact significance of the No-Go Alternative considers that even without development fossils would still be destroyed by natural weathering and erosion. Other factors such as current farming activities within the project area (viz. small stock farming) as well as potential illegal fossil collection are considered to have a negligible effect on local palaeontological resources. In the case of the No-Go Alternative (i.e. no Wind Farm development), the likely loss of local heritage resources through construction activities (negative impact) would be avoided while potential improvements in palaeontological understanding through professional mitigation - i.e. recording and collection of palaeontological material and data (positive impacts) - would be lost. The slow destruction of fossils exposed at the surface through natural weathering and erosion would continue, while new fossils would be revealed and prepared-out for scientific study. It is concluded that the No-Go alternative would have a neutral impact on palaeontological heritage.

7.10.6 Conclusion and Recommendations

Despite the Very High provisional palaeosensitivity assigned to large parts of the combined project area for the proposed Hoogland 3 and Hoogland4 Wind Farms, desktop and field data suggest that, in practice, the area is of low palaeosensitivity overall, with only a sparse, and largely unpredictable, scatter of fossil sites of scientific and / or conservation value.

In terms of palaeontological heritage resources, the proposed Hoogland 3 and Hoogland 4 Wind Farm developments are assigned a similar overall impact significance rating (Construction Phase). No significant further impacts on fossil heritage resources are anticipated in the planning, operational and decommissioning phases. The No-Go Alternative will probably have a neutral impact.

The proposed Hoogland Wind Farms developments are not fatally flawed. On condition that the recommended mitigation measures are included within the EMPr and implemented in full during the construction phase, there are no objections on palaeontological heritage grounds to their authorisation. These mitigation measures include cross-checking of the final, authorised layout of the projects against the available fossil database and other relevant resources (e.g. satellite imagery, geological maps) by the palaeontological specialist who should make recommendations for pre-construction phase mitigation, if any proves necessary; and inclusion of a Chance Fossil Finds Protocol as detailed in Appendix 4 of the Specialist report found in *Appendix C13: Palaeontology* of this report.

7.11 Noise

This section provides a short summary of the noise specialist report compiled by Morné de Jager of Enviro-Acoustic Research (EARES) which is available in *Appendix C14: Noise.*

7.11.1 Baseline Description

According to EARES (2022), and of relevance to the noise study, the natural veldt has been impacted due to anthropogenic activities related to sheep farming, with significant changes to the natural veldt closer to the farm dwellings and structures. Most of the surface area is well vegetated with shrubs, succulent shrubs, grasses and sedges associated with the Karoo, with a number of significant trees closer to the farm dwellings. The topography of the site is characterised by undulating hills and the project is situated at approximately 1,400 to 1,500 meters above sea level (mamsl). There are little natural features that could act as noise barriers considering practical distances at which sound propagates from turbines. Most dwellings featuring in the vicinity of the project focus area are scattered in a heterogeneous fashion, typical of a sub-urban/rural area. Most of the surrounding areas can be considered wilderness with tourism (and game farming) as well as agricultural activities (sheep farming).

EARES (2022) notes that certain conditions may influence sound propagation, these include natural sounds characteristic to rural areas such as those from insects and birds, with noises such as wind flowing through vegetation increasing as wind speed increases. In addition, factors such as the season (e.g. dry or no leaves versus green leaves), the type of vegetation (e.g. grass, deciduous trees), the vegetation density and the total vegetation surface all determine both the sound level as well as spectral characteristics. In addition, this type of noise has a broad frequency spectrum and is of natural origin, and therefore a good candidate to mask wind turbine noise. Other, environmental factors that impact on sound propagation includes wind, temperature and humidity. The noise monitoring undertaken in September 2021 therefore measured sound levels and the types of noise heard when on site, as well as temperature and humidity both on and off the site; the findings are reported in the specialist report in *Appendix C14: Noise.*

The noise sensitive receptors identified for the site are described in Section 7.11.2 below.

7.11.2 Site Sensitivity

The DFFE National Screening tool indicates that the Noise theme for the Hoogland Southern Cluster Wind Farms is classified as being sensitive (Figure 7-109).

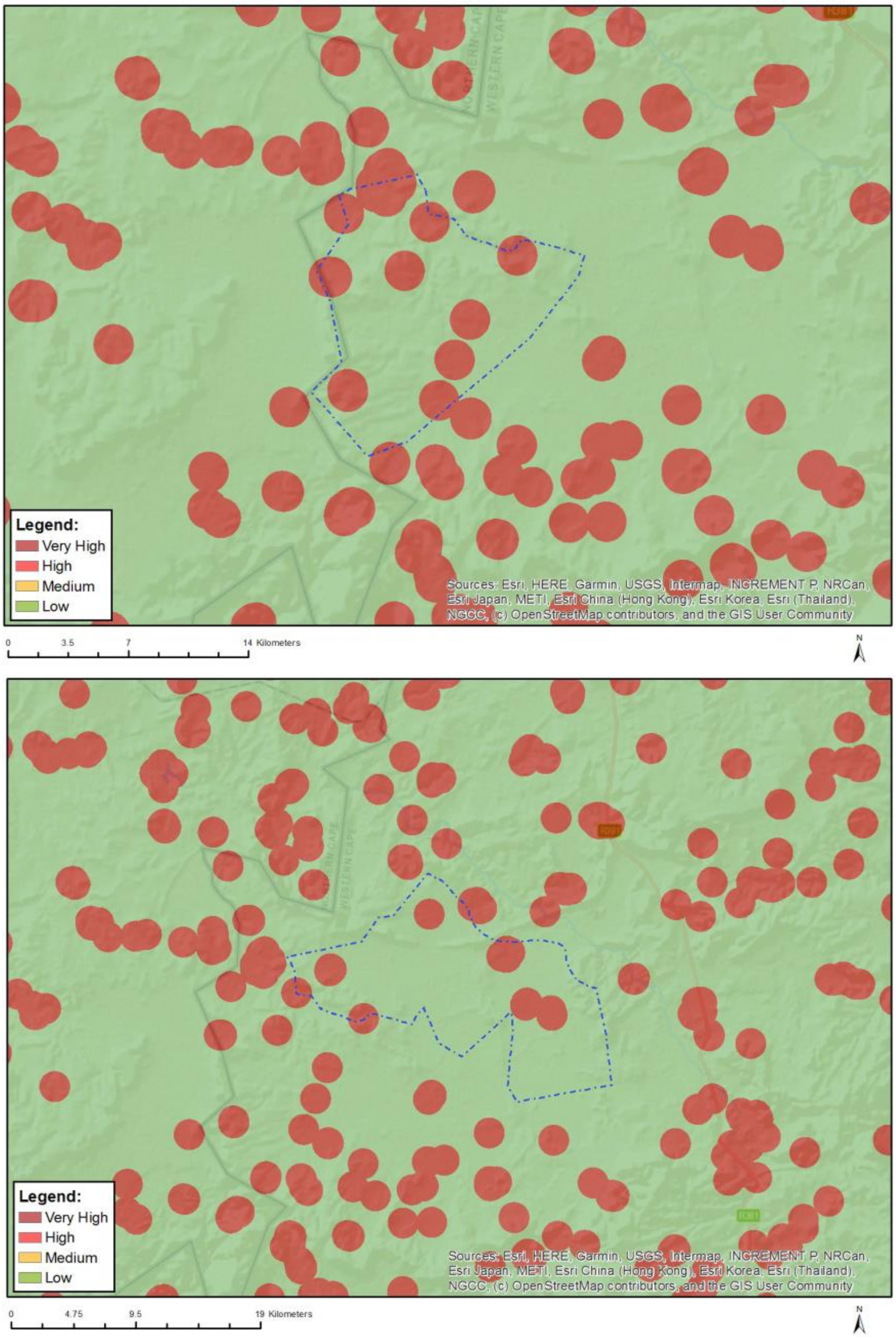


Figure 7-113: Map of relative Noise theme sensitivity for Hoogland 3 Wind Farm (top) and Hoogland 3 Wind Farm (bottom). High sensitivity shown in red.

Potential noise-sensitive developments, receptors and communities (NSRs) were identified using tools such as Google Earth® up to a distance of 2,000m (recommendation SANS 10328:2008) from turbine locations, with the statuses of the NSRs defined during the site visit. These receptors are highlighted in Figure 7-114 and Figure 7-115.

Generally, noises from wind turbines:

- Could be significant within 500m, with receptors[27] staying within 500m from operational wind turbines subject to noises at a potentially sufficient level to be considered disturbing;
- Are normally limited to a distance of approximately 1,000m from operational wind turbines (subject to turbine layout, as the turbines cumulatively contribute to noise levels with 2,000m from each turbine). Night-time ambient sound levels could be elevated and the potential noise impact measurable;
- Likely to be audible up to a distance of 2,000m at night; and
- Are of a low concern at distances greater than 2,000m. During certain meteorological phenomena the sound of the turbines may be audible, but the sound level will be low.

Note from the EAP: As a precautionary approach, the developer applied a 500m buffer from each NSR to ensure that noise impacts were limited from the outset.

It should be noted that the most sensitive receptor based on proximity to proposed infrastructure as discussed in Section 7.11.3 below is NSR 28 (farm RE1/28 Platfontein on Hoogland 3).

As described in Section 6.4 of the specialist report (*Appendix C14: Noise*), setting noise limits relative to the background noise level is relatively straightforward when the prevailing background noise level and source level are constant. However, wind turbines emit noise that is related to wind speed, and the ambient sound levels in the environment within which they are heard will probably also be dependent on the strength of the wind and the noise associated with its effects. It is therefore necessary to derive a background noise level that is indicative of the noise environment at the receiving property for different wind speeds so that the turbine noise level at any particular wind speed can be compared with the background noise level in the same wind conditions. On this basis, the specialist has proposed the following acceptable rating levels based on international guidelines and local regulations (noting that exceeding the noise limit does not immediately prevent a project from continuing):

Table 7-103: Proposed ambient sound levels and acceptable rating levels

10 METER WIND SPEED (m/s)	ESTIMATED AMBIENT SOUND LEVELS (NIGHT-TIME) (dBA)	MoE SOUND LEVEL LIMITS OF CLASS 3 (RURAL) AREAS (dBA)	ETSU-R97 LIMIT FOR PROJECT PARTICIPANTS (dBA)	NIGHT-TIME ZONE SOUND LEVEL (SANS 10103:2008) (dBA)	PROPOSED NIGHT RATING LEVEL (dBA)
4	37.6	40	45	35 (at low wind speeds, this will increase as wind speeds increase)	40
5	38.6	40	45		40
6	39.5	40	45		40
7	40.5	43	45		43
8	41.5	45	45		45
9	42.5	49	45		45

27 Depending on the layout as well as the specific sound power emission levels of the selected wind turbine.

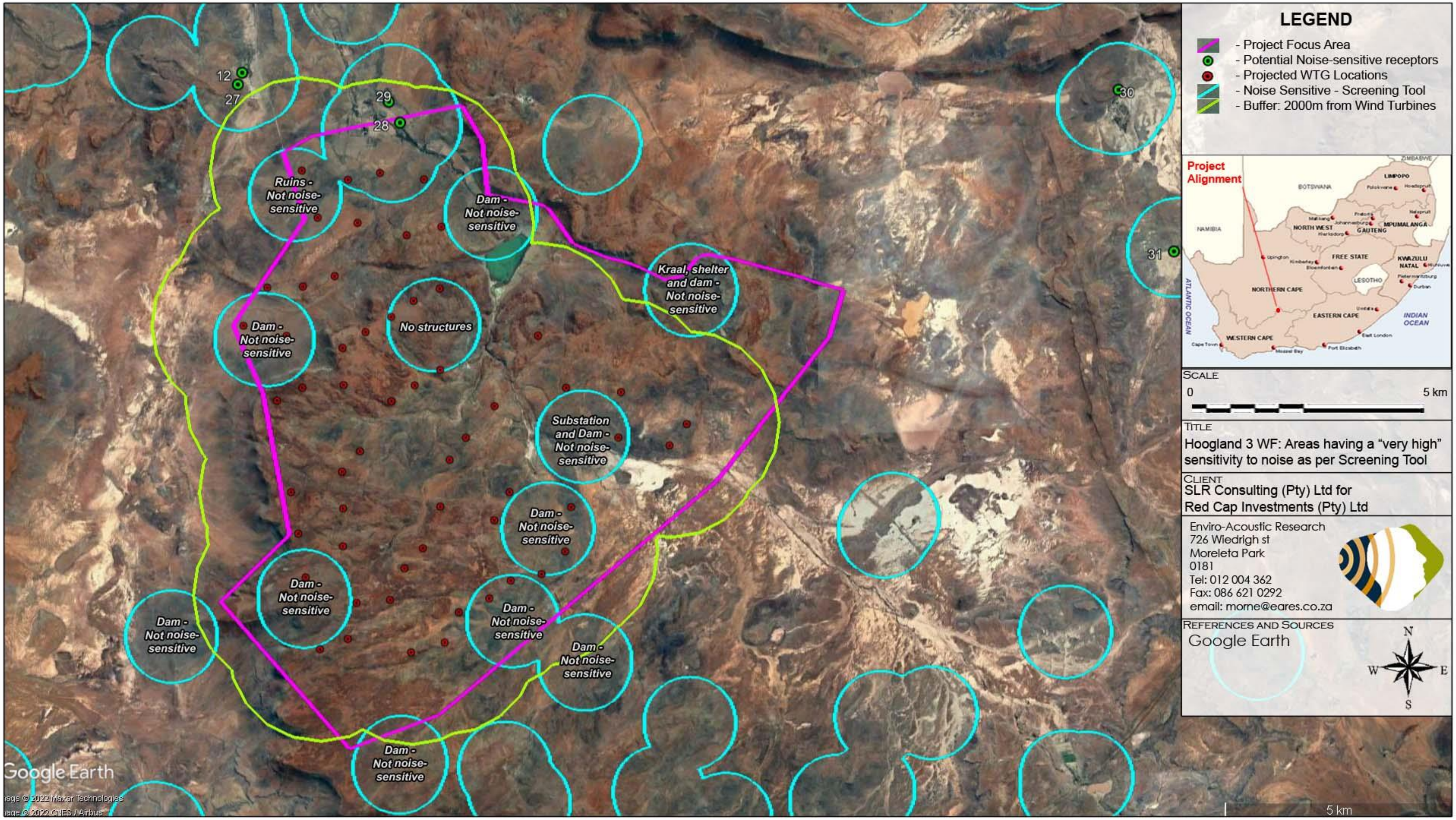


Figure 7-114: Hoogland 3 Wind Farm study area and potential noise-sensitive areas identified by the online screening tool

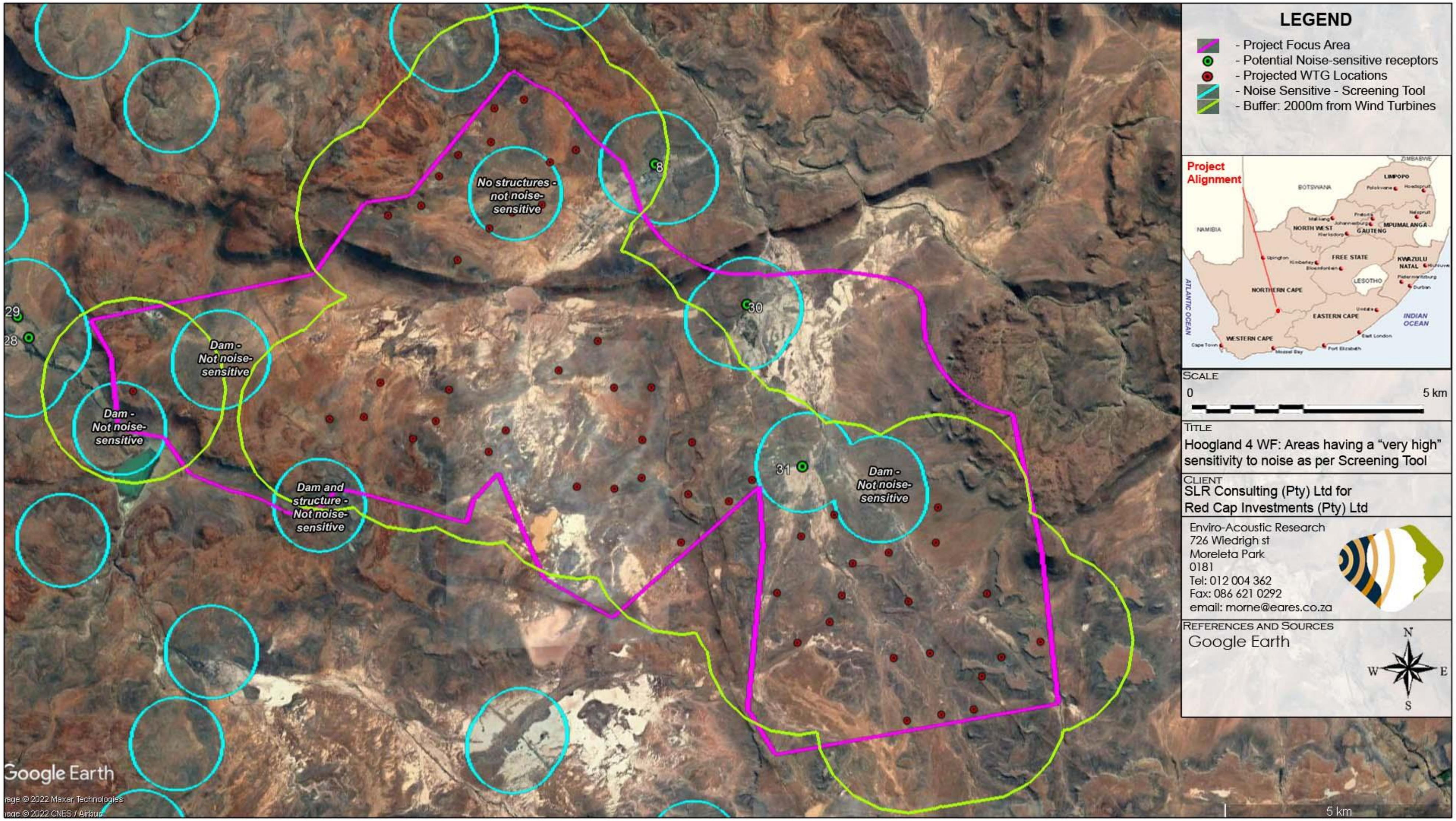


Figure 7-115: Hoogland 4 Wind Farm study area and potential noise-sensitive areas identified by the online screening tool

7.11.3 Impact Assessment and Mitigation

The following noise impacts have been identified and rated by EARES (2022). The potential for a noise impact to occur during the decommissioning and closure phases of the Wind Farms will be much lower than that of the construction and/or operational phases and if required, the noise levels for decommissioning can be compared with the construction phase noise level, and the noise impact will be similar or less. Therefore impact tables for decommissioning have not been prepared.

7.11.3.1 Construction Phase: Hoogland 3

Table 7-104: Construction: Hoogland 3 - Daytime Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities during the day raising ambient sound levels at the Hoogland 3 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements. Daytime construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit – 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Site	Site
Consequence	Very Low	Very Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for daytime construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-105: Construction: Hoogland 3 - Night-time Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities at night raising ambient sound levels at the Hoogland 3 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, night-time sound levels could range between 40.4 (arithmetic average impulse-weighted equivalent value) and 26.7 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 55.0 dBA when considering the 10-minute measurements. Night-time construction activities should not change the existing ambient sound levels by more than 7 dB, or exceed the acceptable rating level (the noise limit– 35 dBA for a rural noise district at night).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low (for NSR 28)	Low (NSR 28)
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Local	Local
Consequence	Low	Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for night-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is very low and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No routine noise monitoring is recommended.*)*	

Table 7-106: Construction: Hoogland 3 - Daytime road construction activities

Issue	Numerous simultaneous road construction activities during the day raising ambient sound levels at the Hoogland 3 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements. Daytime construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit – 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	

Criteria	Without Mitigation	With Mitigation
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Site	Site
Consequence	Very Low	Very Low
Probability	Improbable	Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-107: Construction: Hoogland 3 - Daytime road traffic from construction vehicles

Issue	Road traffic passing NSR during the day raising ambient sound levels at the Hoogland 3 WF and surrounds (along access roads)	
Description of Impact		
Considering the ambient sound level measurements collected in the area, night-time sound levels could range between 40.4 (arithmetic average impulse-weighted equivalent value) and 26.7 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 55.0 dBA when considering the 10-minute measurements. Daytime construction traffic should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Site	Site
Consequence	Very Low	Very Low
Probability	Improbable	Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		

The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.
Monitoring	
The following monitoring is recommended:	No additional noise monitoring is recommended.

7.11.3.2 Construction Phase: Hoogland 4

Table 7-108: Construction: Hoogland 4 - Daytime Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities during the day raising ambient sound levels at the Hoogland 4 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements. Daytime construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit – 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Site	Site
Consequence	Very Low	Very Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-109: Construction: Hoogland 4 - Night-time Wind Turbine construction activities

Issue	Numerous simultaneous WTG construction activities at night raising ambient sound levels at the Hoogland 4 WF
Description of Impact	

Considering the ambient sound level measurements collected in the area, night-time sound levels could range between 40.4 (arithmetic average impulse-weighted equivalent value) and 26.7 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 55.0 dBA when considering the 10-minute measurements. Night-time construction activities should not change the existing ambient sound levels by more than 7 dB, or exceed the acceptable rating level (the noise limit– 35 dBA for a rural noise district at night).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Local	Local
Consequence	Very Low	Very Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for night-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-110: Construction: Hoogland 4 - Daytime road construction activities

Issue	Numerous simultaneous road construction activities during the day raising ambient sound levels at the Hoogland 4 WF	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements. Daytime road construction activities should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low
Duration	Very Short term	Very Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Site	Site

Consequence	Very Low	Very Low
Probability	Improbable	Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is very low and no specific mitigation measures are required.	
Monitoring		
The following monitoring is recommended:	No additional noise monitoring is recommended.	

Table 7-111: Construction: Hoogland 4 - Daytime road traffic from construction vehicles

Issue	Road traffic passing NSR during the day raising ambient sound levels at the Hoogland 4 WF and surrounds (along access roads)	
Description of Impact		
Considering the ambient sound level measurements collected in the area, daytime sound levels could range between 55.2 (arithmetic average impulse-weighted equivalent value) and 40.6 dBA (arithmetic average fast-weighted average). Ambient sound levels range from less than 20 dBA to more than 78.9 dBA when considering the 10-minute measurements. Daytime construction traffic should not change the existing ambient sound levels with more than 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day). 7 dB, or exceed the acceptable rating level (the noise limit– 45 dBA for a rural noise district during the day).		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low
Duration	Short term	Short term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Site	Site
Consequence	Very Low	Very Low
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	**Insignificant**	**Insignificant**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low, although this is a temporary loss of resource (loss of natural quiet environment)	
Degree to which impact can be mitigated	Medium to High, though additional mitigation measures are not required for day-time construction activities.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is insignificant and no specific mitigation measures are required.	
Monitoring		

The following monitoring is recommended:	No additional noise monitoring is recommended.

7.11.3.3 Operational Phase: Hoogland 3

Table 7-112: Operation: Hoogland 3 - Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 3 WF operating simultaneously during the day raising ambient sound levels	
Description of Impact		
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Local	Local
Consequence	Medium	Medium
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	Very Low -	Very Low -
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low (loss of natural environment that may be quiet during the day)	
Degree to which impact can be mitigated	Medium to High.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is very low (for the daytime scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA and additional mitigation is not required.	
Monitoring		
The following monitoring is recommended:	Based on daytime noise levels, no additional noise monitoring is recommended.	

Table 7-113: Operation: Hoogland 3 - Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 3 WF operating simultaneously at night raising ambient sound levels
Description of Impact	
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR and summarized in this table.	
Type of Impact	Direct
Nature of Impact	Negative
Phases	Operation

Criteria	Without Mitigation	With Mitigation
Intensity	Low (NSR 28)	Low (NSR 28)
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Local	Local
Consequence	Medium	Medium
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	**Very Low -**	**Very Low -**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium (loss of natural night-time quiet environment)	
Degree to which impact can be mitigated	Medium to High.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is Very Low (for the night-time scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA.	
Monitoring		
The following monitoring is recommended:	Based on night-time noise levels, no additional noise monitoring is recommended.	

7.11.3.4 Operational Phase: Hoogland 4

Table 7-114: Operation: Hoogland 4 - Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 4 WF operating simultaneously during the day raising ambient sound levels	
Description of Impact		
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR and summarized in this table.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low (NSR 31)	Low (NSR 31)
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Local	Local
Consequence	Medium (NSR 31)	Medium (NSR 31)
Probability	Unlikely / Improbable (all NSR)	Unlikely / Improbable (all NSR)
Significance of Impact	**Very Low -**	**Very Low -**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Low (loss of natural environment that may be quiet during the day)	
Degree to which impact can be mitigated	Medium to High.	

Mitigation actions	
The following measures are recommended:	The potential significance of the noise impact is very low (for the daytime scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA and additional mitigation is not required.
Monitoring	
The following monitoring is recommended:	Based on day-time noise levels, no additional noise monitoring is recommended.

Table 7-115: Operation: Hoogland 4 - Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 4 WF operating simultaneously at night raising ambient sound levels	
Description of Impact		
The projected noise levels, the change in ambient sound levels as well as the potential noise impact is defined per NSR and summarized in this table.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low (NSR 31)	Low (NSR 31)
Duration	Long term	Long term
Extent ($\Delta L_{Aeq,D}$>7dBA)	Local	Local
Consequence	Medium	Medium
Probability	Unlikely / Improbable	Unlikely / Improbable
Significance of Impact	**Very Low -**	**Very Low -**
Degree to which impact can be reversed	The impact can be completely reversed once noise-generating activities cease	
Degree to which impact may cause irreplaceable loss of resources	Medium (loss of natural night-time quiet environment)	
Degree to which impact can be mitigated	Medium to High.	
Mitigation actions		
The following measures are recommended:	The potential significance of the noise impact is Very Low (for the night-time scenario) relating to the use of a WTG with a sound power emission level of 108.5 dBA.	
Monitoring		
The following monitoring is recommended:	Based on night-time noise levels, no additional noise monitoring is recommended.	

7.11.4 Cumulative Impact

The following cumulative impacts have been identified and rated by EARES (2022). The following impacts were considered insignificant and not repeated here:

- Hoogland 3: Daytime WTG construction activities
- Hoogland 3: Nighttime WTG construction activities
- Hoogland 3: Daytime road construction activities

- Hoogland 3: Daytime road traffic from construction vehicles
- Hoogland 4: Daytime WTG construction activities
- Hoogland 4: Nighttime WTG construction activities
- Hoogland 4: Daytime road construction activities
- Hoogland 4: Daytime road traffic from construction vehicles

7.11.4.1 Operational Phase: Hoogland 3

Table 7-116: Cumulative: Hoogland 3 - Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 3 WF operating simultaneously during the day raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 3 and 4 WF will not result in cumulative noise levels.	
Rating of cumulative impacts	**Without Mitigation**	**Without Mitigation**
	Very Low -	**Very Low -**

Table 7-117: Cumulative: Hoogland 3 - Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 3 WF operating simultaneously at night raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 3 and 4 WF will not result in cumulative noise levels.	
Rating of cumulative impacts	**Without Mitigation**	**Without Mitigation**
	Very Low -	**Very Low -**

7.11.4.2 Operational Phase: Hoogland 4

Table 7-118: Cumulative: Hoogland 4 - Daytime operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 3 WF operating simultaneously during the day raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 3 and 4 WFs will not result in cumulative noise levels	
Rating of cumulative impacts	**Without Mitigation**	**Without Mitigation**
	Very Low -	**Very Low -**

Table 7-119: Cumulative: Hoogland 4 - Night-time operation of Wind Turbines

Issue	Numerous WTG of the Hoogland 3 WF operating simultaneously at night raising ambient sound levels	
Nature of cumulative impacts	The development of the Hoogland 3 and 4 WFs will not result in cumulative noise levels	
Rating of cumulative impacts	**Without Mitigation**	**Without Mitigation**
	Very Low -	**Very Low -**

7.11.5 No-Go Alternative

The ‘no-go’ alternative is the option of not constructing the Project where the status quo of the current farming activities would prevail. The ambient sound levels will remain as is and the area would keep the rural noise character.

7.11.6 Conclusion and Recommendations

Considering the potential noise impacts (inclusive of cumulative impacts) for the proposed Wind Farms and associated infrastructure, it is recommended that the Hoogland Southern Cluster Wind Farms (Hoogland 3 and 4) be authorised.

Due to the very low to insignificant noise impact, no mitigation measures are recommended or required, with general measures included for the applicant to note to ensure that annoyance with the project are minimized asdetailed in the specialist report and included in the EMPr.

7.12 Shadow Flicker

This section provides a summary of the shadow flicker specialist report compiled by Emma Lewis and Martin Stevenson of Arcus Consultancy Services Limited is available in *Appendix C15: Shadow Flicker*.

7.12.1 Baseline Description

The topography of the site is characterised by undulating hills and has been described in more detail elsewhere in this report however of most relevance is 7.8.1. A number of buildings are located sporadically within the site and the sensitive receptors are described in more detail in the section below.

7.12.2 Site Sensitivity

Sensitive receptors were identified in conjunction with the Noise study (Section 7.11) and a study area around each proposed turbine location within a distance of 10 x rotor diameter was mapped (1,950 m) as shown in Figure 7-116 and

Figure 7-117: Hoogland 4 study area around each proposed turbine location within a distance 1,950m

. Two potentially sensitive receptors with the potential to experience shadow flicker effects were identified within Hoogland 3 and three respectively in Hoogland 4. The notable receptors on Hoogland 3 are 9S and 10S (both Platfontein) and on Hoogland 4 are 3S and 5S (both Rosary) and 6S (Driefontein).

Potential shadow flicker-sensitive receptors located more than 10 x rotor diameter of the turbines have been excluded from investigation, on the basis that shadow flicker effects are unlikely to be experienced beyond 10 x rotor diameter of the turbines.

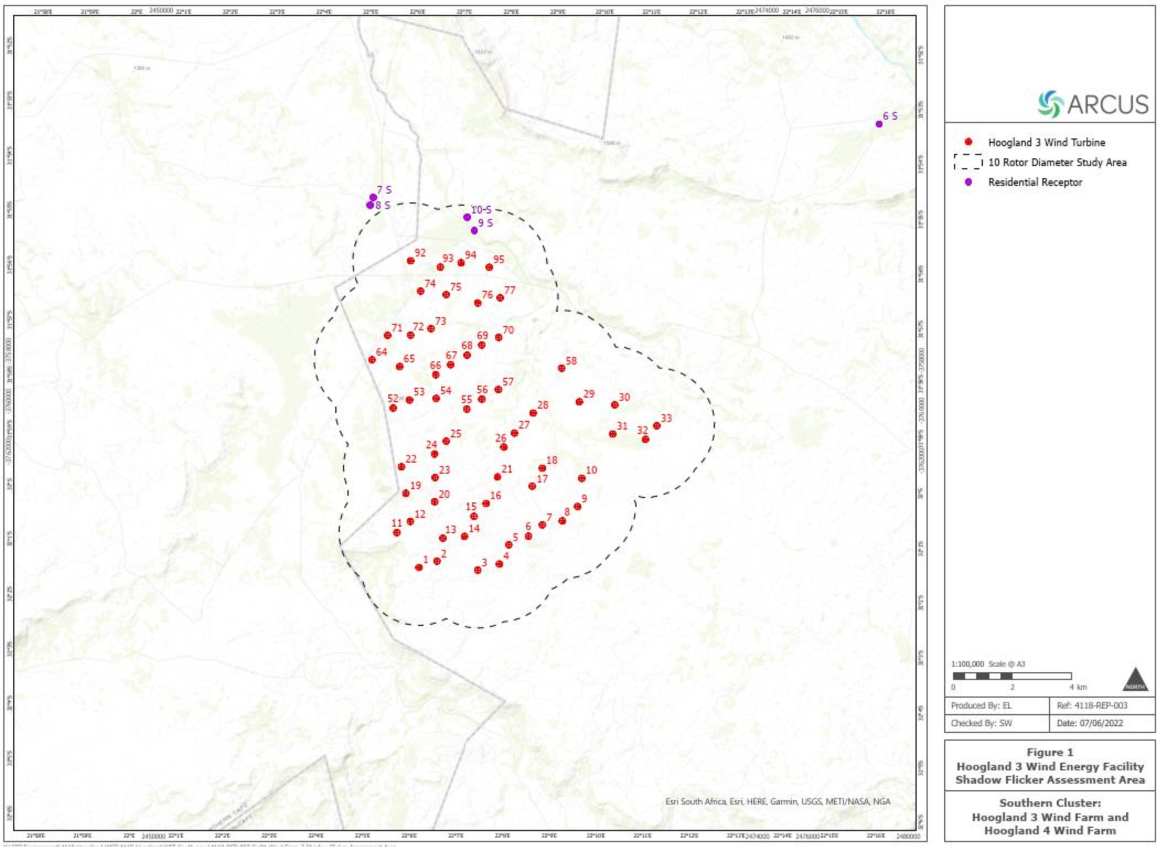


Figure 7-116: Hoogland 3 study area around each proposed turbine location within a distance 1,950m

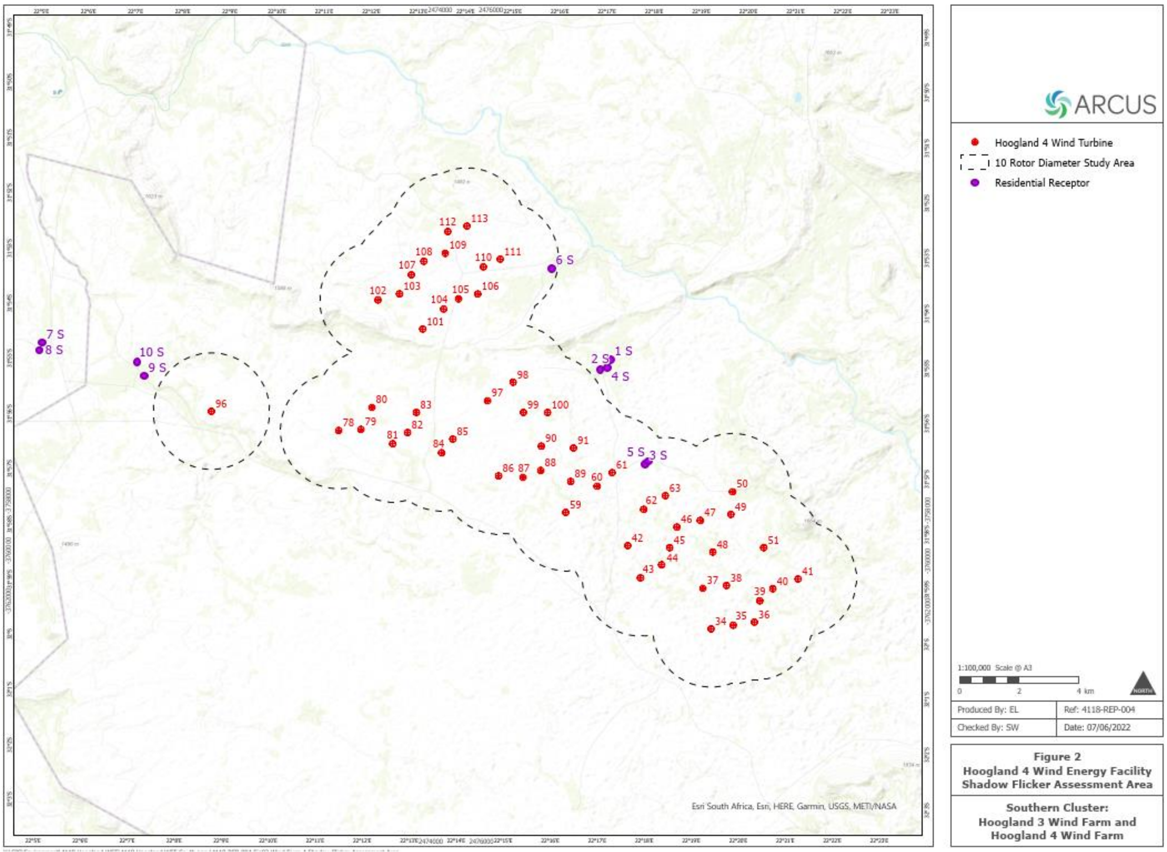


Figure 7-117: Hoogland 4 study area around each proposed turbine location within a distance 1,950m

Shadow flicker is a phenomenon that only occurs once turbines are installed and operational and thus no shadow flicker effects are anticipated (or assessed) during the construction phase of Hoogland 3 Wind Farm or Hoogland 4 Wind Farm.

It has been calculated that shadow flicker would not occur at the two sensitive receptors identified on Hoogland Wind Farm 3, however it has been calculated that shadow flicker could potentially occur all three sensitive receptors for Hoogland 4 Wind Farm (Table 7-120). Also see Figure 7-116 for Hoogland 3 and Figure 7-117 for Hoogland 4 receptors above).

Potential shadow flicker-sensitive receptors located more than 10 x rotor diameter of the proposed Hoogland 3 Wind Farm turbines have been excluded from investigation, on the basis that shadow flicker effects are unlikely to be experienced beyond 10 x rotor diameter of the turbines. Only the modelled results from Hoogland 4 Wind Farm are presented in Table 7-134 below.

The theoretical maximum number of hours per annum predicted to be experienced at each receptor account for any overlap where effects may be experienced at different windows or from different turbines simultaneously. However, based upon weather conditions required to facilitate shadow flicker occurring for 76 % of the time (i.e., no cloud, sufficient wind for the turbines to operate, and a wind direction such that the turbines are not side-on to the receptor in question), the likely number of hours per year where shadow flicker could potentially occur is usually reduced (Table 7-120).

Table 7-120: Hoogland 4 Hours of Shadow Flicker at Modelled Receptors

RECEPTOR	X COORDINATE	Y COORDINATE	THEORETICAL MAXIMUM NUMBER OF HOURS PER ANNUM	LIKELY NUMBER OF HOURS PER ANNUM	TURBINES AFFECTING RECEPTOR
3 S	**622751**	**6464755**	**61**	**46**	**61**
5 S	**622866**	**6464861**	**47**	**36**	**61**
6 S	619625	6471309	13	10	177

It should be noted that the predicted likely number of hours in which shadow flicker is to occur is above the annual 30-hour threshold for two of the receptors on Hoogland 4 Wind Farm (3S and 5S). However, due to the numerous worst-case assumptions made as part of this assessment it is likely that the results over-estimate of actual effects. In addition, considering that none of the turbines are proposed within 500m of any receptor, a worst-case study area for exceedance has been considered.

7.12.3 Impact Assessment and Mitigation

The following shadow flicker impacts have been identified and rated by Arcus (2022) and are only relevant to the operational phase as such impacts do not occur during construction and decommissioning.

As a worst case, the impact assessment assesses the impact on those receptors predicted to receive shadow flicker effects which exceed 30 hours per year, as detailed in Table 7-120 above. No impact assessment tables have been provided for Hoogland Wind Farm 3 as no sensitive receptors are predicted to experience shadow flicker effects and for receptors predicted to receive less than 30 hours per annum. Properties predicted to experience no shadow flicker effects are deemed to be insignificant.

7.12.3.1 Operational Phase: Hoogland 3

None

7.12.3.2 Operational Phase: Hoogland 4

Table 7-121: Operation: Hoogland 4 - Shadow Flicker Impact

Issue	Shadow Flicker	
Description of Impact		
Shadow Flicker effects on identified receptors (3S and 5S)		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Low
Probability	Probable	Unlikely / improbable
Significance	Medium -	Insignificant
Degree to which impact can be reversed	Any potential impact would be completely reversed with the implementation of the proposed mitigation as below.	
Degree to which impact may cause irreplaceable loss of resources	Low - the resource is not damaged irreparably or is not scarce.	

Degree to which impact can be mitigated	The Applicant could assist the affected receptor with shielding (blind, shutters, curtains, or screening with vegetation) or moving the affected window, or any other measure found acceptable to the affected party. Compensation may also be considered. As a last resort, a shut-down calendar could be implemented on turbines directly causing shadow flicker to receptors found to result in an adverse impact. Depending on the mitigation implemented, shadow flicker effects can be mitigated.

7.12.4 Cumulative Impact

Other than the proposed Nuweveld Wind Farms, there are currently no approved renewable energy EA applications within a 30 km (or even 50 km) radius of the project site.

Therefore Arcus (2022) has concluded that no potentially sensitive receptors were identified as being situated within more than one study area of the Hoogland 3 and 4 Wind Farms and the nearby three Nuweveld Wind Farms and Gridline applications. A cumulative assessment for Hoogland 3 and Hoogland 4 is therefore not required.

7.12.5 No-Go Alternative

The 'no-go' alternative is the option of not constructing the Project where the status quo of the current farming activities on the site would prevail. In the event of a No-Go alternative, there will be no shadow flicker impact and as such, the No-Go alternative impact is assessed as insignificant.

7.12.6 Conclusion and Recommendations

The effect of shadow flicker during the operational phase has been assessed using international guidance considered to be appropriate, and effects are considered to be insignificant at Hoogland 3 Wind Farm and of medium (-) significance at Hoogland Wind Farm 4 prior to mitigation.

Mitigation measures include (Section 8 of the specialist report in *Appendix C15: Shadow Flicker* of this report):

- Control at Receptor: The provision of blinds, shutters or curtains to affected receptors;
- Control on Pathway: for example, screening planting close to an affected receptor; and
- Control at Source: for example, shutdown of turbines at times when effects occur.

Following appropriate mitigation, no significant impacts are anticipated on Hoogland 4 Wind Farms, and as such, it is the opinion of the author that the Projects may be authorised in terms of shadow flicker.

7.13 Traffic

This section provides a short summary of the traffic specialist report compiled by Athol Schwarz which is available in *Appendix C16: Traffic.*

7.13.1 Baseline Description

According to Shwarz (2022), the existing road network adjacent to the proposed developments is well established, refer to Figure 7-118. Consisting of a combination of national roads, first, second and third-order roads, which provides the proposed development accessibility to local towns and the major commercial centres within South Africa. The access to the site is off the R381 (main route between Loxton and Beaufort West) which is mostly a gravel (unpaved) road with several tarred (paved) sections (Figure 7-119) and can be reached via several public roads as shown on Figure 7-118.

The majority of the roads in the study area are gravel roads. Some of the roads are in better condition than others. There is a higher level of maintenance on the roads in the Western Cape than there is in the Northern Cape. All roads adjacent to the proposed development are expected to deteriorate due to the increased traffic volumes.

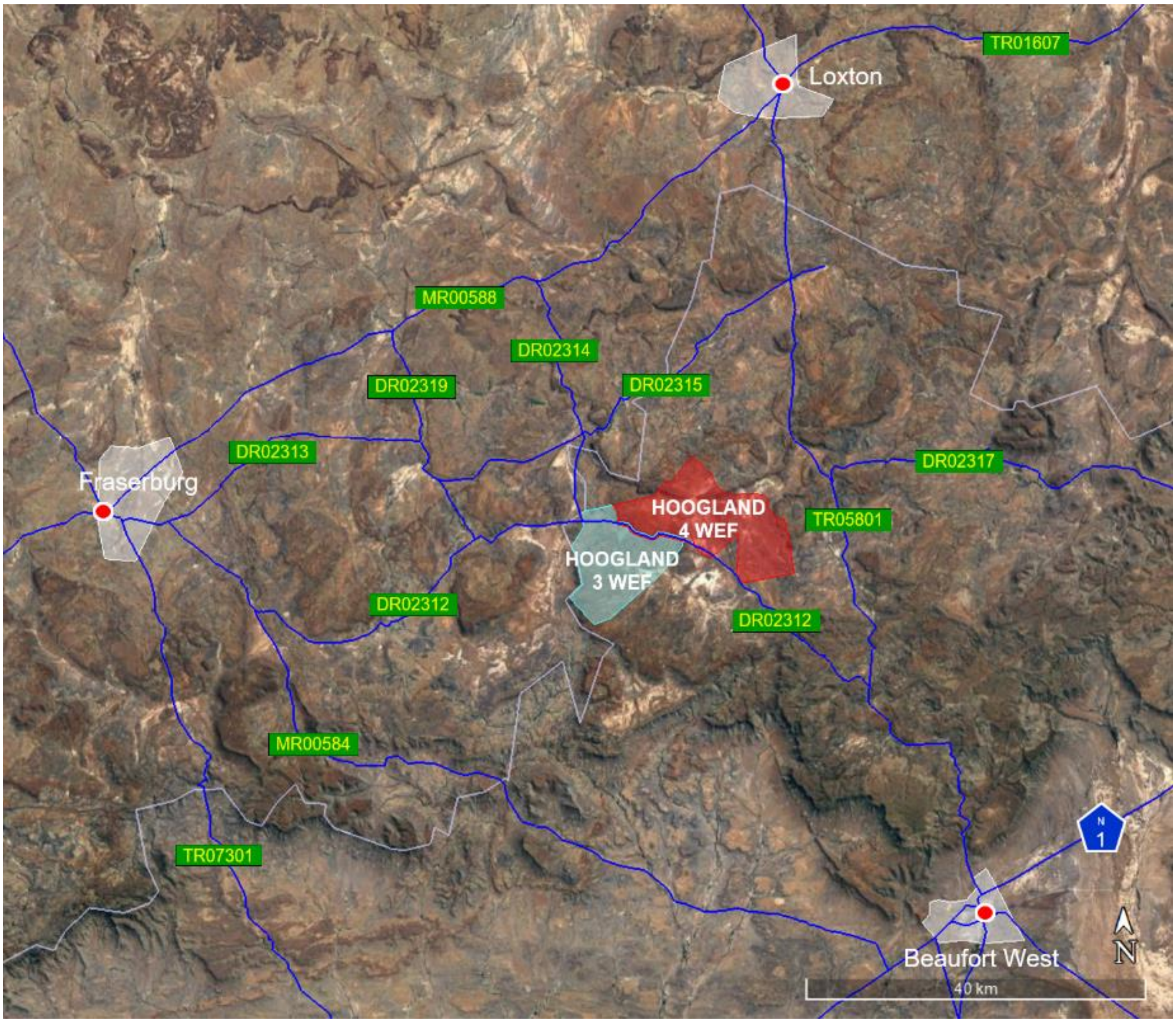


Figure 7-118: Road Network

Figure 7-119: Paved and gravel sections of the R381 which will provide the main access to the site via Beaufort West

7.13.1.1 Transportation Routes

7.13.1.1.1 Commuter Routes

In light of the REIPPPP requirements, it is assumed that the workforce will be drawn from surrounding communities. There are several towns within a 150 km radius of the proposed development. The most relevant include Beaufort West, Carnarvon, Fraserburg, Loxton, Nelspoort, and Victoria West. The proposed development can only be approached from the following directions:

- All abnormal and heavy transportation, including busses and mini-buses, will be via TR05801 (R381) and DR02312;
- Personnel travelling to the proposed development from Carnarvon, Loxton and Victoria West, will be via the TR05801 (R381), MR00588 (R356), DR02314 and DR02312;
- Personnel travelling to the proposed development from Fraserburg, will be via the DR02312;
- Personnel and light transportation (less than 10 tons) travelling to the proposed development from Beaufort West, will be via the TR05801 (R381) and DR02312; and
- Personnel travelling to the proposed development from Nelspoort, will be via the DR02317, TR05801 (R381) and DR02312.

The distance from the proposed developments to the surrounding towns and the estimated travelling time and “working age” population in the various towns are shown in Table 7-122.

Table 7-122: Distance to surrounding towns

Town	Travel Distance*	Estimated Travel Time**	Population
Beaufort West	81 km	1:09	21 608
Carnarvon	183 km	2:11	4 107
Fraserburg	70 km	1:03	1 854
Loxton	119 km	1:34	604
Nelspoort	151 km	2:10	1 212
Victoria West	202 km	2:25	4 978
* Distance from the intersection at TR05801/DR02315 to the main intersection in the Town ** Obtained using Garmin Software			

7.13.1.1.2 Freight Routes

Container Terminals:
The port of entry into South Africa for all import WTG components is limited to Ngqura (located close to Gqeberha) or Saldanha Terminals (Table 7-123).

Table 7-123: Distance from port terminals

Container Terminals	Distance
Ngqura	634 km
Saldanha	851 km

The length and weight of the various turbine components will only be available once the turbine supplier has been appointed. There is a strong possibility that the length of the blades for the turbine units could exceed 95 m.

The following have been considered for the transportation of turbine components for this project.

- In Beaufort West, the traffic circle in Donkin Street poses a significant challenge for the transportation of the blades. However, a potential by-pass route to the north of Beaufort West, as shown in red in Figure 7-120, has been identified for the possible transportation of the turbine components through Beaufort West if the components are imported into South Africa via one of the ports in the Western Cape. Sections of the existing track along the identified by-pass route would need to be upgraded, and new sections would have to be constructed to complete the route. From a traffic impact perspective, this by-pass route is an acceptable route that will help reduce potential traffic impacts for the proposed transportation of the turbine components as it will ensure that the abnormal loads can bypass the centre of the town. Note this Bypass is not included in the Southern Wind Farm applications.
- The trio of passes on the TR05801 (R381) between Beaufort West and the proposed developments pose constraints that will not easily be overcome with the current transportation equipment available in South Africa without significant intervention;
- Transporting the components through towns is always a challenge. Most are conquered with a bit of ingenuity. At Loxton, the TR016 (R63)/TR05801 intersection will have to be redesigned and upgraded. However, this may have already been undertaken as part of the Nuweveld Wind Farm Project. The route through the town should avoid the commercial centre of town if possible however will need to be identified by the appointed logistics company transporting the turbine components.

- The route from Ngqura Container Terminal to the proposed development via Loxton is feasible. This route has been used to transport turbine components for Noblesfontein, Loeriesfontein and Khobab Wind Farms. Construction of Noblesfontein Wind Farm commenced in March 2013.
- The turbine components were transported from the Ngqura Container Terminal to the site. Loeriesfontein and Khobab Wind Farms commenced with the transportation of wind turbine tower components on 20 June 2016. Over 300 wind turbine tower sections, which were fabricated in Atlantis, were transported on the N1 (via Worcester, Laingsburg and Beaufort West), N12 (to Victoria West), R63 (to Carnarvon, Williston and Calvinia) to the site.
- The 53 m long wind turbine blades, nacelles and hubs were transported via Uitenhage, Graaff-Reinet, Beaufort West, Three Sisters, Victoria West and Carnarvon onto Loeriesfontein.
- The geometric design and gradient of the Theekloofpas on the TR07301 (R353) could pose constraints that would inhibit the use of this road with the current transportation equipment available in South Africa, and this route is not recommended at this point.

Figure 7-120: Potential By-Pass of Beaufort West (not included in the Southern Wind Farm applications)

The preferred transportation route would ultimately be identified by the logistic company appointed to transport the various turbine components from the port of entry to the proposed development.

Commercial Centres:

The most likely transportation routes for domestically supplied and manufactured components from the major commercial centres to the proposed developments are either Cape Town or Johannesburg (or any supplier along these routes). The distances from the proposed developments to the major commercial centres in South Africa are shown in Table 7-124.

Table 7-124: Distance from major commercial centres

Commercial Centres	Distance
Cape Town	799 km
Johannesburg (via N1)	1054 km
Johannesburg (via N12)	1041 km

7.13.1.2 Traffic Volumes

The baseline traffic volumes for the road network adjacent to the proposed developments are based on the Average Annual Daily Traffic (AADT) values obtained from the various counting stations. The values used are the average values between intersections, which have been adjusted by a growth factor relevant to the road. The adjusted AADT values used in this assessment are provided in Figure 7-121.

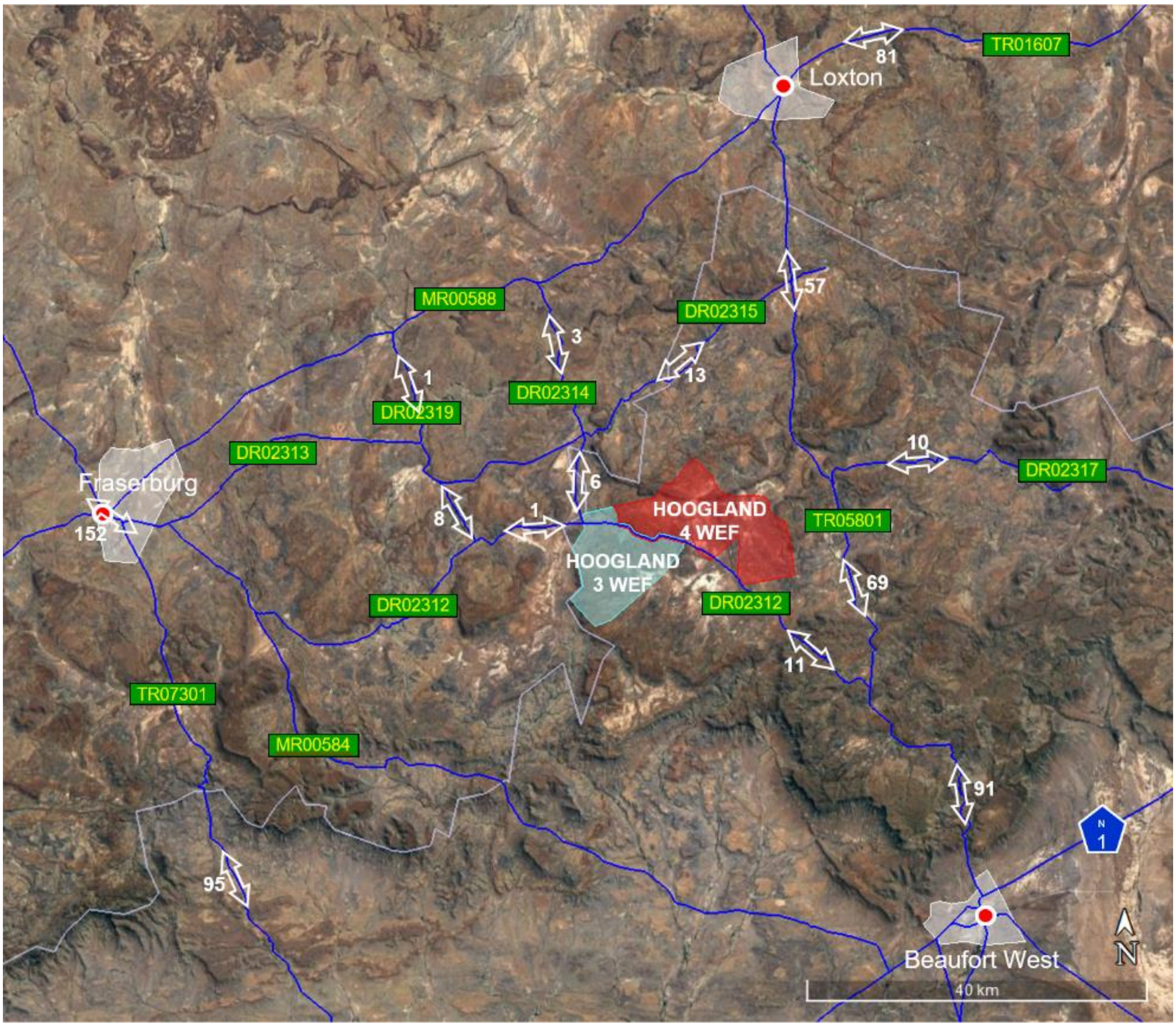


Figure 7-121: Baseline AADT

7.13.2 Site Sensitivity

7.13.2.1 Road Network

The N1 is a Class 1 road, generally consisting of a single paved carriageway, with one lane in each direction and paved shoulders. Climbing lanes are provided along various sections of the road, and there are turning lanes at major intersections. In many cases, the shoulder is wide enough to allow yellow-line driving. The road is in good condition with a speed limit of 120 km/h.

The Trunk Roads in the area are very diverse, from the first world paved roads to third world gravel roads. The R353 is a Minor Arterial providing mobility between provinces, regions, and towns. The paved sections of the R353 consist of a single paved carriageway, with one lane in each direction and unpaved shoulders. There is a noticeable difference in the condition of the roads in the Northern Cape and Western Cape. Of particular concern are several sections of the unpaved road through the Molteno Pass (R381) that are extremely treacherous, with no barriers and steep drop-offs, very tight corners, negative banking and loose gravel. At a distance of 19.5 km from Beaufort West, there is a sharp bend in the road, a very tight bend with poor sighting distance, and is the site of numerous fatalities. A mirror has been installed to mitigate collision at this point. However, the mirror does not prevent single-vehicle incidents.

The Main Road of relevance, (R356) is the Access Collector providing mobility between Beaufort West and Loxton towns. The road consists of a gravel carriageway within a 30 m wide servitude. The condition of the road is good and allows for dual-directional traffic at speed.

The district roads in the area are level 4 roads and are classified as Resident Access Collector roads, providing accessibility to nearby towns and main roads. Most of these roads consist of a gravel carriageway, approximately 7 m wide, within a 20 m wide servitude. As a result of the width, road users have to reduce speed when passing oncoming vehicles. Although most of these roads are suitable for light vehicles, the use of these roads by heavy vehicles is not recommended. The most relevant district roads that will be used to access the site are the DR02312 (off the R381), for access from the south, and the DR02314, off the MR00588 (R356), for access from the north.

7.13.3 Impact Assessment and Mitigation

7.13.3.1 Traffic Volumes expected from the Project

The most significant impact on traffic volumes is because of commuting personnel to and from the site in the morning and in the afternoon, and delivery of equipment and material. At no point during the construction or operational phases does the traffic volume on the various roads exceed fifty trips per hour, which is the threshold for a detailed Traffic Impact Assessment (TIA).

A project duration of 30 months is expected for both Hoogland 3 and Hoogland 4 Wind Farms assuming they are constructed simultaneously. However, an active construction phase of 24 months has been assumed, providing six months for site establishment and final commissioning of the proposed developments.
The envisaged timeframes of traffic activities (as adopted in the specialist report) are:

- Morning Peak Traffic - between 6:30 to 7:30.
- Diurnal Traffic - between 7:30 to 16:30.
- Afternoon Peak Traffic - between 16:30 to 17:30.

The traffic volume generated during the peak construction phase of the development is in the order of:

- Peak Traffic: The maximum number of vehicles on the public road network during the Peak Traffic is in the order of 40 vph. The most significant expected Peak Traffic increase is on R318.
- Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 19.7 vph. Which equates to approximately 158 vehicles, over an eight-hour period.

The traffic volume generated during the operational phase of the proposed developments is in the order of:

- Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 10 vph. The most significant expected Peak Traffic increase is on the DR02312.
- Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 4.25 vph. Which equates to approximately 34 vehicles, over an eight-hour period.

The minimum required level of service for gravel roads is LOS C. For the worst-case scenario, the additional traffic volume of the proposed developments results in a LOS A. Thus, the additional traffic volume does not compromise the level of service of the roads.

The following traffic impacts have been identified and rated by Schwarz (2022). Noting that the impacts for construction and operation have been identified, and for decommissioning, a separate traffic impact assessment should be undertaken since many of the characteristics related to the traffic impact assessment, i.e. access routes, road geometry, traffic volumes, etc., would have changed over the operational life of the development. Thus, the impact assessment for the decommissioning phase has not been provided.

7.13.3.2 Construction Phase

Table 7-125: Construction: Increased Road Incidents

Issue: Increased Road Incidents		
Description of Impact		
The increased traffic volumes on the public roads will increase the potential of incidents on the road network within the study area		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very High	Very High
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Conceivable
Significance	Medium -	Low-
Degree to which impact can be reversed	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation does not exist, or mitigation will slightly reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	• Post relevant road signage along affected routes; • Create local WhatsApp Group, notifying other road users of expected deliveries and associated routes; • Transport Management Plan (TMP) is to be compiled once the contractor has been appointed and all the relevant details of the construction process are known. The TMP needs to address, inter alia: - clearly defined route/s to the site for specific vehicles needed to transport equipment and materials - scheduled deliveries to avoid local congestion; • Ensure all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.	
Monitoring		
The following monitoring is recommended:	Incident register and ongoing road safety awareness training	

Table 7-126: Construction: Road Degradation

Issue: Road Degradation	
Description of Impact	
The increased traffic volumes on the public roads will increase the potential for localised road network degradation within the study area.	
Type of Impact	Indirect
Nature of Impact	Negative

Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Medium	Medium
Probability	Definite / Continuous	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will be able to recover from the impact	
Degree to which impact may cause irreplaceable loss of resources	The resource is not damaged irreparably or is not scarce	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	• Create a local WhatsApp Group for local community and post notices of road conditions and proposed alternatives. • Developer to contribute to the maintenance of the public roads in the area during construction phase of the development/s. • A photographic record of the road condition should be maintained throughout the various phases of the development/s. This provides an objective assessment and mitigates any subjective view from road users. • Upgrade unpaved roads to a suitable condition for proposed construction vehicles. • Ensure that the roads are left in the same or better condition, post-construction.	
Monitoring		
The following monitoring is recommended:	Weekly inspection	

Table 7-127: Construction: Dust

Issue: Dust		
Description of Impact		
The increased traffic volumes on the unpaved public roads will generate more dust. The larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view for over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Medium-term	Short-term
Extent	Regional	Regional

Consequence	High	Medium
Probability	Possible / frequent	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The affected environment will not be able to recover from the impact - permanently modified	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation does not exist, or mitigation will slightly reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	• Reduce travel speed for construction vehicles on the gravel road to reduce dust. • Dust suppression of the roads in the immediate vicinity of the site where feasible. • Regular preventative maintenance of roads within the immediate vicinity of the site should be conducted over weekends to minimise the impact on the average construction period.	
Monitoring		
The following monitoring is recommended:	Continues observation, remedial action needs to be taken as and when required.	

Table 7-128: Construction: Intersection Safety

Issue: Intersection Safety		
Description of Impact		
The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	The affected environment will not be able to recover from the impact - permanently modified	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	

Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts
Mitigation actions	
The following measures are recommended:	• Compile TMP, refer to Section 11 of the Traffic Report. Reduce speed at intersections and use appropriate traffic warning signs. • Identify alternative routes where possible. • Request the assistance of local law enforcement. • Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.
Monitoring	
The following monitoring is recommended:	Incident register and ongoing road safety awareness training

7.13.3.3 Operational Phase

Table 7-129: Operation: Intersection Safety

Issue: Intersection Safety		
Description of Impact		
The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	High
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium -	Medium -
Degree to which impact can be reversed	The affected environment will not be able to recover from the impact - permanently modified	
Degree to which impact may cause irreplaceable loss of resources	The resource is irreparably damaged and is not represented elsewhere	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce the significance of impacts	
Mitigation actions		

The following measures are recommended:	• Compile TMP, refer to Section 11 of the Traffic Report. Reduce speed at intersections and use appropriate traffic warning signs. • Identify alternative routes where possible. • Request the assistance of local law enforcement. • Ensure that all site vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.
Monitoring	
The following monitoring is recommended:	Incident register and ongoing road safety awareness training

7.13.4 Cumulative Impact

The following cumulative impacts have been identified and rated by Schwarz (2022).

7.13.4.1 Construction Phase

Table 7-130: Cumulative impact: Construction Phase - Increased Road Incidents

Issue: Increased Road Incidents		
Nature of cumulative impacts	The cumulative impact resulting from the traffic volumes on the road network	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-131: Cumulative impact: Construction Phase - Road Degradation

Issue: Road Degradation		
Nature of cumulative impacts	The cumulative impact resulting from the traffic volumes on the road network	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-132: Cumulative impact: Construction Phase – Dust

Issue: Dust		
Nature of cumulative impacts	The cumulative impact resulting from the traffic volumes on the road network	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-133: Cumulative impact: Construction Phase - Intersection Safety

Issue: Intersection Safety	
Nature of cumulative impacts	The cumulative impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.

Rating of cumulative impacts	Without Mitigation	With Mitigation
	Medium -	Medium -

7.13.4.2 Operational Phase

Table 7-134: Cumulative impact: Operational Phase - Intersection Safety

Issue: Intersection Safety		
Nature of cumulative impacts	The cumulative impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

7.13.5 No-Go Alternative

If the proposed development does not materialise, the increase in the traffic volume will not transpire, resulting in the following impacts:

- Road Degradation - Less traffic on the roads means that the rate of degradation to the roads will be less. However, the maintenance of the roads will not be augmented by the proposed development. Improved maintenance of the roads will improve the quality of life for the road users and could increase the economic opportunities in the area. The status quo is therefore rated as of low negative significance.
- Road Safety - Less traffic on the roads means less probability of an incident, reducing the likelihood of a fatality. Therefore, the impact is neutral.

The improved road maintenance counteracts the negative impacts on the road network due to the development and economic prospects the development will bring to the local community and the impact the development has on a national scale.

7.13.6 Conclusion and Recommendations

It can be concluded that the development of the Southern Cluster of the Hoogland Wind Farm Project (Hoogland 3 Wind Farm and Hoogland 4 Wind Farm) will have a notable increase in traffic volumes on the road network during the peak construction phase of the proposed developments. However, the specialist report has assessed the impact of these additional traffic volumes on the surrounding road network will be well within the acceptable level of service. Noting that the road network is not well maintained due to budgetary constraints within various spheres of government. The increase in traffic volumes will lead to greater wear and tear, especially during construction, but will not have an undue detrimental impact on the road network within the study area if the mitigation measures are undertaken.

It is the reasoned opinion of the author that the proposed development of the Southern Cluster of the Hoogland Wind Farm Project (Hoogland 3 Wind Farm and Hoogland 4 Wind Farm) can be approved from a traffic and transportation perspective as there are no constraints or notable impacts that would jeopardise the implementation of the development, subject to the specific requirements included within this report. It is recommended that a separate traffic impact assessment be conducted for the decommissioning phase of the development as the traffic characteristics of the area will likely change over the lifespan of each Wind Farm.

7.14 Socio-economic

This section provides a short summary of the socio-economic specialist report compiled by Hugo van Zyl and James Kinghorn of Independent Economic Researchers (IER) which is available in *Appendix C17: Socio-Economic*. From a socio-economic perspective, the project was investigated in terms of its compatibility with South African energy policy and strategic spatial planning, as well as with socio-economic development planning with a focus on local and regional planning.

7.14.1 Baseline Description

The proposed Wind Farm sites are situated predominantly within Ward 7 of the Beaufort West Municipality which forms part of the Central Karoo District Municipality of the Western Cape Province (note that Ward 7 covers a particularly large area of 8,175m^2 and extends as far as the town of Merweville which is over 100km from the sites), with the exception of a part of Hoogland 3, which falls within Ward 3 of the Karoo Hoogland Municipality, in the Namakwa District of the Northern Cape Province. The towns nearest the Wind Farm site are Beaufort West, Loxton and Fraserburg. Loxton is in the Ubuntu Local Municipality which forms part of the Pixley ka Seme District Municipality, while Fraserburg is in the Karoo Hoogland Local Municipality within the Namakwa District Municipality, both in the Northern Cape Province.

Other towns, which are further than 50km from the Wind Farm site but still relatively nearby, include Nelspoort in Beaufort West Municipality, and Victoria West in the Ubuntu Local Municipality of the Northern Cape.

7.14.1.1 Land uses

Current land uses in the wider rural area, where the Wind Farm and majority of the Wind Farm infrastructure would be located, are focused on extensive agriculture with small stock primarily in the form of sheep, game farming, some tourism and conservation primarily in the form of the Karoo National Park. According to IER (2022) Although generally tourisms facilities and attractions in the areas surrounding the project site are very limited and sparsely distributed. Of the tourism establishments identified, five fall within 6km from the perimeter of the Hoogland South Cluster, of which four are owned by a participant in the Hoogland Wind Farms Project. However, one of these five establishments, the Riverine Rabbit Retreat (6km from Hoogland 4), is owned by someone who is not participating in the project. The farms are large and homesteads are few and far between to maintain economically viable farm units. Small communities are housed on the farms and work as farm labourers or in associated tourism ventures. Away from the towns there are few other sources of enterprise or employment. For more details on agricultural land uses, see the Agricultural Specialist Study (Section 7.3).

Drought has been experienced to varying degrees in different parts of the study area, with many of the farms surrounding Loxton having received little to no rain over the past ten years. The financial sustainability of farming in this area has been severely compromised, and many farmers have removed all livestock from their farms or have resorted to other coping strategies given the persistently low forage levels available to livestock in the area. Some farm labourers have been retrenched as a result of the drought and have been forced to relocate to urban centres in search of employment.

7.14.1.2 Demographics

The demographics of the study area are presented in detail in *Appendix C17: Socio-Economic* however some key points are included here for context. Beaufort West Local Municipality (BWLM) had a population of 51 074 in 2019, up from 49 586 in 2011, which translates to a population growth rate of around 0.4% per annum over the eight-year period. This is lower than the annual growth rate for the Central Karoo District Municipality (CKDM), which was 1.2% over the same period. BWLM had an average household size of 3.8 in 2019.

Up-to-date statistics are not available for Ubuntu Local Municipality (ULM). But based on the population growth rate between 2011 and 2016 (average of 0.92% per annum), the 2019 population was estimated to be 20,007. The average growth rate for Pixley ka Seme District Municipality (PkSDM) was estimated to be 0.98% per year over the 2011–2019 period, based on available statistics for these years, which indicate that the PkSDM had a population size of 200,835 in 2019.

Karoo Hoogland Local Municipality (KHLM) had a population of 13 009 in 2016, up from 12 501 in 2011, implying an average growth rate of 0.8%. Up-to-date statistics are not available for KHLM, but assuming that the municipality has grown at a uniform rate since 2011 provides the estimate of a population size of 13,321 in 2019. The average growth rate for NDM over the 2011–2016 period was negative and averaged -0.17% over the same period. However, between 2016 and 2019 NDM's population grew at an average of 7.15% per year. These trends may reflect in-migration to the District, but the statistics should be treated with caution given that they are based on different datasets, one of which is not publicly available and the accuracy of which is therefore difficult to ascertain.

Recent population estimates are not available at the settlement level, but the 2011 census gives some indication of the towns nearby the study site, as outlined in Table 7-135. Beaufort West had a population of 20,053 in 2011, while Loxton had a population of 1,044, Fraserburg 3,029 and Nelspoort 1,696.

Table 7-135: Population groups in the towns surrounding the study site, 2011

POPULATION GROUP	BEAUFORT WEST	LOXTON	FRASERBURG	NELSPOORT
Black African	1 452	28	145	288
Coloured	15 624	895	2 569	1 375
Indian or Asian	107	3	18	14
White	2 741	113	288	13
Other	129	5	9	6
Total	**20 053**	**1 044**	**3 029**	**1 696**

Source: StatsSA, 2012

Between 2011 and 2016, BWLM's dependency ratio[28] showed a decreasing trend over time as an ever-larger proportion of the population was falling into the working age group. More recent information suggests that this trend reversed between 2016 and 2019, with an increase in the dependency ratio to a high in recent years of 65. Interviews with municipal representatives indicate that this could be due to higher than anticipated rates of in-migration over the period.

Between 2011 and 2016, the population of the ULM appeared to be following a similar trajectory to that of the BWLM. Post-2016 data are not available to confirm whether this trend has continued or, as in the case of BWLM, reversed. As in BWLM, the dependency ratio in the ULM decreased in 2016, with an increasingly large portion of the younger population falling into the working age category. The dependency ratio in the KHLM decreased from 2011 to 2016, following a similar trend to ULM, although less pronounced. More recent data are not available to determine whether this trend has continued.

7.14.1.3 Employment and Sectors

BWLM's unemployment rate was around 24.2% in 2019, which is the highest unemployment rate in the CKD. The local municipality's trend has for the most part been consistent with that of the district municipality as well as that of the province at least since 2008.

Recent employment data are not available for ULM, PkSDM or KHLM. The 2011 census revealed that in that year the unemployment rate in ULM was 29.1% and in PkSDM, 28.3%. KHLM unemployment rate peaked around 2003 and has been falling since. However, recent data is not available and there is reason to suspect that this trend may not have continued following the impact of the COVID-19 pandemic and lockdown restrictions, which have tended to increase unemployment in other places where the impact has been measured.

[28] The dependency ratio expresses the ratio of those typically not in the labour force (being lower than the age of 15 and higher than the age of 64) to those typically in the labour force (people of ages 15 to 64).

The sector which contributes most to employment in BWLM is wholesale and retail trade, catering and accommodation. This sector contributed 3,126 of the total of the area's 12,515 jobs in 2018. The second highest number of jobs was in agriculture, forestry and fisheries which employed 2,421 people in that year.

Most jobs in BWLM fall into the semi-skilled (43.1%) and low-skilled (36.4%) categories with skilled jobs making up only 20.5% of jobs in the area (see *Appendix C17: Socio-Economic*).

7.14.1.4 Educational Levels

The proportion of people over the age of 20 years who have obtained a matric certificate increased in the 2011 to 2016 period at both the local and district municipality scales. This indicates that basic education levels have improved in the study area during this time. The proportion of people who have obtained some form of higher education has however decreased over the same period, at both the local and district municipality scales. This metric, previously published by StatsSA, is not available for either BWLM or CKDM in recent years.

Statistics published by the Western Cape Government indicate that learner enrolment has been increasing gradually in recent years (WCPG, 2020a). This is a promising trend. However, while the demand for education has risen, supply has decreased according to the measure of the number of public ordinary schools, which has fallen by one per year over the 2018–2019 period.

According to StatsSA the proportion of people in ULM over the age of 20 years with no schooling fell from 16% to 12% over the 2011–2016 period. For the PkSDM this figure decreased similarly from 15% to 12%. At the same time, the proportion of people who have attained a matric certificate had increased for both ULM and PkSDM during these years. The proportion of people who had attained some form of higher education had meanwhile fallen. More recent data has not been published on the above-reported metrics at either the district or local municipality-level in the Northern Cape.

Education trends in the KHLM and NDM are more or less in line with those in the ULM and PkSDM and the BWLM and CKDM over the 2011–2016 period.

7.14.1.5 Availability of Municipal Services

Access to basic services has improved over time both at the local and district municipality levels, except in the case of water. A greater proportion of households had access to a flush toilet connected to sewerage, weekly refuse removal and electricity and lighting in 2016 as compared to 2011 throughout the local and district municipalities. This progression was somewhat reversed in the 2016–2019 period, with relatively more households not having access to electricity for lighting in recent years. Interviews with municipal representatives suggest that in-migration of poor families has led to the expansion of informal settlements where the provision of service delivery remains relatively low.

According to the Western Cape Government, there are relatively few informal houses in either the BWLM or in the CKDM. In the BWLM, 99.6% of households live in formal dwellings, which is a slightly higher proportion of households than the CKDM with 97.8%.

7.14.1.6 Health

The BWLM supports five primary healthcare centres (PHC) two district hospitals, one specialised hospital, one satellite clinic, one community day centre (CDC) and four mobile clinics. According to the latest available information, the ULM currently has 3 clinics and 2 Community Health Centres, no district hospital, no Mobile Clinics and no Satellite Clinics (HST, no date). The latest available information indicates that the KHM has 3 PHC clinics and 2 Mobile Clinics.

Direct provision of public health services is complemented by service provision more broadly. This is noted in the PkSDM Health Profile, with inadequate provision of basic services such as water and wastewater treatment being stressed as having dire implications for the health status of communities.

Another major concern in the study area is HIV/AIDS and Tuberculosis (TB) treatment and care. BWLM's latest IDP revision notes the importance of providing preventative care to vulnerable communities. This preventative care is provided by government and consists primarily of condom distributions and campaigns to encourage the practice of safe sex. In terms of providing treatment, government provides antiretroviral therapy (ART) to people living with HIV. Similar to the BWLM, communities living in the ULM also face challenges with respect to HIV/AIDS and TB.

Municipalities continue to address health issues facing communities through the provision of health services and through the continued training of Community Health Workers. In addition to treating HIV/AIDS, facilities provide immunisation for children. Other challenges faced by communities include a higher than anticipated neo-natal mortality rate – 13.4 neonatal deaths per 1000 live births for CKDM in 2019, up from 14 in 2016 (the target had been set at 6 or less). The neonatal death rate for BWLM is lower, at 8.4 deaths per live birth.

7.14.1.7 Socio-economic development and spatial planning

Socio-economic development imperatives inform spatial planning imperatives. A critical aspect of socio-economic desirability is thus whether the proposed development complements economic planning as reflected in spatial development planning. Integrated Development Plans (IDPs) and their accompanying Spatial Development Frameworks (SDFs) are particularly important in this regard. SDFs are central to economic development planning and serve to guide overall development in a direction that local and provincial authorities see as desirable. Indeed, the basic purpose of an SDF is to specify the spatial implications of IDPs, with a focus on optimising economic opportunities and other strategic objectives.

Alignment with SDFs, structure plans and other planning documents is a robust way of ensuring economic and social feasibility. Projects that do achieve close alignment are more likely to ensure that positive impacts are optimised, reducing the likelihood of externalities on other stakeholders and productive sectors. Where projects do not achieve alignment with existing planning, there should be clear and compelling reasons why a deviation from planning should be considered.

The following provincial and regional planning documents were found to be of relevance and were consequently reviewed:

- Western Cape SDF 2014
- Northern Cape SDF 2012, updated in 2018
- Central Karoo District Municipality IDP 2021/22
- Central Karoo District Municipality SDF 2014 and draft SDF 2019
- Namakwa District Municipality IDP 2021/22
- Namakwa District Municipality Rural Development Plan 2017
- Beaufort West Local Municipality IDP 2021/22
- Beaufort West Local Municipality SDF 2013
- Ubuntu Local Municipality IDP 2020/21
- Karoo Hoogland Local Municipality IDP 2021/22
- Karoo Hoogland Local Municipality SDF 2019

Considered as a whole, the planning documents reviewed recognise the importance of integrated and diversified economic development that makes optimal use of each area's comparative advantages and creates economic opportunities. The concept of a renewable energy project is therefore broadly supported provided environmental impacts and impacts on other land uses and potentials are acceptable. However, some potentially constraining spatial factors were identified in the documents, including some tension over the kind of development considered appropriate for the Nuweveld Highlands. These findings have been used to guide the remainder of this assessment of socio-economic impacts and in particular those on sense of place and associated tourism.

7.14.2 Site Sensitivity

In spatial terms, site sensitivity in a socio-economic context mainly relates to the sensitivity of the site in terms of tourism. Impacts on tourism would be driven by visual and associated heritage impacts on a relatively isolated area with wilderness quality and limited signs of civilisation. However, tourisms facilities and attractions in the areas surrounding the project site are very limited and sparsely distributed. Of the tourism establishments identified, five fall within 6km from the perimeter of the Hoogland South Cluster, of which four are owned by a participant in the Hoogland Wind Farms Project. However, one of these five establishments, the Riverine Rabbit Retreat (6km from Hoogland 4), is owned by someone who is not participating in the project (see Figure 7-122). For some of these establishments, especially for the Riverine Rabbit Retreat, it is likely that negative impacts would be experienced in terms of reduced tourism demand and this is assessed below.

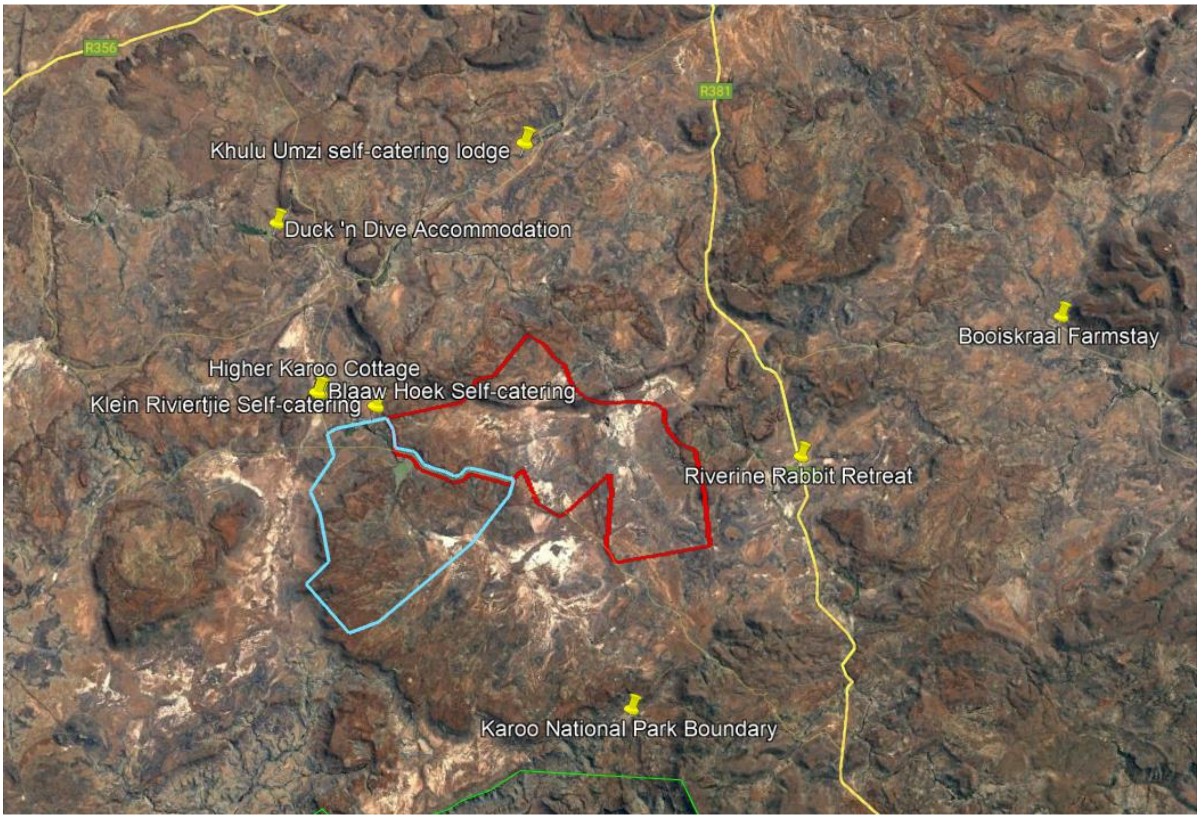


Figure 7-122: Map showing identified prominent tourism establishments in relation to the site

The distance of such facilities from the proposed projects meant it was not necessary to apply buffers as per on site sensitivities or constraints and therefore no socio-economic features have been included in the consolidate no maps in Figure 9-1 to Figure 9-8.

In terms of overall sensitivity, the specialist opinion included in the socio-economic SSSV (Appendix B of *Appendix C17: Socio-Economic*) confirms that no preliminary socio-economic sensitivities or sensitivity rating was identified or provided based on the DFFE Screening Tool. Nevertheless, the specialist report provides all the necessary information and assessment data to provide an opinion on the sensitivity rating of the site. It was therefore found that the site would have a low to medium sensitivity rating based on the following:

- The planning documents relevant to the site do not identify significant or inherent constraints to appropriate development. Considered as a whole, the planning documents reviewed recognise the importance of integrated and diversified economic development that makes optimal use of the area's comparative advantages and creates economic opportunities. The concept of a renewable energy project is therefore broadly supported provided environmental impacts and impacts on other land uses and potentials are acceptable.

- Tourism facilities and attractions in the areas are very limited and sparsely distributed reducing tourism sensitivities. However, it should be recognised that the area is relatively isolated with wilderness quality and limited signs of civilisation which contributes to its tourism potential. It has a remote sense of place which makes it more sensitive to potential impacts on tourism and also on surrounding landowners and communities.
- Given its remote and relatively isolated location, the site would be relatively sensitive to the influx of people, including job seekers, that may be associated with the project. The influx of large numbers of people are not thought likely and these risks should be manageable and are common to most larger projects.
- The area is sensitive, in a positive sense, to increased economic opportunities as they are much needed as reflected in low employment and income levels. Projects that can provide such opportunities are therefore to be encouraged where possible.

7.14.3 Impact Assessment and Mitigation

The following socio-economic impacts have been identified and rated by IER (2022).

7.14.3.1 Construction Phase

Table 7-136: Construction: Impacts from expenditure on the construction of the project

Issue	Impacts from expenditure on the construction of the project	
Description of Impact		
Increased economic activity best measured through changes in expenditure and employment		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	High
Duration	Short-term	Short-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium +	Medium +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Very low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. • Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. • Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. Setting up a skills and services database in partnership with the	

	local municipality and civil society for the local area before any hiring or contracting decisions are made. This can help to ensure fairness and limit potential interference in hiring processes. • An effective employee induction programme is essential to ensuring that new employees, some of whom will be unfamiliar with the responsibilities of maintaining employment, are adequately prepared and motivated to adjust to the lifestyle required of them. This programme should incorporate life skills training as well as basic financial literacy training. • Counselling services should be made available to employees to ensure that they have adequate guidance. Assisting smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects. • Avoiding potential service provider decisions that may lead to abuse or local dissatisfaction. For example, only appointing one accommodating rental agent or one catering supplier may lead to local dissatisfaction regarding the spreading of project benefits. • As far as possible, avoid significant variation in salaries between various contractors for the same types of jobs. When variations are too high, the likelihood of dissatisfaction increases.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-137: Construction: Impacts on tourism

Issue	Impacts on tourism	
Description of Impact		
Reduction in tourism appeal due to construction activities		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.	

Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-138: Construction: Impacts associated primarily with the influx of people

Issue	Impacts associated primarily with the influx of people	
Description of Impact		
Resulting from influx of workers and job-seekers during the construction phase		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• A 'locals first' policy with regard to construction labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction process. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed. • The applicant and the contractor should implement a Tuberculosis and HIV/AIDS awareness programme for all workers at the outset of the construction phase. • Arrangements must be made to enable workers from outside the area to return home at reasonably regular intervals. This would reduce the risk posed by non-local construction workers to local family structures and social networks. • Condoms should be freely available to employees and all contractor workers.	

	• The applicant should honour their commitment to spend R 100 000 per year during construction to contribute to security initiatives in the affected areas. • The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. • Close coordination with the municipality is required, including regular meetings.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-139: Construction: Impacts on surrounding landowners and communities

Issue	Impacts on surrounding landowners and communities	
Description of Impact		
Associated with greater activity nearby and related nuisance and damages		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	• No construction workers, with the exception of security personnel, should be allowed to stay on the site overnight. • The community should be able to contact the site manager to report any issues which they may have. The site manager should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. • The applicant should develop a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. • The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary	

	arrangements for transporting workers to and from site on a daily basis. • The applicant should honour his commitment to spend R 100 000 per year during construction to contribute to security initiatives. • The applicant should implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. • The EMPR must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. • Mitigation measures proposed by other specialists, in particular those prescribed in the Traffic Impact Assessment, need to be adhered to. • The applicant should consult community representatives, including relevant people within the local municipality as well as ward councillors, regarding planning for the use of the N1 temporary bypass to ensure that all stakeholders are kept informed as to the timing of project-traffic and potential ways of ensuring the safety of community members in the area.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-140: Construction: Impacts on property values

Issue	Impacts on property values	
	Description of Impact	
Changes in property values due to visual and other impacts		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on property values are dependent on how the site is developed and managed to minimise negative biophysical and socio-economic impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and	

	ecological impacts) and in this study would thus also minimise property value impacts.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

7.14.3.2 Operational Phase

Table 7-141: Operation: Impacts from expenditure on the operation of the project

Issue	Impacts from expenditure on the operation of the project	
Description of Impact		
Increased economic activity best measured through changes in expenditure and employment		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	High
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	High
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium +	High +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. • Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. • Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. • Setting up a skills and services database in partnership with the local municipality and civil society for the local area before any hiring or contracting decisions are made. This can help to ensure fairness and limit potential interference in hiring processes. • An effective employee induction programme is essential to ensuring that new employees, some of whom will be unfamiliar with the responsibilities of maintaining employment, are adequately prepared and motivated to adjust to the lifestyle required of them. This programme should incorporate life skills training as well as basic financial literacy training. • Counselling services should be made available to employees to ensure that they have adequate guidance.	

	• Assisting smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects. • Avoiding potential service provider decisions that may lead to abuse or local dissatisfaction. For example, only appointing one accommodating rental agent or one catering supplier may lead to local dissatisfaction regarding the spreading of project benefits.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-142: Operation: Impacts associated with the funding of local socio-economic development, enterprise development and shareholding

Issue	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	
Description of Impact		
Economic development resulting from REIPPPP requirements and other Corporate Social Investment (CSI)		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	High
Duration	Long-term	Long-term
Extent	Regional	Regional
Consequence	Medium	High
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium +	High +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• The project must comply with the requirements of the REIPPPP bidding process which will have stringent requirements with regard to socio-economic development, enterprise development, BBEEE shareholding etc. • The applicant must establish a communications committee early on in the project to ensure inclusive planning and regular feedback from stakeholders. • Community development should be guided by a community needs analysis, drawn up by a third party and based on local socio-economic conditions, a review of planning documents such as the IDP, and discussions with local and district-level government and community representatives. Interventions should be planned in collaboration with other energy developers in the area where relevant. • Close liaison with local and district-level municipal managers, local councilors and other stakeholders involved in socio-economic development is required to ensure that any projects	

	are integrated into wider socio-economic development strategies and plans.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-143: Operation: Impacts associated primarily with the influx of people

Issue	Impacts associated primarily with the influx of people	
Description of Impact		
Resulting from influx of workers and other potential movements of people during operations		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Very Low	Very Low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• A 'locals first' policy with regard to construction and operational labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed. • Condoms should be freely available to employees and all contractor workers. • Close coordination with the district and local municipalities is encouraged.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-144: Operation: Impacts on tourism

Issue	Impacts on tourism	
Description of Impact		
Reduction in tourism appeal due to changes in sense of place, increase in business tourism		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Medium
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Medium	Medium
Probability	Probable	Probable
Significance	Medium -	Medium -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation will slightly reduce the significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on tourism are dependent on how the site is developed and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-145: Operation: Impacts on surrounding landowners and communities

Issue	Impacts on surrounding landowners and communities	
Description of Impact		
Associated with greater activity nearby and related nuisance and damages		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	

Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts
Mitigation actions	
The following measures are recommended:	• A 'locals first' policy with regard to labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed. • Condoms should be freely available to employees and all contractor workers. • Close coordination with the district and local municipalities is encouraged.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-146: Operation: Impacts on property values

Issue	Impacts on property values	
Description of Impact		
Changes in property values due to visual and other impacts		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Long-term	Long-term
Extent	Site	Site
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on property values are dependent on how the site is developed and managed to minimise negative biophysical and socio-economic impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and	

	ecological impacts) and in this study would thus also minimise property value impacts.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

7.14.3.3 Decommissioning Phase

Table 7-147: Decommissioning: Impacts from expenditure on the decommissioning of the project

Issue	Impacts from expenditure on the decommissioning of the project	
Description of Impact		
Increased economic activity best measured through changes in expenditure and employment		
Type of Impact	Direct	
Nature of Impact	Positive	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	High
Duration	Short-term	Short-term
Extent	Regional	Regional
Consequence	Medium	Medium
Probability	Definite / Continuous	Definite / Continuous
Significance	Medium +	Medium +
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• Setting targets for how much local labour should be used based on the needs of the applicant and the availability of existing skills and people that are willing to undergo training. Opportunities for the training of unskilled and skilled workers from local communities should be maximized. • Using local sub-contractors where possible and requiring that contractors from outside the local area that tender also meet targets for how many locals are given employment. • Exploring ways to enhance local community benefits with a focus on broad-based BEE and preferential procurement. • Setting up a skills and services database in partnership with the local municipality and civil society for the local area before any hiring or contracting decisions are made. This can help to ensure fairness and limit potential interference in hiring processes. • An effective employee induction programme is essential to ensuring that new employees, some of whom will be unfamiliar with the responsibilities of maintaining employment, are adequately prepared and motivated to adjust to the lifestyle required of them. This programme should incorporate life skills training as well as basic financial literacy training. • Counselling services should be made available to employees to ensure that they have adequate guidance.	

	Assisting smaller enterprises where possible in tendering for contracts and in accessing finance which are common constraints to their participation in projects. • Avoiding potential service provider decisions that may lead to abuse or local dissatisfaction. For example, only appointing one accommodating rental agent or one catering supplier may lead to local dissatisfaction regarding the spreading of project benefits. • As far as possible, avoid significant variation in salaries between various contractors for the same types of jobs. When variations are too high, the likelihood of dissatisfaction increases.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-148: Decommissioning: Impacts associated primarily with the influx of people

Issue	Impacts associated primarily with the influx of people	
Description of Impact		
Resulting from influx of workers and job-seekers during the decommissioning phase		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Local	Local
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Medium	
Mitigation actions		
The following measures are recommended:	• A ‘locals first’ policy with regard to construction labour needs. • The community should be able to contact the site manager or his/her representative to report any issues which they may have. The site manager and his/her representative should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction process. • The applicant and the contractors should, develop a Code of Conduct for the project. The code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. For example, access on land that is not part of the development will not be allowed.	

	• The applicant and the contractor should implement a Tuberculosis and HIV/AIDS awareness programme for all workers at the outset of the construction phase. • Arrangements must be made to enable workers from outside the area to return home over the weekends or /at regular intervals. This would reduce the risk posed by non-local construction workers to local family structures and social networks. • Condoms should be freely available to employees and all contractor workers. • The applicant should honour their commitment to spend R 100 000 per year during construction to contribute to security initiatives in the affected areas. • The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. • Close coordination with the municipality is required, including regular meetings.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-149: Decommissioning: Impacts on tourism

Issue	Impacts on tourism	
Description of Impact		
Reduction in tourism appeal due to decommissioning activities		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on tourism are dependent on how the site is decommissioned and managed to minimise negative biophysical impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) would thus also minimise tourism impacts.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

Table 7-150: Decommissioning: Impacts on surrounding landowners and communities

Issue	Impacts on surrounding landowners and communities	
Description of Impact		
Associated with greater activity nearby and related nuisance and damages		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Probable	Probable
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	• No decommissioning workers, with the exception of security personnel, should be allowed to stay on the site overnight. • The community should be able to contact the site manager to report any issues which they may have. The site manager should be stationed within the area and should therefore be available on hand to deal with and address any concerns which may be raised. • A complaints register should be available on site to any individual who may have a particular complaint with regards to the construction or operations processes. • The applicant should develop a Code of Conduct for the project. The Code should identify what types of behaviour and activities by workers are not permitted in agreement with surrounding landowners and land managers. • The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • The applicant should honour his commitment to spend R 100 000 per year during construction to contribute to security initiatives. • The applicant should implement measures to assist and, if needed, fairly compensate potentially affected surrounding landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. • The EMPR must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.	

	• Mitigation measures proposed by other specialists, in particular those prescribed in the Traffic Impact Assessment, need to be adhered to.
Monitoring	
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.

Table 7-151: Decommissioning: Impacts on property values

Issue	Impacts on property values	
Description of Impact		
Changes in property values due to visual and other impacts		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Decommissioning	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Short-term	Short-term
Extent	Site	Site
Consequence	Low	Low
Probability	Possible / frequent	Possible / frequent
Significance	Low -	Low -
Degree to which impact can be reversed	Low	
Degree to which impact may cause irreplaceable loss of resources	Low	
Degree to which impact can be mitigated	Mitigation exists and will notably reduce significance of impacts	
Mitigation actions		
The following measures are recommended:	Impacts on property values are dependent on how decommissioning happens, how the site is managed to minimise negative biophysical and socio-economic impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) and in this study would thus also minimise property value impacts.	
Monitoring		
The following monitoring is recommended:	Section 7 of the specialist report (*Appendix C17: Socio-Economic*) on mitigation and EMPR requirements provides details on monitoring required for the above mitigation measures.	

7.14.4 Cumulative Impact

The following cumulative impacts have been identified and rated by IER (2022).

7.14.4.1 Construction Phase

Table 7-152: Cumulative impact: Impacts from expenditure on the construction of the project

Issue	Impacts from expenditure on the construction of the project	
Nature of cumulative impacts	Increased intensity of positive impact from multiple projects, potential for virtuous cycle of development (economies of scale for supporting industries)	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium +	High +

Table 7-153: Cumulative impact: Impacts associated primarily with the influx of people – construction phase

Issue	Impacts associated primarily with the influx of people	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms and associated gridlines, as well as all three Nuweveld Wind Farms projects and gridline going ahead at the same time would be an increase in the likelihood of a larger influx of people to the area whether they have jobs secured or are job seekers. This would result in a higher risk of social problems associated with influx particularly during construction.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-154: Cumulative impact: Impacts on tourism during construction

Nature of cumulative impacts	The cumulative impact associated with all four Hoogland wind farms projects and the two associated grid connections going ahead at the same time as the three Nuweveld wind farms and their associated gridline would be an increase in tourism risk but also tourism opportunities from business tourism in particular. However, it is highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that construction would more likely occur in a staggered way so as to spread the effort over the distinct 18–24 months construction period planned for both the Hoogland and Nuweveld projects. Cumulative impacts have therefore been rated medium negative overall bearing in mind the relatively higher levels of uncertainty in making cumulative assessments of this nature.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

Table 7-155: Cumulative impact: Impacts on surrounding landowners and communities during construction

Issue	Impacts on surrounding landowners and communities	
Nature of cumulative impacts	Cumulatively, construction of the Hoogland grid connections alongside the Hoogland Wind Farms as well as the Nuweveld Wind Farms and associated gridline have the potential to substantially change the area's sense of place and impacts on surrounding communities could therefore be noteworthy if all were to go ahead simultaneously. However, it is highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that construction would more likely occur in a staggered way so as to spread the effort over the distinct 18–24 months construction period planned for both the Hoogland and Nuweveld projects. Cumulative impacts associated with these developments are expected to be medium negative without mitigation and low negative with mitigation during construction.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

Table 7-156: Cumulative impact: Impacts on property values during construction

Issue	Impacts on property values

Nature of cumulative impacts	Cumulative impacts associated with all four Hoogland Wind Farms and associated grid infrastructure, as well as all three Nuweveld Wind Farms and associated gridline, are expected to be low negative with mitigation during construction and operations. This reflects the greater scale of development and the findings of the Visual Impact Assessment that the cumulative impacts could be high given the potential effect on the rural landscape and sense of place. It also recognises that development at this scale will provide a more significant boost to the local economy with the potential to boost property values.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.14.4.2 Operation Phase

Table 7-157: Cumulative impact: Impacts from expenditure on the operation of the project

Issue	Impacts from expenditure on the operation of the project	
Nature of cumulative impacts	Increased intensity of positive impact from multiple projects, potential for virtuous cycle of development (economies of scale for supporting industries)	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High +	High +

Table 7-158: Cumulative impact: Impacts associated primarily with the influx of people – operational phase

Issue	Impacts associated primarily with the influx of people	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms and associated grid connection, as well as all three Nuweveld Wind Farms projects and gridline going ahead at the same time would be an increase in the likelihood of a larger influx of people to the area whether they have jobs secured or are job seekers. This would result in a higher risk of social problems associated with influx, but relatively less so than during construction.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-159: Cumulative impact: Impacts on tourism during operation

Issue	Impacts on tourism	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms projects and the two associated grid connections going ahead, as well as the three Nuweveld Wind Farms and their associated gridline would be an increase in tourism risk but also tourism opportunities from business tourism. For the operational phase, cumulative impacts are rated as medium negative without and with mitigation.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

Table 7-160: Cumulative impact: Impacts on surrounding landowners and communities during operation

Issue	Impacts on surrounding landowners and communities
Nature of cumulative impacts	Cumulatively, the Hoogland grid connections considered alongside the Hoogland Wind Farms as well as the Nuweveld Wind Farms and

	associated gridline have the potential to substantially change the area's sense of place and impacts on surrounding communities could therefore be noteworthy. Cumulative impacts associated with these developments are expected to be medium negative without mitigation and low negative with mitigation during operations.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-161: Cumulative impact: Impacts on property values during operation

Issue	Impacts on property values	
Nature of cumulative impacts	Cumulative impacts associated with all four Hoogland Wind Farms and associated grid infrastructure, as well as all three Nuweveld Wind Farms and associated gridline, are expected to be low negative with mitigation during construction and operations. This reflects the greater scale of development and the findings of the Visual Impact Assessment that the cumulative impacts could be high given the potential effect on the rural landscape and sense of place. It also recognises that development at this scale will provide a more significant boost to the local economy with the potential to boost property values.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-162: Cumulative impact: Impacts associated with the funding of local socio-economic development, enterprise development and shareholding during operation

Issue	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	
Nature of cumulative impacts	The total cumulative funding of local socio-economic and enterprise development associated with all four Hoogland projects as well as all three Nuweveld projects would generate a substantial amount of economic activity. Combined minimum investment would be in the region of between R30.7 million – R34.0 million in the average year during operation.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High +	Very High +

7.14.4.3 Decommissioning Phase

Table 7-163: Cumulative impact: Impacts from expenditure on the decommissioning of the project

Issue	Impacts from expenditure on the decommissioning of the project	
Nature of cumulative impacts	Increased intensity of positive impact from multiple projects, potential for virtuous cycle of development (economies of scale for supporting industries).	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium +	High +

Table 7-164: Cumulative impact: Impacts associated primarily with the influx of people – decommissioning phase

Issue	Impacts associated primarily with the influx of people
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms and associated grid connections, as well as all three Nuweveld Wind

	Farms projects and gridline being decommissioned at the same time would be an increase in the likelihood of a larger influx of people to the area whether they have jobs secured or are job seekers. This would result in a higher risk of social problems associated with influx, but relatively less so than during construction.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-165: Cumulative impact: Impacts on tourism during decommissioning

Issue	Impacts on tourism	
Nature of cumulative impacts	The cumulative impact associated with all four Hoogland Wind Farms projects and the two associated grid connections going ahead at the same time as the three Nuweveld Wind Farms and their associated gridline would be an increase in tourism risk but also tourism opportunities from business tourism in particular. However, it is highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that the construction and decommissioning phases would more likely occur in a staggered way. Cumulative impacts have therefore been rated medium negative overall bearing in mind the relatively higher levels of uncertainty in making cumulative assessments of this nature.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Medium -

Table 7-166: Cumulative impact: Impacts on surrounding landowners and communities during decommissioning

Issue	Impacts on surrounding landowners and communities	
Nature of cumulative impacts	Cumulatively, decommissioning of the Hoogland gridline alongside the Hoogland Wind Farms as well as the Nuweveld Wind Farms and associated gridline have the potential to substantially change the area's sense of place and impacts on surrounding communities could therefore be noteworthy if all were to go ahead simultaneously. However, it is highly unlikely that all of these developments would go ahead at the same time, as the applicant has indicated that decomissioning would more likely occur in a staggered way. Cumulative impacts associated with decommissioning are expected to be medium negative without mitigation and low negative with mitigation.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 7-167: Cumulative impact: Impacts on property values during decommissioning

Issue	Impacts on property values	
Nature of cumulative impacts	Cumulative impacts associated with all four Hoogland Wind Farms and associated grid infrastructure, as well as all three Nuweveld Wind Farms and associated gridline, are expected to be low negative with mitigation during decommissioning. This reflects the greater scale of development and the findings of the Visual Impact Assessment that the cumulative impacts could be high given the potential effect on the rural landscape and sense of place. It also recognises that development at this scale will provide a more significant boost to the local economy with the potential to boost property values.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

7.14.5 No-Go Alternative

The no-go alternative is, by definition, the continuation of the status quo the impacts of which can best be described as neutral. In particular, it can be noted that the no-go alternative would result in:

- Neutral impacts linked to project expenditure as this expenditure would not occur.
- Neutral impacts associated with the funding of local socio-economic development initiatives as there would be no additional funding from the project.
- Neutral social impacts associated primarily with the influx of people as there would be no influx.
- Neutral impacts on surrounding landowners and communities as the risk factors associated with the project would be absent.
- Neutral impacts on tourism as the risk factors associated with the project would be absent.
- Neutral impacts on property values as risks associated with factors that might influence property values would be absent.

7.14.6 Conclusion and Recommendations

In term of positive impacts, the project would be largely supportive of local and regional socio-economic development and energy supply planning imperatives including the diversification of the economy and energy sources. The expenditure associated with the project would be about R3 billion to R3.4 billion per Wind Farm (R6 billion–R6.8 billion for both Wind Farms) and R108 million to R119 million would be spent annually during operations per Wind Farm (R216–R238 million for both). Roughly 160 to 200 jobs of 18 to 24-month duration would be associated with construction per Wind Farm (320–400 jobs for both) and between 40 and 60 direct employment opportunities would be created during operations per Wind Farm (80–120 jobs for both), resulting in major benefits. In addition, each Wind Farm would contribute a minimum of R4.3 to R4.7 million per annum if averaged over 20 years to local socio-economic development, local community shareholding and enterprise development (R8.6 million–R9.4 million for both Wind Farms). As these figures are based on the minimum requirements, they represent conservative estimates.

Negative impacts would primarily arise at a local scale. It is anticipated that, with mitigation, the risks posed to the community by the influx of people, including job seekers, would be manageable and of a low significance with mitigation. Impacts on tourism would be driven by visual and associated heritage impacts on a relatively isolated area with wilderness quality and limited signs of civilisation. However, tourism facilities and attractions in the areas surrounding the project site are very limited and sparsely distributed, with a few exceptions. The tourism context itself should limit impacts to a low significance during construction and a medium significance during operations with mitigation. Overall impacts on property values should also remain low with mitigation in keeping with the avoidance of no-go and high visual sensitivity areas and reflecting the findings of the assessment of other socio-economic impacts.

It is considered most likely that the combined positive impacts of the Hoogland 3 and Hoogland 4 Wind Farm projects would exceed the negative impacts resulting in an overall net benefit with mitigation. The projects are therefore deemed acceptable in terms of socio-economic impacts and should be allowed to proceed.

8 SUMMARY OF IMPACT ASSESSMENT

8.1 Summary of Impact Assessment for Hoogland 3 Wind Farm

8.1.1 Summary of Individual Impacts

Table 8-1 provides a summary of the potential environmental impacts that have been identified and assessed for the **Hoogland 3 Wind Farm**. The findings presented in the Pre-Application Report have been re-evaluated as part of the BA phase (where required), as input from various stakeholders was obtained during PPP; further monitoring results from birds, bats and ecology became available and further refinements were made to the design and layout, and are presented in this BA Report. The summary of potential environmental impacts for the Hoogland 4 Wind Farm are presented separately in Table 8-3. Noting that the main differences in impact ratings between Hoogland 1 and Hoogland 2 are in relation to terrestrial ecology, heritage and shadow flicker.

Table 8-1: Summary of potential impacts assessed pre- and post-mitigation for Hoogland 3 Wind Farm

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
Climate Change	All Phases	Climate change impacts (GHG emissions)	Very High +	N/A
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Geotechnical	Construction	Ground disturbance during construction	High -	Medium -
	Construction	Soil erosion during construction	Medium -	Low -
	Operational	Soil erosion during operational phase	Medium -	Low -
	Decommissioning	Ground disturbance during decommissioning	High -	Medium -
	Decommissioning	Soil erosion during decommissioning stage	Medium -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Agriculture	Construction	Loss of agricultural potential by occupation of land, soil degadation and dust	Very Low -	Very Low -
	Operational	Increased financial security for farming operations	Very Low +	Very Low +
	Decommissioning	Loss of agricultural potential by soil degradation	Very Low -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Terrestrial Ecology	Construction	Impact on the Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Medium -	Low -
	Construction	Impact on the Riverine Rabbit	Medium -	Low -
	Construction	Habitat loss and degradation impact on the Karoo Dwarf Tortoise	High -	Low -
	Construction	Karoo Dwarf Tortoise mortalities due to earthworks and roadkill	Medium -	Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Operational	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Medium -	Low -
	Operational	Impact on the Riverine Rabbit	Medium -	Low -
	Operational	Karoo Dwarf Tortoise mortalities due to roadkill	High -	Low -
	Operational	Karoo Dwarf Tortoise mortalities due to predation by corvids	High -	Low -
	Decommissioning	Impact on the Riverine Rabbit	Medium -	Low -
	No-go alternative	The impact of the status quo prevailing	Low -	Low -
Bats	Construction	Loss of foraging habitat by clearing of vegetation	Low -	Very Low -
	Construction	Roost destruction during earthworks	Low -	Insignificant
	Operation	Bat mortalities during foraging	High -	Low -
	Operation	Bat mortalities during migration	Medium -	Low -
	Operation	Increased bat mortalities due to light attraction and habitat creation	High -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Avifauna	Construction	Habitat destruction	Medium -	Medium -
	Construction	Disturbance of birds	Low -	Low -
	Operational	Disturbance of birds	Low -	Low -
	Operational	Displacement of birds	Low -	Low -
	Operational	Collision of birds with turbines	High -	Medium -
	Operation	Collision & electrocution of birds on overhead power lines	High -	Low -
	Decommissioning	Disturbance of birds	Low -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Aquatic	Construction	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Construction	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Construction	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Construction	Potential impacts on localised surface water quality	Medium -	Very Low -
	Construction	Groundwater abstraction	Medium -	Very Low -
	Operational	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Operational	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Operational	Groundwater abstraction	Medium -	Very Low -
	Decommissioning	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Decommissioning	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Decommissioning	Potential impacts on localised surface water quality	Medium -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Visual	Construction	Visual intrusion of construction activities on the Karoo landscape	Medium -	Medium -
	Operational	Visual intrusion of wind turbines on the Karoo landscape	High -	High -
	Operational	Visual intrusion of infrastructure on the Karoo landscape	Medium -	Medium -
	Operational	Visual intrusion of lighting at night	Medium -	Medium -
	Decommissioning	Visual intrusion of activities to remove infrastructure	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Heritage	Construction	Impacts to archaeological resources	High -	Low -
	Construction	Impacts to the cultural landscape	High -	Medium -
	Operation	Impacts to the cultural landscape	Medium -	Medium -
	Decommissioning	Impacts to the cultural landscape	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Palaeontology	Construction	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value	Low -	Very Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Noise	Construction	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Construction	Night-time Wind Turbine construction activities	Insignificant	Insignificant
	Construction	Daytime road construction activities	Insignificant	Insignificant
	Construction	Daytime road traffic from construction vehicles	Insignificant	Insignificant
	Operation	Daytime Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
	Operation	Night time Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Shadow flicker	Operation	Shadow flicker effects on identified receptors	Insignificant	Insignificant

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Traffic	Construction	Increased road incidents	Medium -	Low -
	Construction	Road degradation	Medium -	Low -
	Construction	Dust	Medium -	Low -
	Construction	Intersection safety	Medium -	Medium -
	Operation	Intersection safety	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Low -	Neutral
Socio-economic	Construction	Impacts from expenditure on the construction of the project	Medium +	Medium +
	Construction	Impacts on tourism	Low -	Low -
	Construction	Impacts associated primarily with the influx of people	Low -	Low -
	Construction	Impacts on surrounding landowners and communities	Low -	Low -
	Construction	Impacts on property value	Low -	Low -
	Operation	Impacts from expenditure on the construction of the project	Medium +	High +
	Operation	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	Medium +	High +
	Operation	Impacts associated primarily with the influx of people	Low -	Low -
	Operation	Impacts on tourism	Medium -	Medium -
	Operation	Impacts on surrounding landowners and communities	Low -	Low -
	Operation	Impacts on property value	Low -	Low -
	Decommissioning	Impacts from expenditure on decommissioning of the project	Medium +	Medium +
	Decommissioning	Impacts associated primarily with the influx of people	Low -	Low -
	Decommissioning	Impacts on tourism	Low -	Low -
	Decommissioning	Impacts on surrounding landowners and communities	Low -	Low -
	Decommissioning	Impacts on property value	Low -	Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral

8.1.2 Summary of Cumulative Impacts

For every impact identified and assessed for the **Hoogland 3 Wind Farm** within the specialist assessments outlined in Section 7 and summarised in Section 8.1, the cumulative impact of the said impact was also considered. The summary of potential cumulative impacts for the Hoogland 4 Wind Farm are presented separately in Table 8-4, noting the main differences are with respect to terrestrial ecology and heritage. As mentioned in Section 6.4, the cumulative impact assessed will be the collective impact of the four Hoogland Wind Farms and Grid Connection applications with the three Nuweveld Wind Farm and Gridline applications[11]. Please refer to each specialist assessment's impact assessment tables in Section 7, as every specialist assessment also includes an assessment of cumulative impacts, pre- and post- mitigation. Please see Table 8-2 below for a summary of these.

Table 8-2: Summary of cumulative impacts assessed pre- and post-mitigation for Hoogland 3 Wind Farm

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
Climate Change	Impact on Climate Change	Very High +	N/A
Geotechnical	Ground disturbance during construction	Medium -	Low -
	Soil erosion during construction	Medium -	Low -
	Soil erosion during operational phase	Medium -	Low -
	Ground disturbance during decommissioning	Medium -	Low -
	Soil erosion during decommissioning	Medium -	Low -
Agriculture	Loss of agricultural potential	Very Low -	Very Low -
Terrestrial ecology	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes during construction	Low -	Low -
	Impact on the Riverine Rabbit during construction	Medium -	Low -
	Impact on the Karoo Dwarf Tortoise: Habitat loss and degradation during construction	Medium -	Low -
	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes site during operation	Low -	Low -
	Impact on the Riverine Rabbit during operation	Medium -	Low -
	Karoo Dwarf Tortoise mortalities due to earthworks, roadkill and predation by corvids	Medium -	Low -
	Impact on the Riverine Rabbit during decommissioning	Medium -	Low -
Bats	Loss of foraging habitat by clearing of vegetation during construction	Low -	Very Low -
	Roost destruction during earthworks during construction	Low -	Very Low -
	Bat mortalities during foraging during operation	High -	Medium -
	Bat mortalities during migration during operation	High -	Medium -
	Increased bat mortalities due to light attraction and habitat creation during operation	High -	Medium -

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
Avifauna	Habitat destruction during construction	High -	Medium -
	Disturbance of birds during construction	Low -	Low -
	Disturbance of birds during operation	Low -	Low -
	Displacement of birds during operation	Low -	Low -
	Direct mortality of birds through collision with turbines during operation	High -	Medium -
Aquatic	Damage or loss of riparian systems and disturbance of waterbodies during construction and decommissioning	Medium -	Very Low -
	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function during all project phases	Medium -	Low -
	Changes to hydrological regimes that could also lead to sedimentation and erosion during construction and operation	Medium -	Low -
	Potential impacts on localised surface water quality during construction and decommissioning	Medium -	Very Low -
	Groundwater abstraction during construction and operation	Low -	Very Low -
Visual	Cumulative visual intrusion of wind turbines on the Karoo landscape	High -	High -
Heritage	Impacts to archaeological resources during construction	Medium -	Very Low -
	Impacts to the cultural landscape during construction	Medium -	Medium -
	Operational phase impacts to the cultural landscape	Medium -	Medium -
	Decommissioning phase impacts to the cultural landscape	Medium -	Medium -
Palaeontology	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value	Medium -	Low -
Noise	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Night-time Wind Turbine construction activities	Insignificant	Insignificant
	Daytime road construction activities	Insignificant	Insignificant
	Daytime road traffic from construction vehicles	Insignificant	Insignificant
	Daytime Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
	Night time Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
Shadow flicker	Shadow Flicker effects on identified receptors	Insignificant	Insignificant
Traffic	Increased road incidents during construction	Medium -	Low -
	Road degradation during construction	Medium -	Low -

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
	Dust during construction	Medium -	Low -
	Intersection safety during construction	Medium -	Medium -
	Intersection safety during operation	Medium -	Medium -
Socio-economic	Impacts from expenditure on construction of the project - construction	Medium +	High +
	Impacts associated primarily with the influx of people - construction	Medium -	Low -
	Impacts on tourism - construction	Medium -	Medium -
	Impacts on surrounding landowners and communities - construction	Medium -	Medium -
	Impacts on property value - construction	Medium -	Low -
	Impacts from expenditure on operation of the project - operation	High +	High +
	Impacts associated with the funding of socio-economic development, enterprise development and shareholding - operation	High +	Very High +
	Impacts associated primarily with the influx of people - operation	Medium -	Low -
	Impacts on tourism - operation	Medium -	Medium -
	Impacts on surrounding landowners and communities- operation	Medium -	Low -
	Impacts on property value - operation	Medium -	Low -
	Impacts from expenditure on decommissioning of the project	Medium +	High +
	Impacts associated primarily with the influx of people - decommissioning	Medium -	Low -
	Impacts on tourism - decommissioning	Medium -	Medium -
	Impacts on surrounding landowners and communities - decommissioning	Medium -	Low -
	Impacts on property value - decommissioning	Medium -	Low -

8.2 Summary of Impact Assessment for Hoogland 4 Wind Farm

8.2.1 Summary of Individual Impacts

Table 8-3 provides a summary of the potential environmental impacts that have been identified and assessed for the **Hoogland 4 Wind Farm**. The findings presented in the Pre-Application Report have been re-evaluated as part of the BA phase (where required), as input from various stakeholders was obtained during PPP; further monitoring results from birds, bats and ecology became available and further refinements were made to the design and layout, and are presented in this BA Report. The summary of potential environmental impacts for the Hoogland 3 Wind Farm are presented separately in Table 8-1.

Table 8-3: Summary of potential impacts assessed pre- and post-mitigation for Hoogland 4 Wind Farm

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
Climate Change	All Phases	Climate change impacts (GHG emissions)	Very High +	N/A
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Geotechnical	Construction	Ground disturbance during construction	High -	Medium -
	Construction	Soil erosion during construction	Medium -	Low -
	Operational	Soil erosion during operational phase	Medium -	Low -
	Decommissioning	Ground disturbance during decommissioning	High -	Medium -
	Decommissioning	Soil erosion during decommissioning stage	Medium -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Agriculture	Construction	Loss of agricultural potential by occupation of land, soil degradation and dust	Very Low -	Very Low -
	Operational	Increased financial security for farming operations	Very Low +	Very Low +
	Decommissioning	Loss of agricultural potential by soil degradation	Very Low -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Terrestrial ecology	Construction	Impact on the Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Medium -	Low -
	Construction	Habitat loss and degradation Impact on the Karoo Dwarf Tortoise	High -	Low -
	Construction	Karoo Dwarf Tortoise mortalities due to earthworks and roadkill	Medium -	Low -
	Operational	Impacts on Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and general ecological processes	Medium -	Low -
	Operational	Karoo Dwarf Tortoise mortalities due to roadkill	High -	Low -
	Operational	Karoo Dwarf Tortoise mortalities due to predation by corvids	High -	Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	No-go alternative	The impact of the status quo prevailing	Low -	Low -
Bats	Construction	Loss of foraging habitat by clearing of vegetation	Low -	Very Low -
	Construction	Roost destruction during earthworks	Low -	Insignificant
	Operation	Bat mortalities during foraging	High -	Low -
	Operation	Bat mortalities during migration	Medium -	Low -
	Operation	Increased bat mortalities due to light attraction and habitat creation	High -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Avifauna	Construction	Habitat destruction	Medium -	Medium -
	Construction	Disturbance of birds	Low -	Low -
	Operational	Disturbance of birds	Low -	Low -
	Operational	Displacement of birds	Low -	Low -
	Operational	Collision of birds with turbines	High -	Medium -
	Operation	Collision & electrocution of birds on overhead power lines	High -	Low -
	Decommissioning	Disturbance of birds	Low -	Low -
	No-go alternative	The impact of the status quo prevailing	Neutral	Neutral
Aquatic	Construction	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Construction	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Construction	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Construction	Potential impacts on localised surface water quality	Medium -	Very Low -
	Construction	Groundwater abstraction	Medium -	Very Low -
	Operational	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -
	Operational	Changes to hydrological regimes that could also lead to sedimentation and erosion	Medium -	Very Low -
	Operational	Groundwater abstraction	Medium -	Very Low -
	Decommissioning	Damage or loss of riparian systems and disturbance of waterbodies	Medium -	Very Low -
	Decommissioning	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function	Medium -	Very Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Decommissioning	Potential impacts on localised surface water quality	Medium -	Very Low -
	No-Go Alternative	The impact of the status quo prevailing	Very Low -	Very Low -
Visual	Construction	Visual intrusion of construction activities on the Karoo landscape	Medium -	Medium -
	Operational	Visual intrusion of wind turbines on the Karoo landscape	High -	High -
	Operational	Visual intrusion of infrastructure on the Karoo landscape	Medium -	Medium -
	Operational	Visual intrusion of lighting at night	Medium -	Medium -
	Decommissioning	Visual intrusion of activities to remove infrastructure	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Heritage	Construction	Impacts to archaeological resources	Medium -	Very Low -
	Construction	Damage to or destruction of built heritage resources	Low -	Insignificant
	Construction	Impacts to the cultural landscape	Medium -	Medium -
	Operation	Impacts to the cultural landscape	Medium -	Medium -
	Decommissioning	Impacts to the cultural landscape	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Palaeontology	Construction	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value	Low -	Very Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Noise	Construction	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Construction	Night-time Wind Turbine construction activities	Insignificant	Insignificant
	Construction	Daytime road construction activities	Insignificant	Insignificant
	Construction	Daytime road traffic from construction vehicles	Insignificant	Insignificant
	Operation	Daytime Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
	Operation	Night time Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral
Shadow flicker	Operation	Shadow flicker effects on identified receptors	Medium -	Insignificant
	No-Go alternative	The impact of the status quo prevailing	Insignificant	Insignificant
Traffic	Construction	Increased road incidents	Medium -	Low -
	Construction	Road degradation	Medium -	Low -
	Construction	Dust	Medium -	Low -

FIELD	PHASE	POTENTIAL IMPACT	SIGNIFICANCE	
			PRE- MITIGATION	POST- MITIGATION
	Construction	Intersection safety	Medium -	Medium -
	Operation	Intersection safety	Medium -	Medium -
	No-Go alternative	The impact of the status quo prevailing	Low -	Neutral
Socio-economic	Construction	Impacts from expenditure on the construction of the project	Medium +	Medium +
	Construction	Impacts on tourism	Low -	Low -
	Construction	Impacts associated primarily with the influx of people	Low -	Low -
	Construction	Impacts on surrounding landowners and communities	Low -	Low -
	Construction	Impacts on property value	Low -	Low -
	Operation	Impacts from expenditure on the construction of the project	Medium +	High +
	Operation	Impacts associated with the funding of socio-economic development, enterprise development and shareholding	Medium +	High +
	Operation	Impacts associated primarily with the influx of people	Low -	Low -
	Operation	Impacts on tourism	Medium -	Medium -
	Operation	Impacts on surrounding landowners and communities	Low -	Low -
	Operation	Impacts on property value	Low -	Low -
	Decommissioning	Impacts from expenditure on decommissioning of the project	Medium +	Medium +
	Decommissioning	Impacts associated primarily with the influx of people	Low -	Low -
	Decommissioning	Impacts on tourism	Low -	Low -
	Decommissioning	Impacts on surrounding landowners and communities	Low -	Low -
	Decommissioning	Impacts on property value	Low -	Low -
	No-Go alternative	The impact of the status quo prevailing	Neutral	Neutral

8.2.2 Summary of Cumulative Impacts

For every impact identified and assessed for the **Hoogland 4 Wind Farm** within the specialist assessments outlined in Section 7 and summarised in Section 8.1, the cumulative impact of the said impact was also considered. The summary of potential cumulative impacts for the Hoogland 3 Wind Farm are presented separately in Table 8-2. As mentioned in Section 6.4, the cumulative impact assessed will be the collective impact of the four Hoogland Wind Farms and Grid Connection applications with the three Nuweveld Wind Farm and Gridline applications[11]. Please refer to each specialist assessment's impact assessment tables in Section 7, as every specialist assessment also includes an assessment of cumulative impacts, pre- and post- mitigation. Please see Table 8-4 below for a summary of these.

Table 8-4: Summary of potential cumulative impacts assessed pre- and post-mitigation for Hoogland 4 Wind Farm

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
Climate Change	Impact on Climate Change	Very High +	N/A
Geotechnical	Ground disturbance during construction	Medium -	Low -
	Soil erosion during construction	Medium -	Low -
	Soil erosion during operational phase	Medium -	Low -
	Ground disturbance during decommissioning	Medium -	Low -
	Soil erosion during decommissioning	Medium -	Low -
Agriculture	Loss of agricultural potential	Very Low -	Very Low -
Terrestrial ecology	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes during construction	Low -	Low -
	Impact on the Karoo Dwarf Tortoise: Habitat loss and degradation during construction	Medium -	Low -
	Impacts on Critical Biodiversity Areas (CBAs) and Ecological Processes site during operation	Low -	Low -
	Karoo Dwarf Tortoise mortalities due to earthworks, roadkill and predation by corvids	Medium -	Low -
Bats	Loss of foraging habitat by clearing of vegetation during construction	Low -	Very Low -
	Roost destruction during earthworks during construction	Low -	Very Low -
	Bat mortalities during foraging during operation	High -	Medium -
	Bat mortalities during migration during operation	High -	Medium -
	Increased bat mortalities due to light attraction and habitat creation during operation	High -	Medium -
Avifauna	Habitat destruction during construction	High -	Medium -
	Disturbance of birds during construction	Low -	Low -
	Disturbance of birds during operation	Low -	Low -
	Displacement of birds during operation	Low -	Low -
	Direct mortality of birds through collision with turbines during operation	High -	Medium -
Aquatic	Damage or loss of riparian systems and disturbance of waterbodies during construction and decommissioning	Medium -	Very Low -
	Impact on riparian and wetland systems through the possible increase in surface water runoff on form and function during all project phases	Medium -	Low -
	Changes to hydrological regimes that could also lead to sedimentation and erosion during construction and operation	Medium -	Low -
	Potential impacts on localised surface water quality during construction and decommissioning	Medium -	Very Low -

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
	Groundwater abstraction during construction and operation	Low -	Very Low -
Visual	Cumulative visual intrusion of wind turbines on the Karoo landscape.	High -	High -
Heritage	Impacts to archaeological resources during construction	Low -	Very Low -
	Impacts to built heritage during construction	Low -	Very Low -
	Impacts to the cultural landscape during construction	Medium -	Medium -
	Operational phase impacts to the cultural landscape	Medium -	Medium -
	Decommissioning phase impacts to the cultural landscape	Medium -	Medium -
Palaeontology	Loss or degradation of local palaeontological heritage resources of scientific and/or conservation value	Medium -	Low -
Noise	Daytime Wind Turbine construction activities	Insignificant	Insignificant
	Night-time Wind Turbine construction activities	Insignificant	Insignificant
	Daytime road construction activities	Insignificant	Insignificant
	Daytime road traffic from construction vehicles	Insignificant	Insignificant
	Daytime Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
	Night time Wind Turbine operation raising ambient sound levels	Very Low –	Very Low -
Shadow flicker	Shadow Flicker effects on identified receptors	Insignificant	Insignificant
Traffic	Increased road incidents during construction	Medium -	Low -
	Road degradation during construction	Medium -	Low -
	Dust during construction	Medium -	Low -
	Intersection safety during construction	Medium -	Medium -
	Intersection safety during operation	Medium -	Medium -
Socio-economic	Impacts from expenditure on construction of the project - construction	Medium +	High +
	Impacts associated primarily with the influx of people - construction	Medium -	Low -
	Impacts on tourism - construction	Medium -	Medium -
	Impacts on surrounding landowners and communities - construction	Medium -	Medium -
	Impacts on property value - construction	Medium -	Low -
	Impacts from expenditure on operation of the project - operation	High +	High +
	Impacts associated with the funding of socio-economic development, enterprise development and shareholding - operation	High +	Very High +

FIELD	POTENTIAL CUMULATIVE IMPACT	SIGNIFICANCE	
		PRE- MITIGATION	POST- MITIGATION
	Impacts associated primarily with the influx of people - operation	Medium -	Low -
	Impacts on tourism - operation	Medium -	Medium -
	Impacts on surrounding landowners and communities- operation	Medium -	Low -
	Impacts on property value - operation	Medium -	Low -
	Impacts from expenditure on decommissioning of the project	Medium +	High +
	Impacts associated primarily with the influx of people - decommissioning	Medium -	Low -
	Impacts on tourism - decommissioning	Medium -	Medium -
	Impacts on surrounding landowners and communities - decommissioning	Medium -	Low -
	Impacts on property value - decommissioning	Medium -	Low -

Key recommendations from the various specialists for consideration are provided in Section Table 8-5 and Table 8-6 below.

8.3 Key Recommendations

8.3.1 Key Recommendations for Hoogland 3 Wind Farm

The table below provide a synopsis of the specialist recommendations that are specific to the Hoogland 3 Wind Farm. Noting that terrestrial ecology, heritage and shadow flicker are the only disciplines with different recommendations to Hoogland 4 Wind Farm.

Table 8-5: Specialist Key Recommendations for Hoogland 3 Wind Farm

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 3 WIND FARM
Climate Change	• The biggest climate change vulnerability of the project lies in the increased number of extremely hot days that could potentially occur. In this respect, it is recommended that the project owners engage with the turbine manufacturers to ensure the operability of the turbines under those conditions.
Geotechnical	• Formal monitoring during construction should be undertaken on a weekly basis. Routine operational monitoring should form part of the standard operating procedures for each site. • Weekly monitoring should be undertaken during the decommissioning stage and thereafter at four monthly intervals until final sign-off.
Agriculture	• Design and implement an effective system of stormwater run-off 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 run-off water from all accumulation points, and it must prevent any potential down slope erosion. This is included in the stormwater management plan. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.
Terrestrial ecology (including Riverine Rabbit and Karoo Dwarf Tortoise)	• Undertake a pre-construction walk through of the development footprint to refine the layout through micro-siting of turbines, buildings, substation (and associated battery facility), access roads and internal roads where it impacts on SCC. • It is recommended that a Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. • The details of the monitoring programme should be developed in collaboration with the EWT Dryland Programme and should at minimum include the following components and outcomes: ○ Preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site. ○ Matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. ○ It is estimated that each phase of the above monitoring would need to last approximately 1 year (not necessarily continuously, but in order to capture different seasons and different associated activity levels). The monitoring must be conducted in a manner which allows for reliable effect sizes and statistically-backed inferences to be made.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 3 WIND FARM
	○ Funding to conduct the above monitoring and a feedback mechanism to improve future wind energy development in areas with Riverine Rabbits (i.e., input on guidelines for wind energy development in Riverine Rabbit areas). • All incidents involving Riverine Rabbits should be documented and reported to the local EWT field office in Loxton. If Rabbits are killed, the carcases should be collected and provided to EWT for the collection of DNA and other samples. • For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. • A Karoo dwarf tortoise Monitoring Plan must be compiled for the construction and operational phases prior to construction, to provide for monitoring of the following components: ○ Monitor construction activities aimed at reducing impacts on the Karoo Dwarf Tortoise, i.e., an ECO must oversee the implementation of mitigating measures. ○ Monitor (keep log of) tortoise killed by earthworks and traffic. • Conduct annual karoo dwarf tortoise surveys along the powerlines to 1) census crow numbers, 2) log crow nesting sites, and 3) log tortoise carcases observed along the powerlines.
Bats	• A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed. • Should it be found that the wind farm is in a migration path, the appropriate mitigation measures should be applied to ensure that each facility's bat mortalities are below a sustainable threshold. • At turbine bases (if applicable) and other infrastructure buildings, only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools. • During the operational bat mortality monitoring, the bat specialist should visit and make observations on the operational wind farm to determine that no outside lights are installed and positioned in a way where it can increase the probability of bat mortalities from turbines. • Ensure the design does not allow for any entrance holes into any roof cavity.
Avifauna	• A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. • Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline), as well as in accordance with the operational monitoring plan.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 3 WIND FARM
	• Blade painting and/or shutdown on demand (either observer or technology led) implemented to mitigate bird-turbine collision risk[29]; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer. • Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these. • The safety of the pole design currently proposed should be improved by using a bird perch at the very top of the pole. • The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins *et al.,* 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into an Adaptive Management Plan for the facility.
Aquatic Ecology	• A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the Stormwater Management Plan and Aquatic Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. • A detailed stormwater management plan must be developed in the pre-construction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil. Specific measures relating to watercourse crossing upgrades are detailed in the specialist report (and in the EMPr). These stormwater control systems must be monitored in the first few months of use and then inspected on an annual basis during operation to ensure they are functional. • All alien plants within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed watercourse crossings. • Where large cut and fill areas are required, these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation.

[29] Since it will be several years before the proposed wind farm is constructed, there is an opportunity to learn more about these two measures in the interim and make a decision on which option is implemented at that time. Several operational wind farms have just begun observer led shutdown on demand programmes in SA, and two wind farms are about to trial blade painting. There is therefore a high likelihood of having more experience on the effectiveness of such measures a year or two from now.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 3 WIND FARM
	• Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes; as well as for contamination.
Visual	• Visually sensitive skylines, such as dolerite ridges, koppies and rock outcrops avoided where possible in the layout design. • Where a choice exists between turbines to be dropped, and all other factors are equal, priority should be given to dropping outlier turbines or those in the 'high' visual sensitivity areas, and consideration given to removing turbines where widening of gaps improve the clustering effect. • Use of available technology to minimise the visual effect of navigation lights conforming with CAA requirements. **Note from EAP**: The Applicant has committed to adopting on demand aviation warning lights as a condition of the authorisation even though CAA has not yet approved such a system (see Section 10.3).
Heritage	• A pre-construction survey of the entire authorised footprint must be undertaken in order to determine whether any further archaeological sites may need mitigation or protection through micro-siting (if possible). • The various sites that will be directly impacted must be considered for protection through micrositing or else, if unavoidable, archaeological mitigation (recording, tracing and photography of engravings; excavation and sampling of artefacts) must be implemented. This affects waypoints 123-124, 131, 132, 150, 151, 1563, 1564, 168, 173 & 1854; • Micrositing is strongly advised to avoid the ruins at waypoints 1563 and 1564; • The various sites whose buffers will be intersected and where the activity will be quite close to the site should be marked on the ground with No-Go signage. This affects waypoints 128, 1660, 1827 & 1835; • If the wind farm is approved and the final layout does not need all approved turbine locations, then where a choice exists between turbines to be dropped, and all other factors are equal, priority should be given to dropping turbines in the high visual sensitivity areas, as well as Turbines 54, 66, 67, 68, 69 and/or 70 which are within the main part of the rock art landscape; • A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity exists at the time of construction, then such a system must be used to reduce the night-time impacts to the sense of place; • If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.
Palaeontology	• The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey. • An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work. • Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 3 WIND FARM
Noise	Due to the very low to insignificant noise impact, no mitigation measures are recommended or required, with general measures to ensure annoyance with the project are minimized. These measures may include: • that the Contractor and Environmental Control Officer (ECO) must liaise with the potential NSRs that may be affected (with regard to unavoidable road construction activities in the vicinity of NSRs), keeping them informed of the nature and duration of intended activities; and, • to minimise construction activities (that generate significant impulsive noises) within 2,000 m from NSRs at night, planning the completion of these noisiest activities (such as pile driving, rock breaking and excavation) only during the daytime period
Shadow Flicker	• N/A
Traffic	• The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development. • The access into Loxton from the TR016 (R63) is to be upgraded by the developer to accommodate the expected transportation requirements. This upgrade would need to be implemented to facilitate the delivery of abnormal loads to the proposed development. This is only applicable if this has not already been undertaken as part of the Nuweveld Wind Farm Project. • The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801. • The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete. • The developer shall contribute to the maintenance of all roads affected by the development, during the construction and operational phases of the development. • A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development. • The developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network. • The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road. • The interaction of concrete delivery trucks on the public road network is a serious concern that needs to be mitigated prior to the approval of the proposed development.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 3 WIND FARM
Socio-economic / tourism	• Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce). • Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REIPPPP local content requirements. • Ensure that employees are adequately prepared to cope with the challenges that come with being employed through the establishment of an employee induction programme. • Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development. • The Project Owner and the contractors should develop a Code of Conduct for the project and all staff, contractors and members of the workforce must be made aware of the Code of Conduct during the recruitment process. • Awareness training must be provided during their induction onsite and prior to commencement of work duties on site. • The Project Owner and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase. • The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. • Establish a Monitoring Programme in collaboration with affected landowners that is specifically designed to provide clarity on impacts and risks. Aspects or risks that should be monitored need to be agreed on with affected landowners. The Contractor/ Project Owner should formally commit to mitigation and potential compensation actions that may arise from REIPPPP monitoring requirements. • The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.

8.3.2 Key Recommendations for Hoogland 4 Wind Farm

The table below provides a synopsis of the specialist recommendations that are specific to the Hoogland 4 Wind Farm. Noting that terrestrial ecology, heritage and shadow flicker are the only disciplines with different recommendations to the Hoogland 3 Wind Farm.

Table 8-6: Specialist Key Recommendations for Hoogland 4 Wind Farm

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 4 WIND FARM
Climate Change	• The biggest climate change vulnerability of the project lies in the increased number of extremely hot days that could potentially occur. In this respect, it is recommended that the project owners engage with the turbine manufacturers to ensure the operability of the turbines under those conditions.
Geotechnical	• Formal monitoring during construction should be undertaken on a weekly basis. Routine operational monitoring should form part of the standard operating procedures for each site. • Weekly monitoring should be undertaken during the decommissioning stage and thereafter at four monthly intervals until final sign-off.
Agriculture	• Design and implement an effective system of stormwater run-off 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 run-off water from all accumulation points, and it must prevent any potential down slope erosion. This is included in the stormwater management plan. • Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize disturbed soil against erosion.

Terrestrial Ecology (including Karoo Dwarf Tortoise, noting that the Riverine Rabbit was not relevant for this site)	• Undertake a pre-construction walk through of the development footprint to refine the layout through micrositing of turbines, buildings, substation (and associated battery facility), access roads and internal roads where it impacts on SCC.
	• A log should be kept detailing all fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. during construction and operation. These should be reviewed annually and used to inform operational management and mitigation measures.
	• A Karoo dwarf tortoise Monitoring Plan must be compiled for the construction and operational phases prior to construction, to provide for monitoring of the following components:
	    ○ Monitor construction activities aimed at reducing impacts on the Karoo Dwarf Tortoise, i.e., an ECO must oversee the implementation of mitigating measures.
	    ○ Monitor (keep log of) tortoise killed by earthworks and traffic.
	• Conduct annual karoo dwarf tortoise surveys along the powerlines to 1) census crow numbers, 2) log crow nesting sites, and 3) log tortoise carcases observed along the powerlines.

Bats	• A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed. • Should it be found that the wind farm is in a migration path, the appropriate mitigation measures should be applied to ensure that each facility's bat mortalities are below a sustainable threshold. • At turbine bases (if applicable) and other infrastructure buildings, only use lights with low sensitivity motion sensors that switch off automatically when no persons are nearby, to prevent the creation of regular insect gathering pools.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 4 WIND FARM
	• During the operational bat mortality monitoring, the bat specialist should visit and make observations on the operational wind farm to determine that no outside lights are installed and positioned in a way where it can increase the probability of bat mortalities from turbines. • Ensure the design does not allow for any entrance holes into any roof cavity.
Avifauna	• A pre-construction avifaunal walk down should be conducted to confirm final layout and identify any sensitivities that may arise between the conclusion of the Environmental Authorisation process and the construction phase. • Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline) as well as in accordance with the operational monitoring plan. • Blade painting and/or shutdown on demand (either observer or technology led) to mitigate bird-turbine collision risk[30]; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer. • Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these. • The safety of the pole design currently proposed should be improved by using a bird perch at the very top of the pole. • The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins *et al.,* 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into an Adaptive Management Plan for the facility.
Aquatic Ecology	• A pre-construction walkthrough with an aquatic specialist is recommended and they can assist with the development of the Stormwater Management Plan and Aquatic Rehabilitation and Monitoring Plan, coupled to micro-siting of the final layout. • A detailed stormwater management plan must be developed in the pre-construction phase, detailing the stormwater structures and management interventions that must be installed to manage the increase of surface water flows directly into any natural systems. Effective stormwater management must include effective stabilisation (gabions and Reno mattresses) of exposed soil. Specific measures relating to watercourse crossing upgrades are detailed in the specialist report (and in the EMPr). These

30 Since it will be several years before the proposed wind farm is constructed, there is an opportunity to learn more about these two measures in the interim and make a decision on which option is implemented at that time. Several operational wind farms have just begun observer led shutdown on demand programmes in SA, and two wind farms are about to trial blade painting. There is therefore a high likelihood of having more experience on the effectiveness of such measures a year or two from now.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 4 WIND FARM
	stormwater control systems must be monitored in the first few months of use and then inspected on an annual basis during operation to ensure they are functional. • All alien plants within the greater region must be monitored and should it occur, these plants must be eradicated within the project footprints and especially in areas near the proposed watercourse crossings. • Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. • Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes; as well as for contamination.
Visual	• Visually sensitive skylines, such as dolerite ridges, koppies and rock outcrops avoided where possible in the layout design. • Where a choice exists between turbines to be dropped , and all other factors are equal, priority should be given to dropping outlier turbines or those in the 'high' visual sensitivity areas and consideration given to removing turbines where widening of gaps improve the clustering effect. • Use of available technology to minimise the visual effect of navigation lights conforming with CAA requirements. **Note from EAP**: The Applicant has committed to adopting on demand aviation warning lights as a condition of the authorisation (see Section 10.3).
Heritage	• A pre-construction survey of the entire authorised footprint must be undertaken in order to determine whether any further archaeological sites may need mitigation or protection through micrositing (if possible). • The farm road to be reused adjacent to waypoint 1807 may not be widened towards the north; • The various sites whose buffers will be intersected and where the activity will be quite close to the site should be marked on the ground with No-Go signage. This affects waypoints 1780, 1801, 1806, 1807, 1588-1598 and 1781-1791; • The complexes at waypoints 1588-1598 and 1781-1791 must be monitored by the ECO during road construction; • A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity exists at the time of construction, then such a system must be used to reduce the night-time impacts to the sense of place; • If the wind farm is approved and the final layout does not need all approved turbine locations, then where a choice exists between turbines to be dropped, and all other factors are equal, priority should be given to dropping Turbine 96; and • If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.
Palaeontology	• The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey. • An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 4 WIND FARM
	• Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase.
Noise	Due to the very low to insignificant noise impact, no mitigation measures are recommended or required, with general measures to ensure annoyance with the project are minimized. These measures may include: • that the Contractor and Environmental Control Officer (ECO) must liaise with the potential NSRs that may be affected (with regard to unavoidable road construction activities in the vicinity of NSRs), keeping them informed of the nature and duration of intended activities; and, • to minimise construction activities (that generate significant impulsive noises) within 2,000 m from NSRs at night, planning the completion of these noisiest activities (such as pile driving, rock breaking and excavation) only during the daytime period
Shadow Flicker	• In the event of a complaint received by the Developer Site Operator or local municipality, and an appropriate investigation confirms occurrence, then measures such as those outlined below will be explored with the residents or receptor owners to select the most suitable measures to prevent re-occurrence and protect residential amenity. ○ Control at Receptor: The provision of blinds, shutters or curtains to affected receptors; ○ Control on Pathway: for example, screening planting close to an affected receptor; and ○ Control at Source: for example, shutdown of turbines at times when effects occur.
Traffic	• The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development. • The access into Loxton from the TR016 (R63) is to be upgraded by the developer to accommodate the expected transportation requirements. This upgrade would need to be implemented to facilitate the delivery of abnormal loads to the proposed development. This is only applicable if this has not already been undertaken as part of the Nuweveld Wind Farm Project. • The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801. • The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete. • The developer shall contribute to the maintenance of all roads affected by the development, during the construction and operational phases of the development. • A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development. • The TMP should consider the scope of the development and take cognisance of the existing condition of the road network at the time the project commences.

DISCIPLINE	KEY RECOMMENDATIONS HOOGLAND 4 WIND FARM
	• The developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network. • The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road. • The interaction of concrete delivery trucks on the public road network is a serious concern that needs to be mitigated prior to the approval of the proposed development.
Socio-economic / tourism	• Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce). • Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REIPPPP local content requirements. • Ensure that employees are adequately prepared to cope with the challenges that come with being employed through the establishment of an employee induction programme. • Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development. • The Project Owner and the contractors should develop a Code of Conduct for the project and all staff, contractors and members of the workforce must be made aware of the Code of Conduct during the recruitment process. • Awareness training must be provided during their induction onsite and prior to commencement of work duties on site. • The Project Owner and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase. • The movement of workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences. • Establish a Monitoring Programme in collaboration with affected landowners that is specifically designed to provide clarity on impacts and risks. Aspects or risks that should be monitored need to be agreed on with affected landowners. The Contractor/ Project Owner should formally commit to mitigation and potential compensation actions that may arise from REIPPPP monitoring requirements. • The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.

9 SENSITIVITY MAPS

As detailed in Section 6.1, the layout and design of the Wind Farms that the specialist assessments considered was determined by inputs from the Screening and Pre-Application Phase. In the specialist assessments of the layout during the Pre-Application Phase, some specialists identified additional features/areas that required avoidance by the development. The recommended changes to avoid such features/areas have been implemented in the design of the layouts for the BA Phase and are detailed in the BA Report (this report).

Specifically, the specialists identified key features/areas on site pertaining to their respective field of study and developed sensitivity criteria for each of the following infrastructure types: turbines; internal overhead power lines; roads and underground cables; and buildings, see Table 9-1. These outputs were provided spatially and were compiled into the consolidated No-Go maps (which combines the No-Go sensitivities of all specialist fields into one map). The No-Go maps for each infrastructure type are shown in Figure 9-1 – Figure 9-8. Note that all specialist No-Go areas have been avoided in totality, however, due to the scale of the mapping it may appear that some of the infrastructure infringes into these areas.

Table 9-1: No-Go and sensitivity criteria informing the sensitivity mapping

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
Geotech	**No-Go** • 1:4 slopes with 30 m buffer	None	None	None	None	
Agriculture	**No-Go** • Very High sensitivity areas (crop boundaries showing arable land)	**High** Very High sensitivity areas (crop boundaries showing arable land)	**No-Go** Very High sensitivity areas (crop boundaries showing arable land)	**No-Go** • Very High sensitivity areas (crop boundaries showing arable land)	None	
Ecology	**No-Go** • Drainage Lines & Basins • Plains Wash • Dolerite Hills & Outcrops • Slopes (Steep) • Slopes (Other) • Flat Plains, Calcrete and Plateau areas • Dams • Ridges, Escarpments & Hills • RR Habitat, Connectivity & Buffering[31]	**No-Go** • Drainage Lines & Basins • Plains Wash • Dolerite Hills & Outcrops • Slopes (Steep) • Flat Plains and Plateau areas • Ridges, Escarpments & Hills • RR Habitat, Connectivity & Buffering[31] **High** • Drainage • Dams • Dolerite Slopes • Slopes (Steep) • Slopes (Other) • Flats • Plains Wash • RR Habitat, Connectivity & Buffering	Same as turbines	**No-Go** • Drainage Lines & Basins • Plains Wash • Dolerite Hills & Outcrops • Slopes (Steep) • Flat Plains and Plateau areas • Ridges, Escarpments & Hills • RR Habitat, Connectivity & Buffering31	None	**Definition of No-Go:** Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas represent no-go areas from a developmental perspective and should be avoided. For roads and cables no-go where these features need to be traversed, existing roads or disturbance footprints should be used. **Definition of High:** Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is undesirable and should only proceed with caution. Where roads are required through these areas, existing access roads should preferably be used as this reduces both the impact and the footprint of any access roads.
Aquatic	**No-Go** • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines[32]. Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) **High** • None **Medium** • None **Low**	**No-Go** • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) **High** • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines[32]. Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) **Medium** • N/A **Low** Artificial - Dams & Reservoirs some with permanent water	**No-Go** • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines[32]. Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) **High** • None **Medium** • None **Low** Artificial - Dams & Reservoirs some with permanent water	**No-Go** • Endorheic Pan (wetland) (50m buffer) • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) **High** • Large Mainstem rivers and Alluvial plains and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) • Minor drainage lines[32]. Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer) **Medium** • N/A **Low** Artificial - Dams & Reservoirs some with permanent water	None	No WTG, Hard stands, related buildings, transmission line towers, or new internal roads are allowed within: • Endorheic Pan areas Including their buffers, • Valley bottom wetland -Seepage areas with subsurface water and or pools, some with reeds and sedges (50m buffer) Only existing roads may be used, and any upgrades may only take place once the proposed designs have been evaluated in the field by the specialist. No WTG, Hard stands, related buildings, or new internal roads are allowed within: • Large Mainstem rivers and alluvial pans, and minor drainage lines. The placement of pylons and new internal roads should avoid these areas but will be evaluated on a case-by-case basis. • Minor drainage lines-. Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or

[31] Riverine Rabbit buffer between 300m-500m depending on topography.

[32] Minor watercourse: The feature itself is 20m wide, with additional 10m buffer on either side. Total 40m width.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
	• Artificial - Dams & Reservoirs some with permanent water	**Additional No-Go's for Platforms Only:** **No-Go** • Large Mainstem rivers and Alluvial pans and washes. Floodplain and riparian dominated systems, typically with a large main channel with or without broader riparian habitat (45m buffer) Minor drainage lines[32]. Channels with limited to no riparian vegetation, i.e., a water course either with alluvium or bed rock as riverbed (10m buffer)				bed rock as riverbed (10m buffer). The placement of new internal roads should avoid these areas, but will be evaluated on a case by case basis. No constraints are associated with artificial systems, the only restrictions being if these provide bird or bat habitat then they should be avoided / excluded from the development footprint Pylon placement can be evaluated on a case by case basis during the planning phase.
Bats	**No-Go** • Valley bottom wetlands (200m buffer plus 97.5m blade buffer) • Pans and depressions (200m buffer plus 97.5m blade buffer) • Dams (200m buffer plus 97.5m blade buffer) • Rocky boulder koppies (tors) (200m buffer) • Exposed rocky cliff edges (200m buffer plus 97.5m blade buffer) • Drainage lines capable of supporting riparian vegetation. (200m buffer plus 97.5m blade buffer) • Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds (200m buffer plus 97.5m blade buffer) **Medium** • Alluvial plains and washes (150m plus 97.5m blade buffer) • Seasonal drainage lines (150m plus 97.5m blade buffer) • Small and low exposed rocky cliffs and edges (150m plus 97.5m blade buffer)	**High** • Valley bottom wetlands • Pans and depressions • Dams • Rocky boulder koppies (tors) • Exposed rocky cliff edges • Drainage lines capable of supporting riparian vegetation. Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds	**No-Go** • Valley bottom wetlands • Pans and depressions • Dams • Rocky boulder koppies (tors) • Exposed rocky cliff edges • Drainage lines capable of supporting riparian vegetation. • Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds **High** • Valley bottom wetlands (200m buffer) • Pans and depressions (200m buffer) • Dams (200m buffer) • Rocky boulder koppies (tors) (200m buffer) • Exposed rocky cliff edges (200m buffer) • Drainage lines capable of supporting riparian vegetation. (200m buffer) Other water bodies and other sensitivities such as manmade structures, buildings, houses, barns and sheds (200m buffer)	None	None	**Roads and Underground Cables & Buildings High:** Preferably keep to a minimum within these areas where practically feasible.
Avifauna	**No-Go** Priority bird species nests: • Martial Eagle Nest (6km buffer) • Verreaux's Eagle VERA High areas • Verreaux's Eagle VERA Medium areas[33] • Secretarybird Nest (2.5km buffer) • Booted Eagle Nest (2km buffer) • Hamerkop Nest (1km buffer) • Jackal Buzzard Nest (500m buffer) • Corvid Nest (500m buffer) • Pale Chanting Goshawk Nest (500m buffer) Habitat features: • Selected large dams buffered by 1km from edge of dam when full.	**No-Go** Priority bird species nests: • Martial & Verreaux's Eagle & Secretarybird nests (1km buffer) **High** Priority bird species nests: • Martial & Verreaux's Eagle nests (2km buffer) **Medium** Remainder of site **Low** N/A	Same as roads and underground cables	**No-Go** Priority bird species nests: • Martial Eagle Nest, Verreaux's Eagle (1.5km buffer) • Secretarybird Nest (1km buffer) Habitat features: • Several large dams buffered by 1km from edge of dam when full. Remaining small dams buffered by 200m • Rivers: 1km buffer either side of the Sakriver **High** Priority bird species nests: • Martial Eagle Nest (6km buffer) • Verreaux's Eagle VERA High areas	Same as Internal overhead power lines (roads and pylons)	For roads and cables, and buildings, the bird nest buffers take care of disturbance at nests. Restrictions for high areas • Restriction on new roads, existing roads may be used • Restriction on total cumulative length of power line in High area

[33] Noting the specialist had VERA medium categorised as high however the developer has escalated this into a No-go category.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
	Remaining small dams buffered by 300m • East-west ridges: Manually delineated & buffered by 300m • Pans: Manually delineated – no buffer • Rivers: 1km buffer either side of the Sakriver & 300m buffer either side of other rivers • Arable lands: Avoid by development but not delineated since Agricultural specialist has delineated based on national 'field crop boundary' layers, and arable lands are mostly located adjacent to dams & rivers which have been buffered **High** N/A • **Medium** Remainder of site **Low** N/A			• Secretarybird Nest (2.5km buffer) • Booted Eagle Nest (2km buffer) • Hamerkop Nest (1km buffer) • Jackal Buzzard Nest (500m buffer) Habitat features: • Rivers: 300m buffer either side of other rivers • East-west ridges: Manually delineated & buffered by 300m • Pans: Manually delineated – no buffer **Medium** Remainder of site **Low** N/A		
Heritage (including Palaeontology, Archaeology, Graves, Built Environment, Cultural landscape)	**No-Go** • GRADE IIIA Features, sites or cultural landscapes (50m buffer) (Points representing the locations of heritage features and sites deemed to have high local heritage significance or cultural landscapes of high heritage significance) **High** • GRADE IIIB Feature - Points representing the locations of heritage features deemed to have medium local heritage significance. **Medium** • GRADE IIIB Feature 50 m buffer around features. • GRADE IIIB Site 50 m buffer around site complexes of medium local heritage significance. • GRADE IIIC Feature - Points representing the locations of heritage features deemed to have low local heritage significance. **Low** • GRADE IIIC Feature 50 m buffer around low features. • GRADE IIIC Site 50 m buffer around low sites. **Neutral** • NCW Features Points representing the locations of heritage features deemed to have very low to no heritage significance.	**New Roads:** Same as turbines **Existing Roads:** Same as overhead lines (spanning)	Same as turbines	**Pylons:** Same as turbines	**No-Go** • GRADE IIIA Features (Points representing the locations of heritage features deemed to have high local heritage significance or cultural landscapes of high heritage significance) **High** • GRADE IIIA Features, sites or cultural landscapes (50m buffer around high resources) **Medium** • GRADE IIIB Feature - Points representing the locations of heritage features deemed to have medium local heritage significance. **Low** • GRADE IIIB Feature 50 m buffer around medium features. • GRADE IIIB Site 50 m buffer around medium site complexes. • GRADE IIIC Features - points representing the locations of heritage features deemed to have low local heritage significance. • GRADE IIIC Feature 50 m buffer around low features. • GRADE IIIC Site 50 m buffer around low sites. **Neutral** • NCW Features Points representing the locations of heritage features deemed to have very low to no heritage significance.	**Roads:** Note that existing roads would obviously not go over point sites but they may pass through larger multi-component sites. • Existing roads to be widened/upgraded get a lower level of sensitivity as they are already present, and it is more desirable to upgrade than to build a second road nearby. • Occasionally very small 'twee-spoor' jeep tracks can pass very close to heritage sites and create minimal existing impacts. For this reason, their upgrades are best treated like building new roads. **Overhead lines:** • Overhead lines spanning over sites also get lower ratings because there would be no physical damage. BUT there is still a chance of damage during construction so spanning lines are only one sensitivity level lower.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines: Roads and pylons	Internal overhead power lines: Overhead lines / spanning	Notes
Visual	**No-Go** • Feature - Topographic feature: prominent scarps, peaks and ridges (TOPO Scarp) • Feature - Topographic feature: minor ridges, scarps and outcrops (TOPO Minor) • Slopes > 1:10 • Scenic water features - within buffer 250m • National Parks (Karoo NP) -within 5km buffer (*none encroaching on site*) • Private reserves / game farms - within 1,5km buffer • Farmsteads outside site – within 1km buffer • Farmsteads inside site - within 500m buffer • Arterial route R381 - within 750m buffer • Scenic Passes/ Poorts (R381) - within 1km buffer • Scenic Poorts (District Road) within 500m buffer • Main district road - within 250m buffer **High** • Topographic feature: prominent scarps, peaks and ridges – within 250 buffer • Topographic feature: minor ridges, scarps and outcrops - within 150m buffer • Slopes 1:10 - 1:20 • Scenic water features - between 250m and 500m buffer • National Parks (Karoo NP) -within 10km buffer (*none encroaching on site*) • Private reserves / game farms - within 3km buffer • Farmsteads outside site – within 2km buffer • Farmsteads inside site - within 750m buffer • Arterial route R381 - within 1km buffer • Scenic Passes/ Poorts (R381) - within 1,5km buffer • Scenic Poorts (District Road) within 750m buffer • Main district road - within 500m buffer **Medium** • Topographic feature: prominent scarps, peaks and ridges - within 500 buffer	**No-Go** • Feature - Topographic feature: prominent scarps, peaks and ridges • Slopes > 1:4 • Scenic water features - within buffer 50m • Farmsteads inside site - within 50m buffer **High** • Feature - Topographic feature: prominent scarps, peaks and ridges - 50m buffer • Feature - Topographic feature: minor ridges, scarps and outcrops • Slopes 1:4 to 1:10 • Scenic water features - within buffer 100m • Farmsteads inside site - within 100m buffer • Scenic Passes/ Poorts (R381) - within 100m buffer **Medium** • Farmsteads inside site - within 150m buffer • Scenic Passes/ Poorts (R381) - within 150m buffer **Low** N/A	**No-Go** • Topographic feature: prominent scarps, peaks and ridges • Minor ridges, scarps and outcrops • Steep slopes > 1:4 • Scenic water features - within 50m buffer • Private reserves / game farms -250m buffer • Farmsteads outside - 250m buffer • Farmsteads inside - 150m buffer • Scenic routes / Poorts - 500m buffer • Arterial route R381 - 250m buffer • Main district road - 150m buffer • Scenic district road - 250m buffer **High** • Topographic feature: prominent scarps, peaks and ridges - within 100m buffer • Minor ridges, scarps and outcrops - within 100m buffer • Steep slopes > 1:10 • Scenic water features - within 100m buffer • Private reserves / game farms -500m buffer • Farmsteads outside - 500m buffer • Farmsteads inside - 250m buffer • Scenic routes / Poorts - 750m buffer • Arterial route R381 - 500m buffer • Main district road - 250m buffer • Scenic district road - 500m buffer **Medium** • Private reserves / game farms - 1km buffer • Farmsteads outside - 750m buffer • Farmsteads inside - 500m buffer • Scenic routes / Poorts - 1km buffer • Arterial route R381 - 750m buffer • Main district road – 500m buffer • Scenic district road - 750m buffer **Low** N/A	**No-Go** • Scenic water features (within buffer 50m) • Farmsteads inside site (within 50m buffer) • Arterial route R381 (within 50m buffer) • Scenic Passes/ Poorts (R381) (within 100m buffer) **High** • Feature - Topographic feature: prominent scarps, peaks and ridges • Feature - Topographic feature: minor ridges, scarps and outcrops • Slopes > 1:4 • Scenic water features (within buffer 100m) • Farmsteads inside site (within 100m buffer) • Arterial route R381 (within 100m buffer) • Scenic Passes/ Poorts (R381) (within 150m buffer) • Main district road (within 50m buffer) **Medium** • Slopes > 1:10 **Low** N/A	None	Cultural landscapes have been determined by heritage specialist. Roads: • Visual impacts in relation to cultural landscapes have been captured and mapped under the scenic resources such as "topographic features, ridges, peaks, scarps", "scenic water features", "farmsteads", "scenic routes" etc. Internal Overhead Powerlines: • Exceptions would apply where internal overhead power lines ascend/descend scarps at right angles. The lines should follow valleys and avoid peaks/ridges where possible. The final route of internal lines needs to be reviewed by the specialist/s. Note that the predominant pylon style is a 132 kV style monopole of 20 m high even though the voltage will be a maximum of 33 kV.

	Turbines	Roads and underground cables	Buildings	Internal overhead power lines		Notes
				Roads and pylons	Overhead lines / spanning	
	• National Parks (Karoo NP) - within 15km buffer • Private reserves / game farms - within 5km buffer • Farmsteads outside site – within 3km buffer • Farmsteads inside site - within 1km buffer • Arterial route R381 - within 1.5km buffer • Scenic Passes/ Poorts (R381) - within 2km buffer • Scenic Poorts (District Road) within 1km buffer • Main district road - within 750m buffer **Low** N/A					
Noise	**No-Go** • 500m buffer from noise sensitive receptors (occupied buildings)	None	**No-Go** • 200m buffer from noise sensitive receptors (occupied buildings) **High** 200-500m buffer from noise sensitive receptors (occupied buildings)	None	None	Note these buffers have been identified by the developer and are prescribed in the specialist report.

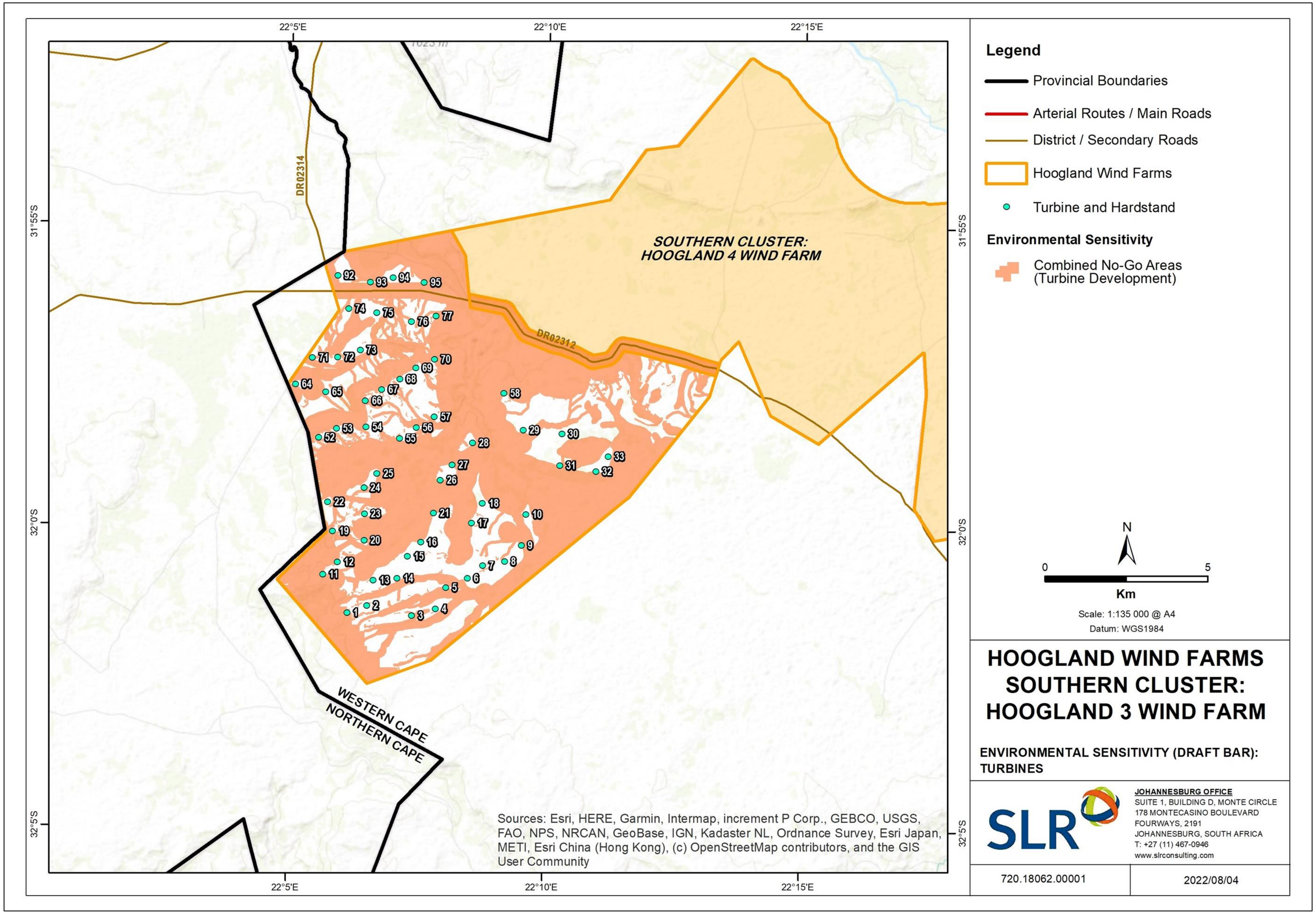


Figure 9-1: Hoogland 3 – BA Phase Consolidated No-Go map for Turbines

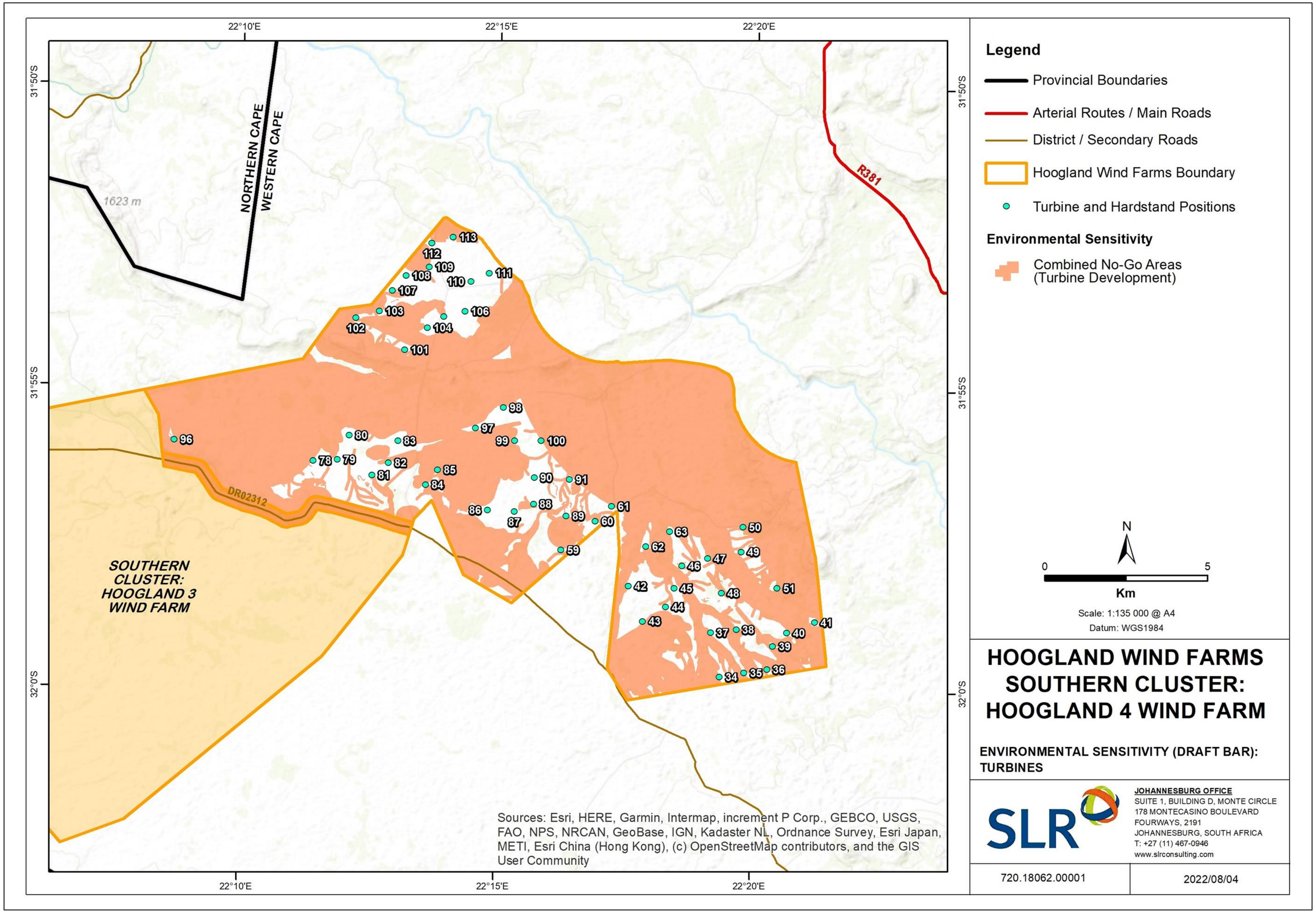


Figure 9-2: Hoogland 4 - BA Phase Consolidated No-Go map for Turbines

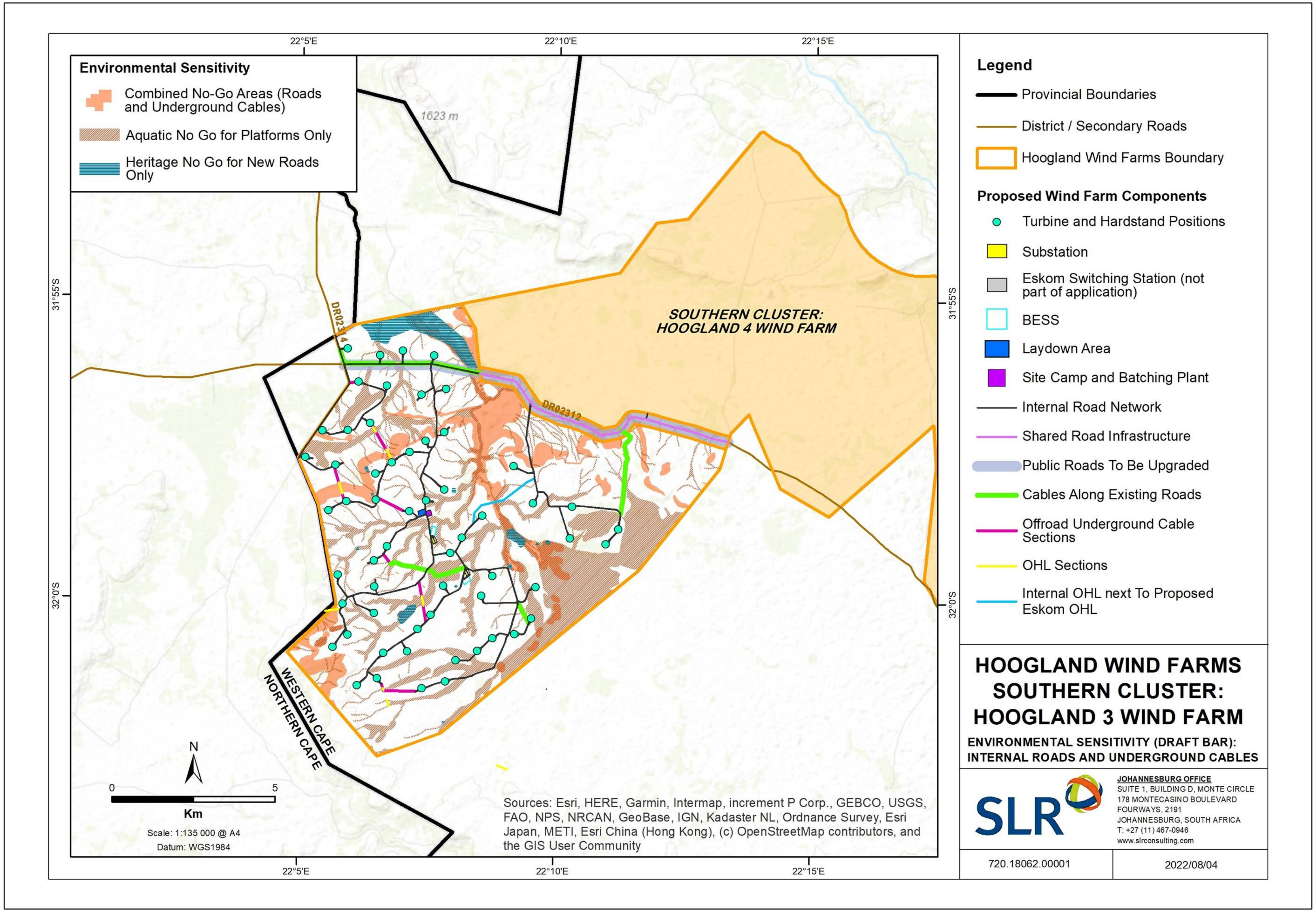


Figure 9-3: Hoogland 3 - BA Phase Consolidated No-Go map for Roads and Underground Cables

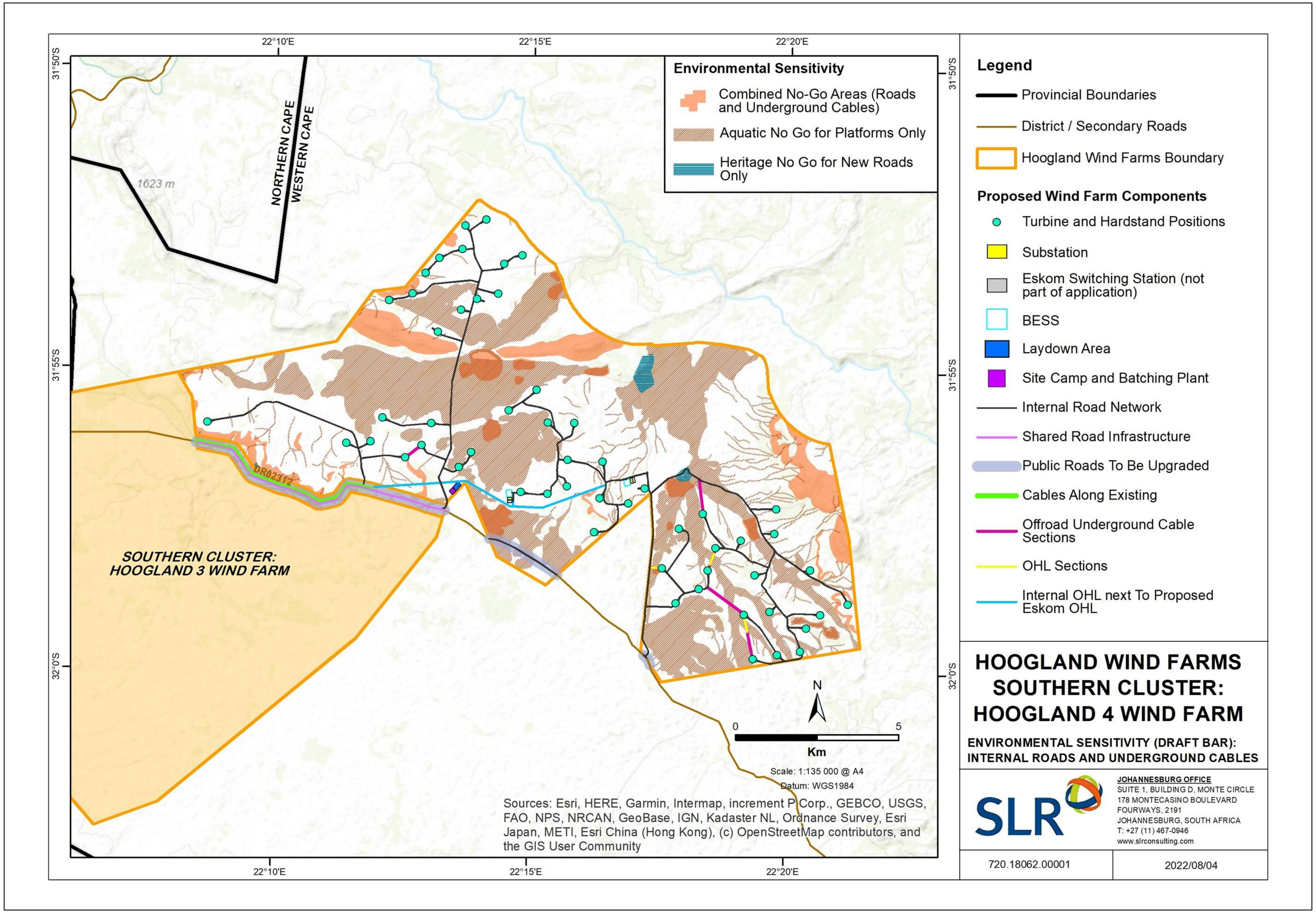


Figure 9-4: Hoogland 4 - BA Phase Consolidated No-Go map for Roads and Underground Cables

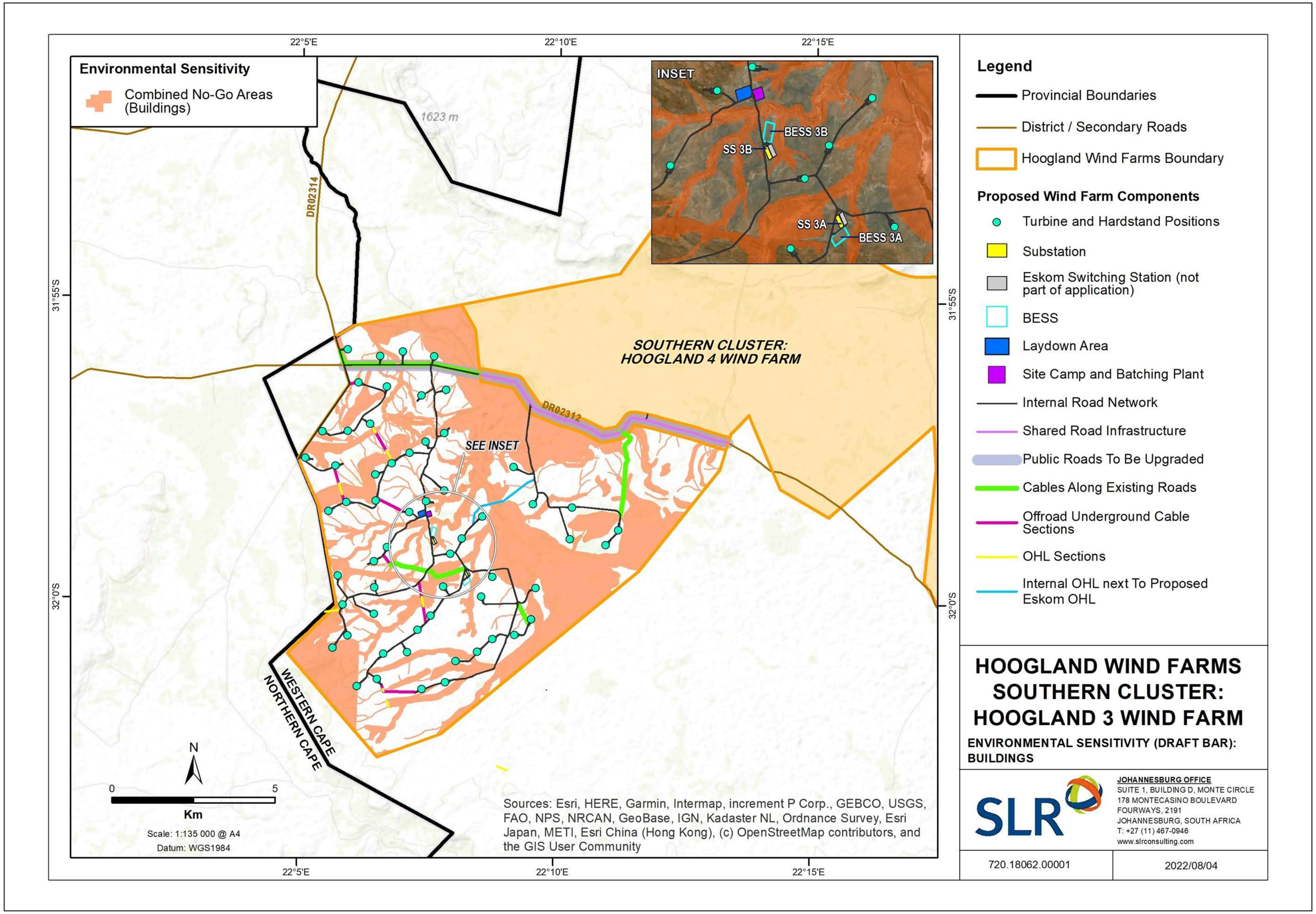


Figure 9-5: Hoogland 3 - BA Phase Consolidated No-Go map for Buildings

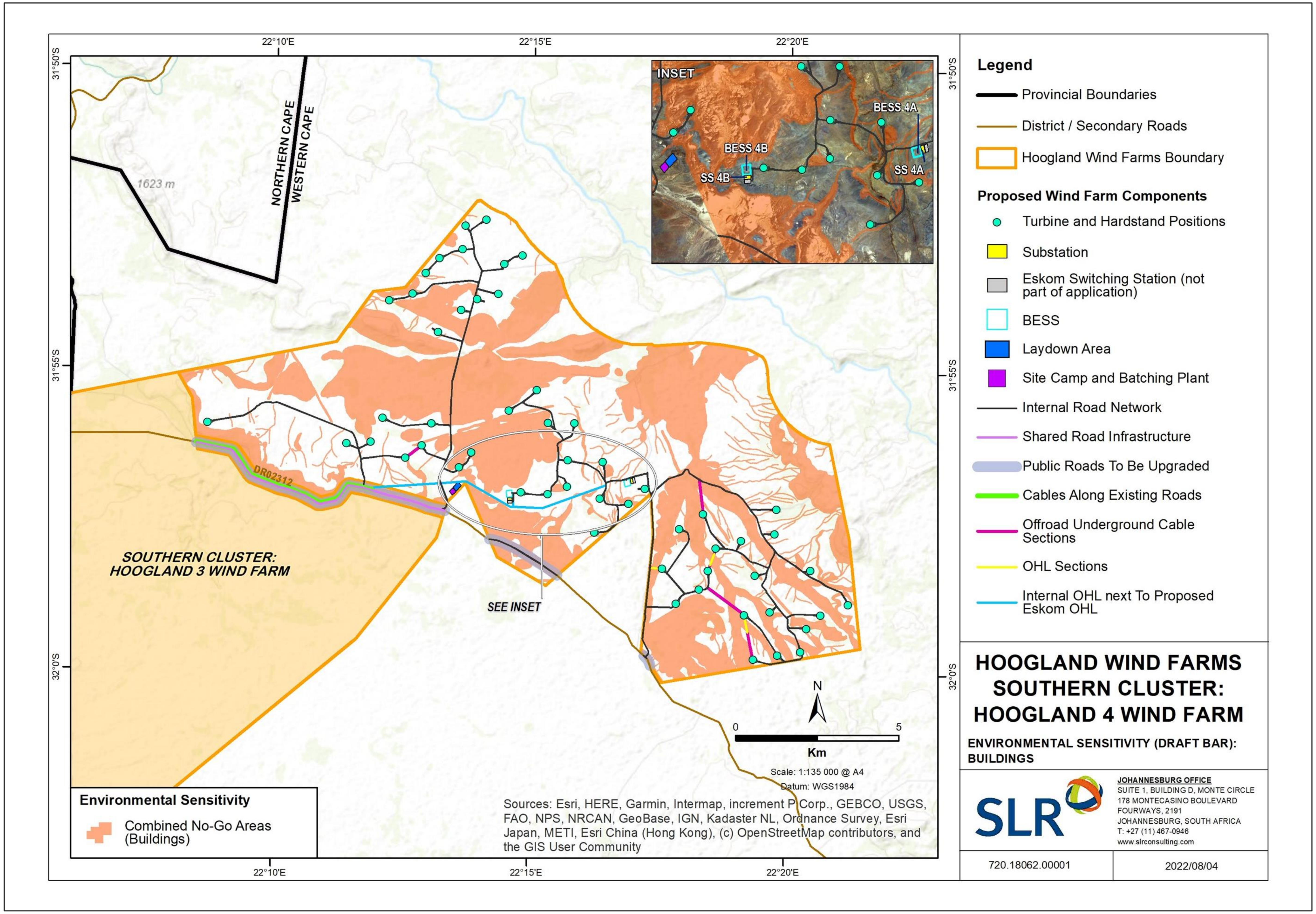


Figure 9-6: Hoogland 4 - BA Phase Consolidated No-Go map for Buildings

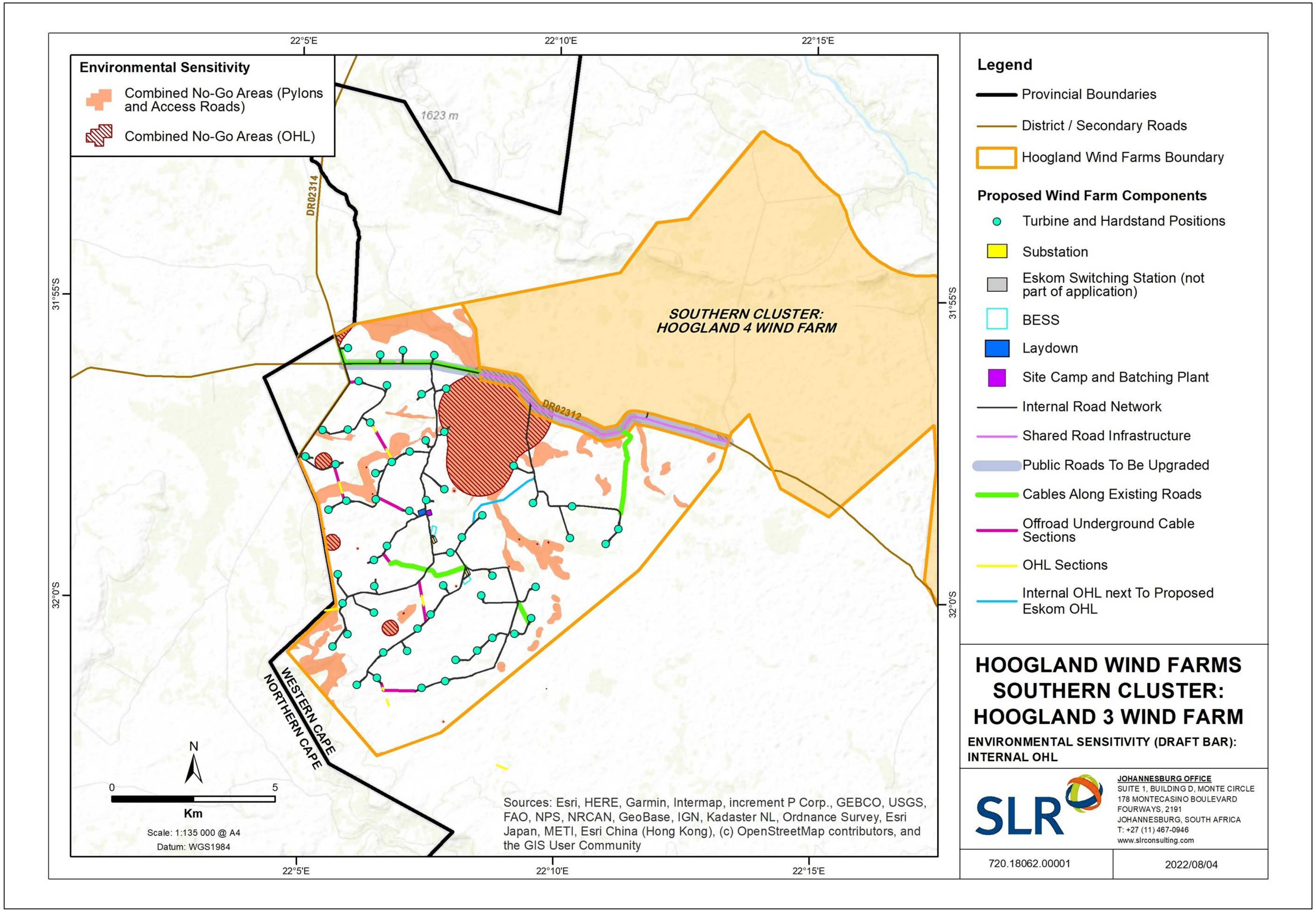


Figure 9-7: Hoogland 3 - BA Phase Consolidated No-Go map for Internal Overhead Powerlines

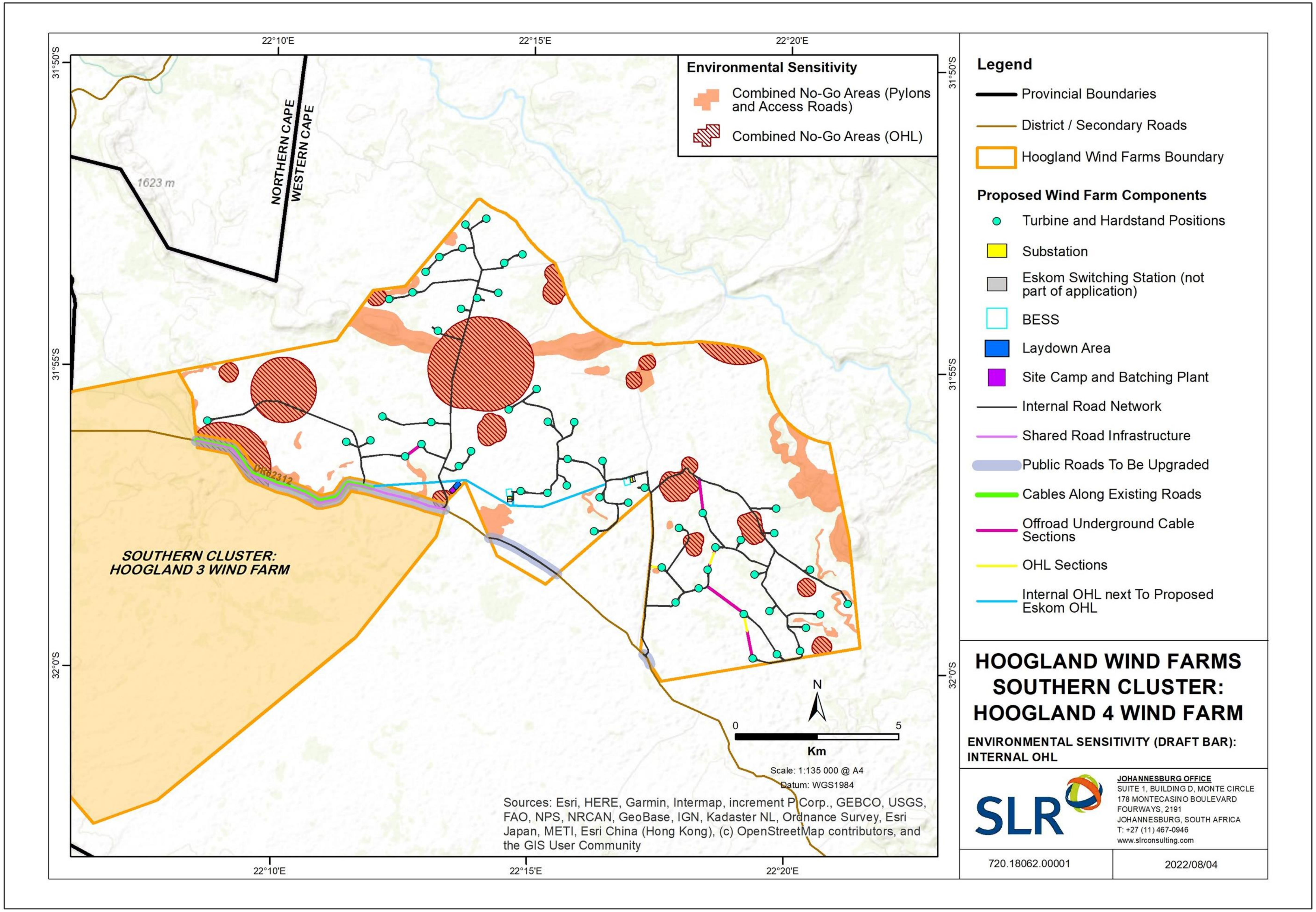


Figure 9-8: Hoogland 4 - BA Phase Consolidated No-Go map for Internal Overhead Powerlines

10 CONCLUSION

10.1 Summary of the Process

The proposed Hoogland Southern Wind Farm projects (design and layout specifics discussed in Section 2) offer the potential to contribute in part to resolving South Africa's energy crisis and also to the national commitment to transition to a low carbon economy. The project thus stems from a sound needs and desirability basis (detailed in Section 5).

A detailed Screening, Pre-Application and Iterative Design process preceded the formal BA process and has informed the project layout that has resulted in 58 potential turbine locations considered as part of this assessment for the Hoogland 3 Wind Farm and 55 potential turbine locations for Hoogland 4 Wind Farm. Section 6 outlines the approach taken to determine the layout and design of the wind farms. Section 3 discusses the motivation for why alternatives have not been assessed and outlines the detailed Screening, Pre-Application and Iterative Design approach. The No-Go alternative assumes that the *status-quo* remains and is considered the 'no impact alternative' since in this scenario the wind farms would not be developed. However, the No-Go alternative is also a lost opportunity for socio-economic benefits and sustainable energy production and in most cases has been assessed by the specialists as neutral or insignificant. Given the findings presented in the BA Report (this report) and input from the various specialist assessments, the No-Go alternative is not considered to be the preferred alternative for either Hoogland 3 or Hoogland 4 Wind Farms.

The BA Phase has therefore included an assessment of the 'No-Go alternative' against the Hoogland Southern Cluster Wind Farm projects proposed in the preferred location, as detailed in Section 2.4, utilising horizontal axis wind turbines (that are restricted by a defined rotor swept envelop) as the preferred technology and the preferred layout, developed through the iterative design process undertaken for this project.

An array of environmental aspects was identified as having the potential to be impacted by the proposed wind farm projects. The specialists listed in Table 1-3 have undertaken site visits (where required) and compiled their assessment reports based on the preferred layout. The potential impacts expected to occur as a result of the proposed wind farm projects, and any possible mitigation measures to reduce these impacts, are assessed and discussed in Section 7. All the specialist studies found that, should the required mitigation measures be implemented, the impacts associated with the Hoogland 3 Wind Farm and Hoogland 4 Wind Farm projects can be mitigated to acceptable levels and the projects are not fatally flawed in terms of their impact on the receiving environment. The cumulative impacts associated with the project have been investigated and assessed in Section 7 (and summarised in Section 8.1.2 & Section 8.2.2) and none of the cumulative impacts were deemed to be significant enough to be considered a fatal flaw.

10.2 Environmental Impact Statement

Red Cap have proactively sought to identify the best practical environmental option possible for the identified project site through a rigorous, iterative and multi-disciplinary process, that has involved detailed specialist studies. This approach aligns with the NEMA principles advocating for sustainable development through the adoption of the mitigation hierarchy as set out in section 2 of NEMA. Through application of this hierarchy, 'avoidance' of environmental impacts was then the basis for the approach to the process. The outcome has been a preferred layout for Hoogland 3 and Hoogland 4 Wind Farm respectively, which is the subject of this report.

The potential impacts expected to arise from the proposed Hoogland 3 and Hoogland 4 Wind Farms and associated infrastructure are summarised in Table 8-1 and Table 8-3 in Section 8.1 and Section8.2. Various negative and positive impacts were identified and assessed for the construction, operational and decommissioning phases of the respective wind farm projects. The impact significance post-mitigation for the various specialist fields were assessed as ranging mainly from neutral / insignificant to medium negative significance post-mitigation, with one impact of high negative significance being the visual intrusion of wind turbines on the Karoo landscape during the operational phase as well as the high cumulative visual impact associated with this. The high impacts associated with bat, avifauna and the Karoo Dwarf tortoise mortalities can be mitigated to being of medium or low negative significance. Several positive impacts have been identified and are mostly socio-economic, ranging between medium and very high positive post-mitigation, with one very low positive agricultural related impact (namely increased financial security for farming operations) also being identified post-mitigation. Most notable is the very high positive impact on climate change through avoided GHG emissions as well as the post-mitigation high positive impact on the economy from operational expenditure, and the high positive impacts in relation to local socio-economic development, enterprise development and shareholding.

Cumulative impacts associated with the proposed wind farms were found to be acceptable post-mitigation, with the only the high residual cumulative negative impact being the visual intrusion of wind turbines on the Karoo landscape (Table 8-1 and Table 8-3). A number of residual medium negative impacts remain in terms of bats, avifauna, heritage, traffic and socio-economic receptors. Positive residual cumulative impacts are largely socio-economic from expenditure and SED initiatives. However, from a cumulative impact perspective, there are no fatal flaws that would prevent authorisation of either of the wind farms, provided the proposed mitigation measures are adhered to, and the wind farms are therefore considered acceptable in terms of cumulative impacts.

In summary, the specialist studies that informed the BA Report have not found any fatal flaws or critical issues with the current layouts, with the most notable post-mitigation impacts being the high negative visual impacts in relation to the Karoo landscape, the high positive SED benefits, and very high positive climate change impacts (through avoided emissions), and have all concluded that the development of the wind farms may go ahead, if the proposed mitigation measures are adhered to.

After consideration of the findings presented in the BA Report and based on the preferred layout presented within this report, it is the reasoned opinion of the EAP that the impacts associated with the proposed Hoogland 3 and Hoogland 4 Wind Farms respectively are acceptable and Environmental Authorisation (EA) (including the conditions stipulated below) should therefore be granted.

10.3 Proposed Conditions of Authorisation

10.3.1 Hoogland 3 Wind Farm Conditions

Validity of the EA

- The formal BA process typically takes 4 to 6 months to complete and if authorised, it is the intention that the developer / applicant would then prepare the project for submission to the REIPPPP during a forthcoming bidding window. It is currently unknown when the future bidding windows will be. Should the EAs be issued for the Hoogland 3 and Hoogland 4 Wind Farm projects, a 10-year validity period is requested. The reason for this is due to the uncertainty regarding when the future REIPPPP bidding rounds may occur, when the Hoogland 3 Wind Farm are bid and if it receives preferred bidder status. A valid EA is one of the requirements for the submission of a project in the REIPPPP.

Micro-Siting

- The expertise of a Terrestrial Ecologist, an Aquatic Ecologist, an Archaeologist, a Palaeontologist, and an Avifaunal Specialist are to be enlisted to conduct post-authorisation micro-siting of the wind farm infrastructure with the design engineers to reduce potential impacts relating to these specialist fields.
- Final adjustments to the layouts shall be made once the specialist micro-siting recommendations from the walkthrough process have been provided. Any No-Go Areas (areas that shall be excluded from any construction activity or general access by the construction team) within the development sites or servitudes shall be clearly indicated on maps and included with the micro-siting reports or attached to the EMPr.

Terrestrial Ecology

- A Riverine Rabbit Monitoring Programme should be implemented at the site to evaluate the post-construction impact of the development on the Riverine Rabbit as well as other key fauna at the site. As there is some potential for noise and disturbance-related impacts on Riverine Rabbits, the development presents a clear opportunity to evaluate the degree to which wind farms are compatible with the maintenance and conservation of Riverine Rabbit populations within their boundaries. The monitoring programme should take account of the following:
  - It should be conducted with input from EWT and should include preconstruction monitoring to establish a reliable baseline of Riverine Rabbit abundance and distribution at the site.
  - This should be followed by matched post-construction monitoring to evaluate the potential negative impacts on the Riverine Rabbit population. The exact duration and frequency of monitoring would need to be determined based on the number of cameras to be used and the desired precision and statistical power to be obtained.
  - The monitoring should include a feedback mechanism to use these findings to improve future wind energy development in Riverine Rabbit areas should be developed.
- For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo, with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. The Applicant should therefore make provision for R250,000 per annum towards this fund during the construction and operational phases of the wind farm commencing at the start of construction. The annual amount of R250,000 is applicable to the year 2022 and should be escalated in accordance with CPI each year after that.
- A Monitoring Plan for the Karoo dwarf tortoise must be compiled for the construction and operational phases prior to construction.

Bats

- A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed.

Avifauna

- The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins et al., 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into the Adaptive Management Plan for the facility.
- Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline), as well as in accordance with the operational monitoring plan.
- Blade painting and/or shutdown on demand (either observer or technology led) implemented to mitigate bird-turbine collision risk; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer.
- Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these.
- If required by the avifaunal specialist after the walkthrough, bird perches at the top of the powerline structures should be fitted at relevant locations.

Aquatic Ecology

- Update the Stormwater Management Plan following micro-siting of the final layout.
- Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes, as well as for contamination.

Visual

- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place.

Heritage

- The various sites that will be directly impacted must be considered for protection through micrositing or else, if unavoidable, archaeological mitigation (recording, tracing and photography of engravings; excavation and sampling of artefacts) must be implemented. This affects waypoints 123-124, 131, 132, 150, 151, 1563, 1564, 168, 173 & 1854;
- Micrositing is strongly advised to avoid the ruins at waypoints 1563 and 1564;
- The various sites whose buffers will be intersected and where the activity will be quite close to the site should be marked on the ground with No-Go signage. This affects waypoints 128, 1660, 1827 & 1835;
- If the wind farm is approved and the final layout does not need all approved turbine locations, then where a choice exists between turbines to be dropped, and all other factors are equal, priority should be given to dropping turbines in the high visual sensitivity areas, as well as Turbines 54, 66, 67, 68, 69 and/or 70 which are within the main part of the rock art landscape;
- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Palaeontology

- The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey. An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work.
- Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase.

Noise

- Implement noise monitoring plan.

Traffic

- All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process).
- The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development.
- The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is

identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801.

- A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development.

Socio-Economic

- Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce).
- Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REI4P local content requirements.
- Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development.
- The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences.

Radio Interference (RFI)

- Due to the high risk to the SKA and based on a request from SARAO, a detailed EMC Control Plan must be developed by the renewable energy facility developer should an EA be granted, and development must not commence prior to complying with the AGA Act.

10.3.2 Hoogland 4 Wind Farm Conditions

Validity of the EA

- The formal BA process typically takes 4 to 6 months to complete and if authorised, it is the intention that the developer / applicant would then prepare the project for submission to the REIPPPP during a forthcoming bidding window. It is currently unknown when the future bidding windows will be. Should the EAs be issued for the Hoogland 4 Wind Farm, a 10-year validity period is requested. The reason for this is due to the uncertainty regarding when the future REIPPPP bidding rounds may occur, when the Hoogland 4 Wind Farm is bid and if one of it receives preferred bidder status. A valid EA is one of the requirements for the submission of a project in the REIPPPP.

Micro-Siting

- The expertise of a Terrestrial Ecologist, an Aquatic Ecologist, an Archaeologist, a Palaeontologist, and an Avifaunal Specialist are to be enlisted to conduct post-authorisation micro-siting of the wind farm infrastructure with the design engineers to reduce potential impacts relating to these specialist fields.
- Final adjustments to the layouts shall be made once the specialist micro-siting recommendations from the walkthrough process have been provided. Any No-Go Areas (areas that shall be excluded from any construction activity or general access by the construction team) within the development sites or servitudes shall be clearly indicated on maps and included with the micro-siting reports or attached to the EMPr.

Terrestrial Ecology

- For longer term mitigation the Applicant should, develop and fund a conservation initiative for the life of the wind farm in partnership with EWT or a similar qualified NGO with experience of Riverine Rabbit Conservation in the area. This initiative should focus on enhancing management of the most suitable Riverine Rabbit Riparian habitat in the broader Karoo, with the aim of halting the current trend of degradation and the associated decline in the Riverine Rabbit population. The Applicant should therefore make provision for R250,000 per annum towards this fund during the construction and operational phases of the wind farm commencing at the start of construction.

The annual amount of R250,000 is applicable to the year 2022 and should be escalated in accordance with CPI each year after that.

- A Monitoring Plan for the Karoo dwarf tortoise must be compiled for the construction and operational phases prior to construction.

Bats

- A minimum of 2 years of operational bat mortality monitoring should be conducted from the start of the operation of the facility. The monitoring will enable a detailed mitigation schedule to be implemented as needed.

Avifauna

- Monitoring of breeding status of Martial and Verreaux's Eagles should be conducted in all breeding seasons post acceptance of the project as preferred bidder prior to and during construction (to establish a baseline), as well as in accordance with the operational monitoring plan.
- Blade painting and/or shutdown on demand (either observer or technology led) implemented to mitigate bird-turbine collision risk; alternatives approved by the bird specialist and which the specialist believes would achieve similar results to these other two options may also be considered. A decision on which of these is applied should be taken within 6 months of the project achieving preferred bidder status. In the meantime, all necessary financial and technical provisions must be made by the developer.
- Where relevant, overhead conductors or earth wires should be fitted with an Eskom approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The location of these will be determined through the final walkthrough. Should new more effective bird flight diverters (BFDS) come available the developer needs to be ready to procure and fit these.
- If required by the avifaunal specialist after the walkthrough, bird perches at the top of the powerline structures should be fitted at relevant locations.
- The facility must be monitored once operational in accordance with the most recent version of the best practice guidelines available at the time (Jenkins et al., 2015, 2022 in prep). These guidelines currently state that a minimum of two years of monitoring must be completed, although if significant impacts are detected this will need to be extended. The results of this monitoring should feed into the Adaptive Management Plan for the facility.

Aquatic Ecology

- Update the Stormwater Management Plan following micro-siting of the final layout.
- Where necessary, water use authorisations must be obtained for groundwater abstraction from new or existing boreholes. Quarterly groundwater monitoring should be implemented to ensure sustainable use that is within the authorised volumes, as well as for contamination.

Visual

- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place.

Heritage

- The farm road to be reused adjacent to waypoint 1807 may not be widened towards the north;
- The various sites whose buffers will be intersected and where the activity will be quite close to the site should be marked on the ground with No-Go signage. This affects waypoints 1780, 1801, 1806, 1807, 1588-1598 and 1781-1791;
- The complexes at waypoints 1588-1598 and 1781-1791 must be monitored by the ECO during road construction;
- A CAA-approved warning system which only requires the red lights to come on when an aircraft is in the vicinity (on demand warning lights) must be used to reduce the night-time impacts to the sense of place;

- If the wind farm is approved and the final layout does not need all approved turbine locations, then where a choice exists between turbines to be dropped, and all other factors are equal, priority should be given to dropping Turbine 96; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Palaeontology

- The final layout must be evaluated by a palaeontologist to determine which areas, if any, need a pre-construction survey.
- An approved Work Plan from Heritage Western Cape will be required by the specialist palaeontologist responsible for mitigation work.
- Chance Fossil Finds Protocol to be included within the EMPr and implemented in full during the construction phase.

Noise

- Implement noise monitoring plan.

Shadow Flicker

- In the event of a complaint received, and an appropriate investigation confirms occurrence, then measures included in the EMPr will be applied.

Traffic

- All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process).
- The treacherous section of the gravel road, through the Molteno Pass on the TR05801, is to be upgraded by the developer to improve the safety of the road for all road users, including the personnel commuting to and from the site on a daily basis. This upgrade would need to be implemented prior to or during site establishment but before major earthworks commence on the development.
- The route for construction vehicles from the TR016 (R63) to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton. In this regard, unless a technical issue is identified once the final turbine and abnormal trucks specifications are known, the route from R63 is via Auret Street, onto Fraserburg Street, onto the TR05801.
- A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development.

Socio-Economic

- Set targets for use of local labour, based on REIPPPP thresholds and targets outlined in DMRE, 2021 (e.g., RSA-based employees who are citizens and from local communities should make up at least 20% of the workforce).
- Maximise the use of local sub-contractors where possible through tendering and procurement and ensure meeting the REI4P local content requirements.
- Close liaison with local municipal and other stakeholders involved in socio-economic development in order to ensure that any projects are integrated into wider strategies. and plans with regard to socio-economic development.
- The Contractor/ Project Owner should implement measures to assist and, if needed, fairly compensate potentially affected landowners whereby damages to farm property, stock theft or significant disruptions to farming activities can be minimized or reduced. Measures should be agreed on before construction commences.

Radio Interference (RFI)

- Due to the high risk to the SKA and based on a request from SARAO, a detailed EMC Control Plan must be developed by the renewable energy facility developer should an EA be granted, and development must not commence prior to complying with the AGA Act.

11 REFERENCES

Climate Change

Promethium Carbon. 2022. Specialist Climate Change Impact Assessment: Proposed Hoogland Wind Farms and Grid Connection Project.

1. Böttinger, M and D. Kasang. 2021. The SSP Scenarios. Deutsches Klimarechenzentrum, Hamburg, Germany. Available at: https://www.dkrz.de/en/communication/climate-simulations/cmip6-en/the-ssp-scenarios.
2. Bourne, A, P. deAbreu, C. Donatti, S. Scorgie, and S. Holness. 2015. A Climate Change Vulnerability Assessment for the Namakwa District, South Africa: The 2015 revision. Conservation South Africa, Cape Town.
3. Climate Action Tracker. 2021. CAT Emissions Gap. Available at: https://climateactiontracker.org/global/cat-emissions-gaps/.
4. Department of Energy, 2019, Integrated Resources Plan (IRP2019), Government Gazette, [Online] Available at: http://www.energy.gov.za/IRP/2019/IRP-2019.pdf [Accessed on 10/05/2020].
5. Department of Energy. 2019. Integrated Resources Plan (IRP2019), Government Gazette. Available at: http://www.energy.gov.za/IRP/2019/IRP-2019.pdf.
6. Department of Environmental Affairs, 2016, Technical Guidelines for Monitoring, Reporting and Verification of GHG Emissions by Industry.
7. Department of Environmental Affairs, 2017, Technical Guidelines for Monitoring Reporting and Verification of Greenhouse Gas Emissions by Industry.
8. Department of Environmental Affairs, 2017, Technical Guidelines for Monitoring Reporting and Verification of Greenhouse Gas Emissions by Industry.
9. Department of Mineral Resources and Energy. 2020. Overview of the Request for Qualification and Proposals for New Generation Capacity under the Risk Mitigation IPP Procurement Programme. Available at: https://www.ipp-rm.co.za/.
10. Department of Minerals and Energy (2005). Energy Efficiency Strategy of the Republic of South Africa. Available at https://www.gov.za/sites/default/files/gcis_document/201409/energy-efficiencystrategy051.pdf
11. Earthlife Africa Johannesburg v Minister of Environmental Affairs and others [2017] 2 All SA 519 (GP).
12. Engelbrecht, F, Le Roux, A, Arnold, K. and Malherbe, J. 2019. Green Book. Detailed projections of future climate change over South Africa. Pretoria: CSIR. Available at: https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=b161b2f892194ed5938374fe2192e537.
13. Engelbrecht, F, Le Roux, A, Arnold, K. and Malherbe, J. 2019. Green Book. Detailed projections of future climate change over South Africa. Pretoria: CSIR. Available at: https://pta-gis-2-web1.csir.co.za/portal/apps/GBCascade/index.html?appid=b161b2f892194ed5938374fe2192e537.
14. Equator Principles, 2020, The Equator Principles: July 2020, [Online] Available at: https://equator-principles.com/wp-content/uploads/2020/05/The-Equator-Principles-July-2020-v2.pdf
15. Equator Principles, 2020, The Equator Principles: July 2020, [Online] Available at: https://equator-principles.com/wp-content/uploads/2020/05/The-Equator-Principles-July-2020-v2.pdf
16. European Bank for Reconstruction and Development (EBRB), EBRD Values, [Online] Available at: https://www.ebrd.com/our-values.html
17. Gale, J, and Freund, P. 2001. Greenhouse gas abatement in energy intensive industries. Australia.
18. GIZ. 2014. The vulnerability sourcebook. Gesellschaft für Internationale Zusammenarbeit, Bonn, Germany.
19. GIZ. 2014. The vulnerability sourcebook. Gesellschaft für Internationale Zusammenarbeit, Bonn, Germany.
20. Greenbook.co.za. 2021. Green Book I Adapting settlements for the future. [online] Available at: https://greenbook.co.za/ [Accessed 11 November 2021].
21. Greenhouse Gas Protocol, 2015, A Corporate Accounting and Reporting Standard: Revised Edition.
22. https://www.gov.za/sites/default/files/gcis_document/202106/44761gon559.pdf
23. IFC, 2012, IFC Performance Standards on Environmental and Social Sustainability, International Finance Corporation, World Bank Group.

24. IFC, 2012, IFC Performance Standards on Environmental and Social Sustainability, International Finance Corporation, World Bank Group.
25. International Council on Mining and Minerals, 2013, Adapting to a changing climate: implications for the mining and metals industry. ICMM.
26. International Council on Mining and Minerals, 2013, Adapting to a changing climate: implications for the mining and metals industry. ICMM.
27. International Finance Corporation, 2012, Performance Standards, [Online] Available at: https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards [Accessed on 30/08/2020].
28. IPCC, 2006, 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2 Energy, Intergovernmental Panel on Climate Change.
29. IPCC, 2006. IPCC Guidelines for National Greenhouse Gas Inventories, [Online] Available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/ [Accessed on 05/04/2020].
30. IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.
31. IPCC, 2014. Fifth Assessment Report of the IPCC, Annex 1: Glossary s.l.: s.n. Viewed 29 July 2019 https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_AnnexI_Glossary.pdf.
32. IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri, and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
33. IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V, P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.
34. IPCC, n.d, Data Distribution Centre Glossary: Vulnerability, IPCC [Website] Available at: https://www.ipcc-data.org/guidelines/pages/glossary/glossary_uv.html [Accessed on 10/08/2020].
35. IPCC. 2021. Climate Change 2021 – The Physical Science Basis. Summary for Policy Makers. Intergovernmental Panel on Climate Change, Geneva, Switzerland.
36. Le Roux, A, Van Niekerk, W, Arnold, K, Pieterse, A, Ludick, C, Forsyth, G, Le Maitre, D, Lötter, D, du Plessis, P. and Mans, G, 2019. Green Book Risk Profile Tool. Green Book. https://riskprofiles.greenbook.co.za/
37. Mimura, N, 2013. Sea-level rise caused by climate change and its implications for society. Proceedings of the Japan Academy, Series B, 89(7), pp.281-301.
38. Republic of South Africa (2018). Climate Change Bill, 2018. Government Gazette No. 41689. Available at https://www.dffe.gov.za/sites/default/files/legislations/climatechangebill2018_gn41689.pdf
39. Republic of South Africa (2019). Act No. 15 of 2019: Carbon Tax Act, 2019. Government Gazette No. 42483. Available at https://www.gov.za/sites/default/files/gcis_document/201905/4248323-5act15of2019carbontaxact.pdf
40. Republic of South Africa. 2021. First Nationally Determined Contribution under the Paris Agreement (Updated September 2021). Republic of South Africa, Pretoria.
41. Ritchie, H, and M. Roser. CO2 and greenhouse gas emissions. Our World in Data. Available at: https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions. Accessed on 1/02/2022.
42. Sacket, P, Steffen, W, and K. Jesson. 2018. What is a carbon budget? ACT Climate Change Council, Dickson, Australia. Available at: https://www.environment.act.gov.au/__data/assets/pdf_file/0006/1297707/What-is-a-Carbon-Budget.pdf.
43. Standards South Africa, 2021, SANS 14064-1:2021 Greenhouse Gases Part 1: Specification with guidance at the organisational level for the quantification and reporting of greenhouse gas emissions and removals, Pretoria.

44. Stephens, A. and Thieme, V, 2019, Towards >60Gigatonnes of Climate Innovations: Module 2. The Avoided Emissions Framework, Missions Innovation.
45. Tabari, H, 2020. Climate change impact on flood and extreme precipitation increases with water availability, Sci. Rep, 10, 13768.
46. The Equator Principles Association, 2020, Equator Principles EP4, [Online] Available at: https://equator-principles.com/about/ [Accessed on 30/08/2020].
47. The World Bank. 2021. Population, total – South Africa. The World Bank Data. Available at. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ZA
48. The World Bank. 2021. Population, total. The World Bank Data. Available at: https://data.worldbank.org/indicator/SP.POP.TOTL
49. Tucker, J, Daoud, M, Oates, N. et al. Reg Environ Change (2015) 15: 783. https://doi.org/10.1007/s10113-014-0741-6. Equator Principles 4, July 2020. https://equator-principles.com/app/uploads/The-Equator-Principles_EP4_July2020.pdf including Annex A (Equator Principles Guidance Note on Climate Change Risk Assessment, September 2020).
50. WRI Aqueduct Tool 2015. Available at: https://www.wri.org/aqueduct.
51. Wri.org. 2021. Aqueduct Water Risk Atlas. [online] Available at: https://www.wri.org/applications/aqueduct/water-risk-atlas/ [Accessed 11 November 2021].
52. WWF. 2012. Understanding carbon budgets. WWF-SA, Cape Town, South Africa. Available at: http://awsassets.wwf.org.za/downloads/understanding_carbon_budgets_final_nov_2014.pdf.

Geotechnical

Bradshaw, R.A.2021. Desktop Geotechnical Study of Southern Cluster: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm

1. Almond, J.E. 2021. Hoogland Wef 1-4 and Grid Connection Projects near Loxton, Beaufort West and Fraserburg Districts of The Western and Northern Cape Provinces: Initial Palaeontological Heritage Input. Report by Natura Viva cc.
2. Bradshaw, R.A. 2019. Desk Study of Potential Sources of Construction Materials. Report by R.A. Bradshaw and Associates cc. Ref. No. 1-169519.
3. Le Roux, F.G. and Keyser, A.W. 1988. Die Geologie van Die Gebied Victoria-Wes. Department of Mineral and Energy Affairs. Geological Survey.
4. Weinert, H.H. 1980. Natural road construction materials of Southern Africa. CSIR.

Agriculture

Lanz, J. 2022. Site Sensitivity Verification and Agricultural Compliance Statement for the Proposed Hoogland Wind Farms and Grid Connection Project Southern Cluster: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm.

1. Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/
2. Crop Estimates Consortium, 2019. Field Crop Boundary data layer, 2019. Pretoria. Department of Agriculture, Forestry and Fisheries.
3. Department of Agriculture, Forestry and Fisheries, 2017. National land capability evaluation raster data layer, 2017. Pretoria.
4. Department of Agriculture, Forestry and Fisheries, 2002. National land type inventories data set. Pretoria.
5. Schulze, R.E. 2009. SA Atlas of Climatology and Agrohydrology, available on Cape Farm Mapper. Available at: https://gis.elsenburg.com/apps/cfm/

Terrestrial Ecology

Todd, S. 2022. Terrestrial Biodiversity Specialist Study: Hoogland South 3 Wind Energy Facility

Todd, S. 2022. Terrestrial Biodiversity Specialist Study: Hoogland South 4 Wind Energy Facility

1. Agha, M, Lovich, J.E, Ennen, J.R, Augustine, B, Arundel, T.R, Murphy, M, Meyer-Wilkins, K, Bjurlin, C, Delaney, D, Briggs, J, Austin, M, Madrak, SV, Price, S.J. 2015. Turbines and terrestrial vertebrates: variation in tortoise survivorship between a wind energy facility and an adjacent undisturbed wildland area in the Desert Southwest (USA). Environmental Management 56, 332–341.
2. Alexander, G. and Marais, J. 2007. A Guide to the Reptiles of Southern Africa. Struik Nature, Cape Town.
3. Bates, M.F, Branch, W.R, Bauer, A.M, Burger, M, Marais, J, Alexander, G.J. and de Villiers, M.S. 2013. Atlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland. Strelitzia 32. SANBI, Pretoria.
4. Branch, W.R. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town.
5. Burger, M. 2021. Herpetofaunal Study of the Nuweveld Wind Farms. Sungazer Faunal Surveys for Zutari South Africa.
6. Department of Environmental Affairs and Tourism. 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa.
7. Du Preez, L. and Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature, Cape Town.
8. Lovich, J.E, Ennen, J.R, Madrak, S, Meyer, K, Loughran C, Bjurlin, C, Arundel, T, Turner, W, Jones, C, Groenendaal, G.M. 2011. Effects of wind energy production on growth, demography, and survivorship of a desert tortoise (Gopherus agassizii) population in southern California with comparisons to natural populations. Herpetological Conservation and Biology 6, 161–174.
9. Minter, L.R, Burger, M, Harrison, J.A, Braack, H.H, Bishop, P.J and Kloepfer, D. 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho, and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.
10. Mucina, L and Rutherford, M.C. 2006. The Vegetation of South Africa, Lesotho, and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
11. Nel, J.L, Murray, K.M, Maherry, A.M, Petersen, C.P, Roux, D.J, Driver, A, Hill, L, Van Deventer, H, Funke, N, Swartz, E.R, Smith-Adao, L.B, Mbona, N, Downsborough, L. and Nienaber, S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.
12. Skinner, J.D. and Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.
13. 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.
14. Taylor, A, Avenant, N, Schulze, E, Viljoen, P, Child, M.F. 2016. A conservation assessment of Redunca fulvorufula fulvorufula. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland, and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa
15. Todd, S.W. 2021. Fauna and Flora Specialist Study for the Nuweveld North, East, and West WEFs. 3Foxes Biodiversity Solutions for Zutari South Africa.

Riverine Rabbit Species Assessment

Todd, S. 2022. Riverine Rabbit Species Assessment: Hoogland South 3 Wind Energy Facility

1. Collins K, Bragg C, Birss C, Child MF. 2016. A conservation assessment of Bunolagus monticularis. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
2. Collins K, Toit JT. 2016. Population status and distribution modelling of the critically endangered riverine rabbit (Bunolagus monticularis). African Journal of Ecology 54:195–206.
3. Duthie AG, Skinner JD, Robinson TJ. 1989. The distribution and status of the riverine rabbit, Bunolagus monticularis, South Africa. Biological Conservation 47:195–202.
4. Duthie AG. 1989. The ecology of the riverine rabbit (Bunolagus monticularis). Ph.D. Thesis. University of Pretoria, Pretoria, South Africa.
5. Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.
6. 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.
7. Todd, S.W. 2021. Fauna and Flora Specialist Study for the Nuweveld North, East and West WEFs. 3Foxes Biodiversity Solutions for Zutari South Africa.

Faunal Compliance Statement

Todd, S. 2022. Fauna Comliance Statement: Hoogland South 4 Wind Energy Facility

1. Collins K, Bragg C, Birss C, Child MF. 2016. A conservation assessment of Bunolagus monticularis. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
2. Collins K, Toit JT. 2016. Population status and distribution modelling of the critically endangered riverine rabbit (Bunolagus monticularis). African Journal of Ecology 54:195–206.
3. Duthie AG, Skinner JD, Robinson TJ. 1989. The distribution and status of the riverine rabbit, Bunolagus monticularis, South Africa. Biological Conservation 47:195–202.
4. Duthie AG. 1989. The ecology of the riverine rabbit (Bunolagus monticularis). Ph.D. Thesis. University of Pretoria, Pretoria, South Africa.
5. Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.
6. 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.
7. Todd, S.W. 2021. Fauna and Flora Specialist Study for the Nuweveld North, East and West WEFs. 3Foxes Biodiversity Solutions for Zutari South Africa.

Flora Compliance Statement

Todd, S. 2022. Fauna Comliance Statement: Hoogland South 3 Wind Energy Facility
Todd, S. 2022. Fauna Comliance Statement: Hoogland South 4 Wind Energy Facility

1. Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa.
2. Mucina L. & Rutherford M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
3. Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.
4. 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.

Karoo Dwarf Tortoise Species Assessment

Burger, M. 2022. Karoo Dwarf Tortoise Species Assessment: Hoogland South 3 Wind Energy Facility
Burger, M. 2022. Karoo Dwarf Tortoise Species Assessment: Hoogland South 4 Wind Energy Facility

1. Agha, M., Lovich, J.E., Ennen, J.R., Augustine, B., Arundel, T.R., Murphy, M., Meyer-Wilkins, K., Bjurlin, C., Delaney, D., Briggs, J., Austin, M., Madrak, S.V. and Price, S.J. 2015. Turbines and terrestrial vertebrates: variation in tortoise survivorship between a wind energy facility and an adjacent undisturbed wildland area in the Desert Southwest (USA). Environmental Management 56: 332–341.
2. Burger, M. 2020. Nuweveld Wind Farms: A herpetofaunal synopsis. Sungazer Faunal Surveys report compiled for Zutari South Africa – September 2020.
3. Burger, M. 2022a. Hoogland Northern Cluster Wind Farm: Site Sensitivity Verification and Terrestrial Animal Species Specialist Assessment for the Karoo Dwarf Tortoise. Sungazer Faunal Surveys report compiled for SLR Consulting – June 2022.
4. Burger, M. 2022b. Hoogland Northern Grid Connection: Site Sensitivity Verification and Terrestrial Animal Species Specialist Assessment for the Karoo Dwarf Tortoise. Sungazer Faunal Surveys report compiled for SLR Consulting – June 2022.
5. Burger, M. 2022c. Hoogland Southern Cluster Wind Farm: Site Sensitivity Verification and Terrestrial Animal Species Specialist Assessment for the Karoo Dwarf Tortoise. Sungazer Faunal Surveys report compiled for SLR Consulting – June 2022.
6. Colloty, B. 2022. Hoogland Southern Grid Connection: Aquatic Impact Assessment. EnviroSci (Pty) Ltd report compiled for SLR Consulting – June 2022.
7. Driver, A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L. and Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria, South Africa.
8. Du Toit, J.C.O., O'Connor, T.G. and Van den Berg, L. 2015. Photographic evidence of fire-induced shifts from dwarf-shrub- to grass-dominated vegetation in Nama-Karoo. South African Journal of Botany 101: 148–152.
9. Fincham, J.E. and Lambrechts, N. 2014. How many tortoises do a pair of Pied Crows Corvus alba need to kill to feed their chicks? Ornithological Observations 5: 135–138.
10. Fincham, J.E. and Nupen, P. 2016. A Pied Crow Corvus albus survey covering 4 000 km2 of the Karoo: Autumn 2015. Biodiversity Observations 7(3): 1–4.
11. Hofmeyr, M.D. and Baard, E.H.W. 2014. Homopus boulengeri Duerden, 1906. In: Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. and De Villiers, M.S. (eds). 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Suricata 1. South African National Biodiversity Institute, Pretoria.

12. Hofmeyr, M.D. and Branch, W.R. 2018. The padloper's tortuous path (Chelonia: Testudinidae): Two genera, not one. African Journal of Herpetology 67(2): 99–112.
13. Hofmeyr, M.D., Loehr, V.J.T., Baard, E.H.W. and Juvik, J.O. 2018. Chersobius boulengeri. The IUCN Red List of Threatened Species 2018: e.T170521A115656360. **https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T170521A115656360.en**. Downloaded on 20 November 2021.
14. Hofmeyr, M.D., Loehr, V.J.T., Baard, E.H.W. and Juvik, J.O. Chersobius boulengeri (Duerden, 1906). In: Tolley, K.A., Conradie, W., Pietersen, D.W., Weeber, J., Burger, M. and Alexander G.J. (eds). In press. The Conservation Status of the Reptiles of South Africa, Eswatini and Lesotho. South African National Biodiversity Institute, Pretoria, South Africa.
15. Hofmeyr, M.D., Vamberger, M., Branch, W., Schleicher, A. and Daniels, S.R. 2017. Tortoise (Reptilia, Testudinidae) radiations in southern Africa from the Eocene to present. Zoologica Scripta 46: 389– 400.
16. Horn, B.K.P. 1981. Hill shading and the reflectance map. Proceedings of the IEEE 69(1): 14–47.
17. Joseph, G.S., Seymour, C.L. and Foord, S.H. 2017. The effect of infrastructure on the invasion of a generalist predator: Pied crows in southern Africa as a case-study. Biological Conservation 205: 11–15.
18. Juvik, J.O. and Hofmeyr, M. 2015. Vanishing with little fanfare: Boulenger's Tortoise on the South African Karoo. The Tortoise (Turtle Conservancy) 1(4): 142–149.
19. Loehr, V.J.T. 2018. Chersobius boulengeri (Duerden, 1906), Karoo padloper: reproduction. African Herp News 68: 37–39.
20. Loehr, V.J.T and Keswick, T. 2022. Structure and projected decline of a Karoo dwarf tortoise population. Journal of Wildlife Management 2022: 1–13.
21. Loehr, V.J.T, Keswick, T., Reijnders, M.A.D.E. and Zweers, I.M. 2021. High-Level Inactivity Despite Favorable Environmental Conditions in the Rock-Dwelling Dwarf Tortoise Chersobius boulengeri. Herpetologica 77(3): 232–238.
22. Lovich, J.E., Agha, M., Ennen, J.R., Arundel, T., Turner, W., Jones, C. and Austin, M. 2018. Agassiz's desert tortoise (Gopherus agassizii) activity areas are little changed after wind turbine-induced fires in California. International Journal of Wildland Fire. **https://doi.org/10.1071/WF18147**
23. Lovich, J.E., Ennen, J.R., Madrak, S., Meyer, K., Loughran, C., Bjurlin, C., Arundel, T., Turner, W., Jones, C. and Groenendaal, G.M. 2011. Effects of wind energy production on growth, demography, and survivorship of a desert tortoise (Gopherus agassizii) population in southern California with comparisons to natural populations. Herpetological Conservation and Biology 6: 161–174.
24. Mucina, L. and Rutherford, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
25. Masubelele, M.L., Hoffman, M.T., Bond, W.J. and Gambiza, J. 2014. A 50 year study shows grass cover has increased in shrublands of semi-arid South Africa. Journal of Arid Environments104: 43–51.
26. 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.
27. Stevens, N., Bond, W., Hoffman, T. and Midgley, G. 2015. Change is in the air: Ecological trends and their drivers in South Africa. South African Environmental Observation Network (SAEON), Pretoria. **http://www.saeon.ac.za/**.
28. Schwarz, A. 2022. Hoogland Southern Grid Connection: Traffic Impact Assessment. Report compiled for SLR Consulting – June 2022.
29. Smallie, J. 2022. Hoogland Southern Grid Connection: Avifaunal Impact Assessment. Wildskies Ecological Services (Pty) Ltd report compiled for SLR Consulting – June 2022.
30. Telford, N.S., Alexander, G.J., Becker, F.S., Conradie, W., Jordaan, A., Kemp, L., Le Grange, A., Rebelo, A.D., Strauss, P., Taft, J.M., Weeber, J. and Tolley, K.A. 2022. Extensions to the known geographic distributions of reptiles in the Great Karoo, South Africa. Herpetological Conservation and Biology 17(1):145–154.
31. Todd, S. 2021. Fauna & flora specialist screening study: Hoogland North Wind Energy Facility. Report compiled by 3Foxes Biodiversity Solutions – July 2021.

32. Todd, S.W. 2022. Fauna and Flora Specialist Study for the Hoogland Southern Grid Connection. Report compiled by 3Foxes Biodiversity Solutions.
33. Tolley, K.A., Conradie, W., Pietersen, D.W., Weeber, J., Burger, M. and Alexander G.J. (eds). (in press). The Conservation Status of the Reptiles of South Africa, Eswatini and Lesotho. South African National Biodiversity Institute, Pretoria, South Africa.
34. Van Wijk, J.C.P. and Bates, M.F. 1999. Geographical Distribution: Homopus boulengeri Duerden, 1906. Karroo Padloper. African Herp News 29:42–43.

Bats

Animalia Consultants. 2022. Bat pre-application impact assessment report for the proposed Hoogland 3 and 4 Wind Farms (Hoogland Southern Cluster), Western Cape

1. African Chiroptera Report. 2018. *African Bats, Pretoria.*
2. Baerwald, E. F, D'Amours, G. H, Klug, B.J, and Barclay, R.M.R. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology* 18: 695-695.
3. Barclay, R.M.R, Baerwald, E.F, and Gruver, J.C. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. *Canadian Journal of Zoology* 85: 381-387.
4. Hester, S.G. and Grenier, M.B. 2005. *A conservation plan for bats in Wyoming*. Lander, WY: Wyoming Game and Fish Department, Nongame Program.
5. Horn, J.W, Arnett, E.B. and Kunz, T.H. 2008. Behavioural responses of bats to operating wind turbines. *Journal of Wildlife Management* 72: 123-132.
6. Howe, R.H, Evans, W, and Wolf, A.T. 2002. Effects of wind turbines on Birds and Bats on Northeastern Wisconsin. Report submitted to *Wisconsin Public Service Corporation and Madison Gas and Electric Company*.
7. Johnson, G.D, Erickson, W.P, Stickland, M.D, Shepherd, M.F, Shepherd, D.A, and Sarappo, S. A. 2003. Mortality of bats at a large-scale wind power development at Buffalo Ridge, Minnesota. *The American Midland Naturalist Journal* 150: 332-342.
8. Kunz, T. H, Arnett, E.B, Erickson, W.P, Hoar, A.R, Johnson, G.D, Larkin, R.P, Strickland, M.D, Thresher, R.W, Tuttle, M.D. 2007. Ecological impacts of wind energy development on bats: questions, research needs, and hypothesis. *Frontiers in Ecology and the Environment* 5: 315-324.
9. Lynch, C.D. 1989. The mammals of the north-eastern Cape Province. *Mem. Nas. Mus. Bloemfontein* 25: 1-116.
10. 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.*
11. Monadjem, A, Taylor, P.J, Cotterill, F.P.D. and Schoeman, M.C. 2020. Bats of southern and central Africa, 2nd Edition – A biogeographic and taxonomic synthesis, Wits University Press, Johannesburg.
12. Mucina, L. and Rutherford, M. C. 2012. The Vegetation of South Africa, Lesotho and Swaziland-*Strelitzia 19,* South African National Biodiversity Institute, Pretoria.
13. Neuweiler, G. 2000. *The Biology of Bats*. Oxford University Press.
14. O'Shea, T. J, Bogan, M. A. and Ellison, L. E. 2003. Monitoring trends in bat populations of the United States and territories: Status of the science and recommendations for the future. *Wildlife Society Bulletin*, 31: 16-29.
15. Rautenbach, I.L. 1982. *Mammals of the Transvaal*. Pretoria: Ecoplan.
16. Taylor, P.J. 2000. Bats of southern Africa, University of Natal Press, Pietermaritzburg.
17. Tuttle, M.D. and Hensley, D. L. 2001. *The Bat House Builder's Handbook*. (BCI) Bat Conservation International.
18. van der Merwe, M. 1979. Growth of ovarian follicles in the Natal clinging bat. *South African Journal of Zoology* 14: 111-117.
19. van der Merwe, M. 1994. Reproductive biology of the Cape serotine bat, *Eptesicus capensis,* in the Transvaal, South Africa. *South African Journal of Zoology* 29: 36-39.

Avifauna

WildSkies Ecological Services. 2022. Avifaunal assessment for the proposed construction of Southern Cluster: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm.

1. Allan, D.G. and Anderson, M.D. 2010. Assessment of the threats faced by South African bustards. Unpublished BirdLife South Africa report.
2. Allan, D.G. 2003. Abundance sex ratio, breeding and habitat of Stanley's Bustard *Neotis denhami stanleyi* in western South Africa. Durban Museum, Novit 28: 1-10.
3. Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Karoo Large Terrestrial Bird Powerline Project, Directorate Conservation and Environment (Northern Cape), Kimberley.
4. BirdLife South Africa. 2017. Verreaux's Eagle and Wind Farms: Guidelines for Impact Assessment, monitoring and mitigation. BirdLife South Africa Occasional Report Series.
5. Bose, A, Dürr, T, Klenke, R.A. and Henle, K. 2018. Collision sensitive niche profile of the worst affected bird-groups at wind turbine structures in the Federal State of Brandenburg, Germany. *Scientific Reports* 8: 3777
6. Claassen, J, Rodriques, L, and Davies, R. 2013. The present status and breeding success of Verreaux's Eagles (Aquila verreauxii) in the Karoo National Park and surrounding areas. Unpublished research report.
7. Davies, R.A.G, and D.G. Allan. 1997. "Black eagle Aquila verreauxii." *The atlas of southern African birds* 1 175-177.
8. Drewitt, A.L, and Langston, R.H.W. 2006. Assessig the impacts of wind farms on birds. Ibis 148:29-42
9. Drewitt, A.L, and Langston, R.H.W. 2008. Collision effects of wind-power generators and other obstacles on birds. Annals of the New York Academy of Science 1134: 233-266
10. Dwyer, J.F, Landon, M.A, and Mojica, E.K. 2018. Impact of Renewable Energy Sources on Birds of Prey. In: Sarasola, J.H, Grande, J.M. and Negro, J.J. (eds). 2018. *Birds of Prey Biology and conservation in the XXI century*. p 303-321
11. Endangered Wildlife Trust – Eskom Strategic Partnership. 2019. Central Incident Register data for Karoo region.
12. FitzPatrick Institute of African Ornithology and HawkWatch International. 2020. Verreaux's Eagle Risk Assessment. Site: Nuweveld, Red Cap. Application date: 2020 July 27
13. Harrison, J.A, Allan, D.G, Underhill, L.G, Herremans, M, Tree, A.J, Parker, V and Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1and2. BirdLife South Africa, Johannesburg.
14. Hockey, P.A.R, Dean, W.R.J. and Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.
15. Hötker, H, Thomsen, K.M. and Jeromin, H. 2006. Impacts on biodiversity of exploitation of renewable energy resources: the example of birds and bats- facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Bergenhusen.
16. IFC. Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets." International Finance Corporation.
17. IUCN. 2021. IUCN Red List of Threatened Species. Version 2012.2. <**www.iucnredlist.org**>.
18. Jenkins, A.R, Van Rooyen, C.S, Smallie, J, Harrison, J.A, Diamond, M, Smit-Robbinson, H.A. and Ralston, S. 2015. "Best practice guidelines for assessing and monitoring the impact of wind energy facilities on birds in southern Africa" Unpublished guidelines
19. Jordan, M, and Smallie, J. 2010. A briefing document on best practice for pre-construction assessment of the impacts of onshore wind farms on birds. Endangered Wildlife Trust, Unpublished report.
20. Kingsley, A and Whittam, B. 2005. Wind turbines and birds – A background review for environmental assessment. Unpublished report for Environment Canada/Canadian Wildlife Service.

21. Kuvlevsky, W.P, Brennan, L.A, Morrison, M.L, Boydston, K.K, Ballard, B.M. and Bryant, F.C. 2007. Wind energy development and wildlife conservation: challenges and opportunities. Journal of Wildlife Management 71: 2487-2498.
22. Ledec, G.C, Rapp, K. W. and Aiello, R.G. 2011. Greening the Wind: Environmental and Social Considerations for Wind Power Development in Latin America and Beyond. The World Bank ESMAP Report. 148 pp.
23. MacEwan, K, and Smallie, J. 2016. Jeffreys Bay Wind Farm Operational Bird and Bat Monitoring Year 2 Final Report. Unpublished report to Jeffreys Bay Wind Farm.
24. Marques, A.T, Batalha, H, Rodrigues, S, Costa, H, Pereira, M.J.R, Fonseca, C, Mascarenhas, M. and Bernardino. 2014. Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. *Biological Conservation* 179: 40-52.
25. Marnewick, M.D, Retief, E.F, Theron, N.T, Wright, D.R. and Anderson, T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.
26. Martinéz, J.E, Calco, J.F, Martinéz, J.A, Zuberogoitia, I, Cerezo, E, Manrique, J, Gómez, G.J, Nevado, J.C, Sánchez, M, Sánchez, R, Bayo, J. Pallarés, A, González, C, Gómez, J.M, Pérez, P. and Motos, J. 2010. Potential impact of wind farms on territories of large eagles in southeastern Spain. Biodiversity and Conservation 19: 3757-3767.
27. Masden, E.A, Fox, A.D, Furness, R.W, Bullman, R. and Haydon, D.T. 2009. Cumulative impact assessments and bird/wind farm interactions: Developing a conceptual framework. Environmental Impact Assessment Review 30: 1-7.
28. May, R, Nygard, T, Lie Dahl, E, Reitan, O, and Bevanger, K. 2010. Collision risk in white-tailed eagles, Modelling kernel-based collision risk using satellite telemetry data in Smøla wind-power plant. NINA report 692.
29. Mucina, L, and Rutherford, C. 2006. The Vegetation of South Africa, Lesotho and Swaziland, South African National Biodiversity Institute, Pretoria.
30. Perold, V, Ralston-Paton, S. and 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
31. Murgatroyd, M, Avery, G, Underhill, L. and Amar, A. 2016b. Adaptability of a specialist predator: The effects of land use on diet diversification and breeding performance of Verreaux's eagles. Journal of Avian Biology. 47:001-012.
32. Murgatroyd, M, Underhill, L, Rodrigues, L, and Amar, A. 2016a. The influence of agricultural transformation on the breeding performance of a top predator: Verreauxs' Eagles in contrasting land use areas. Condor 118: 238-252.
33. 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 Wind Farms in South Africa. BirdLife South Africa Occasional Report Series No. 2. BirdLife South Africa, Johannesburg, South Africa.
34. Ralston-Paton, S. and Camagu, N. 2019. Birds and Renewable Energy: Update for 2019. Unpublished presentation at the Birds and Renewable Energy Forum on 10 October 2019, Cape Town.
35. Retief, E, Anderson, M, Diamond, M, Smit, H, Jenkins, A. and Brooks, M. 2011/2014. Avian Wind Farm Sensitivity Map for South Africa: Criteria and Procedures used.
36. Rydell, J, Engstrom, H, Hedenstrom, A, Larson, J.K, Petterrson, J.and Green, M. 2012. The effect of wind power on birds and bats – a synthesis. Unpublished report by the Swedish Environmental Protection Agency. ISBN 978-91-620-6511-9
37. Rydell, J, Ottvall, R, Petterrson, J. and Green, M. 2017. *The effects of wind power on birds and bats – an updated synthesis report.* Report by the Swedish Environmental Protection Agency.
38. Shaw, J.M. 2009. The End of the Line for South Africa's National Bird? Modelling Power Line Collision Risk for the Blue Crane. Master of Science in Conservation Biology. Percy FitzPatrick Institute of African Ornithology
39. Shaw J, Jenkins AR, and Ryan PG 2010a. Modelling power line collision risk in the Blue Crane Anthropoides paradiseus in South Africa. Ibis 152: 590-599.
40. Shaw, J, Jenkins, A.R, Ryan, P.G. and Smallie J. 2010b. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. Ostrich 81: 109-113.

41. Stewart, G.B, Pullin, A.S. and Coles, C.F. 2007. Poor evidence-base for assessment of windfarm impacts on birds. Environmental Conservation 34: 1-11.
42. Steyn, P. 1989. Birds of Prey of southern Africa. Creda Press Pty Ltd
43. Smales, I. and Muir, S. 2005. Modelled cumulative impacts on the Tasmanian Wedge-tailed Eagle of wind farms across the species range. Biosis Research Pty. Ltd (for Australian Department of the Environment and Heritage.
44. Smallie, J. 2015. Verreaux's' Eagle *Aquila verreauxii* wind turbine collision fatalities. Wildskies Ecological Services Short Note.
45. Smallie, J. 2019. Nuweveld Wind Farms Pre-Construction Bird Monitoring reports. Unpublished reports submitted to Red Cap.
46. Smallwood, K.S. and Thelander, C. 2008. Bird mortality in the Altamont Pass Wind Resource Area, California. Journal of Wildlife Management 72: 215-223.
47. Taylor, M. R, Peacock, F, and Wanless, R. 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland.
48. Taylor, P.B, Navarro, R.A, Wren-Sargent, M, Harrison, J.A. and Kieswetter, S.L. 1999. *Coordinated waterbird Counts in South Africa, 1992-1997*. Avian Demography Unit, Cape Town.
49. Thelander, C.G, and Rugge, L. 2001. Examining relationships between bird risk behaviours and fatalities at the Altamont Wind Resource Area: a second-year progress report in: Schwartz, S.S. (Ed), Proceedings of the National Avian – Wind Power Planning Meeting 4 Carmel, CA, May 16-17, 2000.
50. Thaxter, C.B, Buchanan, G.M, Carr, J. Butchart, S.H.M, Newbold, T, Green, R.E, Tobias, J.A, Foden, W.B, O'Brien, S, and pearce-Higgins, J.W. 2017. Bird and bat species'global vulnerability to collision mortality at wind farms revealed through a trait-based assessment. *Proc. R. Soc. B.* 284: 20170829
51. van Eeden, R, Whitfield, D.P, Botha, A, and Amar, A. 2017 Ranging behaviour and habitat preferences of the Martial Eagle: Implications for the conservation of a declining apex predator. PLoS ONE 12(3): e0173956. https://doi.org/ 10.1371/journal.pone.0173956
52. Van Rooyen, C.S. and Ledger, J.A. 1999. Birds and utility structures: Developments in southern Africa. Pp 205-230 in Ferrer, M. and G. F.M. Janns. (eds.) Birds and Power lines. Quercus, Madrid, Spain. 238pp.
53. Van Rooyen, C.S. 2004. The Management of Wildlife Interactions with overhead lines. In: The Fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg 2004.
54. Vasilakis, D.P, Whitfield, D.P. and Vassiliki, K. 2017. A balanced solution to the cumulative threat of industrialized wind farm development on cinereous vultures (Aegypius monachus) in south-eastern Europe. PLoS ONE 12(2): e0172685. Doi: 10.371/journal.pone.0172685
55. Young, D.J, Harrison, J.A, Navarro, R.A, Anderson, M.D, and Colahan, B.D. (eds) 2003. Big Birds on Farms: Mazda CAR Report 1993-2001. Avian Demography Unit. Cape Town.

Websites:

56. www.sabap2.adu.org.za. The Second Southern African Bird Atlas Project. In progress.
57. www.iucnredlist.org.
58. www.abcbirds.org American Bird Conservancy
59. www.sibleyguides.com Sibley Guides
60. www.nssf.org National Shooting Sports Foundation
61. www.project-gpwind.eu The Good Practice Wind project
62. www.birdlife.org Birdlife International
63. www.birdlife.org.za BirdLife South Africa
64. www.iucnredlist.org. Accessed 2017
65. www.car.adu.org.za. CAR project
66. www.africanraptors.org
67. www.redz.csir.co.za
68. www.cwac.adu.org.za

Aquatic

EnviroSci. 2022. Aquatic pre-application impact assessment: Hoogland South Wind Farms.

1. Agenda 21. 1998. Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT).
2. Agricultural Resources Act. 1983. (Act No. 43 of 1983).
3. Davies, B, and Day J. 1998. Vanishing Waters. University of Cape Town Press.
4. Department of Water Affairs and Forestry – DWAF. 2005. A practical field procedure for identification and delineation of wetland and riparian areas Edition 1. Department of Water Affairs and Forestry, Pretoria.
5. Department of Water Affairs and Forestry – DWAF. 2008. Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.
6. Driver A, Sink, K.J, Nel, J.N, Holness, S, Van Niekerk, L, Daniels, F, Jonas, Z, Majiedt, P.A, Harris, L. and Maze, K. 2012. National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
7. Du Preez, L. And Carruthers, V. 2009. A Complete Guide to Frogs of Southern Africa. Struik Nature, Cape Town
8. Ewart-Smith J.L, Ollis D.J, Day J.A, and Malan H.L. 2006. National Wetland Inventory: Development of a Wetland Classification System for South Africa. WRC Report No. KV 174/06. Water Research Commission, Pretoria.
9. IUCN. 2019. Red List of Threatened Species. IUCN Species Survival Commission, Cambridge Available: http://www.iucnredlist.org/
10. Kleynhans C.J, Thirion C, and Moolman J. 2005. A Level 1 Ecoregion Classification System for South Africa, Lesotho, and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria.
11. Kotze D.C, Marneweck G.C, Batchelor A.L, Lindley D.S, and Collins N. 2008. WET-EcoServices A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report No: TT 339/08.
12. Macfarlane, D.M. and Bredin, I.P. 2017. Buffer Zone Guidelines for Rivers, Wetlands and Estuaries Buffer Zone Guidelines for Rivers, Wetlands and Estuaries. WRC Report No TT 715/1/17 Water Research Commission, Pretoria.
13. Minerals and Petroleum Resources Development Act. 2002. (Act No. 28 of 2002), as amended.
14. Mitsch, J.G. and Gosselink, G. 2000. Wetland's 3rd End, Wiley, NewYork, 2000, 920 pg.
15. Mucina, L, and Rutherford, M.C. 2006. The Vegetation of South Africa, Lesotho and Swaziland, Strelitzia 19, South Africa.
16. National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.
17. National Water Act, 1998 (Act No. 36 of 1998), as amended
18. Nel, J, Maree, G, Roux, D, Moolman, J, Kleynhans, N, Silberbauer, M. and Driver, A. 2004. South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 2: River Component. CSIR Report Number ENV-S-I-2004-063. Council for Scientific and Industrial Research, Stellenbosch.
19. Nel, J.L, Murray, K.M, Maherry, A.M, Petersen, C.P, Roux, D.J, Driver, A, Hill, L, Van Deventer, H, Funke, N, Swartz, E.R, Smith-Adao, L.B, Mbona, N, Downsborough, L. and Nienaber, S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.
20. Ollis, D.J, Snaddon, C.D, Job, N.M. and Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.

21. Parsons R. 2004. Surface Water – Groundwater Interaction in a Southern African Context. WRC Report TT 218/03, Pretoria.
22. Ramsar Convention, (1971) including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000).
23. Rowntree, K, Wadesone, R. and O'Keeffe, J. 2000. The development of a geomorphological classification system for the longitudinal zonation of South African rivers. South African Geographical Journal 82(3): 163-172.
24. South African Bird Atlasing Project 2 (SABAP2). 2017. Animal Demographic Unit. Available online: http://sabap2.adu.org.za/
25. Stuart, C and Stuart, T. 2007. A field guide to the mammals of Southern Africa. Struik Nature, Cape Town.
26. van Deventer H, Smith-Adao, L. Petersen C, Mbona N, Skowno A, Nel, J.L. 2018. Review of available data for a South African Inventory of Inland Aquatic Ecosystems (SAIIAE). Water SA 44 (2) 184-199.

Visual

Lawson, Q. and Oberholzer, B. 2022. Visual Impact Assessment: Southern Cluster: Hoogland 3 and Hoogland 4 Wind Farms.

1. SLR. 2021. Proposed Hoogland Wind Farms and Grid Connection: Terms of Reference for Specialist Studies.
2. Mucina, L. and Rutherford, M.C. (eds) 2006. The Vegetation of South Africa, Lesotho, and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria.
3. Oberholzer, B. 2005. Guideline for Involving Visual and Aesthetic Specialists in EIA Processes. Edition 1. Provincial Government of the Western Cape.

Heritage

ASHA Consulting. 2022. Heritage Impact Assessment: Proposed Hoogland 3 Wind Farm and Hoogland 4 Wind Farm, Beaufort West Magisterial District, Western Cape.

1. Almond, J.E. 2021.: Proposed Hoogland Wind Farms and Grid Connection Project: Southern Cluster: Hoogland 3 Wind Farm, Hoogland 4 Wind Farm, and associated Hoogland Southern Grid Connection. Palaeontological Heritage. Report for Red Cap Energy (Pty) Ltd. Cape Town: Natura Viva cc.
2. Anonymous. 2016. Embark on a historic journey to the Karoo National Park. Website visited on 24 April 2019 at: https://lowvelder.co.za/352763/embark-on-a-historic-journey-to-the-karoo-national-park/.
3. Battiss, W.W. 1948. The artists of the rocks. Pretoria: Red Fawn Press
4. Böeseken, A.J. 1975. The Company and its subjects. In: Muller, C.F.J. (ed) 500 Years: a history of South Africa: 63-79. Pretoria and Cape Town: Academica.
5. Botha, C.G. 1926. Place names in the Cape Province. Cape Town and Johannesburg: Juta and Co. Ltd.
6. Bulpin, T.V. 2001. Discovering Southern Africa. Muizenberg: Discovering Southern Africa Productions cc.
7. Department of Environment, Forestry and Fisheries (DEFF). 2021. Identification of geographical areas of strategic importance for the development of large-scale wind and solar photovoltaic energy facilities. Government Gazette 144: 72-74.
8. Department of Environmental Affairs (DEA). 2016. Strategic Environmental Assessment for Electricity Grid Infrastructure in South Africa. CSIR Report Number: CSIR/02100/EMS/ER/2016/0006/B. Stellenbosch.
9. Fagan, G. 2008. Brakdak: flatroofs in the Karoo. Cape Town: Breestraat Publikasies.
10. Fock, G.J. 1979. Felsbilder in Sudafrika, Teil 1: Die Gravierungen auf Klipfontein, Kapprovinz. Köln: Böhlau Verlag.

11. Frandsen, D. 2018. History. Accessed online at https://www.karoo-southafrica.com/koup/beaufort-west/history-of-beaufort-west/ on 11 July 2018.
12. Fransen, H. 2004. The old buildings of the Cape. Johannnesburg and Cape Town: Jonathan Ball Publishers.
13. Goetze, T.M. 1993. Thomas Bain, Road Building, and the Zwartberg Pass: with particular emphasis on socio-economic and civil engineering aspects in the Southern Cape, c. 1843-1962. Unpublished Masters Dissertation, University of Stellenbosch.
14. Halkett, D. and Webley, L. 2011. Heritage Impact Assessment: proposed Victoria West Mini Renewable Energy Facility on the farm Bultfontein 217, Northern Cape Province. St James: ACO Associates cc.
15. Hart, T. 2015. Heritage Impact Assessment for the proposed Komsberg East and West Wind Energy Facilities and grid connections to be situated in the Western Cape Province, Escarpment Area, moordenaars Karoo. Unpublished report prepared for Arcus Consulting (Pty) Ltd. Diep River: ACO Associates cc.
16. Hart, T. 2016. Heritage Impact Assessment for the proposed Umsinde Emoyeni Wind Energy Facility. Unpublished report prepared for Arcus Consulting (Pty) Ltd. Diep River: ACO Associates cc.
17. Heritage Western Cape. 2016. Grading: purpose and management implications. Document produced by Heritage Western Cape, 16 March 2016.
18. Kaplan, J. 2005. Archaeological and Heritage scoping proposed upgrading and construction of new roads Karoo National Park. Unpublished report prepared for Ecobound Environmental. Riebeek West: Agency for Cultural Resource Management.
19. Kaplan, J. 2006 Phase 1 Archaeological Impact Assessment proposed Klavervlei powerline Karoo National Park. Unpublished report prepared for Enviroafrica. Riebeek West: Agency for Cultural Resource Management.
20. Kramer, P. 2012. The history, form, and context of the 19th century corbelled buildings of the Karoo. MPhil dissertation. Rondebosch: University of Cape Town.
21. Lawson, Q. and Oberholzer, B. 2021. Proposed Hoogland Wind Farms and Grid Connection Project. Southern Cluster: Hoogland 3 and Hoogland 4 Wind Farms. Visual Impact Assessment. Report for Red Cap Energy (Pty) Ltd. Hout Bay and Stanford: Quinton Oberholzer and Bernard Oberholzer.
22. Marincowitz, H. 2006. Karoostyle: Folk architecture of Prince Albert and its environs. Prince Albert: Fransie Pienaar Museum.
23. Morris, D. 1988. Engraved in Place and Time: A Review of Variability in the Rock Art of the Northern Cape and Karoo. South African Archaeological Bulletin 43: 109-120.
24. Muller, C.F.J. 1975. The period of the Great Trek, 1834 – 1854. In: Muller, C.F.J. (ed) 500 Years: a history of South Africa: 146-182. Pretoria and Cape Town: Academica.
25. Orton, J. 2010. Heritage assessment of the proposed upgrade to the N1 between Beaufort West and Three Sisters, Beaufort West, and Victoria West Magisterial Districts, Western and Northern Cape. Unpublished report prepared for CCA Environmental (Pty) Ltd. Archaeology Contracts Office: University of Cape Town.
26. Orton, J. 2013. Geometric rock art in western South Africa and its implications for the spread of early herding. South African Archaeological Bulletin 68: 27-40.
27. Orton, J. 2016. Prehistoric cultural landscapes in South Africa: a typology and discussion. South African Archaeological Bulletin 71: 119-129.
28. Orton, J. 2017. Heritage Impact Assessment: proposed construction of a substation and 132 kV distribution line to support the proposed Sutherland WEF, Sutherland, and Laingsburg Magisterial Districts, Northern and Western Cape. Unpublished report prepared for CSIR. Lakeside: ASHA Consulting (Pty) Ltd.
29. Orton, J. 2021a. Heritage Impact Assessment: proposed 132 kV/400 kV Power Line, Beaufort West Magisterial District, Western Cape. Report prepared for Red Cap Nuweveld North (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.
30. Orton, J. 2021b. Heritage Impact Assessment: proposed Nuweveld East Wind Farm, Beaufort West Magisterial District, Western Cape. Report prepared for Red Cap Nuweveld East (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.

31. Orton, J. 2021c. Heritage Impact Assessment: proposed Nuweveld North Wind Farm, Beaufort West Magisterial District, Western Cape. Report prepared for Red Cap Nuweveld North (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.
32. Orton, J. 2021d. Heritage Impact Assessment: proposed Nuweveld West Wind Farm, Beaufort West Magisterial District, Western Cape. Report prepared for Red Cap Nuweveld West (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.
33. Orton, J, Almond, J, Clarke, N, Fisher, R, Hall, S, Kramer, P, Malan, A, Maguire, J. and Jansen, L. 2016. Impacts on Heritage. In Scholes, R, Lochner, P, Schreiner, G, Snyman- Van der Walt, L. and de Jager, M. (eds.). 2016. Shale Gas Development in the Central Karoo: A Scientific Assessment of the Opportunities and Risks. CSIR/IU/021MH/EXP/2016/003/A, ISBN 978-0-7988-5631-7, Pretoria: CSIR.
34. Parkington, J, Morris, D and Rusch, N. 2008. Karoo Rock Engravings. Cape Town: Creda Communications.
35. Penn, N. 2005. The Forgotten Frontier: Colonist and Khoisan on the Cape's Northern Frontier in the 18th Century. Athens: Ohio University Press and Cape Town: Double Storey Books.
36. PGWC. 2006. Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape: towards a regional methodology for wind energy site selection. Cape Town: Provincial Government of the Western Cape and CNdV africa planning and design.
37. Ross, G.L.D. 2013. Mountain passes, roads, and transportation in the Cape: a guide to research. 5th Edition. Accessed online on 25th April 2019 at: https://www.researchgate.net/publication/258376061_Mountain_Passes_Roads_and_Transportation_in_the_Cape_-_a_Guide_to_Research_Fifth_edition_June_2013_767_pages.
38. Sampson, C.G. 2010. Chronology and dynamics of Later Stone Age herders in the upper Seacow River valley, South Africa. Journal of Arid Environments 74:842-848.
39. SANParks. 2017. Karoo National Park: Park Management Plan for the period 2017-2027. Website visited on 24 April 2019 at: https://www.sanparks.org/assets/docs/conservation/park_man/karoo-draft-plan.pdf.
40. Sauer, C.O. 1925. The Morphology of Landscape. University of California Publications on Geography 2(2): 19-54.
41. Schoeman, C. 2013. The Historical Karoo: traces of the past in South Africa's arid interior. Cape Town: Zebra Press.
42. Smith, B.W. and Ouzman, S. 2004. Taking stock: identifying Khoekhoen herder rock art in southern Africa. Current Anthropology 45: 499–526.
43. Storrar, P. 1984. A Colossus of Roads. Murray and Roberts/Concor.
44. Van der Walt, J. 2016. Archaeological Impact Assessment report for the proposed Gunstfontein Wind Energy Facility, Northern Cape. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Modimolle: HCAC.
45. Van Zyl, M.C. 1975. Transition, 1795-1806. In: Muller, C.F.J. (ed) 500 Years: a history of South Africa: 101-116. Pretoria and Cape Town: Academica.
46. Walker, E.A. 1928. A History of South Africa. London: Longmans, Green and Company Ltd.
47. Watt, S. 2013. Uitspanfontein, De Pannen 5 February 1902. Military History Journal 16(2). Accessed online at: http://samilitaryhistory.org/vol162sw.html on 25th April 2019.
48. Webley, L. and Hart, T. 2010. Scoping Archaeological Impact Assessment: proposed prospecting on Taaiboschfontein 137 (Site 49), Victoria West, Northern Cape. Unpublished report prepared for Tasman Pacific Minerals Limited. University of Cape Town: Archaeology Contracts Office.
49. Winter, S. and Oberholzer, B. 2013. Heritage and Scenic Resources: Inventory and Policy Framework for the Western Cape. Report prepared for the Provincial Government of the Western Cape Department of Environmental Affairs and Development Planning. Sarah Winter Heritage Planner, and Bernard Oberholzer Landscape Architect / Environmental Planner, in association with Setplan.

Palaeontology

Almond, J.E. 2022.: Proposed Hoogland Wind Farms and Grid Connection Project: Southern Cluster: Hoogland 3 Wind Farm, Hoogland 4 Wind Farm, and associated Hoogland Southern Grid Connection. Palaeontological Heritage. Report for Red Cap Energy (Pty) Ltd. Cape Town: Natura Viva cc

1. Almond, J.E. and Pether, J. 2008. Palaeontological Heritage of The Western Cape. Interim Sahra Technical Report, 20 Pp. Natura Viva Cc, Cape Town.
2. Almond, J.E. 2020a. Proposed Redcap Nuweveld North Wind Farm, Beaufort West Local Municipality, Central Karoo District Municipality, Western Cape. Palaeontological Heritage Assessment: Desktop and Field-Based Report, 116 Pp. Natura Viva Cc, Cape Town.
3. Almond, J.E. 2020b. Proposed Redcap Nuweveld West Wind Farm, Beaufort West Local Municipality, Central Karoo District Municipality, Western Cape. Palaeontological Heritage Assessment: Desktop and Field-Based Report, 116 Pp. Natura Viva Cc, Cape Town.
4. Almond, J.E. 2020c. Proposed Redcap Nuweveld East Wind Farm, Beaufort West Local Municipality, Central Karoo District Municipality, Western Cape. Palaeontological Heritage Assessment: Desktop and Field-Based Report, 115 Pp. Natura Viva Cc, Cape Town.
5. Almond, J.E. 2021. Grid Connection for The Proposed Redcap Nuweveld Wind Farms, Beaufort West Local Municipality, Central Karoo District Municipality, Western Cape. Palaeontological Heritage Assessment: Desktop and Field-Based Report, 101 Pp. Natura Viva Cc, Cape Town.
6. Anderson, J.M. and Anderson, H.M. 1985. Palaeoflora Of Southern Africa. Prodromus Of South African Megafloras, Devonian to Lower Cretaceous, 423 Pp. Botanical Research Institute, Pretoria and Balkema, Rotterdam.
7. Bamford, M. 1999. Permo-Triassic Fossil Woods from The South African Karoo Basin. Palaeontologia Africana 35, 25-40.
8. Bender, P.A. 2004. Late Permian Actinopterygian (Palaeoniscid) Fishes from The Beaufort Group, South Africa: Biostratigraphic and Biogeographic Implications. Council For Geoscience Bulletin 135, 84 Pp.
9. Bender, P.A, and Brink, J.S. 1992. A Preliminary Report on New Large Mammal Fossil Finds from The Cornelia-Uitzoek Site. South African Journal of Science 88: 512-515.
10. Blackwell, L, Steininger, C, Neveling, J. Abdala, F, Pereira, L, Mayer, E, Rossouw, L, De La Peña P. and Brink, J. 2017. Holocene Large Mammal Mass Death Assemblage from South Africa. Quaternary International Xxx (2017), P1-15.
11. Bousman, C.B. Et Al. 1988. Palaeoenvironmental Implications of Late Pleistocene and Holocene Valley Fills in Blydefontein Basin, Noupoort, C.P, South Africa. Palaeoecology Of Africa 19: 43-67.
12. Brink, J.S. and Rossouw, L. 2000. New Trial Excavations at The Cornelia-Uitzoek Type Locality. Navorsinge Van Die Nasionale Museum Bloemfontein 16, 141-156.
13. Churchill, S.E. Et Al. 2000. Erfkroon: A New Florisian Fossil Locality from Fluvial Contexts in The Western Free State, South Africa. South African Journal of Science 96: 161-163.
14. Cluver, M.A. and King, G.M. A Reassessment of The Relationships of Permian Dicynodontia (Reptilia, Therapsida) And A New Classification of Dicynodonts. Annals Of the South African Museum 91, 195-273.
15. Cole, D. and Smith, R. 2008. Fluvial Architecture of The Late Permian Beaufort Group Deposits, S.W. Karoo Basin: Point Bars, Crevasse Splays, Palaeosols, Vertebrate Fossils and Uranium. Field Excursion Ft02 Guidebook, Aapg International Conference, Cape Town October 2008, 110 Pp.
16. Cole, D.I, Johnson, M.R. and Day, M.O. 2016. Lithostratigraphy Of the Abrahamskraal Formation (Karoo Supergroup), South Africa. South African Journal of Geology 119.2, 415-424.
17. Cole, D.I, Neveling, J, Hattingh, J, Chevallier, L.P, Reddering, J.S.V. and Bender, P.A. 2004. The Geology of The Middelburg Area. Explanation To 1: 250 000 Geology Sheet 3124 Middelburg, 44 Pp. Council for Geoscience, Pretoria.
18. Day 2013a. Middle Permian Continental Biodiversity Changes as Reflected in The Beaufort Group of South Africa: A Bio- And Lithostratigraphic Review of The Eodicynodon, Tapinocephalus and Pristerognathus Assemblage Zones. Unpublished Phd Thesis, University of The Watwatersrand, Johannesburg, 387 Pp Plus Appendices.

19. Day, M. and Rubidge, B. 2010. Middle Permian Continental Biodiversity Changes as Reflected in The Beaufort Group of South Africa: An Initial Review of The Tapinocephalus and Pristerognathus Assemblage Zones. Proceedings Of The 16th Conference of The Palaeontological Society of Southern Africa, Howick, August 5-8, 2010, Pp. 22-23.
20. Day, M. 2013b. Charting the Fossils of The Great Karoo: A History of Tetrapod Biostratigraphy in The Lower Beaufort Group, South Africa. Palaeontologia Africana 48, 41-47.
21. Day, M.O. and Rubidge, B.S. 2020. Biostratigraphy Of the Tapinocephalus Assemblage Zone (Beaufort Group, Karoo Supergroup), South Africa. South African Journal of Geology 123, 149 - 164.
22. Day, M.O. and Rubidge, B.S. 2021. The Late Capitanian Mass Extinction of Terrestrial Vertebrates in The Karoo Basin of South Africa. Frontiers In Earth Science 9, Article 631198, 15 Pp.
23. Day, M.O. and Smith, R.M.S. 2020. Biostratigraphy Of the Endothiodon Assemblage Zone (Beaufort Group, Karoo Supergroup), South Africa. South African Journal of Geology 123, 164 - 180.
24. Day, M.O, Guven, S, Abdala, F, Jirah, S, Rubidge, B.S. And Almond, J. 2015. Youngest Dinocephalian Fossils Extend the Tapinocephalus Zone, Karoo Basin, South Africa. South African Journal of Science 111, 78-82.
25. Day, M.O, Ramezani, J, Bowring, S.A, Sadler, P.M, Erwin, D.H, Abdala, F. and Rubidge, B.S. 2015b. When And How Did the Terrestrial Mid-Permian Mass Extinction Occur? Evidence From the Tetrapod Record of The Karoo Basin, South Africa. Proc. R. Soc. B 282: 20150834. Http://Dx.Doi.Org/10.1098/Rspb.2015.0834
26. De Ruiter, D.J, Brophy, J.K, Lewis, P.J, Kennedy, A.M, Stidham, T.A, Carlson, K.B. and Hancox, P.J. 2010. Preliminary Investigation of Matjhabeng, A Pliocene Fossil Locality in The Free State of South Africa. Palaeontologia Africana 45, 11-22.
27. Duncan and Marsh 2006. The Karoo Igneous Province. In: Johnson, M.R, Anhaeusser, C.R. and Thomas, R.J. (Eds.) The Geology of South Africa, Pp. 501-520. Geological Society of South Africa, Marshalltown.
28. Heritage Western Cape 2021. Guide For Minimum Standards for Archaeology and Palaeontology Reports Submitted to Heritage Western Cape - June 2021, 6 Pp.
29. Johnson, M.R. and Keyser, A.W. 1979. The Geology of The Beaufort West Area. Explanation Of Geological Sheet 3222, 14 Pp. Council for Geoscience, Pretoria.
30. Johnson, M.R, Van Vuuren, C.J, Visser, J.N.J, Cole, D.I, Wickens, H. De V, Christie, A.D.M, Roberts, D.L. and Brandl, G. 2006. Sedimentary Rocks of The Karoo Supergroup. In: Johnson. M.R, Anhaeusser, C.R. and Thomas, R.J. (Eds.) The Geology of South Africa, Pp. 461-499. Geological Society of South Africa, Johannesburg and The Council for Geoscience, Pretoria.
31. Keyser, A. W. 1966. Some Indications of Arid Climate During the Deposition of The Beaufort Series. Annals Of the Geological Survey of South Africa 5,77–79.
32. Keyser, A.W. and Smith, R.M.H. 1977-78. Vertebrate Biozonation of The Beaufort Group with Special Reference to The Western Karoo Basin. Annals Of the Geological Survey of South Africa 12: 1-36.
33. Kitching, J.W. 1977. The Distribution of The Karroo Vertebrate Fauna, With Special Reference to Certain Genera and The Bearing of This Distribution on The Zoning Of The Beaufort Beds. Memoirs Of the Bernard Price Institute for Palaeontological Research, University of The Witwatersrand, No. 1, 133 Pp (Incl. 15 Pls).
34. Klein, R.G. 1984. The Large Mammals of Southern Africa: Late Pliocene to Recent. In: Klein, R.G. (Ed.) Southern African Prehistory and Paleoenvironments, Pp 107-146. Balkema, Rotterdam.
35. Le Roux, F.G. and Keyser, A.W. 1988. Die Geologie Van Die Gebied Victoria-Wes. Explanation To 1: 250 000 Geology Sheet 3122 Victoria West, 31 Pp. Council for Geoscience, Pretoria.
36. Macrae, C. 1999. Life Etched in Stone. Fossils Of South Africa, 305 Pp. The Geological Society of South Africa, Johannesburg.
37. Mccarthy, T. and Rubidge, B. 2005. The Story of Earth and Life: A Southern African Perspective on A 4.6-Billion-Year Journey. 334pp. Struik, Cape Town.
38. Mckay, M.P, Weislogel, A.L, Fildani, A, Brunt, R.L, Hodgson, D.M. and Flint, S.S. 2015.U-Pb Zircon Tuff Geochronology from The Karoo Basin, South Africa: Implications of Zircon Recycling on Stratigraphic Age Controls. International Geology Review, 57, 393-410. Doi: 10.1080/00206814.2015.1008592
39. Nicolas, M.V. 2007. Tetrapod Diversity Through the Permo-Triassic Beaufort Group (Karoo Supergroup) Of South Africa. Unpublished Phd Thesis, University of Witwatersrand, Johannesburg.

40. Partridge, T.C. and Maud, R.R. 1987. Geomorphic Evolution of Southern Africa Since the Mesozoic. South African Journal of Geology 90: 179-208.
41. Partridge, T.C. and Scott, L. 2000. Lakes and Pans. In: Partridge, T.C. and Maud, R.R. (Eds.) The Cenozoic of Southern Africa, Pp.145-161. Oxford University Press, Oxford.
42. Partridge, T.C, Botha, G.A. and Haddon, I.G. 2006. Cenozoic Deposits of The Interior. In: Johnson, M.R, Anhaeusser, C.R. and Thomas, R.J. (Eds.) The Geology of South Africa, Pp. 585-604. Geological Society of South Africa, Marshalltown.
43. Retallack, G.J, Metzger, C.A, Greaver, T, Hope Jahren, A, Smith, R.M.H. and Sheldon, N.D. 2006. Middle – Late Permian Mass Extinction on Land. Gsa Bulletin 118, 1398-1411.
44. Rossouw, L. 2006. Florisian Mammal Fossils from Erosional Gullies Along the Modder River at Mitasrust Farm, Central Free State, South Africa. Navorsinge Van Die Nasionale Museum Bloemfontein 22, 145-162.
45. Rubidge, B.S. 2005. Re-Uniting Lost Continents – Fossil Reptiles from The Ancient Karoo and Their Wanderlust. 27th Du Toit Memorial Lecture. South African Journal of Geology 108, 135-172.
46. Rubidge, B.S. (Ed.) 1995. Biostratigraphy Of the Beaufort Group (Karoo Supergroup). South African Committee for Biostratigraphy, Biostratigraphic Series No. 1, 46 Pp. Council for Geoscience, Pretoria.
47. Sahra 2013. Minimum Standards: Palaeontological Component of Heritage Impact Assessment Reports, 15 Pp. South African Heritage Resources Agency, Cape Town.
48. Skead, C.J. 1980. Historical Mammal Incidence in The Cape Province. Volume 1: The Western and Northern Cape, 903pp. Department of Nature and Environmental Conservation, Cape Town.
49. Smith, R, Rubidge, B. and Van Der Walt, M. 2012. Therapsid Biodiversity Patterns and Paleoenvironments of The Karoo Basin, South Africa. Chapter 2 Pp. 30-62 In Chinsamy-Turan, A. (Ed.) Forerunners of Mammals. Radiation, Histology, Biology. Xv + 330 Pp. Indiana University Press, Bloomington, and Indianapolis.
50. Smith, R.M.H, Hancox, P.J, Rubidge, B.S, Turner, B.R. and Catuneanu, O. 2002. Mesozoic Ecosystems of The Main Karoo Basin: From Humid Braid Plains to Arid Sand Sea. International Symposium on Mesozoic Terrestrial Ecosystems, Cape Town, South Africa. Post-Conference Field Excursion Guidebook, 116 Pp.
51. Smith, R.M.H. 1979. The Sedimentology and Taphonomy of Flood-Plain Deposits of The Lower Beaufort (Adelaide Subgroup) Strata Near Beaufort West, Cape Province. Annals Of the Geological Survey of South Africa 12, 37-68.
52. Smith, R.M.H. 1980. The Lithology, Sedimentology and Taphonomy of Flood-Plain Deposits of The Lower Beaufort (Adelaide Subgroup) Strata Near Beaufort West. Transactions Of the Geological Society of South Africa 83, 399-413.
53. Smith, R.M.H. 1986. Trace Fossils of The Ancient Karoo. Sagittarius 1 (3), 4-9.
54. Smith, R.M.H. 1987. Helical Burrow Casts of Therapsid Origin from The Beaufort Group (Permian) Of South Africa. Palaeogeography, Palaeoclimatology, Palaeoecology 60, 155-170.
55. Smith, R.M.H. 1987a. Morphological and Depositional History of Exhumed Permian Point Bars in The Southwestern Karoo, South Africa. Journal Of Sedimentary Petrology 57, 19-29.
56. Smith, R.M.H. 1987b. Helical Burrow Casts of Therapsid Origin from The Beaufort Group (Permian) Of South Africa. Palaeogeography, Palaeoclimatology, Palaeoecology 60, 155-170.
57. Smith, R.M.H. 1988. Fossils for Africa. An Introduction to The Fossil Wealth of The Nuweveld Mountains Near Beaufort West. Sagittarius 3, 4-9. Sa Museum, Cape Town.
58. Smith, R.M.H. 1990. Alluvial Paleosols and Pedofacies Sequences in The Permian Lower Beaufort of The Southwestern Karoo Basin, South Africa. Journal Of Sedimentary Petrology 60, 258-276.
59. Smith, R.M.H. 1993b. Vertebrate Taphonomy of Late Permian Floodplain Deposits in The Southwestern Karoo Basin of South Africa. Palaios 8, 45-67.
60. Smith, R.M.H. and Almond, J.E. 1998. Late Permian Continental Trace Assemblages from The Lower Beaufort Group (Karoo Supergroup), South Africa. Abstracts, Tercera Reunión Argentina De Icnologia, Mar Del Plata, 1998, P. 29.
61. Smith, R.M.H. and Keyser, A.W. 1995a. Biostratigraphy of The Pristerognathus Assemblage Zone. Pp. 13-17 In Rubidge, B.S. (Ed.) Biostratigraphy of The Beaufort Group (Karoo Supergroup). South African Committee for Stratigraphy, Biostratigraphic Series No. 1. Council For Geoscience, Pretoria.

62. Smith, R.M.H. and Keyser, A.W. 1995b. Biostratigraphy of the Tropidostoma Assemblage Zone. Pp. 18-22 In Rubidge, B.S. (Ed.) Biostratigraphy of The Beaufort Group (Karoo Supergroup). South African Committee for Stratigraphy, Biostratigraphic Series No. 1. Council For Geoscience, Pretoria.
63. Smith, R.M.H. 1981. Sedimentology And Taphonomy of The Lower Beaufort Strata Near Beaufort West, Cape Province. Unpublished Msc Thesis, University of Witwatersrand, Johannesbyrg, 126 Pp.
64. Smith, R.M.H. 1989a. Fossils in the Karoo – Some Important Questions Answered. Custos 17, 48-51.
65. Smith, R.M.H. 1989b. Fluvial Facies, Vertebrate Taphonomy and Palaeosols of The Teekloof Formation (Permian) Near Beaufort West, Cape Province, South Africa. Unpublished Ph.D. Dissertation, University of Cape Town, 230 Pp.
66. Smith, R.M.H. 1993a. Sedimentology and Ichnology of Floodplain Paleosurfaces in The Beaufort Group (Late Permian), Karoo Sequence, South Africa. Palaios 8, 339-357.
67. Smith, R.M.H, Rubidge, B.S, Day, M.O. and Botha, J. 2020. Introduction To the Tetrapod Biozonation of The Karoo Supergroup. South African Journal of Geology 123, 131-140.
68. Stear, W.M. 1978. Sedimentary Structures Related to Fluctuating Hydrodynamic Conditions in Flood Plain Deposits of The Beaufort Group Near Beaufort West, Cape. Transactions Of the Geological Society of South Africa 81, 393-399.
69. Stear, W.M. 1980. Channel Sandstone and Bar Morphology of The Beaufort Group Uranium District Near Beaufort West. Transactions Of the Geological Society of South Africa 83: 391-398.
70. Van Der Walt, J. 2019. Phase 2 Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy Development in South Africa. Appendix A3. Heritage Scoping Assessment Report, 65 Pp. Csir.
71. Van Der Walt, M, Day, M, Rubidge, B, Cooper, A.K. and Netterberg, I. 2010. A New Gis-Based Biozone Map of The Beaufort Group (Karoo Supergroup), South Africa. Palaeontologia Africana 45, 1-5.
72. Watkeys, M.K. 1999. Soils of The Arid South-Western Zone of Africa. In: Dean, W.R.J. and Milton, S.J. (Eds.) The Karoo: Ecological Patterns and Processes, 374 Pp. Cambridge University Press.
73. Wilson, A, Flint, S, Payenberg, T, Tohver, E. and Lanci, L. 2014. Architectural Styles and Sedimentology of The Fluvial Lower Beaufort Group, Karoo Basin, South Africa. Journal Of Sedimentary Research 84, 326-348.

Noise

Enviro Acoustic Research. 2022. Environmental Noise Impact Assessment for the proposed Hoogland 3 and Hoogland 4 Wind Farms and Associated Infrastructure Near Loxton, Western Cape Province.

1. Acciona Windpower. 2017. "*General Document – Sound Power Levels AW132/3300*". Document DG200725, Revision A, dated 05/07/2017
2. Acoustics Bulletin. 2009. *Prediction and assessment of wind turbine noise*
3. Acoustics, 2008. *A review of the use of different noise prediction models for wind farms and the effects of meteorology*
4. Ambrose, S.E. and Rand, R.W. 2011. *The Bruce McPherson Infrasound and Low Frequency Noise Study. Adverse health effects produced by large industrial wind turbines confirmed*. Rand Acoustics, December 14, 2011.
5. Atkinson-Palombo, C and Hoen, B. 2014. *Relationship between Wind Turbines and Residential Property Values in Massachusetts – A Joint Report of University of Connecticut and Lawrence Berkley National Laboratory.* Boston, Massachusetts
6. Audiology Today. 2010. *Wind-Turbine Noise – What Audiologists should know*
7. Autumn, Lyn Radle. 2007. *The effect of noise on Wildlife. A literature review*
8. Barber, J.R, K.R. Crooks, and K. Fristrup. 2010. *The costs of chronic noise exposure for terrestrial organisms*. Trends Ecology and Evolution 25(3). 180–189
9. Bass JH, Bullmore AJ, Sloth E. 1996. *Development of a wind farm noise propagation prediction model.* Contract JOR3-CT95-0051. Renewable Energy Systems Limits, Hoare Lea and Partners Acoustics, Acoustica A/S

10. BAYNE, E, HABIB, L. and BOUTIN, S. 2008. *Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest*. *Conservation Biology*, 22(5), pp.1186-1193.
11. Bolin K, Nilsson M, Shafiquzzaman K. 2010. *The potential of natural sounds to mask wind turbine noise*. Acta Acust Acust 2010;96.131–7.
12. Bolin, K. 2009. *Prediction method for wind-induced vegetation noise*. Acta Acust Acust 2009;95.607–19.
13. Bolin, K, Bluhm, G, Eriksson, G. and Nilsson, M. 2011. *Infrasound and low frequency noise from wind turbines. exposure and health effects*. *Environmental Research Letters*, 6(3), p.035103.
14. Bowdler, Dick. 2008. *Amplitude modulation of wind turbine noise. a review of the evidence*
15. Bray, W and James, R. 2011. *Dynamic measurements of wind turbine acoustic signals, employing sound quality engineering methods considering the time and frequency sensitivities of human perception*. Noise-Con 2011.
16. Broucek, J. 2014. *Effect of Noise on Performance, Stress and Behaviour of Animals.* Slovak J. Anim. Sci, 47, 2014 (2). 111-123
17. BWEA. 2005*. Low Frequency Noise and Wind Turbines – Technical Annex*
18. Chapman, S, St. George, A, Waller, K, Cakic, V. 2013. *Spatio-temporal differences in the history of health and noise complaints about Australian wind farms. evidence for the psychogenic, "communicated disease" hypothesis*. Sydney School of Public Health, University of Sydney
19. Chief Medical Officer of Health. 2010. *The Potential Health Impact of Wind Turbines*, Canada
20. Cooper. 2012. *Are Wind Farms too close to communities*, The Acoustic Group (date posted on Wind-watch.org. Referenced on various anti-wind energy websites)
21. Crichton, F, Dodd, G, Schmid, G, Gamble, G. and Petrie, K. 2014. Can expectations produce symptoms from infrasound associated with wind turbines?. *Health Psychology*, 33(4), pp.360-364.
22. CSIR. 2002. *Integrated Environmental Management Information Series. Information Series 5. Impact Assessment*. Issued by the Department of Environmental Affairs and Tourism, Pretoria
23. CSIR. 2015. *The Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa.* Issued by the Department of Environmental Affairs and Tourism, Pretoria
24. Cummings, J. 2009. *AEI Special Report. Wind Energy Noise Impacts*. Acoustic Ecology Institute, (online resource. **http.//acousticecology.org/srwind.html**)
25. Cummings, J. 2012. *Wind Farm Noise and Health. Lay summary of new research released in 2011*. Acoustic Ecology Institute, April 2012 (online resource. **http.//www.acousticecology.org/wind/winddocs/AEI_WindFarmsHealthResearch2011.pdf**)
26. DEFRA, 2003. *A Review of Published Research on Low Frequency Noise and its Effects*, Report for Defra by Dr Geoff Leventhall Assisted by Dr Peter Pelmear and Dr Stephen Benton
27. DEFRA, 2007. *Research into Aerodynamic Modulation of Wind Turbine Noise. Final Report*
28. DELTA, 2008. *EFP-06 project. Low Frequency Noise from Large Wind Turbines, a procedure for evaluation of the audibility for low frequency sound and a literature study*. Danish Energy Authority
29. Derryberry EP *et al.* 2016. *Patterns of song across Natural and Anthropogenic Soundscapes suggest that White-Crowned Sparrows minimize acoustic masking and maximize signal content*. PLOS ONE| DOI. 10.1371/journal.pone.0154456, April 29, 2016
30. Dooling R. J, and A. N. Popper. 2007. *The effects of highway noise on birds*. Report to the California Department of Transportation, contract 43AO139. California Department of Transportation, Division of Environmental Analysis, Sacramento, California, USA
31. Dooling, R. 2002. *Avian Hearing and the Avoidance of Wind Turbines*. National Renewable Energy Laboratory, NREL/TP-500-30844
32. Duncan, E. and Kaliski, K. 2008. *Propagation Modelling Parameters for Wind Power Projects*
33. Enertrag. 2008. *Noise and Vibration*. Hempnall Wind Farm (http.//www.enertraguk.com/technical/noise-and-vibration.html)
34. ETSU R97. 1996. '*The Assessment and Rating of Noise from Wind Farms. Working Group on Noise from Wind Turbines*'
35. Evans Tom, Cooper Jonathan. 2012. *Comparison of predicted and measured wind farm noise levels and implications for assessments of new wind farms*. Acoustics Australia, Vol. 40, No. 1, April 2012.

36. Evans, T. Cooper, J. Lenchine, V. 2012. *Infrasound Levels near Windfarms and in other Environments. Resonate Acoustics in conjunction with Environment Protection Authority, South Australia*
37. Fégeant, O. 2002. Masking of Wind Turbine Noise. Influence of Wind Turbulence on Ambient Noise Fluctuations.
38. Garrad, H. 2013. *Summary of results of the noise emission measurement, in accordance with IEC 61400-11, of a WTGS of the type N117/3000. Doc.* GLGH-4286 12 10220 258-S-0002-A (extract from GLGH-4286 12 10220 258-A-0002-A)
39. Gibbons, S. 2014. *Gone with the Wind. Valuing the Visual Impacts of Wind turbines through House Prices*, Spatial Economics Research Centre
40. Guillaume Dutilleux. 2012. *Anthropogenic outdoor sound and wildlife. it's not just bioacoustics!*. Soci´et´e Fran¸caise d'Acoustique. Acoustics 2012, Apr 2012, Nantes, France
41. Hanning, 2010. *Wind Turbine Noise, Sleep and Health*. (referenced on a few websites, especially anti-wind energy. No evidence that the study has been published formally.)
42. Havas, M. and Colling, D. 2011. *Wind Turbines Make Waves. Why Some Residents Near Wind Turbines Become Ill*. *Bulletin of Science Technology and Society published online 30 September 2011*
43. Hessler, D. 2011. *Best Practices Guidelines for Assessing Sound Emissions From Proposed Wind Farms and Measuring the Performance of Completed Projects*. Prepared for the Minnesota Public Utilities Commission, under the auspices of the National Association of Regulatory Utility Commissioners (NARUC)
44. HGC Engineering. 2006. *Wind Turbines and Infrasound*, report to the Canadian Wind Energy Association
45. HGC Engineering. 2007. *Wind Turbines and Sound*, report to the Canadian Wind Energy Association
46. HGC Engineering. 2011. *Low frequency noise and infrasound associated with wind turbine generator systems. A literature review*. Ontario Ministry of the Environment RFP No. OSS-078696.
47. IFC. 2007. '*Environmental, Health, and Safety General Guidelines*'. International Finance Corporation, Washington
48. IFC. 2015. '*Environmental, Health, and Safety Guidelines for Wind Energy*'. International Finance Corporation, Washington
49. ISO 9613-2. 1996. '*Acoustics – Attenuation of sound during propagation outdoors – Part 2. General method of calculation*'
50. Jeffery *et al*. 2013. *Adverse health effects of industrial wind turbines*, Can Fam Physician, 2013 May. 59(5). 473-475
51. Journal of Acoustical Society of America, 2009. *Response to noise from modern wind farms in the Netherlands*
52. Kaliski, K. and Duncan, E. 2008. *Propagation modelling Parameters for Wind Power Projects.*
53. Kaliski, K. and Wilson, D.K. 2011. *Improving predictions of wind turbine noise using PE modelling*. Noise-con 2011.
54. Kamperman, G.W and James, R.R. 2008. *The "How to" guide to siting wind turbines to prevent health risks from sound*
55. Knopper, L, Ollson, C, McCallum, L, Whitfield Aslund, M, Berger, R, Souweine, K. and McDaniel, M. 2014. Wind Turbines and Human Health. *Frontiers in Public Health*, 2.
56. Kroesen and Schreckenberg. 2011. *A measurement model for general noise reaction in response to aircraft noise*. J. Acoust. Soc. Am. 129 (1), January 2011, 200-210
57. Lohr B *et al*. 2003. *Detection and discrimination of natural calls in masking noise by birds. estimating the active space of a signal*. B Lohr, TF Wright and RJ Dooling. Animal Behavior 65.763-777
58. McMurtry RY. 2011. *Toward a Case Definition of Adverse Health Effects in the Environs of Industrial Wind Turbines. Facilitating a Clinical Diagnosis*. Bulletin of Science Technology Society. August 2011 vol. 31 no. 4 316-320
59. Ministry of the Environment. 2008. *Noise Guidelines for Wind Farms, Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities*
60. Minnesota Department of Health. 2009. *Public Health Impacts of Wind Farms*
61. Møller, H. 2010. *Low-frequency noise from large wind turbines*. J. Acoust. Soc. Am, 129(6), June 2011, 3727 - 3744

62. Nissenbaum, A. 2012. *Effects of industrial wind turbine noise on sleep and health*. Noise and Health, Vol. 14, Issue 60, p 237 – 243.
63. Noise quest, Aviation Noise Information and Resources. 2010. **http.//www.noisequest.psu.edu/pmwiki.php?n=Main.HomePage**
64. Noise-con. 2008. *Simple guidelines for siting wind turbines to prevent health risks*
65. Norton, M.P. and Karczub, D.G. 2003. *Fundamentals of Noise and Vibration Analysis for Engineers*, Second Edition.
66. O'Neal, *et al*. 2011. *Low frequency noise and infrasound from wind turbines*. Noise Control Eng. J. 59 (2), March-April 2011
67. Oud, M. 2012. *Low-frequency noise. a biophysical phenomenon* (**http.//www.leefmilieu.nl/sites/www3.leefmilieu.nl/files/imported/pdf_s/2012_OudM_Low-frequency%20noise_0.pdf)** (unpublished webresource)
68. Parry, G. 2008. *A review of the use of different noise prediction models for windfarms and the effect of meteorology.* Acoustics 2008, Paris.
69. Pedersen, E. 2011. "*Health aspects associated with wind turbine noise—Results from three field studies",* Noise Control Eng. J. 59 (1), Jan-Feb 2011
70. Pedersen, E.J.A; Halmstad, Högskolan I, 2003. '*Noise annoyance from wind turbines. a review*'. Naturvårdsverket, Swedish Environmental Protection Agency, Stockholm
71. Phillips, C.V. 2011. *"Properly Interpreting the Epidemiologic Evidence About the Health Effects of Industrial Wind Turbines on Nearby Residents"*. Bulletin of Science Technology and Society 2011 31. 303 DOI. 10.1177/0270467611412554
72. Pierpont, N. 2009. *"Wind Turbine Syndrome. A Report on a Natural Experiment",* K Select Books, 2009
73. Punch, *et al*. 2010. *Wind Turbine Noise. What Audiologists should know.* Audiology Today. JulAug2010
74. Quinn, J.L, M.J. Whittingham, S.J. Butler, and W. Cresswell. 2006. *Noise, predation risk compensation and vigilance in the chaffinch Fringilla coelebs*. Journal of Avian Biology 37. 601-608
75. Rabin, L.A, R.G. Coss, D.H. Owings. 2006. *The effects of wind turbines on antipredator behavior in California ground squirrels (Spermophilus beecheyi)*. Biological Conservation 131. 410-420
76. Renewable Energy Research Laboratory. 2006. *Wind Turbine Acoustic Noise*
77. Report to Congressional Requesters. 2005. *Wind Power – Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife*
78. SANS 10103.2008. '*The measurement and rating of environmental noise with respect to annoyance and to speech communication*'.
79. SANS 10210.2004. '*Calculating and predicting road traffic noise*'.
80. SANS 10328.2008. '*Methods for environmental noise impact assessments*'.
81. SANS 10357.2004. *The calculation of sound propagation by the Concave method*'.
82. Schaub, A, J. Ostwald and B.M. Siemers. 2008. "*Foraging bats avoid noise*". The Journal of Experimental Biology 211. 3174-3180
83. Sheperd, D and Billington, R. 2011. *Mitigating the Acoustic Impacts of Modern Technologies. Acoustic, Health, and Psychosocial Factors Informing Wind Farm Placement*. *Bulletin of Science Technology and Society* published online 22 August 2011, DOI. 10.1177/0270467611417841
84. Shepherd. D *et al*. 2011. *Evaluating the impact of wind turbine noise on health related quality of life*. Noise and Health, September-October 2011, 13.54,333-9.
85. Smith. M (*et al*). 2012. "*Mechanisms of amplitude modulation in wind turbine noise*"; Proceedings of the Acoustics 2012 Nantes Conference
86. Stigwood (*et al*). 2013. "*Audible amplitude modulation – results of field measurements and investigations compared to psycho-acoustical assessments and theoretical research*"; Paper presented at the 5th International Conference on Wind Turbine Noise, Denver 28 – 30 August 2013
87. Tachibana, H (*et al*) .2013. "*Assessment of wind turbine noise in immission areas*"; Paper presented at the 5th International Conference on Wind Turbine Noise, Denver 28 – 30 August 2013

88. Teneler, A. 2018. Health Effects of Wind Turbines. A Review of the Articles Published Between 2008-2018. *European Journal of Public Health*, 28(suppl_4).
89. Thorne et al. 2010. *Noise Impact Assessment Report Waubra Wind Farm Mr and Mrs N Dean Report No 1537 - .Rev 1*
90. Thorne. 2010. *The Problems with "Noise Numbers" for Wind Farm Noise Assessment*. Bulletin of Science Technology and Society, 2011 31. 262
91. Tonin, R, Brett, J, Colagiuri, B. 2016. *The effect of infrasound and negative expectations to adverse pathological symptoms from wind farms*. Journal of Low Frequency Noise, Vibration and Active Control 2016, Vol 35(1) 77-90
92. USEPA. 1971. *Effects of Noise on Wildlife and other animals*
93. Van den Berg, G.P. 2003. *'Effects of the wind profile at night on wind turbine sound'.* Journal of Sound and Vibration
94. Van den Berg, G.P. 2004. *'Do wind turbines produce significant low frequency sound levels?'*. 11th International Meeting on Low Frequency Noise and Vibration and its Control
95. Wang, Z. 2011. *Evaluation of Wind Farm Noise Policies in South Australia. A Case Study of Waterloo Wind Farm*. Masters Degree Research Thesis, Adelaide University 2011
96. Whitford, J. 2008. *Model Wind Turbine By-laws and Best Practices for Nova Scotia Municipalities*
97. Williams, S. and Moore, A. 2020. *Noise and Shadow Flicker Scoping Report for the Proposed Nuweveld North Wind Farm, Western Cape Province – Red Cap Energy (Pty) Ltd.* ARCUS Consultancy Services, York
98. World Health Organization. 1999. *Protection of the Human Environment; Guidelines for Community Noise*
99. World Health Organization. 2009. *Night Noise Guidelines for Europe*
100. World Health Organization. 2018. *Environmental Noise Guidelines for the European Region*. Copenhagen, Denmark

Shadow Flicker

Arcus Consultancy Services. 2022. Desktop Shadow Flicker Assessment Southern Cluster: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm

1. Planning and Environmental Policy Group. 2009. Best Practice Guidance to Planning Policy Statement 18 'Renewable Energy'
2. Planning and Environmental Policy Group. 2009. Planning Policy Statement 18. 'Renewable Energy'.

Traffic

Schwarz, A. 2022. Traffic Impact Assessment Southern Cluster: Hoogland 3 Wind Farm and Hoogland 4Wind Farm

Socio-Economic

Independent Economic Researchers. 2022. Socio-Economic Impact Assessment Southen Cluster: Hoogland 3 Wind Farm and Hoogland 4 Wind Farm.

3. Aitchison, C. 2012. Tourism impact of wind farms. Submitted to Renewables Inquiry, Scottish Government. The University of Edinburgh.
4. BiGGAR Economics. 2016. Wind Farms and Tourism Trends in Scotland: A Research Report. BiGGAR Economics, Midlothian, Scotland.

5. Broughton, E. 2019. EIA of for the proposed Boulders Wind Farm near Vredenburg in the Western Cape: Property values, tourism, and economic issues assessment report. Prepared for Savannah Environmental. Urban-Econ, Pretoria.
6. Barbour, T, 2007. Guideline for undertaken Social Impact Assessment in the EIA process: Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.
7. Barbour, T. and van der Merwe, S. 2012. EIA of the SAGIT Wind Energy Facility near Wolseley, Western Cape: Social Impact Assessment. Report to GIBB, Cape Town.
8. Beaufort West Local Municipality (BWLM). 2021. Integrated Development Plan 2017 – 2022: 4th Annual Review 2021/2022. BWLM, Beaufort West.
9. Broekel, T. and Alfken, C. 2015. Gone with the wind? The impact of wind turbines on tourism demand. Energy Policy, 86: 506-519.
10. Central Karoo District Municipality (CKDM). 2021. Integrated Development Plan 2021-2022 Review. CKDM, Beaufort West.
11. Centre for Economics and Business Research (CEBR). 2014. The effect of wind farms on house prices. CEBR, UK.
12. CNdV Africa. 2013. Beaufort West Municipality SDF. CNdV Africa, Cape Town.
13. De Sousa, AJG. Kastenholz, E. 2015. Wind farms and the rural tourism experience – problem or possible productive integration? The views of visitors and residents of a Portuguese village
14. De Wit, M, van Zyl, H.W. and King, N. 2004. The Cost of Noise Pollution. In: Blignaut, J & de Wit, M (Eds). Sustainable Options: Development Lessons from Applied Environmental Economics. UCT Press, Cape Town.
15. DEA (Department of Environmental Affairs). 2019. Draft National Strategic Environmental Assessment (SEA) for the effective and efficient roll-out of large scale wind and solar development in South Africa Phase 2. Draft CSIR Report to DEA. DEA, Pretoria.
16. DEA (Department of Environmental Affairs). 2016. National Electricity Grid Infrastructure Strategic Environmental Assessment. CSIR Report to DEA. DEA, Pretoria.
17. EARES, 2021. Environmental noise impact assessment for the proposed Hoogland 3 and Hoogland 4 Wind Farms and associated infrastructure near Loxton, Western Cape Province. EARES Enviro Acoustic Research, Garsfontein East.
18. Frantál, B. Kunc, J. 2011. Wind turbines in tourism landscapes: Czech experience. Annals of Tourism Research, 38(2): 499-519. doi:10.1016/j.annals.2010.10.007.
19. Gibbons, S. 2014. Gone with the Wind: Valuing the Visual Impacts of Wind turbines through House Prices. Spatial Economic Research Centre (SERC) DISCUSSION PAPER 159. SERC, London.
20. Gordon, DS. 2017. Wind farms and tourism in Scotland: A review with a focus on mountaineering and landscape. Mountaineering Scotland, Perth.
21. Health Systems Trust (HST). no date. Pixley ka Seme District Profile (Online). Available: https://www.hst.org.za/publications/NonHST%20Publications/Northern%20Cape%20-%20Pixley%20ka%20Seme%20District.pdf [Accessed 18/12/2019].
22. Helblich, S, Olner, D, Pryce, G. & Timmins, C. 2016. Impact of wind turbines on house prices in Scotland. Report for ClimateXChange, the Scotland's centre of expertise on climate change. funded by the Scottish Government. https://www.climatexchange.org.uk/media/1359/cxc_wind_farms_impact_on_house_prices_final_17_oct_2016.pdf
23. Hinman. J.L. 2010. Wind farm proximity and property values: a pooled hedonic regression analysis of property values in central Illinois. In partial fulfilment of the requirements for the degree of Master of Science in Applied Economics, Illinois State University, Normal, Illinois.
24. Hoen, B, Brown, J.P, Jackson, T, Wiser, R, Thayer, M. and Cappers, P. 2013. A Spatial Hedonic Analysis of the Effect of Wind Energy Facilities on Surrounding Property Values in the United States. Berkley National Laboratory, California, USA.

25. Hoen, B, Wiser, R, Cappers, P, Thayer, M. & Sethi, G. 2009. The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis. Report Nr. LBNL-2829E prepared for the Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. Prepared by Berkeley National Laboratory, Environmental Energy Technologies Division, Berkeley, California.
26. Lang, C. and Opaluch, J. 2013. Effects of Wind Turbines on Property Values in Rhode Island. Environmental and Natural Resource Economics Dept, University of Rhode Island.
27. Lewis, E. 2021. Proposed Hoogland Wind Farms and Grid Connection Project, Southern Cluster: Hoogland 3 wind Farm and Hoogland 4 Wind Farm. Arcus Consulting, York.
28. Kalashnikova, Y. 2016. The ABC of tourist attitudes towards wind industry in Skåne: affective, behavioral and cognitive dimensions. Master Thesis, Lund University Centre for Sustainability Studies.
29. Karoo Hoogland Local Municipality (KHLM). 2021. Integrated Development Plan (IDP) of the Karoo Hoogland Municipality 2017 – 2022. KHLM, Williston.
30. Kielisch, K. 2009. Wind Turbine Impact Study: Dodge and Fond Du Lac Counties, WI. Appraisal Group One. Prepared for Calumet County Citizens for Responsible Energy (CCCRE), Calumet County, WI. September 9, 2009. 73 pages.
31. Lawson, Q and Oberholzer, B. 2022. Proposed Hoogland Wind Farms and Grid Connection Project: Southern Cluster: Hoogland 3 and Hoogland 4 Wind Farms, Visual Impact Assessment.
32. Magoro, TB. 2021. PFL Live Webinar: Analysing South Africa’s Renewable Energy Bid Window 5 Results. Independent Power Producers Office.
33. Namakwa District Municipality (NDM) 2021. Integrated Development Plan Revision 2021–2022. NDM: Springbok.
34. Nordman, E. Mutinda, J. 2016. Biodiversity and wind energy in Kenya: Revealing landscape and wind turbine perceptions in the world’s wildlife capital. Energy Research & Social Science. Energy Research & Social Science, 19: 108-118.
35. Northern Cape Provincial Government (NCPG) 2021. Northern Cape Socio-economic Review and Outlook 2021. Northern Cape Provincial Treasury, Kimberly.
36. Orton, J. 2021. Heritage Impact Assessment: Proposed Hoogland 3 Wind Farm and Hoogland 4 Wind Farm, Beaufort West Magisterial District, Western Cape. ASHA Consulting, Lakeside.
37. Pixley ka Seme District Municipality (PkSDM) 2021. Integrated Development Plan: Draft IDP 2021–2022.
38. Polecon Research. 2013. The Impact of Wind Farms on Tourism in New Hampshire. Dover, New Hampshire.
39. Schwarz, A. 2021. Red Cap Energy Hoogland Northern Cluster Wind Farms Traffic Impact Assessment. Athol Schwarz, Table View.
40. Sims, S. and Dent, P. 2007. Property Stigma: Wind Farms Are Just The Latest Fashion. Journal of Property Investment & Finance. 25(6): 626-651.
41. Statistics South Africa (Stats SA). 2012. Census 2011. Stats SA, Pretoria.
42. Statistics South Africa (Stats SA). 2017. Community Survey 2016. Stats SA, Pretoria.
43. Ubuntu Local Municipality (ULM). 2021. 2017-2022: 2020/21 Draft IDP Review. ULM, Victoria West.
44. Urbis. 2016. Review of the Impact of Wind Farms on Property Values. Report to the NSW Office of Environment and Heritage, Australia. Urbis, Sydney.
45. Van Zyl, H.W. and Barbour, T. 2014. Environmental Impact Assessment for the Proposed Kleinberg Dam Scheme and Associated Infrastructure, Hex River Valley, Western Cape: Socio-economic Specialist Study. Report to Holland and Associates. Independent Economic Researchers, Cape Town.
46. Van Zyl, H.W. 2007. Property Price Approaches to the Valuation of Urban Wetlands: Theoretical Considerations and Policy Implications. PhD Economics Thesis. School of Economics, University of Cape Town.
47. Van Zyl, H.W. and Leiman, A. 2002. Hedonic Approaches to Estimating the Impacts of Open Spaces: A Case Study in the Cape. South African Journal of Economics and Management Science, Vol. 5(2). June.
48. Wesgro, 2018. Cape Karoo Visitor Trends 2018. Wesgro, Cape Town.
49. Western Cape Provincial Government. 2018a. Socio-economic profile: Beaufort West Municipality. WCPG, Cape Town.

50. Western Cape Provincial Government. 2018b. Socio-economic profile: Central Karoo District Municipality. WCPG, Cape Town.
51. Western Cape Provincial Government. 2020a. Socio-economic profile: Beaufort West Municipality. WCPG, Cape Town.
52. Western Cape Provincial Government. 2020b. Socio-economic profile: Central Karoo District Municipality. WCPG, Cape Town.

APPENDIX A: EAP DETAILS

APPENDIX B: MAPS

APPENDIX C: SPECIALIST REPORTS

APPENDIX C1: CLIMATE CHANGE

APPENDIX C2: GEOTECHNICAL

APPENDIX C3: AGRICULTURE

APPENDIX C4: TERRESTRIAL ECOLOGY

APPENDIX C5: FLORA

APPENDIX C6: RIVERINE RABBIT

APPENDIX C7: KAROO DWARF TORTOISE

APPENDIX C8: BATS

APPENDIX C9: AVIFAUNA

APPENDIX C10: AQUATIC ECOLOGY

APPENDIX C11: VISUAL

APPENDIX C12: HERITAGE

APPENDIX C13: PALAEONTOLOGY

APPENDIX C14: NOISE

APPENDIX C15: SHADOW FLICKER

APPENDIX C16: TRAFFIC

APPENDIX C17: SOCIO-ECONOMIC

APPENDIX C18: GEOHYDROLOGY

APPENDIX D: PUBLIC PARTICIPATION

APPENDIX D1: SCREENING PHASE

APPENDIX D2: PRE-APPLICATION PHASE

APPENDIX D3: BA PHASE

APPENDIX E: DFFE SCREENING TOOL REPORTS

APPENDIX F: ENVIRONMENTAL MANAGEMENT PROGRAMMES

APPENDIX G: BATTERY ENERGY STORAGE RISK ASSESSMENT

RISK	MITIGATION
Li-ion battery technology	
Temperature fluctuations Temperature fluctuations in the Beaufort West area (minimum temperatures of below 0°C and maximum temperatures of over 25°C) mean that the batteries may be at risk of being damaged due to instability of temperatures. Resultant impacts could include fire, or permanent structural damage to the batteries.	The design of the Li-ion system includes: ▪ Insulated containers ▪ High powered HVAC (Heating, Ventilation and Air-Conditioning) System, monitored centrally ▪ Multiple temperature sensors for both the cells and air temperature ▪ Automated shut down mechanism if temperatures get too high ▪ Containers sealed and douse in case of fire to prevent the spread ▪ Battery management system to prevent overuse and maintain good battery condition
Fire and dangerous chemicals The volatility of the battery system, prior to any mitigation, could result in significant fire danger. In addition to this, there is a risk associated with the chemicals contained within the actual battery storage system itself.	The design of the Li-ion system includes: ▪ Fire detection and suppressant systems ▪ Gas level monitoring for several different gases (related to degradation of the batteries that increases risk of fire) ▪ Heat sensors ▪ Battery condition monitoring ▪ Dousing mechanism for emergency cooling and fire suppression ▪ Density limits in the containers ▪ Spacing limits between containers ▪ Limited quantities of chemicals stored on site and stored in several layers of containment
Redox flow battery (RFB) technology	
Fire or explosion Due to the use of aqueous electrolytes, the fire risk of RFB systems is much lower than with other technologies. Overcharging the battery does not lead to fire but to a reduction in battery performance and aging of the stacks.	The design and key mitigation measures of the RFBs includes: ▪ Battery condition monitoring ▪ A Major Hazards Risk Assessment must be undertaken prior to construction and the recommendations of the assessment implemented. ▪ Fire detection and suppressant systems
Accidental leak or spillage of electrolytes The electrolyte solution may be classified as toxic and hazardous to groundwater. The electrolyte is used in a closed system and can escape solely through electrolyte leaks.	The design and key mitigation measures of the RFBs includes: ▪ Electrolyte solutions stored on site should be stored away from incompatible materials (as per the Material Safety Data Sheet) ▪ Leak detection and monitoring system ▪ A secondary containment to prevent the spillage of electrolyte into the environment during operation (storage and refilling when required). ▪ Berms with sufficient storage/containment capacity

APPENDIX H: ADDITIONAL INFORMATION

RECORD OF REPORT DISTRIBUTION

SLR Reference:	720.18062.00001
Title:	Red Cap Hoogland Southern Cluster Pre-Application Report
Report Number:	1 1
Client:	Red Cap Energy (Pty) Ltd

Name	Entity	Copy No.	Date Issued	Issuer

AFRICAN OFFICES

South Africa

CAPE TOWN
T: +27 21 461 1118

JOHANNESBURG
T: +27 11 467 0945

DURBAN
T: +27 11 467 0945

Ghana

ACCRA
T: +233 24 243 9716

Namibia

WINDHOEK
T: + 264 61 231 287