

Final BASIC ASSESSMENT REPORT

Proposed ***Kariega Four Wind Energy Facility*** and associated infrastructure near Aberdeen in the Dr Beyers Naude Local Municipality and Sarah Baartman District Municipality, Eastern Cape Province and Beaufort West Local Municipality and Central Karoo District Municipality, Western Cape Province

Kariega Wind Farm (Pty) Ltd **PROPONENT**

Contact Person

**Land and Environmental Project
Manager**

Kholofelo Rameetse

Tel: 021 670 1402

E-mail: Kholofelo.Rameetse@aced.co.za

Physical address:

2nd Floor Fernwood House
The Oval
1 Oakdale Road
Newlands
7700

Report date
11 September 2024

**DFFE
Reference**
14/12/16/3/3/
1/3019

**Revision: 1
Project Reference**
221010025

EnviroAgri (Pty) Ltd **CONSULTANT**

Contact person

Environmental Assessment Practitioner

Dirk Pretorius

Tel: 072 100 27 12

E-mail: dirk@enviroagri.com

Postal address

P.O. Box 3731
Tyger Valley
7536



Protection of Personal Information Act (POPIA), Act No. 4 of 2013.

EnviroAgri (Pty) Ltd places a high premium on the privacy & personal information of our clients, stakeholders and third parties. The processing of personal information is subject to the Protection of Personal Information Act (POPIA), Act No. 4 of 2013 which came into effect on the 1st of July 2021. As such personal information in this report shall only be processed for a purpose relating to the fulfilment of the contract between the parties in pursuit of the legitimate interests as it relates to the contents of the report. The personal information shall only be processed if it is adequate, relevant, and not excessive, given the purpose for which it is processed and in accordance with the relevant provisions of POPIA. In furtherance, the contents of this report may not be shared to any third parties outside the direct scope of this report without the consent of the proponent, i.e., Kariega Wind Farm (Pty) Ltd, the juristic person.

DISCLAIMER

This Basic Assessment Report has been prepared by EnviroAgri, using information provided by Kariega Wind Farm (Pty) Ltd, as well as several third parties (specialists, map data, sensitivity data, previous assessment in the area), which will be presumed to be correct. While EnviroAgri has endeavoured to supply accurate information, and exercised due care, skill, and diligence in reviewing this information and undertaking this assessment, errors and omissions may occur. Accordingly, EnviroAgri does not warrant the accuracy or completeness of the materials in the assessment report or the materials it references. EnviroAgri does not accept any liability for any loss or damage which may directly or indirectly result from any recommendation, opinion, information, representation, or omission, whether negligent or otherwise, contained in this report. EnviroAgri does not accept any liability for any loss or damage, whether direct, indirect, or consequential, arising out of circumstances beyond the control of EnviroAgri, including the use and interpretation of the assessment report by the client and their representatives, government officials or the public.

NOTE:

Annexure L, Kariega 4 Map Book includes maps in larger format.

All ~~strike through~~ text have been amended or replaced by underlined text.

Document ratification

Report title	Final Basic Assessment Report: Proposed Kariega Four Wind Energy Facility and associated infrastructure near Aberdeen in the Dr Beyers Naude Local Municipality and Sarah Baartman District Municipality, Eastern Cape Province and Beaufort West Local Municipality and Central Karoo District Municipality, Western Cape Province.		
Project number	221010025		
File path	EnviroAgri/1 Projects/025 Kariega WEF/4 Reports/final BAR/ K4 fBAR		
Client	Kariega Wind Farm (Pty) Ltd		
Client contact	Kholofelo Rameetse		
Date	Current report	Author	Report number
2024-06-18	Draft Bar Rev. 1	Dirk Pretorius	025001(K4)
2024-09-11	Final Bar Rev. 0	Dirk Pretorius	025002(K4)

Approval

Author signature			
Name	Dirk Pretorius		
Title	EAP	Date	2024-09-11

This report is to be referred to in bibliographies as: EnviroAgri, 2024. Final Basic Assessment Report: Proposed Kariega Four Wind Energy Facility and associated infrastructure near Aberdeen in the Dr Beyers Naude Local Municipality and Sarah Baartman District Municipality, Eastern Cape Province and Beaufort West Local Municipality and Central Karoo District Municipality, Western Cape Province. Report No. 025001(K4).



Contents

Glossary of terms	xviii
Abbreviations.....	xix
1 INTRODUCTION AND BACKGROUND	1
1.1 Introduction	1
1.2 Location	1
1.3 Project details and extent	2
1.4 Report structure.....	6
1.5 EIA Project Team.....	7
1.6 Assumptions, Limitations and Gaps in Knowledge	8
2 LEGAL AND PLANNING CONTEXT	10
2.1 Relevant Legislation.....	10
2.2 Listed Activities in terms of NEMA	13
2.3 Relevant Policies and plans.....	23
2.4 Relevant Guidelines	24
3 EIA METHODOLOGY	26
3.1 The Pre-Application Phase	26
3.2 BAR Phase	26
3.3 Methodology.....	28
3.4 Public Participation	35
3.5 Authority involvement	36
3.6 Summary of Comments and Responses	37
4 DESCRIPTION OF PROPOSED PROJECT	41
4.1 Project details and extent	41
4.2 Components and Activities	47
4.3 Project Phases.....	55
4.4 Project Need and Desirability.....	57
5 CONSIDERATION OF ALTERNATIVES	67
5.1 Location Alternatives	68
5.2 Design and Layout Alternatives	68
5.3 Technology Alternatives.....	75
5.4 Routing Alternative for Linear Activities	75
5.5 No-Go Alternative	76
5.6 Infrastructure buffer areas	76



6	BASLINE ENVIRONMENT AND ENVIRONMENTAL IMPACT ASSESSMENT	77
6.1	<i>Climate.....</i>	78
6.2	<i>Social Assessment</i>	81
6.3	<i>Agricultural Production, Potential and Soils</i>	119
6.4	<i>Geotechnical</i>	131
6.5	<i>Visual Impact Assessment.....</i>	147
6.6	<i>Shadow Flicker Impact Assessment</i>	183
6.7	<i>Noise Impact Assessment</i>	203
6.8	<i>Avifauna (Birds)</i>	243
6.9	<i>Bats</i>	275
6.10	<i>Terrestrial Biodiversity (including animals and plants).....</i>	290
6.11	<i>Aquatic Biodiversity</i>	311
6.12	<i>Heritage, including Archaeology, Palaeontology and Cultural Landscape</i>	329
6.13	<i>Traffic.....</i>	348
7	ENVIRONMENTAL IMPACT STATEMENT	362
8	CONCLUSIONS AND WAY FORWARD	388
9	REFERENCES and ResourCES	389
10	ANNEXURES	391

Figures

Figure 1-1: Kariega 2, 3 and 4 WEFs study area indicated by the green outline.	4
Figure 1-2: Locality map showing the proposed Kariega 4 WEF location, near the town of Aberdeen in the Dr Beyers Naude Local Municipality, Eastern and Western Cape Province.	5
Figure 3-1: The BA process in terms of NEMA.	26
Figure 3-2: The six-box model for the qualitative communication of confidence (Source: Adopted from IPBES, 2018).	32
Figure 3-3: Developments within a 30km radius of the proposed site in particular renewable energy (wind and solar) and their associated grid connections (REEA: Q4, 2023 and authorised Kudu and Tango WEFs).	35
Figure 3-4: Public participation in the BAR process.	36
Figure 4-1: Kariega WEF cluster (green outline), in context of the nearest towns and access routes.	41
Figure 4-2: Kariega 4 WEF site in relation to Kariega WEF cluster (green outline), provincial boundary and the R61.	42
Figure 4-3: Kariega 4 layout map indicating WTG in the northern section of the proposed WEF, access point 5, 200m assessment buffer (yellow), affected and adjacent properties, laydown, batching, site camp areas, substation, BESS and alternatives.	44
Figure 4-4: Kariega 4 layout map indicating WTG in the central section of the proposed WEF, access point 3 and 4, 200m assessment buffer (yellow), affected and adjacent properties, laydown, batching, site camp areas, substation, BESS, and alternatives.	45



Figure 4-5: Kariega 4 layout map indicating WTG in the southern section of the proposed WEF, 200m assessment buffer (yellow), affected and adjacent properties.	46
Figure 4-6: Kariega 4 WEF development area in relation to Beaufort West REDZ (white), within a 30 km radius (white dashed circle) of the centre of the Kariega 4 development area. Also indicated are the Kariega WEF cluster properties (green outline), proposed Atlantic Aberdeen 1-3 WEF cluster, proposed Atlantic Aberdeen 1-3 PV SEF cluster, proposed Kudu WEF, proposed Tango WEF, and approved Eskom Aberdeen WEF are all adjacent the proposed Kariega WEFs (REEA 2023 Q4).	47
Figure 4-7: Typical WEF layout using Khobab WEF in the Northern Cape as example illustrating the main operational facility components.	51
Figure 4-8: Summary of activities associated with project phases.	55
Figure 5-1: Area of the originally proposed (~2021) Kariega WEF indicated by the green outline.	70
Figure 5-2: Concept layout of the originally proposed (~January 2023) Kariega WEF cluster.	70
Figure 5-3: Updated layout of the Kariega WEF cluster assessed in the fBAR (~September 2024) showing the servitude of the proposed Gamma-Grassridge 765kV powerline.	71
Figure 5-4: Excluding areas of aquatic and terrestrial sensitivity (left in red, right is remainder of area).	71
Figure 5-5: Excluding areas of avifauna and bat sensitivity.	72
Figure 5-6: Excluding areas of heritage visual and flicker.	72
Figure 5-7: Concept developable area of the Kariega WEF cluster.	72
Figure 5-8: General layout of the proposed Kariega 4 WEF (~December 2023).	73
Figure 5-9: General layout of the proposed Kariega 4 WEF as assessed in this dBAR (~April 2024).	74
Figure 5-10: General layout of the proposed Kariega 4 WEF as assessed in this fBAR (~September 2024).	74
Figure 6-1: Average temperature and rainfall for Aberdeen.	78
Figure 6-2: Monthly maximum temperature for Aberdeen.	79
Figure 6-3: The precipitation diagram for Aberdeen shows on how many days per month, certain precipitation amounts are reached.	79
Figure 6-4: Monthly average wind speeds for Aberdeen.	80
Figure 6-5: Wind rose for Aberdeen.	80
Figure 6-6: Local municipalities within Sarah Baartman District Municipality.	81
Figure 6-7: Local municipalities within Central Karoo District Municipality.	82
Figure 6-8: Ward 2.	82
Figure 6-9: Employment contribution by economic sector in the SBDM in 2016 (Source: SBDM IDP 2019/2020 Review).	87
Figure 6-10: Summary of GDP and Employment for BWM (SEP BWM 2021)	92
Figure 6-11: Summary of skills levels for formal employment in the BWM (SEP BWM 2021)	92
Figure 6-12: Kariega 4 WEF development area (pink) in relation to Beaufort West REDZ (orange), historic WEF- (light blue fill) and SEF (orange fill) applications within a 30 km radius (red circle) of the centre of the development area. Also indicated are the proposed Kariega 2-4 WEF site properties (light green outline), proposed Atlantic Aberdeen 1-3 WEF cluster (light blue outline), proposed Atlantic Aberdeen 1-3 PV SEF cluster (light pink), proposed Kudu WEF (dark green), proposed Tango WEF (khaki), and approved Eskom Aberdeen WEF (purple) (Source base map: DFF&E).	95
Figure 6-13: Angora goats (mohair production, top left), Springbuck (game propagation and hunting, top right), Merino sheep (wool and meat, bottom left) and work horses (bottom right) are some of the animals found on the farm properties and those adjacent.	120



Figure 6-14: Typical farm infrastructure found on the proposed development properties include sheering camps with loadings ramps (top left), farm steads with stalls (top right), enclosures for small stock animals (bottom left), mobiles herders outpost (bottom right).	121
Figure 6-15: The area is earmarked by significant sheet (top left) and donga erosion (top right) most likely due to relative recent droughts and historical poor veld and stormwater management practices. Farmers have attempted to vegetate these eroded areas by digging rehabilitation hollows to allow seed capture and water retention as well as innumerable low earth ridges to slow down water flow.	121
Figure 6-16: The infrastructure on some of the farm properties were dilapidated.	122
Figure 6-17: Farm gates with electronic solar powered motor (left) typical jackal proof fence with diamond mesh at bottom and single strand wire at the top, the rocks packed at the base help prevent burrow animals from diggings holes underneath the fence creating access to predators.	122
Figure 6-18: Cultivated fields are very limited in the area with these (the light green patches between the trees) located on farms adjacent the development properties.	122
Figure 6-19: The proposed layout of the facility overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high).	123
Figure 6-20: Geological map of the area	131
Figure 6-21: Blocky, hard sandstone of the Teekloof Formation exposed in road cutting on R61 near site.	132
Figure 6-22: Dolerite exposure on an old borrow pit near site.	132
Figure 6-23: Maximum seismic intensities (Modified Mercalli Scale)	133
Figure 6-24: Peak horizontal ground acceleration map of SA	133
Figure 6-25: Challenging fine-grained soil conditions on low-lying parts of the site	134
Figure 6-26: Erosion of fine-grained alluvial soil cover along drainage lines near site.	135
Figure 6-27: Coarser gravelly soils and shallow bedrock on elevated areas	135
Figure 6-28: Geotechnical map of site	136
Figure 6-29: Local landscape themes map.	148
Figure 6-30: BGIS Biome and Vegetation Type Map (South African National Biodiversity Institute, 2018).	149
Figure 6-31: Regional Digital Elevation Mapping and Profiles Graphs <i>with approximate extent and height depicted.</i>	152
Figure 6-32: Key topographic features map.	153
Figure 6-33: Kariega 4 WEF viewshed with offset 250m above ground to reflect turbine daytime viewshed.	156
Figure 6-34: Combined Turbine viewshed with offset 250m above ground.	157
Figure 6-35: Turbine Key Observation Points location, view and distance map for <i>combined projects for cumulative viewpoints.</i>	158
Figure 6-36: Combined WEFs Physiographic Rating Units with K4 WEF focus area.	164
Figure 6-37: Visual Resource Management Classes map: Kariega 4 WEF.	165
Figure 6-38: Average temperature and rainfall (www.Climate-Data.org)	183
Figure 6-39: Wind rose of expected prevailing wind directions (www.globalwindatlas.info).	184
Figure 6-40: 3D generated model of the proposed turbine.	185
Figure 6-41: 3D model depicting shadow incidence in early morning winter periods.	185
Figure 6-42: 3D model depicting shadow incidence in late evening winter periods.	186
Figure 6-43: 3D model depicting shadow incidence in early morning summer periods.	186
Figure 6-44: 3D model depicting shadow incidence in late evening summer periods.	186



Figure 6-45: Mapped area for shadow potential that was incorporated into ArcGIS.	187
Figure 6-46: Example of Shadow Flicker survey screening with SF expected impact area overlay.	188
Figure 6-47: Residential dwelling survey point locality map within the project area.	195
Figure 6-48: Terrain Model depicting topographic variation between turbines and dwellings as negligible.	196
Figure 6-49: Kariega 4 WEF SF impact zone map (south).	197
Figure 6-50: Kariega 4 WEF SF impact zone map (East).	198
Figure 6-51: Kariega 4 WEF SF impact zone map (North).	199
Figure 6-52: Influence of temperature inversions on the propagation of sound	204
Figure 6-53: Effect of Temperature and Humidity on propagation of Sound	205
Figure 6-54: Temperature and Humidity readings measured onsite	206
Figure 6-55: Localities where ambient sound levels were measured .	207
Figure 6-56: Daytime ambient sound levels measured in vicinity of project	210
Figure 6-57: Night-time ambient sound levels measured in vicinity of project.	211
Figure 6-58: Logarithmic Chart of the Hearing Ranges of Some Animals.	213
Figure 6-59: Percentage of annoyed persons as a function of the day-evening-night noise exposure at the façade of a dwelling.	217
Figure 6-60: WTG locations and associated infrastructure for the proposed Kariega 4 WEF.	219
Figure 6-61: Projected conceptual construction noise levels – Decay over distance from linear activities (roads).	220
Figure 6-62: Projected conceptual construction noise levels for the proposed Kariega 4 WEF.	221
Figure 6-63: Projected future noise rating level contours (worst-case WTG with SPL of 114.0 dBA re 1 pW).	224
Figure 6-64: Effect of distance between wind turbines – potential cumulative noise.	225
Figure 6-65: Effect of distance between wind turbines – potential cumulative noise.	226
Figure 6-66: Projected future cumulative noise rating level contours (worst-case SPL of 114.0 dBA re 1 pW).	228
Figure 6-67: Projected future cumulative noise rating level contours for a potential mitigated scenario.	229
Figure 6-68: Projected noise levels at different wind speeds (worst-case SPL).	231
Figure 6-69: Vegetation units present on and surrounding the site (Mucina & Rutherford 2012).	243
Figure 6-70: Typical micro-habitats available to birds in the study area.	244
Figure 6-71: Recorded target bird species flight paths at the site (all species, all seasons).	253
Figure 6-72: Regionally Red Listed species flight paths (full year).	254
Figure 6-73: Close up view of regionally Red Listed species flight paths (full year).	254
Figure 6-74: The position of the project relative to the Avian wind farm sensitivity map (Retief <i>et al.</i> 2011), Important Bird & Biodiversity Areas (Marnewick <i>et al.</i> 2015), and Renewable Energy Development Zones (REDZ/2).	255
Figure 6-75: Biodiversity Importance scoring table (extracted from SANBI 2022).	256
Figure 6-76: Site Ecological Importance scoring table (extracted from SANBI 2022).	257
Figure 6-77: The avifaunal sensitivity map for the overall project (four wind farms).	260
Figure 6-78: The avifaunal sensitivity map for the proposed project.	261
Figure 6-79: Cumulative projects from REEA 2023 Q4 (and authorised Kudu and Tango WEFs) within 30km range of the proposed Kariega WEFs.	269
Figure 6-80: Recording success at bat monitoring stations AB1-6. AB1 and AB4 in the Kariega 4 WEF site, and nearby AB2 are outlined in red.	279
Figure 6-81: Bat sensitivity map for the proposed Kariega 4 WEF.	281



Figure 6-82: The vegetation units as shown in NSBA 2018 vegetation map spatial data (vegmap)	291
Figure 6-83: A typical transitional area between the alluvial portions of a floodplain and the Eastern Lower Karoo vegetation units.	291
Figure 6-84: A view of a typical Eastern Lower Karoo vegetation unit.	293
Figure 6-85: A typical transitional area between the alluvial portions of a floodplain and the Eastern Lower Karoo vegetation units.	293
Figure 6-86: ECBCP Terrestrial CBA and ESAs (ECBCP, 2019) and Western Cape Biodiversity Spatial Plan (WCBSP, 2017) layers	295
Figure 6-87: Screening tool results for the project area for the Animal Biodiversity theme.	296
Figure 6-88: Screening tool results for the project area for the Plants Biodiversity theme.	297
Figure 6-89: Screening tool results for the project area for the Terrestrial Biodiversity theme.	297
Figure 6-90: The delineated habitats and their respective sensitivity ratings in relation to the proposed layout, where all other areas are rated as LOW	301
Figure 6-91: Generalised view of the site, with an alluvial system with containing an undefined riparian thicket (i.e., limited zonation, but woody dominated) in the foreground.	311
Figure 6-92: Mainstem rivers, quinary catchments and Water Management Areas in relation to the various project components.	313
Figure 6-93: Borrow-pit with no aquatic vegetation south of the proposed site.	313
Figure 6-94: The proposed layout in relation to the NFEPA spatial results.	316
Figure 6-95: Eastern Cape Biodiversity Conservation Plan (2019) and Western Cape Biodiversity Spatial Plan (WCBSP, 2017) spatial results in relation to the proposed layout.	317
Figure 6-96: The map presented in the National Screening Tool results.	318
Figure 6-97: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed layout inclusive of the respective buffers, where all artificial systems were rated as LOW.	320
Figure 6-98: Cultural Landscape Elements Map from Winter et al. 2022 (Appendix 3) reflecting an older layout for Kariëga WEF Cluster.	334
Figure 6-99: Map of high-level cultural landscape elements that impact the proposed development area.	334
Figure 6-100: Map of landscape elements within the proposed development area.	335
Figure 6-101: Map of archaeological heritage resources within the proposed development area.	336
Figure 6-102: Geology Map. Extract from the CGS 3222 Beaufort West Map indicating that the development area for the WEF development is underlain by sediments of Pt: Poortjie Member of the Teekloof Formation of the Adelaide Subgroup and Jd: Jurassic Dolerite as well as Qc: Quaternary Sands for Kariëga 4 WEF	337
Figure 6-103: Palaeontological sensitivity of the proposed development area of the Kariëga WEF Cluster.	339
Figure 6-104: Map of palaeontological heritage resources within the proposed development area.	340
Figure 6-105: Route from Cape Town to Kariëga WEF project site.	349
Figure 6-106: Route from Johannesburg to the project site.	350
Figure 6-107: Route from Pinetown to the project site.	351
Figure 6-108: Route from Gqeberha to project site.	351
Figure 6-109: Road network in vicinity of project site.	352
Figure 6-110: Aerial View of Access Points for Kariëga 4 WEF.	353
Figure 7-1: Combined sensitivity map terrestrial and aquatic biodiversity planning features.	381
Figure 7-2: Combined sensitivity map vegetation types.	382



Figure 7-3: Combined sensitivity map birds (avifauna).	383
Figure 7-4: Combined sensitivity map bats.	384
Figure 7-5: Combined sensitivity map terrestrial and aquatic ecology.	385
Figure 7-6: Combined sensitivity map for heritage including archaeology, palaeontology and cultural landscape.	386
Figure 7-7: Combined sensitivity map visual and noise.	387



Tables

Table 1-1: Farm details for Kariega 4 WEF.	1
Table 1-2: Adjacent Farm details for Kariega 4 WEF.	2
Table 1-3: BA Project Team.	7
Table 2-1: Legislation considered in preparation of the BAR.	10
Table 2-2: Listed activities triggered by the proposed project and applied for.	13
Table 3-1: Appendix 1 of the NEMA 2014, EIA regulations (as amended) which was used as guideline for the assessment methodology, as it relates to the assessment of impacts.	29
Table 3-2: Impact assessment terminology explained.	30
Table 3-3: Impact assessment supplementary information terms explained.	32
Table 3-4: Calculation of impact magnitude “D” (sum of impact extent “A”, duration “B” and intensity “C”), significance “F” (product of impact magnitude “D” and probability “E”), and consequence “H” (product of impact significance “F” and importance “G”).	33
Table 4-1: Farm details for Kariega 4 WEF.	42
Table 4-2: Adjacent Farm details for Kariega 4 WEF.	43
Table 4-3: Technical details for Kariega 4 WEF.	48
Table 4-4: The need and desirability of the proposed grid connection infrastructure is motivated in the following table.	57
Table 4-5: Consideration of NEMA objectives.	64
Table 6-1: Health care facilities in DBNLM.	85
Table 6-2: Sports and community facilities in DBNLM.	85
Table 6-3: Education facilities in DBNLM.	86
Table 6-4: SBDM GVA by broad economic sector for the period 2016-2021 (in R Billion at 2010 values) Source: SBDM IDP 2019/2020 Review.	88
Table 6-5: Key economic indicators for the DBNLM 2006-2021 (in R Billion at 2010 values).	88
Table 6-6: Overview of Kariega 4 site- and site-adjacent properties.	93
Table 6-7: Proposed infrastructure in relation to social receptors (distances in km).	95
Table 6-8: Impact assessment of employment and business creation opportunities during the construction phase.	98
Table 6-9: Assessment of impact of the presence of construction workers in the area on local communities.	99
Table 6-10: Assessment of impact of job seekers on local communities.	101
Table 6-11: Assessment of risk to safety, livestock, and damage to farm infrastructure.	101
Table 6-12: Assessment of impact of increased risk of grass fires.	102
Table 6-13: Assessment of the impacts associated with construction related activities	104
Table 6-14: Assessment of impact on farmland due to construction related activities	104
Table 6-15: Improve energy security and support renewable sector	107
Table 6-16: Assessment of employment and business creation opportunities	108
Table 6-17: Assessment of benefits associated with income generated for the affected landowners	108
Table 6-18: Assessment of benefits associated with socio-economic development contributions	109
Table 6-19: Visual impact and impact on sense of place	110
Table 6-20: Assessment of potential impact on property values	111
Table 6-21: Impact on tourism in the region	112



Table 6-22: Cumulative impacts on sense of place and the landscape	112
Table 6-23: Cumulative impacts on local services	114
Table 6-24: Cumulative impacts on local economy	114
Table 6-25: Social impacts associated with decommissioning	116
Table 6-26: Assessment of no-development option	116
Table 6-27: Relationship between land capability and agricultural sensitivity as given by the screening tool.	123
Table 6-28: Occupation of land by the development infrastructure.	124
Table 6-29: Soil erosion and degradation.	125
Table 6-30: Increased financial security for farming operations.	126
Table 6-31: Improved security against stock theft and other crime.	127
Table 6-32: Cumulative agricultural impacts.	128
Table 6-33: SANS10400-H site classification	137
Table 6-34: Construction phase soil disturbance, degradation by removal, mixing, compaction, etc due to the construction of infrastructure.	140
Table 6-35: Construction phase degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement).	141
Table 6-36: Construction phase erosion by wind and/or water of loosened soil in construction areas.	142
Table 6-37: Construction phase degradation of watercourses due to siltation (silt-loading) due to erosion from site.	143
Table 6-38: Construction phase dust pollution due to wind erosion from site.	144
Table 6-39: Operational phase reduction in the in extraction of non-renewable energy sources, such as coal, uranium, etc. due to the provision of renewable energy from the project	145
Table 6-40: Key Landscape Themes	148
Table 6-41: Proposed Project Heights Table	154
Table 6-42: KOP Motivation Table.	159
Table 6-43: Wind Blown Dust.	167
Table 6-44: Topsoil Loss.	167
Table 6-45: Buildings, structures and finishing	168
Table 6-46: Litter.	169
Table 6-47: Security Fencing.	169
Table 6-48: Soil Erosion.	170
Table 6-49: Security Light Spillage at Night.	170
Table 6-50: Un-necessary Roads.	171
Table 6-51: Construction of Turbines.	172
Table 6-52: Laydown, Site Camp and Batching Preferred Alternative	173
Table 6-53: BESS and Substation Infrastructure.	173
Table 6-54: Soil Sterilisation by Compaction.	174
Table 6-55: Static and moving turbines.	175
Table 6-56: Aircraft Warning Lights at Night.	175
Table 6-57: Security Light Spillage at Night.	176
Table 6-58: Old Turbine Blade Dumping.	178
Table 6-59: Abandoning of old structures.	178
Table 6-60: Abandoning of old turbine towers and blades.	179



Table 6-61: Intervisibility of combined wind farms during the day.	180
Table 6-62: Intervisibility of combined wind farms during the night.	181
Table 6-63: List of Sampling Sites and occupational status of dwellings table.	188
Table 6-64: Shadow Flicker operational phase impact Assessment.	200
Table 6-65: Temperature and Humidity measured onsite	206
Table 6-66: Impact Assessment: Construction of access roads.	233
Table 6-67: Impact Assessment: Construction traffic noises.	234
Table 6-68: Impact Assessment: Daytime WTG construction activities.	235
Table 6-69: Impact Assessment: Night-time WTG construction activities.	236
Table 6-70: Impact Assessment: Daytime operation of WTG considering the worst-case SPL.	237
Table 6-71: Impact Assessment: Night-time operation of WTG considering the worst-case SPL.	238
Table 6-72: Impact Assessment: Potential Decommissioning Noise Impacts.	239
Table 6-73: Impact Assessment: Potential Cumulative Noise Impacts.	240
Table 6-74: Small passerine bird data from Walked Transects for all six site visits for the 20 most abundant species.	248
Table 6-75: Summary of large terrestrial & raptor species recorded on the Drive Transects at the site.	249
Table 6-76: Summary of Incidental Observations of relevant bird species on the site.	250
Table 6-77: Target bird species recorded during Vantage Point counts at the site.	251
Table 6-78: Target bird species passage rates and estimated turbine collision fatalities at the site, calculated for up to 80 (now 42) turbines.	252
Table 6-79: Avifaunal Sensitivity mapping factors.	257
Table 6-80: Assessment of destruction of habitat during construction.	263
Table 6-81: Assessment of disturbance of birds during construction.	263
Table 6-82: Assessment of disturbance of birds during operational phase.	264
Table 6-83: Assessment of displacement of birds during operational phase.	265
Table 6-84: Assessment of bird collision with turbines during operational phase.	265
Table 6-85: Assessment of collision of birds with overhead lines during operational phase.	266
Table 6-86: Assessment of bird electrocution on overhead lines during operational phase.	266
Table 6-87: Assessment of disturbance of birds during decommissioning phase.	267
Table 6-88: Cumulative projects from REEA 2023 Q3 and local verification within 30km range of the proposed Kariaga WEFs.	267
Table 6-89: Cumulative impacts table.	270
Table 6-90: Based on this risk, we assessed the potential impacts on birds and made the following findings (based on updated layout with reduced WTG).	273
Table 6-91: Detected and potentially occurring bat species in the study area.	275
Table 6-92: Distance of proposed infrastructure from High and Medium-High sensitive areas under the latest layout.	282
Table 6-93: Roost disturbance or destruction.	283
Table 6-94: Destruction, degradation, and fragmentation of and displacement from foraging habitat.	285
Table 6-95: Bat fatalities from collision with turbines, and potential population declines.	286
Table 6-96: Decline or loss of bat ecosystem services.	287
Table 6-97: Cumulative impact on bats from multiple WEFs in the region.	288
Table 6-98: Species and habitat sensitivity ratings definitions.	299



Table 6-99: Results of the sensitivity rating / constraints assessment.	300
Table 6-100: Loss of species of special concern (SSC).	303
Table 6-101: Damage and disturbance of the habitats rated as Very High Sensitivity – Direct Impact.	303
Table 6-102: Loss of ecosystem services, and or habitats.	304
Table 6-103: Displacement of any animals because of any disturbance or habitat loss.	306
Table 6-104: Displacement of any animals because of any disturbance or habitat loss.	307
Table 6-105: Cumulative impacts on terrestrial biodiversity.	308
Table 6-106: Potential and observed amphibians within the study area.	314
Table 6-107: Results of the sensitivity rating / constraints assessment.	318
Table 6-108: The following direct impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and assessed against the layout.	321
Table 6-109: Damage and disturbance of the habitats rated as High Sensitivity associated with aquatic / alluvial features.	321
Table 6-110: Loss of ecosystem services, and or habitats that would result in habitat fragmentation.	323
Table 6-111: Impact on all watercourse through the possible increase in surface water runoff.	324
Table 6-112: Impact on localised surface water quality.	325
Table 6-113: Impacts on FEPA quinary catchment and Ecological Support Areas.	326
Table 6-114: Cumulative impacts on aquatic biodiversity.	327
Table 6-115: Artefacts identified during the field assessment development area.	336
Table 6-116: Palaeontological observations made during the field assessment for the proposed Grid Connection Infrastructure.	338
Table 6-117: Impact table for Cultural Landscape Heritage Resources impacted by the Kariega 4 WEF.	341
Table 6-118: Impact table for Archaeological Heritage Resources impacted by the Kariega 4 WEF.	343
Table 6-119: Impact table for Palaeontological Heritage Resources impacted by the Kariega 4 WEF.	344
Table 6-120: Traffic, construction and decommissioning phase impacts.	357
Table 6-121: Traffic, operational phase impacts.	358
Table 6-122: Traffic Cumulative impacts.	359
Table 7-1: Summary of the impacts have been assessed as part of the Kariega fBAR.	362
Table 7-2: Summary of the potential impacts associated with the proposed Kariega 4 WEF.	367
Table 7-3: Technical details for Kariega 4 WEF.	375



ANNEXURES

Annexure A, Details of the EAP (CV)

Annexure A1, Details of EAP-Dirk Pretorius CV

Annexure A2, Undertaking under oath or affirmation by the EAP

Annexure B, Correspondence with DFFE

Annexure B1, Correspondence with DFFE

Annexure B2, Pre-application meeting form & DFFE response

Annexure B3, DFFE comment dBAR 14-12-16-3-3-1-3019

Annexure C, Public Participation

Annexure C, PPP

Annexure C 1, PPP Report incl. I&AP

Annexure C 2, CRR

Annexure D, Specialist reports

Annexure D 1, Social Impact Assessment (2024)

Annexure D 2, Agricultural Compliance Statement (2024)

Annexure D 3, Geotechnical Assessment (2024)

Annexure D 4, Visual Impact Assessment (2024)

Annexure D 5, Flicker Impact Assessment (2024)

Annexure D 6, Noise Impact Assessment (2024)

Annexure D 7, Avifauna (Birds) Impact Assessment (2024)

Annexure D 8, Bats Impact Assessment (2024)

Annexure D 9, Terrestrial biodiversity Impact Assessment (2024)

Annexure D 10, Aquatic biodiversity Impact Assessment (2024)

Annexure D 11, Heritage Impact Assessment, including Archaeology, Palaeontology and Cultural Landscape (2024)

Annexure D 12, Traffic Impact Assessment (2024)

Annexure E, Screening Tool Reports

Annexure E1, DFFE Screening Tool Report

Annexure E2, DFFE Screening tool site verification

Annexure F, Project coordinates

Annexure G, EMPr

Annexure G1, EMPr Kariega 4 WEF



Annexure G2, EMPr Substation and BESS

Annexure H, Site photographs

Annexure I, Cumulative Projects within 30km

Annexure J, Other authorisations, Permits and confirmations

Annexure J1, SAHRA Comment

Annexure J2, Water Services Approval, Water Service Act and Water Supply By-Law

Annexure J3, CAA

Annexure J5, Land Claims Clearance

Annexure K1, WEFs in South Africa

Annexure L, Kariega 4 Map Book



NEMA requirements for Basic Assessment Reports		
Appendix 1	Content as required by NEMA	Section/Chapter
3(a)	(i) details of the EAP who prepared the report; and	Control sheet, Section 1.5, Annexure A
	(ii) details of the expertise of the EAP, including a curriculum vitae.	
(b)	the location of the activity, including-	Table 1-1, Chapter 4.
	(i) the 21-digit Surveyor General code of each cadastral land parcel;	
	(ii) where available, the physical address and farm name;	N/A
	(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 at an appropriate scale, or, if it is-	Section, 1.3, Chapter 4 and Chapter 7
	(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or	Chapter 4 and Annexure F
	(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	NA
(d)	a description of the scope of the proposed activity, including-	Chapter 4
	(i) all listed and specified activities triggered;	Section 2.2
	(ii) a description of the activities to be undertaken, including associated structures and infrastructure;	Chapter 4.
(e)	a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process; how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;	Chapter 2
(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;	Section 4.4
(g)	a motivation for the preferred site, activity and technology alternative;	Chapter 5
(h)	a full description of the process followed to reach the proposed preferred alternative within the site, including -	Chapter 5
	(i) details of all the alternatives considered;	Section 3.4, Section 3.5, Annexure C
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	
	(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;	Section 3.6, Annexure C
	(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Chapter 6
	(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 -	Chapter 6.
	(aa) can be reversed;	
	(bb) may cause irreplaceable loss of resources; and	
	(cc) can be avoided, managed or mitigated;	Chapter 3 Section 3.3.2
	(vi) the methodology used in identifying and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	
	(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;	Chapter 6
	(viii) the possible mitigation measures that could be applied and level of residual risk;	Chapter 6
	(ix) the outcome of the site selection matrix;	Chapter 5
	(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and	Chapter 5
	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Chapter 7



(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— (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;	Chapter 6
(j)	an assessment of each identified potentially significant impact and risk, including— (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 avoided, managed or mitigated;	Chapter 6
(k)	where applicable, a summary of the findings and impact management measures identified in 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 report;	Chapter 6 Annexure G
(l)	an environmental impact statement which contains— a summary of the key findings of the environmental impact assessment; 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 a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Chapter 7 Annexure L
(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;	Chapter 6 Annexure G
(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;	Chapter 6
(o)	a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 1.6
(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;	Chapter 7
(q)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	NA
(r)	an undertaking under oath or affirmation by the EAP in relation to— (i) the correctness of the information provided in the report; (ii) the inclusion of comments and inputs from stakeholders and interested and affected parties; and (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Annexure A
(s)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	NA
(t)	any specific information required by the competent authority; and	Annexure B1 and B2
(2)	any other matter required in terms of section 24(4)(a) and (b) of the Act.	NA



GLOSSARY OF TERMS

Basic Assessment Report	A basic report assessing the potential significant impacts of issues identified during scoping.
Environment	The surroundings (biophysical, social and economic) within which humans exist and that are made up of i. the land, water and atmosphere of the earth; ii. micro-organisms, plant and animal life; iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Impact Assessment (EIA)	A study of the environmental consequences of a proposed course of action. A systematic process of identifying, assessing and reporting environmental impacts associated with an activity and includes Basic Assessment and Scoping & Environmental Impact Reports
Environmental impact	An environmental change caused by some human act.
Environmental Management Programme (EMPr)	A document that provides procedures for mitigating and monitoring environmental impacts, during the pre-construction, construction, operation and decommissioning phases.
Public Participation Process	A process of involving the public to identify needs, address concerns, to contribute to more informed decision making relating to a proposed project, programme or development.
Wind Turbine	A wind turbine is a rotary device that extracts energy from the wind.

UNITS OF MEASUREMENT

≈	Approximately
ha	Hectares
kL	Kilolitre
km	kilometres
Km/h	Kilometre per hour
kV	Kilovolt
m	Metre
MW	Megawatts



ABBREVIATIONS

ACED	African Clean Energy Developments (Pty) Ltd
BA	Basic Assessment
BAR	Basic Assessment Report (dBAR= draft and fBAR=final)
BESS	Battery Energy Storage System
BW	Bidding Window
CAA	Civil Aviation Authority
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA	Critical Biodiversity Area
COP	Convention of the Parties
CRR	Comments and Response Report
DBNLM	Dr Beyers Naudé Local Municipality
DEA&DP	Department of Environmental Affairs and Development Planning (Western Cape)
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism (Eastern Cape)
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 (Act 73 of 1989)
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EMF	Environmental Management Framework
GN	Government Notice
I&APs	Interested and Affected Parties
IDZ	Industrial Development Zone
IEIM	Integrated Environmental Information Management
IPP	Independent Power Producer
IRP	Integrated Resource Plan
LM	Local Municipality
MTS	Main Transmission Substation
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (No. 25 of 1999)
NRTA	National Road Traffic Act (Act 93 of 1996)
NWA	National Water Act (Act 36 of 1998)
OHL	Overhead Transmission Line
PPP	Public Participation Process
RE	Renewable Energy
REDZ	Renewable Energy Development Zone
REFIT	Renewable Energy Feed-In Tariffs
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SAHRA	South African Heritage Resources Agency
SACNSP	South African Council for Natural Scientific Professions
SBDM	Sarah Baartman District Municipality
SDF	Spatial Development Framework
SKA	Square Kilometre Array
ToR	Terms of Reference
UNEP	United Nations Environmental Programme
WEF	Wind Energy Facility
WESSA	Wildlife and Environment Society of South Africa



1 INTRODUCTION AND BACKGROUND

1.1 Introduction

The applicant, Kariega Wind Farm (Pty) Ltd proposes to develop the up to 420 MW Kariega 4 Wind Energy Facility (WEF) near the town of Aberdeen in the Eastern and Western Cape Province. The Kariega 4 WEF is one of three WEFs which together form the Kariega WEF cluster (the others are Kariega 2 and 3, Figure 1-1, which are applied for through separate applications¹). The Kariega 4 WEF is applied for and assessed through this Basic Assessment process since it falls within the Beaufort West Renewable Energy Development Zone (REDZ) 11. EnviroAgri (Pty) Ltd (EnviroAgri) has been appointed by Kariega Wind Farm (Pty) Ltd to undertake the requisite Basic Assessment (BA) process for the proposed WEF as required in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA), as amended, on behalf of the applicant.

Important from the draft BAR to the final BAR the number of turbines were reduced from 50 to 42. Thus, although calculation and reference may still indicate 50 the number of turbines applied for are 42.

1.2 Location

The proposed Kariega 4 WEF is situated approximately 35km east of Aberdeen in the Eastern and Western Cape Province (Figure 1-2). It's located wholly in the Dr Beyers Naude Local Municipality in the Sarah Baartman District Municipality. The area for the proposed WEF development consists of several farm portions (Table 1-1) with directly adjacent farms provided in Table 1-2. The site can be accessed from the south via the R61, the road between Beaufort West and Aberdeen. On site access is mainly via unimproved gravel roads and jeep tracks although access can also be gained via a gravel road east of the site leading to Murraysburg.

Table 1-1: Farm details for Kariega 4 WEF.

Farm name	Portion	Farm no.	SG	Farm size (ha)	Infrastructure
SARELS RIVIER 141	RE	141	C05200000000014100000	4120	WEF
KEUNA 74	RE	74	C00100000000007400000	1789	WEF
KEUNA 74	1	74	C00100000000007400001	1776	WEF
KEUNA 74	2	74	C00100000000007400002	592	WEF
KEUNA 74	3	74	C00100000000007400003	600	WEF
TAFEL KOP 75	RE	75	C00100000000007500000	4023	Roads
TAFEL KOP 75	1	75	C00100000000007500001	2010	Roads
BEENKRAAL 90	RE	90	C00100000000009000000	4114	Roads
PRETORUIS KUIL 89	RE	89	C00100000000008900000	2262	Roads

¹ Kariega 2, 3 and 4 WEFs are applied for through a consolidated process, whilst Kariega 1 may be applied for at a later stage if current technical issues are resolved. Consequently, Kariega 1 may be mentioned and considered as part of feasibility studies undertaken of the Kariega WEF cluster.



KLIPDRIFT 73	RE	73	C00100000000007300000	1283	Roads
FARM 91	RE	91	C00100000000009100000	2968	Roads

Table 1-2: Adjacent Farm details for Kariega 4 WEF.

Farm name	Portion	Farm no.	SG
OORLOGSPOORT 85	2	85	C00100000000008500002
OORLOGSPOORT 85	1	85	C00100000000008500001
TULP LEEGTE 76	RE	76	C00100000000007600000
FARM 142	RE	142	C05200000000014200000
SARELS RIVIER 141	1	141	C05200000000014100001
HARMONIE 140	RE	140	C05200000000014000000
WALPLAATS 1	2	1	C0010000000000100002
WINDERMERE 271	RE	271	C00100000000027100000
GLEN CLIFF 272	RE	272	C00100000000027200000
75/2	2	75	C00100000000007500002
KLIPDRIFT 73	1	73	C00100000000007300001
KLIPDRIFT 73	2	73	C00100000000007300002
SAMBOKDOORNS 92	RE/4	92	C00100000000009200004
KOEDOES KOP 88	RE	88	C00100000000008800000
BASSONS HOEK 4	1	4	C0010000000000400001
71/1	1	71	C00100000000007100001
72/2	2	72	C00100000000007200002
72/4	4	72	C00100000000007200004

1.3 Project details and extent

The main and ancillary infrastructure components applied for include:

- Up to 42 wind turbines
- Access and facility roads
- Substation and Eskom Switching Station
- Operations and Maintenance (O&M) Complex
- Battery Energy Storage System (BESS)
- Medium Voltage (MV) Collector cables
- Construction Laydown area & Site Camp
- Batching plant and stockpile areas

The details of these components are described in detail in Section 4.2 of this report.



Note: The Kariega 4 WEF will likely connect to the national grid at the planned Aberdeen Collector Substation via a 132kV grid Overhead Transmission Line (OHL). This OHL route will only be established at a later stage since it requires significant technical input from Eskom network planners in terms of the existing and planned grid capacity. Thus, the proposed OHL will be assessed as part of a separate BA process in consideration of Eskom's on the preferred grid connection point and feasible route alternatives. Importantly, the entire extent of the Kariega 4 WEF falls within the Beaufort West REDZ 11 as well as the Eastern Strategic Transmission Corridor which means these areas are preferable for renewable energy developments as well as transmission lines and have been subject to high level Strategic Environmental Assessments (SEAs).

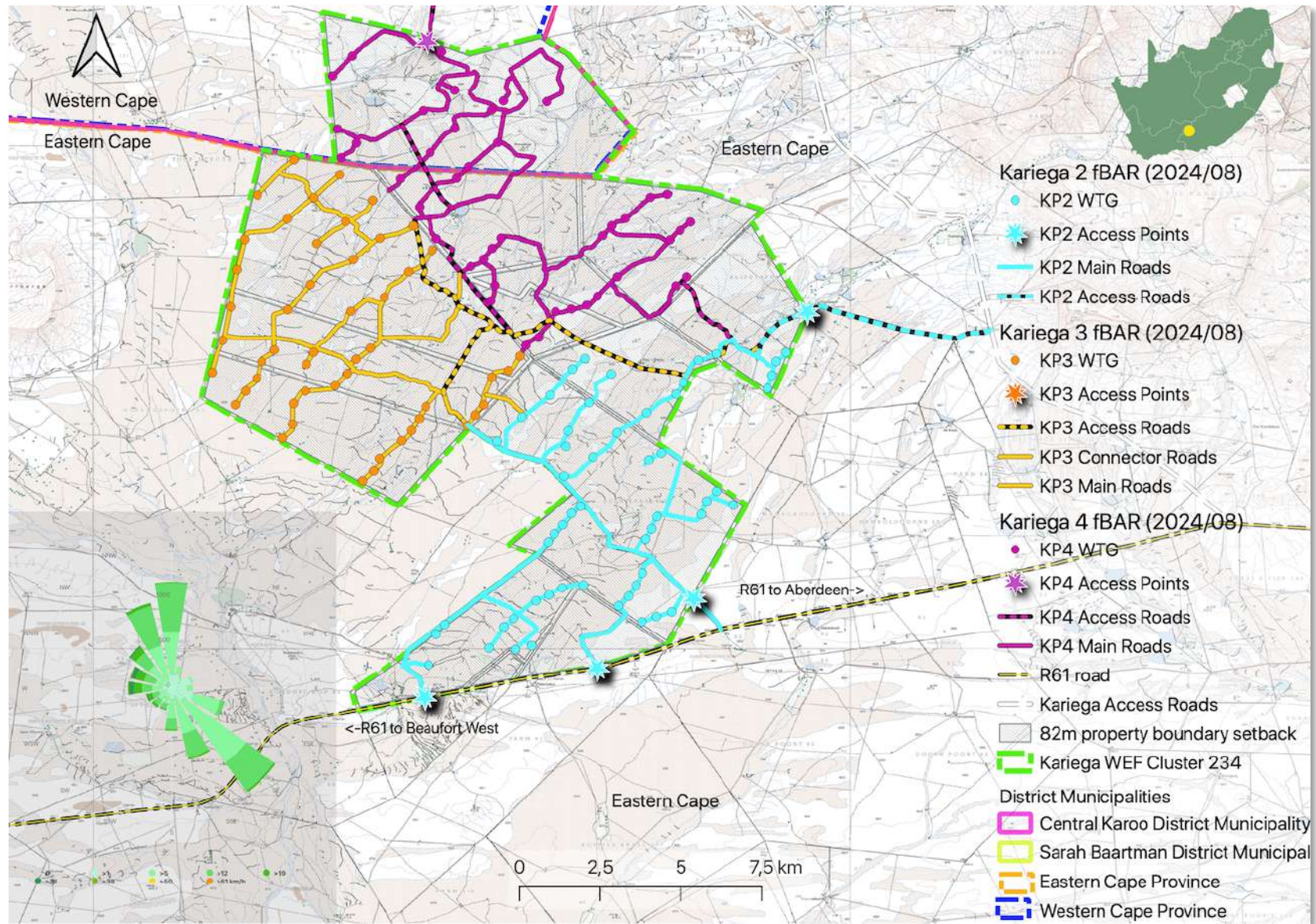
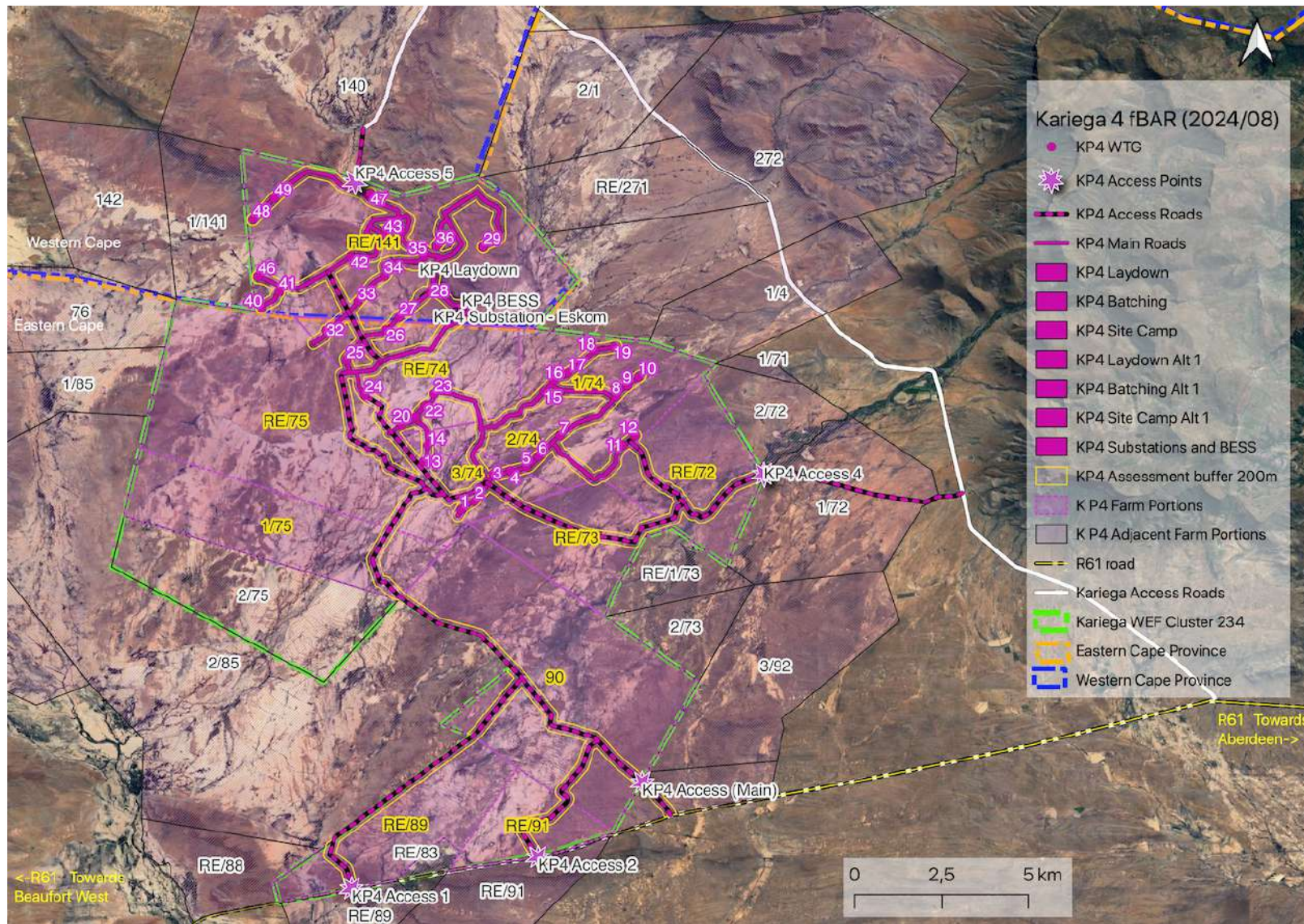


Figure 1-1: Kariega 2, 3 and 4 WEFs study area indicated by the green outline.



RR 01 fBAR-Kariega 4 WEF_20240911.docx



1.4 Report structure

In terms of the NEMA, the proposed project would typically trigger a suite of listed activities which require authorisation from the competent environmental authority. The competent authority is DFFE, and their decision will be based on the outcome of this BA process. The BA process entails several phases which are further detailed in Section 3.2.

The purpose of this BAR² is to set out and assess the environmental outcomes, impacts and residual risks of the proposed activity. Accordingly, the BAR includes the following chapters:

- Chapter 1
 - Introduces the project, assessment team and provides a summary of the main assumptions and limitations.
- Chapter 2
 - Outlines an analysis of the legal framework relevant to the project.
- Chapter 3
 - EIA methodology, detailing the phases of the BA process as well as the public participation process.
- Chapter 4
 - Project description.
- Chapter 5
 - Alternatives (none).
- Chapter 6
 - Baseline environment and assessment of the potential impacts on the environment that may be caused by the project.
- Chapter 7
 - Environmental Impacts Statement summarising the outcomes of the impact assessment and key issues and a
- Chapter 8
 - Conclusion and way forward in terms of the application for Environmental Authorisation.

Annexures to this report and include:

- Annexure A
 - Details on the Environmental Assessment Practitioners (EAP) who compiled this report.
- Annexure B
 - Correspondence with DFFE to date and relevant documents preceding this BA.
- Annexure C
 - Public participation process, including Comment and Response Report (CRR) and PPP proof.
- Annexure D
 - Specialist input, where this was submitted in a report format.
- Annexure E
 - DFFE Screening Tool Report.
- Annexure F
 - Project coordinates

² Appendix 1 of amended EIA Regulations (GN R982) of NEMA lists the content required in a Basic Assessment Report. This has been listed for cross checking purposes on the page following the table of contents.



- Annexure G
 - WEF EMPr
 - Substation and BESS EMPr
- Annexure H
 - Site photographs
- Annexure I
 - Cumulative Projects within 30km
- Annexure J, Other authorisations, Permits and confirmations
 - Annexure J1, ECHPRA and HWC final comments
 - Annexure J2, Water Services Approval
 - Annexure J3, CAA
 - Annexure J4, Land Claims Clearance
- Annexure K1, WEFs in South Africa
- Annexure L, Kariaga 4 Map Book

1.5 EIA Project Team

A team of experienced sub-consultants (specialists) and practitioners have contributed to this BA, Table 1-3 BA Project Team. CV of the EAP is attached in Annexure A. Should a CV of a Specialist be required it will be provided upon request from EnviroAgri.

Table 1-3: BA Project Team.

Specialist field	Name	Company
EAP	Dirk Pretorius	EnviroAgri
Agricultural	Johann Lanz	Johann Lanz
Avifauna	Jon Smallie	Wild Skies Ecological Services
Bats	Dr Caroline Lötter	Inkululeko Wildlife Services
Noise	Morné de Jager	EARS Enviro Acoustic Research
Landscape/Visual and Flicker	Stephen Stead	VRM Africa
Archaeological and Cultural Heritage	Jenna Lavin and Nic Wiltshire	CTS Heritage
Palaeontology	Dr John E. Almond	Natura Viva cc
Geotechnical	Iain Paton	Outeniqua Geotechnical Services
Biodiversity Terrestrial (incl. Plant and Animal Species)	Dr Brian Colloty	EnviroSci
Biodiversity Aquatic	Dr Brian Colloty	EnviroSci
Socio Economic	Tony Barbour and Schalk van der Merwe	Tony Barbour Environmental Consulting
Traffic	Iris Wink	iWink Consulting
RFI	Site confirmation by EAP	
CAA	Site confirmation by EAP	

1.5.1 Independence

The amended 2014 EIA Regulations pursuant to NEMA, provide general requirements for EAPs and specialists with the intention of reducing the potential for bias in the environmental process. The first requirement is that the EAP



should be independent (Regulation 13(1)(a) of GN R982, as amended). Neither EnviroAgri nor any of the sub-consultants are subsidiaries of *Kariega Wind Farm (Pty) Ltd*, nor is *Kariega Wind Farm (Pty) Ltd* a subsidiary to EnviroAgri. EnviroAgri and the sub-consultants do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed project.

1.6 Assumptions, Limitations and Gaps in Knowledge

In undertaking the investigation and compiling the BAR, the following has been assumed:

- The information provided by the applicant is accurate and unbiased, and no information that could change the outcome of the BA process has knowingly been withheld.
- The scope of this investigation is limited to assessing the environmental impacts associated with the proposed WEF and ancillary infrastructure as described in this report which includes cumulative impacts.
- Cumulative impacts assessed in this BAR speaks to the cumulative impacts as listed in Annexure I, Cumulative Project within 30km and Figure 3-3 have been considered in the cumulative impact assessment.
- Considering the scale of all the Kariega phases and other renewable energy developments in the area it's likely that there will be unintended consequences of these developments not identified in this assessment process, albeit positive or negative, and therefore an adaptative management approach will be pivotal to mitigate these impacts.
- It is assumed that the WEF layout identified by the developer represents a technically suitable and feasible site.
- It assumed that if Eskom does not grant relaxation to the safety setback from the proposed Gamma Grassridge powerline for turbine no. 1, 2, 3, 4, 5 and 11, it will not be constructed.
- It's assumed that the additional research study on the Camdeboo requested by ECPHRA to be undertaken prior to the development taking place will not have any specific bearing on the project design or layouts.
- The environmental impacts of the OHL infrastructure will be assessed in terms of an ensuing BA processes.
- The footprints have been assessed within development corridors specific to each infrastructure component to allow the developer to make on site adjustments in terms of detailed design prior to construction without changing the impact significance of the proposed component.
- The BA process is based on Best Practice Guidelines which were available at the time of writing this report.
- For this assessment, it is assumed the WEF will be constructed. If the WEF does not reach construction, the ancillary infrastructure will also not be constructed.
- The requisite permits and consents, including the Water Use Authorisation will be obtained by the applicant prior to the time such consents/permits are required, a Risk Assessment Matrix (RAM) will be undertaken for the WEF infrastructure which includes all ancillary infrastructure.
- Detailed design of the roads and culverts are not available during the BA process. It's assumed these will be designed to specifications that do not cause or increase erosion or degradation of the environment and account for stormwater management in accordance with industry best practice.
- Post decommissioning³ rehabilitation is not assessed as part of this BA process. NEMA 2014 EIA regulations (as amended) Listing notice 1 Activity 31 "*The decommissioning of existing facilities, structures or infrastructure for- (i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014*". Thus, in accordance with current environmental legislation it's

³ NEMA definition of "decommissioning" means to take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily recommissioned.



assumed that the decommissioning of the Kariega 4 WEF will be subject to a Basic Assessment prior to such decommissioning.

- This BA process is specific to the Kariega 4 WEF and thus no alternative power generation technologies e.g. solar PV, were assessed.
- The EMPr submitted with the final BAR will be final as are the plans included therewith. Further details on the implementation of the specific plans should be added by the respective responsible person(s) to indicate impact management actions to achieve the impact management outcomes of the EMPr.

Gaps and assumptions specific to specialist studies are provided in the specific reports, where relevant.

These assumptions, limitations and gaps in knowledge will not affect the EAPs assessment or findings of the proposed project.



2 LEGAL AND PLANNING CONTEXT

There are a host of legal and policy documents and guidelines to consider when undertaking such a project. These have been detailed in the sections that follow.

2.1 Relevant Legislation

An overview of the relevant legislation is provided in Table 2-1.

Table 2-1: Legislation considered in preparation of the BAR.

Legal Requirements		
Legislation considered	Relevant Organ of State / authority	Aspect of Project
National Environmental Management Act, Act No. 107 of 1998 (NEMA), as amended	Department of Forestry, Fisheries, and the Environment (DFFE) and Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), Eastern Cape Department of Environmental Affairs and Development Planning	Listed activities in terms of NEMA GN No R983, R984 and R985 in the Government Gazette of 4 December 2014 (as amended on 7 April 2017) are triggered and needs to be authorised (also see Table 2-2). Although the listed activities triggered requires a full scoping and EIR process to be followed the proposed development site is located within the Renewable Energy Development Zone (REDZ 11 Beaufort West) as per Government Notice 114, National Environmental Management Act, 1998 (Act No. 107 of 1998) and therefore on a Basic Assessment process has to be undertaken with a shortened 57-day decision making period by the competent authority.
National Environmental Management: Biodiversity Act, Act No. 10 of 2004 (NEMBA)	Department of Forestry, Fisheries, and the Environment (DFFE)	The act calls for the management of all biodiversity within South Africa and has specific reference to Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA). Wetland conservation is driven by the South African National Biodiversity Institute (SANBI), a requirement under NEMBA with special reference to wetlands and Freshwater Ecosystem Priority Areas (NFEPA). These areas have been avoided as far possible by the refined layouts.
Environmental Conservation Act, Act No. 73 of 1989 (ECA)	Department of Forestry, Fisheries, and the Environment (DFFE)	Noise impacts associated with the substation is generally confined to the construction phase and low-level noise “humming” during operation and negligible operational phase traffic. 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. Mitigation measures, are included in the BAR and EMPr. Also note the applicability of Western Cape Noise Control Regulations promulgated in Provincial Notice 200/2013, as it relates to Noise regulations.
National Water Act, Act No. 36 of 1998 (NWA)	Department of Water and Sanitation (DWS)	Section 21 of the NWA recognises water uses that require authorisation by DWS before they commence. Typical water uses associated with wind farms include: Section 21 (a) Taking water from a water resource for use during construction and operation; 21 (c) Impeding or diverting the flow of water in a watercourse, typically for construction of roads structures within watercourse; 21 (e) Engaging in a controlled activity identified as



		such in section 37(1) or declared under section 28(1) of the NWA such as dust suppression with treated sewage; Section 21 (i) Altering the bed, banks, courses or characteristics of a watercourse typically associated with construction of roads, bridges, pipelines, 21 (j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of the people. i.e. extraction of seep water from excavations for safe continuation of construction activities. The water use authorisation can be obtained in the form of either a General Authorisation (GA) or Water Use License (WUL). The GA/WUL will be obtained by the applicant prior to the time such licence is required. A Risk Assessment Matrix (RAM) will be undertaken of the relevant infrastructure and activities that constitute a water use. Applications will be initiated via the eWULAAS system once the risk matrix is finalised. No water use may begin without the appropriate authorisation.
National Environmental Management: Waste Act, Act No. 59 of 2008 (NEMWA)	Department of Forestry, Fisheries, and the Environment (DFFE) and Department of Economic Development, Environmental Affairs and Tourism (DEDEAT), Eastern Cape Department of Environmental Affairs and Development Planning	Waste management during construction, operation and decommissioning must be strictly undertaken in terms of NEWA. The Kariega WEF must protect the health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and undertake ecologically sustainable development. Moreover, should any national norms and standards for regulating the management of waste be applicable these must be adhered to. The project will also be held to the general principals of the waste hierarchy and will be responsible for undertaking specific waste management measures depending on the waste streams generated i.e. recyclable material, general waste and hazardous waste.
National Heritage Resources Act, Act No. 25 of 1999 (NHRA)	South African Heritage Resources Agency (SAHRA), and Eastern Cape Provincial Heritage Resources Authority (ECHRA) Heritage Western Cape (HWC)	The proposed footprint will exceed 300m in length and 5000m². Therefore, Section 38 of the NHRA is applicable. As such, a Heritage Impact Assessment including Archaeology, Palaeontology and cultural landscape have been undertaken as required by the NHRA. Comment on the project will be obtained from ECHRA, HWC and SAHRA during the PPP and appropriate mitigation measures have been included in the BAR and EMP.
Conservation of Agricultural Resources Act, Act No. 43 of 1983 (CARA)	Eastern Cape Department: Rural Development and Agrarian Reform Western Cape Department of Agriculture	The purpose of this Act is to ensure that natural agricultural resources of South Africa are conserved through maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of water sources, protecting vegetation, and combating weeds and invader plants. As such, as part of the BA process, recommendations were made to ensure that measures are implemented to maintain the agricultural production of land, prevent soil erosion, and protect any water bodies and natural vegetation on site. The holder of the EA with the relevant farmers should also ensure the control of any undesired aliens, declared weeds, and plant invaders listed in the regulation that may pose a problem because of the proposed project. The majority of the project footprint is of low agricultural sensitivity based on low land capability.



Subdivision of Agricultural Land Act, 70 of 1970 (SALA)	Department of Agriculture, Land Reform and Rural Development, Eastern Cape Western Cape Department of Agriculture	Where agricultural land is to be subdivided, approval from the Minister of Agriculture will be necessary in terms of the SALA.
National Road Traffic Act, Act No. 93 of 1996 (NRTA)	South African National Roads Agency Limited (SANRAL) Eastern Cape Department of Transport Western Cape Mobility Department	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. It's envisaged that several of the WEF components including wind turbine blades, towers, nacelles etc. will need to be transported via "abnormal loads".
The National Energy Act, Act No. 34 of 2008	Department of Energy (DoE)	One of the purposes of which The National Energy Act is to promote sustainable development of renewable energy infrastructure.
Astronomy Geographic Advantage Act, Act No. 21 of 2007 (AGA), and associated Regulations	Department of Science and Innovation (DSI)	In terms of Schedule D of the Regulations on the Protection of the Karoo Central Astronomy Advantage Areas (KCAAA)(GN 1411 of 15 December 2017), transmission lines located more than 50km away from the SKA Infrastructure Territory are exempt from requiring a permit from the DSI unless the operation of such infrastructure are found to cause interference with the SKA. The proposed infrastructure is more than 50km away from the SKA Infrastructure Territory and is thus exempt from the AGA permitting requirements. Specific KCAAA requirements for transmission of power include: 5. Additional conditions for distribution or transmission power systems (1) In addition to the conditions in regulation 3 of these regulations, no person may construct or install any new overhead distribution or transmission power systems with a voltage rating – (2) (a) equal or greater to sixty-six thousand Volts (66 000 V) within sixteen km of SKA Infrastructure Territory; and (b) less than sixty-six thousand Volts (66 000 V) within six km of SKA Infrastructure Territories. Despite compliance with sub-regulation (1), the distribution or transmission power system may not cause electromagnetic interference to SKA Infrastructure Territories which exceeds the protection levels prescribed in the Radio Astronomy Protection Levels Regulations, 2012. No potential red flags for RFI or EMI exists within the development area and no sensitivity has been identified by the DFFE screening tool report.
Civil Aviation Act, 13 of 2009	Civil Aviation Authority (CAA)	In terms of the Civil Aviation Regulations, 2011 published under the Civil Aviation Act, 13 of 2009, the CAA must give approval for the erection of any structure in the vicinity of an aerodrome which constitutes an obstruction or potential hazard to aircraft or which will affect the performance of the radio navigation or instrument landing systems, e.g. a wind turbine. Thus, it is a legal requirement to obtain prior approval for an obstacle in terms of the Aviation Act.
Mineral and Petroleum Resources Development Act, 28 of 2002	Department of Mineral Resources (DMR)	Where mineral and/or petroleum rights are held in respect of land on which a RE development is to take place, the developers are required to submit applications to the DMR for approval in terms of section 53 of the Mineral and Petroleum Resources Development Act, 28 of 2002.



National Environmental Management: Air Quality Act, Act No. 39 of 2004)(NEMAQA)	DFFE and delegated authority	Dust generated during all phases of the proposed activities must comply with NEMAQA in terms of the National Dust Control Regulations, promulgated in Government Notice N No. R. 827 of 1 November 2013. These regulations prohibit a person from conducting any activity in such a way as to give rise to dust in such quantities and concentrations that the dust, or dust fallout, has a detrimental effect on the environment, including human health.
Occupational Health and Safety Act, 1993	Department of Labour (DoL)	The Major Hazard Installation Regulations (MHI Regulations) were promulgated in GN R 692 of 30 July 2001. A “major hazard installation” means an installation: a) where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or b) where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident. The quantities and type of substances are prescribed in the General Machinery Regulation 8 and its Schedule A, on notify-able substances. A “major incident” means an occurrence of catastrophic proportions, resulting from the use of plant or machinery, or from activities at a workplace. The potential for a major incident is determined through a risk assessment which may have to be undertaken for the proposed BESS depending on the chosen battery technology used.
Restitution of Land Rights Act, 22 of 1994	Commission on restitution of Land Rights	Confirmation on whether there are any land claims is required from the regional land claims commissioner specific to each property.
Spatial Planning and Land Use Management Act, 16 of 2015 (SPLUMA)	Dr Beyers Naude Local Municipality / Sarah Baartman District Municipality, Eastern Cape Beaufort West Local Municipality / Central Karoo District Municipality, Western Cape	Land use planning authorisation based on subdivision of land; and/or change of use of the land.

2.2 Listed Activities in terms of NEMA

NEMA is the primary legislation tasked with the management of environmental resources and, accordingly, identifies activities that require authorisation prior to commencement. Such activities listed in the amended 2014 EIA Regulations (GN R982, as amended) are detailed in Table 2-2.

Table 2-2: Listed activities triggered by the proposed project and applied for.

Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 1 of the EIA Regulations, 2014 as amended	Describe the portion of the proposed project to which the applicable listed activity relates. Ensure to include thresholds/area/footprint applicable.
11	The development of facilities or infrastructure for the transmission and distribution of electricity-	Two on site substations adjacent each other (wind farm substation and Eskom substation) would be required for the Kariega 4 WEF which would step up power from 33 kV to 132



	(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or ~~(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;~~ ~~excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is-~~ ~~(a) temporarily required to allow for maintenance of existing infrastructure;~~ ~~(b) 2 kilometres or shorter in length;~~ ~~(c) within an existing transmission line servitude; and~~ ~~(d) will be removed within 18 months of the commencement of development.~~	kV. A BESS (export Capacity of up to 250MW, Storage Capacity 1000MWh) will be constructed adjacent the substations. Turbines would be linked to each other and the wind farm substation via subterranean medium voltage cables (~33 kV). The development is outside an urban area and none of the exclusions apply.
12	The development of- ~~(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or~~ (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; ~~(b) in front of a development setback; or~~ (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; - Excluding- ~~(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;~~ ~~(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;~~ ~~(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;~~ ~~(dd) where such development occurs within an urban area;~~ ~~(ee) where such development occurs within existing roads, road reserves or railway line reserves; or~~ ~~(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.~~	Drainage lines are scattered across the proposed site. The proposed roads, underground powerlines and/ or other infrastructure are to cross several drainage lines and be within 32 m thereof. None of the exclusions apply.
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 infilling or depositing of any material of more than 10 m³ into a watercourse will be triggered with the construction of internal service roads or cables across drainage lines. None of the exclusions apply.



	but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	
24	The development of a road- (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road- (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.	Permanent roads up 20m wide (with no formal reserve) for crawler cranes may be required for the proposed WEF. Construction road width of ~12m road surface width (i.e. wider than 8 meters), 1m for side drains either side, 6m one side of the road surface for MV cable trenches and associated disturbance
28	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: (i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	The proposed farm portions on which the project is proposed are being used for agriculture, i.e. livestock grazing and game farming. The development will occur outside urban areas and is significantly larger than 1 ha. The development type is classified as mixed and industrial and include wind turbines, batching plants, substations and BESS.
56	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 reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.	Some sections of existing roads are wider than 8m and may be widened to up to 20m wide or lengthened by more than 1km. The roads are all outside urban areas.
Activity No(s):	Provide the relevant Scoping and EIA Activity(ies) as set out in Listing Notice 2 of the EIA Regulations, 2014 as amended	Describe the portion of the proposed project to which the applicable listed activity relates. Ensure to include thresholds/area/footprint applicable.



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, ~~excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs—~~ (a) ~~within an urban area; or~~ (b) ~~on existing infrastructure.~~	The wind farm would have a maximum generation capacity of up to 420 MW. None of the exclusions apply.
4	The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	The approximate area of 5 ha has been designated for a BESS within the substation and O&M Complex. The BESS (export Capacity of up to 250MW, Storage Capacity 1000MWh) would likely use lithium-ion technology (or other more efficient technology that may be available at the time of construction). The BESS would contain material, e.g. lithium salts, that would be classified as “dangerous good” and these are housed in above ground containers. Lithium-ion batteries pose characteristics listed in the SANS 10234, supplement 2008, Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards. Diesel fuel will be stored on site at the construction camp in tanks of $\pm 23\text{m}^3$ each of which there would be at least three per site, i.e. $\pm 69\text{m}^3$. Diesel poses characteristics listed in the SANS 10234, supplement 2008, Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards. Batching plants will store cement which can be classified as “dangerous good” since it poses characteristics listed in the SANS 10234, supplement 2008, Hazard Statements in section 4.2.3, namely health hazards or environmental hazards.
15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	Physical alteration of undeveloped land for the WEF would take place and would require clearing of indigenous vegetation. The total area to be cleared is expected to be approximately 271,83 ha (of which 138ha is roads which are excluded from this activity).
Activity No(s):	Provide the relevant Basic Assessment Activity(ies) as set out in Listing Notice 3 of the EIA Regulations, 2014 as amended	Describe the portion of the proposed project to which the applicable listed activity relates. Ensure to include thresholds/area/footprint applicable.
4	The development of a road wider than 4 metres with a reserve less than 13,5 metres. a. Eastern Cape i. Outside urban areas:	Road width of 15-20m wide, 12m road surface width, 1m for side drains either side, 6m one side of the road surface for MV cable trenches and associated disturbance (topsoil, subsoil and vehicle movement). No formal road reserve will be proclaimed.



	~~(aa) A protected area identified in terms of NEMPAA, excluding disturbed areas;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(dd) Sites or areas identified in terms of an international convention;~~ (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(ff) Core areas in biosphere reserves;~~ ~~(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas;~~ ~~(hh) Areas seawards of the development setback line or within 1 kilometre from the high water mark of the sea if no such development setback line is determined; or~~ ~~(ii) In an estuarine functional zone, excluding areas falling behind the development setback line; or~~ ii. Inside urban areas: ~~(aa) Areas zoned for use as public open space;~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; or~~ ~~(cc) Seawards of the development setback line or within urban protected areas.~~ i. Western Cape ~~i. Areas zoned for use as public open space or equivalent zoning;~~ ii. Areas outside urban areas; (aa) Areas containing indigenous vegetation; ~~(bb) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined; or~~ iii. Inside urban areas: ~~(aa) Areas zoned for conservation use; or~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority.~~	Identified CBA as per 2019 Eastern Cape Biodiversity Conservation Plan (ECBCP) and areas of indigenous vegetation in the Western Cape.
10	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. i. Western Cape	The approximate area of 5 ha has been designated for a BESS within the substation and O&M Complex. The BESS (export Capacity of up to 250MW, Storage Capacity 1000MWh) would likely use lithium-ion technology (or other more efficient technology that may be available at the time of construction). The



	~~i. Areas zoned for use as public open space or equivalent zoning;~~ ~~ii. All areas outside urban areas; or~~ ~~iii. Inside urban areas:~~ ~~(aa) Areas seawards of the development setback line or within 200 metres from the high water mark of the sea if no such development setback line is determined;~~ ~~(bb) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined; or~~ ~~(cc) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined.~~	BESS would contain material, e.g. lithium salts, that would be classified as “dangerous good” and these are housed in above ground containers. Lithium-ion batteries pose characteristics listed in the SANS 10234, supplement 2008, Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards. This activity will take place outside urban areas. Not applicable in terms of Eastern Cape specific areas.
12	The clearance of an area of 300 square metres or more of indigenous vegetation ~~except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.~~ a. Eastern Cape ~~i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;~~ ~~ii. Within critical biodiversity areas identified in bioregional plans;~~ ~~iii. Within the littoral active zone or 100 metres inland from the high water mark of the sea, whichever distance is the greater,~~ ~~excluding where such removal will occur behind the development setback line on erven in urban areas;~~ ~~iv. Outside urban areas, within 100 metres inland from an estuarine functional zone; or~~ ~~v. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.~~ i. Western Cape ~~i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;~~ ~~ii. Within critical biodiversity areas identified in bioregional plans;~~ ~~iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater,~~ ~~excluding where such removal will occur behind the development setback line on erven in urban areas;~~ ~~iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned~~	Some internal roads will cross a watercourse mapped as freshwater CBA in terms of the 2019 ECBCP and 2017 Western Cape Biodiversity Spatial Plan (WCBSP). During the construction of these roads more than 300m² of indigenous vegetation will be cleared. None of the exclusions apply.



	open space, conservation or had an equivalent zoning; or ~~v. On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner, or a Spatial Development Framework adopted by the MEC or Minister.~~	
14	The development of- ~~(i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or~~ (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs (a) within a watercourse; ~~(b) in front of a development setback; or~~ (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; ~~excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.~~ a. Eastern Cape i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) World Heritage Sites;~~ ~~(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(ee) Sites or areas identified in terms of an international convention;~~ (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(gg) Core areas in biosphere reserves;~~ ~~(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;~~ ~~(ii) Areas seawards of the development setback line or within 1 kilometre from the high water mark of the sea if no such development setback line is determined; or~~ ~~(jj) In an estuarine functional zone, excluding areas falling behind the development setback line; or~~ ii. Inside urban areas: ~~(aa) Areas zoned for use as public open space;~~	The WEF will require infrastructure with a physical footprint exceeding 10m² in or within 32m of a watercourse drainage features, ephemeral washes or streams present within the project site. The WEF is located within areas mapped as CBA and ESA as identified in the 2019 ECBCP and 2017 WCBSP, and falls outside of an urban area. The ESA are relevant since the ECBCP 2019 views ESA as areas which provide ecosystem services. None of the exclusions apply.



	~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority, zoned for a conservation purpose; or~~ ~~(cc) Areas seawards of the development setback line.~~ i. Western Cape i. Outside urban areas: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) World Heritage Sites;~~ ~~(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(ee) Sites or areas listed in terms of an international convention;~~ (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(gg) Core areas in biosphere reserves; or~~ ~~(hh) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined.~~	
18	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. a. Eastern Cape i. Outside urban areas: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(dd) Sites or areas identified in terms of an international convention;~~ (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(ff) Core areas in biosphere reserves;~~ ~~(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;~~ ~~(hh) Areas seawards of the development setback line or within 1 kilometre from the high water mark of the sea if no such development setback line is determined;~~ (ii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined;	Existing farm roads within the WEF site will be widened to up to 20m or lengthened by more than 1km. The project site is located in the Eastern Cape and Western Cape, outside of an urban area, and some of the road sections will cross CBAs in terms of 2019 ECBCP, contain natural vegetation and will be in or within 100m of the edge of a watercourse.



	~~(jj) An estuarine functional zone, excluding areas falling behind the development setback line; or~~ ~~(kk) A watercourse; or~~ ii. Inside urban areas: ~~(aa) Areas zoned for use as public open space; or~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.~~ i. Western Cape ~~i. Areas zoned for use as public open space or equivalent zoning;~~ ii. All areas outside urban areas: ~~(aa) Areas containing indigenous vegetation;~~ ~~(bb) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined; or~~ iii. Inside urban areas: ~~(aa) Areas zoned for conservation use; or~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority.~~	
23	The expansion of- ~~(i) dams or weirs where the dam or weir is expanded by 10 square metres or more; or~~ ~~(ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs-~~ ~~(a) within a watercourse;~~ ~~(b) in front of a development setback adopted in the prescribed manner; or~~ ~~(c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse;~~ ~~excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.~~ a. Eastern Cape i. Outside urban areas: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(dd) Sites or areas identified in terms of an international convention;~~ ~~(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;~~ ~~(ff) Core areas in biosphere reserves;~~	Existing road infrastructure within the development footprint will be expanded upon. The road infrastructure cross freshwater CBAs in terms of 2019 ECBCP and 2017 WCBSP, where associated infrastructure (e.g. culverts) will be expanded upon in or within 32m of a watercourse.

	~~(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;~~ ~~(hh) Areas seawards of the development setback line or within 1 kilometre from the high water mark of the sea if no such development setback line is determined; or~~ ~~(ii) An estuarine functional zone, excluding areas falling behind the development setback line; or~~ ~~ii. Inside urban areas:~~ ~~(aa) Areas zoned for use as public open space; or~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.~~ i. Western Cape i. Outside urban areas: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) World Heritage Sites;~~ ~~(dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;~~ ~~(ee) Sites or areas listed in terms of an international convention;~~ ~~(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;~~ ~~(gg) Core areas in biosphere reserves; or~~ ~~(hh) Areas on the estuary side of the development setback line or in an estuarine functional zone where no such setback line has been determined.~~	

2.2.1 DFFE Screening Tool

Government Notice 960, gazetted on 05 July 2019, in accordance with the NEMA EIA Regulations 2014 (as amended) requires that a national web based environmental screening tool is used to produce a report that should be submitted with an EA application to the DEA⁴ from 05 October 2019 and onwards (i.e., 90 days following the date of publication of this notice).

A screening tool report undertaken at inception of the project and site verification report is appended in Annexure E. These reports show, on a high level, the site's sensitivity to the proposed development based on different environmental themes (including, inter alia, aquatic ecology, terrestrial ecology, heritage) and identifies assessment protocols that must be undertaken depending on the environmental theme's sensitivity rating within the development site.

⁴ DEA is now referred to as DFFE effective 1 April 2021.



Assessment protocols that set out 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” were Gazetted on 20 March 2020. These protocols in terms of reporting of identified environmental themes were met in terms NEMA, as listed below:

1. Agricultural Impact Assessment - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on agricultural resources.
2. Landscape/Visual Impact Assessment- No specific assessment protocol has been prescribed.
3. Archaeological and Cultural Heritage Impact Assessment - No specific assessment protocol has been prescribed.
4. Palaeontology Impact Assessment - No specific assessment protocol has been prescribed.
5. Terrestrial Biodiversity Impact Assessment - protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity.
6. Aquatic Biodiversity Impact Assessment - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity
7. Avian Impact Assessment - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20 MW or more.
8. Civil Aviation Assessment - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on civil aviation installations
9. Defence Assessment - protocol for the specialist assessment and minimum report content requirements for environmental impacts on defence installations
10. Noise Impact Assessment - Protocol for specialist assessment and minimum report content requirements for noise impacts
11. Flicker Assessment - No specific assessment protocol has been prescribed.
12. Traffic Impact Assessment- No specific assessment protocol has been prescribed.
13. Geotechnical Assessment - No specific assessment protocol has been prescribed.
14. Socio-Economic Assessment - No specific assessment protocol has been prescribed.
15. Plant Species Assessment - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species
16. Animal Species Assessment - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species

2.3 Relevant Policies and plans

South Africa’s Constitution (1997), together with the policies and plans indicated, have been key in developing and directing South Africa’s renewable energy industry. These policies and plans include:

- White paper in the Energy Policy of the Republic of South Africa (1998)
- White Paper on Renewable Energy (2003)
- National climate Change Response Policy (NCCRP), 2011
- The National Development Plan (NDP) 2030
- Integrated Energy Plan (IEP), 2016
- Integrated Resource Plan (IRP) for Electricity 2010 – 2030
- New Growth Path (NGP) Framework, 2010
- National Infrastructure Plan (NIP) of 2012



Specific to the Eastern Cape Province, Dr Beyers Naude Local Municipality and Sarah Baartman District Municipality the following plans and documents provide direction on the projects such as the proposed Kariega WEF, these include:

- Eastern Cape Provincial 2030 Draft Development Plan (PDP), 2014
- Eastern Cape Provincial Growth and Development Program
- Eastern Cape Sustainable Energy Strategy 2012
- Eastern Cape Climate Change Response Strategy (2011)
- Eastern Cape Environmental Management Bill (Department of Economic Development, Environmental Affairs and Tourism, 2019)
- Eastern Cape Biodiversity Conservation Plan (2019)
- Dr Beyers Naude Municipality Spatial Development Framework (SDF) Final Report (2021)
- Sarah Baartman District Municipality Draft Integrated Development Plan for 2022/2027 (2021/2022)
- Dr Beyers Naude Municipality Integrated Development Plan 2020/ 2021

Specific to the Western Cape Province, Beaufort West Local Municipality and Central Karoo District Municipality, the following plans and documents provide direction on the projects such as the proposed Kariega WEF, these include:

- Central Karoo District Municipality IDP 2023/2024
- Central Karoo District Municipal Spatial Development Framework, 2019
- Beaufort West Municipality Draft Amendment IDP 2024-2025
- Beaufort West Municipal Spatial Development Framework (SDF) 2023
- Western Cape Infrastructure Framework (WCIF)(2013)
- Western Cape Green Economy Strategy (2013)
- Western Cape Climate Change Response Strategy: Vision 2050 (2022)
- Western Cape Provincial Spatial Development Framework (2014)
- Western Cape Provincial Strategic Plan (2014)

2.4 Relevant Guidelines

This BA process is informed by the series of national Environmental Guidelines where applicable and relevant:

- EIA Guideline for Renewable Energy Projects (DEA, 2015).
- Integrated Environmental Information Management (IEIM), Information Series 5: Companion to the NEMA EIA Regulations of 2010 (DEA, 2010).
- IEIM, Information Series 2: Scoping (Department of Environmental Affairs and Tourism (DEAT), 2002).
- IEIM, Information Series 3: Stakeholder Engagement (DEAT, 2002).
- IEIM, Information Series 4: Specialist Studies (DEAT, 2002).
- IEIM, Information Series 11: Criteria for determining Alternatives in EIA (DEAT, 2004).
- IEIM, Information Series 12: Environmental Management Plans (DEAT, 2004).
- IEM Guideline Series 7: Public Participation in the Environmental Impact Assessment Process (DEA, 2012)
- Birds and Wind-Energy Best-Practice Guidelines: Third Edition (BirdLife SA and EWT, 2015).
- Environmental, Health, and Safety Guidelines for Wind Energy (World Bank Group, 2015).
- National Biodiversity Offset Guideline, June 2023
- Guidelines for Heritage Impact Assessments, 2015
- Public Participation guidelines in terms of NEMA EIA Regulations, DFFE 2017



- Guideline on Need and Desirability, Version 2, DFFE 2017

The following guidelines from the Department of Environmental Affairs and Development Planning (Western Cape) (DEA&DP) were also taken into consideration:

- Guideline for involving biodiversity specialists in EIA process (Brownlie. 2005).
- Guideline for involving heritage specialists in the Environmental Impact Report process (June Winter & Baumann, 2005).
- Guideline for involving visual and aesthetic specialists in the Environmental Impact Report process (Oberholzer.2005).
- Guideline for Environmental Management Plans (Lochner, 2005).
- Guideline for determining the scope of specialist involvement in EIA Processes (2005).
- Guideline for the review of specialist input into the EIA Process (June 2005).
- Guideline on Alternatives, EIA Guideline and Information Document Series. (DEA&DP, 2011).
- Guideline on Need and Desirability, EIA Guideline and Information Document Series. (DEA, 2012).
- Guideline on Public Participation, EIA Guideline and Information Document Series. (DEA&DP, 2011)

This BA process is aligned to a series of international guidelines and frameworks including:

- IFC Environmental, Health and Safety Guidelines for Wind Energy (2015)
- United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)
- The Equator Principles IV (October 2020)
- Kyoto Protocol, 1997
- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (January 2012)
- IFC Sustainable Development Goals
- World Bank Environmental and Social Framework
- World Bank Group Environmental, Health, and Safety Guidelines

3 EIA METHODOLOGY

As outlined in Figure 3-1, there are two distinct phases in the BA process, namely Pre-Application Phase, and the BAR Phase. A description of the activities which have been, and will be, undertaken during each phase is provided in the following sections. Note that this report covers the second phase, viz. the BAR Phase.

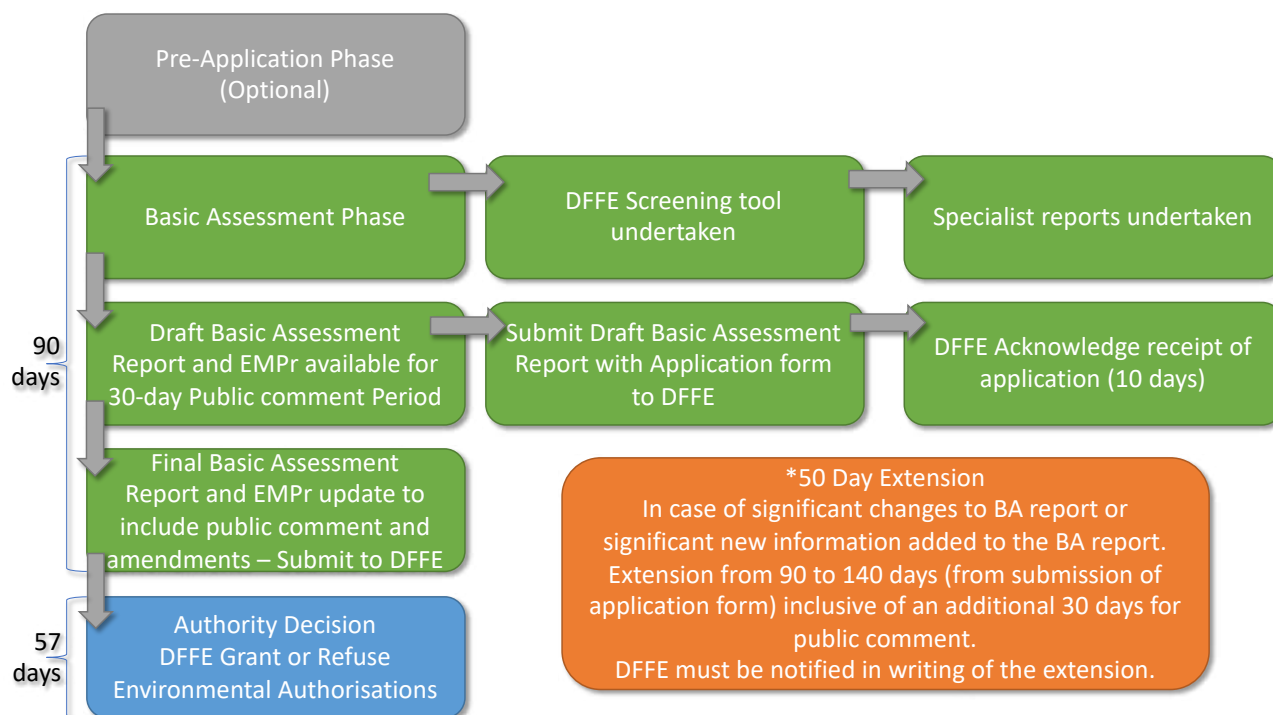


Figure 3-1: The BA process in terms of NEMA.

As illustrated in Figure 3-1, only one stage of public participation is included in the BA process, i.e., comment period on the draft BAR. More information on the Public Participation Process (PPP) is included in Section 3.4.

3.1 The Pre-Application Phase

The pre-application phase included a meeting with DFFE and site visits by the EAP to familiarise them with the site and to allow for a rapid site survey. The EAP also undertook site verification against the screening tool report for Kariega 4 WEF. All specialist studies were concluded including the requisite bird and bat monitoring. All the properties in question were subject to rigorous specialist investigations and environmental assessments which provide a notable amount of baseline information to be called on in this BAR. The facility design went through numerous updates and refinements based on specialist findings and technical considerations (currently at revision eight of the optimised layout). Information was also gathered from previous EIAs and BAs undertaken for WEFs in the area with specific cognisance of comments raised by I&APs and stakeholder in context of the locality. Site notices were put up on site and in Aberdeen requesting potential I&APs to register on the Kariega WEF database to engage on the BA process going forward. No pre-application BID or BAR was released given the amount of consultation undertaken in the area on other WEFs in recent years (five BAs for WEFs adjacent to the Kariega properties during 2022-2023).

3.2 BAR Phase

The objective of the basic assessment process is to, through a consultative process -



- a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;
- b) identify the alternatives considered, including the activity, location, and technology alternatives;
- c) describe the need and desirability of the proposed alternatives;
- d) through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine –
 - i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
 - ii) 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;
- e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to identify and motivate a preferred site, activity and technology alternative;
- i) identify suitable measures to avoid, manage or mitigate identified impacts; and
- ii) identify residual risks that need to be managed and monitored.

Various methods and sources were utilised to identify the potential social and environmental aspects associated with the proposed project and to develop the Terms of Reference (ToRs) for the specialist studies. The sources of information for the preparation of this report include, inter alia, the following:

- Project description;
- Collection of information specific to the project, as provided by the applicant;
- Basic methodology for construction of the various project components;
- Basic methodology during operations and decommissioning;
- Expected timeframe for project development;
- Maps and figures, outlining the proposed facilities;
- Technical information relating to design;
- Other relevant BARs/ EIRs prepared for BAs/EIAs undertaken in the area;
- Environmental baseline literature and desktop spatial surveys for this site and surrounding areas;
- Environmental baseline surveys for this site and surrounding areas from site visits by specialists;
- Previous WEF EIAs in the country and specific location;
- Consultation with the project team (including specialists); and
- Consultation with I&APs, including authorities.

An application form for the project will be submitted to DFFE (to register the project on the Department's databases) along with the final BAR which was circulated for a +30-day public comment period. All comments received are recorded and responded to in a Comments and Response section within the Public Participation Report (Annexure C). The BAR will be updated to address I&AP comments, where appropriate. The final BAR will be submitted to DFFE



for decision making, no later than 90 days from the receipt of the application form. The competent authority must then, **within 57 days⁵** of receipt of the final BAR and EMPr, in writing –

- (a) Grant environmental authorisation in respect of all or part of the activity applied for; or
- (b) Refuse environmental authorisation.

Summary of the key dates of the BAR process:

- Site visit - 13 to 16 April 2023 (Complete)
- Placement of Site notices -13 to 16 April 2023 (Complete)
- Advertisement in Graaff-Reinet advertiser (local) newspaper 13 June 2024 and Die Burger (regional) newspaper - 18 June 2024
- Lodging of Draft BAR at Aberdeen Public Library and on Dropbox - 18 June 2024
- Notification of I&APs and state departments of availability of draft BAR - 18 June 2024
- PPP officially starts on 19 June 2024
- Public Open house meeting Aberdeen Library - 25 June 2024
- Last day to submit comment on draft BAR - 19 July 2024 (31 days)
- Submit Final BAR to DFFE - ±16 July 2024
- DFFE provide decision on application (57 days) - September 2024
- Notification of registered I&APs of DFFE decision and appeal process - upon receipt of DFFE decision

3.3 Methodology

3.3.1 Specialist Assessments

To provide a scientific assessment that is transparent and robust, a clear methodology is required. Although each specialist required a methodology that was specific to their investigation (detailed in their reports in Annexure D), they were each given the following Terms of Reference (ToR):

- Undertake a site investigation to determine the *status quo* and identify any sensitive features or no-go areas;
- Provide datafiles of all sensitive features;
- Assess all proposed site alternatives within a 300m buffer⁶ associated with the proposed grid connection infrastructure;
- Make use of the EnviroAgri Impact Assessment Methodology (explained below in Section 3.3.2) when assessing impacts for all alternatives proposed as part of the proposed OHL, as well as cumulative impacts (detailed below in Section 3.3.3);
- Provide a detailed description of appropriate mitigation measures that can be adopted to reduce or avoid negative impacts and improve positive impacts for each phase of the project. Indicate the level of significance of impacts pre- and post-mitigation;
- Provide a summary of succinct and practical recommendations based on mitigation measures identified to form the basis of environmental authorisation requirements, should the development be authorised;
- Comply with the content requirements for specialist reports listed in Appendix 6 of the 2014 EIA Regulations (GN R982 of 2014, as amended); and

⁵ The WEF falls entirely within the Beaufort West REDZ 11 therefore DFFE has **57 days** to issue their decision on the application.

⁶ A 300m buffer area was assessed by the EAP and specialists to allow for siting of infrastructure prior to construction.

- Comply with procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the NEMA, 1998, when applying for environmental authorisation (GN R320, of 20 March 2020).
- The comply with the DFFE protocols as per the Screening tool reports.
- Sign standard certified specialist declaration of interest and undertaking of oath.

3.3.2 Assessment Methodology

The methodology used by EnviroAgri to undertake the assessment of impacts, i.e. to identify, assess, and rank the impact of the proposed development activities, is based on a culmination of the NEMA 2014, EIA regulations (Appendix 1, as amended Table 3-1), as well as the IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) guide on the production of assessments (IPBES, 2018). The objective of the methodology is to allow the assessor (EAP) to undertake an impact assessment which culminates into a full description of the process undertaken to identify, assess and rank the impacts of the proposed development activities and alternatives.

Table 3-1: Appendix 1 of the NEMA 2014, EIA regulations (as amended) which was used as guideline for the assessment methodology, as it relates to the assessment of impacts.

Appendix 1 Basic Assessment Process	
Objectives of the basic assessment process	
2. The objective of the basic assessment process is to, through a consultative process—	
(d) through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine—	
(i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and	
(ii) 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; and	
(e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—	
(i) identify and motivate a preferred site, activity and technology alternative;	
(ii) identify suitable measures to avoid, manage or mitigate identified impacts; and	
(iii) identify residual risks that need to be managed and monitored.	
(h) a full description of the process followed to reach the proposed preferred alternative within the site, including—	
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	
(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 associated with the alternatives;	
(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;	
(viii) the possible mitigation measures that could be applied and level of residual risk;	
(ix) the outcome of the site selection matrix;	
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	
(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—	
(iv) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	

(v)	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-
(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 avoided, managed or mitigated.

The impact assessment process, including the criteria applied to establish the likely **significance** and **consequence** of an impact are provided in Table 3-2. For each predicted impact, the EAP/Specialist applies expert judgement in ascribing a numerical rating for each of these criteria respectively as per Table 3-4. The criteria include the sum of **severity** (degree scale); the **duration** (temporal scale); and the **extent** (spatial scale), to calculate the **magnitude** of the impact. To calculate the significance of an impact, the **probability** (or likelihood) that a well-defined outcome will occur in the future, based on expert judgment is considered, therefore **significance** is calculated as the product of **magnitude** and **probability**. Once the significance of an impact occurring without mitigation has been calculated, the EAP/Specialist must apply their expert judgement to assign ratings for the same impact after the proposed mitigation has been implemented. Ultimately, each impact needs to be contextualised in terms of the **consequence** within its extent and the **importance** of the specific impact area or aspect. Therefore, the consequence is calculated as the product of **significance** and **importance**. The impact magnitude, significance and consequence are auto generated by completing a spreadsheet which uses the calculations provided in Table 3-4 the assessor can comment on the generated rating in terms of their reasoned on its accuracy.

Table 3-2: Impact assessment terminology explained.

Extent	The spatial influence (geographical coverage) of the impact or the area that will be affected by the impact
Duration	The period (time) over which the impact will have an effect on the aspect being assessed.
Intensity	The intensity of an impact will to some extent be affected by the sensitivity or resilience (ability to withstand adverse impacts) of the aspect impacted upon.
Magnitude	The measurable change in impact amplitude in terms of intensity, duration and extent of the impact.
Probability	Probabilistic estimates on expert judgment considering available evidence and are described in terms of likelihood of impacts occurring. In making their expert judgement, assessors start at “about as likely as not” and consider whether there is sufficient quantitative information available to assign either a likely or unlikely probability, or more extreme levels of probability. Note that using a likelihood term for a specific outcome implies that alternative outcomes have the inverse likelihood, e.g. if an outcome is very likely (a range of >90%) then that would imply that other outcomes are very unlikely (0 - 89% probability).
Significance	An impact that by its magnitude (in terms of duration, intensity and extent) and probability (likelihood) of occurrence may have a notable effect on the environment.
Importance	A value placed on the aspect impacted upon though expert judgement and/or science-based criteria. Considers resource-irreplaceability and/or value.
Consequence	A value placed on the change by different affected parties, i.e. level of acceptability. It is an anthropocentric concept, which makes use of value judgements and science-based criteria, i.e. biophysical, social and economic.

Further to the core impact assessment there are several parameters which provide supplementary information on the impact including the: i. project phase; ii. nature (type), iii. mitigatability; iv. reversibility; v. resource irreplaceability and vi. confidence (Table 3-3). The outcome of an impact assessment is underpinned by the quality and quantity of evidence associated with impacts and scientific agreement thereof. Therefore, assessors need to make qualitative assessments of confidence pertaining their expert estimates on impact consequence Figure 3-2. Confidence should



not be confused with probability of an outcome, e.g., the probability of an impact occurring might be very low and the assessor might be virtually certain thereof in his/her rating, the fact that the assessor is confident in his/her assessment should not influence the significance or consequence thereof.

Table 3-3: Impact assessment supplementary information terms explained.

CRITERIA	CATEGORY	DESCRIPTION
Project phase	Construction	From commencement of activity to the start of production / operation
	Operation	From start of production /operation
	Decommissioning	Make inoperative and dismantle of infrastructure
Nature (Type)	Positive	Where positive attributes of impact outweigh negative attributes
	Negative	Where negative attributes of impact outweigh positive attributes
Mitigatability	Low	Mitigation does not exist; or mitigation will slightly reduce the significance of impacts
	Medium	Mitigation exists and will notably reduce significance of impacts
	High	Mitigation exists and will considerably reduce the significance of impacts
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified
	Medium	The affected environment will only recover from the impact with significant intervention
	High	The affected environmental will be able to recover from the impact
Confidence	Deficient	Judgement is made with limited support data or specialist knowledge
	Inconclusive	Judgement is based on intuition or some support data
	Unresolved / Established but incomplete	Determination is based on common sense and general knowledge, but there are factors that are unresolved or incomplete.
	Well established	Substantive supportive data and or experience exists to verify the assessment
	Virtually certain	Empirical evidence supportive data exists to verify the assessment

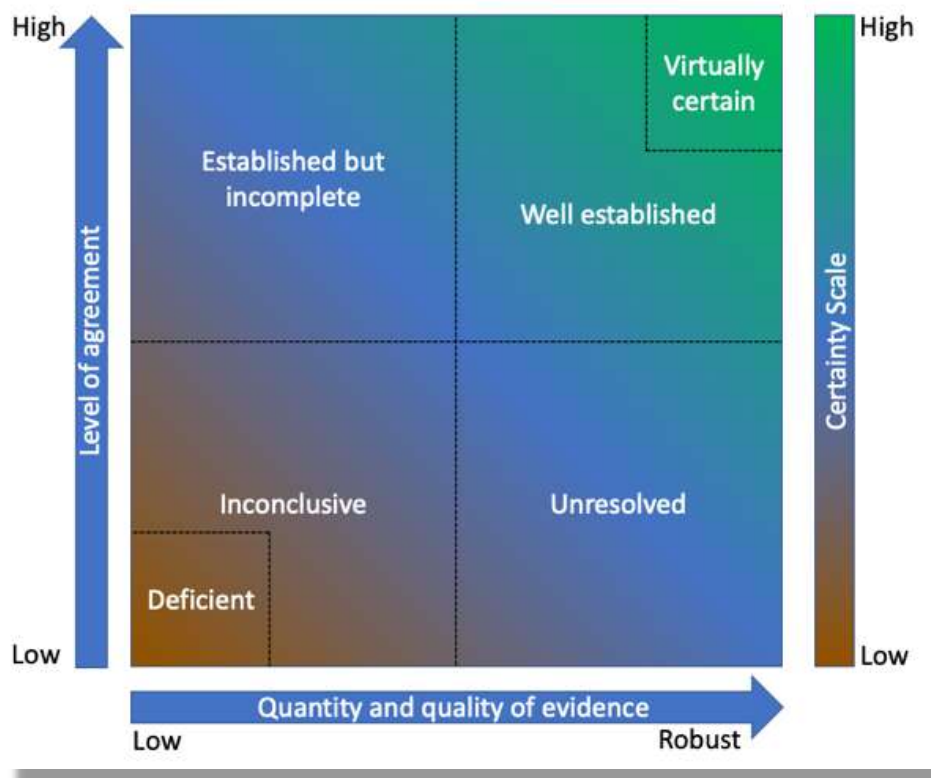


Figure 3-2: The six-box model for the qualitative communication of confidence (Source: Adopted from IPBES, 2018).



Table 3-4: Calculation of impact magnitude “D” (sum of impact extent “A”, duration “B” and intensity “C”), significance “F” (product of impact magnitude “D” and probability “E”), and consequence “H” (product of impact significance “F” and importance “G”).

Magnitude			Significance		Consequence																																						
How far?	How long?	How intense are the impacts?	How severe?	What is the chance of it happening?	How bad or good is it?	How unique/ irreplaceable is the impacted area?	What would the outcome be of this happens?																																				
A. Extent	B. Duration	C. Intensity	=	D. Magnitude	X	E. Probability	=	F. Significance	X	G. Importance	=	H. Consequence																															
5 - International: The affect will occur beyond country borders. 4 - National: Will affect the entire country. 3 - Regional: Will affect the greater region. 2 - Local: Extending across the site and to nearby surroundings / settlements. 1 - Limited: Limited to the site and its immediate surroundings.	5 - Permanent: 25 years or more 4 - Long term: 6-25 years 3 - Medium term: 1-5 years 2 - Short term: Less than 1 year 1 - Temporary: Less than 1 month	5 - Very High: Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease. 4 - High: Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease. 3 - Medium : Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered. 2 - Low: Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected. 1 - Very low: Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	<table><tr><th></th><th>Range</th></tr><tr><td>5 - Very high</td><td>13 - 15</td></tr><tr><td>4 - High</td><td>10 - 12</td></tr><tr><td>3 - Moderate</td><td>7 - 9</td></tr><tr><td>2 - Low</td><td>4 - 6</td></tr><tr><td>1 - Very low</td><td>1 - 3</td></tr></table>		Range	5 - Very high	13 - 15	4 - High	10 - 12	3 - Moderate	7 - 9	2 - Low	4 - 6	1 - Very low	1 - 3	5 - Very likely/Certain (>90%): There are sound reasons that the impact will occur. 4 - Likely (>66%): The impact may occur, but not necessarily proof that it will. 3 - About as likely as not (33-66%): The impact has occurred before and could occur in the lifetime of the project. 2 - Unlikely (>33%): The impacts occurrence is rare but has happened before. 1 - Very unlikely (>10%): There are scientific reasons that make the impact conceivable, yet improbable.	<table><tr><th></th><th>Range</th></tr><tr><td>5 - Severe</td><td>61 - 75</td></tr><tr><td>4 - Major</td><td>46 - 60</td></tr><tr><td>3 - Moderate</td><td>31 - 45</td></tr><tr><td>2 - Minor</td><td>16 - 30</td></tr><tr><td>1 - Minimal</td><td>1 - 15</td></tr></table>		Range	5 - Severe	61 - 75	4 - Major	46 - 60	3 - Moderate	31 - 45	2 - Minor	16 - 30	1 - Minimal	1 - 15	5 - Very high: natural, cultural and/or social importance. 4 - High: natural, cultural and/or social importance. 3 - Moderate: natural, cultural and/or social importance. 2 - Low: natural, cultural and/or social importance. 1 - Very low: natural, cultural and/or social importance.	<table><tr><th></th><th>Range</th></tr><tr><td>5 - Extremely-detrimental / beneficial</td><td>21 - 25</td></tr><tr><td>4 - Highly-detrimental / beneficial</td><td>16 - 20</td></tr><tr><td>3 - Moderately-detrimental / beneficial</td><td>11 - 15</td></tr><tr><td>2 - Slightly-detrimental / beneficial</td><td>6 - 10</td></tr><tr><td>1 - Very slightly-detrimental / beneficial</td><td>1 - 5</td></tr></table>		Range	5 - Extremely-detrimental / beneficial	21 - 25	4 - Highly-detrimental / beneficial	16 - 20	3 - Moderately-detrimental / beneficial	11 - 15	2 - Slightly-detrimental / beneficial	6 - 10	1 - Very slightly-detrimental / beneficial	1 - 5
	Range																																										
5 - Very high	13 - 15																																										
4 - High	10 - 12																																										
3 - Moderate	7 - 9																																										
2 - Low	4 - 6																																										
1 - Very low	1 - 3																																										
	Range																																										
5 - Severe	61 - 75																																										
4 - Major	46 - 60																																										
3 - Moderate	31 - 45																																										
2 - Minor	16 - 30																																										
1 - Minimal	1 - 15																																										
	Range																																										
5 - Extremely-detrimental / beneficial	21 - 25																																										
4 - Highly-detrimental / beneficial	16 - 20																																										
3 - Moderately-detrimental / beneficial	11 - 15																																										
2 - Slightly-detrimental / beneficial	6 - 10																																										
1 - Very slightly-detrimental / beneficial	1 - 5																																										



Even though impacts are considered both qualitatively and quantitatively, the assessment of the predicted significance of impacts is inherently uncertain. To manage this uncertainty, this standardised methodology has been developed. This methodology was applied to assess the consequence of the environmental impacts. Since the rationalisation of impacts within any context will ultimately be prejudiced by the assessor, there can be no wholly objective measure by which to judge the components of consequence, let alone how they are integrated into a single comparable measure.

To facilitate informed decision-making, environmental assessments must endeavour to come to terms with the potential consequence of the environmental impacts associated with activities. Recognising this, the assessor has attempted to address potential subjectivity in the assessment process as follows:

- Being explicit about the difficulty of being completely objective in the determination of consequence, as outlined above;
- Developing an explicit methodology for assigning consequence to impacts and outlining this methodology in detail.
 - Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing towards the determination of consequence, thereby avoiding arbitrary assignment.
 - Provides the reader with a clear summary of how the specialist derived the assigned consequence and their confidence in these assessments.

Although these measures may not eliminate subjectivity, they provide an explicit and repeatable context within which to review the assessment of impacts.

3.3.3 Assessment of Cumulative Effects

Cumulative effects are commonly understood to be impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts. The assessment of cumulative effects must therefore be considered for all developments within a 30km radius of the proposed site in particular renewable energy (wind and solar) and their associated grid connections (Figure 3-3). The projects considered in the cumulative assessment are projects that have received environmental authorisation, including those currently under construction and where construction has not yet commenced or that the consultant is aware of within this area based on ongoing EIA processes. It's of particular interest that consideration is given to WEF properties directly adjacent the proposed Kariega 4 (42 Turbines and ancillary infrastructure) site and thus the cumulative impact of Kariega 3 (50 Turbines and ancillary infrastructure) and Kariega 2 (54 Turbines and ancillary infrastructure) must be considered with all the relevant proposed WEFs in the area.

The relevant projects with potential associated cumulative impacts have been identified as detailed in Annexure I, Cumulative Project within 30km. The cumulative assessments are included in Section 6.

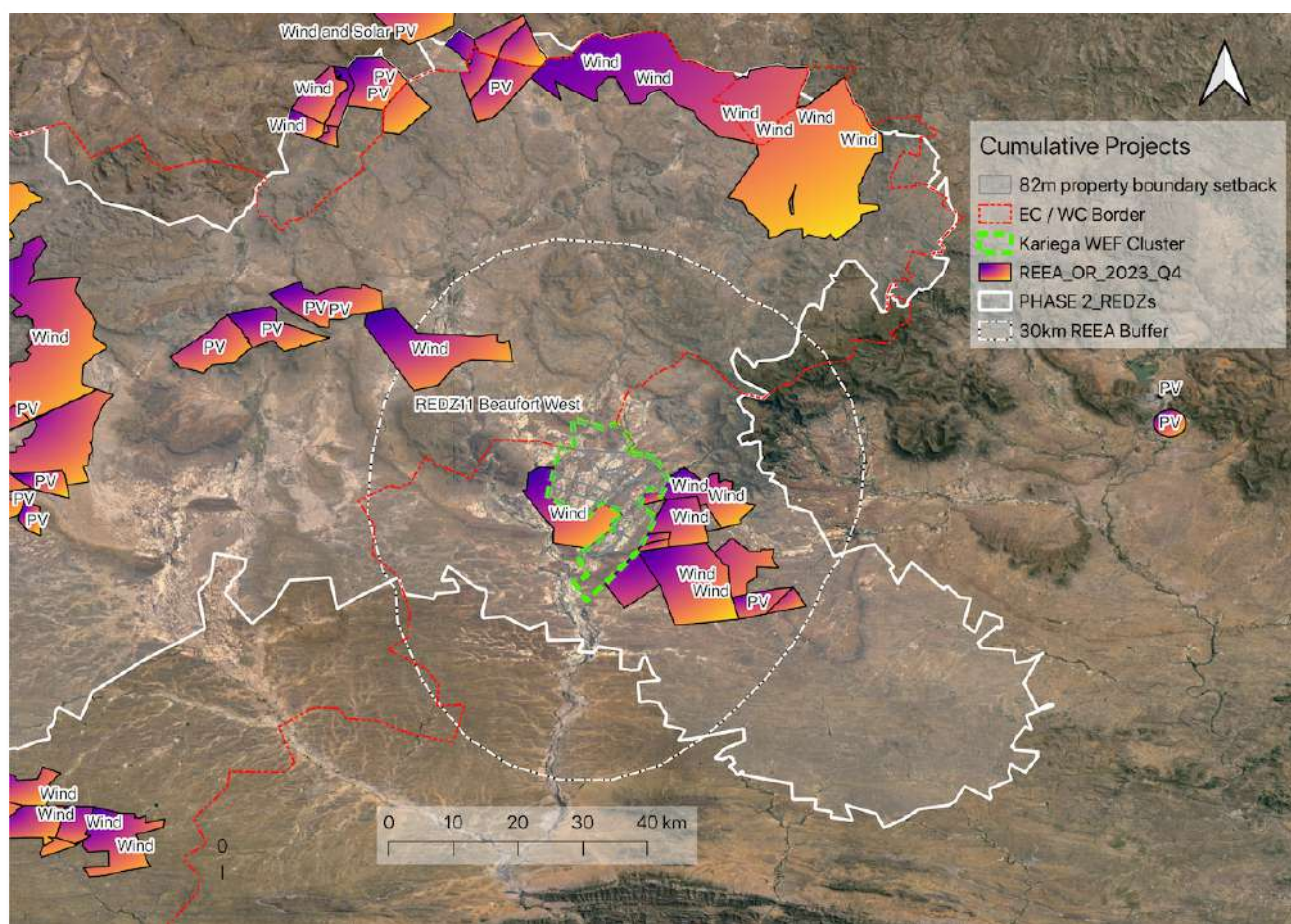


Figure 3-3: Developments within a 30km radius of the proposed site in particular renewable energy (wind and solar) and their associated grid connections (REEA: Q4, 2023 and authorised Kudu and Tango WEFs).

3.4 Public Participation

The aim of stakeholder engagement differs at different stages of the project lifecycle. During the BA process, the aim is to provide an opportunity for stakeholders to be informed of projects occurring in their area and that may affect them directly or indirectly. It also aims to provide an accessible and meaningful opportunity for people to ask questions, raise concerns or grievances and to ensure that these are used to guide the new development, and ongoing operations, in a responsible manner that complements the local socio-economic environment and enhances the benefit of a given project.

South African legislation and guidelines (refer to Chapter 2) have formalised stakeholder engagement in the BA process and refer to it as the Public Participation Process (PPP). PPP therefore forms an integral component of this investigation and enables interested and affected parties (I&APs) to identify their issues, concerns, and suggestions during the BA process. This PPP has been structured to provide I&APs with an opportunity to gain more knowledge about the proposed project, to provide input through the review of documents/ reports, and to voice any issues of concern at various stages throughout the BA process. These stages are described below.

A Public Participation Report has been included in Annexure C and provides detail on the process that has been followed to date. This document will be updated as the project progresses.

3.4.1 Stages of the Public Participation Process

The PPP for this project is illustrated in Figure 3-4 below.

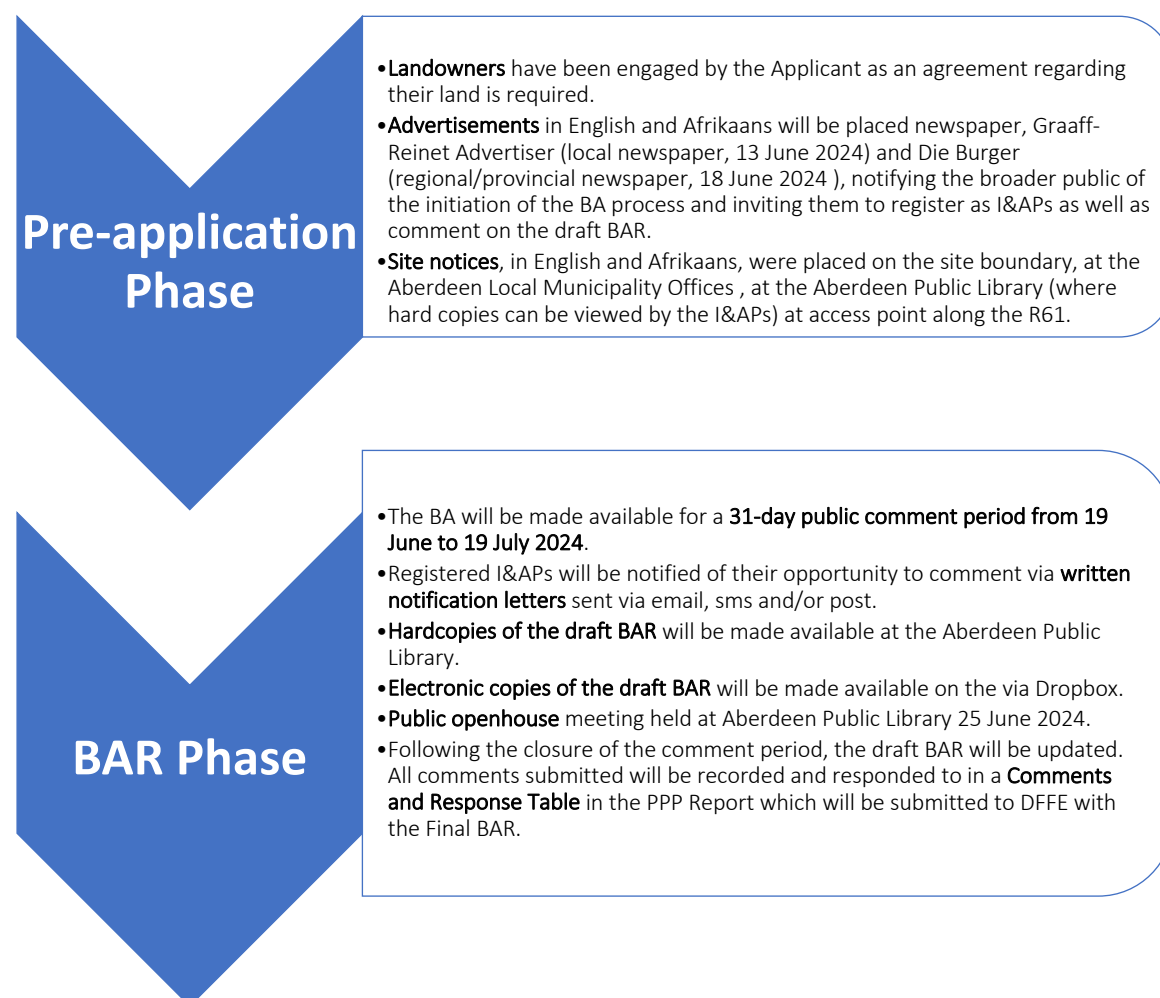


Figure 3-4: Public participation in the BAR process.

3.4.2 Identification of Stakeholders

A generic database from previous WEF BAs and EIA was supplemented by site specific stakeholders, i.e., landowners, adjacent landowners, relevant district and local municipalities, relevant national government officials and organisations in the area. This database will continually be augmented via chain referral during the BA process and continually updated as new I&APs were identified throughout the project lifecycle. The list of I&APs is included in Annexure C.

3.5 Authority involvement

In terms of Section 24O (2) and (3) of the NEMA, the following state departments and/or parastatal bodies were sent a copy of the draft BAR for comment (not limited to, see Annexure C for full I&AP list).

- Provincial and local authorities, and parastatal organisations:
 - Department of Economic Development, Environmental Affairs and Tourism (Eastern Cape)
 - Department of Environmental Affairs and Development Planning



- Dr Beyers Naude Local Municipality;
- Sarah Baartman District Municipality;
- Beaufort West Local Municipality;
- Central Karoo District Municipality;
- Eastern Cape Provincial Heritage Resources Authority (ECPHRA);
- Heritage Western Cape (HWC)
- Air Traffic and Navigation Services (ATNS) SOC Limited;
- Eastern Cape Department of Rural Development and Agrarian Reform; and
- Western Cape Department of Agriculture.
- Capenature
- National departments and organisations:
 - Department of Forestry, Fisheries, and the Environment;
 - Department of Human Settlement, Water and Sanitation;
 - Department of Agriculture, Land Reform and Rural Development.
 - Department of Transport;
 - Department of Mineral Resources & Energy;
 - DFFE: Integrated Environmental Management;
 - DFFE: Biodiversity Conservation;
 - Eskom Generation;
 - South African National Roads Agency Limited;
 - South African Heritage Resources Agency;
 - South African National Defence Force;
 - National Energy Regulator of South Africa;
 - Civil Aviation Authority;
 - BirdLife South Africa;
 - Square Kilometre Array (SKA);
 - South African Radio Astronomy Observatory (SARAO)
 - South African Weather Services; and
 - Conservation agencies: WESSA.
 - Endangered Wildlife Trust (EWT).
- Other national/ provincial departments, as deemed necessary (see I&AP list as part of Annexure C).

3.6 Summary of Comments and Responses

All comments received are included in the Comments and Response Report (Annexure C). Comments and added measures, requests and requirements were included in the Final BAR and the EMP.

The preliminary comments received, and responses included:

- Q: Fitting proper gates where new roads are made on properties, i.e., existing fence lines cut. New gates should be jackal-proofed (with wire meshing), as commonly used on local farms.
 - A: All gates and fences effected by the facility will be brought on and maintained in a manner that allows the landowner to maintain farming activities i.e. they will be jackal-proof. This will be undertaken in consultation with and in cognisance of the landowner requirements.
- Q: Stock and equipment theft (solar panels, fencing etc.).
 - A: Stock theft is a reality in all rural areas and the developer cannot preclude stock theft from ever happening. However, the developer will be liable for implementation of a security management plan which includes landowners and adjacent landowners to ensure people, animal and infrastructure safety. Considering the developers substantial investment in the properties and the infrastructure such as substations and BESS security and access will have to be strictly enforced.
- Q: Damage to roads due to additional traffic and heavy vehicles



- A: All site roads will be maintained by the developer. Communal or public roads will also be maintained in context of the development and certain roads may require upgrading to ensure safe passage of construction vehicles.
- Q: Unpleasant views/scenery and degradation of the pristine Karoo landscape
 - A: The visual and cultural heritage assessments have addressed these issues. The reality is that the turbines and ancillary infrastructure as well as cumulative impact of all the wind and solar projects planned for the area will change the landscape. These impacts can and have been mitigated to a certain extent by infrastructure placement and design aspects (lights, colour, cladding etc.) but the view and scenery as it currently will change.
- Q: Pressure on the scarce water resource, water use for the construction of the towers, and will the water usage comply with the National water use legislation
 - A: Water use will strictly be undertaken in terms of the National Water Act and section 21 water uses will either be registered or licensed depending on the volumes. Water conservation and reuse mechanisms will also be implemented by the developer. Typical water sources are from boreholes on the properties or where the developer can legally source water from surrounding properties.
- Q: Security issues resulting from influx of outsourced labour/no locals
 - A: The developer will be liable to implement an influx management plan which consider among other things influx of job seekers, appointment of locals, housing and socio-economic considerations, grievance mechanisms to deal with issues and site security measures and protocols to avoid negative impacts.
- Q: Dust pollution.
 - A: Dust pollution will be strictly monitored and mitigated through means of the EMP during construction. This is implemented by the contractors ESO, overseen by an ECO and will be audited as well. If issues arise such as dust pollution which is not effectively mitigated the impacted people will be able to lodge complaints in terms of the grievance mechanism and if these complaints are not resolved and the impacts persist the ECO and/or authorities may take further action such as fines, penalties or even stopping work.
- Q: What benefit will this wind farm offer the local area in terms of electricity ?
 - A: Since the local area receives electricity from the Eskom grid they will benefit as all other people on the Eskom grid from increased stability in the electricity network and receiving energy from a sustainable resource.
- Q: What happens to these towers once they reach to their life expectancy? Who will demolish them and who will pay?
 - A: The holder of the Environmental Authorisation will be responsible for the towers at the end of their life. Depending on the tower material it will either be reused, upcycled (used for other purpose) or recycled.
- Q: The birders did a day time survey, what about the nocturnal birds and animals (barn owls, eagle owl, nightjars, aardwolf, armadillo, bats, serval). What will be the influence of the wind farm on the breeding of the blue cranes, Kori bustard, Ludwig's bustards, korhaan and various raptors? If any studies have been done on the Vaalkorhaan bird or as known here as the "Vlakte korhaan" which is limited to a small area in the Karoo. What will be the impact on this species.
 - A: A full avifaunal impact assessment which included monitoring over an 18-month period was undertaken. These studies include the above-mentioned species. Where species are cryptic or difficult to study due to among others nocturnal habits, the habitat is used as proxy to avoid impacts to these species. Specifically, night time species are susceptible to construction activities when it's dark which will happen at the WEF. Impacts on these species are mitigated through management activities such as awareness training, reduced speed levels for vehicles and fines/penalties for injuring or killing these species.
- Q: What is the influence of the wind farm on the local climate?
 - A: Unfortunately, it's impossible to say (model) before construction what the WEFs influence will be on local climate since there are so many variables involved. Even after construction it will be difficult to establish what if any impact the WEF has on the local climate. It's likely that the WEF may have a minor effect on wind (typically through wake effect), air and land surface temperature (through mixing of air layers). Numerous studies have attempted to quantify these impacts after construction and results have varied depending on location, wind resources, turbine technology/numbers and density and numerous other variables.



- Q: Noise pollution? The stillness and the beauty of the Karoo will be affected.
 - A: Noise impacts have been modelled and assessed based on worst case scenario turbines specifications. Key infrastructure has been located sufficiently away from noise sensitive receptors, i.e. houses to mitigate these impacts. Construction phase noise will be monitored and mitigated through management and oversight of activities which include speed limits (vehicles noise), working hours (limit disturbance times) and use/maintenance of equipment that don't generate excessive noise.
- Q: ECPHRA requested additional study to be undertaken on the Camdeboo prior to commencement of the development.
 - A: The current status of this request is that the requirement remains that this study be undertaken as prior to the commencement of the development. The heritage consultant will further engage with ECPHRA in terms of the NHRA on the way forward on this study as it pertains living heritage issues and cultural landscapes. The understanding is that cultural landscape elements identified by specialist, Sarah Winter, on this project (part of heritage assessment) is robust and sufficient for decision making purpose by the CA as the information is consistent with adjacent wind farm projects recently authorised adjacent to the Kariega Wind Farm.
- Q: DFFE Biodiversity Turbines P2 — WTG 013, 014, 015, 016 (updated layout 12, 13, 14 and 15) were perceived to be in a bad location because they are close to bustard lek area and two bustard/korhaan nests..
 - A: The Ludwig's Bustard Leks have been buffered by 1km and nests by 1.5km. Moreover, Korhaan nest have also been buffered by 1km. Thus, these turbines are sufficiently setback from these sensitive areas. Nevertheless, it will be included as proposed condition of the EA that WTG 12 and 15 be located at the northern extent of the assessed buffers turbine buffers to ensure that no part of the turbine overlaps with the setback buffers. The layout as such has not changed as the setback is deemed sufficient by the avifauna specialist and consistent with the methodology used for placing of turbines on this and other WEF projects.
- Q: ARRPA (Aberdeen Residents and Ratepayers Association) requested support in benefit the immediate beneficiaries but also contribute to the long-term development and prosperity of our community. The also raised the issue of using funds in a diligent manner.
 - A: The applicant acknowledge the work that ARRPA is doing in the local community. Should the Kariega Wind Farm project receive a positive Environmental Authorisation and the project come to realisation it will engage with ARRPA in terms of potential support for the numerous programs they are involved with. Kariega Wind Farm dually notes the potential for contributions to make a significant impact by enabling ARRPA to expand your reach, enhance program effectiveness, and ultimately empower more people in need.
- Q: The local taxi associations raised the issue of transport of labour to site which they have had personal experience with and where issues arose due to poor planning and communication.
 - A: A meeting was help with the taxi association facilitated by the DBNLM. It was established that should the project come to fruition communication with stakeholders shall be undertaken as soon as viable. It was also explained that transport of labour is typically a function of the main contractor and as such will only commence at time when such contractor has been appointed.
- Q: DFFE required the decommissioning phase section of the EMPr for the WEF to contain information relating to the handling, repurposing or disposal of dysfunctional, severely damaged batteries, modules, and containers.
 - A: This section of the WEF EMPr has been updated as such as well as the substation EMPr since the BESS will form part of the substation complex.
- Q: These was a general and numerous questions about employment, especially during the public open house meeting.



-
- A: Yes, there will be temporary (contract) and some although limited permanent employment created by the project. This will include all skill levels from unskilled to semi-skilled to professionals. Preferential procurement for local based people and companies will be undertaken where feasible and in an equitable manner.
 - Q: DEADP requested that additional information in terms of the Socio-economic context for the Western Cape Province be added to the report, although the acknowledge that the majority of the project is within the Eastern Cape.
 - A: The Socio-economic report and relevant sections of the fBAR were updated with additional information on the relevant socio economic context of the this region, specifically Beaufort West Municipality.

Note the above questions and answers are a summary of the comments received, please see Annexure C, CRR of all comments and responses thereto. Note there are no comments or requirements which have not been addressed in the fBAR or EMPr unless the reason has been stated here.

4 DESCRIPTION OF PROPOSED PROJECT

The following subsections provide more information on the project context, location, components, activities, and alternatives.

4.1 Project details and extent

The study area is located approximately 40 km west of the small town of Aberdeen in the central western part of the Eastern and Western Cape Province. Aberdeen is located in the Dr Beyers Naudé Local Municipality (DBNLM) and Sarah Baartman District Municipality (SBDM), with one property (Sarels Rivier 141) as part of the development in the Beaufort West Local Municipality (BFLM) and Central Karoo District Municipality (CKDM). Graaff-Reinet, located approximately 90 km east of the site, is the largest town in the DBNLM and serves as its administrative seat and regional service centre. Other settlements in the DBNLM include Jansenville, Steylerville, Willowmore and Klipplaar. Aberdeen is located at the intersection of the N9 (Graaff-Reinet-Willowmore), the R61 (Aberdeen-Beaufort West) and the R338 (Aberdeen-Klipplaar). Murraysburg is the closest town in the BFLM to the site. The R61 is a key route between the Western and Eastern Cape Provinces. Access to properties in the immediate study area is off the R61. The large town of Beaufort West (Western Cape Province) is located approximately 90 km west of the site on the R61 where it intersects with the N1 (Figure 4-1 and Figure 4-2).

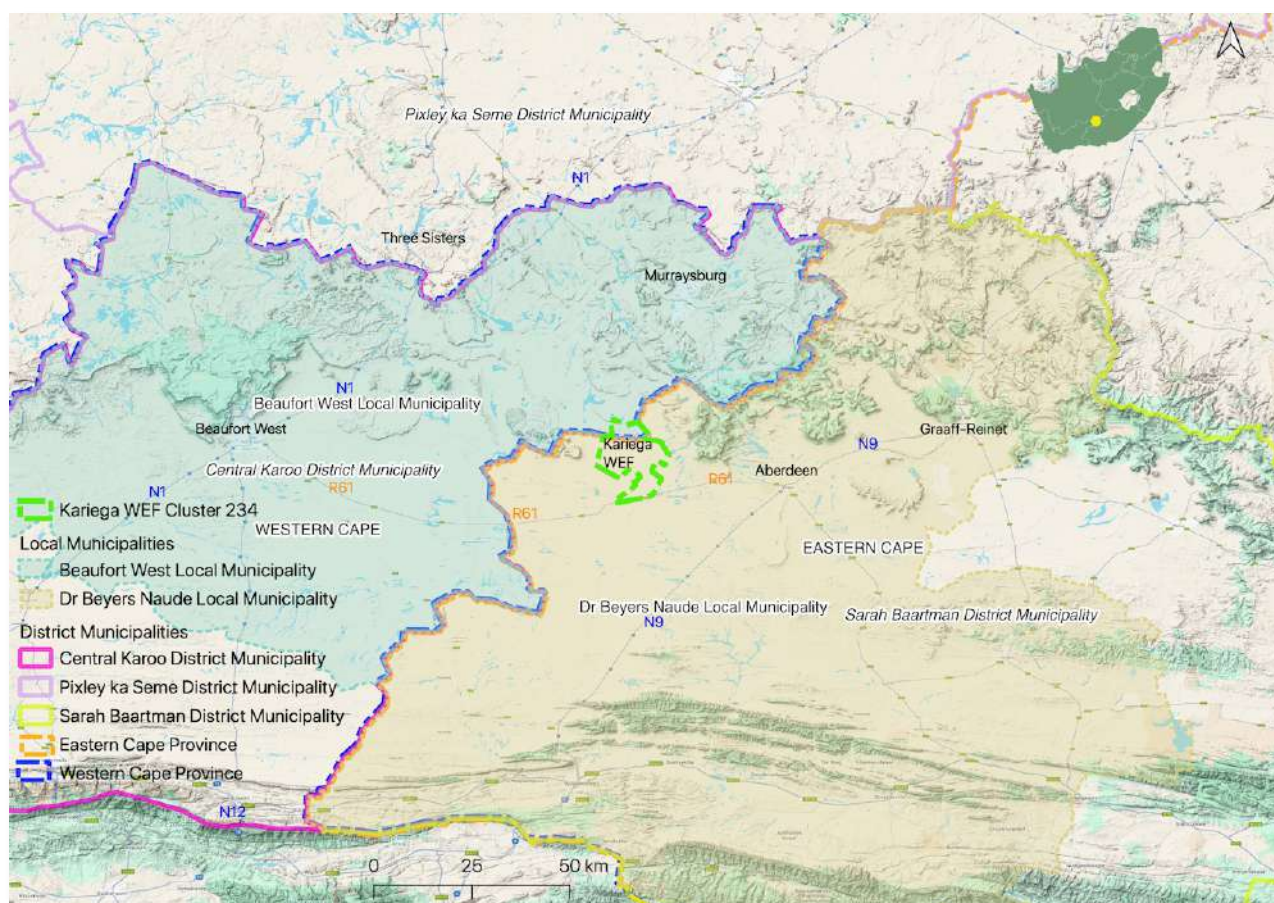


Figure 4-1: Kariega WEF cluster (green outline), in context of the nearest towns and access routes.

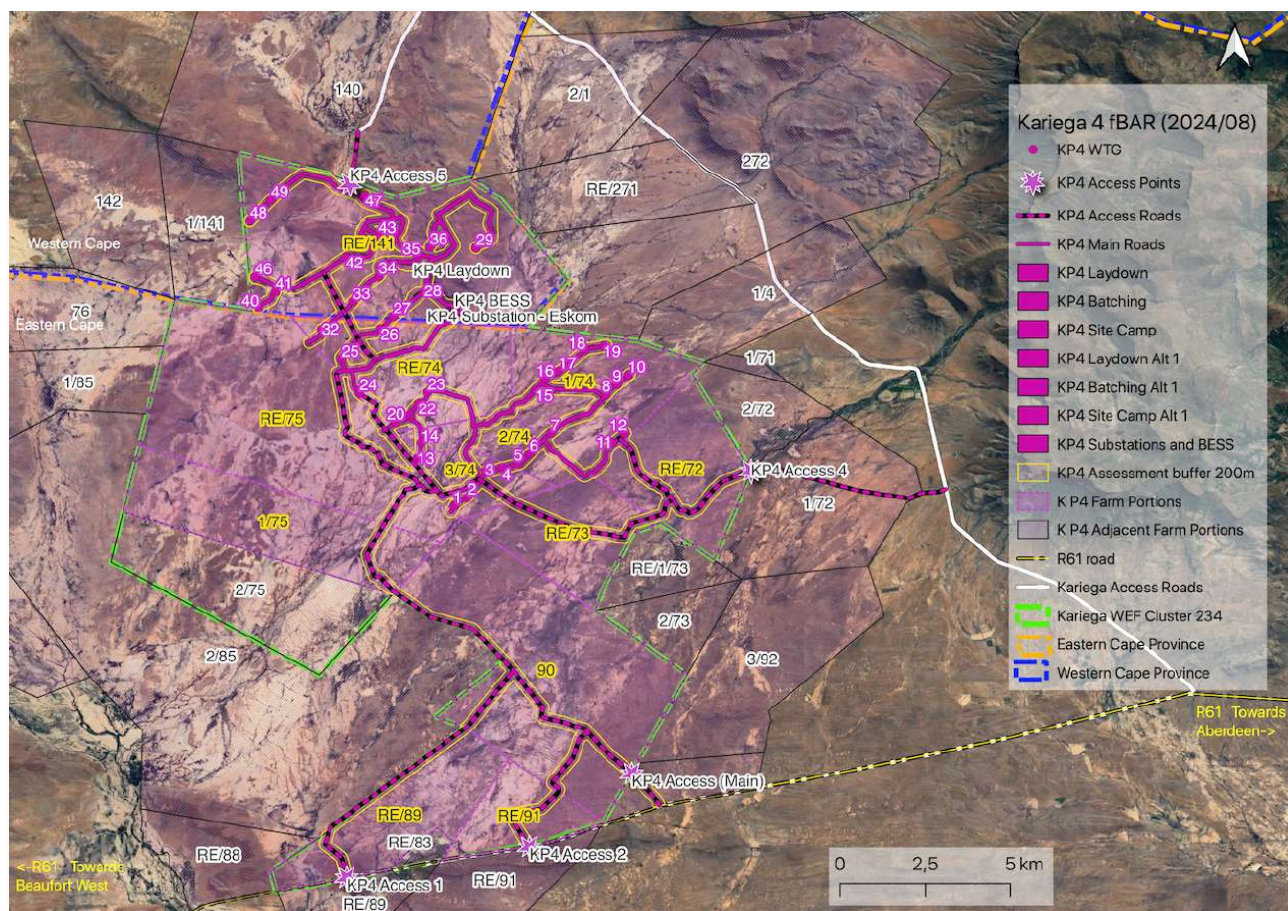


Figure 4-2: Kariega 4 WEF site in relation to Kariega WEF cluster (green outline), provincial boundary and the R61.

The study area is in the northern portion of the Central Karoo plain, near the transition into the Great Escarpment. Kamdebooerg is located approximately 17 km northeast of the site. No major energy generation or transmission infrastructure is associated with the study area, although significant REFs are planned and authorised within the vicinity of the Kariega WEF cluster (Figure 4-6). A 66 kV line feeds onto a small substation on Kaapse Poortjie east of the N9 from the east. No other transmission lines are in the study area.

4.1.1 Affected properties

The Kariega 4 WEF is one of three WEFs which together form the Kariega WEF cluster (the others are Kariega 2 and 3 which are applied for through separate applications). The area for the proposed WEF development consists of several farm portions (Table 4-1) with directly adjacent farms provided in Table 4-2. Only the portions north of the R61 form part of the Kariega 4 assessment area. No infrastructure is proposed on Farm 91/RE apart from a site access point and associated road.

Table 4-1: Farm details for Kariega 4 WEF.

Farm name	Portion	Farm no.	SG	Farm size (ha)	Infrastructure
SARELS RIVIER 141	RE	141	C05200000000014100000	4120	WEF
KEUNA 74	RE	74	C00100000000007400000	1789	WEF
KEUNA 74	1	74	C00100000000007400001	1776	WEF



KEUNA 74	2	74	C00100000000007400002	592	WEF
KEUNA 74	3	74	C00100000000007400003	600	WEF
TAFEL KOP 75	RE	75	C00100000000007500000	4023	Roads
TAFEL KOP 75	1	75	C00100000000007500001	2010	Roads
BEENKRAAL 90	RE	90	C00100000000009000000	4114	Roads
PRETORUIS KUIL 89	RE	89	C00100000000008900000	2262	Roads
KLIPDRIFT 73	RE	73	C00100000000007300000	1283	Roads
FARM 91	RE	91	C00100000000009100000	2968	Roads

Table 4-2: Adjacent Farm details for Kariega 4 WEF.

Farm name	Portion	Farm no.	SG
OORLOGSPOORT 85	2	85	C00100000000008500002
OORLOGSPOORT 85	1	85	C00100000000008500001
TULP LEEGTE 76	RE	76	C00100000000007600000
FARM 142	RE	142	C05200000000014200000
SARELS RIVIER 141	1	141	C05200000000014100001
HARMONIE 140	RE	140	C05200000000014000000
WALPLAATS 1	2	1	C0010000000000100002
WINDERMERE 271	RE	271	C00100000000027100000
GLEN CLIFF 272	RE	272	C00100000000027200000
75/2	2	75	C00100000000007500002
KLIPDRIFT 73	1	73	C00100000000007300001
KLIPDRIFT 73	2	73	C00100000000007300002
SAMBOKDOORNS 92	RE/4	92	C00100000000009200004
KOEDOES KOP 88	RE	88	C00100000000008800000
BASSONS HOEK 4	1	4	C0010000000000400001
71/1	1	71	C00100000000007100001
72/2	2	72	C00100000000007200002
72/4	4	72	C00100000000007200004

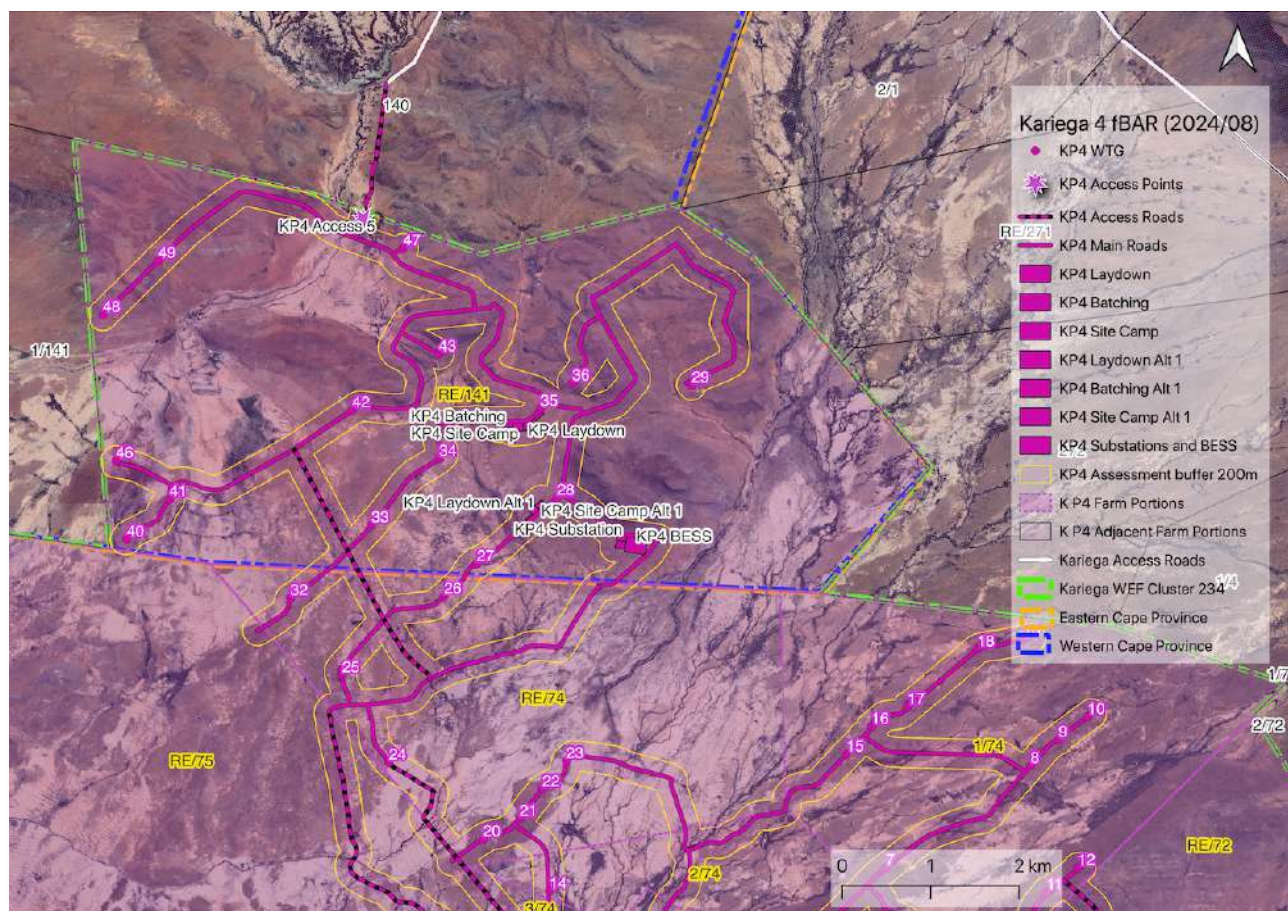


Figure 4-3: Kariega 4 layout map indicating WTG in the northern section of the proposed WEF, access point 5, 200m assessment buffer (yellow), affected and adjacent properties, laydown, batching, site camp areas, substation, BESS and alternatives.

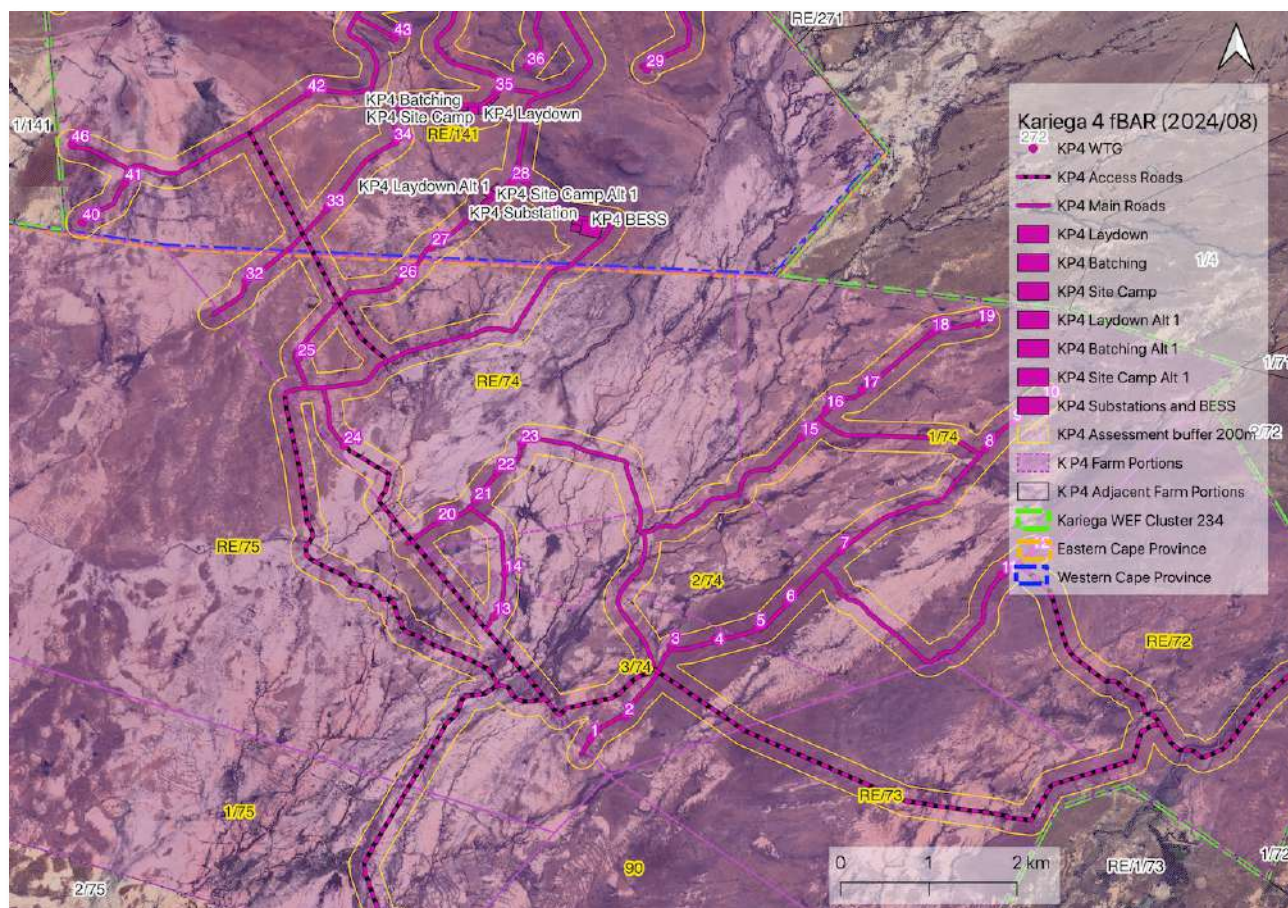


Figure 4-4: Kariega 4 layout map indicating WTG in the central section of the proposed WEF, access point 3 and 4, 200m assessment buffer (yellow), affected and adjacent properties, laydown, batching, site camp areas, substation, BESS, and alternatives.

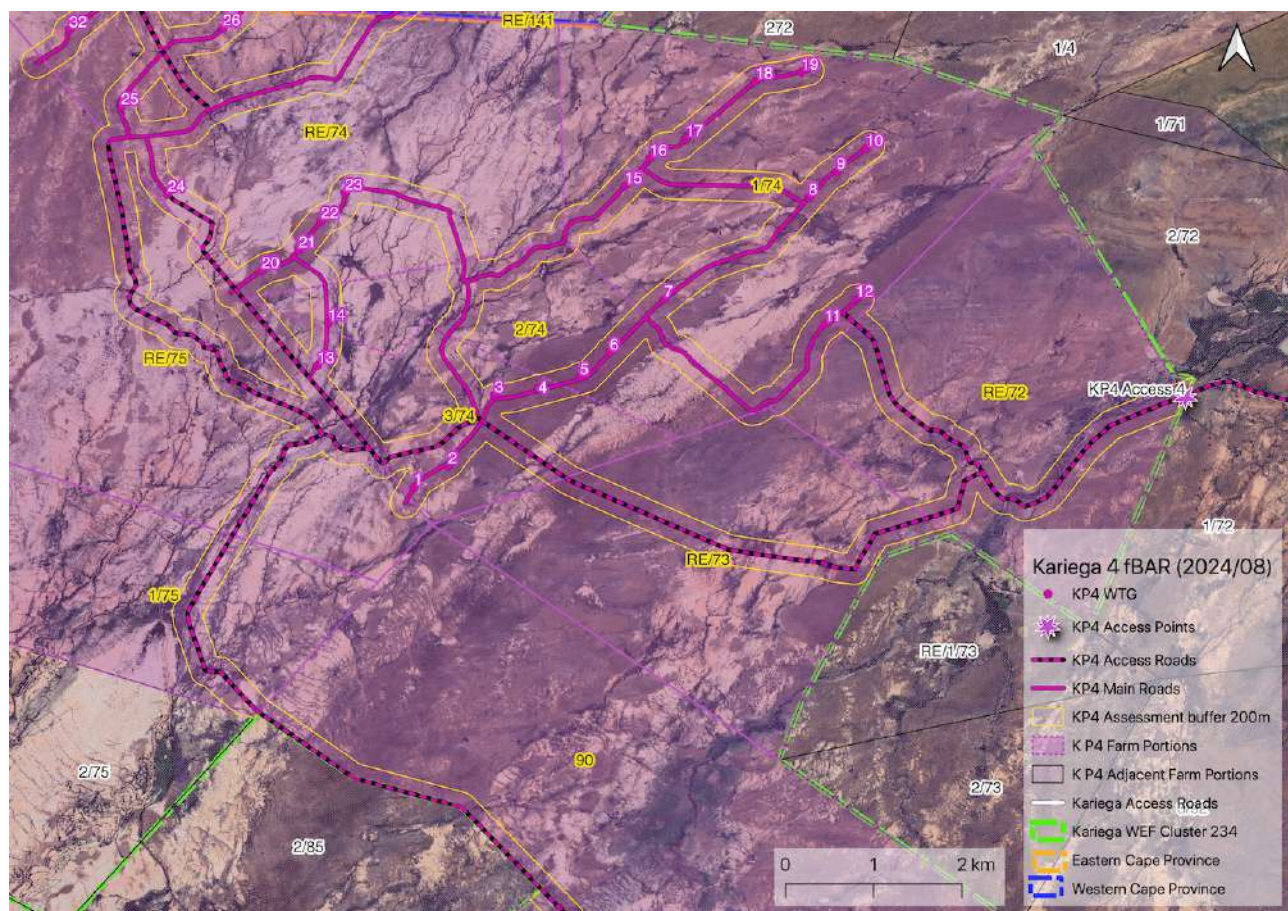


Figure 4-5: Kariega 4 layout map indicating WTG in the southern section of the proposed WEF, 200m assessment buffer (yellow), affected and adjacent properties.

The Kariega 4 WEF site is located on 12 properties, namely Klip Stavel 72/RE, Klipdrift 73/RE, Keuna 74/RE, 74/1, 74/2, 74/3; Tafelkop 75/RE, 75/1; Pretorius Kuil 89/RE, Beenkraal 90, Farm 91, and Sarels Rivier 141/RE. Only the portions of 89/RE and 90/RE north of the R61 form part of the assessment area.

Turbines are proposed on only the five of the 12 site properties, namely the four portions of Keuna 74 and Sarels Rivier 141/RE. The preferred and alternative construction terrain sites cluster (laydown/ construction camp/ batching plant) as well as the substation/ O&M/ BESS complex site are proposed on 141/RE. The sites are located within 2.5 km of another. The other seven site properties only serve to provide access to the development area.

Five site access points are proposed, three effectively off the R61, and two off the Murraysburg public gravel road. The south-westernmost access point (1) is proposed at the intersection of the R61 and the Nelspoort public gravel road. Access point 2 is at the intersection with an existing internal farm road. Two access points are proposed on the road linking the R61 to the Murraysburg road via the site, the southern one (3) on the boundary with Sambokdoorns 92/4/RE (Eskom Aberdeen WEF site), and the northern one (4) with Klip Stavel 72/1 (Tango WEF site). Access point 5 is proposed on the boundary of Sarels Rivier 141/RE and site-adjacent Harmonie 140 via a public gravel road which provides access to the relevant properties and adjacent Tulp Leegte 160 off the Murraysburg gravel road from the north.

4.1.2 Other renewable energy facilities

The Kariega 4 WEF site is in the Beaufort West REDZ and forms part of a cluster of three proposed WEFs. Several REFs have been or are currently being proposed (and authorised) to the north, east and south of the site. The DFFE's

Renewable Energy Applications website indicates several contiguous historic REF applications to the south and east of the Kariega site (Figure 4-6).

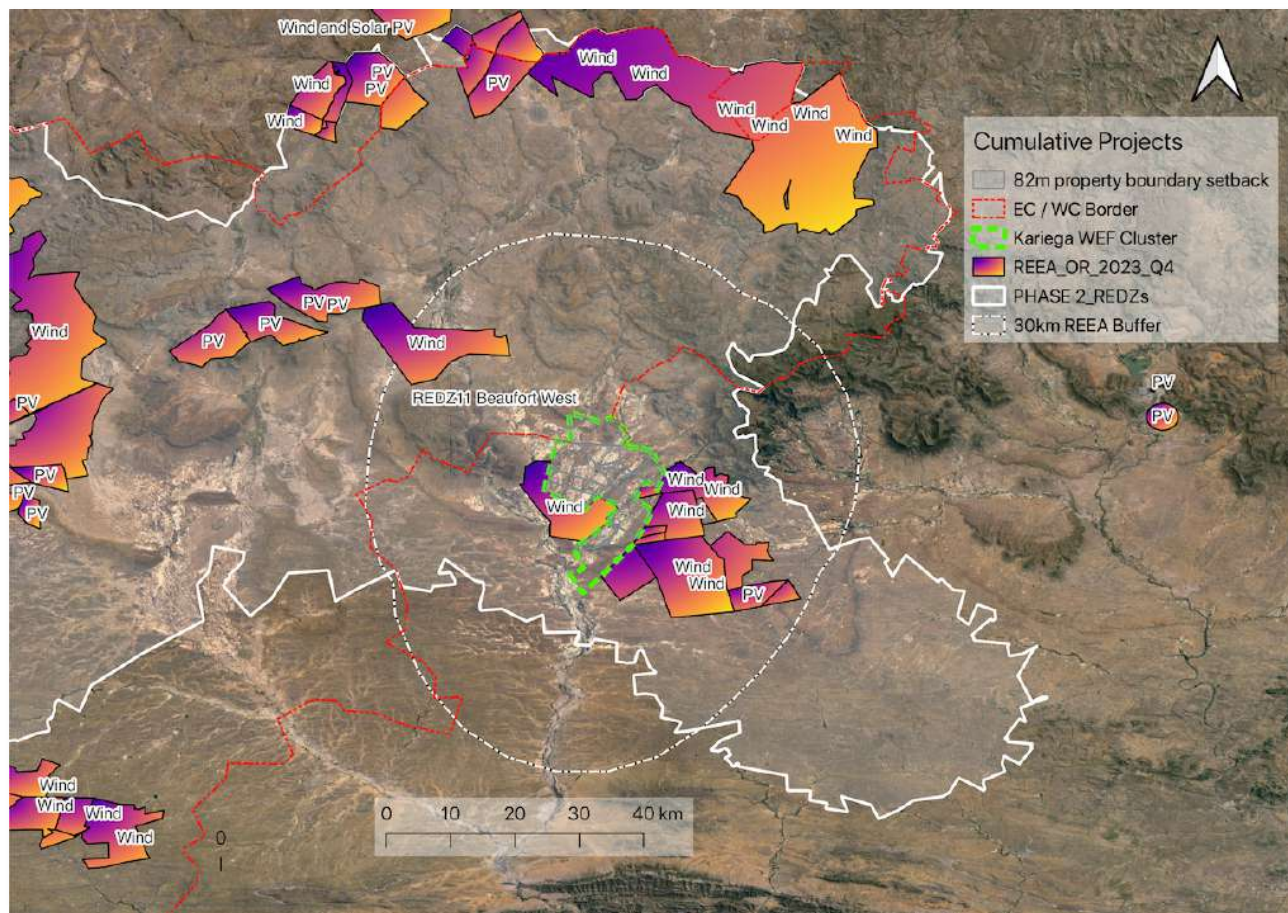


Figure 4-6: Kariega 4 WEF development area in relation to Beaufort West REDZ (white), within a 30 km radius (white dashed circle) of the centre of the Kariega 4 development area. Also indicated are the Kariega WEF cluster properties (green outline), proposed Atlantic Aberdeen 1-3 WEF cluster, proposed Atlantic Aberdeen 1-3 PV SEF cluster, proposed Kudu WEF, proposed Tango WEF, and approved Eskom Aberdeen WEF are all adjacent the proposed Kariega WEFs (REEA 2023 Q4).

Applications within a 30 km of the site include the Camdeboo WEF, Eskom Aberdeen WEF, Atlantic Aberdeen 1-3 WEFs, and Biotherm's Aberdeen PV SEF. Not yet indicated, are the Kariega 1-4 WEFs, and 2023 applications for the Tango and Kudu WEFs and Atlantic Aberdeen 1-3 PV SEFs. The Tango WEF is proposed on a portion of the Camdeboo WEF site. Atlantic PV 1-3 is located on a portion of the Atlantic Energy Partners' WEF 1-3 site. The 200 MW Eskom WEF was approved in 2016. It would consist of 100 turbines (140 m hub height). Eskom in August 2021 announced that it plans to construct the Aberdeen WEF as part of phase 2 of its REF build programme up to 2030. The phase 2 projects are envisaged for construction 2023-5. The status of the project is unclear. Atlantic Aberdeen WEF 1-3 was submitted in 2023. The Camdeboo WEF was approved in 2015, and the 20MW Biotherm SEF in 2016, but it is unclear whether these projects are still active.

A selection of site photos has been included in Annexure H as additional information to the context and location of the proposed project. Coordinates of the infrastructure centre points are provided in Annexure F.

4.2 Components and Activities

The proposed WEF layout has been defined by specialist inputs, sensitivity mapping for the study area and technical considerations. The technical details of the proposed Kariega 4 WEF are provided in Table 4-3. The components are



also illustrated in Figure 4-7 with a general overview of WEFs in South Africa included in Annexure K1 which provide detailed visual representation of South African and international examples of WEF infrastructure.

Table 4-3: Technical details for Kariega 4 WEF.

Component	Description
Turbines	○ Up to 42 turbines ▪ Up to 420 MW total generation capacity ▪ Up to 10MW each ▪ Hub height (HH) up to 150m (tower) ▪ Rotor diameter (RD) up to 200m (consists of rotor and three blades) ▪ Includes nacelle and generator This is the maximum specification for assessment purposes and depends on technology available at the time of construction.
	○ Turbine foundations ▪ Up to 30 m in diameter ▪ Up to ~3 m deep ▪ Construction (disturbance) footprint of approximately 32 m x 32 m= 1024m². ▪ Total turbine footprint ~4,3ha (1024m²x42 turbines)
	○ Crane Hardstands (permanent) ▪ Up to 150m X 100m= 15000m² ▪ Total crane hardstand footprint ~63ha (42 turbines) ○ Temporary laydown/ assembly areas (temporary, construction phase) ▪ Up to 150m X 15m ▪ Total Temporary laydown/ assembly areas footprint ~9,45ha (2250m²x42 turbines) The exact position and orientation of the hardstands and laydowns will be determined during the detailed design / micro siting of infrastructure.
Access roads & Site roads	○ Five Potential access points are proposed: ▪ K4 Access 1, 32°30'57.74"S; 23°36'33.12"E (Directly from R61) ▪ K4 Access 2, 32°30'23.39"S; 23°39'58.74"E (Directly from R61) ▪ K4 Access 3 (main), 32°29'0.33"S; 23°41'53.55"E (via R61 over Farm RE/4/92) ▪ K4 Access 4, 32°23'19.89"S; 23°44'8.61"E (via R61, Aberdeen/Murraysburg road and over Farm 1/72, Farm 1/95, Farm 5/72) ▪ K4 Access 5, 32°17'57.50"S; 23°36'36.33"E (via R61, Aberdeen/Murraysburg road and over Farm RE/140 and Farm RE/139) One or all access points may be utilised, given the extent of the site. ○ Access roads and internal site roads ▪ Road width of 15-20m wide • 12m road surface width, 1m for side drains either side, 6m one side of the road surface for MV cable trenches and associated disturbance (topsoil, subsoil and vehicle movement). • Existing roads ±66km • Total ±126 km (31km shared with Kariega 2 and 49km shared with Kariega 3)



	• Total road footprint ~252ha (126km x 20m width) ▪ Post construction roads will be rehabilitated down to 5-10m width • 8m wide road surface, 1m side drain either side • Total road footprint ~126ha (126km x 10m width) ○ All roads will have a gravel wearing course (imported from offsite borrow pits) ○ Where possible, existing tracks will be followed. ○ All roads associated with the WEF will remain indefinitely and be available for use by landowner post construction. ○ Turning areas ▪ Required to allow heavy and abnormal vehicles to turn safely. ▪ Strategic points on site and at end of roads ▪ To be identified during detailed design / micro siting
Substation and O&M Complex	○ On-site Substation and O&M Building ▪ Up to ~1 ha ▪ Up to 132kV ▪ Includes site office, workshop, parking, storeroom and ablution facilities ○ Substation - Eskom ▪ Up to ~1 ha
Battery Energy Storage System	Battery Energy Storage System (BESS) Areas ○ Up to ~5ha (Adjacent O&M Complex) ○ Lithium-Ion Battery ▪ Export Capacity of up to 250MW ▪ Storage Capacity 1000MWh ▪ Storage duration 4hrs
MV Collector cables	Medium Voltage (MV) cables ○ up to 33kV ○ From each turbine to the on-site substation and BESS ○ Underground parallel to the roads within the road reserve (no additional footprint, no overhead MV)
Construction Laydown area & Site Camp	○ Laydown area ▪ ~1ha per phase ○ Site camp ▪ ~1ha per phase The site camp and adjacent laydown area will include temporary site offices, stores, workshops, turbine storage areas, fuel storage, worker mess and ablution facilities etc. These areas will be rehabilitated after construction. <u>Two alternative locations</u> assessed.
Batching plant and stockpile area	○ Concrete batch plant (temporary, construction phase) ▪ 0,5ha per phase ▪ include cement silos, stockpile areas, parking and turning areas, quality test area, and the batch plant itself.



	▪ Batching areas situated adjacent laydown area <u>Two alternative locations</u> to be assessed.
Water and Electricity (Construction)	○ Construction period (18-24 months) water requirement. ▪ 5 to 30 kℓ per day ▪ used for road construction; hardstand compaction; concrete foundations; cleaning equipment and dust suppression. ○ Operational phase (approximately 25 years) water requirement. ▪ About 8kℓ per month for 11 months of the year. ▪ Approximately 3780kℓ (30kℓ/km of road, 126 km) for 1 month of the year for annual road maintenance (grading and compacting of the roads). ▪ Water header tanks will be used to provide potable water. ▪ Potable water will be sourced from the property, or from the municipality or neighbouring farmers Trucked to site as required during the construction and operational phases. ○ Sanitation on site during the construction and operational phases ▪ Portable toilets and conservancy/septic tanks. ▪ Wastewater to be collected at regular intervals. ▪ Transported to Municipal Wastewater Treatment Works; or ▪ Treated on site and with treated water used for dust suppression and roadworks. Electricity for construction could be obtained from temporary diesel generators and possibly small scale mobile photovoltaic units.

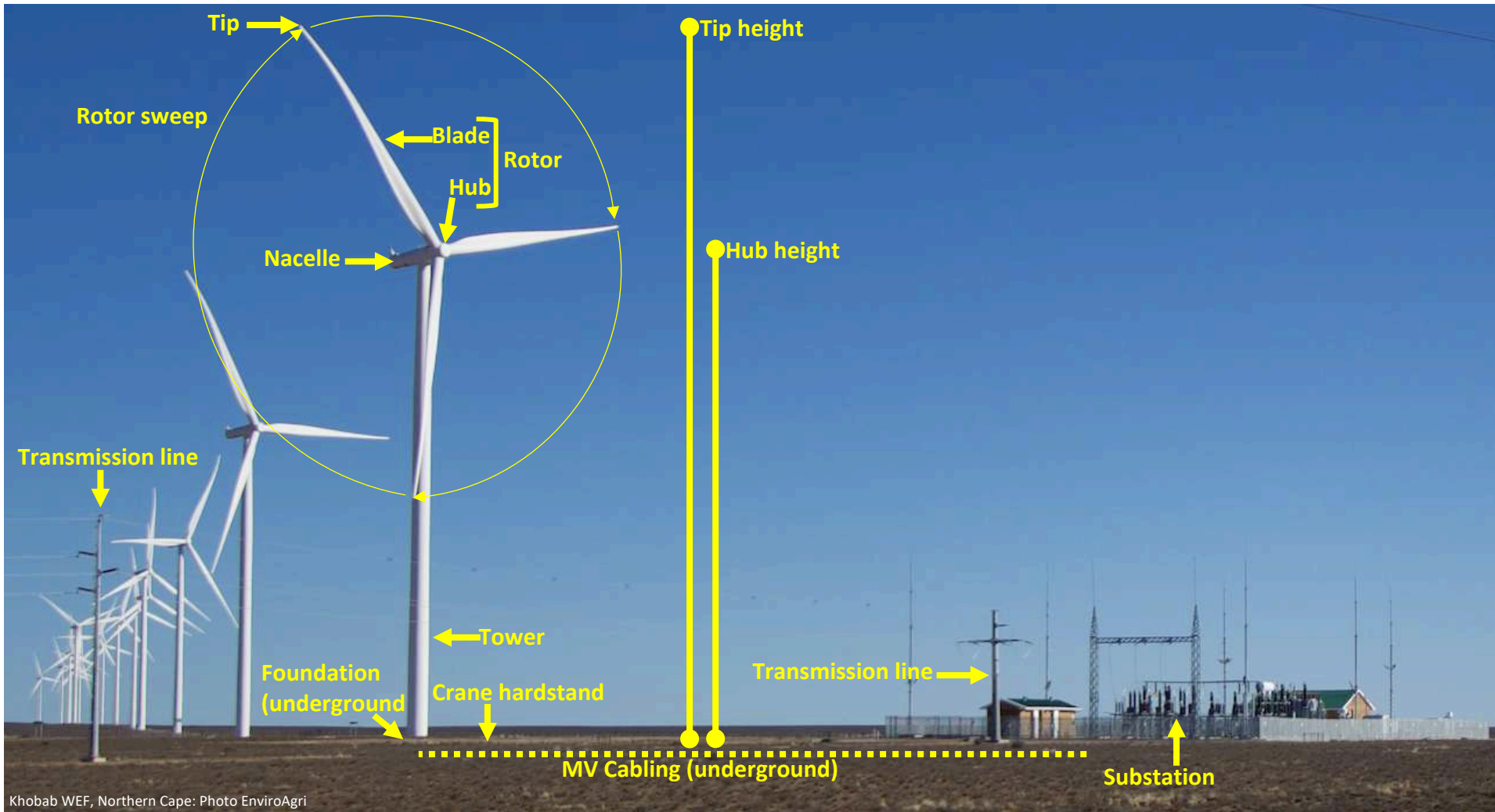


Figure 4-7: Typical WEF layout using Khobab WEF in the Northern Cape as example illustrating the main operational facility components.



4.2.1 Turbines

The wind turbines are the main functional components of the proposed WEF and in essence consist of a rotary device that extracts energy from the wind and this mechanical energy generated is converted to electricity to be transported to the end user. For the Kariega WEF these wind turbines will be large commercial scale turbines consisting of a rotor which consists of three blades and a hub, a nacelle which houses the generator, a tower and foundation. When the wind blows at optimal speeds the blades turn at tip speeds of 200-300 km/hour or more depending on turbine specifications, effectively turning the geared generator to produce mechanical energy which is transformed into electricity transport by underground MV cables to the on-site substation from where it's either connect to the Eskom switching station or BESS.

At Kariega 4 up to 42 turbines of 10MW each with generation capacity of up to 420MW is proposed. The hub height may be up to 150m (i.e. the height of the tower) and the rotor diameter (RD) may be up to 200m (consists of rotor and three blades). The rotor has three blades that typically rotate up to 25 revolutions per minute (rpm) depending on the turbine specifications, wind speed and pitch. The blades are usually coloured white or light grey and in the case of this project are proposed with one blade painted with two signal red bands to reduce potential birds strikes. The nacelle typically contains the generator, control equipment, gearbox and anemometer in order to monitor the wind speed and direction which is used to turn the turbine to face into the wind and thus increase power generation. The tower is constructed from steel or concrete and supports the rotor and nacelle. An increase in tower height typically coincides with wind of greater velocity, therefore increasing the height of a turbine increases the expected wind speeds and generation output. At the base of the turbine tower a transformer steps up the voltage for electricity evacuation to the substation/BESS. The turbines are built on concrete foundations which are ~3 m deep and up to 30 m in diameter. The exact dimensions of foundations are underpinned by founding conditions which will only be established during detailed design. The foundations are one of the main contributors to construction traffic since they typically consist of $\pm 600\text{m}^3$ of concrete and at 6m^3 concrete per truck means a 100 loads per turbine.

Infrastructure ancillary to the turbines include permanent crane hardstands used to assemble the turbine components as well as undertake maintenance (hence it being permanent). Temporary laydown and assembly areas (i.e. construction phase) are used adjacent each turbine to place turbine components, park vehicles, and in general provide a formal space to undertake construction activities. The exact position and orientation of the hardstands and laydowns will be determined during the detailed design of infrastructure within allocated buffer areas.

The reason why these specification are provide in terms of an "up to" context is because the developer may decide to use components with lesser dimensions but due to the constant advancement in technology the greater threshold of turbine specifications are assessed as a "worst case scenario" although in some instance the larger dimension may actually be a positive mitigation factor (e.g. a higher bottom tip height may have reduced impact on low flying birds and greater generation capacity is a positive socio-economic factor). Thus, these dimensions represent a maximum specification for assessment purposes and depends on technology available at the time of construction.

Turbines are remotely controlled and in the case of excessive wind speeds or required curtailment because of sensitive bird or bat species the blades may be turned away (sideways) from the wind to stop rotation which is aided by a braking mechanism. When the wind speed is optimal, or the risk of species impact is mitigated the rotor is turned into the wind again and production resumes.

4.2.2 Access roads & Site roads

Five Potential access points are proposed for the Kariega 4 WEF:

- K4 Access 1, 32°30'57.74"S; 23°36'33.12"E (Directly from R61)



- K4 Access 2, 32°30'23.39"S; 23°39'58.74"E (Directly from R61)
- K4 Access 3 (main), 32°29'0.33"S; 23°41'53.55"E (via R61 over Farm RE/4/92)
- K4 Access 4, 32°23'19.89"S; 23°44'8.61"E (via R61, Aberdeen/Murraysburg road and over Farm 1/72, Farm 1/95, Farm 5/72)
- K4 Access 5, 32°17'57.50"S; 23°36'36.33"E (via R61, Aberdeen/Murraysburg road and over Farm RE/140 and Farm RE/139)

It's likely that all the access points may be utilised, given the extent of the site but the main access point will be used most of the time with the alternatives used when it's required to optimise construction traffic. Access roads and internal site roads will have a width of 15-20m wide which consists of 12m road surface width, 1m for side drains either side, 6m one side of the road surface for MV cable trenches and associated disturbance (topsoil, subsoil and vehicle movement). Of the proposed roads ±66km are existing although mostly substantially narrower than proposed road widths (site roads are about 3-4m on average and are often only jeep tracks or unimproved dirt roads, i.e. without wearing course and little to no drainage or stormwater infrastructure). The total ± 126 km (31km shared with Kariega 2 and 49km shared with Kariega 4) with a total road footprint ~254ha (126km x 20m width). It should be noted that the 20m width is a requirement for crane movement and where possible the width will be reduced. Post construction the roads will be rehabilitated down to 5-10m width which consist of 8m wide road surface, 1m side drain either side (Total Road footprint ~126ha). All roads will have a gravel wearing course (imported from offsite borrow pits). Where possible, existing tracks will be followed, and all roads associated with the WEF will remain indefinitely and be available for use by landowner post construction. Turning areas or sidings will be required to allow heavy and abnormal vehicles to turn safely. These will be brought on at strategic points on site and at end of roads as identified during detailed design. All roads will be developed with the assessed buffers and may be realigned in terms of stormwater considerations, to reduce cut and fill or optimise detail design.

4.2.3 Substation and O&M Complex

The power generated by each wind turbine will be transformed (by a transformer at each turbine) and then connected through underground MW cables to the on-site substation which in turn is connected to the Eskom switching station (for distribution into the national grid) or BESS for storage to be used later. The OHL routes and connecting to a Main Transmission Substation has not been assessed at this stage and depends on Eskom requirements and capacity prior to construction of the proposed WEF.

The On-site Substation and O&M Building will be up to ~1 ha in extent and transform the 33kV power up to 132kV. This area will include site office, workshop, parking, storeroom (which include part storage and oil) and ablution facilities. Directly adjacent will be the Eskom switching station of up to ~1 ha which will connect to the on-site substation to evacuate electricity into the national grid.

4.2.4 Battery Energy Storage System (BESS)

The purpose of a BESS is to save and store excess power as it is generated until such time when the capacity is required. BESS systems therefore aim to overcome one of the key constraints faced by REFs, i.e. providing energy when the demand is greatest and not necessarily when the resource is optimal thus offsetting grid fluctuations. Technological advances within BESS are frequent and at this stage it's envisioned that Lithium-Ion technology will be used, as assessed, although in future more efficient technology might be considered for the BESS. Lithium-Ion technology entails rechargeable electrochemical battery where lithium ions are transferred between the electrodes during the charge and discharge reactions. Currently, Lithium-Ion technology is the dominant energy storage technology for utility-scale applications due to its high level of energy efficiency, relatively high energy density (smaller area required), relative low maintenance and long lifecycle of up to 15-year life (depending on a host of technical factors).

Lithium-Ion technology is not without risk which include temperature fluctuations which may render batteries at risk of being damaged due to instability of temperatures with resultant impacts that could include fire, or permanent



structural damage to the batteries. In addition, there is a risk associated with the chemicals contained within the actual battery storage system itself since the Lithium-Ion battery would contain heavy metals (e.g. cobalt or manganese) to effect electron transfer. These risks are typically mitigated by monitoring and cooling system as well as fire detection and suppression systems, but it's highly likely that the BESS will be subject to a MHI risk assessment before construction to ensure it is compliant in terms of local laws and regulations and health and safety requirements governing battery facilities as well as international standards.

The BESS proposed for Kariaga 4 includes an area of up to ~5ha (Adjacent O&M Complex), Lithium-Ion Battery technology with an export capacity of up to 250MW and Storage Capacity 1000MWh (Storage duration 4hrs).

The BESS batteries are typically stored inside containers and the facility will be connected via underground MV cabling to on site substation. The BESS will be fenced for security purposes with a firebreak around the BESS facility included in the footprint.

4.2.5 Medium Voltage (MV) cables

Each turbine will connect to the on-site substation via underground MV collector cables (up to 33kV) which follow that facility roads. Typically imported bedding material is needed to lay the cables which will be obtained from a registered, legal commercial source. The footprint of the cables is included in the road widths and therefore no additional footprint is assessed for the MV cables. The trenched areas for MV cables adjacent the roads will be revegetated as part of rehabilitation measures on site.

4.2.6 Construction Laydown area & Site Camp

The site camp and adjacent laydown area will include temporary site offices, stores, workshops, turbine storage areas, fuel storage, worker eating/rest area and ablution facilities etc. These areas will be rehabilitated after construction. The laydown area will be ~1ha and Site camp another ~1ha per phase.

4.2.7 Batching plant and stockpile area

Concrete batch plant (temporary, construction phase) will be ±0,5ha per phase and include cement silos, stockpile areas, parking and turning areas, quality test area and the batch plant itself. Batching areas will be situated adjacent laydown areas.

4.2.8 Provision of services (Water and Electricity) required during construction

The estimated construction period would be around 18-24 months. The water requirement for this period would be around 5 to 30 kℓ per day used for road construction; hardstand compaction; concrete foundations; cleaning equipment and dust suppression. During the operational phase (approximately 25 years) water requirement would be about 8kℓ per month for 11 months of the year, which equates to approximately 3780kℓ (30kℓ/km of road, 126 km) for 1 month of the year for annual road maintenance (grading and compacting of the roads). Water header tanks will be used to provide potable water and potable water will be sourced from the property, or from the municipality or neighbouring farmers and trucked to site as required during the construction and operational phases.

Sanitation on site during the construction and operational phases will include portable toilets and conservancy/septic tanks with wastewater to be collected at regular intervals and transported to municipal



Wastewater Treatment Works or treated on site and with treated water used for e.g. dust suppression and roadworks.

Electricity for construction would be obtained from temporary diesel generators and small scale mobile photovoltaic units.

4.3 Project Phases

A summary of activities associated with project phases are provided in Figure 4-8.

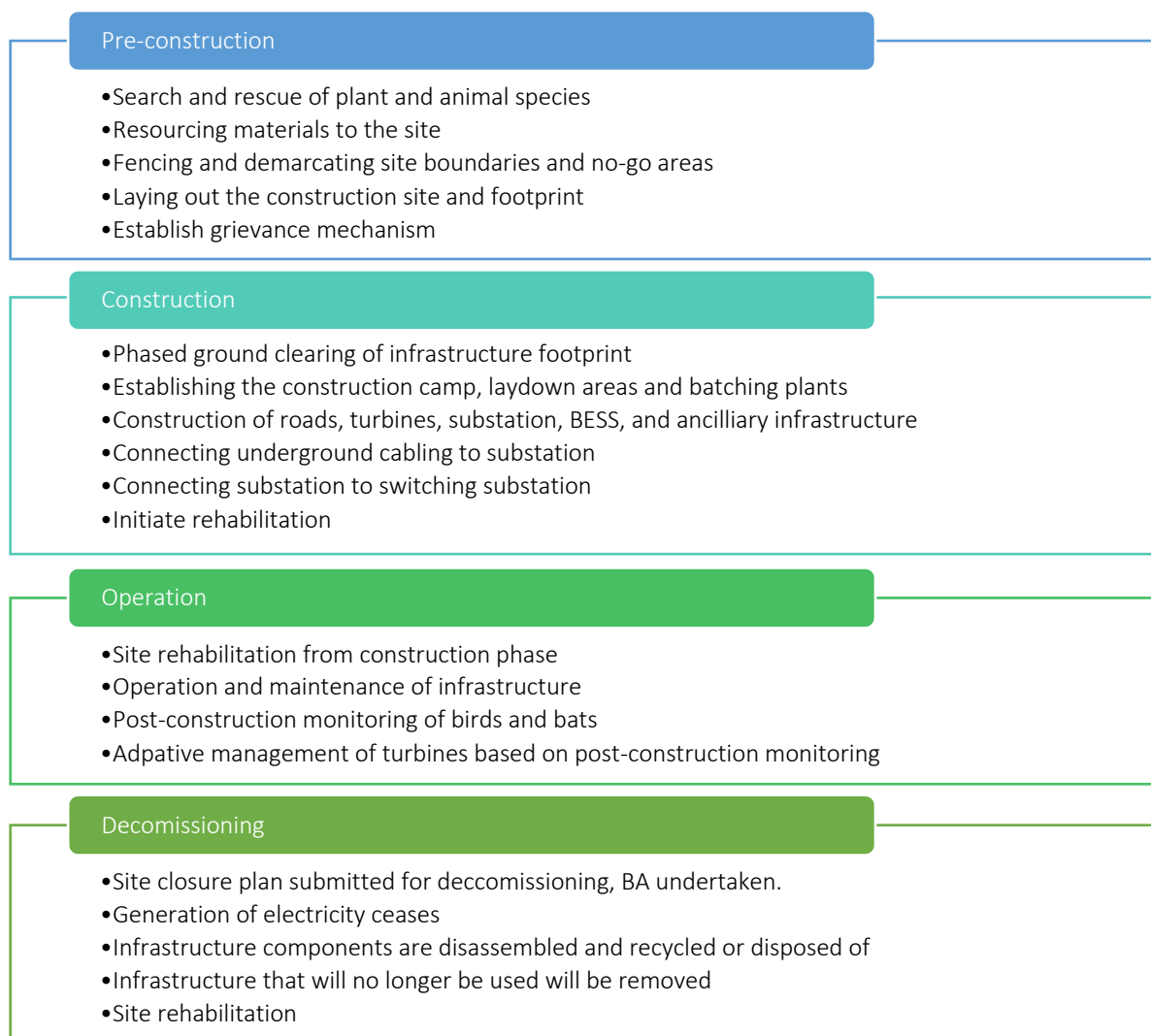


Figure 4-8: Summary of activities associated with project phases.

4.3.1 Pre-Construction

Pre-construction activities involve tasks that establish the site, both in terms of the construction activities, as well as the social and environmental management systems. During this time, all effort should be made to ensure that the planning of the project is completed effectively to ensure that there are no delays to the project and that no unnecessary environmental degradation occurs.

During this period, the site detailed design will be refined withing the authorised site footprint. The site establishment boundaries, i.e. actual development footprint, will be demarcated, and no-go areas will be identified. Site demarcation will occur for the formal infrastructure footprints, i.e., turbine foundations, crane hard stands,



substation, laydown areas, construction camps, switching stations etc. Storage areas for materials, spoil and topsoil piles will be identified. It's important that the Environmental Control Officer (ECO) and Environmental Site Officer (ESO) be engaged in this process to ensure compliance with the EA and EMPr.

It is also important to ensure that social risk is addressed during the construction period by ensuring that an appropriate grievance mechanism is put in place during the pre-construction period and communicated well in advance (typically at the same time the DFFE is notified of commencement of construction) to affected persons. Furthermore, all the Contractors' staff must undergo training to ensure they understand the environmental sensitivities of the site.

4.3.2 Construction Phase Activities

The construction period for the WEF is anticipated to last up to 24 months. An on-site construction camp will be used which includes a site office, storage areas as well as areas for the management of dangerous and hazardous substances such as fuel. Typically clearing of topsoil and construction of access and internal roads are the first port of call for civil teams after which construction is ramped up with batching facilities becoming operational and on-site traffic increasing significantly. Typical construction operations of WEF may run over a 24/7 period given environmental conditions and construction requirements, e.g. the erection of blades may be undertaken at night (even after midnight) when the wind speeds are lowest and hence safest working conditions or casting/floating of the cement foundations for turbines and substations may run into a +20hour cycle depending on factors such as volume of cement and rate at which cement can effectively be cast.

Potential waste streams during construction will include general site waste, spoil (the spoil will be balanced on site in terms of cut and fill requirements and no offsite disposal is envisaged) and hazardous waste, i.e. oil and lubricants. Bins will be placed at suitable locations within the construction camp and a waste management hierarchy (reduce, reuse, recycle) will be required as a condition of the EMPr. Further, waste mitigation measures are detailed in the EMPr.

Rehabilitation will be initiated during the construction phase and will be undertaken in a phased approach to continue into the operational phase. The construction phase period will provide employment opportunities to the local community, mostly in the low and semi-skilled level. This would represent a positive social benefit in an area with employment opportunities. To maximise the potential benefits, the developer will commit to employing local community members to fill the low and medium skilled jobs, as far as possible but not lure away those that have permanent employment for relative short-term gains, i.e., farm labourers.

4.3.3 Operational Phase Activities

During the operational phase, the WEF site will remain available to the farmers as rangeland or retained as wilderness area. The areas disturbed during the construction phase and not used during operation, will be rehabilitated in a phased approach during the operational phase. Operational phase of WEF is expected to be around 25 years.

4.3.4 Decommissioning Phase Activities

The decommissioning of the infrastructure is expected to take around ± 6 months. This will be undertaken based on the outcomes of a site closure plan for decommissioning. After disconnecting the infrastructure from the electricity network, the components of the facility would be disassembled, removed and reused or recycled as far as possible. The rehabilitation of the disturbed areas would form part of the decommissioning phase. The aim would be to restore the land to its original substratum characteristics (or as near as possible). The decommissioning phase will comply with the applicable legislation in effect at the time.

4.4 Project Need and Desirability

Table 4-4 below provides project specific answers to questions included in the Needs and Desirability Guideline⁷. The table illustrates the alignment of the activities applied for in terms of Need and Desirability of the Kariega 4 WEF.

Table 4-4: The need and desirability of the proposed grid connection infrastructure is motivated in the following table.

Need and Desirability	
Need (Timing)	
Question	Response
1. Is the activity permitted in terms of the property's existing land use rights?	The properties are currently zoned for agricultural land use (Agricultural I) and the actual land use is by-and-large extensive farming with goats, sheep and some game. The properties or part thereof will be rezoned to utility use zone and will be subject to subdivision in terms of certain infrastructure components i.e. the substation, BESS and turbine footprints. This will be undertaken in terms of SPLUMA (Spatial Planning and Land Use Management Act 16 of 2013) and the appropriate zoning provided for in the local Municipality's Land Use Ordinance and Zoning Scheme Regulations. The areas not directly used by the wind farm will remain available for farming practices as currently undertaken. This will also include the use of the internal roads by the landowners and occupiers. Further departure use applications in terms of municipal building lines restrictions, height and coverage restrictions and/or any possible subdivision of land may be applicable. The OHL which is not part of this application will also require either a formally proclaimed servitude or wayleave to be registered.
2. Will the activity be in line with the following? (a) Provincial Spatial Development Framework (PSDF)	The Eastern Cape Vision 2030 Provincial Development Plan highlights access to energy by 2030: o Alleviate energy poverty and resultant socioeconomic consequences in remote rural areas through sustainable energy initiatives. o Economics may dictate that off-grid solutions are necessary. <u>Renewable energy</u> hubs for remote rural areas are a potential solution, using solar, <u>wind</u> and biomass/biogas as a resource.

⁷ DEA&DP. 2011. Needs and Desirability Guideline. National Department of Environmental Affairs' Guideline on Need and Desirability (first version published in terms of section 24J of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA") in 2014, and second version in 2017)



	o Promote energy-efficient homes to improve health and well-being, but also enable the adequate, affordable provision of energy services to communities. The plan also notes that approved wind energy projects already account for 63 percent of the average provincial energy demand (1700 MW). Whilst highlighting some serious institutional hindrances to wind-farm developments it identified the potential of the province to contribute to manufacturing industries for renewable industries (the Kariega WEF are proposing local manufacturing of concrete turbines towers). The Western Cape PSDF (2014) outlines in deliver clean resources of energy to urban consumers and adapt to and mitigate against climate change; o Pursue energy diversification and energy efficiency in order for the Western Cape to transition to a low carbon, sustainable energy future, and delink economic growth from energy use. o Support emergent Independent Power Producers (IPPs) and sustainable energy producers (wind, solar, biomass and waste conservation initiatives) in sustainable rural locations (as per recommendations of the strategic Environmental Assessment for wind energy).
(b) Urban edge / Edge of Built environment for the area	N/A - The proposed infrastructure is outside the urban edge.
(c) Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g., would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).	The Dr Beyers Naude Municipality Spatial Development Framework (SDF) Final Report (2021). Spatial Goal 3 lists several objectives that are relevant to the proposed development, specifically the use of appropriate technology. It identifies the Camdeboo as suitable for wind energy initiatives highlights the promotion of Green Energy, specifically wind farms. The SDF does however note the potential strain on the water resource from large scale developments such as wind and solar. It also notes the potential damage to roads and other infrastructure, especially with abnormal load vehicular traffic which has increased drastically because of the transportation of wind turbine components. It also mentions the potential impact on the environment and wildlife by wind farms close to Aberdeen. Nevertheless, Dr BNLM SDF supports green energy developments in principal provided that any negative impacts on the tourism and agricultural economy are avoided. These developments, particularly wind energy production facilities, have a high visual impact on the surrounding area and should be located away from existing and



	future tourism focus area - Preferably outside of the 10km 'buffer' surrounding the World Heritage Site. Dr Beyers Naude Municipality 2022 – 2027 IDP (2nd Draft Edition: 2023/24 IDP) includes little information that can be directly related to the proposed development, potentially owing to still being in draft format. Notwithstanding this, the municipal vision of a safe, sustainable environment for all to live and thrive in and overall strategic goal to create and maintain an enabling environment within which development, on all fronts, can be materialised aligns well with the proposed development of the Kariega WEF. Sarah Baartman District Municipality Draft IDP for 2022/2027 identifies investment in alternative energy such as wind turbines as projects which will stimulate spin-offs for economic growth and therefore wishes to promote these developments. Moreover, the importance of wind energy generation in the district has been confirmed by the announcement by the Department of Energy in terms of successful wind farm developments, as eight of the thirteen approved wind farm developments are to be developed in the district, with an additional two wind farms to be developed in Nelson Mandela Bay Municipality. The CKDM (IDP) 2023- 2024 create an environment for robust economic development. The IDP highlights the strategic objectives which include a united integrated development path in a safe and sustainable environment and pursue economic growth opportunities that will create descent work. It recognises ample wind and solar potential of the CKDM, and by undertaking urgent and proactive long-term adaptation that will increase the country and CKDM own resilience. It also renewable energy production can be up scaled in the region and create downstream opportunities. CKDM IDP Policy A5: Support and Promote the Renewable Energy Economy. The Beaufort West Municipality Integrated Development Plan (2022-2027, as amended, 5th Generation) makes specific reference to Renewable Energy as a Strategic Economic Sector and highlights how REIPPPP contributes to Broad Based Black Economic Empowerment and how renewable energy projects through different procurement strategies contribute the local and regional economy.



	Beaufort West Municipality Spatial Development Framework (2023 draft) considers green energy (solar and wind) in its municipal planning framework and under its Policy A4: Climate Change Adaptation and Disaster Mitigation looks to promote renewable energy generation and use. It also emphasizes that when delivering any renewable energy, or any infrastructure in rural areas, it must be ensured that key view sheds and vistas are not undermined and that, where appropriate, set-backs and screenings (in the form of tree planting) are provided from roads.
(d) Approved Structure Plan of the Municipality	The WEF and ancillary infrastructure will be located outside urban areas and all structure will have to be approved by the municipality.
(e) An Environmental Management Framework (EMF) adopted by the Department (e.g., Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations?)	The district and local municipalities do not have an approved EMF.
(f) Any other Plans (e.g. Guide Plan)	The Dr Beyers Naude Municipality Local Economic Development (LED) Strategy 2019 -2023 deals with among others rural development and job creation as well as supporting of investments into the municipality to ensure infrastructure and basic services are delivered. The proposed WEF will create a significant amount of job opportunities as well as substantial financial injection into the local economy.
3. 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 credible IDP)?	The Dr Beyers Naude Municipality Spatial Development Framework (SDF) Final Report (2021) identifies the Camdeboo as suitable for wind energy initiatives highlights the promotion of Green Energy, specifically wind farms. Dr Beyers Naude Municipality 2022 – 2027 IDP (2nd Draft Edition: 2023/24 IDP) the municipal vision of a safe, sustainable environment for all to live and thrive in and overall strategic goal to create and maintain an enabling environment within which development, on all fronts, can be materialised aligns well with the proposed development of the Kariëga WEF. Sarah Baartman District Municipality Draft IDP for 2022/2027 identifies investment in alternative energy such as wind turbines as projects which will stimulate spin-offs for economic growth and therefore wishes to promote these developments.



	The CKDM 2019 SDF recognises several onshore wind and solar energy projects which are currently being planned for the district in terms of their energy and electricity planning. It also highlights opportunities exist for expanding renewable energy projects related to solar and wind power in the CKDM. The Beaufort West Municipality IDP (2022-2027, as amended, 5th Generation) and Beaufort West Municipality SDF (2023 draft) considers utility scale wind energy in the municipal planning with reference to climate change adaptation and its current transition from non-renewable to renewable energy.
4. Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g., development is a national priority, but within a specific local context it could be inappropriate.)	The WEF would directly benefit the local community, by creating a source of income to the landowners of the properties on which the WEF is located and would improve the economic viability of the landowner's current farming operations. The proposed project would also create direct, indirect and induced job opportunities for the local community. This is especially true when considering the cumulative impacts of the currently approved and potential future RE projects in the REDz11 area will bring much needed job opportunities to the area. With numerous projects planned for the area it will also create a constant work stream for people to be upskilled and form part of the formal and informal economy.
5. Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	It's likely that additional capacity will need to be created in Aberdeen considering the cumulative requirements of the project authorised and planned for the area. This capacity will likely be in terms of landfill space for solid waste management but may also include support service such as community clinics which may have to service an influx of project staff to the area.
6. 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 placement of services and opportunity costs)?	The development is not specifically provided for in the infrastructure planning of the municipality. It's foreseeable that additional infrastructure planning will be required by the municipality to cater for the cumulative requirements of the WEF authorised and planned for the area.
7. Is this project part of a national programme to address an issue of national concern or importance?	The proposed WEF will support the national Department of Mineral Resources and Energy (DMRE) mandate to ensure efficient supply of electricity to service the South African economy and society by strengthening the existing electricity grid for the area.



8. Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.)	The proposed WEF is within REDZ 11 and EGI corridor as well as proven area with optimal wind resource.
9. Is the development the best practicable environmental option for this land/site?	The development of the WEF would not significantly impede on current agricultural land use of predominately goat, sheep and game farming. The WEF can therefore be viewed in terms of additionality meaning it is a complimentary beneficial use of the land if the necessary mitigation measures are undertaken to avoid substantial environmental impact.
10. Will the benefits of the proposed land use/development outweigh the negative impacts of it?	The Basic Assessment and Specialist have concluded that the benefits of the proposed land development will outweigh the negative impacts with the provision that the provided mitigation measures are successfully implemented.
11. Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?	There are already a number of other wind farm developments authorised in the area and considering that the area is within a REDZ and EGI corridor it's highly likely that similar activities will be applied for in the area.
12. Will any person's rights be negatively affected by the proposed activity/ies?	The authorisation of the listed activity applied for in this BAR will not affect any person's rights negatively. It's also the obligation of any person who feels their rights may be negatively affected by the proposed development to state as such during public comment period for potential unforeseen issues to be addressed.
13. Will the proposed activity/ies compromise the "urban edge" as defined by the local municipality?	The proposed development occurs outside the urban edge, therefore the urban edge will not be compromised.
14. Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPs)?	The proposed WEF is not yet gazetted as a SIP but may be in future. It's likely that it may be registered in terms of SIP 20c Embedded Generation Investment Programme (EGIP). The EGIP forms part of the Energy Strategic Integrated Project No. 20c, which was gazetted in Government Gazette 43547 on 24 July 2020. These projects are classified as Strategic Integrated Projects (SIP) and are to be managed within the requirements as set out in the Infrastructure Development Act (Act No. 23 of 2014) and its amendments.
15. What will the benefits be to society in general and to the local communities?	The benefits to society in general and to the local communities include socio-economic upliftment of local communities; job creation; increased energy security, water resource saving, sustainable exploitation of renewable energy resource; reduction in pollution;



	aligning with international agreements and climate friendly development.
16. Any other need and desirability considerations related to the proposed activity?	South Africa has experienced energy blackouts since 2007. This energy crisis has led the Government embarked on a process to introduce new energy resources including renewable energy on a large scale. This translates into a significant national need for investment in renewable energy projects described in among others the 2030 NDP.
17. How does the project fit into the National Development Plan for 2030?	The WEF which would contribute significantly to the National Development Plan for 2030 aims to create jobs, develop and expand infrastructure, transition to a low carbon economy and unify South Africa.
18. Please describe how the general objectives of Integrated Environmental Management as set out in section 23 of NEMA have been considered.	The purpose of section 23 of NEMA is to promote the application of appropriate management tools to ensure the integrated environmental management of activities. Table 4-5 below lists the general objectives of integrated management and provides a motivation as to how the proposed development has taken the objectives into account.

Table 4-5: Consideration of NEMA objectives.

Section 23(2) of NEMA: The general objective of integrated environmental management is to:	Description as to how the proposed development has taken these general objectives into account.
(a) promote the integration of the principles of environmental management set out in section 2 of NEMA into the making of all decisions which may have a significant effect on the environment;	The underlying principle of this Basic Assessment process is to ensure that the development is socially, environmentally, and economically sustainable. This has guided the assessment of impacts of the project by Specialists to ensure that the project will be undertaken in an environmentally responsible manner. In recognition that social responsibility is something which needs to be actively developed, a public participation process (PPP) was undertaken. This process was undertaken in such a manner to promote active participation and foster a clear understanding of the project and transparent sharing of information.
(b) identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in section 2;	This BAR includes the list of potential impacts associated with this project. Each aspect was evaluated to determine the significance of the impact and mitigation measures have been proposed to reduce negative impacts and to enhance positive impacts. The Environmental Management Programme (EMPr) will be by recommendations from the PPP process to guide the construction and operational phases in an environmentally and socially sound manner (Refer to Annexure G).
(c) ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them.	Specialist studies were undertaken to ensure the effects of activities on the environment where addressed and appropriate mitigation measures are proposed.
(d) ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment.	The PPP that has been undertaken for the proposed WEF as described in detail in Section 4. The PPP was undertaken in accordance with Regulation 41 of the 2014 EIA Regulations (GN R982, as amended) and the applicable best practise guidelines.
(e) ensure the consideration of environmental attributes in management and decision-making which may have a significant effect on the environment.	The areas of environmental sensitivity (illustrated in a map in Figure 7-1 have been avoided in the layout. Mitigation measures will be overseen by an ECO in terms of the EMPr and reported on to the competent authority this reporting and implantation of the EMPr will also be subject to audits to verify compliance.
(f) identify and employ the modes of environmental management best suited to ensuring that a particular	Recommendations and mitigation/ enhancement measures for each of the impacts identified in Section 6 have been included in the EMPr in Annexure G. The



activity is pursued in accordance with the principles of environmental management set out in section 2.	purpose of these recommendations is to minimise the disturbance to the environment, and enhance possible opportunities associated with the proposed development. Where negative impacts are unavoidable, strict management and rehabilitation is recommended to minimise the potential negative impacts.
19. Please describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.	Section 2 of NEMA lists several principles that underpin the role of Sustainable Development and the consideration of environmental impact within the Act. These principles are critical to achieve Sustainable Development as it is important to find the balance between the competing demands for resources from the Economic system, the Social system, and the Ecological system. These principles are applicable to the “actions of all organs of state that may significantly affect the environment” and it is therefore crucial to apply them to the proposed development, for decision-makers to be confident that their decision to allow a development, promotes Sustainable Development. The underlying principle of this BA process is to ensure that the development is socially, environmentally, and economically sustainable. This has guided the assessment of impacts of the project to ensure that the project will be undertaken in an environmentally responsible manner. Recognising that social responsibility is something that needs to be actively developed, PPP was undertaken (as detailed above in Section 3.3). This process was undertaken in a manner which promotes active participation and foster a clear understanding of the project and transparent sharing of information. Knowledge from I&APs have been included in all forms, including traditional or ordinary knowledge. The PPP and consultation with the directly affected landowners will also aim to improve environmental awareness in the area (Section 2(4)(h) of NEMA). Key organs of state that may have interest in the project have been proactively identified, and an effort has been made to promote intergovernmental coordination as far as possible to reduce the potential for conflicts of interest, caused by lack of information or inappropriate communication channels. Proof of this correspondence is detailed in Section 3.3 and Annexure C. Environmental management has been considered to place people and their needs at the forefront of its concern, aiming to serve their physical, psychological,



	developmental, cultural and social interests equitably (Section 2(2) of NEMA). However, it is crucial that ecological considerations are also considered through this process and avoidance, minimising or rehabilitating measures are detailed for the disturbance of ecosystems and loss of biodiversity, pollution and degradation of the environment, disturbance of landscapes, and sites that constitute the nation's cultural heritage, waste, and the use and exploration of non-renewable natural resources (Section 2(4)(a) (i-v) of NEMA). Where a negative impact is unavoidable, measures have been considered to remedy the disturbance and address the effects (Section 2(4)(p) of NEMA). Fortunately, this proposed development, are located in an area that is not highly sensitive, vulnerable, highly dynamic, or overly stressed (Section 2(4)(r)). The nature of this BA process has been undertaken in a risk-averse and cautious approach, and where relevant the worst-case scenario has been assessed. The findings of these assessments have been amalgamated into this BAR which has not only assessed the impact of this proposed development, but also the cumulative impacts of the other similar developments authorised within a $\pm 30\text{km}$ radius (Section 2(4)(a) (vii & viii) and 2(4)(b)). Should this BAR be granted a positive environmental authorisation, approximately 24 months of construction will be required to build the proposed infrastructure. During this construction period (and also the rest of the lifecycle of this project), stringent environmental health and safety standards will be required. It will also acknowledge the right of workers to refuse work that is harmful to human health, or the environment, and be informed of any potential dangers (Section 2(4) (e & j)). In addition, this process been undertaken in a manner that meets the principles and objectives of the South African legislation and meets global and international responsibilities relating to the environment by contributing to the renewable energy targets and reducing the reliance on carbon heavy energy sources using fossil fuels (Section 2(4)(n)).

5 CONSIDERATION OF ALTERNATIVES

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

The DEA&DP Guideline on Alternatives (2013) states that:

“Every EIA process must identify and investigate alternatives, with feasible and reasonable alternatives to be comparatively assessed. If, however, after having identified and investigated alternatives, no feasible and reasonable alternatives were found, no comparative assessment of alternatives, beyond the comparative assessment of the preferred alternative and the option of not proceeding, is required during the assessment phase. What would, however, have to be provided to the Department in this instance is proof that an investigation was undertaken and motivation indicating that no reasonable or feasible alternatives other than the preferred option and the no-go option exist.”

The 2014 EIA Regulations (GN R982) (as amended) provide the following definition:

“Alternatives”, in relation to a proposed activity, means different ways of meeting the general purpose and requirements of the activity, which may include alternatives to the -

- (a) *property* on which or location where the activity is proposed to be undertaken;
- (b) type of *activity* to be undertaken;
- (c) *design* or *layout* of the activity;
- (d) *technology* to be used in the activity;
- (e) *operational* aspects of the activity; and
- (f) includes the option of not implementing the activity (“No-Go” alternative).

In addition to the list above, the 2013 DEA&DP Guidelines on Alternatives also considers the following as alternatives:

- (a) Demand alternative:
Arises when a demand for a certain product or service can be met by some alternative means.
- (b) Input alternative:
Input alternatives are applicable to applications that may use different raw materials or energy sources in their process.
- (c) Routing alternative:
Consideration of alternative routes generally applies to linear developments.
- (d) Scheduling and timing alternative:
Where several measures might play a part in an overall programme, but the order in which they are scheduled will contribute to the overall effectiveness of the end result.
- (e) Scale and Magnitude alternative:
Activities that can be broken down into smaller units and can be undertaken on different scales.

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

- Location alternatives;



- Layout alternatives;
- Technology alternatives; and
- The “no-go” alternative.

5.1 Location Alternatives

The location for the WEFs was selected based on the following parameters:

- Quality of the wind resource;
- Proximity to Eskom grid connection point, i.e. existing Eskom substation which has sufficient capacity (or planned capacity) to support the proposed WEF project;
- Landscape features of the site being relative flat, which makes construction easier and reduces cost;
- Relatively remote site (fewer sensitive receptors in terms of visual and noise impacts);
- Landowner support of the proposed development;
- Accessibility from the R61; and
- Relatively low agricultural potential land mostly used for extensive low intensity livestock grazing.

Based on these considerations, the Kariega 4 WEF site has been selected as the preferred alternative due to the favourable factors listed above. The Kariega 4 location forms part of the greater Kariega WEF cluster, which have been chosen in terms of the same location factors as mentioned above. The proximity of the proposed Kariega 2 and 3 WEFs to Kariega 4 is also a positive location factor. If all three are authorised and if all three will be constructed this provides an opportunity to share infrastructure such as roads which positively influences the ratio between development footprint and impacts against to total number of installed MW, in plain terms there will be more power generated in comparison to the area impacted upon.

5.2 Design and Layout Alternatives

A single site layout has been compiled and presented in the final BAR, based on inter alia the following criteria:

- Technical constraints:
 - Spatial orientation requirements of turbines and associated infrastructure (e.g. other turbines, existing roads, construction phase traffic);
 - Geotechnical considerations;
 - Required setbacks from property boundaries, roads, powerlines etc.; and
 - Wind resource profile.
- Environmental constraints:
 - Topographical constraints, including surface water features and to a lesser extent slope (since the area is very flat);
 - Avifauna sensitivities;
 - Bat sensitivities;
 - Agricultural landscape;
 - Sensitive terrestrial and aquatic features such as ridgelines and watercourses;
 - Visual impacts from both in terms of landscape and cultural heritage;
 - Sensitive heritage, including archaeological and palaeontological areas;
 - Sensitive receptors such as houses which are exposed to potential noise and flicker impacts; and
 - Landowner requirements.

The site layout has undergone numerous changes since the concept layout was configured in 2022. Original specialist assessments were undertaken on the entire Kariega WEF cluster area Figure 5-1. Based on the specialist findings and conclusion of the bat and bird monitoring a concept layout was provided for assessment which include four Kariega phases as part of the WEF cluster, ~ January 2023 (Figure 5-2). However, Kariega 1 was excluded from the cluster due to land use negotiations which had not been concluded and therefore the original properties were reduced (since the specialist report considered the entire cluster reference to Kariega 1 remain in some reports with reference to potential cumulative impacts which must consider the worst-case scenario).

Given the outcome of the specialist assessments concluded in 2023 the applicant had to move and remove some infrastructure components to avoid sensitivities. This was done in terms of cumulative impact mapping which indicated a potential developable footprint based on reducing sensitivities for turbine and ancillary infrastructure placement (~May 2023). The concept of this process, ie. the site selection matrix is provided in Figure 5-4, Figure 5-5, Figure 5-6 and Figure 5-7, which ended up providing conceptual developable area (these sensitivities are all provided in the cumulative sensitivity maps and are illustrated here for illustrative purposes of the selection process followed). The reason why it was a conceptual developable area is that it didn't consider existing infrastructure such as roads or access points as well potential cumulative and small-scale features that needed to be avoided. This developable area was used by the applicant to redesign the facility and place infrastructure outside of the major sensitive areas.

The new refined layouts (~December 2023, Figure 5-8) were provided to all specialists to update their assessments. These layouts included an increase in the total number of turbines for each phase based on the developable area. The layouts however phase three problems: 1. The potential cumulative impact of all the proposed turbines on avifauna pushed the potential bird strike fatality into a threshold based on turbine density which would have seen impacts rated as major negative after mitigations which was the construed as an inherent fatal flaw; 2. The bat assessment indicated the exact proximity of the turbines in terms sensitivities and those that had to be moved or removed; and 3. The heritage assessment indicated that some turbines in Kariega 4 where in an area of high cultural landscape value and had to be moved / removed. In response to these three problems the applicant removed and moved turbines (Kariega 4 was reduced from 80 turbines to 42) and the specialist were required to either update their assessments based on the new layout (Figure 5-9, as assessed in this fBAR) or attach an addendum to their impacts assessment reports stating whether the changes made a difference to their reports or not (~April 2024). In the case where there was a difference the specialist clearly indicated the change in impact significance.



Figure 5-1: Area of the originally proposed (~2021) Kariega WEF indicated by the green outline.

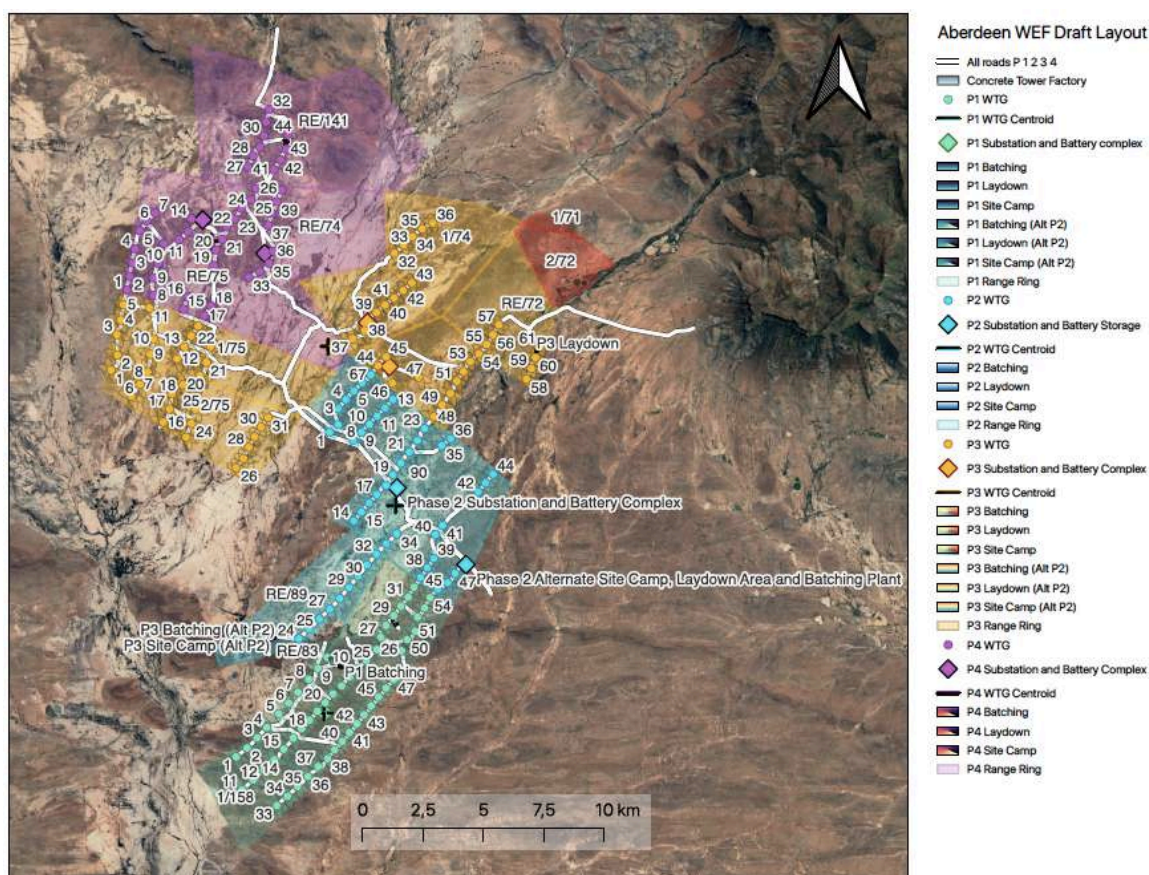


Figure 5-2: Concept layout of the originally proposed (~January 2023) Kariega WEF cluster.

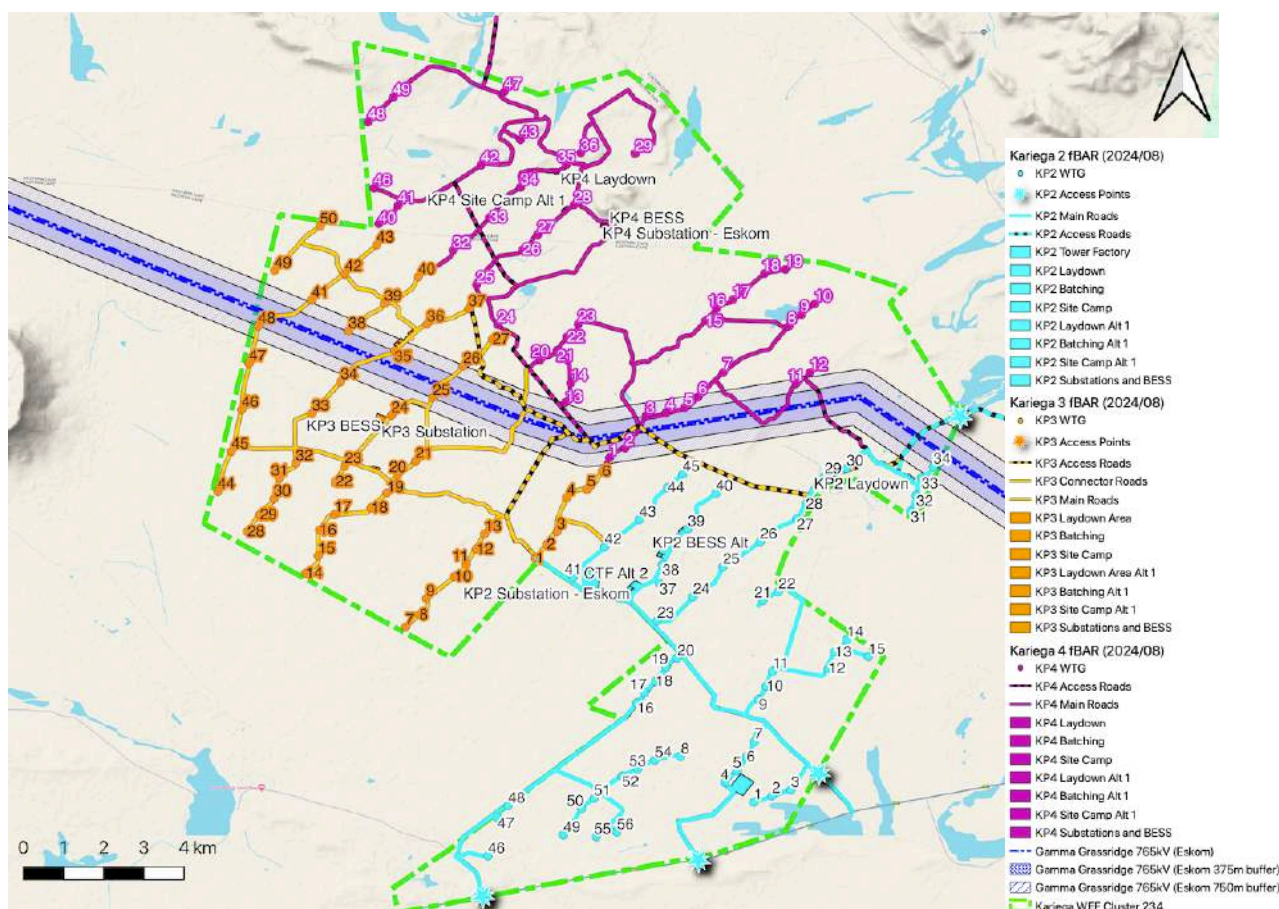


Figure 5-3: Updated layout of the Kariega WEF cluster assessed in the fBAR (~September 2024) showing the servitude of the proposed Gamma-Grassridge 765kV powerline.

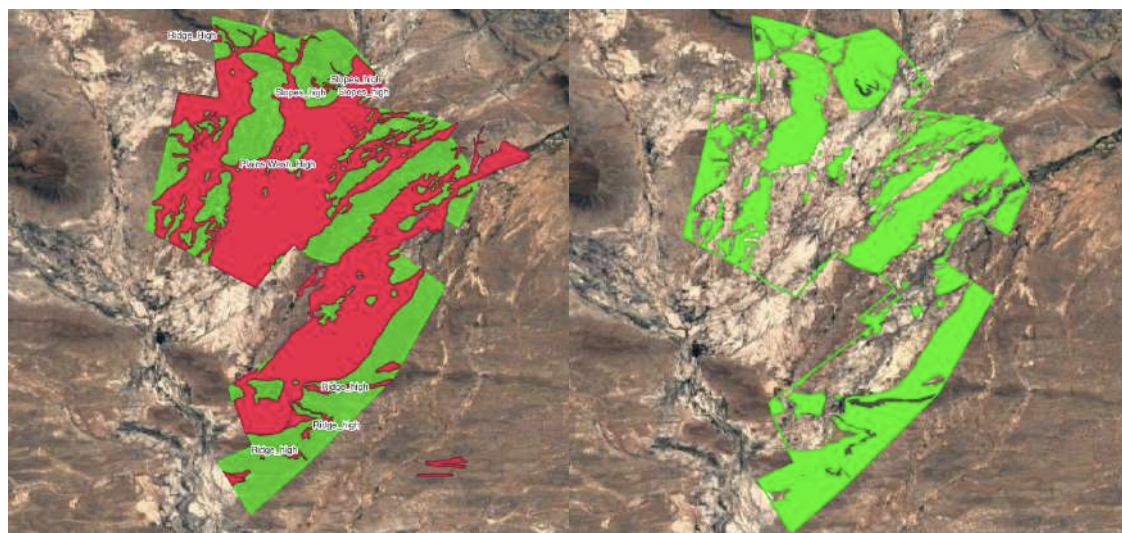


Figure 5-4: Excluding areas of aquatic and terrestrial sensitivity (left in red, right is remainder of area).

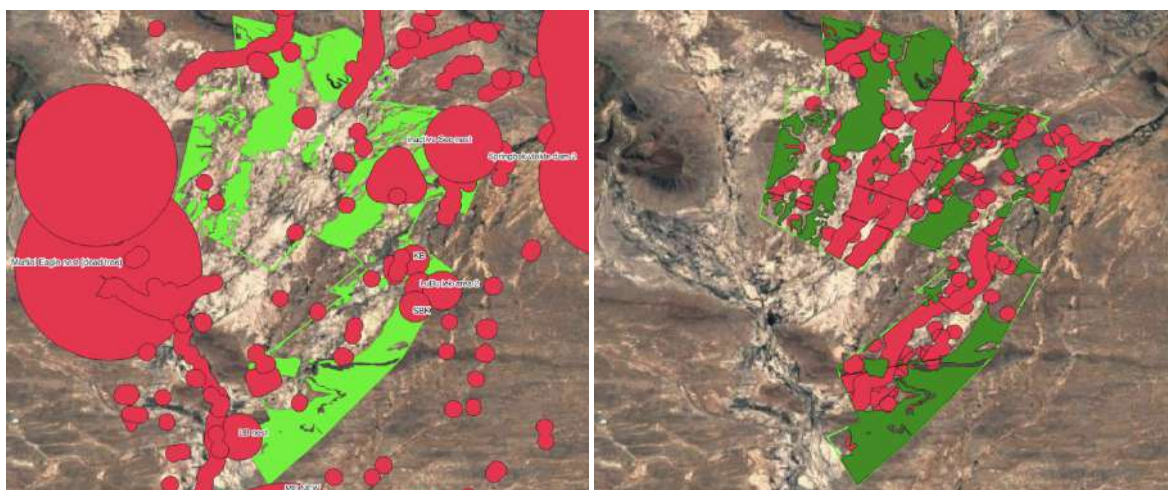


Figure 5-5: Excluding areas of avifauna and bat sensitivity.

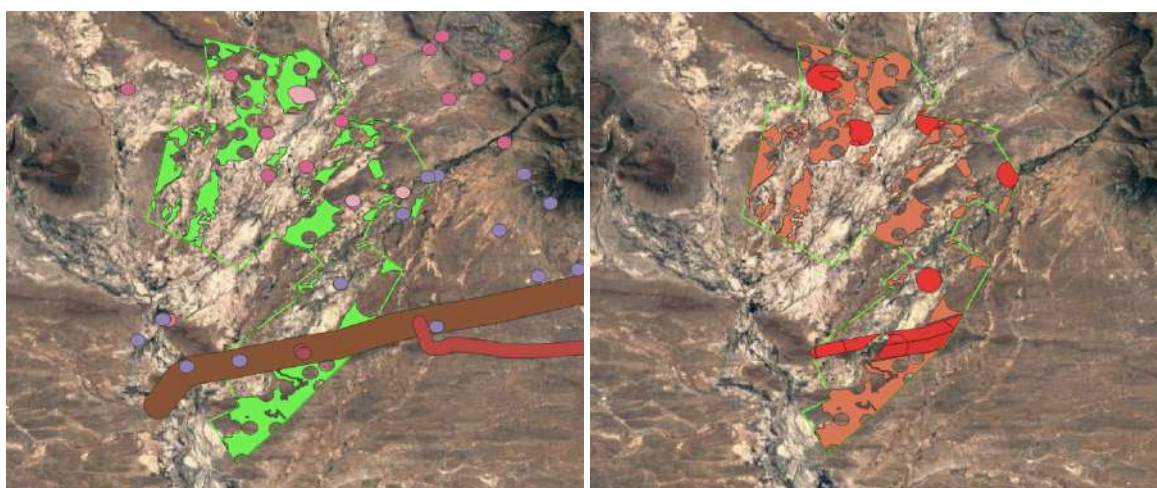


Figure 5-6: Excluding areas of heritage visual and flicker.



Figure 5-7: Concept developable area of the Kariega WEF cluster.

RR 01 fBAR-Kariega 4 WEF_20240911.docx

[illegible]

Page 74

The site layout has changed slightly from the dBAR in response to the environmental, social and technical sensitivities identified during the BA process specialist assessments, and via engagement with the public and other stakeholders such as Eskom because of the Gamma-Grassridge powerline servitude Figure 5-3. This change included dropping eight turbines (no. 30, 31, 37, 38, 39, 44, 45 and 50) from the layout as illustrated in Figure 5-9 and updated in Figure 5-10. The proposed WEF layout has therefore been developed and refined during the BA process and was presented in the draft BA which was made available for public comment. The layout has been designed taking all environmental sensitivities and constraints into consideration upfront. Accordingly, a single layout was assessed in the draft BA. The final detailed design layout map will be provided to DFFE prior to construction with the notification of commencement of construction and appointment of the ECO. The detailed design will be restricted to the extent of the property boundaries within allocated buffer areas and will meet all technical specifications while avoiding fine scale environmental sensitivities. As built drawings of the facility will be submitted to the DFFE post construction for record purposes. No significant changes were made to the dBAR layout or significant additional information added to the fBAR.

The Kariega WEF cluster will provide an opportunity for shared infrastructure if one or more of the phases are built and commenced with, e.g. the batching area, laydown area and site camp of one phase may be used for another which would mean that additional batching, laydown areas and site camps may not have to be established. At Kariega 4 WEF there are two alternative locations (preferred and alternative 1) for the batching area, laydown area and site camp.

5.3 Technology Alternatives

Turbine technology is continually improving, with newer and more efficient turbine models being released on an ongoing basis. Based on these characteristics, a turbine which is best suited to the site will be selected closer to the time of construction and cannot be confirmed during the BA process. The maximum turbine specifications are provided in Table 4-3, which will be assessed during the BA although actual built specifications may be reduced.

The applicant is proposing to deploy up to 42 turbines of up to 10 MW each. Technically this means that if all 42 are constructed the facility may generate up to 420MW. However, it's most likely that each wind turbine generators' capacity will be between 5MW and 10 MW. Turbine alternatives will not be considered as part of the EIA.

5.4 Routing Alternative for Linear Activities

5.4.1 Roads

Route alternatives include different access and service route alternatives. Road routings will be designed to follow existing farm tracks and impacted areas as far as possible, while minimising total road length and avoiding environmental sensitivities. Route alternatives may change based on micro-siting of the turbines and ancillary infrastructure.

5.4.2 Transmission Lines

Medium voltage (MV) cables, up to 33 kV, will be used to connect the turbines with the proposed onsite substation and BESS facility will be placed underground within the road corridor assessed.

Overhead high voltage (HV) transmission line (OHL) to evacuate the power from the proposed Kariega WEF into the national grid will be applied for through a separate BA process.



5.5 No-Go Alternative

The “no-go” option, i.e. the option of not implementing the activity, is the baseline against which all other alternatives are measured. The no-go will see the *status quo* activities persist, i.e. extensive farming. The “no-go” option is taken to be the existing rights on the property, and this includes all the duty of care and other legal responsibilities that apply to the owner of the property.

5.6 Infrastructure buffer areas

Each component of the proposed development has been buffered by 200m around the central line, point or parameter. Effectively this means that infrastructure like roads is buffered within a 400m width whilst turbine locations are buffered 200m from the central point and areas like the BESS have a buffer of 200m around the proposed border.⁸ The components need to be assessed within these buffers to allow for changes during detailed design without having to formally amend layouts. The final layouts will still be accountable to no-go areas and sensitivities and will be submitted to DFFE and DWS. In the case of turbine placement consider that there will be a crane hardstand and laydown/ assembly areas within this buffer which may be up to 150m in length. Turbines will also be set back at least 82m from the property boundaries as not to encroach (depending on blade length) on adjacent properties.

⁸ Coordinate Reference System (CRS) EPSG:4326 - WGS 84. The buffers were mapped using a fixed distance parameter in degrees thus there will be some variation in actual parameters compared to using an equidistant projection in metric units. The buffers were also cropped where it extended beyond the site boundaries.

6 BASELINE ENVIRONMENT AND ENVIRONMENTAL IMPACT ASSESSMENT

The description of the affected environment provided below draws on existing knowledge from published data, previous studies, site visits to the site and surround area, specialist studies and discussions with various role players. The high-level identification of potential impacts which may occur because of the proposed activities (described in Section 4) is broad and covers the four phases of the project (i.e., pre-construction, construction, operation and decommissioning). Cumulative impacts from existing infrastructure, proposed projects (renewable including associated infrastructure) have been assessed per environmental aspect in the BAR and by specialists. Impacts of negligible significance have been screened out, to ensure that the BA is focused on the potentially significant impacts associated with the substation.

The following environmental aspects are further discussed in this chapter below:

- Climate (Baseline)
- Social
- Agricultural
- Geotechnical
- Visual landscape
- Shadow flicker
- Noise
- Avifauna (Birds)
- Bats
- Terrestrial biodiversity
- Aquatic biodiversity
- Cultural Heritage, including archaeology and Palaeontology
- Traffic

A baseline description of the project area climate is provided for context. Whereas the impacts of the rest of the aspects as listed above are formally assessed.

Aspects not assessed due to being screened out in the site sensitivity verification as confirmed being in low sensitivity areas include:

- Civil Aviation Assessment
- Defence Assessment
- RFI Assessment

The relevant stakeholders in terms of the above fields were engaged during the public comment period to confirm these sensitivities as well as provide input into the relevant consideration around these fields.

Note: Specialist assessments have gone through an extensive revision and amendment process based conceptual layouts and updates thereto during the pre-application phase. The specialist reports included in Annexure D have considered the latest layouts as provided for in Section 4 of the fBAR and include these findings in their reports or an addendum thereto.

6.1 Climate

6.1.1 Description of Climate

The study area and surrounding plain is classified as arid (rainfall 100-200 mm/a). Rainfall increases progressively northward from the site as elevation increases which can be seen through the change in vegetation. The plains veld consists of karroid scrub, with trees essentially limited to ephemeral watercourses and farmyards. The study area is prone to extended periods of drought and at the time of this report still recovering from a severe decade-long drought.

The following graphs describe the climatic parameters based on 30 years of hourly weather model simulations from a central point in Aberdeen⁹. Figure 6-1 illustrates the average temperatures and precipitation levels over a calendar year. The solid red and blue lines indicate the mean daily maximum and minimum respectively per month. The dashed red and blue lines show the average hottest day and coldest night of each month for the last 30 years.

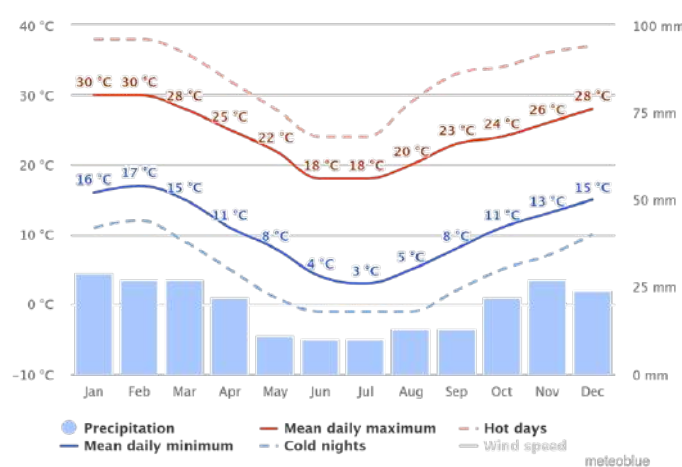


Figure 6-1: Average temperature and rainfall for Aberdeen.¹⁰

The mean maximum temperature in summer is a hot at $\approx 30^{\circ}\text{C}$, the mean minimum temperature in summer is $\approx 18^{\circ}\text{C}$. The mean maximum temperature in winter is $\approx 17^{\circ}\text{C}$, the mean minimum temperature in winter is a near freezing $\approx 3^{\circ}\text{C}$. This monthly temperature distribution is illustrated below in Figure 6-2.

⁹ Meteoblue. 2024. Climate Aberdeen (Eastern Cape, South Africa, Eastern Cape, South Africa, 32.48°S 24.07°E, 750masl). (Online). https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/Aberdeen_south-africa_972549 [Accessed 16 February 2024].

¹⁰ Meteoblue. 2024. Climate Aberdeen (Eastern Cape, South Africa, Eastern Cape, South Africa, 32.48°S 24.07°E, 750masl). (Online). https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/Aberdeen_south-africa_972549 [Accessed 16 February 2024].

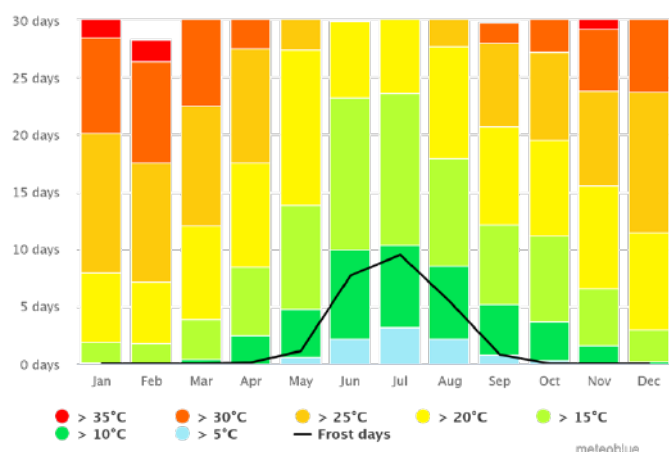


Figure 6-2: Monthly maximum temperature for Aberdeen.¹¹

Precipitation is highest in the spring and autumn, and generally throughout the summer (normally thunder showers) and to a lesser extent winter (frontal) rainfall (Figure 6-3). Rainfall peaks in February with the least amount of precipitation between the winter months of July and August.

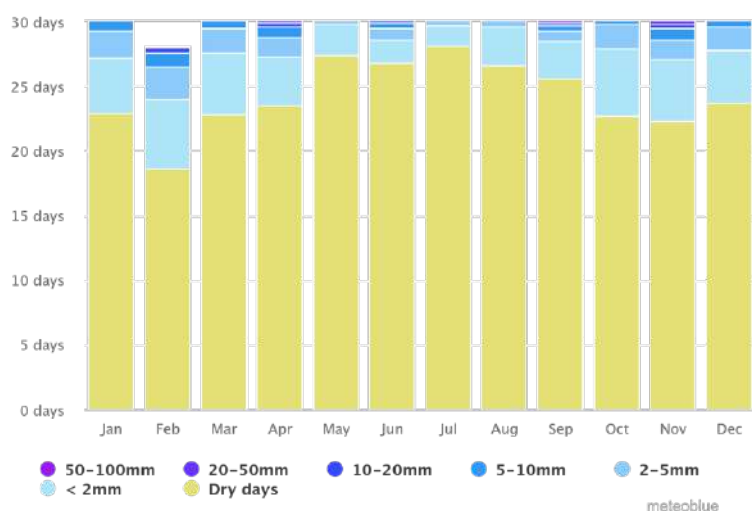


Figure 6-3: The precipitation diagram for Aberdeen shows on how many days per month, certain precipitation amounts are reached.¹²

Wind in the area is greatest in winter and early spring often reaching average speeds of 19 to 38 km/h. Figure 6-4 illustrates how these wind speeds are spread per month over a calendar year. In the graph, August and September have several days where exceptionally high wind speeds occur of higher than 38 km/h. Figure 6-5 illustrates that the dominant wind direction is from the north and northwest as well as southeast. The wind rose shows how many hours per year the wind blows in a particular direction.

¹¹ Meteoblue. 2024. Climate Aberdeen (Eastern Cape, South Africa, Eastern Cape, South Africa, 32.48°S 24.07°E, 750masl). (Online). https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/Aberdeen_south-africa_972549 [Accessed 16 February 2024].

¹² Meteoblue. 2024. Climate Aberdeen (Eastern Cape, South Africa, Eastern Cape, South Africa, 32.48°S 24.07°E, 750masl). (Online). https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/Aberdeen_south-africa_972549 [Accessed 16 February 2024].

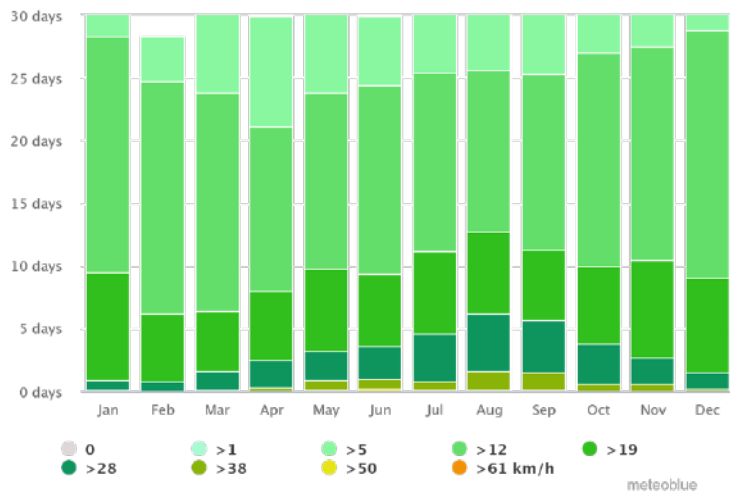


Figure 6-4: Monthly average wind speeds for Aberdeen.¹³

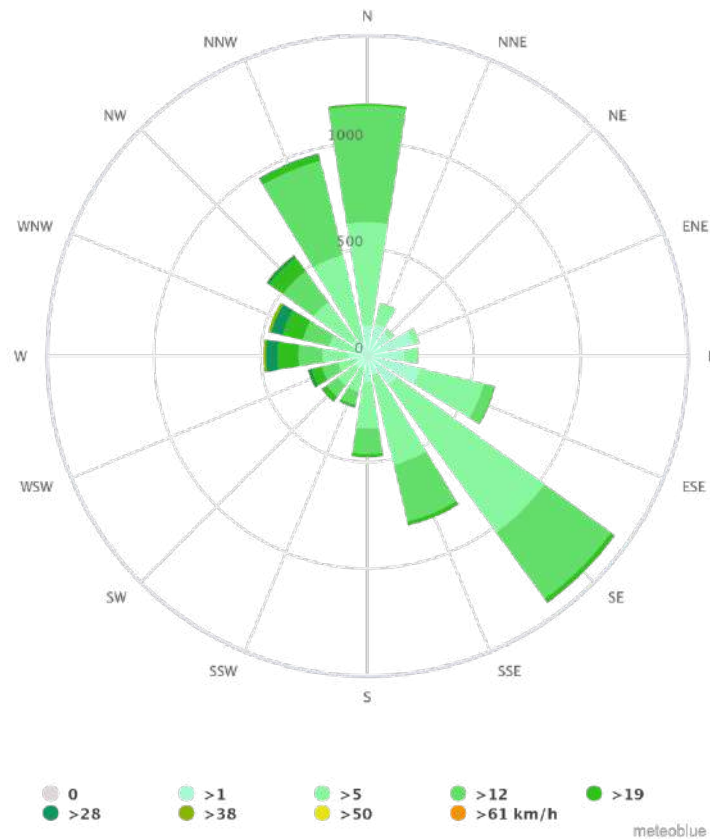


Figure 6-5: Wind rose for Aberdeen.¹⁴

¹³ Meteoblue. 2024. Climate Aberdeen (Eastern Cape, South Africa, Eastern Cape, South Africa, 32.48°S 24.07°E, 750masl). (Online). https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/Aberdeen_south-africa_972549 [Accessed 16 February 2024].

¹⁴ Meteoblue. 2024. Climate Aberdeen (Eastern Cape, South Africa, Eastern Cape, South Africa, 32.48°S 24.07°E, 750masl). (Online). https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/Aberdeen_south-africa_972549 [Accessed 16 February 2024].

6.2 Social Assessment

The Social Impact Assessment (SIA) was undertaken by Tony Barbour and Schalk van der Merwe of *Tony Barbour Environmental Consulting*. The findings of the SIA indicate that the proposed Kariega 4 WEF will result in several social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phases. The project will also contribute to local economic development through socio-economic development (SED) contributions. In addition, the development will improve energy security and reduce the carbon footprint associated with energy generation. The significance of SED contributions is rated Major Positive. The findings of the SIA also indicate that the potential negative impacts associated with both the construction and operational phases are likely to be Low Negative with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. The site is also located within the Beaufort West REDZ. The area has therefore been identified as suitable for the establishment of renewable energy facilities and associated infrastructure. The establishment of the proposed Kariega 4 WEF and associated infrastructure is supported by the findings of the SIA.

The full specialist report is attached hereto as Annexure D 1, Social Impact Assessment (2024).

6.2.1 Baseline Description

The study area is located approximately 40 km west of the small town of Aberdeen. Aberdeen is located in the Dr Beyers Naudé Local Municipality (Sarah Baartman District Municipality) in the central western part of the Eastern Cape Province. Graaff-Reinet, located approximately 81 km northeast of the site, is the largest town in the Dr Beyers Naudé LM, and also serves as its administrative seat and regional services centre. Other settlements in the DBNLM include Jansenville, Steytlerville, Willowmore and Klipplaat. The majority of the site is located within the Dr Beyers Naude Local Municipality (DBNLM) and the northern portion of the site falls within the Beaufort West Local Municipality in the Western Cape Province. The large town of Beaufort West (Western Cape Province) and the N1 corridor are located approximately 90 km west of the site (Figure 6-6 and Figure 6-7). The Kariega Wind Energy Facility site is in Ward 1 of the DBNLM and Ward 1 of Beaufort West Local Municipality (BFLM) (Figure 6-8).

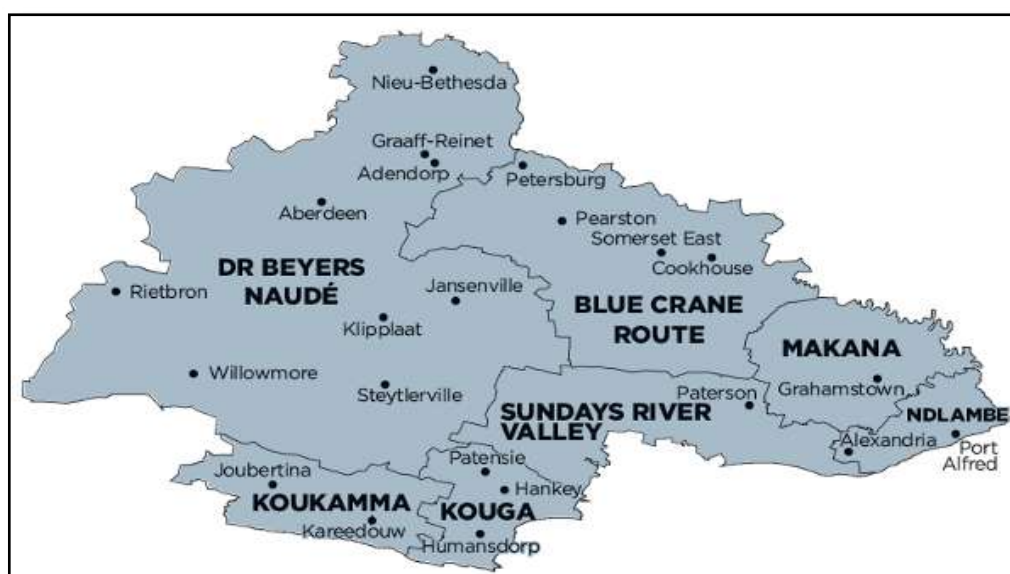


Figure 6-6: Local municipalities within Sarah Baartman District Municipality.

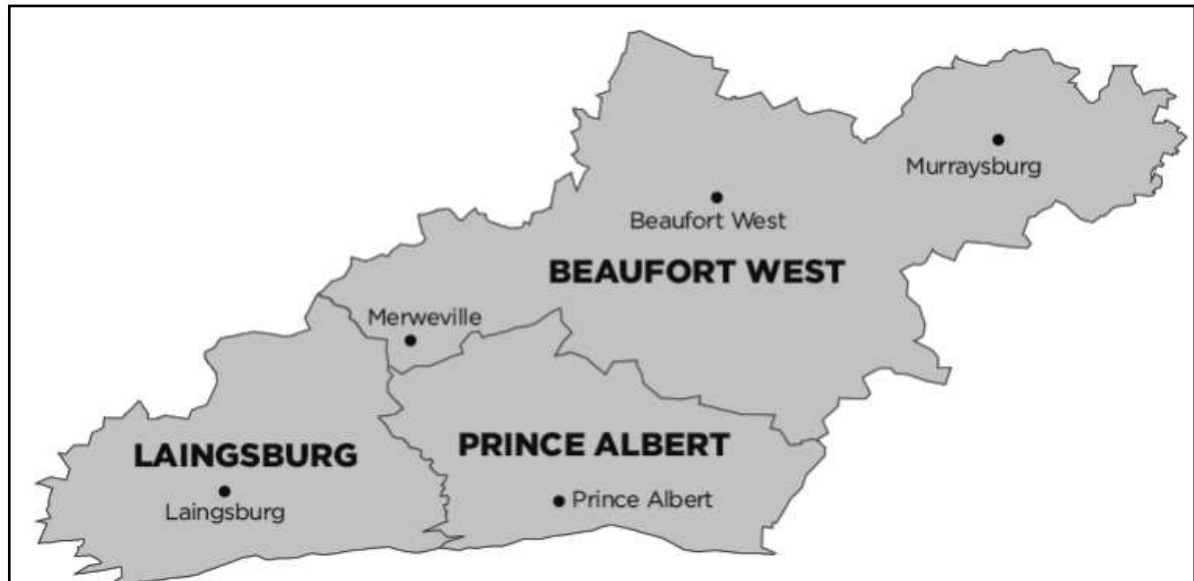


Figure 6-7: Local municipalities within Central Karoo District Municipality.

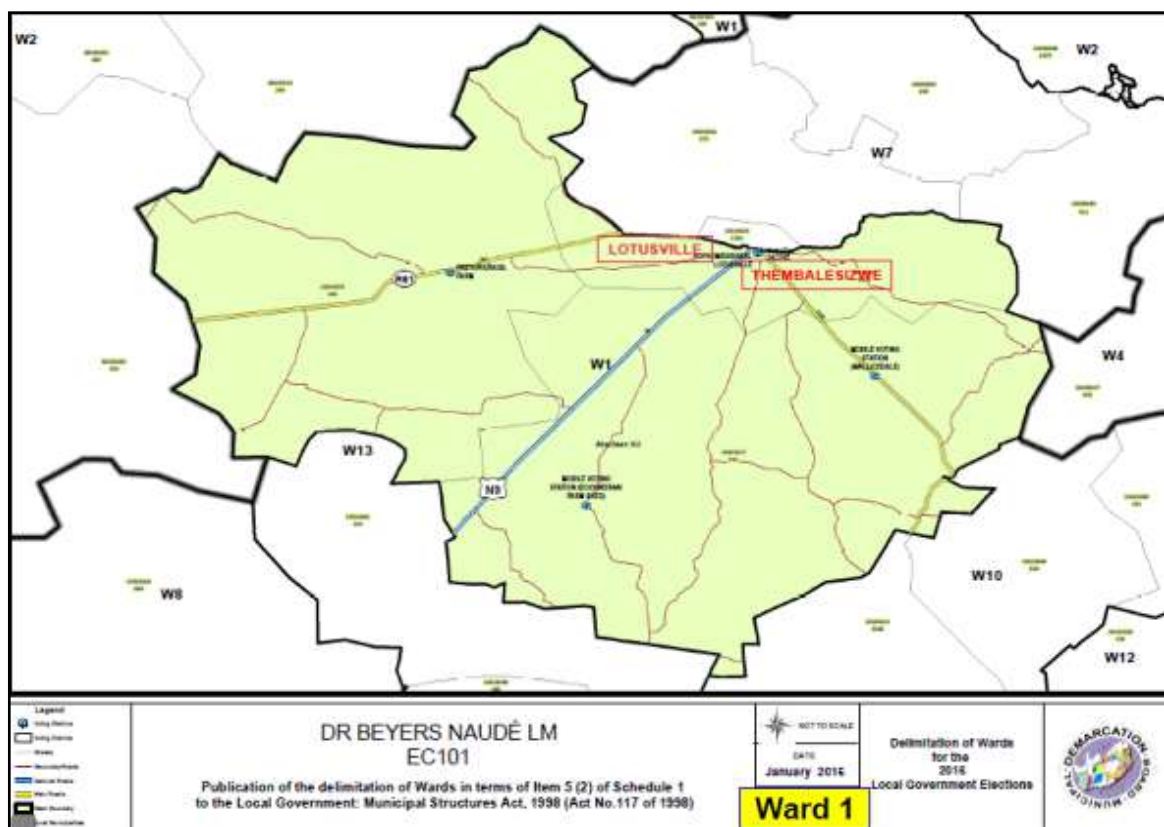


Figure 6-8: Ward 2.

6.2.1.1 DR Beyers Naude Municipality

Population

Based on the Household Community Survey (2016), the population of the DBNLM increased from 79 291 in 2011 to 82 197 in 2016. Based on Census 2011 data, the DBNLM represented around 17.5% (79 291) of the SBDM's population (450 584). The total number of households in 2016 was 20 749, giving an average household size of 4. Of the total number of households, the majority were houses (90.5%), followed by backyard structures (4.4%) and shacks (3.6%). The percentage of informal structures is therefore low when compared to the SBDM where shacks made up 9.4% of the total number of houses.

In terms of language, most of the population are Coloured (67.3%), followed by Black African (25.1%) and Whites (7.6%). In terms of age breakdown, under 18 age group made up 41.1%, 18-64 made up 52.9% and the over 65 group the remaining 6%. The dominant language was Afrikaans (75.4%), followed by IsiXhosa (20.9%) and English (2.1%).

The dependency ratio for the DBNLM in 2011 was 60, which was higher than the SBDM (52). The dependency ratio is the ratio of dependents, people younger than 15 or older than 64, to the working, age population, those ages 15-64. A higher dependency ratio typically translates into a greater likelihood of grant dependencies.

The population of Ward 1 in 2011 was 8 048, made up of 2 241 households. Of the total number of households in Ward 1 the majority were formal houses (94.2%). In terms of population group, majority of the population in Ward 1 were Coloured (77.7%), followed by Black African (18%) and Whites (3.8%). The dominant language was Afrikaans (83.4%), followed by IsiXhosa (13.4%) and English (1.6%).

In terms of age breakdown, under 18 age group made up 37.2%, 18-64 made up 57.4% and the over 65 group the remaining 5.4% in Ward 1. Based on these figures the dependency ratio for Ward 1 was 74.2%. These figures are considerably higher than the ratio for the SBDM (52). A high dependency ratio typically translates into a greater likelihood of grant dependencies and increasing pressure on local authorities to generate income to cover costs associated with service delivery.

Household income

Based on the data from the 2016 data, 10.3% of the population of the DBNLM had no formal income, 3.4% earned under R 4 800 per annum, 6.4% earn between R 5 000 and R 10 000, 22.4% between R 10 000 and 20 000 and 24.4% between R 20 000 and R 40 000 per annum (Household Community Survey 2016). Based on the data from the 2011 Census the data for Ward 1, 11% had no formal income, 5.5% earned under R 4 800 per annum, 9% earned between R 5 000 and R 10 000, 26.9 % between R 10 000 and 20 000 and 25.2% between R 20 000 and R 40 000 per annum (Census 2011).

The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household. This equates to R 38 400 per annum. Based on this measure, in the region of 66.9% of households in the DBNLM live close to or below the poverty line. In 2011 this figure was 65.3%. The figure for Ward 1 was 80.3%. The low-income levels reflect the limited formal employment opportunities in the DBNLM and Ward 1 and the dependence on the agricultural sector. The low-income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low-income levels also result in reduced spending in the local economy and less tax and rates revenue for the district and local municipality.

The COVID 19 pandemic is likely have had a further impact on household income levels.

Employment

According to Census 2011, 24.9% of the SBDM's working age population was officially unemployed in 2011, with the youth unemployment rate considerably higher, namely 31.4%. According to the 2019/2020 DBNLM IDP Review, the 2018/2019 unemployment rate for the SBLM is between 30% and 33%. The IDP notes that according to StatsSA, the number of unemployed persons in the Eastern Cape continues to increase, and it remains the province with the highest unemployment rate in the country.

The relevant figures for the DBNLM were somewhat higher, namely 26% and 33%, respectively. No information for youth unemployment was collected in 2016. However, the national youth unemployment level in 2019 was 39.6%, one of the highest in the world. Youth unemployment in the DBNLM is therefore still likely to be high. Due to the COVID 19 pandemic unemployment levels are likely to be higher.

Education

Education levels in the DBNLM improved between 2011 and 2016 with the percentage of the population over 20 years of age with no schooling dropping from 10% to 5.4%. The percentage of the population over the age of 20 with matric also increased from 20.3% to 26.6%. These figures are higher than the provincial averages of 8 % (no-education) and 26.2% (matric). The overall education levels in the DBNLM are therefore higher than the provincial averages.

Based on the 2011 Census the education levels of for Ward 1 indicate that 14.7% of the population over the age of 20 had no education, 11.6% had matric, and 3% has an undergraduate qualification. The matric rate for Ward 1 was considerably lower than the provincial level of 22.6%. The low education levels in Ward 1 are linked to the rural nature of the area and create challenges in terms of meeting local employment targets during the construction phase.

Access to water

Based on the 2011 Census, 75.9% of households in Ward 1 were provided with water by a service provider, namely the DBNLM, while 19.9% relied on boreholes and 2% on rainwater tanks. The high percentage that relies on boreholes in Ward 1 reflects the rural nature of the area. Due to the rural, dispersed nature of the area, it is both difficult and costly to provide municipal services, hence the reliance on boreholes.

Sanitation

Based on the 2011 Census data 86.1% of the households in Ward 1 had flush toilets, 0.8% relied on bucket latrines, while 10.6% reported no access to toilet facilities.

Refuse collection

75.8% of the households in Ward 1 had their waste collected by a service provider on a regular basis, while 22.9% disposed of their waste at their own dump. The relatively high percentage of households that use their own dump reflects the sparsely populated, rural nature of the area and the challenges associated with providing services across large distances.

Health facilities

The IDP notes that the DBNLM boasts the recently upgraded Midlands Provincial Hospital (situated in Graaff-Reinet). The facilities in Aberdeen include 1 primary health care clinic, 1 mobile clinic and 1 provincially aided hospital (Table 6-1).

Table 6-1: Health care facilities in DBNLM.

CATEGORY	GRAAFF-REINET	ABERDEEN	NIEU-BETHESDA	JANSENVILLE	KLIPPLAAT	WILLOWMORE	STEYTLERVILLE	RIETBRON	TOTAL
Primary Health Care Clinics	3	1	1	2	1	1	1	1	11
Mobile Clinics	2	1	0	1	0	1	1	1	7
Community Health Centre (Day Hospital)	1	0	0	0	0	0	0	0	1
TB Hospital	1	0	0	0	0	0	0	0	1
Provincial Hospitals	1	0	0	0	0	0	0	0	1
Provincially-aided Hospitals	0	1	0	1	0	1	0	0	3

Community facilities

The IDP notes that all the towns have Community Halls and Libraries. The more remote settlements utilize Church or School Halls (in some instances, even School classrooms) for public meetings and gatherings. The sports, recreation, and community facilities in Aberdeen include 3 community halls, a library, four sports fields for soccer/ rugby, a swimming pool, tennis and netball courts, two play parks and a caravan park. (Table 6-2).

Table 6-2: Sports and community facilities in DBNLM.

MUNICIPAL-OWNED FACILITIES	GRAAFF-REINET	ABERDEEN	NIEU-BETHESDA	JANSENVILLE	KLIPPLAAT	WATERFORD	WILLOWMORE	STEYTLERVILLE	RIETBRON	BAVIAANSKLOOF	TOTAL
Town- and Community Halls	4	3	1	3	3	1	3	2	1	1	22
Libraries	4	1	1	1	1	-	1	1	1	1	12
Multi-code Sports complexes	2	-	-	-	-	-	-	-	-	0	2
Rugby & Soccer Fields	5	4	1	3	2	-	1	1	1	1	19
Cricket Fields	2	-	1	-	-	-	1	1	-	0	5
Tennis & Netball Courts	1	1	1	-	-	-	-	-	-	0	3
Swimming Pools	2	1	-	-	-	-	-	-	-	0	3
Play Parks	7	2	1	-	-	-	-	-	-	1	11
Caravan Parks	1	1	1	1	-	-	1	-	-	-	5

Education facilities

The IDP notes that the DBNLM has 47 schools registered with the Department of Education. Of interest the IDP notes that there are 3 primary and 1 high school in Aberdeen, but no pre-primary schools. There is also one farm school (Table 6-3).

Table 6-3: Education facilities in DBNLM.

CATEGORY	GRAAFF-REINET	ABERDEEN	NIEU-BETHESDA	JANSENVILLE	KLIPPLAAT	WATERFORD	WOLWEFONTEIN	WILLOWMORE	STEYTLERVILLE	RIETBRON	TOTAL
Pre-primary	2	0	0	0	0	0	0	2	0	0	4
Primary	10	3	1	0	2	1	1	2	2	2	24
Secondary (High)	5	1	0	2	1	0	0	1	1	0	11
Farm Schools (Primary)	6	1	1	0	0	0	0	0	0	0	8

Economic Overview

According to the 2019/2020 SBDM IDP Review, The SBDM is the third largest economy in the Eastern Cape Province, and the largest economy outside the largely “urban economies” of the Nelson Mandela Bay Municipality and Buffalo City Municipality. The predominant sectors in terms of the District’s economy are agriculture and tourism, contributing approximately R690 million and R680 million respectively to the Gross Geographic Product (GGP) of the District. These sectors also hold the greatest potential for economic development in the DM.

The key established agricultural sub-sectors in the SBDM are red meat, wool & mohair, dairy, poultry, pork, chicory, and pineapple. Agricultural production around Graaff-Reinet is focused on red meat, wool, and mohair production. Key diversification sectors in the DM include essential oils, exotic fruit, bee keeping and aquaculture. Water is the key limiting factor to agricultural development in the DM.

In terms of the SBDM’s economic sectors’ relative contribution to employment, the three biggest sectors in 2016 were Trade (21%), Community Services (19%) and Agriculture (16%), with Construction (11%), Manufacturing (10%) and Finance (8%) making further substantial contributions (Figure 3.3).

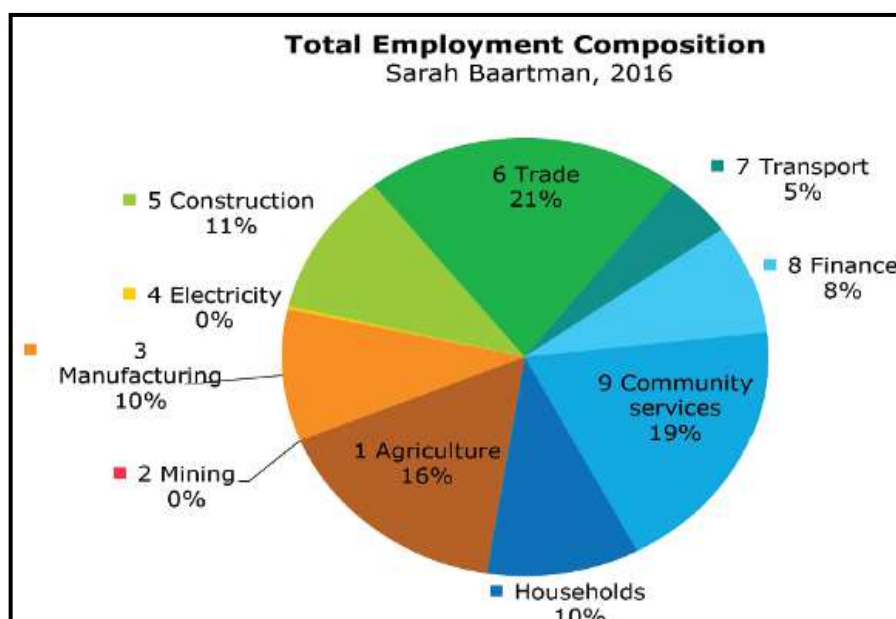


Figure 6-9: Employment contribution by economic sector in the SBDM in 2016 (Source: SBDM IDP 2019/2020 Review).

According to the 6-year (2016-2021) Gross Value Added (GVA) projections included in the IDP Review (Table 6-4), the agricultural sector is expected to grow the fastest of the DM's sectors until 2021, namely at an average of 3.89% annually from R 1.33 billion in 2017 to R 1.61 billion in 2021. The community services sector is estimated to be the largest sector within the SBDM by 2021, with a total share of 28.6% of the total GVA (as measured in current prices), growing at an average annual rate of 1.3%.

No separate figures for the Tourism sector are available. However, according to the 2019/2020 IDP Review, during the period 2006-2016, the number of bed nights spent by domestic tourists in the DM decreased at an average annual rate of -5.27%, while in the same period the international tourists increased by an average annual rate of 1.75%. The total number of bed nights spent by tourists in the DM decreased at an average annual growth rate of -3.55% from 3.01 million in 2006 to 2.1 million in 2016. The reason(s) for these decreases are not addressed in the IDP.

Like the SBDM, Agriculture and Tourism are the key sectors and drivers of the DBNLM economy. The LM also enjoys comparative advantages in these two sectors. This is linked to the Graaff-Reinet area being the country's leading producer of mohair, and one of its key wool producing districts (agriculture), and unique tourism assets associated with the historic town of Graaff-Reinet, the Owl House in Nieu-Bethesda, and wilderness resources associated with the general Great Karoo landscape and the Baviaanskloof Mega-Reserve in the south of the LM.

Table 6-4: SBDM GVA by broad economic sector for the period 2016-2021 (in R Billion at 2010 values) Source: SBDM IDP 2019/2020 Review.

	2016	2017	2018	2019	2020	2021	Average Annual growth
Agriculture	1.33	1.44	1.48	1.52	1.56	1.61	3.89%
Mining	0.18	0.18	0.18	0.18	0.19	0.19	0.17%
Manufacturing	1.90	1.90	1.93	1.96	2.01	2.07	1.76%
Electricity	0.18	0.18	0.18	0.18	0.19	0.20	1.18%
Construction	1.66	1.69	1.72	1.76	1.82	1.89	2.67%
Trade	4.71	4.75	4.83	4.94	5.11	5.28	2.32%
Transport	1.70	1.72	1.75	1.79	1.84	1.90	2.23%
Finance	3.54	3.56	3.64	3.73	3.84	3.96	2.26%
Community services	6.41	6.50	6.51	6.58	6.69	6.84	1.31%
Total Industries	21.61	21.92	22.22	22.65	23.24	23.93	2.06%

In 2016, the DBNLM's Gross Domestic Product (GDP) was R4.65 billion, its GVA R2.98 billion, in both instances a ~3% gain over 2006 (Table 8). In terms of GVA, Community Services (R931.1 million) was the biggest sectoral contributor in 2016, followed by Finance, Trade and Manufacturing (Table 6-5). The LM's spatially dominant Agriculture sector only contributed R153.1 million to GVA in 2016. Projections to 2021 indicate that the LM's GVA was expected to increase to R3.3 billion by that date. The relative contributions of the relevant sectors are anticipated to remain unchanged.

Table 6-5: Key economic indicators for the DBNLM 2006-2021 (in R Billion at 2010 values)¹⁵.

REGIONAL GROSS DOMESTIC PRODUCT			R4.65 billion	Average annual growth of 3.02% from 2006			
REGIONAL GROSS VALUE ADDED			R2.98 billion	Average annual growth of 3.01% from 2006			
TOTAL PERSONAL INCOME			R3.74 billion	Average annual growth of 2.5% from 2006			
PER CAPITA INCOME			R44,400	Substantial increase year-on-year from 2006			
GINI CO-EFFICIENT			0.58	10% improvement from 2006 to 2016			
POVERTY GAP			26.9%	11% improvement from 2006 to 2016			
PER SECTOR GVA FOR 2016				PER SECTOR GVA FORECAST FOR 2021			
1	Community Services	R931.1 million	1	Community Services	R1 billion		
2	Trade	R492.1 million	2	Finance	R558.5 million		
3	Finance	R501.2 million	3	Trade	R554.6 million		
4	Manufacturing	R310.2 million	4	Manufacturing	R343.4 million		
5	Transport	R237.2 million	5	Construction	R266.3 million		
6	Construction	R231.1 million	6	Transport	R264.9 million		
7	Mining	R153.1 million	7	Mining	R153.1 million		
8	Agriculture	R119.8 million	8	Agriculture	R146.0 million		
9	Electricity	R8.9 million	9	Electricity	R9.6 million		
REGIONAL GVA TOTAL		R2.98 billion	REGIONAL GVA TOTAL		R3.3 billion		

¹⁵ Source: DBNLM IDP 2019/2020 Review

According to the DBNLM IDP 2019/ 2020 Review, the Karoo region does not lend itself well to industrialization. Most of its small to medium-sized industries are situated in Graaff-Reinet, and some of the main manufacturers (and biggest employers) have only established their business in the industrial area in recent years. There is scope for expansion in Graaff-Reinet.

Government Services generate good employment opportunities in the LM, and the DBNLM is one of the biggest employers. Several Sector Departments have offices in the larger towns, particularly Graaff-Reinet. Commercial and retail enterprise are relatively strongly represented in Graaff-Reinet and Willowmore, and to a lesser degree in the smaller towns of Aberdeen, Steytlerville and Jansenville. Mining of minerals such as sand, stone and clay also provides employment opportunities in the region, but there is concern about natural resources being over-exploited and causing irreversible damage to the environment.

According to the IDP Review, SMMEs are finding it quite hard to survive in the current poor economic climate. The lack of a sustainable water supply, affordable and regular transportation, skills and expertise are identified as some of the key challenges curtailing economic growth in the region.

6.2.1.2 Beaufort West Municipality

Population

The 2021 Socio-Economic Profile (SEP) for the BWM prepared by the Western Cape Department of Social Development, indicates that the population of the BWM in 2021 was 51 177. Based on 2022 Census data the population of the BWM was 72 972 in 2022. There is therefore a significant discrepancy between the 2021 estimate and the 2022 Census figure which raises concerns regarding the accuracy of the 2022 Census data. In this regard the SEP also predicts a decrease in the population of the BWM to 50 613 by 2025, a decrease of - 0.3%. The 2022 Census data does therefore not align with the predictions of the SEP for the BWM. The total number of households in 2021 was 13 122 (SEP), with an average household size of 3.9. Census 2022 data indicates a total of 19 216 households.

Based on Census 2022, 27.72% of the population were under the age of 15, 65.80% fell within the economically active age group of 15 and 64 years old, while only 6.47% were 65 and older. Based on this the dependency ratio was 51%. Based on the SEP, young children under the age of 15 made up 30% of the population, the working age cohort (15-64) made up 61% and people 65 years and older made up 9%. Based on these figures the dependency ratio was 64%, significantly higher than the 2022 Census figure. The higher the dependency ratio the larger the percentage of the population dependent on the economically active age group. This in turn translates reduced revenue for local authorities to meet the growing demand for services. The difference between the 2021 SEP and 2022 Census data is therefore a concern.

Based on 2022 Census data Coloureds made up 78% of the population of the BWM, followed by Black Africans (16%) and Whites (5%). The main first language spoken was Afrikaans (83%), followed IsiXhosa (13.4%) by English (1.5%).

Household types

As indicated above, based on 2022 Census data there were a total of 19 216 households in the BWM. The majority reside in formal dwellings (99.42%), while 0.26% of households reside in informal dwellings within backyards and 0.11% reside in informal dwellings not in a backyard. Based on the 2022 Census data informal housing does not represent a key challenge for the BWM. The lack of informal housing is also likely to be linked to the lack of employment opportunities in the BWM and limited influx of job seekers to the area. As indicated above, the 2021 SEP for the BWM predicts a decrease in population by 2025.

In terms of household heads, 45.04% of the households within the BWM were headed by females in 2022. The high percentage of female headed households reflects the limited employment opportunities in the BWM and the migration of men away from the area in the search of employment opportunities. Female headed households are traditionally more vulnerable.

Household income

At the time of preparing the report no data on household income was available from the 2022 Census. The data is therefore still based on 2011 Census. Based on this data, 8% of the population of the BWM had no formal income, 4% earned less than R 4 800, 9% earned between R 5 000 and R 10 000 per annum, 24% between R 10 000 and R 20 000 per annum and 30% between R 20 000 and R 40 000 per annum (2011).

The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household (~ 40 000 per annum). Based on this measure, in the region of 75% of the households in the BWM live close to or below the poverty line. The figure for Western Cape was 50.1%. The low-income levels reflect the limited employment opportunities and dependence on the agricultural sector. This is also reflected in the high unemployment rates. The low-income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low-income levels also result in reduced spending in the local economy and less tax and rates revenue for the BWM. This in turn impacts on the ability of the BWM to maintain and provide services.

Employment

The 2021 SEP for the BWM notes that at 22.4 % in 2020 the unemployment rate in the BWM was the highest in the CKDM. The figure for CKDM and Western Cape was 20.3% and 8.9% respectively. The SEP notes that the high unemployment rate is a major concern given that it is based on the narrow definition of unemployment, namely the percentage of people that can work, but unable to find employment. The broad definition generally refers to people that can work, but not actively seeking employment.

Education

Based on Census 2022 the percentage of the population over 20 years of age in BWM with no schooling was 5.16%. The proportion of the population over 20 years old with matric as their highest level of education was 32.62% while 6.84% had a higher education qualification.

Based on the information contained in the SEP, the matric pass rate in the BWM was 70.9% in 2021, down from 79.2% in 2018.

Municipal Services

Based on the information from the 2021 SEP 92.6% of households in the BWM had access to electricity, 98% had access to water, 92.8% had access to sanitation services, and 84.3% had their refuse removed on a regular basis (Figure 3.4). In summary, service levels in the BWM can be described as good. Except for access to water, access to services for residents of the BWM is higher than the averages for the CKDM.

The figures from the 2022 Census indicate that 97.08% have access to electricity, 87.25% access to piped water inside their dwellings, 12.19% had access to piped water inside their yards and 0.33% had access to water on a community stand, 97.97% had flush toilets (sewer and septic tank), and 92.76% had their waste collected. Some of the figures are similar to the SEP figures, while others are higher and or lower.

Economic Overview Beaufort West Municipality

The Economic activity in the BWM plays a key role in terms of creating employment opportunities and addressing poverty and human development. The ability of households to pay for services such as water, electricity, sanitation, and refuse removal is dependent upon the ability to generate income from economic activities. A slowdown or deterioration in economic activities typically results in job losses and the inability of households to pay for services, which in turn impacts on municipal revenues and the ability to provide and maintain services and municipal infrastructure.

Economic sectors

In terms of key sectors, the local economy in the BWM was dominated by the tertiary sector which contributed 77.4% towards the Gross Domestic Product for the Region (GDPR) in 2019, followed by the Secondary Sector (12.5%) and the Primary Sector (10.1%) (Figure 6-10). Within Tertiary Sector, the most important subsectors were General Government (22.4%), Transport, storage, and communication (17%) and Finance, insurance, real estate and business services (13%), both contributing more than the entire Primary Sector. The Agriculture, forestry and fishing subsector within the Primary Sector contributed 10% towards GGDP.

Employment

In terms of employment, the Tertiary Sector was made up 74.4% of all jobs in 2019, followed by the Primary Sector (19%) and the Secondary Sector (6.6%) (Figure 6-11). However, in terms of subsectors the Agriculture, forestry and fishing sector was the second most important sector in 2019, making up 19% of all jobs. The Wholesale and retail trade, catering and accommodation sector was the most important (25%). The COVID-19 pandemic is likely to have resulted in job losses during 2020, extending into 2022/23.

	GDPR			Employment		
	R Million value 2019	Trend 2015 – 2019	Real GDPR growth 2020e	Number of jobs 2019	Average annual change 2015 - 2019	Net change 2020e
Primary Sector	225.3	-2.8	10.7	2 423	77	-73
Agriculture, forestry & fishing	223.7	-2.9	10.8	2 421	77	-73
Mining & quarrying	1.6	0.5	-17.6	2	0	0
Secondary sector	278.6	-0.3	-12.8	787	-11	-94
Manufacturing	67.4	0.4	-10.3	249	-2	-16
Electricity, gas & water	120.3	0.2	-6.2	65	0	-3
Construction	90.9	-1.3	-22.0	473	-9	-75
Tertiary sector	1 727.3	0.5	-6.3	9 342	70	-558
Wholesale & retail trade, catering & accommodation	346.4	-0.2	-11.3	3 165	41	-280
Transport, storage & communication	382.2	-1.2	-16.9	649	-1	-38
Finance, insurance, real estate & business services	287.9	2.2	-3.6	1 277	2	-86
General government	500.3	1.0	1.0	2 319	7	26
Community, social & personal services	210.5	0.7	-2.9	1 932	21	-180
Beaufort West	2 231.2	-0.1	-4.8	12 552	136	-725

Figure 6-10: Summary of GDPR and Employment for BWM (SEP BWM 2021)

In terms of skills levels, the labour forces in the BWM in 2020 consisted mainly of semi-skilled (42.7%), followed by low-skilled (36%) and skilled (21.3%) workers (Figure 3.9). The high percentage of low and semi-skilled workers is linked to the agricultural sector.

Skill Levels Formal employment	Skill Level Contribution 2020 (%)	Average growth (%) 2016 - 2020	Number of jobs	
			2019	2020
Skilled	21.3	0.4	1 967	1 918
Semi-skilled	42.7	-0.7	4 051	3 851
Low-skilled	36.0	-1.4	3 468	3 252
TOTAL	100.0	-0.7	9 486	9 021

Figure 6-11: Summary of skills levels for formal employment in the BWM (SEP BWM 2021)

6.2.2 Site Sensitivity

The study area economy is strongly anchored in agriculture, with extensive small stock grazing the predominant land use, supplemented by ostrich on some properties. Veld carrying capacities are modest, ranging from 2.6 hectares per sheep/goat (plains) to 1.2 hectares (Kamdebooberg slopes). Cropping activities are very limited, essentially to fodder cropping for own use. Relatively few employment opportunities are associated with extensive stock farming. The study area settlement pattern is sparse. This is linked to the nature of extensive stock farming. Farming units are typically large and consist of a number of properties. In many instances, inhabitation is limited to one or two properties, with the balance serving only as stock posts.

The Kariega 4 WEF site is located on 12 properties, namely Klip Stavel 72/RE, Klipdrift 73/RE, Keuna 74/RE, 74/1, 74/2, 74/3; Tafelkop 75/RE, 75/1; Pretorius Kuil 89/RE, Beenkraal 90, Farm 91, and Sarels Rivier 141/RE. Only the portions of 89/RE and 90/RE north of the R61 form part of the assessment area.

Turbines are proposed on only the 5 of the 12 site properties, namely the 4 portions of Keuna 74 and Sarels Rivier 141/RE. The preferred and alternative construction terrain sites cluster (laydown/ construction camp/ batching plant) as well as the substation/ O&M/ BESS complex site are proposed on 141/RE. The sites are located within 2.5 km of another. The other 7 site properties only serve to provide access to the development area.

Five site access points are proposed, three effectively off the R61, and two off the Murraysburg public gravel road. The south-westernmost access point (1) is proposed at the intersection of the R61 and the Nelspoort public gravel road. Access point 2 is at the intersection with an existing internal farm road. Two access points are proposed on the road linking the R61 to the Murraysburg road via the site, the southern one (3) on the boundary with Sambokdoorns 92/4/RE (Eskom Aberdeen WEF site), and the northern one (4) with Klip Stavel 72/1 (Tango WEF site). Access point 5 is proposed on the boundary of Sarels Rivier 141/RE and site-adjacent Harmonie 140 via a public gravel road which provides access to the relevant properties and adjacent Tulp Leegte 160 off the Murraysburg gravel road from the north.

Table 6-6: Overview of Kariega 4 site- and site-adjacent properties.

OWNER ¹⁶	KEY ¹⁷	PROPERTY ¹⁸	DWELLINGS ¹⁹	USE/ COMMENT
ESKOM	9	Klipdrift 73/1	Klipdrift (uninhabited)	Leased out as grazing; 73/1, 92/3, 92/4 part of Eskom Aberdeen 200 MW WEF site
	10	Klipdrift 73/2	n.a.	
	11	Sambokdoorns 92/3	n.a.	
	12	Sambokdoorns 92/4/RE	n.a.	
Gouws, Mr Hannes	14	Koedoes Kop 88/RE	Koedoeskop (shed)	Extensive small stock farming
Hayward, Mr Chris	15	Oorlogspoort 85/2	Rooidraai (owner, labour) Karoo Secret& Lark Cottage	Extensive small stock farming; Guest accommodation x 2; Proposed Kudu WEF site
Hayward, Mr John	17	Oorlogspoort 85/1	Oorlogspoort (owner, labour)	Extensive small stock farming
Lombard, Mr Cristiaan	5	Bassons Hoek 4/1	Vriespoort (owner, labour)	Mixed small stock farming and Commercial hunting
Mans, Mr Johannes	1	Harmonie 140	Sarelsrivier (owner, labour)	Extensive small stock farming
McNaughton, Mr Phillip	SITE	Klipdrift 73/RE	Wag 'n Bietjie (ruin)	Extensive small stock farming; Labourers reside on 89/RE and Beenkraal 90; 73/RE, 89/RE and 90 part of Kariega 2 turbine development area; 75/ and 75/2 part of Kariega 3 turbine development area;
	SITE	Tafel Kop 75/1	n.a.	
	16	Tafel Kop 75/2	n.a.	
	13	Pretorius Kuil Outspan 83	n.a.	
	SITE	Pretorius Kuil 89/RE	Kariegasfontein (owner, labour)	

¹⁶ Shading indicates owners currently affected by WEF projects.

¹⁷ Please refer to Figure 3.6.

¹⁸ Shading indicates Kariega 4 turbine development area properties.

¹⁹ Shading indicates inhabited dwellings.

	SITE	Beenkraal 90	Benekraal (labour only)	
Paxton, Mr Grant	SITE	Keuna 74/1	Kalkgat (sheds)	Extensive small stock farming; Part of an operation based north of Aberdeen
	SITE	Keuna 74/2	n.a.	
Pienaar, Mr Willie	2	Walkraal 1/2	Kykrug (unclear)	Extensive small stock farming
Smit, Mr JP	SITE	Farm 91/RE	Pretoriuskuil (labour only)	Extensive small stock farming; Part of an operation based east of Aberdeen; Study area properties used as stock posts; 3 labourer h/h live on 91/RE; 91/RE investigated by 2 WEF developers
	3	Windermere 271	Windermere (unclear)	
Terblanche, Mr Johan	4	Glen Cliff 272	Glencliff (owner, labour)	Extensive small stock farming
Van der Merwe, Mr HP	18	Tulp Leegte 76	De Put (owner, labour)	Extensive small stock farming
Van der Merwe, Mr Izak	6	Farm 71/1	n.a.	Extensive small stock farming; Operation based on 72/RE 72/RE part of Kariega 2 turbine development area; 74/RE and 74/3 part of Kariega 4 turbine development area
	SITE	Klip Stavel 72/RE	Waaikraal (owner, labour)	
	7	Klip Stavel 72/2	n.a.	
	SITE	Keuna 74/RE	Kunna (labour only)	
	SITE	Keuna 74/3	n.a.	
Van der Merwe, Mr Roelof	8	Klip Stavel 72/1	Klipstavel (owner; labour)	Extensive small stock farming; Proposed Tango WEF site
Van Schalkwyk, Mr Dirk	SITE	Tafel Kop 75/RE	Tafelkop (shed)	Extensive small stock farming; Operation based on 141/RE 75/RE part of Kariega 3 turbine development area
	SITE	Sarels Rivier 141/RE	Sarelsrivier (owner; labour)	
	19	Sarels Rivier 141/1	n.a.	

All the study properties are used for extensive small stock farming, mainly sheep and Angora goat. Commercial hunting is only associated with Basons Hoek 4/1 (Vriespoort). The hunting operation was established in 2000. It caters mainly to paying biltong hunters in season, but also provides trophy hunting opportunities. The portion of the property between the Kariega site (Keuna 74/1) and the Murraysburg road is used for hunting Springbuck. Hunting guests are accommodated on Vriespoort yard east of the Murraysburg road.

The Kariega 4 site is located in a sparsely populated area. Only 15 residential receptors and 2 tourism receptors (Karoo Secret and Lark Cottage) are located on the 31 subject properties (Table 6-7, Figure 6-12). Only one major tarred road, the R61, is located in significant proximity to the project. It is not a scenic route.

The Proposed infrastructure footprints would affect relatively small areas of relatively low carrying capacity veld on extensive farming operations able to dispense with the relevant grazing affected by footprint impacts. The stock farming study area is vulnerable to veld disturbance and security risks.

Commercial hunting is associated with Bassons Hoek 4/1 (Vriespoort). The owner has expressed concerns regarding potential safety-related setback implications on his hunting activities. A 2-3 km setback would be required (Lombard, pers. comm). The nearest turbine (26, on 74/1) is proposed approximately 1 km from the boundary. Six turbines on 74/1 are proposed <2 km from the boundary, and 9 turbines <3 km.

The proposed infrastructure footprints would affect relatively small areas of relatively low carrying capacity veld on extensive farming operations able to dispense with the relevant grazing affected by footprint impacts. The stock farming study area is vulnerable to veld disturbance and security risks.

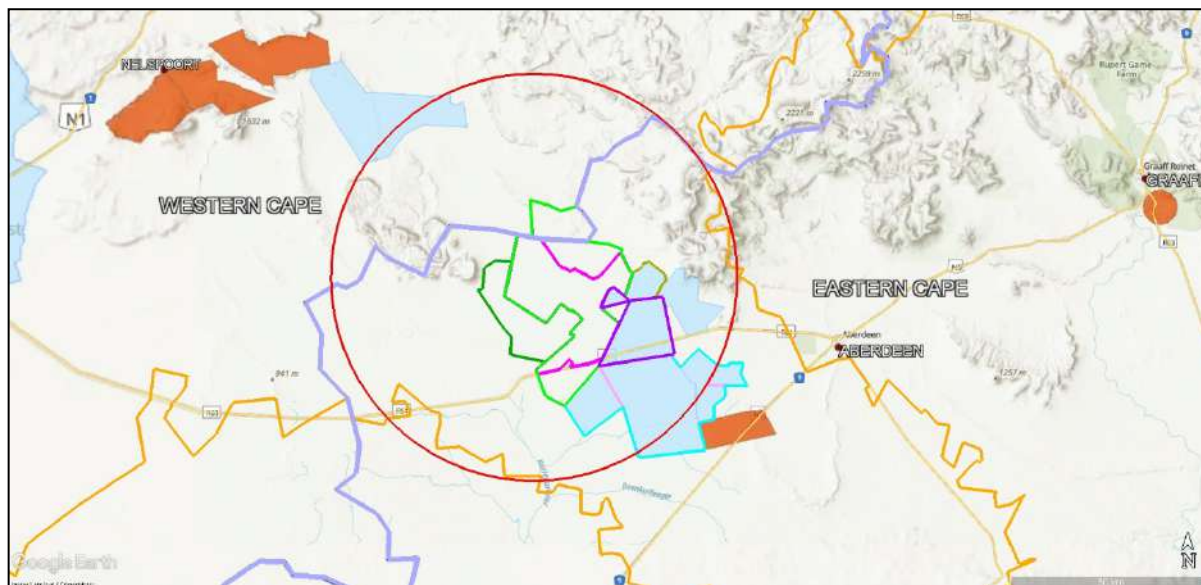


Figure 6-12: Kariega 4 WEF development area (pink) in relation to Beaufort West REDZ (orange), historic WEF- (light blue fill) and SEF (orange fill) applications within a 30 km radius (red circle) of the centre of the development area. Also indicated are the proposed Kariega 2-4 WEF site properties (light green outline), proposed Atlantic Aberdeen 1-3 WEF cluster (light blue outline), proposed Atlantic Aberdeen 1-3 PV SEF cluster (light pink), proposed Kudu WEF (dark green), proposed Tango WEF (khaki), and approved Eskom Aberdeen WEF (purple) (Source base map: DFF&E)²⁰.

Table 6-7: Proposed infrastructure in relation to social receptors (distances in km).

RECEPTOR ²¹	RD ²²	CON (200 m buffer)		SS, O&M, BESS	TURB	COMMENT ²³
		PREF	ALT			
Kykrug yard (pot) Walkraal 1/2	n.a.	9.1	9.9	9.9	6.1	Inhabitation status unclear; Adjacent to Murraysburg road
Vriespoort yard Bassons Hoek 4/1	2.3	12.4	12.4	11.5	7.7	Commercial hunting
Waaikraal yard Klip Stavel 72/RE	0.2	11.6	10.9	9.8	3.6	Kariega 2-4 site access (4); Kariega 2 turbine dev area
Klipstavel yard Klip Stavel 72/1	0.06	12.1	11.5	10.4	4.3	Tango WEF site; Kariega 2-4 site access (4)
Kunna labour Keuna 74/RE	0.08	3.4	2.5	2.8	1.1	Kariega 4 turbine development area
De Put yard Tulp Leegte 76	8.7	9.9	10.1	11.4	5.7	
Oorlogspoort yard Oorlogspoort 85/1	19	18.7	18.4	19.3	14.4	
Rooidraai yard Oorlogspoort 85/2	5.7	19.5	18.5	18.8	13.4	Kudu WEF site

²⁰ https://egis.environment.gov.za/renewable_energy

²¹ Shading indicates Kariega 4 turbine development properties.

²² Distance from portion of public gravel road affected by project traffic.

²³ Shading indicates potentially sensitive receptors.

Karoo Secret Oorlogspoort 85/2	5.1	19.4	18.3	18.6	12.3	Tourist accommodation; Kudu WEF site
Lark Cottage Oorlogspoort 85/2	2.8	19.4	18.1	18.3	12.2	Tourist accommodation; Kudu WEF site
Kariegasfontein yard Pretorius Kuil 89/RE	0.8	21.2	19.9	19.9	13.5	Kariega 2 turbine dev area; Kariega 2-4 site access (1)
Beenkraal labour Beenkraal 90	0.06	15.6	14.3	13.9	7.5	Kariega 2 turbine dev area; Kariega 2-4 site access road (3)
Pretoriuskuil labour Farm 91/RE	2.1	20.6	19.3	19	12.4	Kariega 2-4 site access (2); Potential WEF
Sarelsrivier yard Harmonie 140	0.25	5.3	6.4	7.2	3.2	Affected by access road (5)
Sarelsrivier yard Sarels Rivier 141/RE	2	3.3	3.9	5.1	1.2	Kariega 4 turbine dev area; Kariega 4 site access (5)
Windermere (pot) Windermere 271	3.1	5.8	6.1	5.6	3.1	Inhabitation status unclear
Glen Cliff yard Glen Cliff 272	1.8	11.1	11.4	10.7	7.8	
R61	n.a.	20	18.7	18.1	11.9	3 x site access points (1-3); Various road-adjacent REF sites along this portion R61

Only 6 of the 17 receptors are located in immediate proximity (<5 km) to a proposed turbine, namely the farmyards on Klip Stavel 72/RE (3.6 km), 72/1 (4.3 km), Harmonie 140 (3.2 km) and Sarelsrivier 141/RE (1.2 km); labourer's dwellings on Keuna 74/RE (1.1 km), and potentially inhabited dwellings on Windermere 271 (3.1 km). Both receptors <2.3 km form part of the Kariega 4 development area. The two tourism receptors (Karoo Secret and Lark Cottage) on Oorlogspoort 85/2 are located >12.2 km from the nearest turbine. The Kudu WEF is currently proposed on Oorlogspoort 85/2. The nearest turbine to the R61 is proposed to 11.9 km to the north of the road. The relevant stretch of the road is flanked by properties proposed for several REF projects. Turbines on several of these would be closer to the road than Kariega 4 (see below).

Both proposed construction terrain alternatives as well as the proposed substation/ BESS/ O&M site are located >2.5 km of all receptors, i.e., not in significant proximity to any.

Five receptors are located <500 m of proposed project roads and associated traffic movements. Three receptors – the labourer's dwellings on Beenkraal 90 (via site access points 2 and 3) and Keuna 74/RE (access point 5), and the farmyard on Klip Stavel 72/1 (access point 4) – are located <80 m, and the farm yards on Klip Stavel 72/RE and Harmonie <250 m. These receptors are potentially at risk of noise, dust and traffic safety impacts.

The Nelspoort public gravel road (access point 1) provides access to several farms west of the site, as well as Karoo Secret and Lark Cottage. Only the portion of the road on the site itself (viz, Pretorius Kuil 89/RE) would be affected. No residential receptors are accessed off this road portion. The farmyard on 89/RE is accessed via a separate access road off the R61, i.e., its access would not be affected. Project traffic movement along the small public gravel road which links the R61 to the Murraysburg gravel road (access points 3 and 4) provides access to 4-5 properties, all of which the subject of Kariega 2-4 or other WEF projects. The access road from the north off the Murraysburg road (access 5) provides access to 5-6 farm yards. Of the relevant properties, only Sarels Rivier 141/RE forms part of a WEF project.

6.2.3 Impact assessment

This provides an assessment of the key social issues identified during the study. The identification of key issues was based on:

- Review of project related information, including other specialist studies.
- Site visit and interviews with key interested and affected parties.
- Experience/ familiarity of the author with the area and local conditions.
- Experience with similar projects.

The assessment section is divided into the following sections:

- Assessment of compatibility with relevant policy and planning context “planning fit”.
- Assessment of social issues associated with the construction phase.
- Assessment of social issues associated with the operational phase.
- Assessment of social issues associated with the decommissioning phase.
- Assessment of the “no development” alternative.
- Assessment of cumulative impacts.

The focus on the assessment is on the wind turbines. Based on experience the most significant social issues are associated with wind turbines. Separate assessments have not been undertaken of the different components of the WEF, such as the BESS.

6.2.3.1 Assessment of policy and planning fit

The development of renewable energy is strongly supported at a national, provincial, and local level. The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The DBNLM SDF and IDP also support the development of renewable energy and the site is located within the Beaufort West REDZ. The development of the proposed Aberdeen Wind Energy Facility is therefore supported by key policy and planning documents.

6.2.3.2 Construction phase social impacts

Potential positive impacts

- Creation of employment and business opportunities, and opportunity for skills development and on-site training (Table 6-8).

Potential negative impacts

- Impacts associated with the presence of construction workers on local communities (Table 6-9).
- Impacts related to the potential influx of jobseekers (Table 6-10).
- Increased risks to livestock and farming infrastructure associated with the construction related activities and presence of construction workers on the site (Table 6-11).
- Increased risk of grass fires associated with construction related activities (Table 6-12).
- Nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles (Table 6-13).
- Impact on productive farmland (Table 6-14).

The construction phase will extend over a period of approximately 18-24 months and create in the region of 250 employment opportunities. Members from the local communities in Aberdeen, Graaff Reinet and Beaufort West may potentially qualify for low skilled and semi-skilled and some skilled employment opportunities. Most of these employment opportunities will accrue to Historically Disadvantaged (HD) members of the community.



Given relatively high local unemployment levels and limited job opportunities in the area, this will represent a significant, if localised, social benefit. The total wage bill will be in the region of R 78 million (2024 Rand values). A percentage of the wage bill will be spent in the local economy which will also create opportunities for local businesses in the local towns in the area and the DBNLM.

The capital expenditure associated with the construction phase will be approximately R 19 billion (2024 Rand value). This will create opportunities for local companies and the regional and local economy. Due the lack of diversification in the local economy the potential for local companies is likely to be limited. The majority of benefits are therefore likely to accrue to contractors and engineering companies based outside the DBNLM. The local service sector will also benefit from the construction phase. The potential opportunities would be linked to accommodation, catering, cleaning, transport, and security, etc. associated with the construction workers on the site.

The findings of the SIA indicate that the significance of all the potential negative impacts with mitigation are likely to be Minor Negative. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented.

Table 6-8: Impact assessment of employment and business creation opportunities during the construction phase.

Project phase	Construction			
Impact title	Employment and business creation opportunities during the construction phase			
Impact description	Employment and business creation opportunities during the construction phase			
Impact Assessment	Impact not mitigated/enhanced		Impact mitigated/enhanced	
Nature	Positive		Positive	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - positive		Moderate - positive	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Minor - positive		Moderate - positive	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-beneficial		Slightly-beneficial	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential Enhancement	Employment - Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. - Where reasonable and practical, the proponent should appoint local contractors and implement a ‘locals first’ policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area. - Where feasible, efforts should be made to employ local contractors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria. - Before the construction phase commences the proponent should meet with representatives from the DBNLM to establish the existence of a skills database for the area. If such a database exists, it should be made available to the contractors appointed for the construction phase.			

	- The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project. - Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase. - The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. Business - The proponent should liaise with the DBNLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction service providers. These companies should be notified of the tender process and invited to bid for project-related work. Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.
Comment on ratings	The project will create employment and business opportunities. However, due to low skills and education levels in the area the consequences are likely to be limited.

Table 6-9: Assessment of impact of the presence of construction workers in the area on local communities.

Project phase	Construction			
Impact title	Impacts on family structures and social networks			
Impact description	Impacts on family structures and social networks associated with the presence of construction workers			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Moderate - negative		Minor - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommended enhancement measures: - Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. - Preparation and implementation of a Community Health and Safety (CHSP) prior to and during the construction phase. - The SEP and CHSP should include a Grievance Mechanism that enables stakeholders to report resolve incidents.			

	• Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories. • The proponent should consider the option of establishing a Monitoring Committee (MC) for the construction phase that representatives from local landowners, farming associations, and the local municipality. This MC should be established prior to commencement of the construction phase and form part of the SEP. • The proponent and contractor should develop a Code of Conduct (CoC) for construction workers. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be subject to appropriate disciplinary action and/or dismissed. All dismissals must comply with the South African labour legislation. The CoC should be signed by the proponent and the contractors before the contractors move onto site. The CoC should form part of the CHSSP. • The proponent and the contractor should implement an HIV/AIDS, COVID-19 and Tuberculosis (TB) awareness programme for all construction workers at the outset of the construction phase. The programmes should form part of the CHSSP. • The contractor should provide transport for workers to and from the site on a daily basis. This will enable the contractor to effectively manage and monitor the movement of construction workers on and off the site. • The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end. No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.
Comment on ratings	The potential impact on local communities associated with the presence of construction workers can be mitigated by maximising local employment opportunities.



Table 6-10: Assessment of impact of job seekers on local communities.

Project phase	Construction			
Impact title	Impact of influx of job seekers			
Impact description	Potential impacts on family structures, social networks and community services associated with the influx of job seekers			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Low - negative	
Probability	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Minor - negative		Minor - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommended mitigation measures: It is impossible to stop people from coming to the area in search of employment. However, as indicated above, the proponent should ensure that the employment criteria favour residents from the area. In addition: • Preparation and implementation of a Stakeholder Engagement Plan (SEP) prior to and during the construction phase. • Preparation and implementation of a Community Health, Safety and Security Plan (CHSSP) prior to and during the construction phase. • The proponent, in consultation with the DBNLM should investigate the option of establishing a MC to monitor and identify potential problems that may arise due to the influx of job seekers to the area. • The proponent should implement a “locals first” policy, specifically with regard to unskilled and low skilled opportunities. • The proponent should implement a policy that no employment will be available at the gate. • The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end. • No construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.			
Comment on ratings	Due to the location of the sites and relatively short duration of the construction phase the potential for influx of job seekers is likely to be low.			

Table 6-11: Assessment of risk to safety, livestock, and damage to farm infrastructure.

Project phase	Construction	
Impact title	Impact on safety of farmers and farm workers, livestock and damage to farm infrastructure	
Impact description	Risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the presence of construction workers on site	
Impact Assessment	Impact not mitigated	Impact mitigated
Nature	Negative	Negative



Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Minor - negative		Minor - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommended mitigation measures: - The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences. - Investigate the option of moving game and livestock to other farm portions during construction to reduce potential incidents. - All farm gates must be closed after passing through. - Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. - The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before construction activities commence. - The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below). - The Environmental Management Programme (EMPr) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested. - Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained in the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. - Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation. - It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.			
Comment on ratings	The potential impact on farming operations can be effectively mitigated. However, this will require keeping affected landowners informed of construction related activities. .			

Table 6-12: Assessment of impact of increased risk of grass fires.

Project phase	Construction
Impact title	Impact of grass fires on farming operations
Impact description	Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires

Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Minor - negative		Minor - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommended mitigation measures • The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc., during the construction phase will be compensated for. The agreement should be signed before the construction phase commences. • Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas. • Smoking on site should be confined to designated areas. • Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high-risk dry, windy winter months. • Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle. • Contractor should provide fire-fighting training to selected construction staff. • No construction staff, with the exception of security staff, to be accommodated on site overnight. • As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.			
Comment on ratings	Fire related losses will impact on farmers livelihoods. The risks can be mitigated and potential losses can be offset by compensation.			

Table 6-13: Assessment of the impacts associated with construction related activities

Project phase	Construction			
Impact title	Nuisance related construction impacts			
Impact description	Potential noise, dust and safety impacts associated with construction related activities			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Minor - negative		Minor - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommended mitigation measures The potential impacts associated with heavy vehicles can be effectively mitigated. The mitigation measures include: • The movement of construction vehicles on the site should be confined to agreed access road/s. • Establishment of a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads. • The movement of heavy vehicles associated with the construction phase should be timed to avoid times and days of the week, such as weekends, when the volume of traffic travelling along the access roads may be higher. • Establishment of a Grievance Mechanism that provides local farmers and other road users with an effective and efficient mechanism to address issues related to construction related impacts, including damage to local gravel farm roads. • Dust suppression measures should be implemented, such as wetting on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. • All vehicles must be road worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.			
Comment on ratings	Nuisance related construction impacts can be avoided and or effectively mitigated via the implementation of the recommended mitigation measures.			

Table 6-14: Assessment of impact on farmland due to construction related activities

Project phase	Construction	
Impact title	Loss of farmland	
Impact description	Loss of farmland due establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the project etc.	
Impact Assessment	Impact not mitigated	Impact mitigated

Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Moderate - negative		Minor - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommended mitigation measures The potential impacts associated with damage to, and loss of farmland can be effectively mitigated. The aspects that should be covered include: • Implement recommendations of the agriculture / soil study. • An Environmental Control Officer (ECO) should be appointed to monitor the construction phase. • Existing internal roads should be used where possible. In the event that new roads are required, these roads should be rehabilitated on completion of the construction phase. • The footprint associated with the construction related activities (access roads, construction camps, workshop etc.) should be minimised. • All areas disturbed by construction related activities, such as access roads on the site, construction camps etc., should be rehabilitated at the end of the construction phase. • The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be included in the EMPr. • The implementation of the Rehabilitation Programme should be monitored by the ECO.			
Comment on ratings	The loss of valuable farmland can be avoided and or mitigated by careful planning and implementation of the recommendations of the agriculture / soil study			

6.2.3.3 Operational phase social impacts

The following key social issues are of relevance to the operational phase:

Potential positive impacts

- Establishment of infrastructure to improve energy security and support the renewable sector (Table 6-15).
- Creation of employment opportunities (Table 6-16).
- Benefits to the affected landowners (Table 6-17).
- Benefits associated with the socio-economic contributions to community development (Table 6-18).

Potential negative impacts

- Visual impacts and associated impacts on sense of place (Table 6-19).
- Impact on property values (Table 6-20).

-
- Impact on tourism (Table 6-20).

The proposed project will supplement South Africa's energy and assist to improve energy security. In addition, it will also reduce the country's reliance on coal as an energy source. This represents a positive social benefit. The findings of the SIA indicate that the significance of all the potential negative impacts with the exception of visual impacts will be Minor Negative with mitigation. The majority of the potential negative impacts can therefore be effectively mitigated.

Table 6-15: Improve energy security and support renewable sector

Project phase	Operation			
Impact title	Improve energy security and support renewable energy			
Impact description	Development of infrastructure to improve energy security and support the renewable sector			
Impact Assessment	Impact not mitigated / enhanced		Impact mitigated / enhanced	
Nature	Positive		Positive	
Extent	National	Impacts manifest at a national level / provincial.	National	Impacts manifest at a national level / provincial.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently altered.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently altered.
Magnitude	High - positive		High - positive	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Major - positive		Major - positive	
Importance	High	High	High	High
Consequence	Highly-beneficial		Highly-beneficial	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential enhancement	Recommended mitigation measures - Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members. - Maximise opportunities for local content, procurement, and community shareholding.			
Comment on ratings	The investment in renewable energy represents a significant social and socio-economic benefit given South Africa's current energy challenges.			

Table 6-16: Assessment of employment and business creation opportunities

Project phase	Operation			
Impact title	Employment and business opportunities			
Impact description	Creation of employment and business opportunities associated with the operational phase			
Impact Assessment	Impact not mitigated / enhanced		Impact mitigated / enhanced	
Nature	Positive		Positive	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - positive		Moderate - positive	
Probability	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Minor - positive		Moderate - positive	
Importance	High	High	High	High
Consequence	Slightly-beneficial		Moderately-beneficial	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential enhancement	Employment - Before the operational phase commences the proponent should meet with representatives from the DM to establish the existence of a skills database for the area. - The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the potential job opportunities for locals and the employment procedures that the proponent intends for the operational phase of the project. - Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the operational phase. - The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. Business - The proponent should liaise with the DBNLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g., waste collection companies, security companies etc.). These companies should be notified of the tender process and invited to bid for project-related work. Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the operational phase.			
Comment on ratings	Enhancing potential benefits will require a commitment to maximising local employment opportunities			

Table 6-17: Assessment of benefits associated with income generated for the affected landowners

Project phase	Operation	
Impact title	Income for affected landowners	
Impact description	Generate additional income for affected landowners to reduce vulnerability of farming to climate change etc.	
Impact Assessment	Impact not mitigated / enhanced	
Nature	Positive	Positive

Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	Moderate - positive		High - positive	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - positive		Major - positive	
Importance	High	High	High	High
Consequence	Moderately-beneficial		Highly-beneficial	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential enhancement	Recommended enhancement measures Implement agreements with affected landowners.			
Comment on ratings	Income from renewable energy projects can represent an important additional revenue stream for landowners and make farming operations more resilient to external shocks, such as climate change and increases in input costs etc.			

Table 6-18: Assessment of benefits associated with socio-economic development contributions

Project phase	Operation			
Impact title	Socio-economic development opportunities			
Impact description	Socio-economic development opportunities and investment linked to revenue from renewable energy project			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Positive		Positive	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	Moderate - positive		High - positive	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - positive		Major - positive	
Importance	High	High	High	High
Consequence	Moderately-beneficial		Highly-beneficial	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential enhancement	Recommended enhancement measures To maximise the benefits and minimise the potential for corruption and misappropriation of funds the following measures should be implemented: The proponents should liaise with the DBNLM to identify projects that can be supported by SED contributions.			

	- Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community. - Strict financial management controls, including annual audits, should be instituted to manage the SED contributions.
Comment on ratings	The establishment of SED opportunities do create benefits for local rural communities. However, care must be taken to identify appropriate and effective SED projects.

Table 6-19: Visual impact and impact on sense of place

Project phase	Operation			
Impact title	Visual impact on sense of place			
Impact description	Visual impact on sense of place associated with renewable energy facility			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Moderate - negative		Moderate - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommendations contained in the VIA should be implemented.			
Comment on ratings	Not possible to effectively mitigate visual impact of wind turbines. However, perception of nature and severity of visual impacts varies from person to person. The site is also located in Beaufort West REDZ and therefore has been identified as suitable for renewable energy facilities.			

Table 6-20: Assessment of potential impact on property values

Project phase	Operation			
Impact title	Impact on property values			
Impact description	Impact on property values associated with visual impacts			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Minor - negative		Minor - negative	
Importance	Low	Low	Low	Low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommendations contained in the VIA should be implemented.			
Comment on ratings	Limited evidence to suggest that WEFs impact on rural farm values, specifically given the location.			

Table 6-21: Impact on tourism in the region

Project phase	Operation			
Impact title	Impact on tourism			
Impact description	Impact on tourism associated with visual impacts			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Minor - negative		Minor - negative	
Importance	Low	Low	Low	Low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Recommendations contained in the VIA should be implemented.			
Comment on ratings	Limited evidence to suggest that WEFs impact on tourism, specifically given the location.			

Table 6-22: Cumulative impacts on sense of place and the landscape

Project phase	Operation			
Impact title	Cumulative impact on sense of place			
Impact description	Cumulative impact on sense of places associated with one or more renewable energy facilities			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - negative		Moderate - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		



Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.
Potential mitigation	Recommendations contained in the VIA should be implemented.	
Comment on ratings	Not possible to effectively mitigate cumulative visual impact on sense of place. The site is however located in Beaufort West REDZ and therefore has been identified as suitable for renewable energy facilities.	

Table 6-23: Cumulative impacts on local services

Project phase	Operation			
Impact title	Cumulative impact on local services and accommodation			
Impact description	Cumulative impact on local services and accommodation			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Moderate - negative		Minor - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The proponent should liaise with the DBNLM to address potential impacts on local services and accommodation.			
Comment on ratings	The significance will be linked to the timing of the construction phase of other renewable energy projects in the area.			

Table 6-24: Cumulative impacts on local economy

Project phase	Operation			
Impact title	Cumulative impact on local economy			
Impact description	Creation of socio-economic opportunities associated with establishment of numerous renewable energy facilities in the DBNLM			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Positive		Positive	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	High - positive		High - positive	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - positive		Major - positive	
Importance	Moderate	Moderate	High	High
Consequence	Slightly-beneficial		Highly-beneficial	



Confidence	Well established		Well established
Reversibility	High	The affected environment may be able to recover from the impact.	
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.	
Potential mitigation	The proposed establishment of suitably sited renewable energy facilities and associated projects, such as the proposed WEF, within the DBNLM should be supported.		
Comment on ratings	The potential cumulative benefits for the local and regional economy will be associated with both the construction and operational phase of renewable energy projects and associated infrastructure and extend over a period of 20-25 years.		

6.2.3.4 Decommissioning phase

Typically, the major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of the proposed facility the decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20 - 25 year's post commissioning. The decommissioning phase is therefore likely to create additional construction type jobs, as opposed to the jobs losses typically associated with decommissioning. Given the moderate number of people employed during the operational phase (~ 20), the social impacts at a community level associated with decommissioning can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative). Decommissioning will also create temporary employment opportunities, which would represent a positive temporary impact. The significance would be Low (positive) with enhancement due to limited opportunities and short duration.

Table 6-25: Social impacts associated with decommissioning

Project phase	Operation			
Impact title	Impact of decommissioning			
Impact description	Loss of jobs and economic opportunities associated with decommissioning			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Low - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Minor - negative		Minor - negative	
Importance	Moderate	Moderate	High	High
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Mitigation: - The proponent should ensure that retrenchment packages are provided for all staff retrenched when the plant is decommissioned. - All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning.			
Comment on ratings	The impacts associated with decommissioning are limited and can be effectively mitigated.			

Table 6-26: Assessment of no-development option

Project phase	Operation
Impact title	No development option

Impact description	Assessment of lost opportunities associated with no development option			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	National	Impacts manifest at a national level / provincial.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		High - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Moderate - negative		Moderate - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The proposed WEF should be developed, and the mitigation and enhancement measures identified in the SIA and other specialist studies should be implemented.			
Comment on ratings	No development option would represent a lost opportunity to develop renewable energy and improve energy security. No development option is not supported by the findings of the SIA.			

6.2.3.5 Assessment of no-development option

The No-Development option would represent a lost opportunity for South Africa to improve energy security and supplement its current energy needs with clean, renewable energy. Given South Africa's current energy security challenges and its position as one of the highest per capita producers of carbon emissions in the world, this would represent a significant negative social cost. The No-Development option is not supported by the findings of the SIA.

6.2.4 Conclusion and Recommendations

The findings of the SIA indicate that the proposed Kariëga 4 WEF will result in several social and socio-economic benefits, including creation of employment and business opportunities during both the construction and operational phases. The project will also contribute to local economic development through socio-economic development (SED) contributions. In addition, the development will improve energy security and reduce the carbon footprint associated with energy generation. The significance of SED contributions is rated Major Positive. The findings of the SIA also indicate that the potential negative impacts associated with both the construction and operational phases are likely to be Minor Negative with mitigation. The potential negative impacts can therefore be effectively mitigated if the recommended mitigation measures are implemented. The site is also located within the Beaufort West REDZ. The area has therefore been identified as suitable for the establishment of renewable energy facilities and associated infrastructure. The establishment of the proposed Kariëga 4 WEF and associated infrastructure is supported by the findings of the SIA. It's recommended that the developer should meet with the owner of Bassons Hoek 4/1 (Vriespoort) to discuss location of wind turbines that have potential to impact on commercial hunting operations.

The changes affecting the Kariega 4 WEF involve a reduction in the number of wind turbines from 80 to 42, and a new alternative site for the batching area. There are no changes to the technical specifications.

The reduction of turbines from 80 to 42 will assist in reducing the overall visual impact of the Kariega 4 WEF. However, the significance rating will remain Medium Negative. The alternative site for alternative site camp, laydown area and batching area will have no bearing on the findings of the SIA for the Kariega 4 WEF undertaken by Barbour and van der Merwe (February 2024). The findings of the SIA (Barbour and van der Merwe, February 2024) and associated enhancement and mitigation measures therefore remain valid.

6.3 Agricultural Production, Potential and Soils

An Agricultural Site Sensitivity Verification and Agricultural Compliance Statement was undertaken by Johan Lanz of Johan Lanz Soil Science. The findings indicated that the site has low agricultural potential predominantly because of climate constraints, but also because of soil constraints. As a result of the constraints, the site is unsuitable for crop production, and agricultural production is limited to low-capacity grazing. The land impacted by the development footprint is verified in the assessment as being of low agricultural sensitivity. The amount of agricultural land loss caused by the project is well within the allowable development limits prescribed by the agricultural protocol to ensure appropriate conservation of agricultural production land. 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. From an agricultural impact point of view, it is recommended that the development be approved.

The full specialist report is attached hereto as **Annexure D 2, Agricultural Compliance Statement (2024)**.

6.3.1 Baseline Description

The arid climate (low rainfall of approximately 211 to 223 mm per annum and high evaporation of approximately 1,446 to 1,501 mm per annum) (Schulze, 2009) is the limiting factor for land capability, regardless of the soil capability and terrain. Moisture availability is very limiting to any kind of agricultural production, including grazing (typical farm animals, infrastructure and farm related features shown in Figure 6-13 to Figure 6-18). Because climate is the limiting factor that controls production potential, it is the only aspect of the agro-ecosystem description that is required for assessing the agricultural impact of this development. All other agricultural potential parameters become irrelevant under the dominant limitation of aridity. The farm is located in a sheep farming agricultural region. Grazing is the dominant agricultural land use on the site and surrounds. Grazing capacity of the site is low at 24 hectares per large stock unit (DAFF, 2018).



Figure 6-13: Angora goats (mohair production, top left), Springbuck (game propagation and hunting, top right), Merino sheep (wool and meat, bottom left) and work horses (bottom right) are some of the animals found on the farm properties and those adjacent.



Figure 6-14: Typical farm infrastructure found on the proposed development properties include sheering camps with loadings ramps (top left), farm steads with stalls (top right), enclosures for small stock animals (bottom left), mobiles herders outpost (bottom right).



Figure 6-15: The area is earmarked by significant sheet (top left) and donga erosion (top right) most likely due to relative recent droughts and historical poor veld and stormwater management practices. Farmers have attempted to vegetate these eroded areas by digging rehabilitation hollows to allow seed capture and water retention as well as innumerable low earth ridges to slow down water flow.



Figure 6-16: The infrastructure on some of the farm properties were dilapidated.



Figure 6-17: Farm gates with electronic solar powered motor (left) typical jackal proof fence with diamond mesh at bottom and single strand wire at the top, the rocks packed at the base help prevent burrow animals from diggings holes underneath the fence creating access to predators.



Figure 6-18: Cultivated fields are very limited in the area with these (the light green patches between the trees) located on farms adjacent the development properties.

6.3.2 Site Sensitivity

In terms of the gazetted agricultural protocol, a site sensitivity verification must be submitted that:

1. confirms or disputes the current use of the land and the environmental sensitivity as identified by the screening tool, such as new developments or infrastructure, the change in vegetation cover or status etc.;
2. contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity.

Agricultural sensitivity is a direct function of the capability of the land for agricultural production. All arable land that can support viable crop production, is classified 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 crop production 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 used for cropland or not. All cropland is classified as at least high sensitivity, based on the logic that if it is under crop production, it is indeed suitable for it, 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. The data is

generated by GIS modelling. 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, based on its soil, climate and terrain. The higher land capability values (≥ 8 to 15) are likely to be suitable as arable land for crop production, while lower values are only likely to be suitable as non-arable grazing land. The direct relationship between land capability and agricultural sensitivity is shown in Table 6-27.

Table 6-27: Relationship between land capability and agricultural sensitivity as given by the screening tool.

Land capability value	Agricultural sensitivity
1 - 5	low
6 - 8	medium
9 - 10	high
11 - 15	very high

A map of the proposed development area overlaid on the screening tool sensitivity is given in Figure 6-19.

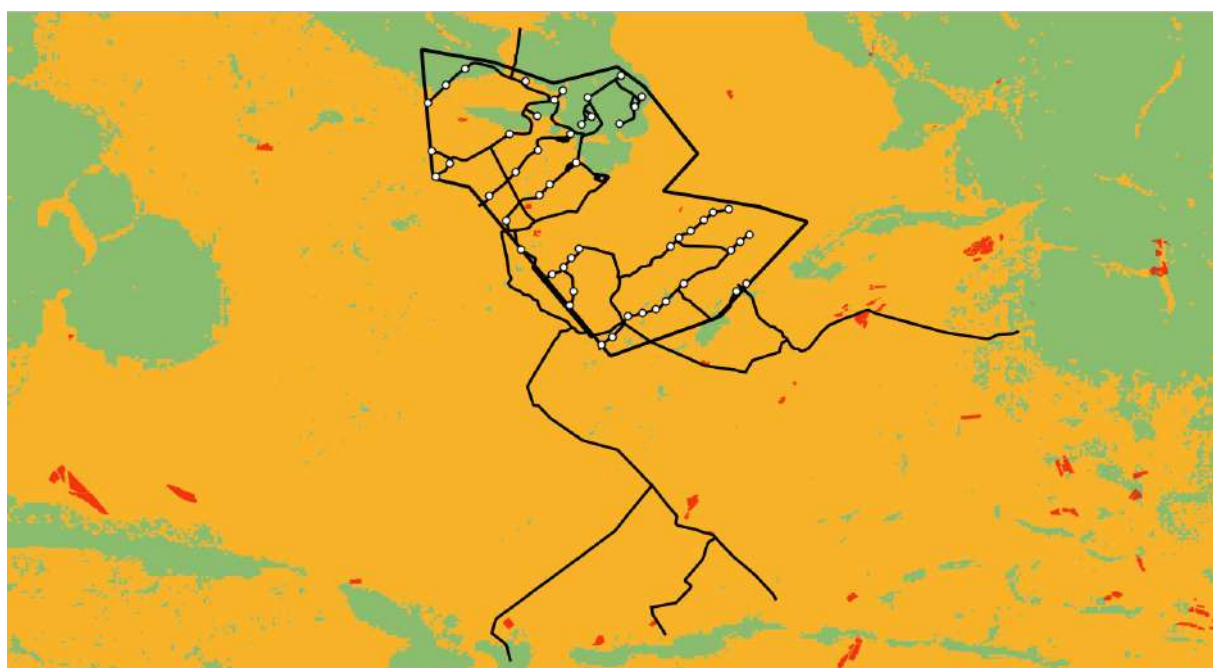


Figure 6-19: The proposed layout of the facility overlaid on agricultural sensitivity, as given by the screening tool (green = low; yellow = medium; red = high).

The classified land capability of the site is predominantly 6 but ranges from 2 to 8. The small-scale differences in the modelled land capability across the project area are not very accurate or significant at this scale and are more a function of how the data is generated by modelling, than actual meaningful differences in agricultural potential on the ground. There is little real difference between low and medium agricultural sensitivity on the ground.

The classification of some isolated patches within the site as high agricultural sensitivity (red in Figure 6-19) is because those parts are classified as cropland in the data set used by the screening tool. However, that data set is outdated. All land across the site is no longer used as cropland and has not been cropped in the last twenty

years according to the historical imagery available on Google Earth. It should not therefore still be classified as high agricultural sensitivity.

The fact that previously cropped lands are no longer viable for cropping is not because the soil has changed but because the suitability for cropping changes with a changing agricultural economy. Poorer soils or marginal climates that may have been cropped with economic viability in the past, are abandoned as cropland because they become too marginal for viable crop production in a more challenging agricultural economy with higher input costs. Climate change and changes in rainfall patterns have also led to the increasing marginality of agricultural lands.

This site sensitivity verification has assessed the site as being of low to medium agricultural sensitivity based on its crop status and agricultural production potential. The required level of agricultural assessment is therefore confirmed as an Agricultural Compliance Statement.

6.3.3 Impact assessment

There is ultimately only ever a single agricultural impact of a development and that is a change to the future agricultural production potential of the land. This impact occurs by way of different mechanisms some of which lead to a decrease in production potential and some of which lead to an increase. It is the net sum of positive and negative effects that determines the overall agricultural impact.

Two direct mechanisms have been identified that lead to decreased agricultural potential by:

1. occupation of land - Agricultural land directly occupied by the development infrastructure will become restricted for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime. As discussed above, the small and widely distributed nature of the agricultural footprint of the facility means that only an insignificant proportion of the available agricultural land is impacted in this way (Table 6-28).
2. soil erosion and degradation – Erosion can occur because of the alteration of the land surface run-off characteristics, predominantly through the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Soil erosion and loss of topsoil are completely preventable. The stormwater management that will be an inherent part of the engineering on site and standard, best-practice erosion control and topsoil management measures recommended and included in the Environmental Management Programme (EMPr), are likely to be effective in preventing soil erosion and loss of topsoil Table 6-29.

Table 6-28: Occupation of land by the development infrastructure.

Project phase	Construction, Operation & Decommissioning			
Impact title	Occupation of land by the development infrastructure			
Impact description	Agricultural land directly occupied by the development infrastructure will become restricted for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime. As discussed above, the small and widely distributed nature of the agricultural footprint of the facility means that only an insignificant proportion of the available agricultural land is impacted in this way			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.

Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Low - negative		Low - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Minor - negative		Minor - negative	
Importance	Very low	Very low	Very low	Very low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Don't develop high value agricultural land.			
Comment on ratings	None.			

Table 6-29: Soil erosion and degradation.

Project phase	Construction & Operation			
Impact title	Soil erosion and degradation			
Impact description	Erosion can occur as a result of the alteration of the land surface run-off characteristics, predominantly through the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - negative		Minor - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		



Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.
Potential mitigation	Soil erosion and loss of topsoil are completely preventable. The stormwater management that will be an inherent part of the engineering on site and standard, best-practice erosion control and topsoil management measures recommended and included in the EMPr, are likely to be effective in preventing soil erosion and loss of topsoil.	
Comment on ratings	None.	

Two indirect mechanisms have been identified that lead to increased agricultural potential through:

1. increased financial security for farming operations – Reliable and predictable income will be generated by the farming enterprises through the lease of the land to the energy facility. This is likely to increase their cash flow and financial security and could improve farming operations and productivity through increased investment into farming (Table 6-30).
2. improved security against stock theft and other crime due to the presence of security infrastructure and security personnel at the energy facility (Table 6-31).

Considering the extent to which any of these mechanisms is likely to affect levels of agricultural production is small and the overall impact of a change in agricultural production potential is therefore small.

Table 6-30: Increased financial security for farming operations.

Project phase	Construction & Operation			
Impact title	Increased financial security for farming operations			
Impact description	Reliable and predictable income will be generated by the farming enterprises through the lease of the land to the energy facility. This is likely to increase their cash flow and financial security and could improve farming operations and productivity through increased investment into farming.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Positive		Positive	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - positive		Moderate - positive	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - positive		Moderate - positive	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-beneficial		Slightly-beneficial	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		



Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.
Potential mitigation	Secure land tenure between landowner and applicant.	
Comment on ratings	None.	

Table 6-31: Improved security against stock theft and other crime.

Project phase	Operation			
Impact title	Improved security			
Impact description	Improved security against stock theft and other crime due to the presence of security infrastructure and security personnel at the energy facility.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Positive		Positive	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - positive		Moderate - positive	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - positive		Moderate - positive	
Importance	Low	Low	Low	Low
Consequence	Slightly-beneficial		Slightly-beneficial	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Include landowners in facility security measures and protocol.			
Comment on ratings	None.			

Cumulative Impacts

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.



The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this:

What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?

DFFE requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, in the opinion of the author, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

This cumulative impact assessment determines the quantitative loss of agricultural land if all renewable energy project applications within a 30 km radius become operational. Note that electrical grid infrastructure projects do not contribute to a loss of agricultural land and are not therefore included in this calculation of cumulative land loss. The area of land taken out of agricultural use as a result of all the projects listed in Appendix 4 (of the Agricultural assessment) (total generation capacity of 4623 MW) will amount to a total of approximately 1431 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30 km radius (approximately 282,700 ha), this amounts to only 0.51% of the surface area. This is well within an acceptable limit in terms of loss of low potential agricultural land, which is only suitable for grazing, and of which there is no scarcity in the country. This is particularly so when considered within the context of the following point.

For South Africa to develop the renewable energy generation that it urgently needs, agriculturally zoned land will need to be used for renewable energy generation. It is preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no crop production potential, and low grazing capacity, then to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country.

All the projects contributing to cumulative impact for this assessment have the same agricultural impacts in a very similar agricultural environment, and therefore the same mitigation measures apply to all.

It should be noted that there are few land uses, other than renewable energy, that are competing for agricultural land use in this area. The cumulative impact from developments, other than renewable energy, is therefore likely to be low.

The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites. Soil degradation does not therefore pose a cumulative impact risk.

Due to all the considerations discussed above, the cumulative impact of loss of future agricultural production potential is assessed as low (Table 6-32). It will not have an unacceptable negative impact on the agricultural production capability of the area, and it is therefore recommended.

Table 6-32: Cumulative agricultural impacts.

Project phase	Construction, Operation & Decommissioning
Impact title	Cumulative agricultural impacts
Impact description	Cumulative agricultural impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect agricultural production.



Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Minor - negative		Minor - negative	
Importance	Low	Low	Low	Low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites. Soil degradation does not therefore pose a cumulative impact risk.			
Comment on ratings	It is preferable to incur a cumulative loss of agricultural land in a region such as the one being assessed, which has no crop production potential, and low grazing capacity, then to lose agricultural land that has a higher potential, and that is much scarcer, to renewable energy development elsewhere in the country.			

Impacts of the No-Go Alternative

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 irregular rainfall, 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 compliments agriculture by providing an additional income source, without excluding agriculture from the land, or decreasing production. 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. In addition, the no-go option would prevent the proposed development from contributing to the environmental, social and economic benefits associated with the development of renewable energy in South Africa.

Comparative Assessment of Alternatives

Due to the low agricultural sensitivity of the site, and the effectively uniform agricultural conditions across the site, there will be absolutely no material difference between the agricultural impacts of any layout alternatives. Technology alternatives will also make absolutely no material difference to the significance of the agricultural impacts.

6.3.4 Conclusion and Recommendations

The site has low agricultural potential predominantly because of climate constraints, but also because of soil constraints. As a result of the constraints, the site is unsuitable for crop production, and agricultural production is limited to low-capacity grazing. The land impacted by the development footprint is verified in this assessment as being of low agricultural sensitivity.

Two potential mechanisms of negative agricultural impact were identified as occupation of land and soil erosion and degradation. Two potential mechanisms of positive agricultural impact were identified as increased financial security for farming operations, and improved security against stock theft and other crime. All of these are likely to have very low impact on future agricultural production potential and are therefore assessed as having very low significance.

The amount of agricultural land loss caused by the project is well within the allowable development limits prescribed by the agricultural protocol to ensure appropriate conservation of agricultural production land. The footprint of the development is approximately eight times smaller than what the development limits allow.

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 facts that the land is of limited land capability and is not suitable for crop production, the amount of agricultural land loss is well within the allowable development limits prescribed by the agricultural protocol, and that the proposed development offers some positive impact on agriculture by way of improved financial security for farming operations and improved security against stock theft and crime, as well as wider, societal benefits.

From an agricultural impact point of view, it is recommended that the development be approved.

The conclusion of this assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any conditions, other than recommended mitigation (included in the EMP).

6.4 Geotechnical

A Preliminary Geotechnical and Environmental Geology Report was undertaken by Iain Paton of Outeniqua Geotechnical Services. The study established a baseline study of the local geology of the site and provided high-level development constraints for project planning. Potential environmental impacts relating to the geology of the site were assessed and found to be generally acceptable. The investigation indicated that the site was suitable for the proposed development of a WEF but that further investigations will be required during detailed design to investigate the subsurface conditions for engineering design purposes, specifically area identified as “Terrain 2” which consist of quaternary alluvium.

The full specialist report is attached hereto as Annexure D 3, Geotechnical Assessment (2024).

6.4.1 Baseline Description

The geological map of the area (see Figure 6-20) indicated that the bedrock geology of the site consisted of sandstone and mudstone of the Permian Teekloof Formation (green on map) of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup), Figure 6-21. The mapping indicated very gentle folding of these sedimentary strata on an east-west trending fold axis, with dip angles generally less than 20°. Prominent Jurassic dolerite intrusions were also mapped within the site area and surrounds (red on Figure 6-20). An old borrow pit was identified on the site (32.512°S, 23.633°E) where local sources of dolerite had been mined in the past, presumably for the construction of the R61 road. Significant deposits of quaternary alluvium were mapped along the western and northern side of the site (yellow on map) which were associated with the Kariega River and its braided network of tributaries.

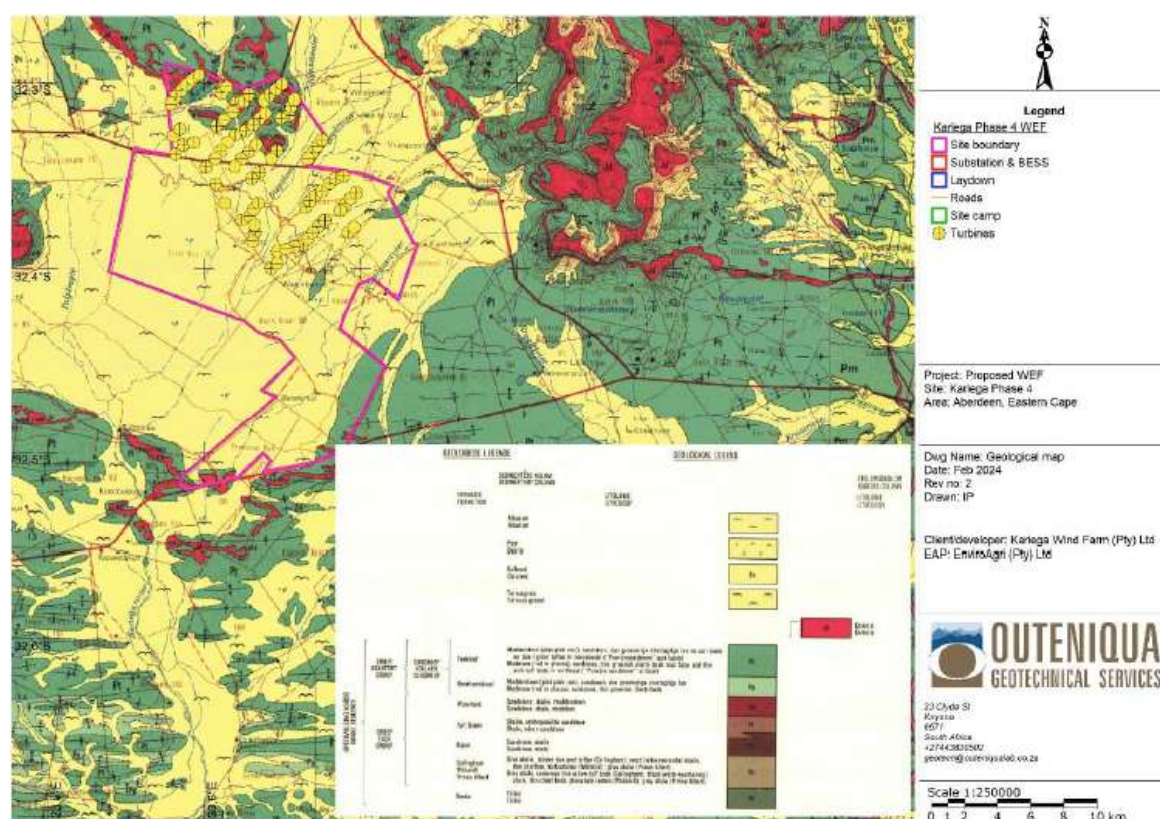


Figure 6-20: Geological map of the area



Figure 6-21: Blocky, hard sandstone of the Teekloof Formation exposed in road cutting on R61 near site.



Figure 6-22: Dolerite exposure on an old borrow pit near site.

No major geological faults were indicated on the map and according to the Seismic Hazard map of SA (Fernandez, et. al., 1992), the site was located in a zone of low seismic activity (see Figure 6-23 and Figure 6-24) with maximum intensity of V on the Modified Mercalli Scale, or 4.5 on the Richter scale (rather strong, felt by all, minimal damage to buildings), and a maximum peak horizontal ground acceleration of $<50\text{cm/s}^2$ ($0.05g$), with a 10% probability of being exceeded at least once in a period of 50 years.

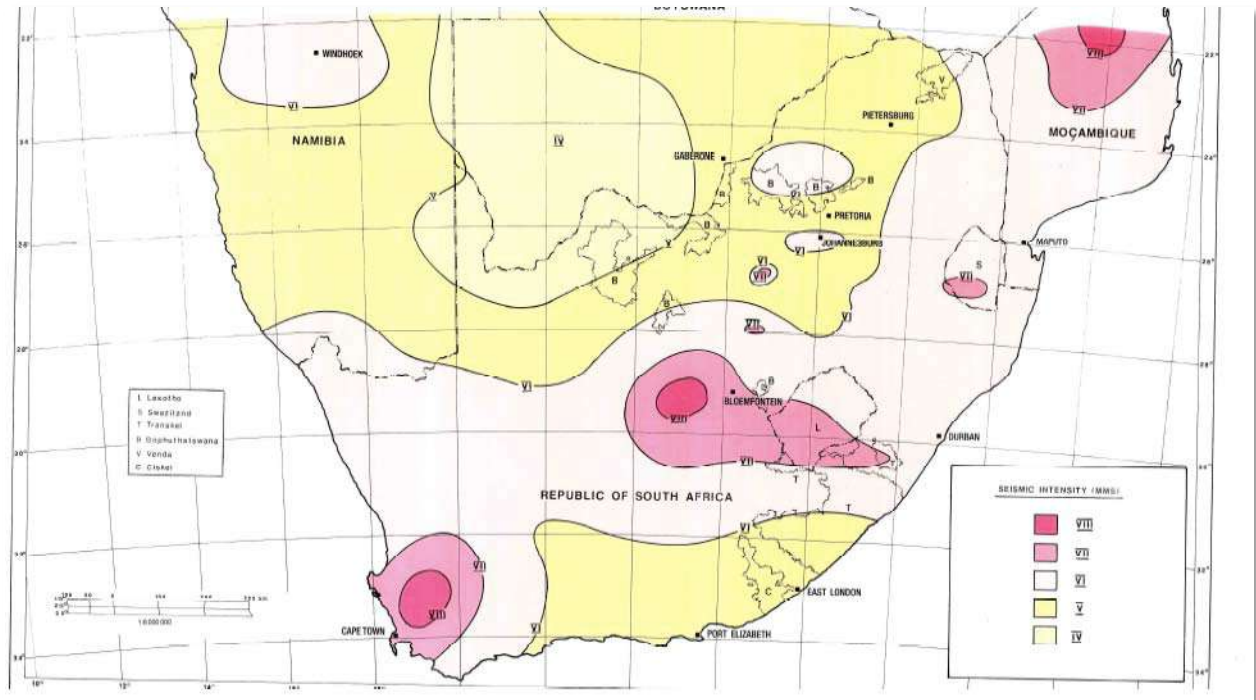


Figure 6-23: Maximum seismic intensities (Modified Mercalli Scale)

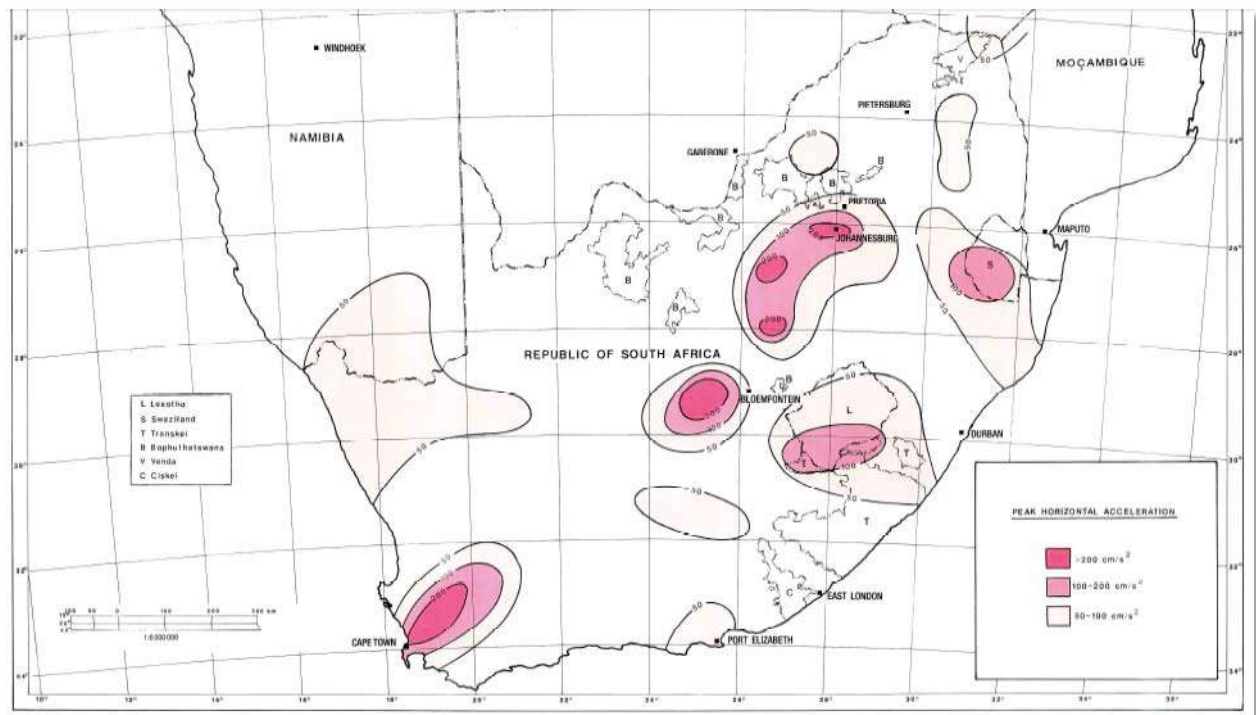


Figure 6-24: Peak horizontal ground acceleration map of SA

6.4.2 Site Sensitivity

6.4.2.1 Local soil types

Observations made on site indicated that the soil types generally consisted of the following horizons:

- Transported soils – Reddish orange, soft/loose to medium dense, pinholed, clayey silty fine sand with localised gravel and pebbles (colluvial or alluvial origin).
- Residual soil – Generally thin or absent horizon of light brown or dark grey, dense to very dense, silty sandy gravel with some possible clay alteration on remnant joints (completely weathered mudstone, sandstone or dolerite).
- Bedrock – Light to dark reddish brown or grey, medium to hard, highly fractured, moderately to highly weathered sandstone, mudstone or dolerite.

The thickness of the transported soil cover was observed to vary widely across the site, but generally thicker on the western edges of the site adjacent to the natural drainage system of the Kariega River. Visual and tactile observations of the fine-grained alluvial deposits indicated these soils to be potentially problematic in terms of the engineering of access roads, platforms and structures. This was mainly due to their moisture sensitivity, which rendered the subgrade very soft and highly compressible in wet conditions (Figure 6-25), and their propensity for erosion under hydraulic forces (Figure 6-26). Such fine-grained soils typically display low CBR strength (vehicle load-carrying capacity) and poor workability, requiring improvement and/or replacement with engineered materials, typically imported from commercial quarries, which can have significant cost implications. The implications of highly erodible soils may also include the requirement for preventative measures along drainage lines, including hydraulic structures to mitigate erosion and special engineering of culverts where roads cross natural drainage lines..



Figure 6-25: Challenging fine-grained soil conditions on low-lying parts of the site



Figure 6-26: Erosion of fine-grained alluvial soil cover along drainage lines near site.

In elevated areas the fine grained alluvial/colluvial soils were absent and replaced by residual gravel or coarse colluvial soils (hill-wash) and the underlying bedrock was observed at relatively shallow depth (Figure 6-27). The shallow rock in these could have implications in terms of deep excavations (e.g. for foundations).



Figure 6-27: Coarser gravelly soils and shallow bedrock on elevated areas

6.4.2.2 Geotechnical terrains

The site was broadly mapped according to the expected geotechnical characteristics, including soil type and estimated thickness, slope gradients, surface water bodies, natural drainage lines, and areas with shallow groundwater or drainage problems such as marshes (Figure 6-28).

- Terrain 1 was characterised by low to moderate slope gradients and likely shallow bedrock within a depth range of 0-3m below surface. Terrain 1 was expected to carry a lower risk of geotechnical problems, but ground testing would be required to verify this.
- Terrain 2 covered large areas on the western side of the site which were characterised by low-lying areas adjacent to a large natural drainage line with potentially higher risk of flooding (to be verified by flood line analysis) or other geotechnical challenges such as thicker profile of potentially highly compressible/collapsible soils. Terrain 2 was deemed to carry a higher risk of geotechnical challenges, but ground testing would be required to verify this.

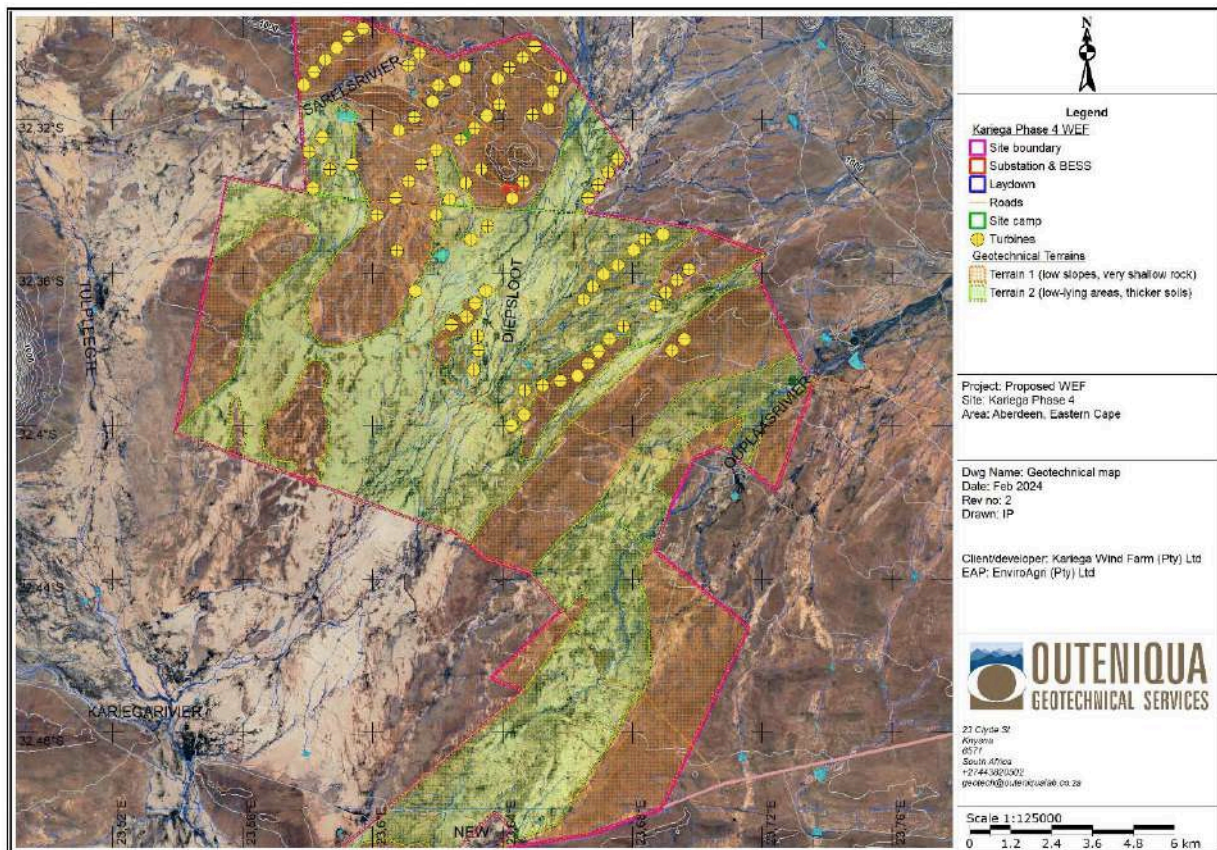


Figure 6-28: Geotechnical map of site

6.4.2.3 Proposed development and infrastructure

The proposed project entails the generation of up to a maximum export capacity of 420 MW to be generated by a maximum of 42 wind turbines of up to 10 MW each (maximum power per turbine). The associated infrastructure included crane hardstands and laydown areas, underground MV collector cables, access roads, electrical substation(s), battery energy storage system (BESS), auxiliary buildings for general operation and maintenance purposes, and a concrete batching plant.

6.4.2.4 Foundations for structures

The proposed wind turbine structures would be supported on reinforced concrete gravity bases or piles. Spread foundations, such as gravity bases, would typically have a diameter of 26m and embedded at a typical depth of 3.0m, depending on the underlying soil profile and geotechnical characteristics of the profile, which would have to be investigated during on-site testing. Similarly, the depth and size of the pile foundations would also be

determined based on site testing. Piled foundations typically have a smaller footprint area than gravity-based foundations.

6.4.2.5 Slope stability and erosion

The slope gradient on the site was predominantly low to moderate (less than 1v:5h) and natural slope stability problems were not considered to be a significant risk. No areas with large-scale or severe erosion problems were apparent during the investigation but erosion was observed along drainage lines and this could present localised problems and challenges, particularly in Terrain 2.

6.4.2.6 Excavation classification

Excavation classification would have to be determined after on-site testing, but preliminary indications were that hard excavations were expected at shallow depths less than 3m in Terrain 1, which would affect foundations for turbines and trenching for cable ducting.

6.4.2.7 Natural construction material sources

On-site formations of sandstone, mudstone and dolerite were deemed to be a potentially useful source of low to medium quality materials for construction of access roads and platforms and general filling material around structures and over pipe cradles. Material availability and quality would have to be determined during on-site testing.

6.4.2.8 Site classification

In accordance with SANS 10400-H Section 4.2, the applicable geotechnical site classifications are shown in Table 6-33.

Table 6-33: SANS10400-H site classification

<i>Terrain unit</i>	<i>Geotechnical Constraint</i>	<i>Expected movement (mm)</i>	<i>Site Classification</i>
1	Potentially compressible and/or collapsible soil	<10	C-C1
	Shallow rock		R
2	Potentially compressible and/or collapsible soil	10-20	C1-C2
	Shallow groundwater or marshy, soft ground conditions		P

6.4.3 Impact assessment

6.4.3.1 Land-use potential and development constraints

Terrain 1 (Figure 6-28) is potentially highly suitable for the development of a wind energy facility with only minor to moderate geotechnical constraints expected, which would be taken into consideration in the engineering design.

Although not necessarily precluded as a “No-go” area, Terrain 2 was considered to have a higher risk of geotechnical challenges due to the presence of thicker transported soils and natural drainage lines or low-lying areas adjacent to natural drainage lines with higher risk of flooding. The risk of flooding would have to be determined by a flood line assessment to identify any areas that may be precluded from development.

6.4.3.2 Potential impacts relating to the geological environment

Based on preliminary assessments of the geological nature of the site and the proposed activity, the project could potentially involve the following negative direct impacts:

Soil and/or bedrock degradation - Soil degradation is the negative alteration of the natural soil profile, usually directly or indirectly related to human activity, including erosion, excavation/removal, loosening, mixing, compaction and contamination/pollution or chemical alteration. Soil degradation negatively affects soil formation, natural weathering processes, moisture levels and soil stability. This could, in time, have a significant effect on agricultural potential and biodiversity (not assessed as part of this study). Soil erosion induced or increased by human activity is termed accelerated erosion and is an integral element of global soil degradation. Accelerated soil erosion is generally considered the most important impact in any development due to its potential impact on a local and regional scale (i.e. on and off site) and as a potential threat to global biodiversity.

Soil erodibility – the susceptibility of soil to erosion – is a complex variable, not only because it depends on soil chemistry, texture, and characteristics, but because it varies with time and other variables, such as mode of transport (i.e. wind or water). Erosion of soil due to water run-off is generally considered as being more important due to the magnitude of the potential impact over a relatively short period of time, which can be very difficult to control or reverse. Erosion potential is typically increased in areas where soil is loosened, and vegetation cover is stripped (such is the case on most construction sites). Removal of vegetation (ground cover) may increase the risk of soil erosion, making the soil less fertile and less able to support the regeneration of vegetation in future. Unconsolidated or partly consolidated, fine-grained soils of low plasticity occurring along or near drainage lines, on moderate to steep slopes or at the base of steep slopes are most vulnerable to severe levels of erosion due to water run-off. Areas where these factors occur are typically classified as “highly erosion-sensitive” areas. To combat erosion, special engineering measures may be required, and this may have further knock-on impacts due to additional earthworks, soil loosening, etc.

The activity may also lead to the following negative indirect impacts:

- a. Dust pollution.
- b. Siltation of watercourses adjacent to or away from the site or activity areas.

Negative impacts are dominantly related to the construction phase with insignificant additional impacts in the post construction and decommissioning phases, as explained below.

Construction Phase - The construction phase typically takes 1-2 years and includes the following activities:

1. Site clearing and grubbing (except for protected vegetation and sensitive areas).
2. Construction of site camps, access roads, laydown areas and platforms (possibly including importation of large volumes of fill materials).
3. Electrical reticulation (trenching, cabling and/or overhead lines).
4. Construction of turbine foundations and tower structures.
5. Construction of substation(s) and operational buildings.

Operation Phase - The following activities were envisaged during the operational phase:

1. Infrastructure maintenance (mechanical & electrical).
2. Road maintenance (grading and drainage).
3. Environmental maintenance (erosion control, etc).

Decommissioning Phase - The following activities were envisaged during the decommissioning phase:

1. Disassembling structures.
2. Removing equipment and infrastructure from site.
3. Rehabilitating soil, vegetation and surrounds.

The proposed development also has potential positive impacts on the geological environment (either directly or indirectly), such as a reduced demand for non-renewable energy sources (such as coal, uranium) and an improvement in the status quo in terms of erosion due to improved storm water and roads engineering on the site (more specifically on highly degraded sites).

6.4.3.3 Alternatives

Location

The location for the WEF was selected based on the following parameters:

- Quality of the wind resource.
- Proximity to Eskom grid connection point, i.e. existing Eskom substation which has sufficient capacity (or planned capacity) to support the proposed WEF project.
- Landscape features of the site being relative flat, which makes construction easier and reduces cost.
- Remoteness of site with fewer sensitive receptors in terms of visual and noise impacts.
- Landowner support of the proposed development.
- Accessibility to main road infrastructure
- Relatively low agricultural potential land mostly used for extensive low intensity livestock grazing.

Based on these considerations, the Kariega Phase 4 WEF site has been selected as the preferred alternative due to the favourable factors listed above.

Layout

The site layout may change during the BA process in response to the sensitivities identified during the process by specialists, and via engagement with the public and other stakeholders. The proposed WEF layout (turbines, access roads and other infrastructure) will therefore be developed and refined during the BA process. Micro-siting (restricted to the extent of the property boundaries) of the final layout that meets all technical specifications while avoiding fine scale environmental sensitivities will only be undertaken if the proposed WEF received a positive EA.

The most significant potential negative impacts on the geological environment that were identified were that of soil degradation and erosion. However, if these impacts were successfully mitigated the impact on the environment of proposed activity would have only a slightly to moderately detrimental negative effect on the environment, but the proposed activity also carried a very significant positive potential impact.

An assessment of the cumulative impacts on soil degradation in the vicinity considered the proposed nearby wind energy facilities which would contribute to cumulative soil degradation in the area. However, the cumulative impact of the degradation of the local soil resource is low and this should not hinder its development.

The proposed development was supported in principle, but micro-siting may be required based on outcome of further studies.

Table 6-34: Construction phase soil disturbance, degradation by removal, mixing, compaction, etc due to the construction of infrastructure.

No.	1	Alternative 1		
Project phase	Construction			
Impact title	Soil degradation			
Impact description	Soil disturbance, degradation by removal, mixing, compaction, etc due to the construction of infrastructure			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - negative		Moderate - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Virtually certain		Virtually certain	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	» Minimise excavations and disturbance areas. » Rehabilitate topsoil & vegetation around site after construction.			
Comment on ratings	Soil degradation in the area has been significantly affected by past agricultural activity. The cumulative impact of further development in the area is considered low.			

Table 6-35: Construction phase degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement).

No.	2	Alternative 1		
Project phase	Construction			
Impact title	Soil degradation			
Impact description	Degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement).			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Low - negative		Low - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Minor - negative		Minor - negative	
Importance	Low	Low	Low	Low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Virtually certain		Virtually certain	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	» Provide contamination prevention systems on site. » Control use and disposal of potential contaminants or hazardous materials. » Remove contaminants and contaminated topsoil, reinstate ground levels and replace topsoil in affected areas.			
Comment on ratings	Soil degradation in the area has been significantly affected by past agricultural activity. The cumulative impact of further development in the area is considered low.			

Table 6-36: Construction phase erosion by wind and/or water of loosened soil in construction areas.

No.	3	Alternative 1			
Project phase	Construction				
Impact title	Soil Erosion				
Impact description	Erosion by wind and/or water of loosened soil in construction areas				
Impact Assessment	Impact not mitigated			Impact mitigated	
Nature	Negative			Negative	
Extent	Limited	Limited to the site and its immediate surroundings.		Limited	Limited to the site and its immediate surroundings.
Duration	Permanent	Impact may be permanent, or in excess of 25 years.		Permanent	Impact may be permanent, or in excess of 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.		Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative			Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.		Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - negative			Moderate - negative	
Importance	High	High		High	High
Consequence	Moderately-detrimental			Moderately-detrimental	
Confidence	Virtually certain			Virtually certain	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.			
Potential mitigation	» Minimise size of the construction footprint/camp. » Avoid work in or near watercourses where possible. » Restrict activity outside of construction camp areas. » Implement effective erosion control measures around site. » Carry out earthworks in phases across site to reduce the area of exposed ground at any one time. » Protect and maintain denuded areas and material stockpiles to minimise erosion and instability » Rehabilitate affected areas post construction				
Comment on ratings	Erosion in the area has been significantly affected by past agricultural activity. The cumulative impact of further development in the area is considered low.				

Table 6-37: Construction phase degradation of watercourses due to siltation (silt-loading) due to erosion from site.

No.	4	Alternative 1		
Project phase	Construction			
Impact title	Siltation			
Impact description	Degradation of watercourses due to siltation (silt-loading) due to erosion from site			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Permanent	Impact may be permanent, or in excess of 25 years.	Permanent	Impact may be permanent, or in excess of 25 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - negative		Moderate - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Virtually certain		Virtually certain	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	» Install anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites. » Strictly control activity near water courses/natural drainage lines as sediment transport is higher in these areas (avoid construction activity in or near water-courses where possible). » Minimise increased run-off from hard surfaces by channelising and capturing rainwater for re-use (rainwater harvesting)			
Comment on ratings	Downstream siltation in the area has been significantly affected by past agricultural activity. The cumulative impact of further development in the area is considered low.			

Table 6-38: Construction phase dust pollution due to wind erosion from site.

No.	5	Alternative 1			
Project phase	Construction				
Impact title	Dust pollution				
Impact description	Dust pollution due to wind erosion from site				
Impact Assessment	Impact not mitigated			Impact mitigated	
Nature	Negative			Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.	
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.	
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	
Magnitude	Low - negative			Low - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.	
Significance	Minor - negative			Minor - negative	
Importance	Low	Low	Low	Low	
Consequence	Very slightly-detrimental			Very slightly-detrimental	
Confidence	Virtually certain			Virtually certain	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.			
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.			
Potential mitigation	» Apply dust control measures such as straw bales or dampen dusty denuded areas. » Minimise number of disturbance areas at any one time.				
Comment on ratings	Dust pollution in the area has been significantly affected by past agricultural activity. The cumulative impact of further development in the area is considered low.				

Table 6-39: Operational phase reduction in the in extraction of non-renewable energy sources, such as coal, uranium, etc. due to the provision of renewable energy from the project

No.	6	Alternative 1		
Project phase	Operation			
Impact title	Reduced demand for non-renewable energy sources			
Impact description	A reduction in the in extraction of non-renewable energy sources, such as coal, uranium, etc due to the provision of renewable energy from the project			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Positive		<i>Select</i>	
Extent	National	Impacts manifest at a national level / provincial.	<i>Select</i>	
Duration	Long term	Impact will last between 6 and 25 years.	<i>Select</i>	
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	<i>Select</i>	
Magnitude	High - positive			
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	<i>Select</i>	
Significance	Major - positive			
Importance	High	High	<i>Select</i>	
Consequence	Highly-beneficial			
Confidence	Well established		<i>Select</i>	

6.4.4 Conclusion and Recommendations

The preliminary geotechnical investigation has established a baseline study of the local geology of the site and provided high-level development constraints for project planning. Potential environmental impacts relating to the geology of the site were also assessed and found to be generally acceptable. The investigation indicated that the site was potentially suitable for the proposed development of a WEF but that further investigations will be required, in particular to investigate the subsurface conditions for engineering design purposes.

Recommendations as a guideline based on the information gained from the preliminary investigation have been included in the EMP and relate to:

- Earthworks and foundations
- Roads, platforms and lay-down areas
- Earthworks
- Topsoil
- Erosion and Sedimentation Control
- Drilling and Jack-Hammering
- Trenching
- Dust
- Imported Materials and Stockpiles



Although this level of investigation was deemed acceptable for environmental assessment, project feasibility and planning purposes, a detailed geotechnical investigation would have to be commissioned during the detailed design phase of the project. The assessment report dated 20 February 2024 (Revision 2) is valid and no changes were necessary based on latest revised layouts (7 May 2024).

6.5 Visual Impact Assessment

The Visual Impact Assessment (VIA) was undertaken by Steve Stead of Visual Resource Management Africa. The findings of the VIA concluded that while the combined views of the multiple turbines from multiple projects will significantly change the local landscape character, the proposed development Kariega 4 WEF does not constitute a fatal flaw (with mitigation). This is based on the relatively remote location, and other than the significant background landforms of the Sleeping Giant and Wolvekop Mountain features of the Camdeboo Mountains, the proposed development site is predominantly flat. Moreover, although tourism is emphasised in the local and regional planning, and the Camdeboo Mountains are significant landscape elements, active tourism in the area is limited. The landscape planning fit is also positive with the site located within the REDZ11 area, and with Renewable Energy (RE) supported by local planning.

The full specialist report is attached hereto as Annexure D 4, Visual Impact Assessment (2024).

6.5.1 Baseline Description

Landscape character is defined by the U.K. Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place' (IEMA, 2002). This section of the VIA identified the main landscape features that define the landscape character, as well as the key receptors that make use of the visual resources created by the landscape.

6.5.1.1 Local Landscape Context

Land use is a crucial factor in determining landscape character, especially regarding the Visual Absorption Capacity (VAC) of the landscapes. Oberholzer defines VAC as the potential of the landscape to conceal the proposed project (Oberholzer, 2005). i.e.

- High VAC – e.g., effective screening by topography and structures.
- Moderate VAC - e.g., partial screening by topography and structures.
- Low VAC - e.g., little screening by topography or structures.

General land uses of the area are described making use of Open-Source Mapping vector data, overlaid onto ArcGIS World Satellite Imagery.

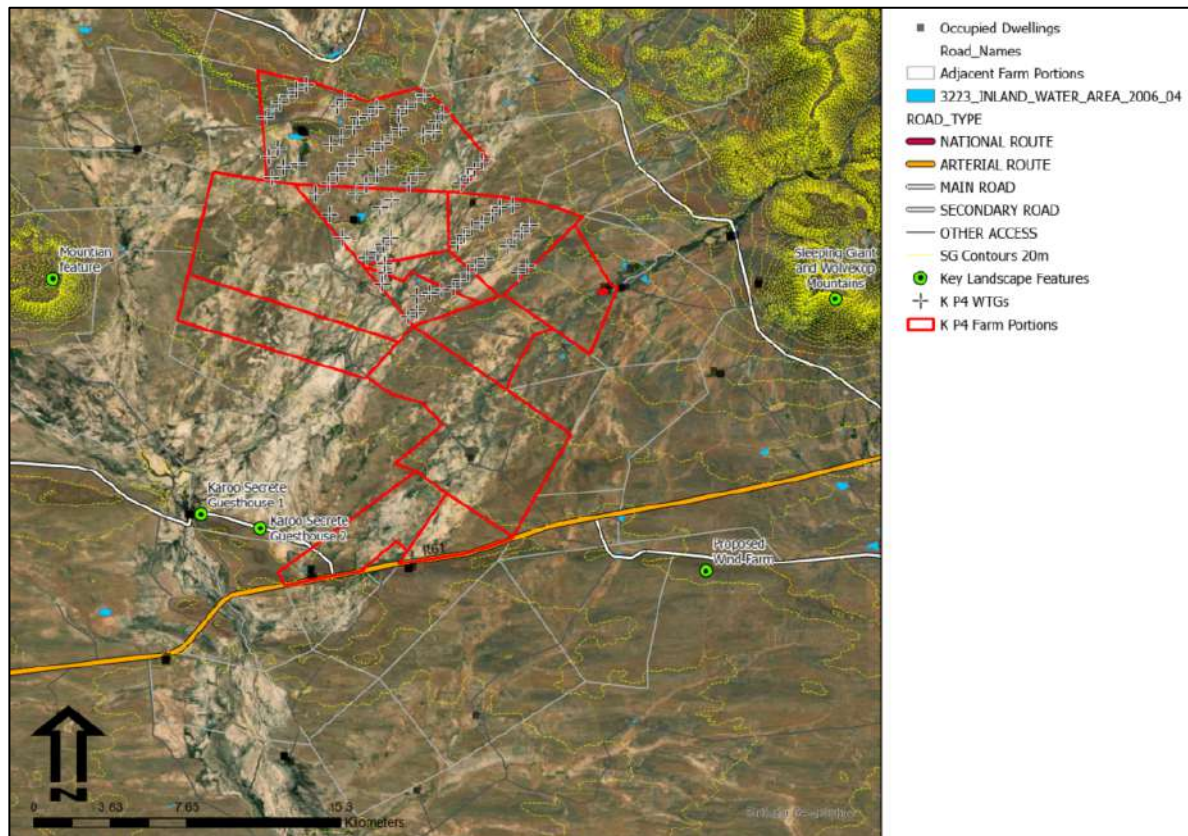


Figure 6-29: Local landscape themes map.

As mapped in Figure 6-29 above, the key landscape themes within the Foreground / Middle Ground (6km) distance are tabled below (Table 6-40):

Table 6-40: Key Landscape Themes

Theme	Category	Description
Sleeping Giant and Wolvekop Mountains	Landscape Heritage	Located approximately 9km to the east of the nearest turbine are the Sleeping Giant and Wolvekop Mountains of the Camdeboo Mountain range. These landforms are significant features, with steep cliffs that form part of the Great Escarpment. These features are listed in the TCS Heritage report as significant and should not be degraded by close proximity development.
Karoo landscape Tourism	Tourism	The Karoo Secretes Guest Houses are located approximately 6km to the west of the wind farm, on flat terrain with the main aspect of the two dwellings facing east towards the wind farm.
Proposed Wind Farming	Renewable Energy	A number of wind farms are located in close proximity to the Kariega WEF, where massing effects from numerous wind farms are likely to degrade the local landscape. This area is however, within the REDZ11 area where RE projects are encouraged. Care would need to be taken to ensure that suitable buffering of the R61 is uniformly implemented.
Karoo Farmsteads	Rural Agriculture	There are numerous farmsteads in the area that continue a long practice of dryland sheep farming. The farmsteads are usually scenic and have well established shade trees around the dwellings.

		As labour is required for farming, a number of labourer dwellings are also located in the vicinity.
R61 Road	View Corridor	The R61 is the main road running west to east below the escarpment, that links the towns of Aberdeen in the east to Beaufort West in the west. As this route could carry traffic en-route to the Karoo National Park at Beaufort West and does currently have scenic value associated with background views of the southern Camdeboo Mountains, it should be considered as a tourist view corridor.

6.5.1.2 Vegetation

Vegetation type is a large factor in determining the scenic quality or the site in terms of colour and texture, as well as influencing the local ability of the landscape to absorb the landscape change. The map below (Figure 6-30) outlines the vegetation type based on BGIS mapping (South African National Biodiversity Institute, 2018).

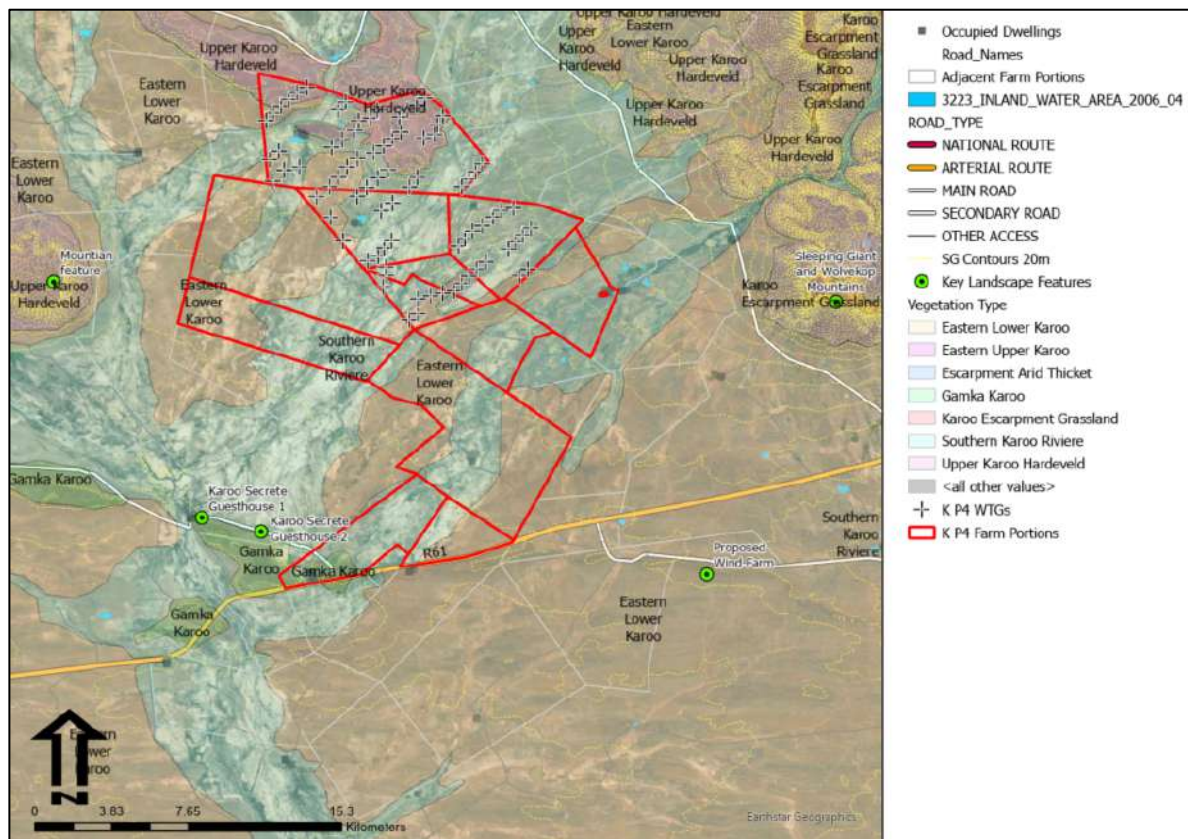


Figure 6-30: BGIS Biome and Vegetation Type Map (South African National Biodiversity Institute, 2018).

According to the South African National Biodiversity Institute (SANBI) 2012 Vegetation Map of South Africa, Lesotho and Swaziland (South African National Biodiversity Institute, 2012) the project area is located in the Nama-Karoo and Azonal Vegetations Biome with the main vegetation types being Eastern Lower Karoo, Southern Karoo Riviere and a small area to the north of Upper Karoo Hardeveld. Much of the area is covered by the lower lying riviere areas with small thorn trees growing along the drainage lines, with the low scrub vegetation of the Eastern Lower Karoo being more representative of the flat Nama-Karoo type landscape.

Of relevance to the project is that the vegetation is low in height and sparse in the arid environment. The vegetation will offer very limited screening for the proposed turbines, and due to the arid environment, is unlikely to be suitable for vegetation screening without a long-term management plan.

6.5.1.3 Landscape Topography

Landform is a key variable informing the aesthetic nature of the landscape within the VRM methodology. The viewshed is strongly associated with the regional topography where topographic screening from undulating terrain would restrict views of the proposed landscape change. The site-specific characteristics are also analysed by gradient analysis to determine if any steep slopes are located on the proposed development site.

6.5.1.4 Regional Landscape Topography

Making use of the NASA STRM digital elevation model, profile lines were generated for the area within 12km on either side of the project area predominantly in the North to South and East to West compass reference but orientated to take into account dominant topographic trends that could influence the local landscape and viewscape. The map depicting the regional elevation profile lines can be viewed on the following page.

The general topography of the site is defined as undulating Nama-Karoo, but with the Camdeboo Mountains to the north-east creating a significant landform that does influence the overall scenic quality and positively influences the landscape character. These landforms have been flagged in the CTS Heritage report as being significant landscape elements. The other dominating topographic element is the large, predominantly flat plain to the south, that typifies the Nama-Karoo landscape.

The North to South Profile depicts a south facing aspect with high ground to the North rising to 1300mamsl, dropping rapidly at the 10km mark to a lower plain elevation of 1000mamsl that continues to fall in gradient to 800mamsl at the 76km mark. The proposed wind farm (combined) starts at the 23km mark and continues to the south up to the 53km mark. The predominant gradient of the proposed development area is defined as flat, with a drop in elevation of 150m over the 30km distance.

The West to East Profile depicts a westerly aspect, with the dominating landform of the Wolvekop Mountain clearly visible to the east rising to 1500mamsl. The elevation drops rapidly from the massive to a wide plain of average height of 900mamsl where the wind farm is proposed. To the west is a smaller hill that rises 200m above the plain. The proposed wind farm begins at the 23km mark at a height of 870mamsl (approx.) and extends to the east to the 42km mark with a maximum height of just over 900mamsl. The scaling of the turbines to the eastern Wolvekop Mountain is relevant, as the turbines should not dominate this cultural heritage landform. With the setback from the massive, and the turbines being half the height of the landform, this is unlikely to occur.

In terms of visibility, the northern and eastern mountain landforms would restrict views to the north and northeast of the more northerly placed turbines, but with the turbine height resulting in widespread views to the northwest, south, southeast and southwest.

6.5.1.5 Key local topographic features and site slopes analysis

A slopes analysis was undertaken making use of NASA SRTM 30m data (

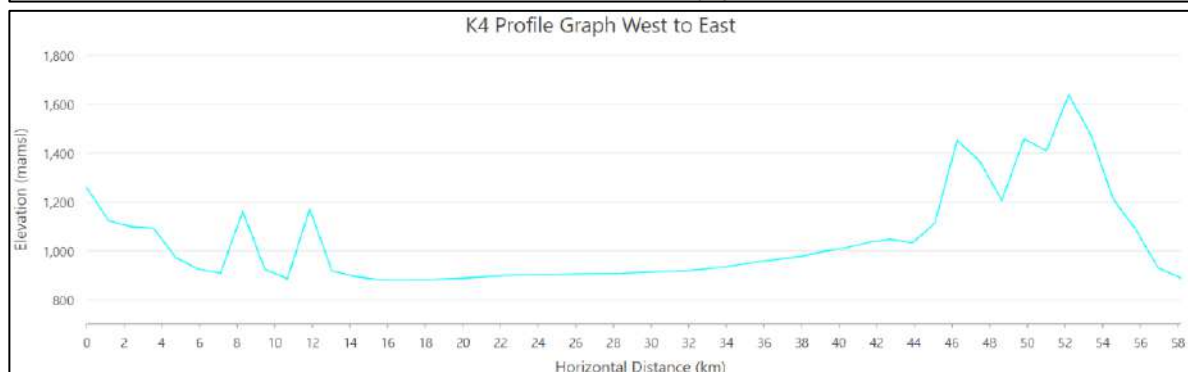
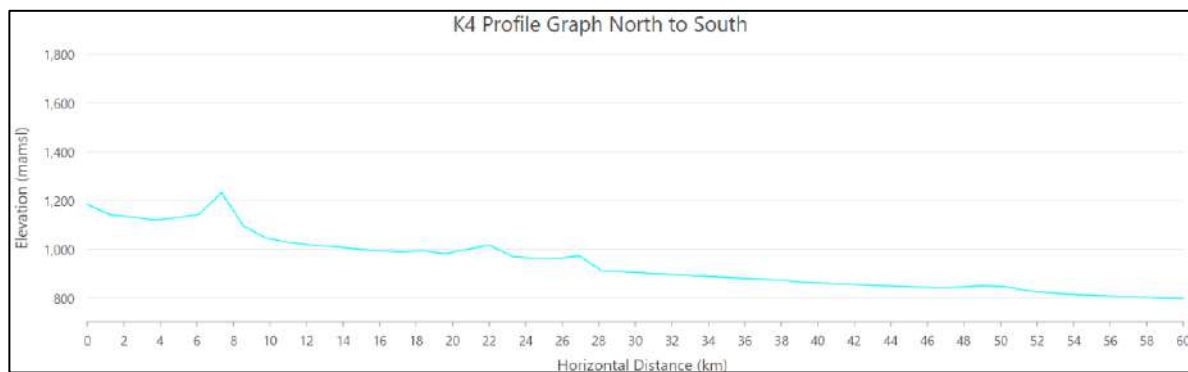
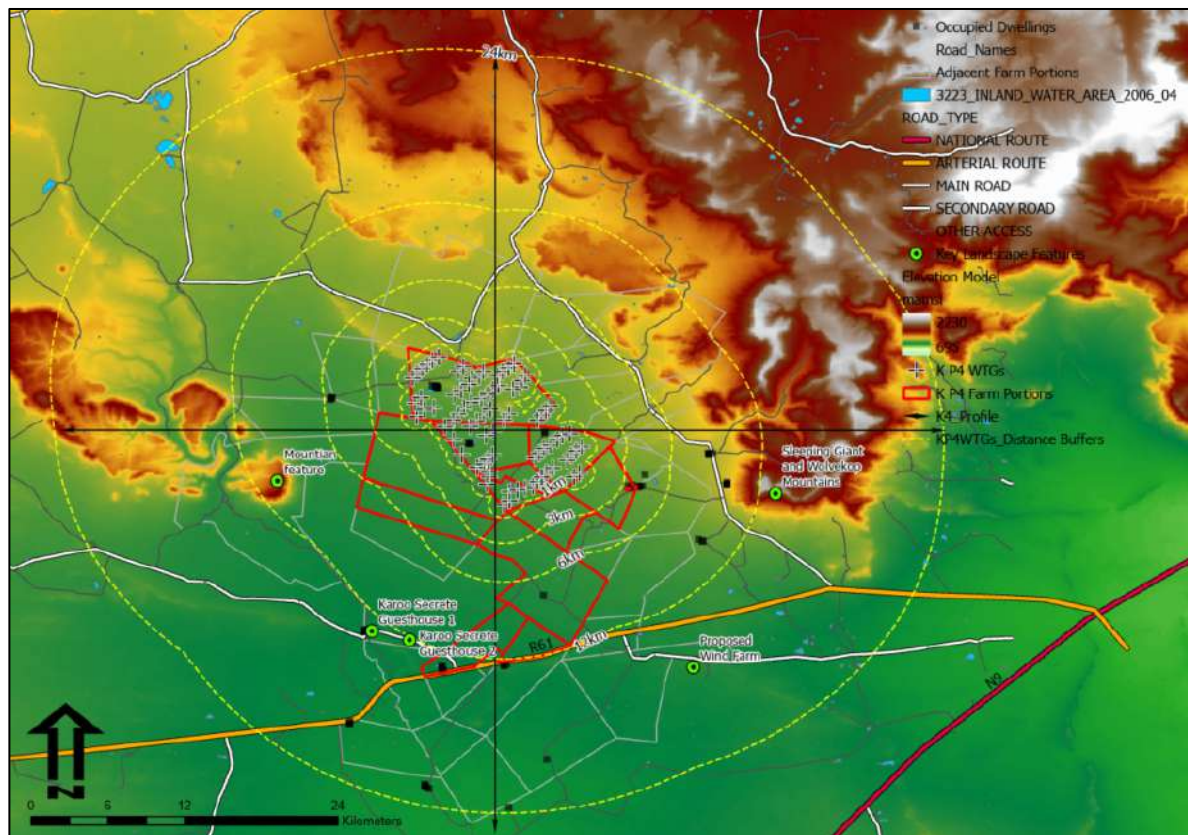


Figure 6-31). The finding of the assessment is that none of the turbines are located on steep slopes areas. The dominating landform element of the site are the many washes that are in the lower lying lands. The turbines have also been excluded from these areas as they are unsuitable to development (Figure 6-32).

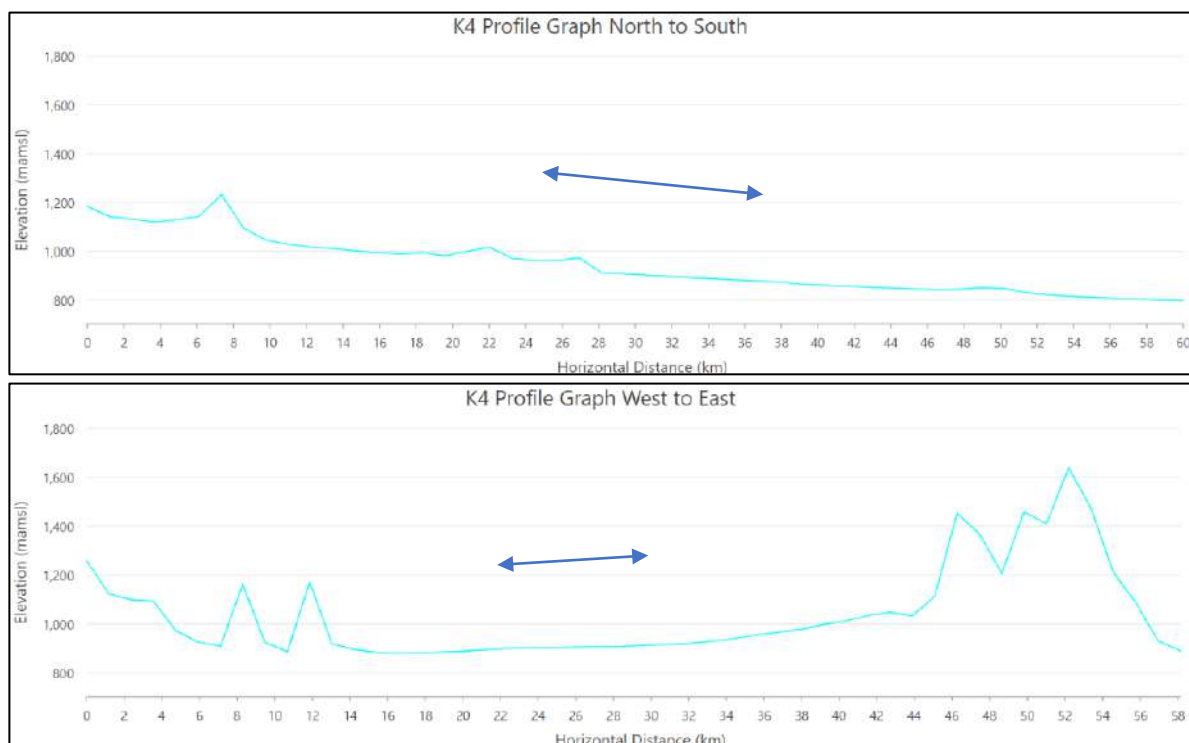
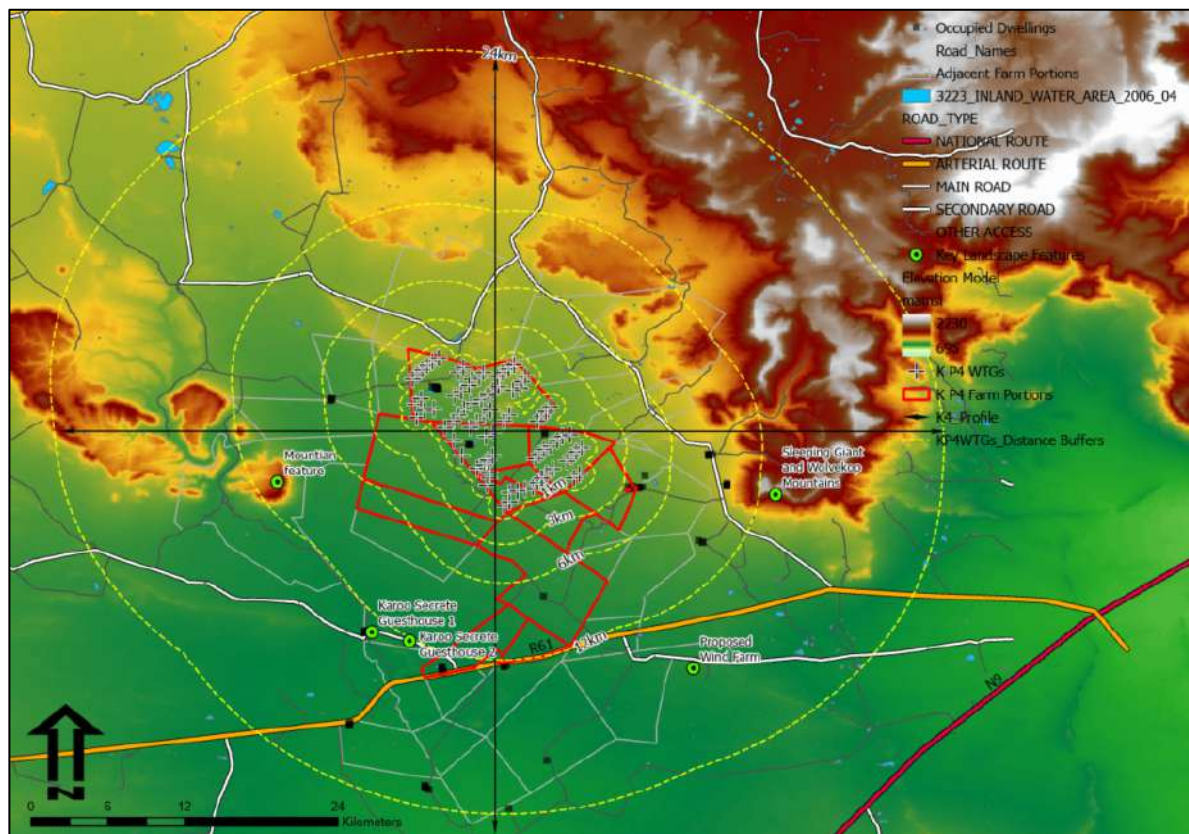


Figure 6-31: Regional Digital Elevation Mapping and Profiles Graphs with approximate extent and height depicted.

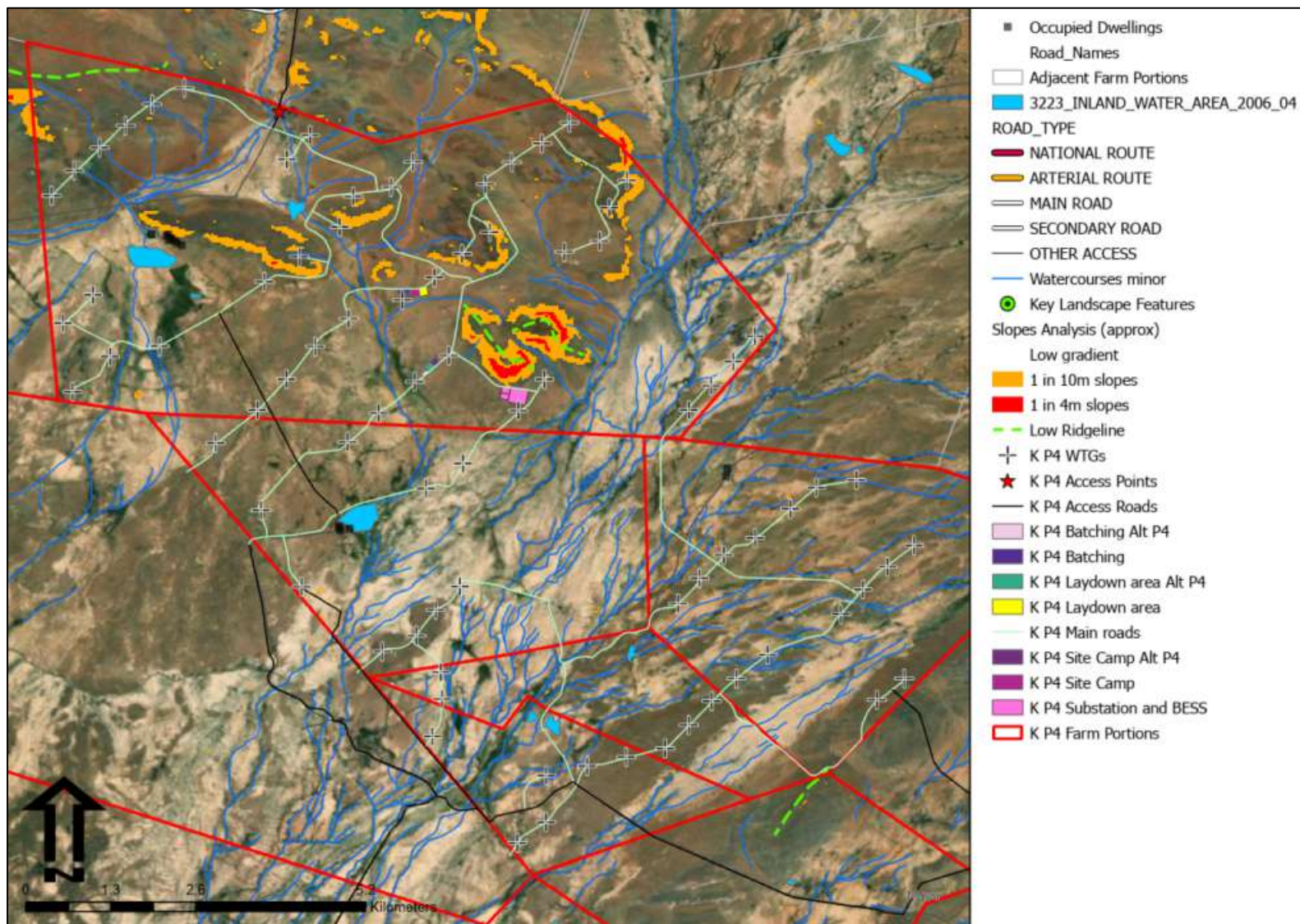


Figure 6-32: Key topographic features map.

6.5.1.6 Project Zone of Visual Influence

The visible extent, or viewshed, is “the outer boundary defining a view catchment area, usually along crests and ridgelines” (Oberholzer, 2005). To define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level as indicated in the table below. This is to define the *theoretical extent* where the proposed landscape change could be visible from. This theoretical viewshed excludes vegetation, structural development as well as distance from the location where atmospheric influence would reduce visual clarity over increasing distance. The viewshed analysis makes use of open-source NASA ASTER Digital Elevation Model data (NASA, 2009).

The extent of the viewshed analysis was restricted to a defined distance that represents the approximate zone of visual influence (ZVI) of the proposed activities, which takes the scale, and size of the proposed projects into consideration in relation to the natural visual absorption capacity of the receiving environment. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988).

Based on the theoretical viewshed and the site visit appraisal of the nature of the landscape, an assessment of the *Zone of Visual Influence (ZVI)* is made. The ZVI is the area where the proposed landscape change is most likely to be noticed by the casual observer, taking the site visit into account where vegetation, existing development and distance is taken into consideration. This is a subjective appraisal but informed by the viewshed and the other factors mentioned.

6.5.1.7 Viewshed Analysis

A viewshed analysis was undertaken for the site making use of an Offset value representing the height of the proposed development was used to represent the approximate height of the proposed development as reflected in the Table 6-41 below. The viewshed was also capped at a defined extent to take atmospheric influences into consideration from where the landscape change would not be clearly visible.

Table 6-41: Proposed Project Heights Table

Proposed Activity	Height (m)	Model Extent	Motivation
Hub height	150m	24km	The height of the turbine is likely to extend to the full expected area of visual influence, usually defined as 24km from the target.
Turbine blade height	250m	24km	

The viewshed is mapped and can be viewed in Figure 6-33 and Figure 6-34 on the following page. This depicts the theoretical area where the proposed landscape change could be visible. This theoretical viewshed excludes vegetation, structural development as well as distance from the location where atmospheric influence would reduce visual clarity over increasing distance. The extent of the theoretical viewshed is defined as Wide-Regional. This is due to the flat terrain surrounding the site, and the height of the turbine. The viewshed is primarily contained within the 24km distance zone, with the mountains to the northeast restricting visibility in this direction to some degree.

The Zone of Visual Influence (ZVI) is the area where the proposed landscape change is most likely to be noticed by the casual observer, taking the site visit into account where vegetation, existing development and distance is taken into consideration. This is a subjective appraisal but informed by the viewshed and the other factors mentioned. With regards to the proposed development, the expected ZVI is likely to be Regional. This is due to atmospheric influence of the arid environment, where visual clarity is likely to limit clarity of views after 12km. However, on clear days after rain, the movement of the which turbine blades, could be visible beyond this distance. Without AWL mitigation, the ZVI would also extend beyond this distance well beyond the 24km distance. As this would detract from the rural karoo sense of place, AWL at night mitigation is required.

The expected ZVI for the turbines of Kariega 4 WEF is rated Wide-Regional with the combined views of the turbines significantly change the sense of place with the 24km distance zone.

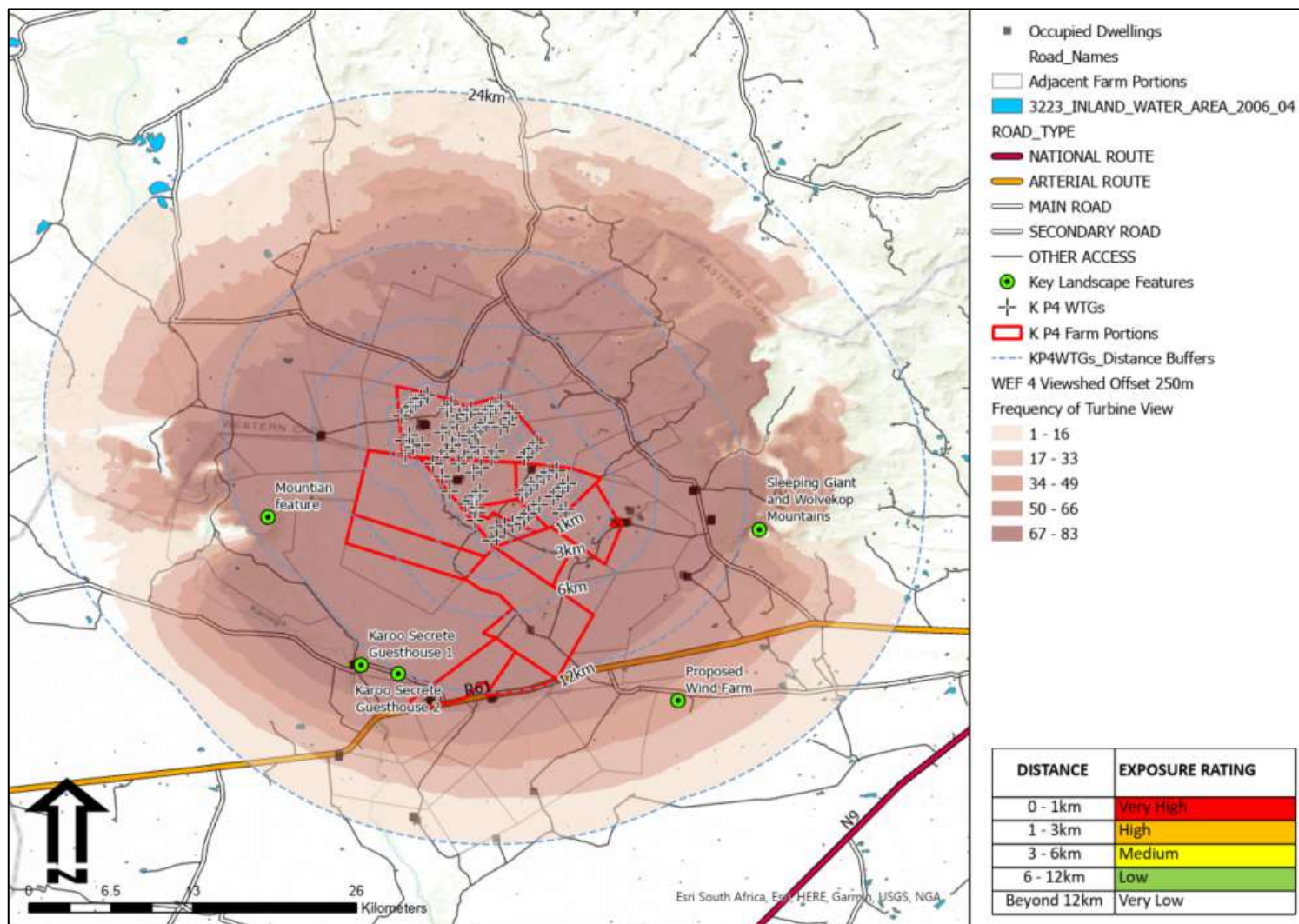


Figure 6-33: Kariega 4 WEF viewshed with offset 250m above ground to reflect turbine daytime viewshed.

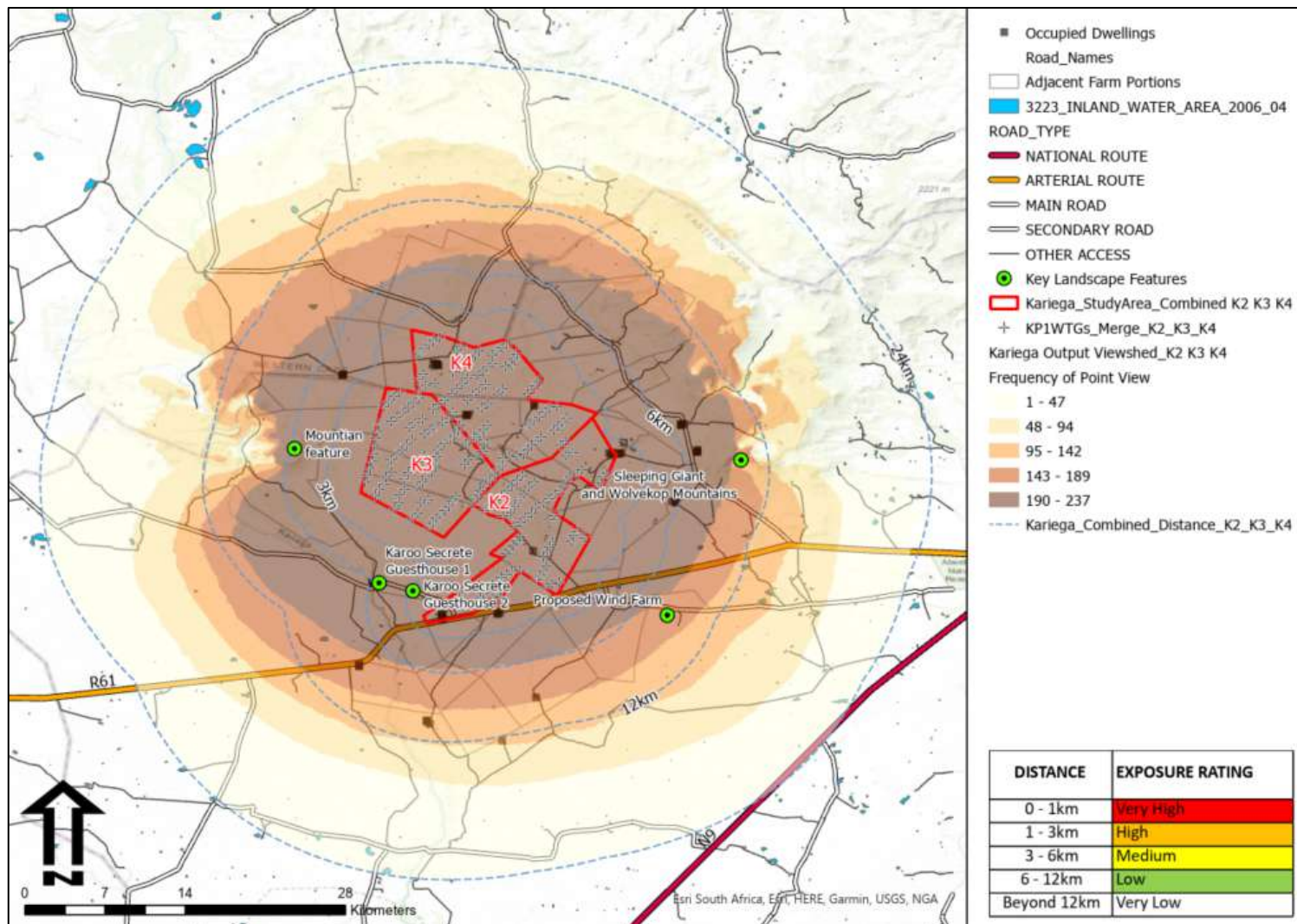


Figure 6-34: Combined Turbine viewshed with offset 250m above ground.

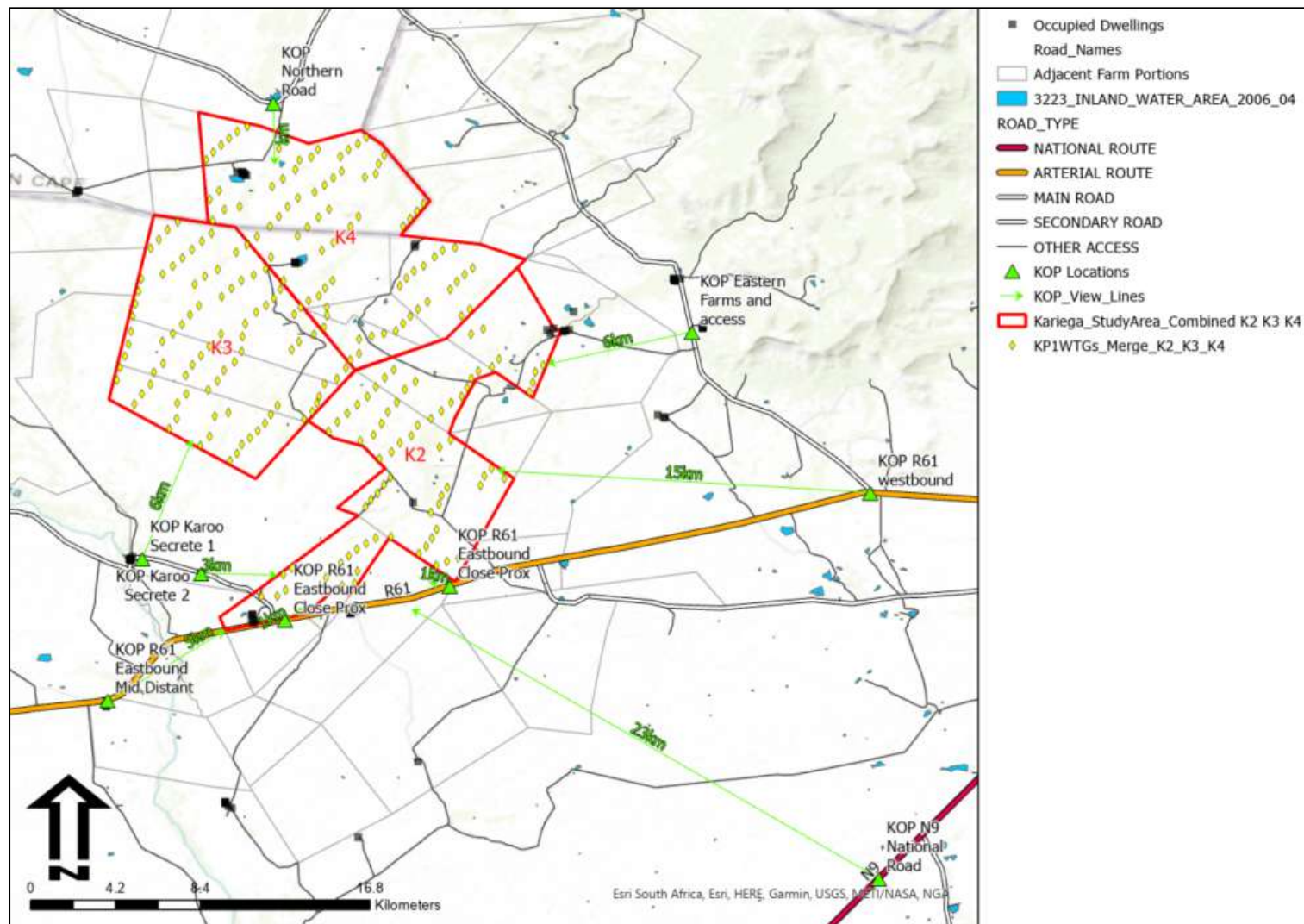


Figure 6-35: Turbine Key Observation Points location, view and distance map for *combined projects for cumulative viewpoints*.

6.5.1.8 Receptors and Key Observation Points

As defined in the methodology, KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. The following table identifies the receptors identified within the ZVI, as well as motivates if they have significance and should be defined as KOP. The receptors located within the ZVI, and KOPs view lines are indicated on the map on the following page. As motivated and mapped in Table 6-42 below and mapped in Figure 6-35 on the previous page, the following receptors have been identified as Key Observation Points and should be used as locations to assess the suitability of the landscape change.

Table 6-42: KOP Motivation Table.

KOP	View	Distance	Motivation
KOP Northern Road	S	3km	The northern and eastern farm roads are relatively remote and pass through the southern portions of the Camdeboo Mountains where the current scenic quality is High. These areas also contain farmsteads that look over the wind farm development area.
KOP Eastern Farms and access	SW	6km	
KOP R61 westbound	W	15km	The R61 has been identified in the CTS Heritage Assessment as a tourist view corridor that has higher levels of scenic quality that include views of the southern portions of the Camdeboo Mountains.
KOP R61 Eastbound Close Prox	E	1km	
KOP R61 Eastbound Mid Distant	E	5.4km	
KOP R61 Eastbound Close Prox	E	1km	
KOP Karoo Secrete 1	NE	6km	The Karoo Secrete comprises of two guest houses located to the west of the proposed wind farm with Mid-Ground views towards the proposed wind farm. The tourist location markets hiking, and mountain biking trails related to landscape resources.
KOP Karoo Secrete 2	NE	5.3km	
KOP N9 Northbound	NW	23km	The N9 National Highway is an important tourist corridor linking the interior to the southern coastal areas of the southern Cape.

6.5.2 Site Sensitivity

ZONE OF VISUAL INFLUENCE

Regional

The visible extent, or viewshed, is “the outer boundary defining a view catchment area, usually along crests and ridgelines” (Oberholzer, 2005). To define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level. Due to the height of the turbines in relation to the surrounding flat terrain to the south, the viewshed extent is likely to be Regional, with the Zone of Visual Influence (ZVI) contained to 14km due to arid climate atmospheric influences. With regards to the proposed development, the expected ZVI is likely to be Regional. This is due to atmospheric influence of the arid environment, where visual clarity is likely to limit clarity of views after 12km. However, on clear days after rain, the movement of the white turbine blades, could be visible beyond this distance. Without AWL mitigation, the ZVI would also extend beyond this distance well beyond the 24km distance. As this would detract from the rural karoo sense of place, AWL at night mitigation is required. The expected ZVI for the Kariega 4 WEF is rated Regional with the combined views of the turbines significantly changing the sense of place within the 24km distance zone.

RECEPTORS AND KEY OBSERVATION POINTS

Multiple Receptor locations and 4 Key Observation Points with Medium to High Visual Exposure

Key Observation Points (KOPs) are the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. The KOPs are (Figure 6-36):

- R61 Road as a tourist view corridor.
- Karoo Secretes Guest House.
- Isolated farmsteads north and east.

SCENIC QUALITY

Medium to High

The overall Scenic Quality is rated Medium to High. This is primarily due to the dominating visual element of the Camdeboo Mountains located approximately 6 – 8 km to the northeast of the proposed development site, significantly adding scenic quality to the adjacent landscape area. This contrasts to the flat open plains of the southern Nama-Karoo landscapes that are interesting but not visually significant at a local level.

RECEPTOR SENSITIVITY TO LANDSCAPE CHANGE

Medium

The receptor sensitivity to landscape change is expected to be Medium. This is due to the remoteness of the locality, with only the single landscape-based tourist activity in the area. The 1km buffer on the R61 is rated higher for sensitivity to landscape change.

VISUAL RESOURCE MANAGEMENT ASSESSMENT

The BLM has defined four Classes that represent the relative value of the visual resources (Figure 6-37) of an area and are defined making use of the VRM Matrix:

Classes I and II are the most valued.

Class III represent a moderate value.

Class IV is of least value

Class I (No-go)

Any river / streams and associated flood lines buffers identified as significant in terms of the WULA process.

Any wetlands identified as significant in terms of the WULA process.

Any ecological areas (or plant species) identified as having a high significance.

Any heritage area identified as having a high significance.

1km buffer on occupied farmsteads and labourer dwellings.

1km buffer from the R61 View Corridor

Class II (Not recommended)

Not applicable

Class III (suitable with mitigation)

Nama-Karoo and Southern Karoo Riviere landscapes where there are no significant risks as identified by other specialist inputs (See Class I).

Class IV (suitable without mitigation)

Not applicable due to the rural Nama-Karoo landscape and proximity to the Camdeboo Mountain landscapes.

EXPECTED Impact significance

High (-ve)

(without mitigation)

Without mitigation, the expected Visual Impact Significance for the Kariaga 4 Wind Farm is rated High Negative. With mitigation, the expected Visual Significance can be reduced to Medium to High Negative. While the intensity will be strongly perceived, the receiving landscape is not so significant such that it should be protected. The Camdeboo Mountains are also set back from the wind farm, and the site is wide and flat with tourism activity limited to the single Karoo Secrete activity. The area is also relatively remote, with limited residential receptors, many who are the landowners who are proponents for the development. While the individual wind farm impact is moderated to some degree, the cumulative impact is a more realistic landscape and visual impact, as there are multiple wind farms proposed for the area. The implementation of the multiple projects is likely to result in the area becoming a permanent windfarm landscape and is likely to strongly transform the existing rural karoo landscape context. The alignment with the REDZ11 planning also moderates the impact as this is where larger-scale renewable energy projects are encouraged.

Medium to High (-ve)

(with mitigation)

CUMULATIVE EFFECTS

Very High (-ve)

(Fatal-flaw without AWL mitigation)

As indicated in the contrast ratings of the cumulative views, the Magnitude of the daytime cumulative Visual Impact from multiple wind farm intervisibility is going to be Very High with and without mitigation. This is due to the massing effect created by the establishment of over 300 wind turbines within the local area. The cumulative effects of the intervisibility of over 300 turbine AWL flashing at the same time from all the wind farms is highly likely to generate very strong levels of visual contrast due to the existing dark sky sense of place of the deep rural Karoo landscape context. However, as the landscape and visual resources are not significant, the importance of maintaining the existing daytime landscape context is rated Medium. The change to the local landscape will be clearly visible and will be perceived as a wind farming landscape.

For night-time intervisibility cumulative effects, without mitigation the rating is Very High Negative. This should be regarded as a Fatal-Flaw and as such, full AWL mitigation should be a condition of authorisation. Mitigation stipulated includes the strategic placement of AWL at project corner turbines. The AWL should also be placed in shallow cups such that ground flash incidence to the adjacent residential receptors is limited. Radar activated AWL should also be implemented to ensure that the existing karoo dark-sky sense of place is retained as much as possible. With this mitigation, the expected cumulative landscape and visual significance can be reduced to Medium to High for night-time scenarios.

Policy Fit

Medium to High Positive

In terms of the *local and regional planning*, there is positive alignment with economic development from RE, with the potential for employment being the key support factor, but with some potential risk from damage to roads. This could be a concern for tourism as there is also an emphasis on tourism as the region has beautiful landscapes and a rich heritage; it is important that its natural and built environment be protected for generations to come. Although tourism is emphasised in the local and regional planning, and the Camdeboo Mountains are significant landscape elements, active tourism in the area is limited to a single farm stay (two dwellings), and the R61 Road as a tourist view corridor.

Methodology

Bureau of Land Management's Visual Resource Management (VRM) method

The methodology for determining landscape significance is based on the United States Bureau of Land Management's Visual Resource Management (VRM) method (USDI., 2004). This GIS-based method allows for increased objectivity and consistency by using standard assessment criteria to classify the landscape type into four VRM Classes, with Class I being the most valued and Class IV, the least. The

Classes are derived from *Scenic Quality*, *Visual Sensitivity Levels*, and *Distance Zones*. Specifically, the methodology involved: site survey; review of legal framework; determination of Zone of Visual Influence (ZVI); identification of Visual Issues and Visual Resources; assessment of Potential Visual Impacts; and formulation of Mitigation Measures.

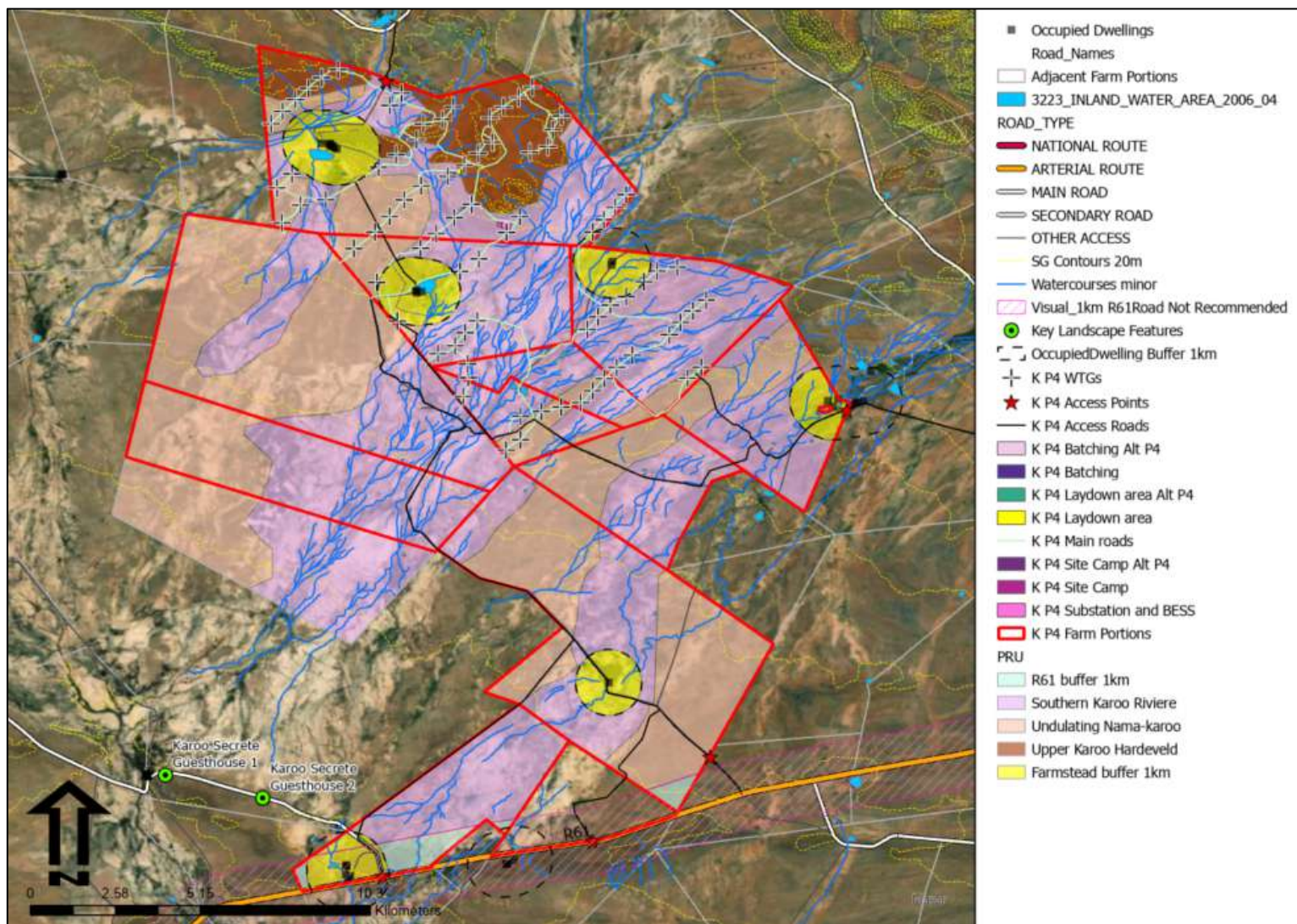


Figure 6-36: Combined WEFs Physiographic Rating Units with K4 WEF focus area.

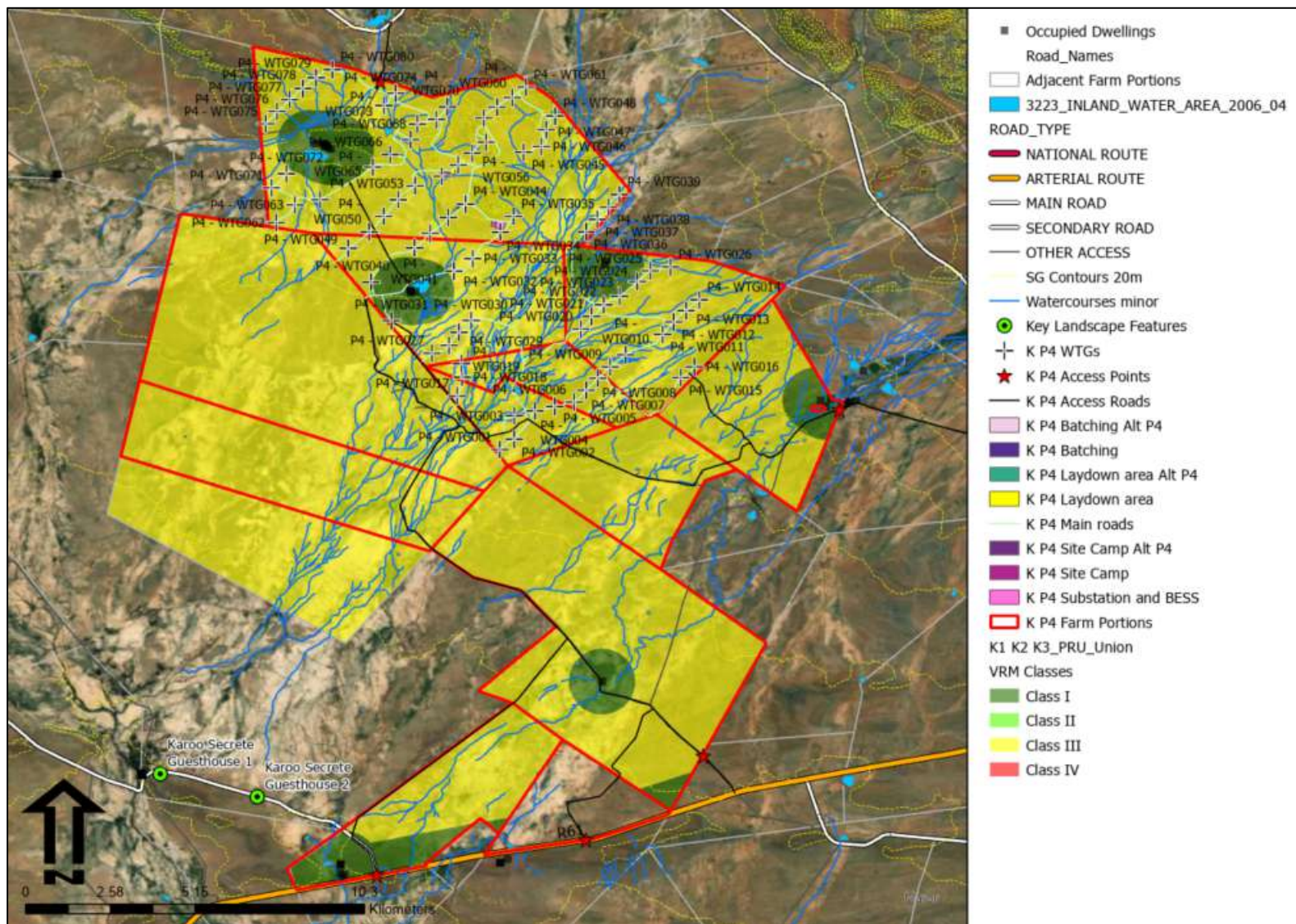


Figure 6-37: Visual Resource Management Classes map: Kariega 4 WEF.

6.5.3 Impact assessment

An impact assessment rating was undertaken making use of the EnviroAgri Impact Assessment Criteria. The defined impacts are in the table below for the following expected visual and landscape impacts:

Construction Phase (Negative)

- Wind-blown dust from loss of vegetation.
- Topsoil loss.
- Dust from moving vehicles.
- Buildings, structures and finishings.
- Litter.
- Fencing.
- Soil erosion.
- Cut and fills.
- Security lights at night.
- Un-necessary roads.
- Construction of turbines.

Construction and Operation Phase (Negative)

- Laydown, Site Camp and Batching (Alt 1 and Alt 2).
- BESS and Substation Infrastructure.
- Soil sterilisation by compaction.

Operational Phase(Negative)

- Movement of turbines in the landscape.
- Aircraft Warning Lights at Night.
- Security Light Spillage at night.
- Old turbine blade dumping.

Decommissioning Phase (Negative)

- Abandoning of old structures.
- Windblown dust from moving vehicles.
- Abandoning of old tower structures and blades.

Cumulative Effects (Negative)

- Intervisibility of wind farm during the day.
- Intervisibility of wind farm during the night.

6.5.3.1 Construction Phase Impacts

Table 6-43: Wind Blown Dust.

No.	1 Generic			
Project phase	Construction			
Impact title	Wind blown dust			
Impact description	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access roads.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Temporary	Impact will last less than 1 month.	Temporary	Impact will last less than 1 month.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Low - negative		Very low - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minimal - negative		Minimal - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Should excessive dust be generated from the movement of vehicles on the roads such that the dust becomes visible to the immediate surrounds, dust-retardant measures should be implemented under authorisation of the EPC.			
Comment on ratings	The semi-arid environment is already fairly dusty and with limited vegetation, dust is a naturally occurring phenomenon in the regional landscape. Large expanse of vegetation removal is also likely to be limited as development is nodal.			

Table 6-44: Topsoil Loss.

No.	2 Generic			
Project phase	Construction			
Impact title	Topsoil loss			
Impact description	Topsoil excavated from the site should be stockpiled and utilised for rehabilitation of the site after construction.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Low - negative		Low - negative	

Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Minor - negative		Minor - negative	
Importance	High	High	High	High
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Topsoil excavated from the site should be stockpiled and utilised for rehabilitation of the site after construction.			
Comment on ratings	The main area with this could take place is for the laydowns, construction areas, and turbine base. In this semi-arid region, topsoil is likely to be limited and as such, if it available, it needs to be protected.			

Table 6-45: Buildings, structures and finishing

Table 6-45: Buildings, structures and finishing				
No.	3 Generic			
Project phase	Construction			
Impact title	Buildings, structures and finishing			
Impact description	Buildings painted bright colours can increase the visual presence of the structures in a rural landscape, creating higher levels of visual contrast and attracting the attention of the casual observer.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Minor - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The buildings should be painted a grey-brown colour (or other colour in keeping with the surrounding landscape) to assist in reducing colour contrast. Sheet metal structures should make use of mid-grey colour, and preferably have a rough textured material.			
Comment on ratings	The area is large and there is an existing precedent for isolated farm structures. The reduction in the colour contrast of the structures will assist in reducing visual intrusion.			

Table 6-46: Litter.

No.	4 Alternative			
Project phase	Construction			
Impact title	Litter			
Impact description	Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Minor - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Littering should be a finable offence. Fencing around the laydown should be diamond shaped to catch wind blown litter. The fences should be routinely checked for the collection of litter caught on the fence.			
Comment on ratings	Litter is a nuisance factor that degrades the local landscape and would undermine the integrity of the exiting karoo landscape character where this occurrence is limited.			

Table 6-47: Security Fencing.

No.	Alternative			
Project phase	Construction			
Impact title	Fencing			
Impact description	Long fencing lines has the potential to be visually dominating, degrading the rural landscape sense of place.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Moderate - negative	

Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Fencing should be simple and appear transparent from a distance and located around the project area, not encircle the total project area or be located within the 1km R61 No-go area.			
Comment on ratings	Large security fencing has the potential to be highly visually intrusive resulting in degradation of local landscape resources. The project does have space to set security fencing back from receptors.			

Table 6-48: Soil Erosion.

No.		6 Alternative		
Project phase	Construction			
Impact title	Soil erosion			
Impact description	In areas where construction has taken place on steeper slopes, soil erosion measures need to be implemented.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Minor - negative		Minimal - negative	
Importance	High	High	High	High
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	In areas where construction has taken place on steeper slopes, soil erosion measures need to be implemented.			
Comment on ratings	As the site is relatively flat, and crossing over river washes are limited, this likely to be a limited risk. Best practice in river wash crossing needs to be implemented to reduce risk of road wash-aways.			

Table 6-49: Security Light Spillage at Night.

No.	8 Alternative			
Project phase	Construction			
Impact title	Security Light Spillage at night			

Impact description	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minimal - negative	
Importance	High	High	Low	Low
Consequence	Moderately-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Light spillage mitigation from security lighting should be implemented and monitored by the ECO during construction to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.			
Comment on ratings	Lights at night have the potential to significantly extend the project zone of visual influence at night. Strict light spillage mitigations need to be implemented.			

Table 6-50: Un-necessary Roads.

No.	9 Alternative			
Project phase	Construction			
Impact title	Unnecessary roads			
Impact description	Unnecessary roads have the potential to create a visual disturbance long after the usage as past.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minor - negative		Minimal - negative	

Importance	High	High	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.		
Potential mitigation	Limit road access to an efficient minimum by coordinated planning between the project management and the environmental control officer. Temporary roads should be well marked and should only cross drainage lines on areas identified as permanent road features where erosion and soil loss management can be contained. Noncompliance with road signage and utilisation of no authorised roads should become a finable offence.			
Comment on ratings	The linear scarring created by long straight lines in the rural setting has the potential to detract from the rural landscape character.			

Table 6-51: Construction of Turbines.

No.	10 Alternative			
Project phase	Construction			
Impact title	Construction of turbines.			
Impact description	The construction of turbines usually requires a number of large cranes that are very visible in the regional landscape.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Moderate - negative		Moderate - negative	
Importance	High	High	High	High
Consequence	Moderately-detrimental		Moderately-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	Low	Mitigation does not exist; or mitigation may only slightly reduce the significance of impacts.		
Potential mitigation	Not applicable other than No-go for certain areas that has already been implemented in this EIA process with a 1km exclusion buffer from the R61 Road, and residential dwellings.			
Comment on ratings	The cranes and the partially constructed turbines generate strong levels of visual contrast, dominating the attention of the casual observer. This will take place continuously during the construction phase.			

6.5.3.2 Construction & Operation Phase Impacts

Table 6-52: Laydown, Site Camp and Batching Preferred Alternative

No.	1 Alternative Both			
Project phase	Construction & Operation			
Impact title	Laydown, Site Camp and Batching			
Impact description	Construction of the Preferred Alternative for the Laydown, Site Camp and Batching Plant.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Minor - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Refer to Buildings, structures and finishings (No. 3)			
Comment on ratings	The proposed development site is well positioned 1.7km to the south of the R61, with raised ground to the northeast where westbound road receptors would not see the development site. Mitigation for colour and texture is a requirement.			

Table 6-53: BESS and Substation Infrastructure.

No.	4 Alternative			
Project phase	Construction & Operation			
Impact title	BESS & Substation Infrastructure			
Impact description	Construction of the BESS and Substation			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.

Intensity		Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.		Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
	Medium		Low	
Magnitude	Moderate - negative		Low - negative	
Probability		The impact may occur, but not necessarily proof that it will.		The impact may occur, but not necessarily proof that it will.
	Likely (>66%)		Likely (>66%)	
Significance	Minor - negative		Minor - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility		The affected environment may not be able to recover from the impact - permanently modified.		
	Low			
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.		
Potential mitigation	Refer to Buildings, structures and finishings (No. 3)			
Comment on ratings	The BESS and Substation are located 8km to the south of the R61 with no proximate residential receptors. With colour and texture mitigation, the visual intrusion is likely to be minimal.			

Table 6-54: Soil Sterilisation by Compaction.

No.	5 Alternative			
Project phase	Construction & Operation			
Impact title	Soil sterilisation by compaction			
Impact description	Compaction of larger areas can result in soil sterilisation and landscape degradation post construction.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Minor - negative		Minimal - negative	
Importance	High	High	Moderate	Moderate
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.		
Potential mitigation	Laydown areas and other construction areas no longer needed post construction for operational management, should be ripped (0.5m depth) to restore compacted topsoil, and then rehabilitated to natural vegetation under the supervision of the rehabilitation specialist.			
Comment on ratings	While this is not a widespread phenomenon, the compaction of soil could well influence the productive/ rehabilitative capacity of areas impacted by heavy earth moving machinery. Mitigation needs to be implemented under the supervision of the ECO/ESO and as per the recommendations of the soil specialist.			

6.5.3.3 Operational Phase Impacts

Table 6-55: Static and moving turbines.

No.	1 Alternative 1			
Project phase	Operation			
Impact title	Static and moving white turbines with red or black single blade tip colour.			
Impact description	Change to rural karoo landscape to wind farm landscape due to the presence of large and moving/ static turbines.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	High - negative		High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Major - negative		Major - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Moderately-detrimental		Moderately-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	Low	Mitigation does not exist; or mitigation may only slightly reduce the significance of impacts.		
Potential mitigation	Other than the existing 1km buffer along the R61 Road, and the 1km buffer around residential receptors, defined as No-go areas, other mitigation is limited. Best practice mitigation is required with no up lighting to be used. Limited branding to be used on the turbines with muted colours with a mid-grey hue.			
Comment ratings	on While the Magnitude is rated High, the proposed WEF is located in a REDZ where large scale renewable energy projects are encouraged. As such, the single Kariega WEF 4 (in isolation from the Kariega WEF 2 & 3), the likely Landscape and Visual Significance of the landscape change is rated Medium. The greater landscape that includes the southern reaches of the Camdeboo Mountains does have some value, the WEF 3 is located 6.5km from the mountains where the site Scenic Quality is Medium to High. The area is also remote with limited local residential receptors and a single District Road. In terms of bird mitigation markings, the photomontages generated with black colour bands appears to be less visually dominating than those of the red colour. This is due to the red colour being more reflective, with the black colour less reflective. The visual preference is for black bird markings as the turbine blades will be more likely to merge with background grey hues of the karoo landscape context.			

Table 6-56: Aircraft Warning Lights at Night.

No.	2 Alternative 1			
Project phase	Operation			
Impact title	Aircraft Warning Lights at Night.			
Impact description	AWL lights at night have the potential to significantly detract from the 'dark-sky' sense of place of the rural landscape.			

Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Major - negative		Moderate - negative	
Importance	Very high	Very high	High	High
Consequence	Highly-detrimental		Moderately-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Strategic placement of AWL at project corner turbines. Placement of the AWL in shallow cups such that ground flash incidence is limited. Radar activated AWL should also be implemented to ensure that the existing karoo dark-sky sense of place is retained as much as possible.			
Comment on ratings	Multiple AWL flashing as at the same time from all the turbines is highly likely to generate very strong levels of visual contrast due to the existing dark sky sense of place of the deep rural Karoo landscape context. This should be regarded as a Fatal-Flaw and as such, full AWL mitigation should be a condition of authorisation.			

Table 6-57: Security Light Spillage at Night.

No.	3 Alternative			
Project phase	Operation			
Impact title	Security Light Spillage at night.			
Impact description	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Limited	Limited to the site and its immediate surroundings.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		Moderate - negative	

Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Major - negative		Moderate - negative	
Importance	High	High	Moderate	Moderate
Consequence	Highly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Light spillage mitigation from security lighting should be implemented and monitored by the ECO during operational phase to ensure that light spillage does not create a glowing effect. No overhead/ flood lighting of structures or areas. No up lighting to be used.			
Comment on ratings	Light spillage is highly likely to generate very strong levels of visual contrast due to the existing dark sky sense of place of the deep rural Karoo landscape context. Lights at night mitigation should be a condition of authorisation.			

Table 6-58: Old Turbine Blade Dumping.

No.	4 Alternative			
Project phase	Operation			
Impact title	Old turbine blade dumping			
Impact description	The dumping of old turbine blades on site has the potential to significantly degrade the local landscape character.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minimal - negative	
Importance	Very high	Very high	Moderate	Moderate
Consequence	Moderately-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Old turbines and equipment should be removed from site and recycled/ managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) or deposited at a registered landfill if it cannot be recycled or reused. Dis-used blades should be dealt with within 6 months.			
Comment on ratings	Dumping of old turbine blades has the potential to render a site landscape degraded. This mitigation should be a condition of authorisation.			

6.5.3.4 Decommissioning Phase Impacts

Table 6-59: Abandoning of old structures.

No.	1 Alternative 1			
Project phase	Decommissioning			
Impact title	Abandoning of old structures			
Impact description	Old, unused structures have the potential to significantly degrade the landscape character.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Positive	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.

Intensity		Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.		Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
	Medium		Low	
Magnitude	Moderate - negative		Moderate - positive	
Probability		The impact may occur, but not necessarily proof that it will.		The impact has occurred before and could occur in the lifetime of the project.
	Likely (>66%)		About as likely as not (33-66%)	
Significance	Moderate - negative		Minor - positive	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-beneficial	
Confidence	Well established		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Medium. All structures not required for agricultural purposes post-closure should be removed and where possible, recycled or reused. Building structures should be broken down (including building foundations but excluding turbine foundations). The rubble should be managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and deposited at a registered landfill if it cannot be recycled or reused.			
Comment on ratings	The presence of abandoned structures can increase the potential of landscape decay. With the removal of all old structures and rehabilitation back to Eastern Lower Karoo vegetation that can once again be farmed, the landscape change would be once again Slightly-beneficial as a rural karoo landscape.			

Table 6-60: Abandoning of old turbine towers and blades.

No.	2 Alternative 1			
Project phase	Decommissioning			
Impact title	Abandoning of old towers and blades.			
Impact description	Old towers have the potential to significantly degrade the landscape character.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Positive	
Extent	Regional	Impacts manifest at a regional / municipal level.	Local	Extending across the site and to nearby settlements.
Duration	Permanent	Impact may be permanent, or in excess of 25 years.	Short term	Impact will last less than 1 year.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Very high - negative		Low - positive	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Major - negative		Minor - positive	
Importance	Very high	Very high	Moderate	Moderate
Consequence	Highly-detrimental		Slightly-beneficial	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		

Potential mitigation	Should turbine towers be constructed from concrete, the towers need to be demolished, the rubble buried in pits and the area shaped to appear as a low, natural dome. The pit areas would need to be rehabilitated to nature veld vegetation within input from a rehabilitation specialist. Steel towers should be removed from site and managed according to the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) and deposited at a registered landfill if it cannot be recycled or reused.
Comment on ratings	The presence of abandoned tower structures can significantly increase the potential of landscape decay at a regional level. With the removal of all old structures and rehabilitation back to Eastern Lower Karoo vegetation that can once again be farmed, the landscape change would be once again Slightly-beneficial as a rural karoo landscape.

6.5.3.5 Cumulative Effects of All Phase Impacts

Table 6-61: Intervisibility of combined wind farms during the day.

No.	Alternative 1			
Project phase	Construction, Operation & Decommissioning			
Impact title	Intervisibility during the day			
Impact description	Intervisibility during the day of all the Kariega WEF projects as well as the other wind farms to the southeast.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.
Magnitude	High - negative		High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Major - negative		Major - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Moderately-detrimental		Moderately-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	Low	Mitigation does not exist; or mitigation may only slightly reduce the significance of impacts.		
Potential mitigation	The primary mitigation for turbines within a wind farm is locational. To some degree this has been applied within the regional setting of the other wind farms, who have also included a 1km buffer from the R61 such that this road view corridor can be retained. Consensus should be obtained prior to construction on the nature of the bird marking on the turbines, with a strong visual preference for black banded markings as these are less reflective than the red.			
Comment on ratings	As indicated in the contrast ratings of the cumulative views, the Magnitude of the cumulative Visual Impact from multiple wind farm intervisibility is going to be Very High. This is due to the massing effect created by the establishment of over 300 wind turbines within the local area. While the intensity will be strongly perceived, the receiving landscape is not so significant such that it should be protected. The Camdeboo Mountains are also set back 6km from the wind turbines, with the Kariega WEF projects appearing to be contained by mountain and hill features to the east, north and west. The site is wide and flat and has limited tourism activity limited to the single Karoo Secrete activity. The area is also relatively			

	remote, with limited residential receptors, many who are the landowners who are proponents for the development. The implementation of the multiple projects is likely to become a permanent landscape change and is also likely to attract other wind farms to the area.

Table 6-62: Intervisibility of combined wind farms during the night.

No.	2Alternative 1			
Project phase	Construction, Operation & Decommissioning			
Impact title	AWL intervisibility during the night			
Impact description	Intervisibility of the AWL during the night of all the Kariega WEF projects as well as the other wind farms to the southeast.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Major - negative		Moderate - negative	
Importance	Very high	Very high	Very high	Very high
Consequence	Highly-detrimental		Moderately-detrimental	
Confidence	Virtually certain		Virtually certain	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Strategic placement of AWL at project corner turbines. Placement of the AWL in shallow cups such that ground flash incidence is limited. Radar activated AWL should also be implemented to ensure that the existing karoo dark-sky sense of place is retained as much as possible.			
Comment on ratings	Multiple AWL flashing as at the same time from all the turbines is highly likely to generate very strong levels of visual contrast due to the existing dark sky sense of place of the deep rural Karoo landscape context. This should be regarded as a Fatal-Flaw and as such, full AWL mitigation should be a condition of authorisation.			

6.5.4 Conclusion and Recommendations

It is the finding of the Visual Impact Assessment report that, while the combined views of the multiple turbines from multiple projects will significantly change the local landscape character, the proposed development Kariega 4 WEF does not constitute a fatal flaw (with mitigation) for the following reasons:

- The area is relatively remote, and other than the significant background landforms of the Sleeping Giant and Wolvekop Mountain features of the Camdeboo Mountains, the proposed development site is predominantly flat.
- Although tourism is emphasised in the local and regional planning, and the Camdeboo Mountains are significant landscape elements, active tourism in the area is limited to a single farm stay (two dwellings), and the R61 Road as a tourist view corridor.
- The landscape planning fit is Medium to High Positive with the site located within the REDZ11 area, and with Renewable Energy (RE) supported by local planning.

The following preliminary mitigations should inform the layout plan prior to final assessment:

- Multiple Aircraft Warning Lights (AWL) flashing at the same time from all the turbines is highly likely to generate very strong levels of visual contrast due to the existing dark sky sense of place of the deep rural Karoo landscape context. This should be regarded as a Fatal-Flaw and as such, full AWL mitigation should be a condition of authorisation.

6.6 Shadow Flicker Impact Assessment

The Shadow Flicker Impact Assessment (SFIA) was undertaken by Steve Stead of Visual Resource Management Africa. The findings of the SFIA concluded that wind farm should be authorised with mitigation which relate to operational phase surveys to measure shadow flicker incidence at low sun angle in the morning and evenings near specified receptors.

The full specialist report is attached hereto as **Annexure D 5, Flicker Impact Assessment (2024)**.

6.6.1 Baseline Description

In South Africa, there are no specific guidelines as to how to assess shadow flicker generated by wind turbines. However, international guidelines state that the practical extent to which shadow flicker should be assessed is to a distance of 265 times the distance of the blade chord (the widest part of the turbine blade), or approximately 1 km.

- A buffer of 1km was generated for each of the turbines to determine if any residential structures were located within the potential SF impact area.
- Making use of GIS technology and satellite imagery, confirmed by the site visit, an audit of structures was undertaken to determine if any structures on the property were used for residential purposes.
- If residential structures were identified within the broad brush 1km SF buffer, a more detailed analysis of the expected SF impact area was generated making use of 3D model of the turbine using 3D modelling software that allows a location specific representation of the SF impact area. As this is a screening exercise, the probability of the SF impact taking place within the SF impact zone is not assessed (this was also not applicable for this study).

6.6.1.1 Locality and Climatic Conditions

As this area is in an arid area, cloud cover is likely to be limited with sunshine and clear skies predominantly taking place. According to the website Climate-Data, rain (thus overcast skies with less potential for shadow) is limited with rainy days ranging from 8 to 2 days per month (Figure 6-38). The approximate average sun hours per day ranges from 10.5 in summer, to 8 in winter. As this area does fall within an arid climatic region, most days during the year are expected to have sun, and as such, have potential for SF impacts.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	22.4 °C (72.3) °F	22.2 °C (72) °F	20.5 °C (68.9) °F	17.2 °C (62.9) °F	14.4 °C (57.9) °F	11.2 °C (52.1) °F	10.9 °C (51.6) °F	12.5 °C (54.5) °F	15 °C (59) °F	17.4 °C (63.4) °F	19.2 °C (66.5) °F	21.3 °C (70.4) °F
Min. Temperature °C (°F)	15.5 °C (59.9) °F	15.7 °C (60.3) °F	14.1 °C (57.4) °F	10.8 °C (51.4) °F	8 °C (46.4) °F	4.7 °C (40.5) °F	4.3 °C (39.7) °F	5.3 °C (41.5) °F	7.5 °C (45.5) °F	10 °C (50) °F	11.9 °C (53.4) °F	14.3 °C (57.7) °F
Max. Temperature °C (°F)	29.7 °C (85.5) °F	29.3 °C (84.7) °F	27.4 °C (81.3) °F	24 °C (75.1) °F	21.5 °C (70.6) °F	18.3 °C (65) °F	18.2 °C (64.8) °F	20 °C (68.1) °F	22.7 °C (72.9) °F	25.1 °C (77.2) °F	26.9 °C (80.4) °F	29 °C (84.1) °F
Precipitation / Rainfall mm (in)	74 (2)	66 (2)	66 (2)	37 (1)	19 (0)	18 (0)	18 (0)	24 (0)	29 (1)	45 (1)	56 (2)	60 (2)
Humidity(%)	52%	55%	55%	53%	50%	50%	46%	42%	42%	47%	47%	49%
Rainy days (d)	7	8	7	5	3	3	2	3	3	5	6	6
avg. Sun hours (hours)	10.3	9.6	9.1	8.5	8.4	8.0	8.2	8.7	9.1	9.6	10.2	10.5

Figure 6-38: Average temperature and rainfall (www.Climate-Data.org)

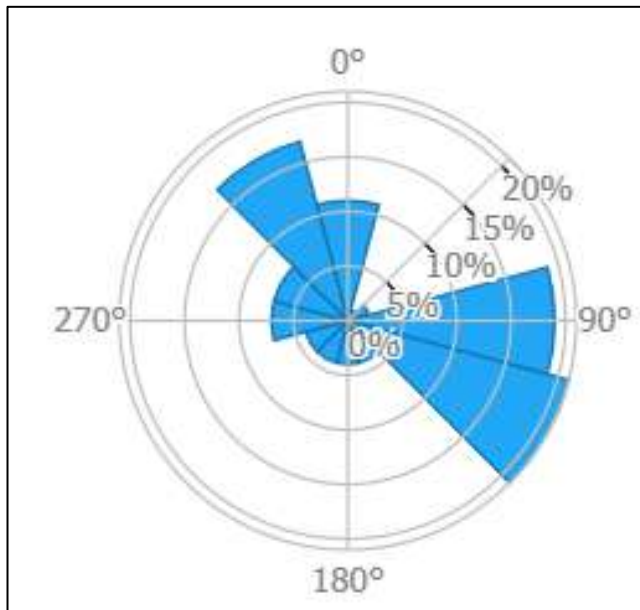


Figure 6-39: Wind rose of expected prevailing wind directions (www.globalwindatlas.info).

Climatic Influences on Flicker Effect

Based on the above wind rose generated by the Global Wind Atlas (Figure 6-39), it is most likely that the turbine will be facing north-west, or south-east direction. Based on the arid climate zoning of the site, cloud cover is rated as having Low potential and is not included as a determinant in reducing shadow flicker effect as most days are likely to be sunny.

6.6.1.2 Elevation Variation influencing turbine height

To determine if turbines are in elevated terrain with regard to the receptor locations, a digital elevation model was generated making use of Global Mapper software using ASTER elevation data. While the data is generalised, it does offer a relatively accurate indication of terrain. From the site terrain model profiles were generated along the north-south/ east-west axis to reflect terrain variation. The finding of the assessment is that the dominating landform element of the site are the many washes that are in the lower lying, and predominantly low gradient to flat lands. There are, however, a few low ridgelines in the 20m to 30m height range, which do increase prominence of these areas due to the predominantly flat surrounding terrain. While not a significant landform element, when near farmstead and roads, the placement of turbines on top of the ridgelines does increase the visual prominence of the turbine and would also extend the shadow flicker effect over a greater distance.

6.6.1.3 Shadow Area Mapping

The objective is not to determine the probability of the SF impact taking place within the SF impact area. As a SF screening exercise in areas of low density, the objective is to estimate the likely extent of the SF impact area, determine if there are dwellings within the impact zone, and make recommendations to reposition the turbine such that the dwelling occupant has a high likelihood of experiencing a Low to Very Low SF Impact. The mapping for the shadow area for the project made use of Sketch-up software to generate a 3D model based on the provided specifications.

As depicted in the image below, a 3D model of the proposed turbine was generated in Sketchup, to reflect the scale model of the structure as per the specified dimensions. The model is a generic design and only has relevance to the project in terms of depicting the approximate structure size, and associated shadow.

In Sketch-up 3D model, an area depicting a one-kilometre area was demarcated in the surface, with the turbine in the centre. The date and time variables provided in the software were then used to depict where the shadow would fall during the year based on early morning and late afternoon shadows. The following graphics depict the shadows falling in different location, which were then mapped in ArcGIS.

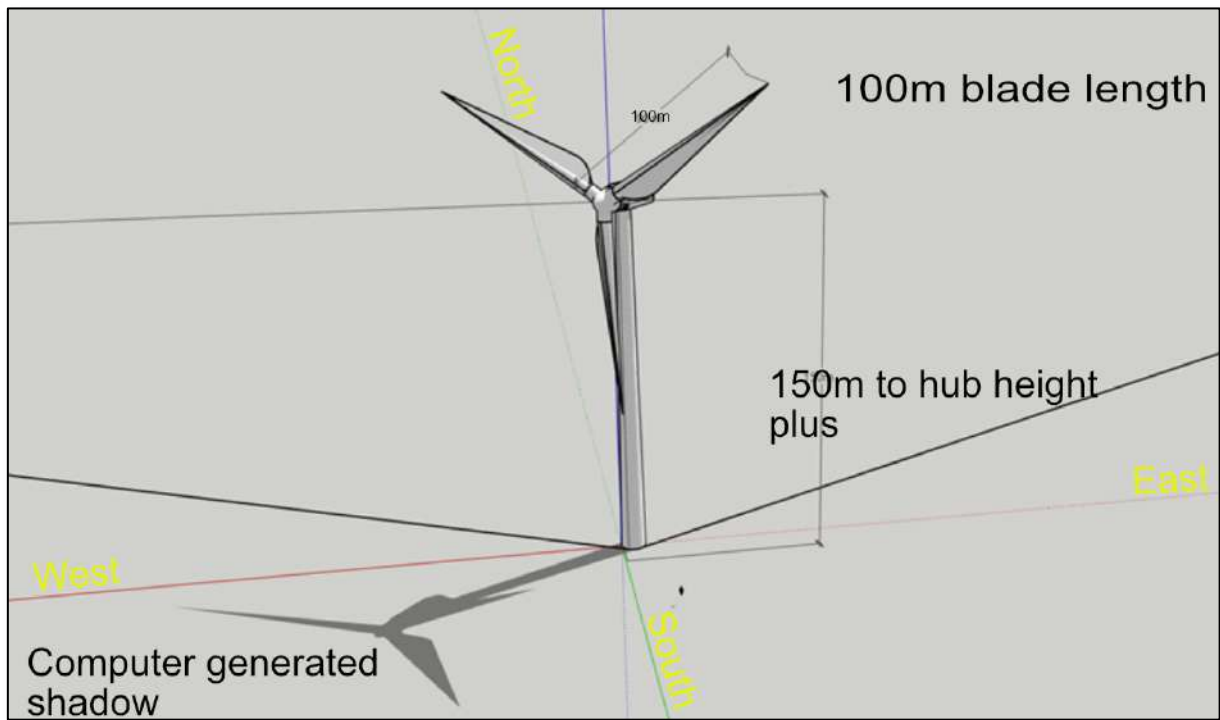


Figure 6-40: 3D generated model of the proposed turbine.

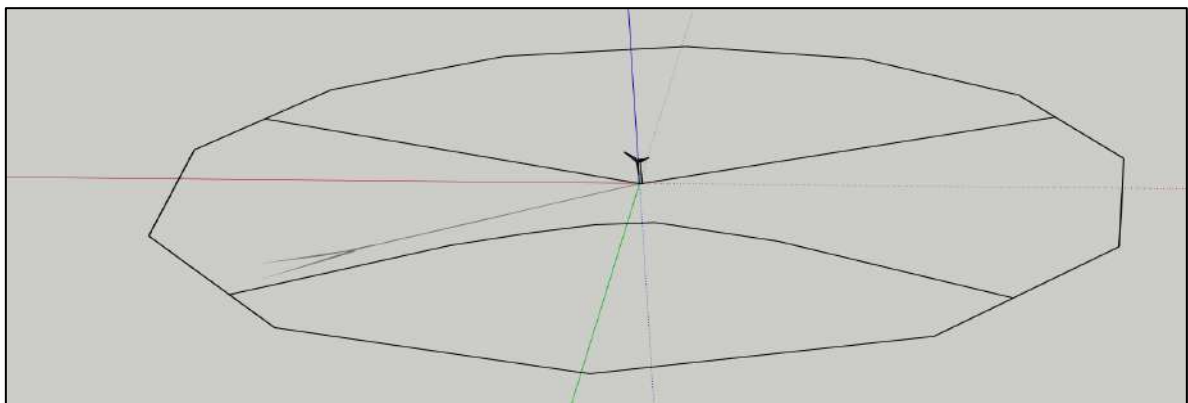


Figure 6-41: 3D model depicting shadow incidence in early morning winter periods.

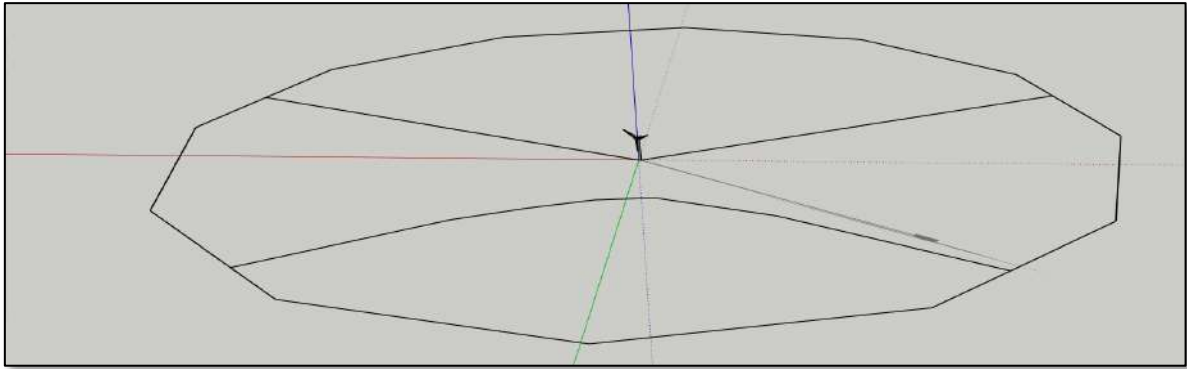


Figure 6-42: 3D model depicting shadow incidence in late evening winter periods.

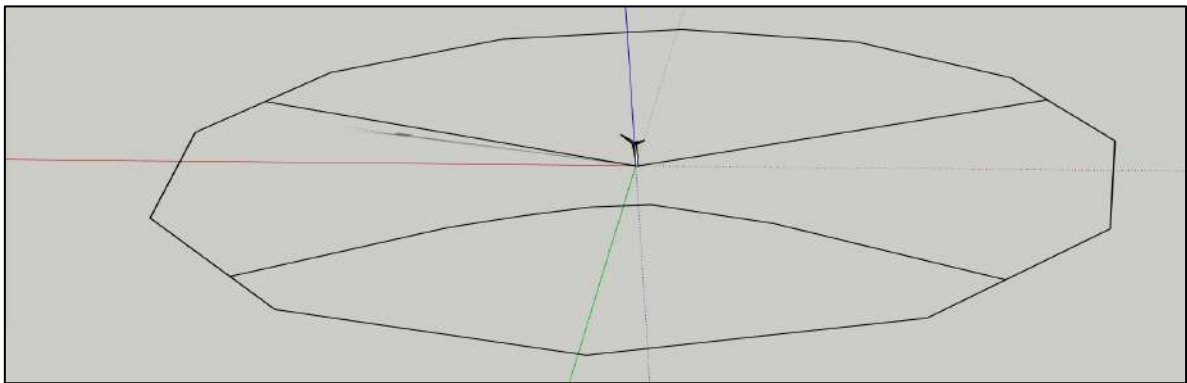


Figure 6-43: 3D model depicting shadow incidence in early morning summer periods.

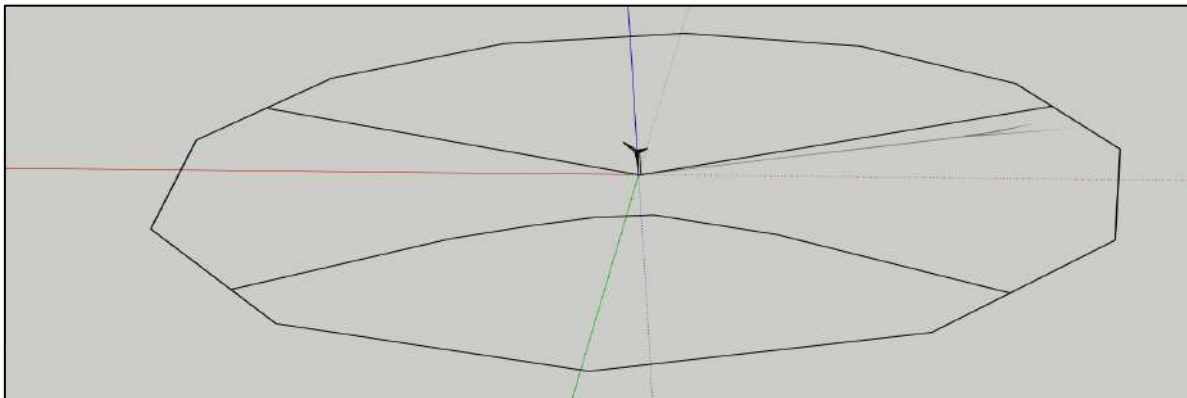


Figure 6-44: 3D model depicting shadow incidence in late evening summer periods.

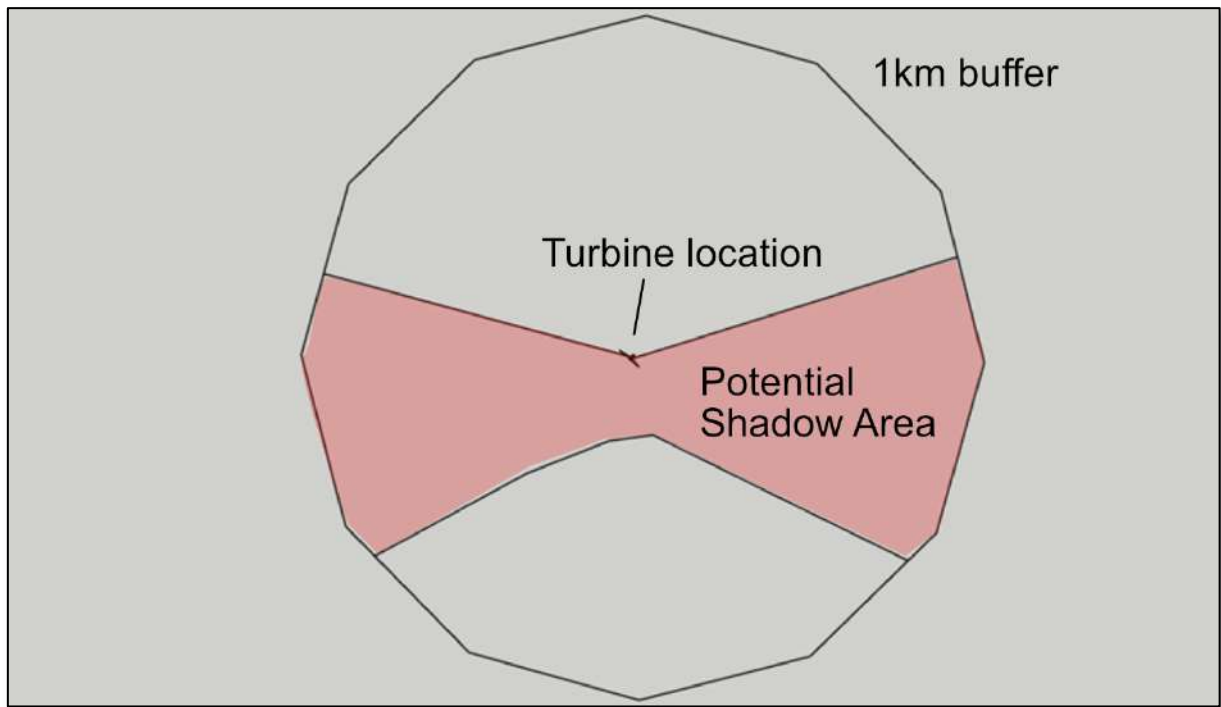


Figure 6-45: Mapped area for shadow potential that was incorporated into ArcGIS.

This area was then mapped to the turbine locations in ArcGIS mapping software to evaluate the extent to which the potential shadow impact zone related to the identified receptors. While the 2km distance was mapped, the area was reduced to a 1km buffer as per the international recommendations where impacts are most likely to take place within a 1km area from the turbine as depicted in the map below.

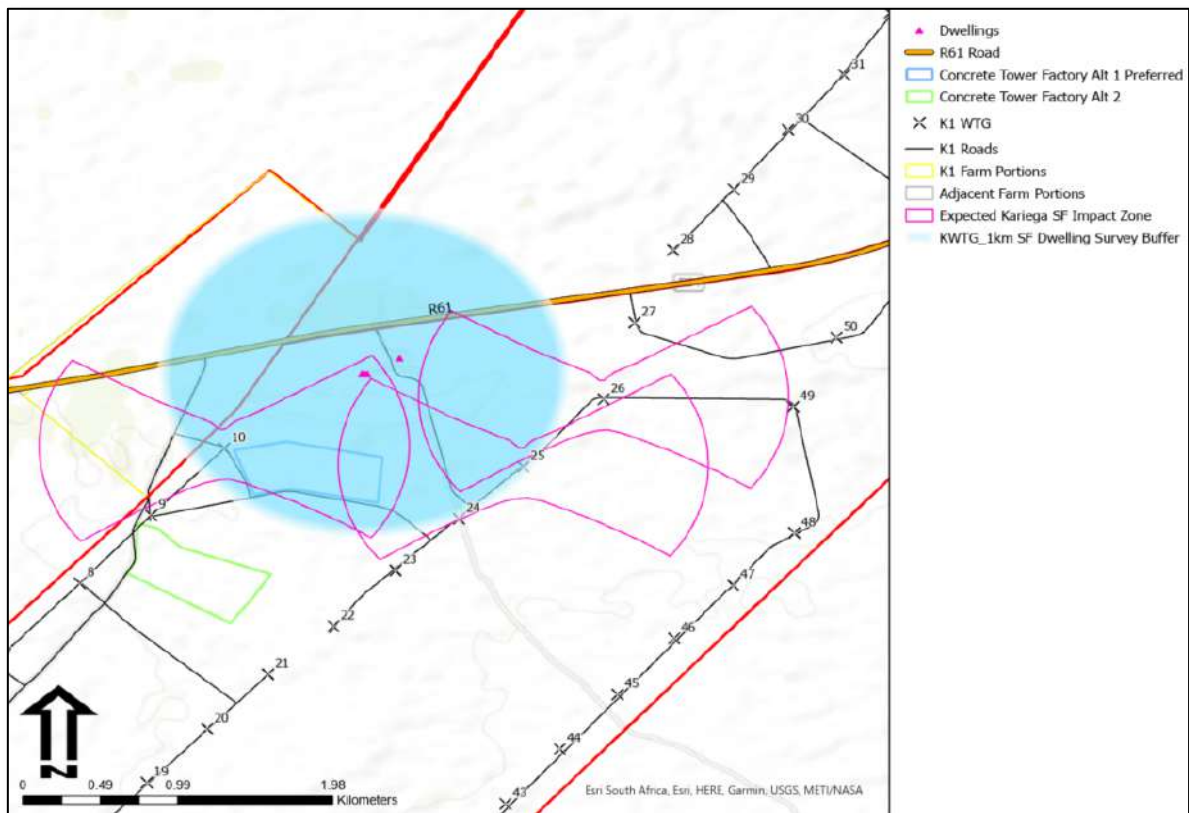


Figure 6-46: Example of Shadow Flicker survey screening with SF expected impact area overlay.

6.6.2 Site Sensitivity

Following a desktop mapping exercise to identify likely residential structures within the study area, a field survey was undertaken on 24th and 25th March 2023 to visit the potential SF impact sites to determine if they were occupied, if there was vegetation screening, and the aspect of the dwelling with respect to the SF impact direction. During the site visit, photographs were taken of each residential locality as per the survey table below. The results of the site verification process are tabled below (Table 6-63) with the mapping depicting on the following pages (Figure 6-47).

Table 6-63: List of Sampling Sites and occupational status of dwellings table.

ID	Project	REC_TIME	LATITUDE	LONGITUDE	STATUS	SF IMPACT ZONE
10	K4	03/23/2023 15:52:03.888 SAST	-32.3569	23.61849	Occupied labour dwelling	Null

14	K4	03/23/2023 16:17:11.000 SAST	-32.3178	23.597	Occupied labour dwelling	Null
15	K4	03/23/2023 16:20:33.000 SAST	-32.3174	23.5962	Occupied labour dwelling	Null
16	K4	03/23/2023 16:20:52.000 SAST	-32.3174	23.5962	Occupied labour dwelling	Null
17	K4	03/23/2023 16:21:08.000 SAST	-32.3174	23.5962	Occupied labour dwelling	Null
18	K4	03/23/2023 16:23:45.000 SAST	-32.3168	23.5955	Occupied labour dwelling	Null
19	K4	03/23/2023 16:24:35.000 SAST	-32.3169	23.59545	Occupied labour dwelling	Null
20	K4	03/23/2023 16:26:32.000 SAST	-32.3163	23.59482	Occupied labour dwelling	Null
29	K4	03/24/2023 10:42:07.999 SAST	-32.4633	23.67042	Occupied dwelling well outside SF Impact Area.	Null
30	K4	03/24/2023 10:42:07.999 SAST	-32.3488	23.670684	Occupied dwellings	1 Dwelling Just within

Dwelling Survey Tables.

ID	10A
PHOTO	K4 SF
DIRECTION	E
COMMENT	Dwelling
MOTIVATION	Edge of SF impact area and main entrance facing away from turbines with local trees.



ID	10B
PHOTO	K4 SF
DIRECTION	N
COMMENT	Occupied dwelling
MOTIVATION	Within SF impact area with the back of the dwelling facing the turbine. Mitigation turbine shift unnecessary but a post development review for possible tree planting is required.



ID	14
PHOTO	K4 Sf
DIRECTION	W
COMMENT	Occupied dwellings
MOTIVATION	Within impact area due to elevated ground placement of turbine with the plus 30m elevation is likely to extend the SF beyond the 1km distance in early morning. Aspect partial facing towards turbine with no vegetation screening. Turbine shift mitigation recommended.



ID	16
PHOTO	K4 SF
DIRECTION	N
COMMENT	Occupied dwelling
MOTIVATION	Partial view facing turbine and no trees. Mitigation as per Point 14.



ID	18
PHOTO	K4 SF
DIRECTION	W
COMMENT	Occupied dwellings
MOTIVATION	Partial view facing turbine and no trees. Mitigation as per Point 14.



ID	19
PHOTO	K4 SF
DIRECTION	N
COMMENT	Occupied dwelling
MOTIVATION	Partial view facing turbine and no trees. Mitigation as per Point 14.



ID	20
PHOTO	K4 SF
DIRECTION	W
COMMENT	Occupied dwelling
MOTIVATION	Likely to be positioned outside of impact zone and with tree screening. sLow impact expected.



ID	30A
PHOTO	K4 SF
DIRECTION	NE
COMMENT	Labour tenant dwelling that appears occupied with limited vegetation screening towards the nearest wind turbine. (Photograph source CTS Heritage)
MOTIVATION	The dwelling is located just within the 1km DFFE High Impact buffer zone. While this peripheral location is unlikely to result in higher levels of SF exposure, the recommendation is that turbine WTG024 is shifted 40m to the southeast.



ID	30B
PHOTO	K4 SF
DIRECTION	N
COMMENT	Labour tenant dwelling that appears occupied with limited vegetation screening towards the nearest wind turbine. (Photograph source CTS Heritage)
MOTIVATION	Positioned outside of impact zone and with tree screening. Low impact expected.



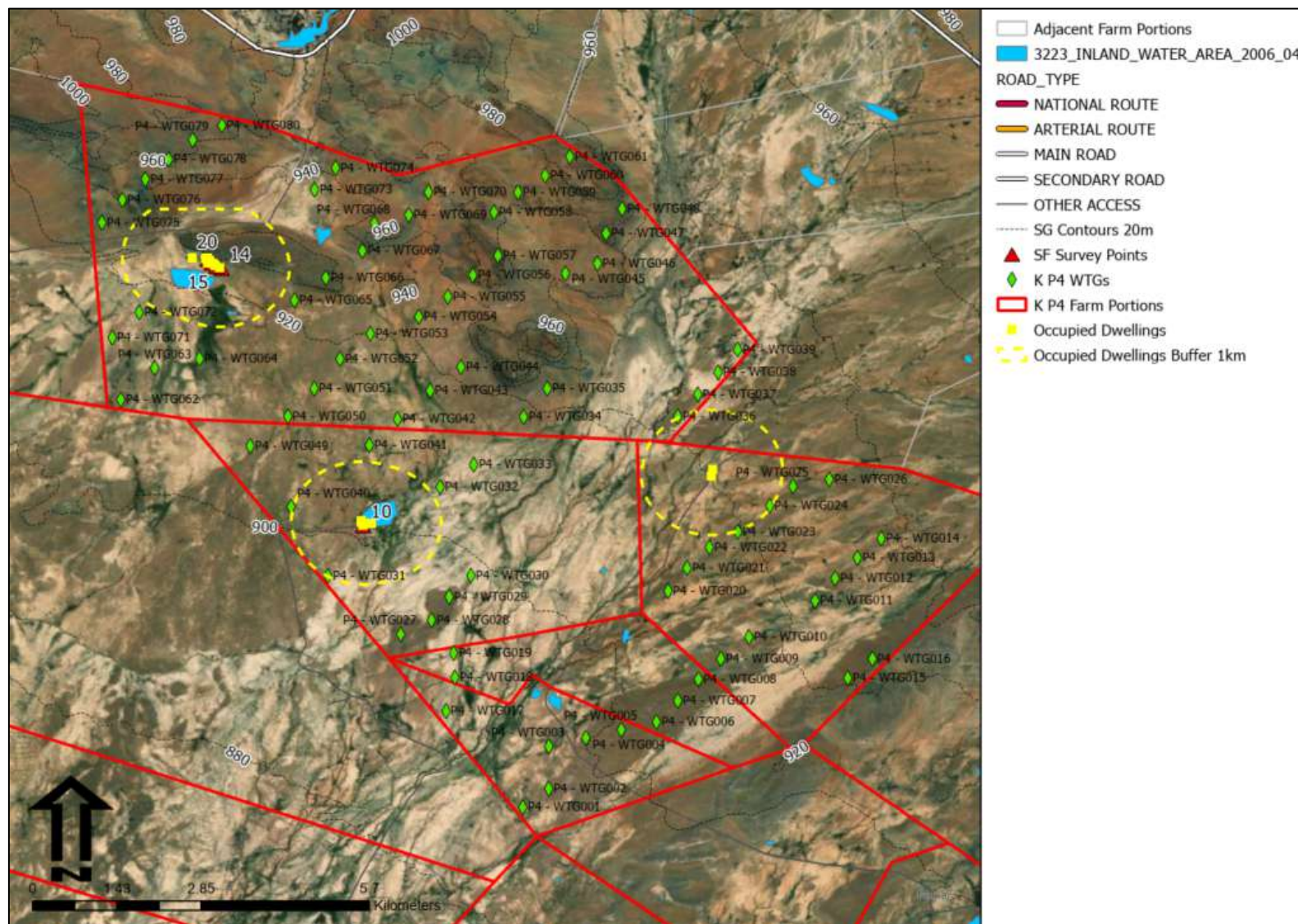


Figure 6-47: Residential dwelling survey point locality map within the project area.

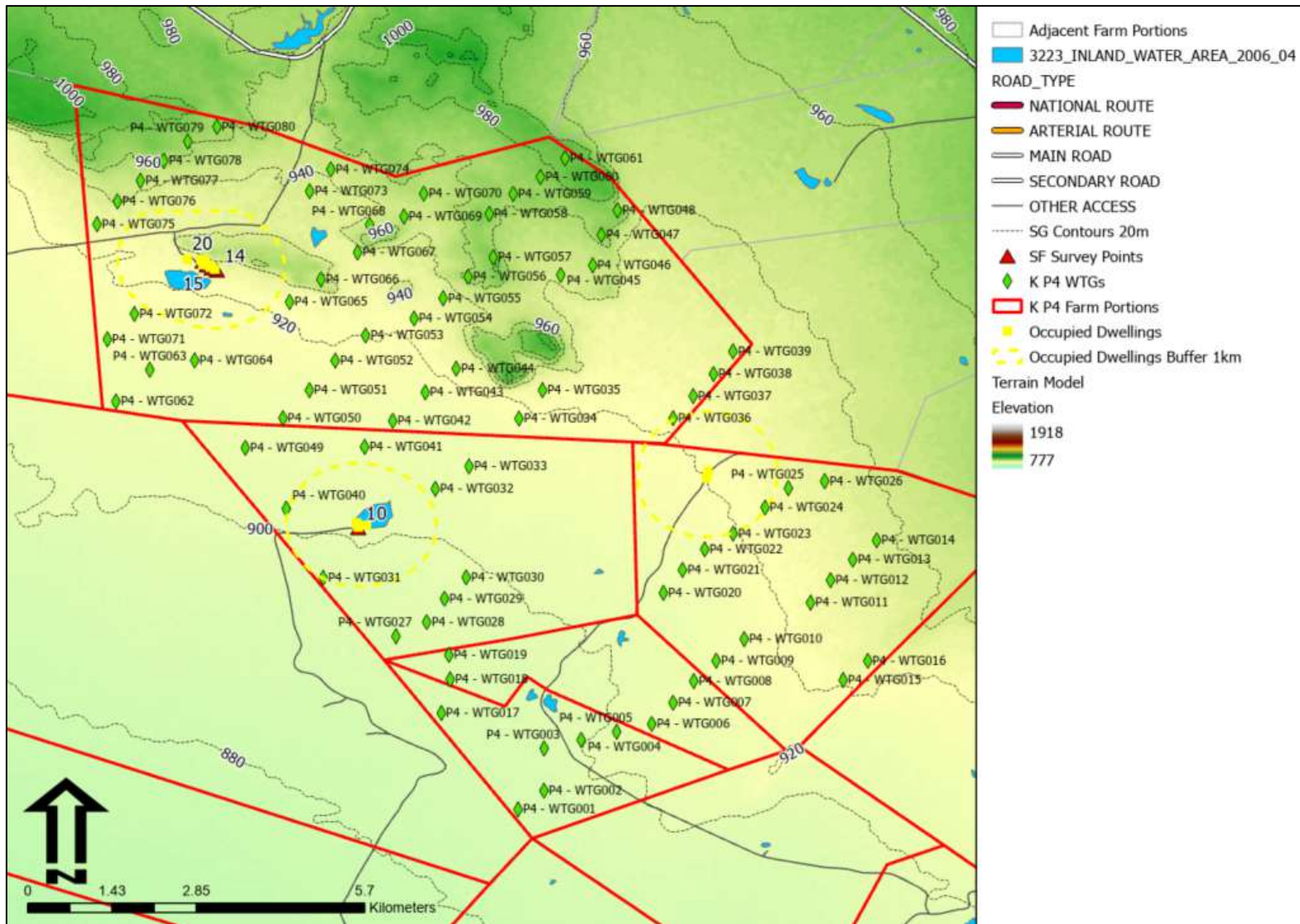


Figure 6-48: Terrain Model depicting topographic variation between turbines and dwellings as negligible.

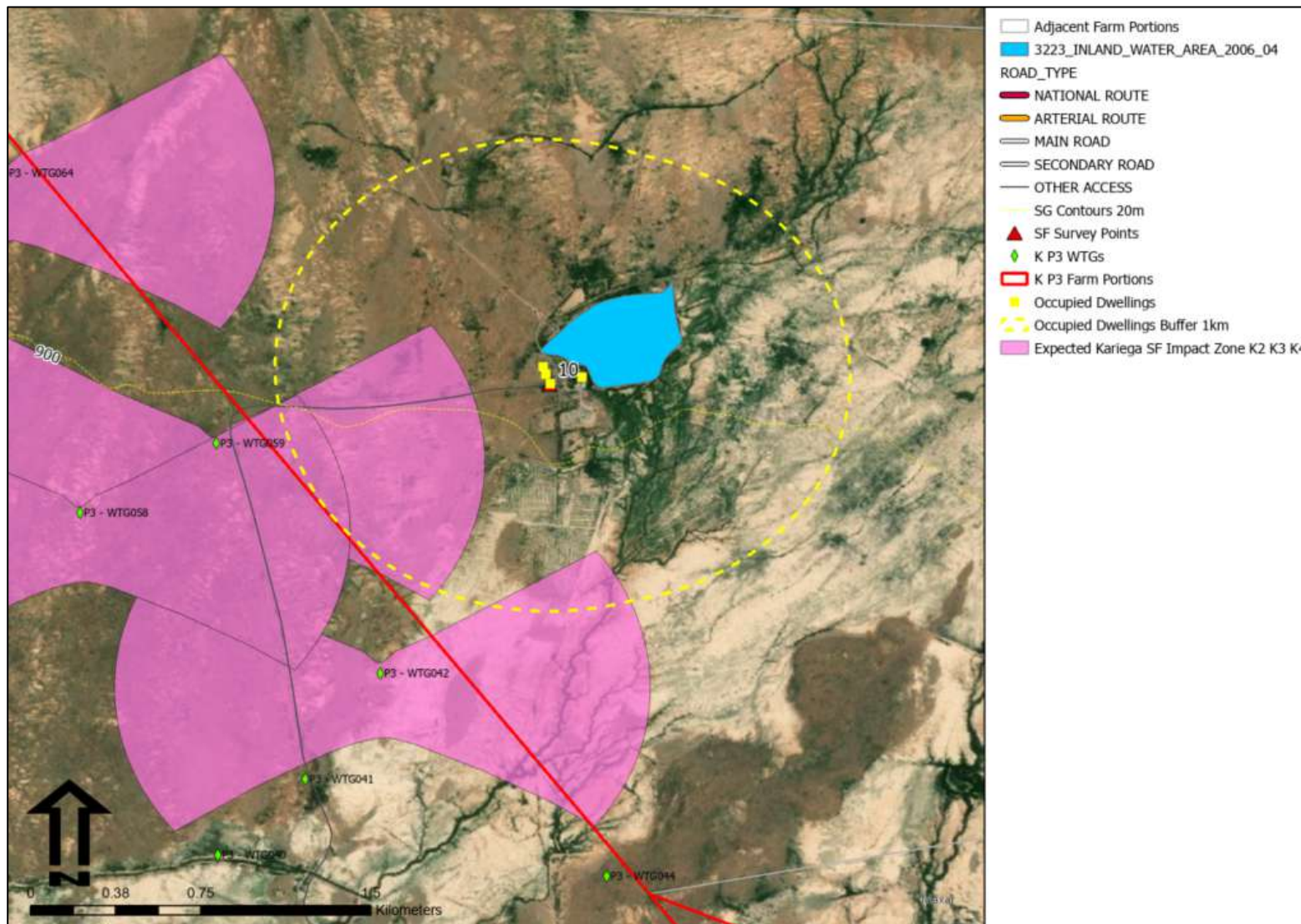


Figure 6-49: Kariega 4 WEF SF impact zone map (south).

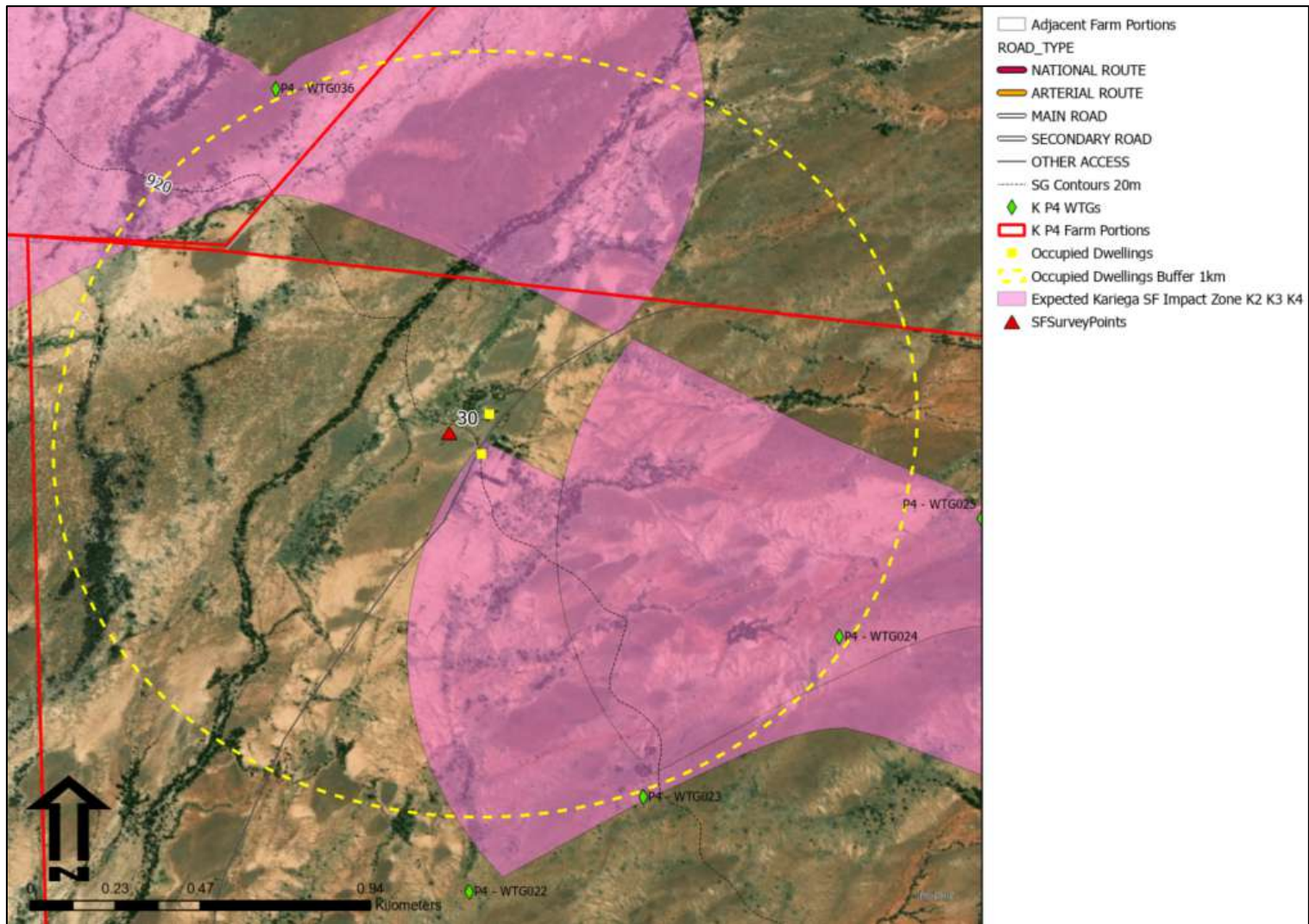


Figure 6-50: Kariega 4 WEF SF impact zone map (East).

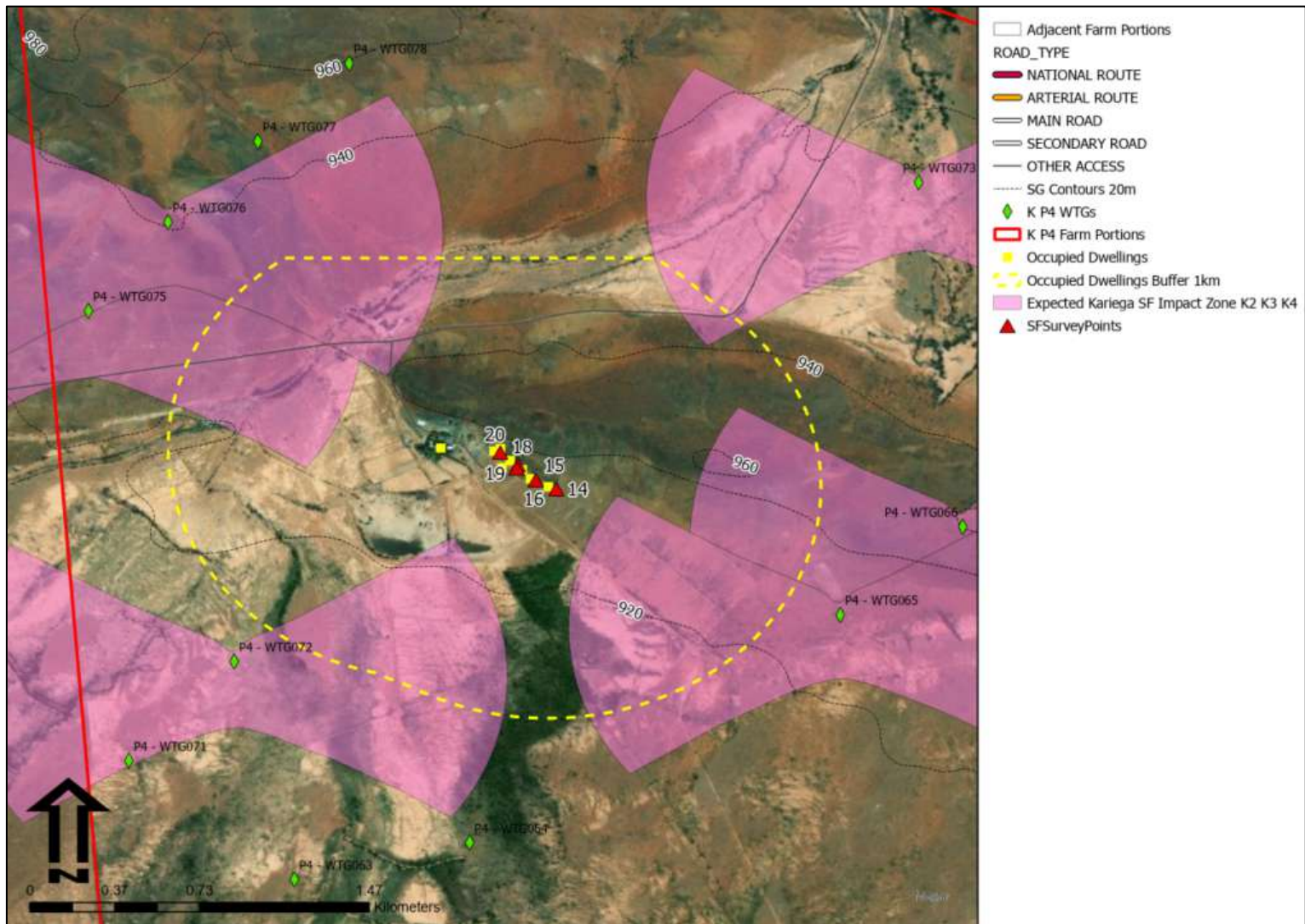


Figure 6-51: Kariega 4 WEF SF impact zone map (North).

6.6.3 Impact assessment

Impacts are defined in terms of the standardised impact assessment criteria provided by the environmental practitioner. Using the EAP impact assessment criteria, the potential environmental impacts identified for the project were evaluated according to severity, duration, extent and significance of the impact. The potential occurrence and cumulative impact (as defined in the methodology) was also assessed. To better understand the nature of the severity of the visual impacts, a Contrast Rating exercise was undertaken.

The impacts considered below therefore include:

- The potential that the turbine shadow flicker effects will cause a nuisance effect for the residents living in proximity to the wind turbines. The impact will only be assessed in Operational Phase as the flicker effect requires the movement of the turbine blades (Table 6-64). The rapid movement of the blades will not take place in Construction, or Decommissioning Phase.

Table 6-64: Shadow Flicker operational phase impact Assessment.

No.	Alternative 1			
Project phase	Operation			
Impact title	Shadow Flicker			
Impact description	The shadow flicker effects generated from the rotating turbine blades on adjacent receptor occupied dwellings.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Temporary	Impact will last less than 1 month.	Temporary	Impact will last less than 1 month.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Low - negative		Very low - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minimal - negative		Minimal - negative	
Importance	High	High	Moderate	Moderate
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		

Potential mitigation	1 year after Operation Phase has commenced, a site visit to all the labour tenant dwellings located on the property within 1.5km from a turbine needs to be undertaken to enquire into their discomfort towards SF effects (if any). If discomfort is expressed, an investigation process needs to be developed to assess if the theoretical residential exposure limit of less than 30 hours per year, 30 minutes per day for the astronomical maximum possible shadow worst-case and that actual or measured shadow flicker duration should not exceed 10 hours per year. Should this exposure limit be exceeded, the following mitigations would need to be implemented: the following mitigations could be used to reduce shadow flicker impact: Planting vegetation or tree lines, which will block the line of sight to the turbines causing flicker (in locations conducive to tree growth). Installation of window blinds or awnings at the receptor. Payments to affected parties.
Comment on ratings	Given that the occupied dwellings are well outside the 1km possible SF impact area, as well as outside of the east to west configuration of the shadow effect, the expect SF Impact Significance is rated Very Slightly Detrimental.

6.6.4 Conclusion and Recommendations

Thirteen labour tenant dwellings and one property owner dwelling were identified within the project area but located outside the expected 1km SF impact area, with the exception of a single labour tenant dwellings located just within the SF impact zone of Turbine P4-WTG024. Due the trees at this locality that are likely to provide the dwelling occupants screening from SF effects, and the remainder of the dwellings located outside the expected SF impact zone, the Magnitude of the Impact is likely to be Low without mitigation, and Very Low with mitigation. Mitigation is a requirement and Turbine WTG024 would need to be shifted 50m to the southeast.

As SF impact assessment is new in the South Africa context, the intensity of the SF impact to rural occupants is untested and as such Operation Phase investigation is recommended to confirm the consequence. Duration is likely to be Temporary and only take place during Operational Phase (plus 20 years), where the SF impact to residential exposure should be less than 30 hours per year, 30 minutes per day for the astronomical maximum possible shadow worst-case and that actual or measured shadow flicker duration should not exceed 10 hours per year. The finding of this assessment is that the wind farm should be authorised with mitigation.

6.7 Noise Impact Assessment

The Noise Impact Assessment (NIA) was undertaken by Morné de Jager of Enviro-Acoustic Research. The findings of the NIA concluded that active noise monitoring is recommended because the projected noise levels are more than 42 dBA (more than 7 dBA of the night-time rating level of a rural noise district) for the layout and WTG as evaluated (noise monitoring will be required for any WTG with an SPL exceeding 107.3 dBA (re 1 pW)). The WTG layout of the Kariega 4 WEF is considered acceptable should the applicant select to use a WTG with a SPL less than 110.5 dBA (re 1 pW). It should be noted, if the Kariega 3 WEF are developed with the Kariega 4 WEF, noise levels could exceed 45 dBA at NSR04 and NSR12. Should the applicant select a WTG with a higher SPL, additional mitigation might be required to ensure that night-time noise levels are less than 45 dBA at all NSR used for permanent residential use. It is recommended that the proposed Kariega 4 WEF (and associated infrastructure) be authorized. If the project is to be developed in the future, the final layout and sound power emission levels of the selected WTG must be modelled to ensure the night-time noise levels are less than 45 dBA at verified NSR.

The full specialist report is attached hereto as **Annexure D 6, Noise Impact Assessment (2024)**.

6.7.1 Baseline Description

6.7.1.1 Influence of Season on Ambient Sound Levels

Natural sounds are a part of the environmental noise surrounding humans. In rural areas the sounds from insects and birds would dominate the ambient sound character, with noises such as wind flowing through vegetation increasing as wind speed increase. Work by Fégeant (2002) stressed the importance of wind speed and turbulence causing variations in the level of vegetation-generated noise. In addition, factors such as the season (e.g., dry or no leaves versus green leaves), the type of vegetation (e.g., grass, conifers, deciduous), the vegetation density and the total vegetation surface all determine both the sound level as well as spectral characteristics.

Ambient sound levels are significantly affected by the area where the sound measurement location (or a listener) is situated. When the sound measurement location is situated within an urban area, close to industrial plants or areas with a constant sound source (ocean, rivers, etc.), seasons and even increased wind speeds have an insignificant to massive impact on ambient sound levels.

Sound levels in undeveloped rural areas (away from occupied dwellings), however, are impacted by changes in season for several complex reasons. The two main reasons are:

- Faunal communication is more significant during the warmer spring and summer months as various species communicate to find mates. Faunal communication is normally less during the colder months.
- Seasonal changes in weather patterns, mainly due to increased wind speeds and potential gustiness of the wind.

For environmental noise, weather plays an important role, the greater the separation distance, the greater the influence of the weather conditions, so, from day to day, a road 1,000 m away can sound very loud or can be completely inaudible. Other, environmental factors that impact on sound propagation includes wind, temperature and humidity, as discussed in the sub-sections below.

Ambient sound levels are generally less during the colder months (due to less faunal communication) and higher during the warmer months.

6.7.1.2 Effect of Temperature inversions

On a typical sunny afternoon, the air is the hottest near the ground surface and temperature decreases at higher altitudes. This temperature gradient causes sound waves to refract upward, away from the ground and results in lower noise levels being heard at a measurement location. In the evening, this temperature gradient will reverse and, during certain meteorological conditions, the normal vertical temperature gradient could be inverted so that the air is colder near the surface, with a warmer layer blanketing the lower layer. This is illustrated in Figure 6-52 below.

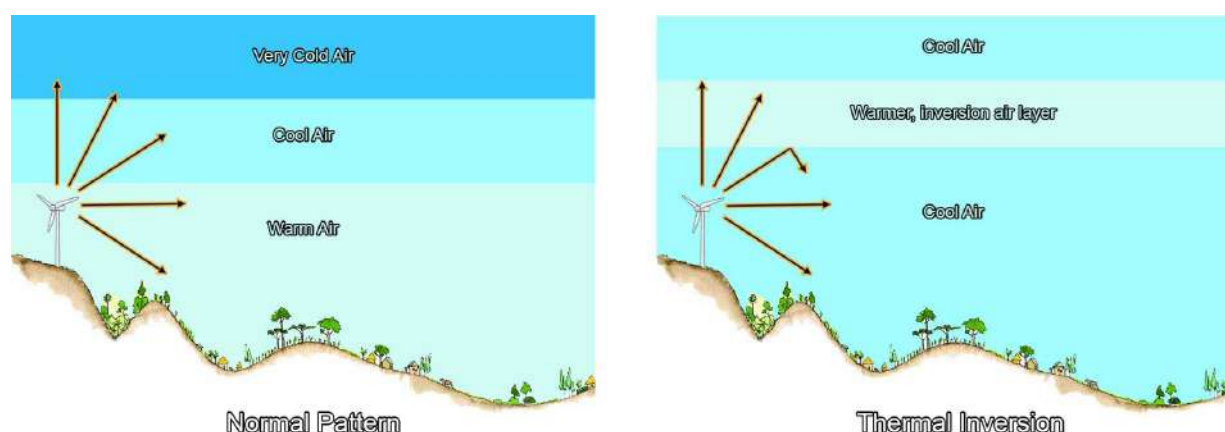


Figure 6-52: Influence of temperature inversions on the propagation of sound

When such an inversion layer is present, some of the sound waves will be refracted²⁴ by the temperature gradient, with the refracted sound waves returned to the ground. This effect has been noticed near airports and roads, where noises can be heard over greater distances at night than other times of day (Parnell, 2015, Saurenman, 2005,,) and reported by Van der Berg (2003) for WEF noises. Like wind gradients, temperature gradients can influence sound propagation over long distances, complicate sound level measurements as well as propagation modelling.

6.7.1.3 Effect of Wind

Wind alters sound propagation by the mechanism of refraction, that is, wind bends sound waves. Wind nearer to the ground moves more slowly than wind at higher altitudes, due to surface characteristics such as hills, trees, and man-made structures that interfere with the wind. This wind gradient, with faster wind at higher elevation and slower wind at lower elevation, causes sound waves to bend downward when they are traveling to a location downwind of the source and to bend upward when traveling toward a location upwind of the source. Waves bending downward means that a listener standing downwind of the source will hear louder noise levels than the listener standing upwind of the source. This phenomenon can significantly impact sound propagation over long distances and when wind speeds are high. Over short distances wind direction has a small impact on sound propagation if wind velocities are reasonably slow, i.e., less than 5 m/s.

Wind speed frequently plays a role in increasing sound levels in natural locations. With no wind, there is little vegetation movement that could generate noises and faunal noises (normally birds and insects) dominate, however, as wind speeds increase, the rustling of leaves increases which subsequently can increase sound levels. This directly depends on the type of vegetation in a certain area. The impact of increased wind speed on sound levels depends on the vegetation type (deciduous versus conifers), the density of vegetation in an

²⁴ Redirecting the wave propagation direction due to a change in the density of the air which influence the speed of sound.

area, seasonal changes (in winter deciduous trees are bare) as well as the height of this vegetation. This excludes unanticipated consequences, as suitable vegetation may create suitable habitats and food sources attracting birds and insects (with the subsequent increase in faunal communication).

6.7.1.4 Effect of Humidity and Temperature

On a typical sunny afternoon, the air is the hottest near the ground surface and temperature decreases at higher altitudes. This temperature gradient causes sound waves to refract upward, away from the ground and results in lower noise levels being heard at a measurement location. In the evening, this temperature gradient will reverse, resulting in cooler temperatures near the ground. This condition, often referred to is a temperature inversion will cause sound to bend downward towards the ground and results in louder noise levels at the listener position. Like wind gradients, temperature gradients can influence sound propagation over long distances, complicate sound level measurements as well as propagation modelling.

Generally, sound propagate better at lower temperatures (down to 10°C), and with everything being equal, a decrease in temperature from 32°C to 10°C could increase the sound level at a listener 600 m away by ± 2.5 dB (at 1,000 Hz).

The effect of humidity on sound propagation is quite complex, but effectively relates to how increased humidity changes the density of air. Lower density translates into faster sound wave travel, so sound waves travel faster at high humidity. With everything being equal, an increase in humidity from 20% to 80% would increase the sound level at a listener 600 m away by ± 4 dB (at 1,000 Hz at 20°C).

Together, the impact of temperature and humidity (together with air pressure - to a minor extent) are complex and highly dependent on the frequency composition of the noise. This is illustrated in Figure 6-53.

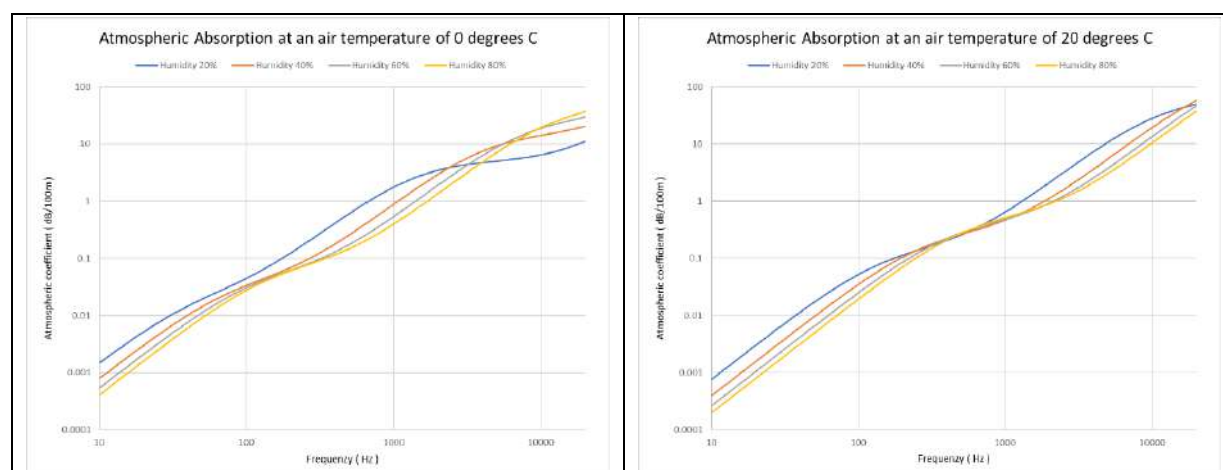


Figure 6-53: Effect of Temperature and Humidity on propagation of Sound

6.7.1.5 Temperature and Humidity Measurements

Temperature and humidity were measured during the site visit from 16 to 18 July 2022, with the average, maximum and minimum readings defined in Table 6-65 with the various readings illustrated in Figure 6-54.

Table 6-65: Temperature and Humidity measured onsite

	Humidity	Temperature
Day average	30.9	18.4
Night average	41.3	12.7
Day minimum	22.0	10.9
Day maximum	49.0	25.0
Night minimum	35.0	10.9
Night maximum	49.0	14.4

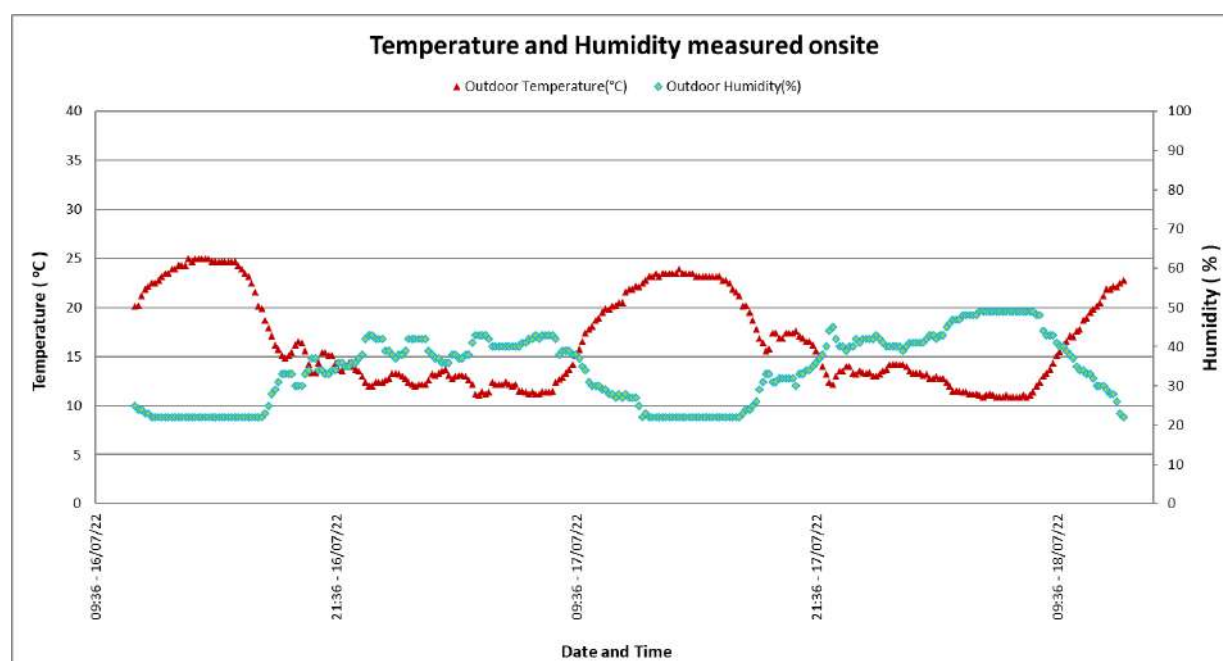


Figure 6-54: Temperature and Humidity readings measured onsite

For the purpose of modelling, average humidity of 70 % and temperatures of 10 °C at an air pressure of 900 kPa will be used for both the day-and night-time periods.

6.7.1.6 Sound Measurements - Procedure

Ambient (background) sound levels were measured over a period of two nights from 16 - 18 July 2022 at five locations (15 – 18 July 2022 at one of these locations). Measurements were done in accordance with the South African National Standard SANS 10103:2008 "*The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication*". The SANS guidelines to be used and time periods (in which measurements must be collected), with the guidelines specifying the acceptable techniques for sound measurements including, the type of equipment (Class 1), minimum duration of measurement, microphone positions and height above ground level, calibration procedures and instrument checks and supplementary weather measurements and observations.

The sound levels were measured using a class-1 Sound Level Meters (SLMs) with the measurement localities presented in Figure 6-55. The SLMs would measure “average” sound levels over 10-minute periods, save the data and start with a new 10-minute measurement until the instruments were stopped.

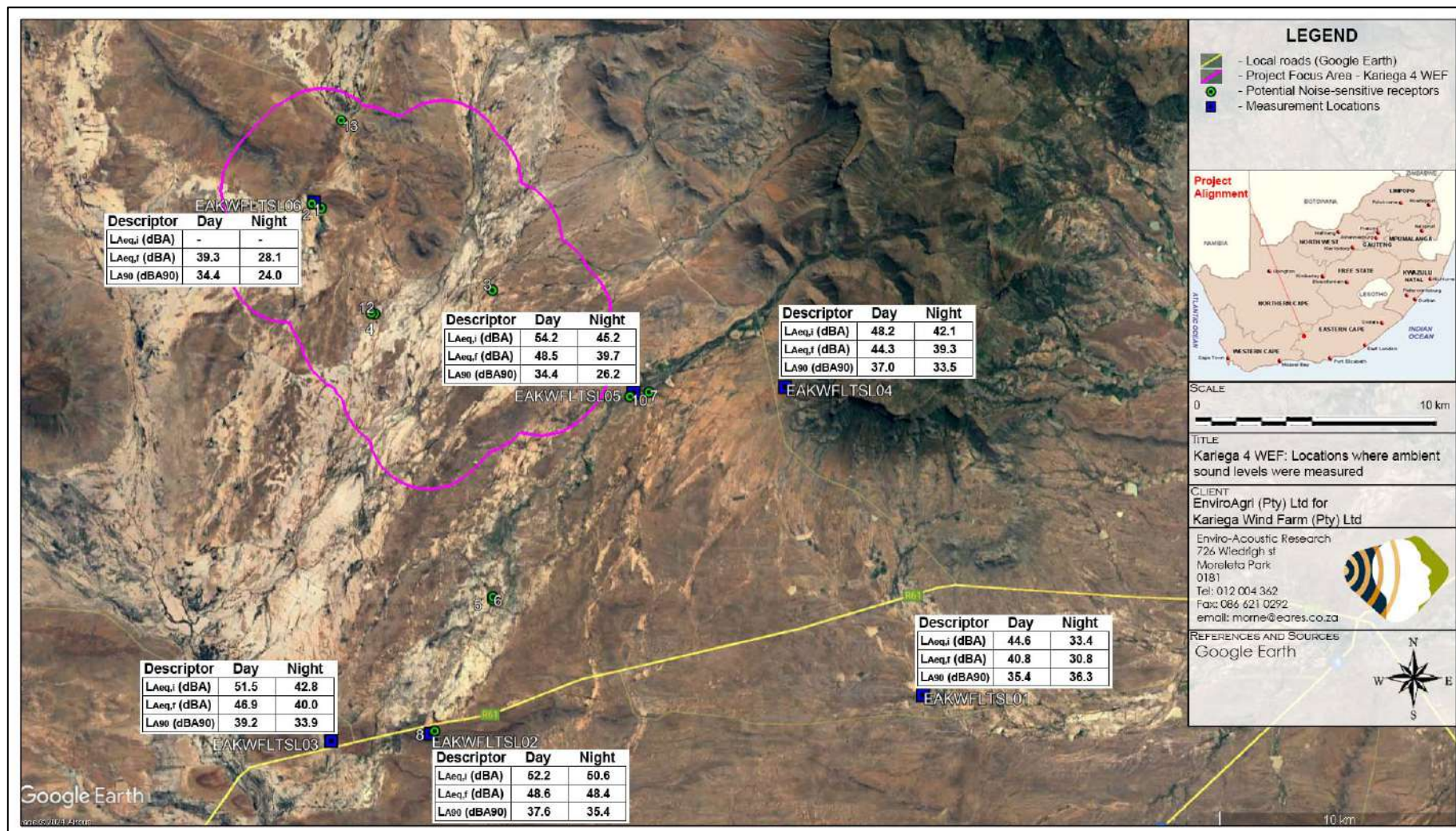


Figure 6-55: Localities where ambient sound levels were measured .

6.7.1.7 Summary of Ambient Sound Levels

This report mainly discusses the fast-weighted sound level ($L_{Aeq,f}$), as this sound descriptor is generally used internationally to define the ambient sound levels. The author generally recommends the use of this sound descriptor to assist to protect the soundscape at the identified NSR. Based on the sound measurements:

- Measurement Location EAKWFLTSLO1
 - based on the full 16-hour daytime period, the $L_{Aeq,f}$ value is 48.6 dBA, with the arithmetic average being 40.8 dBA. This is desired for residential use and typical of the day-time sound levels associated with a rural environment;
 - based on the two full 8-hour night-time periods, the average $L_{Aeq,f}$ value is 32.9 dBA, with the arithmetic average being 30.8 dBA. Ambient sound levels are typical what is expected for a rural noise district (35 dBA) and desired for night-time residential use (when considering the IFC and WHO noise limits);
 - The statistical L_{A90} levels are slightly elevated during the day (35.4 dBA90), though low for the night-time (26.3 dBA90) periods.
- Measurement Location EAKWFLTSLO2
 - based on the one full 16-hour daytime period, the $L_{Aeq,f}$ value is 50.4 dBA, with the arithmetic average being 48.6 dBA. Sound levels are higher than a typical rural noise district and typical of a suburban noise district. Ambient sound levels are acceptable for residential use;
 - based on the two full 8-hour night-time periods, the average $L_{Aeq,f}$ value is 49.5 dBA, with the arithmetic average being 48.4 dBA. Ambient sound levels are higher than the levels expected for a rural area, and more typical of a busy urban (with main roads, workshops and business). The ambient sound level is higher than the recommended noise limit for night-time residential use (when considering the IFC and WHO noise limits);
 - The statistical L_{A90} levels are highly elevated for the day- (37.6 dBA90) and the night-time (35.4 dBA90) periods, higher than expected for a rural noise district.
- Measurement Location EAKWFLTSLO3
 - based on the one full 16-hour daytime period, the daytime $L_{Aeq,f}$ value is 53.9 dBA, with the arithmetic average of the various 10-minute $L_{Aeq,f}$ measurements being 46.9 dBA. This is acceptable for residential use and typical of the day-time sound levels associated with a rural environment;
 - based on the two full 8-hour night-time periods, the average $L_{Aeq,f}$ value is 45.0 dBA, with the arithmetic average being 40.0 dBA. Ambient sound levels are elevated for a rural district, but acceptable for night-time residential use (when considering the IFC and WHO recommended noise limits);
 - The statistical L_{A90} levels are elevated for the day- (39.2 dBA90) and night-time (33.9 dBA90) periods. The ambient sound levels are much higher than expected for a rural noise district.
- Measurement Location EAKWFLTSLO4
 - based on the one full 16-hour daytime period, the $L_{Aeq,f}$ value is 47.4 dBA, with the arithmetic average being 44.3 dBA. This is ideal for residential use and typical of the day-time sound levels associated with a rural noise district;
 - based on the two full 8-hour night-time periods, the average $L_{Aeq,f}$ value is 41.3 dBA, with the arithmetic average being 39.3 dBA. This is typical of a suburban noise district and acceptable for night-time residential use (when considering the IFC and WHO recommended noise limits);
 - The statistical L_{A90} levels are elevated for the day- (37.0 dBA90) and night-time (33.5 dBA90) periods. The ambient sound levels are higher than expected for a rural noise district.
- Measurement Location EAKWFLTSLO5

- based on the one full 16-hour daytime period, the $L_{Aeq,f}$ value is 53.0 dBA, with the arithmetic average being 48.5 dBA. Sound levels are typical of a rural to suburban noise district and acceptable for residential use;
 - based on the two full 8-hour night-time periods, the average $L_{Aeq,f}$ value is 44.0 dBA, with the arithmetic average being 39.7 dBA. Ambient sound levels are typical what is expected for a suburban noise district (40 dBA), but acceptable for night-time residential use (when considering the IFC and WHO noise limits);
 - The statistical L_{A90} levels are slightly elevated for a rural environment for the day (34.4 dBA90), but quiet during the night-time (26.2 dBA90) periods.
- Measurement Location EAKWFLTSLO6
 - based on the one full 16-hour daytime period, the $L_{Aeq,f}$ value is 51.2 dBA, with the arithmetic average being 39.3 dBA. Sound levels are typical of a rural noise district and desired for residential use;
 - based on the two full 8-hour night-time periods, the average $L_{Aeq,f}$ value is 32.4 dBA, with the arithmetic average being 28.1 dBA. Ambient sound levels are typical what is expected for a quiet rural noise district (35 dBA), and desired for residential use (when considering the IFC and WHO night-time noise limits for residential use);
 - The statistical L_{A90} levels are typical of a rural environment for the day (34.4 dBA90) and low for night-time (24.0 dBA90) periods.

Approximately 1,160 10-minute measurements were collected during the day, with the highest fast-weighted sound level (during the various 10-minute measurements) measured at 70 dBA, with the lowest sound level being 24 dBA.

Approximately 576 10-minute measurements were collected during the night-time period, with the highest fast-weighted sound level (during the numerous 10-minute measurements) measured at 60 dBA, with the lowest sound level less than 21 dBA.

The average of the 10-minute sound levels at the six measurement locations were 44.7 dBA for the daytime period and 37.7 dBA for the night-time period (fast-weighted sound levels).

Considering the developmental character, the acceptable zone sound level (noise rating level) during low and no-wind conditions would be expected to be that of a rural noise district for the day- and night-time periods, e.g.:

- 45 dBA for the daytime period; and,
- 35 dBA for the night-time period.

When evaluating the results of the ambient sound levels as measured, ambient sound levels were typical of a rural environment. To assess the noise impact occurring during the construction phase, this assessment will use the following noise limits:

- 52 dBA for the daytime period; and,
- 42 dBA for the night-time period.

Considering measurements collected over the past decade at numerous locations during different seasons, ambient sound levels will likely increase as wind speeds increase, as illustrated in Figure 6-56 and Figure 6-57. The sound level data collected for this project is also illustrated on these figures. This trend of the increased ambient sound levels as wind speed increase is also illustrated on these figures, with this data considered for the operational phase (as the wind turbines will only operate during a period with increased wind speeds).

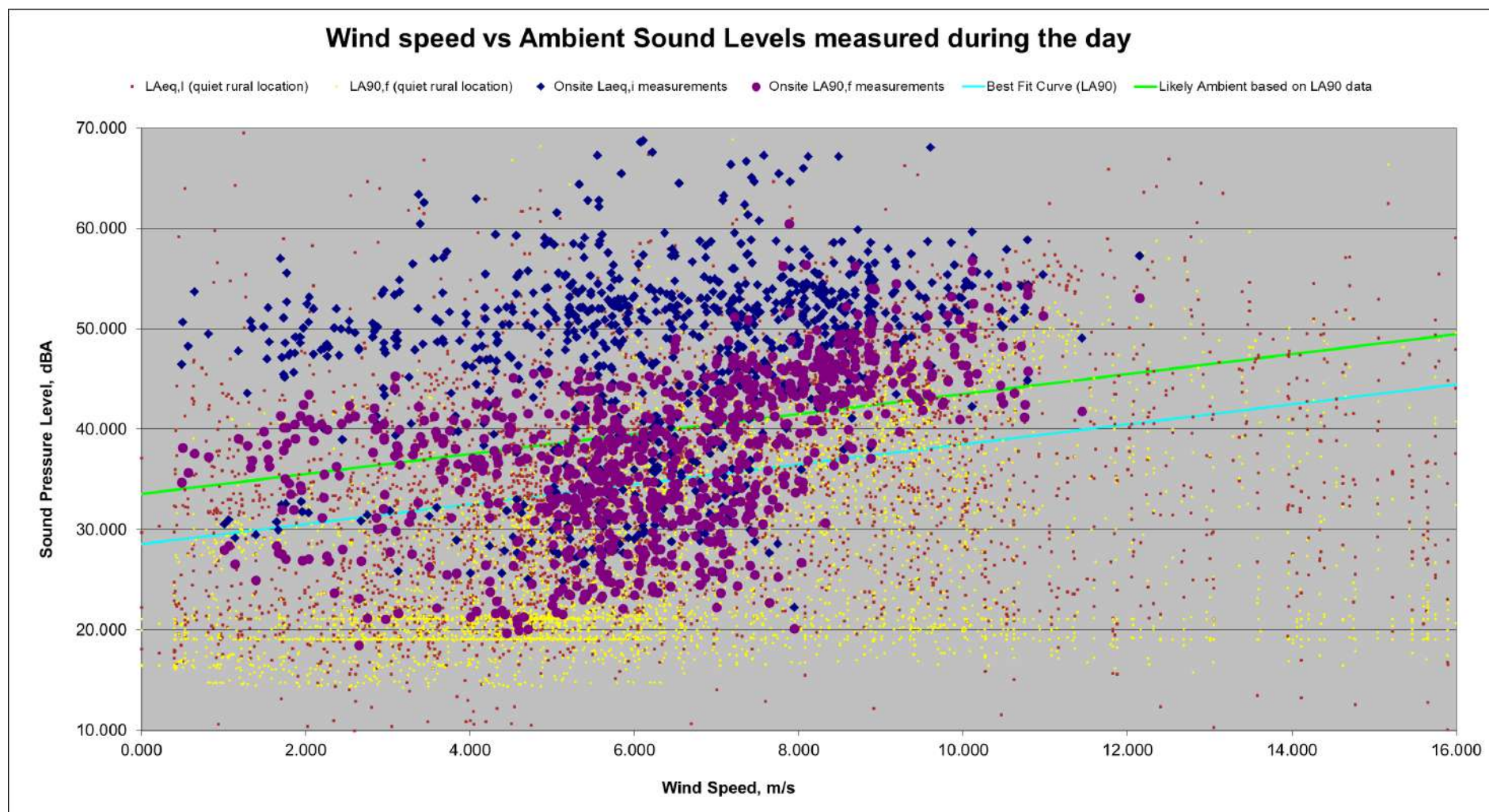


Figure 6-56: Daytime ambient sound levels measured in vicinity of project

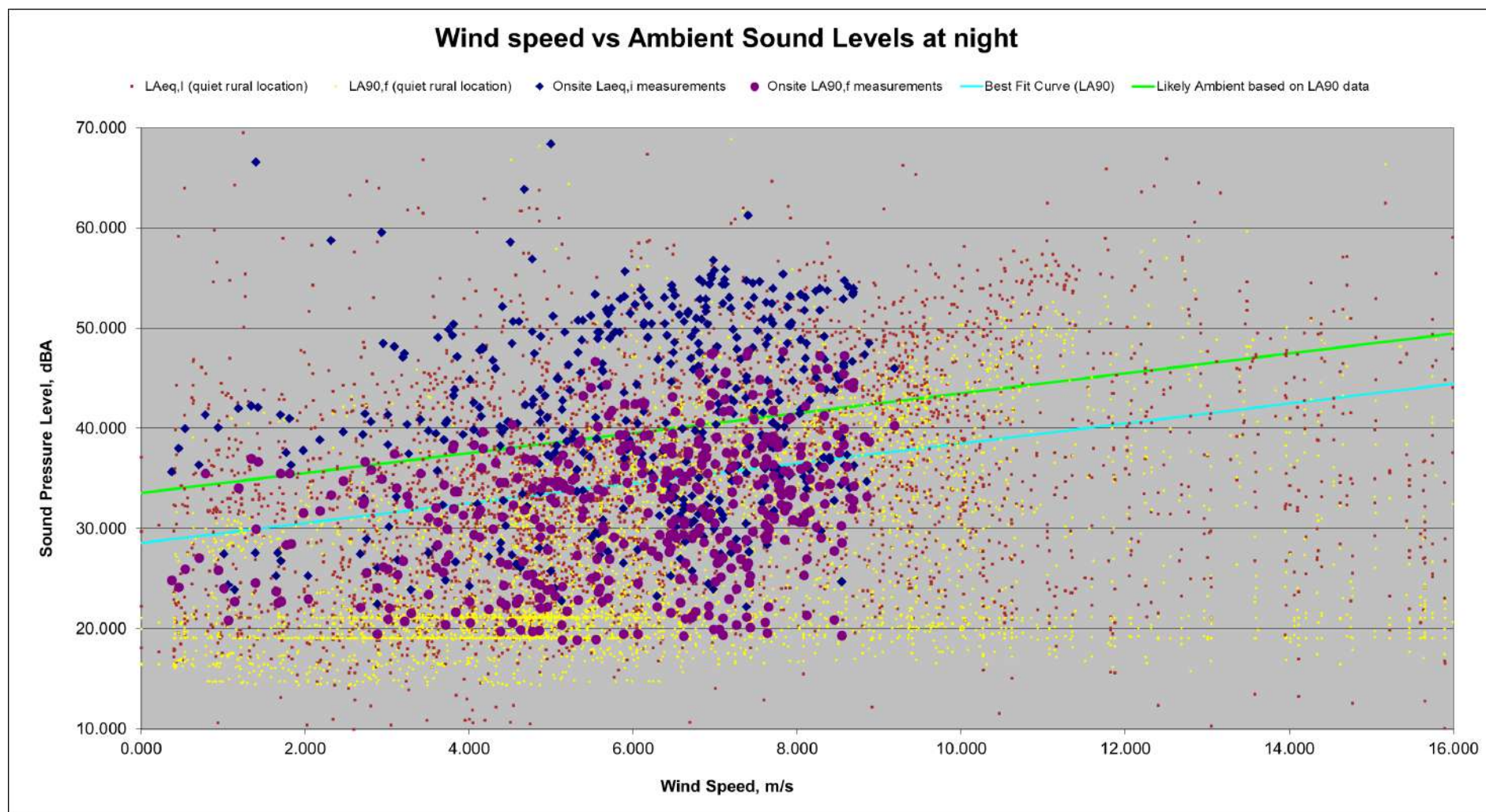


Figure 6-57: Night-time ambient sound levels measured in vicinity of project.

6.7.2 Site Sensitivity

6.7.2.1 Noise Impact on Animals

A significant amount of research was undertaken during the 1960's and 70's on the effects of aircraft noise on animals (Autumn, 2007), (Noise quest, 2010). While aircraft noise has a specific characteristic that might not be comparable with industrial noise, the findings should be relevant to most noise sources. A general animal behavioural reaction to aircraft noise is the startle response with the strength and length of the startle response to be dependent on the following:

- which species is exposed;
- whether there is one animal or a group of animals; and
- whether there have been some previous exposures.

Overall, the research suggests that species differ in their response to noise depending on the duration, magnitude, characteristic and source of the noise, as well as how accustomed the animals are to the noise (previous exposure).

Extraneous noises impact on animals as it can increase stress levels and even impact on their hearing. Masking sounds may affect their ability to react to threats, compete and seek mates and reproduce, hunt and forage, communicate and generally to survive.

Unfortunately, there are numerous other factors in the faunal environment that also influence the effects of noise. These include predators, weather, changing prey/food base and ground-based disturbance, especially anthropogenic. This hinders the ability to define the real impact of noise on animals.

The only animal species studied in detail are humans, and studies are still continuing in this regard. These studies also indicate that there is considerable variation between individuals, highlighting the loss of sensitivity to higher frequencies as humans age. Sensitivity also varies with frequency with humans. Considering the variation in the sensitivity to frequencies and between individuals, this is likely similar with all faunal species. Some of these studies are repeated on animals, with behavioural hearing tests being able to define the hearing threshold range for some animals as indicated on Figure 6-58.

Only a few faunal (animal) species have been studied in a bit more detail so far, with the potential noise impact on marine animals most likely the most researched subject, with a few studies that discuss behavioural changes in other faunal species due to increased noises. Few studies indicate definitive levels where noises start to impact on animals, with most based on laboratory level research (USEPA, 1971) that subject animals to noise levels that are significantly higher than the noise levels these animals may experience in their environment (excluding the rare case where bats and avifauna fly extremely close to an anthropogenic noise, such as from a moving car or the blades of a wind turbine).

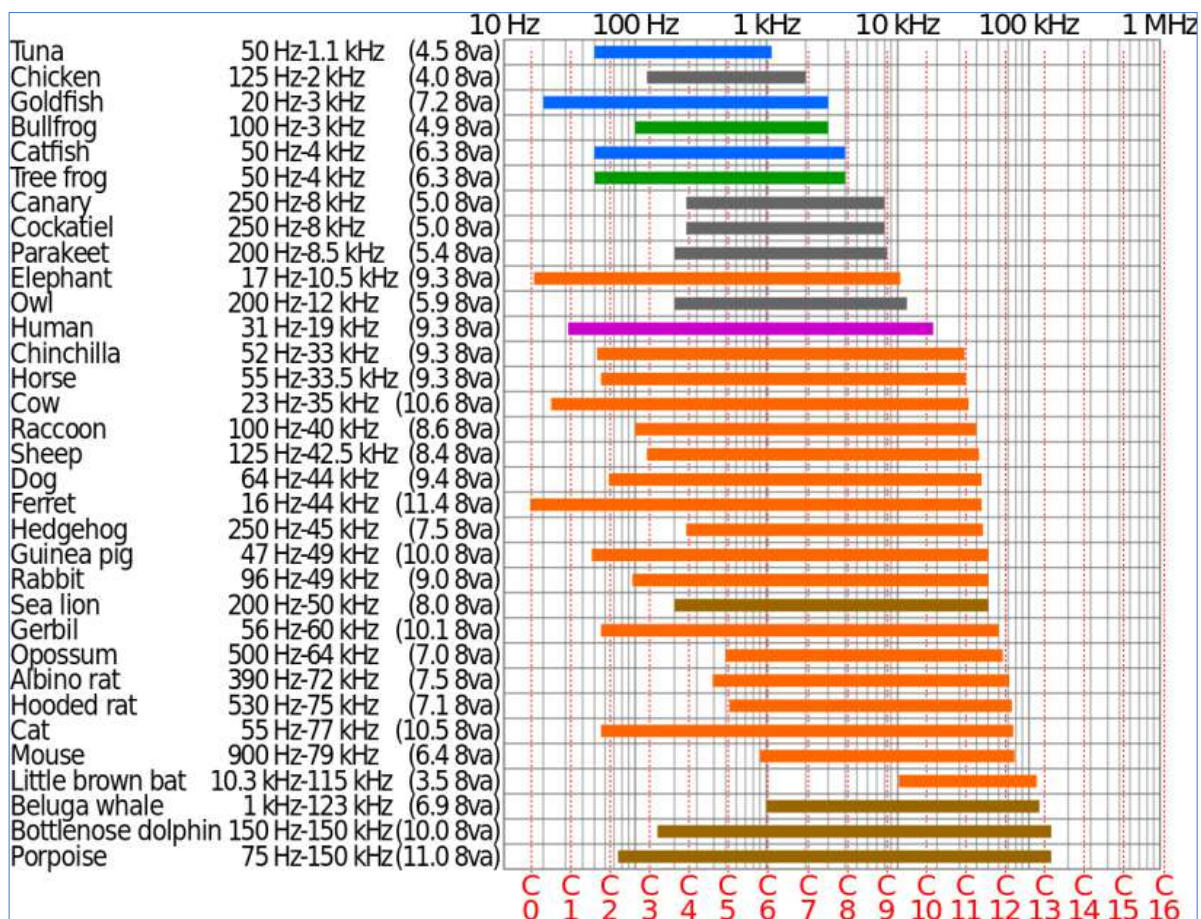


Figure 6-58: Logarithmic Chart of the Hearing Ranges of Some Animals²⁵.

Domesticated Animals

Excluding loud impulsive noises, considering the environmental noise levels (the noise levels were not defined, but levels of up to 100 dB were reported), it has been observed that most domesticated animals are generally not bothered by noise and generally can acclimatize relatively quickly to loud noises (Šottník, 2011). Considering the expected wind turbine noise (WTN) levels (well less than 60 dBA at all locations), WTN will not impact on domestic animals (Noise quest, 2010).

Wildlife

Studies indicated that most animals adapt to noises and would even return to a site after an initial disturbance, even if the noise is continuous. The more sensitive animals that might be impacted by noise would most likely relocate to a quieter area. Helldin (2012) however highlights that the network of access road could be a significant factor impacting on animals. Noise impacts are therefore very highly species dependent (Blickley and Patricelli, 2010), (Cummings, 2012), (Cummings, 2009), (Łopucki, Klich and Gielarek, 2017), (Noise quest, 2010), (Rabin, Coss and Owings, 2006), but there are also other factors that could impact on animals (such as visibility and increased movement of people and vehicles).

Avifauna

As with other terrestrial faunal species, noise (character of sound or change in level) will impact on avifauna (birds of a particular region and/or habitat). Anthropogenic noises result in physical damage to ears, increased stress, flight or flushing, changes in foraging and other behavioural reactions. Ortega (2012) summarized that

²⁵ https://en.wikipedia.org/wiki/Hearing_range

additional responses (with ecological similar controls) include the avoidance of noisy areas, changes in reproductive success and changes in vocal communication. However, as with other faunal species, there are no guidelines to assess at which sound pressure level avifaunal will start to exhibit any response (Autumn, 2007), (Cummings, 2009), (Dooling and Popper, 2007), (Lohr, Wright and Dooling, 2003), (Ortega, 2021), (Schaub, Ostwald and Siemers, 2008), (Zwart et al., 2014).

Concluding Remarks - Noise Impacts on Animals

From these and other studies the following can be concluded:

- To date there are no guidelines or sound limits with regards to noise levels that can be used to estimate the potential significance of noises on animals (Blickley *et al.*, 2010).
- Animals respond to impulsive (sudden) noises (higher than 90 dBA) by running away. If the noises continue, animals will try to relocate (Dooling, 2007).
- Terrestrial wildlife responses begin at noise levels of approximately 40 dBA, with 20% of papers documenting impacts below 50 dBA (Shannon *et al.* 2015).
- Animals start to respond to increased noise levels with elevated stress hormone levels and hypertension. These responses begin to appear at exposure levels of 55 to 60 dBA (Baber, 2010), with Helldin *et al.* (2012) reporting that levels of 60–75 dBA have been shown to cause stress, e.g., increased respiration and heart rate, increased vigilance, and decreased time for grazing in domestic animals such as sheep and horses.
- Animals of most species exhibit adaptation with noise (Broucek, 2014), including impulsive noises, by changing their behaviour.
- There may be a possible impact on the health of animals (Mikolajczak, 2013; Karwowska, 2015) caged very close to an operating WTG (within 500 m) (Karwowska, 2015), (Mikolajczak, 2013);
- Songbirds may change the spectral character of songs and calls used for communication and defence in areas very close to WTGs. This is similar to the effects of other anthropogenic noise sources such as traffic, which can disrupt bird ‘chatter’ to the point of being detrimental to reproductive success (Szymański, 2017; Zwart, 2014);
- More sensitive species would relocate to a quieter area, especially species that depend on hearing to hunt or evade prey, or species that makes use of sound/hearing to locate a suitable mate (Dooling, 2007; Łopucki, 2017).
- Noises associated with helicopters, motor- and quad bikes significantly impact on animals (startle response). This is due to the sudden and significant increase in noise levels due to these activities [(Autumn, 2007);
- Focusing on small species (rodents and shrews), Łopucki (2016) assessed differences between control sites and locations close to wind turbines (the distances from WTG were not defined), concluding no significant differences between the sites;
- Łopucki (2017) studied tracks from various species (Roe deer, European hare, Common pheasant and Red fox), from as close as 100m from WTG to 700m away. That study determined that
 - Roe deer and European hare visit the areas closer to WTG less frequently than areas further away,
 - Common pheasant appear to visit the areas closer to WTG more frequently, and
 - Red fox showed the most neutral response to WTG; and
- Helldin *et al.* (2012) also report that large terrestrial mammals appear to acclimatise to wind farms during the operational phase, arguing that WF mainly affect large terrestrial mammals through an increase in human activity.

With regard to Low-Frequency Noise (LFN) and Infrasound, it is summarized that:

- There are no scientific papers available in reputable journals highlighting the impact of LFN from WTG on wildlife;
- Animal communication is generally the highest during no and low wind conditions. It has been hypothesised that this is one of the reasons why birds sing so much in the mornings (their voices carry the farthest when there less observable wind that may increase wind-induced noises);
- Background noise levels (ambient sound levels) in remote areas are not always low in space or time. The site is windy and this generates significant noise itself and also significantly changes the ability of fauna to hear the environmental noises around them;
- Wind is a significant source of natural noise, with a character similar to the noise generated by wind turbines, with a significant portion of the acoustic energy in the low frequency and infrasound range;
- Wind turbines do not emit broad-band sound on a continual basis as the turbines only turn and generate noise when the wind speeds are above the cut-in speed;
- The wind turbines will only operate during periods of higher wind speeds, a period when background noise levels are already elevated due to wind-induced noises; and
- The elevated background noise relating with wind also provide additional masking of the wind turbine noise, with periods of higher winds also correlating with lower faunal activity, particularly with regard to communication.

It should be noted that LFN and Infrasound is present in the environment and is generated by a wide range of natural sources (e.g., wind, waves etc.). In February 2013, the Environmental Protection Authority of South Australia published the results of a study into infrasound levels near wind farms (Evans, 2013). This study measured infrasound levels at urban locations, rural locations with wind turbines close by, and rural locations with no wind turbines in the vicinity. It found that infrasound levels near wind farms are comparable to levels away from wind farms in both urban and rural locations. Infrasound levels were also measured during organized shut-downs of the wind farms; the results showed that there was no noticeable difference in infrasound levels whether the turbines were active or inactive.

6.7.2.2 Why noise concerns communities

Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person. One can generalise by saying that sound becomes unwanted when it:

- Hinders speech communication;
- Impedes the thinking process;
- Interferes with concentration;
- Obstructs activities (work, leisure and sleeping); and
- Presents a health risk.

However, it is important to remember that whether a given sound is "noise" depends on the listener or hearer. The driver playing loud rock music on their car radio hears only music, but the person in the traffic behind them hears nothing but noise.

Response to noise is unfortunately not an empirical absolute, as it is seen as a multi-faceted psychological concept, including behavioural and evaluative aspects. For instance, in some cases, annoyance is seen as an outcome of disturbances, and in other cases it is seen as an indication of the degree of helplessness with respect to the noise source.

Noise does not need to be loud to be considered “disturbing”. One can refer to a dripping tap in the quiet of the night, or the irritating “thump-thump” of the music from a neighbouring house at night when one would prefer to sleep. Noise impacts are also complex to evaluate as numerous issues could cumulatively contribute to the severity of the impact, as discussed in the following subsections.

How a noise may impact (with this assessment using annoyance about the noise) on a receptor is also very complex to assess. Only considering the intensity of a sound (or noise) level, some people may become annoyed without hearing any noise (perceived impacts) where others may not even be reporting noise to be a concern, even when subjected to very high levels.

Noise Annoyance

Annoyance is the most widely acknowledged effect of environmental noise exposure, and is considered to be the most widespread. It is estimated that less than a third of the individual noise annoyance is accounted for by acoustic parameters, and that the non-acoustic factors play a major role. Non-acoustic factors that have been identified include age, economic dependence on the noise source, attitude towards the noise source and self-reported noise sensitivity (Bakker *et al.*, 2012), (Council of Canadian Academies, 2015), (Ellenbogen *et al.*, 2012), (Halfwerk *et al.*, 2011), (Hanning, 2010), (Janssen *et al.*, 2011), (Knopper *et al.*, 2014), (Merlin *et al.*, 2013), (Miedema and Vos, 2003), (Minnesota Department of Health, 2009), (Nissenbaum, 2012), (Pedersen, 2007), (Pedersen, 2007), (Pedersen, Halmstad and Högskolan, 2003), (Pedersen, 2011), (Pierpont, 2009), (Schmidt and Klokke, 2014), (Van den Berg *et al.*, 2008), (Van den Berg, Verhagen and Uitenbroek, 2014), (World Health Organization, 2009).

On the basis of a number of studies into noise annoyance, exposure-response relationships were derived for high annoyance from different noise sources. These relationships, illustrated in Figure 6-59, are recommended in a European Union position paper published in 2002, stipulating policy regarding the quantification of annoyance. This can be used in environmental health impact assessment and cost-benefit analysis to translate noise maps into overviews of the numbers of persons that may be annoyed, thereby giving insight into the situation expected in the long-term. It is not applicable to local complaint-type situations or to an assessment of the short-term effects of a change in noise levels.

Severity of the annoyance depends on factors such as:

- Background sound levels and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological and health state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

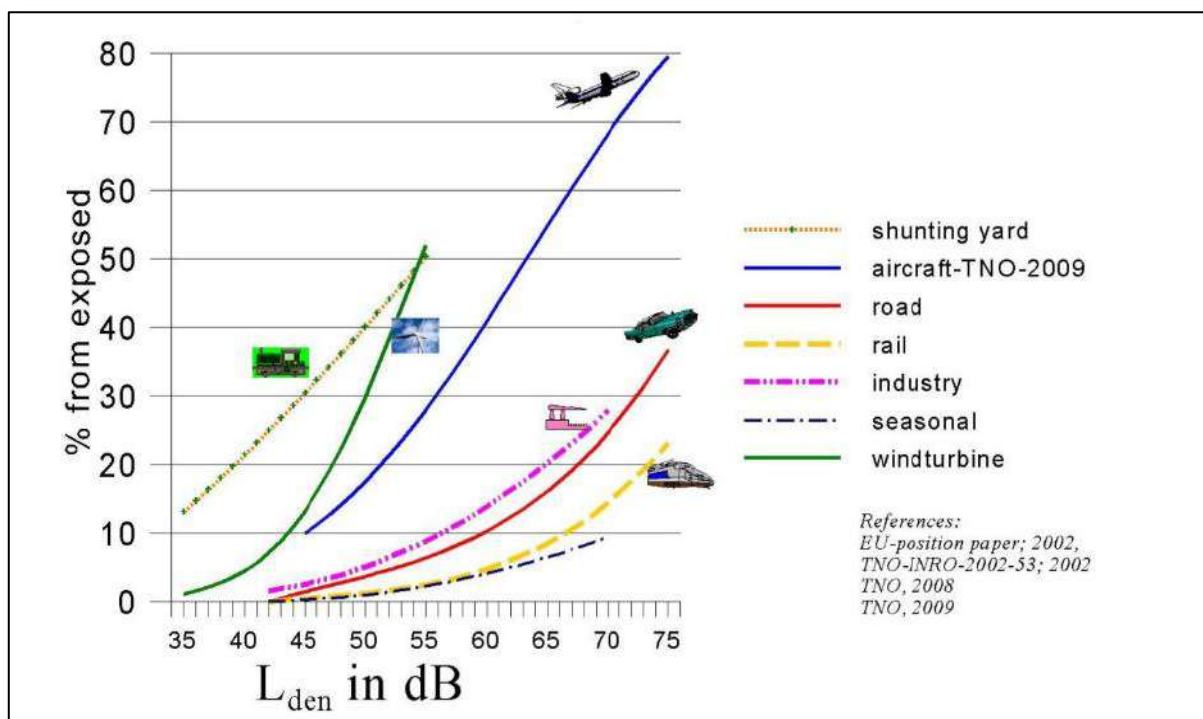


Figure 6-59: Percentage of annoyed persons as a function of the day-evening-night noise exposure at the façade of a dwelling²⁶.

Disturbance to Sleep

Sleep is essential for mental and physical health, and noise is one of the most reported reasons why people may experience sleep interruptions at night. This may be sudden loud noises, with the WHO (2009) reporting that, when maximum noises exceed 60 dBA, with average noise levels exceeding 40 dBA, it may increase the probability of being awakened. People report that quality of life suffer with increased instances of disturbed sleep that may also increase annoyance with a project (Bakker *et al.*, 2012), (Van den Berg, Verhagen and Uitenbroek, 2014). It should be noted that Van den Berg (2014) showed an indirect effect between sleep disturbances and annoyance, but not between sleep disturbance and the noise level. It is postulated that this is due to increased annoyance due to the visual impact from WTG.

Potential Health Effects from WTN

While there has been a number of complaints about the impact of WTN on the health of people living close to WTG (Halfwerk *et al.*, 2011), (Hanning, 2010), (Janssen *et al.*, 2011), (Nissenbaum, 2012), (Pierpont, 2009), other than annoyance and sleep disturbances, there is no evidence of any direct health effects (Council of Canadian Academies, 2015), (Ellenbogen *et al.*, 2012), (Knopper *et al.*, 2014), (Minnesota Department of Health, 2009), (MDEP), (Merlin *et al.*, 2014), (Pedersen, Halmstad and Högskolan, 2003), (Schmidt and Klokke, 2014).

Situational and Personal Factors

There are a few other aspects, collectively referred to as non-acoustical factors that may increase annoyance with a project (Miedema, 2003), (Pedersen, 2007). These could include:

²⁶ Image from <https://rigolett.home.xs4all.nl/ENGELS/topic.htm>. Wind Turbine Annoyance curve from Pedersen (2007)

- Situational factors (visual issues, attractiveness of area) (Merlin *et al.*, 2013), (Michaud *et al.*, 2016), (Van den Berg *et al.*, 2008);
- Socio-economic factors (age, gender, income, level of education) (Miedema, 2003), (Michaud *et al.*, 2016);
- Social factors (attitude towards the applicant/producer/government, media coverage) (Pedersen, 2007); and
- Personal factors (fear or worry in relation to noise source, sensitivity to noise, economic benefit from project, existing health condition) (Miedema, 2003).

6.7.2.3 Projected Noise Rating Levels - Conceptual Scenarios

Noise due to Future Construction Activities

A noise model was developed considering the conceptual construction activities. The proposed layout as provided by the applicant for the Kariega 4 WEF is presented in Figure 6-60. As can be seen from this layout, a number of different activities might take place close to potential NSR, each with a specific potential impact.

As it is unknown where the different activities may take place, it was selected to model the impact of the noisiest activity (laying of foundation totalling 113.6 dBA cumulative noise impact – various equipment operating simultaneously) at all locations where wind turbines may be erected, calculating how this may impact on noise levels at NSR²⁷ (see Figure 6-62). Noise created due to construction traffic (road traffic noises) were also evaluated and plotted against distance as illustrated in Figure 6-61²⁸. Note, the projected noise levels relating to the various construction activities are defined in the main specialist report.

²⁷ The potential cumulative (worst-case) noise level due to construction activities at an NSR are plotted against the distance from the NSR and a potential construction activity. As the expected noise level will be well less than 40 dBA at NSR further than a 1,200m from a construction activity, they were not included in this figure

²⁸ Sound level at a receiver set at a certain distance from a road

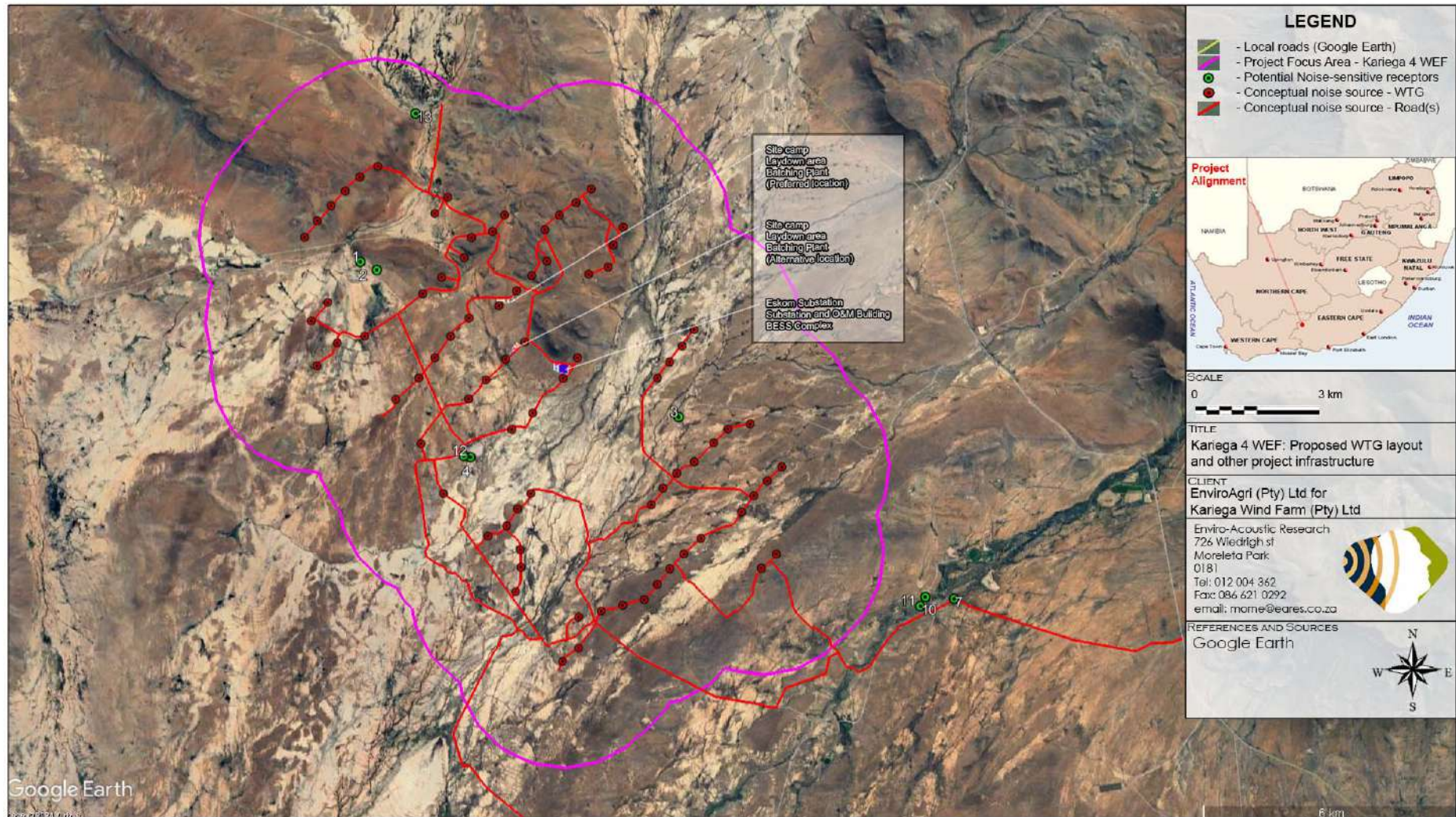


Figure 6-60: WTG locations and associated infrastructure for the proposed Kariega 4 WEF.

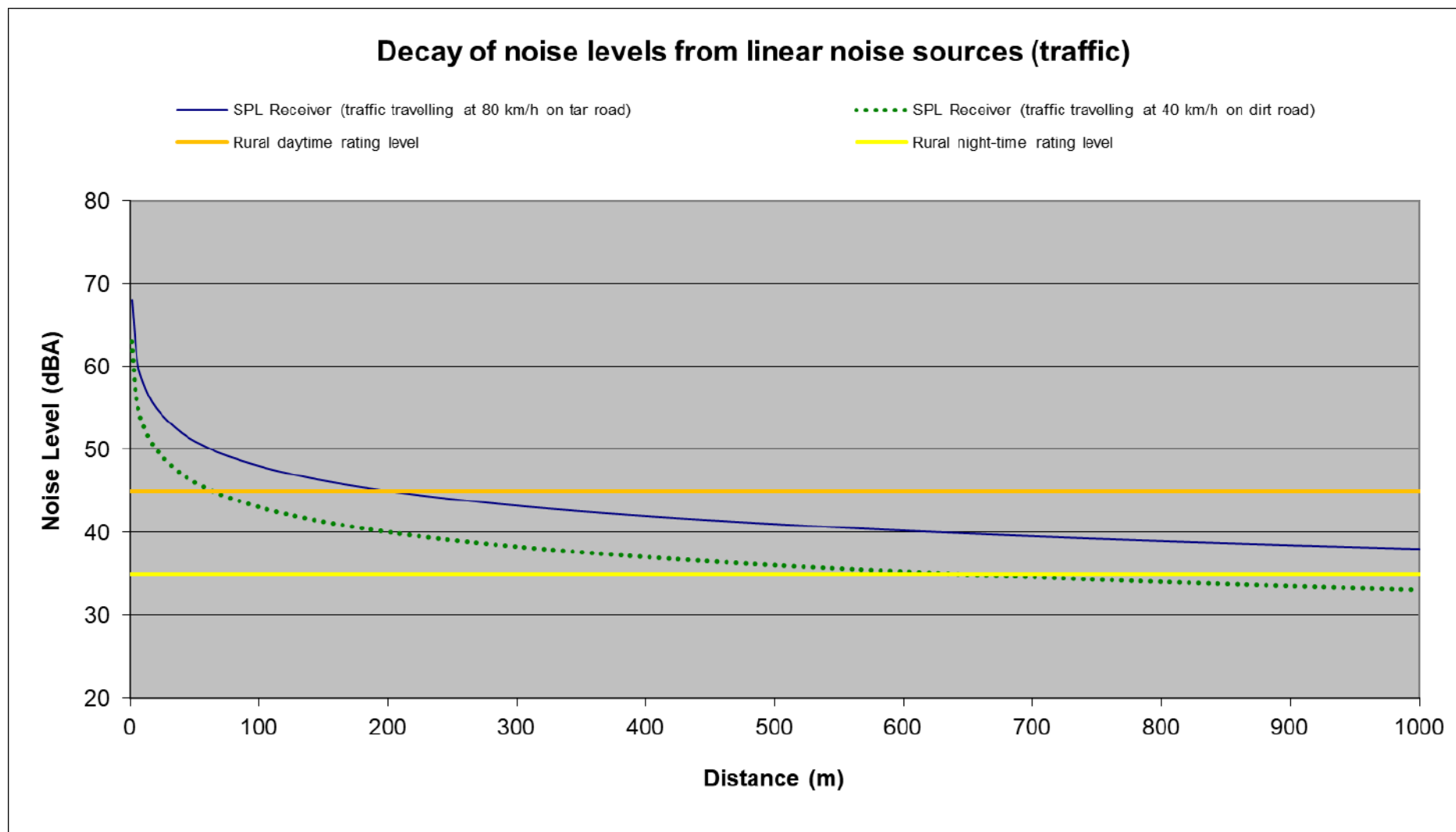


Figure 6-61: Projected conceptual construction noise levels – Decay over distance from linear activities (roads).

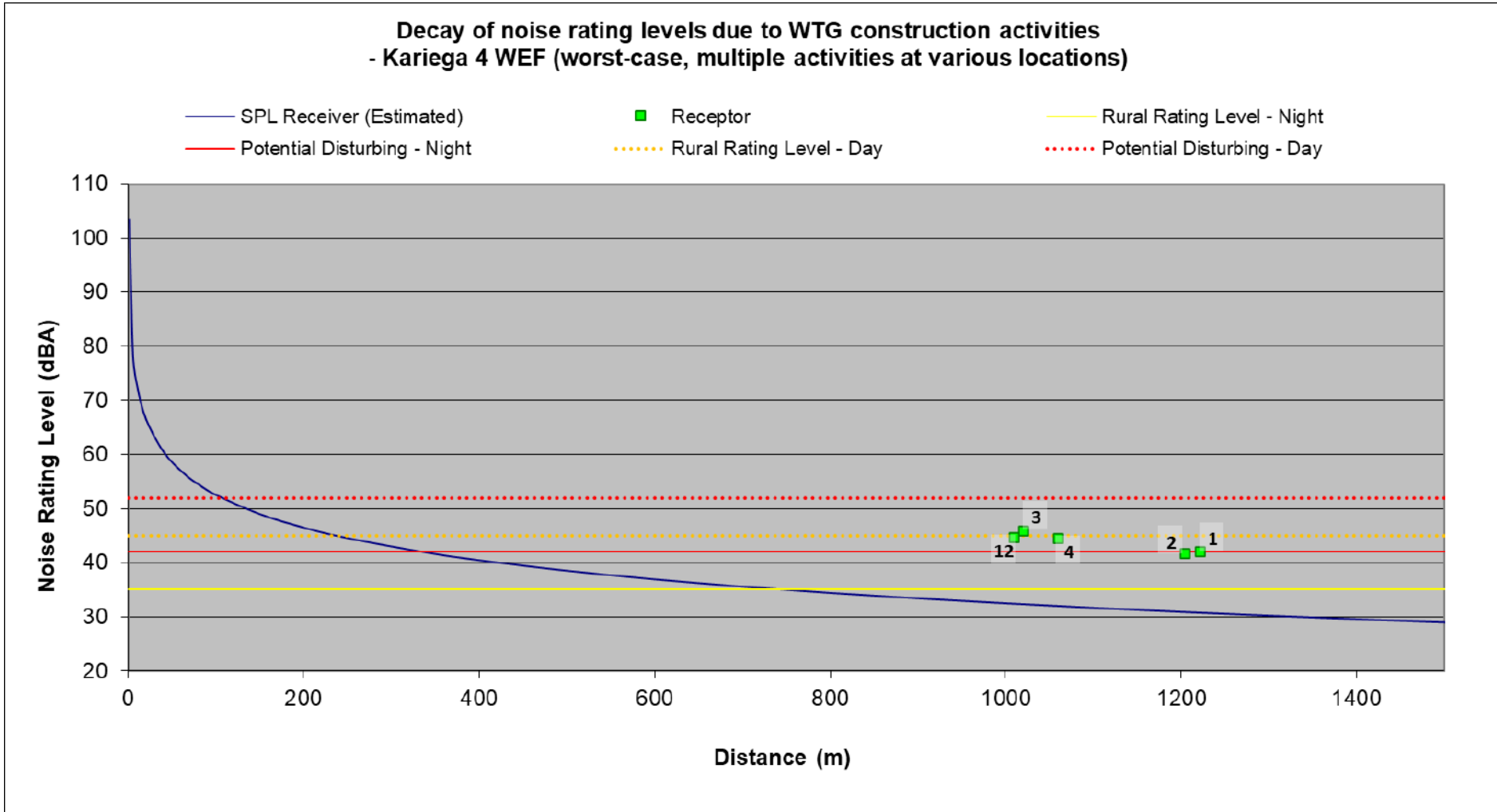


Figure 6-62: Projected conceptual construction noise levels for the proposed Kariega 4 WEF.

Noise due to Future Operational Activities

While the significance of daytime noise impacts was considered, times when a quiet environment is desired (at night for sleeping, weekends etc.) are more critical. Surrounding receptors would desire and require a quiet environment during the night-time (22:00 – 06:00) timeslot and ambient noise levels during the night-time period is critical. It should be noted that maintenance activities normally take place during the day, but normally involve a few light-delivery vehicles moving around during the day, an insignificant noise source. As such maintenance activities will not be considered.

Noise models were developed considering the conceptual operational activities as discussed in the main specialist report, with the potential noise rating level contours illustrated in Figure 6-63 for a worst-case WTG (using a WTG with an SPL of 114.0 dBA re 1 pW). Ambient sound levels are assumed to be 41.5 dBA at an 8 m/s wind speed. The projected worst-case noise levels are defined per NSR in Appendix E, Table 6 (of the specialist report). Though this figure illustrates the potential noise level contours for the cumulative scenario, Figure 6-67 illustrates the potential mitigatory effect of using a noise abatement programme at WTG located within 2,500m from NSR.

Potential Cumulative Noise Impacts

Cumulative noise impacts generally only occur when noise sources (such as other wind turbines) are closer than 2,000m from each other (around 1,000 m from the conceptual receptor located between them). The cumulative impact also only affects the area between the wind turbines of the various wind farms and normally only relate to the operational phase.

If the wind turbines of one wind farm are further than 2,000 m from the wind turbines of the other wind farm, the magnitude (and subsequently the significance) of the cumulative noise impact is reduced. If the distance between the wind turbines of two wind farms are further than 4,000m, cumulative noise impacts are non-existent. This is illustrated in Figure 6-64.

At the time this report was compiled, the author was only aware of the:

- Eskom Aberdeen WEF, with the WTGs of this WEF proposed just south-east of the Kariega 4 WEF. The layout of this WEF was included in the cumulative model, using the SPL characteristics of the Vestas V112 3.0 MW WTG at a hub height of 119 m;
- Aberdeen WEF 1, Aberdeen WEF 2 and Aberdeen WEF 3 projects, with the WTG of these projects located to the south-east of the Kariega 4 WEF. The layouts of these WEF were included in the cumulative model, using the SPL characteristics of the Nordex N163 WTG at a hub height of 118 m;
- Kariega 1 WEF, Kariega 2 WEF and Kariega 4 WEF projects, with the WTG of these projects located just to the south and north of the Kariega 4 WEF. The layouts of these WEF were included in the cumulative model, using the SPL characteristics of the Envision EN171/6.5 WTG at a hub height of 118 m; and
- Poortjie West WEF, located approximately 32 km from the Kariega 4 WEF. The WTG of this WEF will be too far from the WTG of the Kariega 4 WEF to contribute to cumulative noise levels.

Potential cumulative noise rating level contours are illustrated in Figure 6-66 when using a WTG with an SPL of 114.0 dBA (re 1 pW), with the noise rating levels defined per NSR in Appendix E, Table 7 (of the specialist report). The potential noise rating level contours considering a potential mitigated scenario (making use of a noise abatement programme at certain WTG) are illustrated in Figure 6-67.

Potential Decommissioning, Closure and Post-closure Noise Levels

The potential for a noise impact to occur during the decommissioning and closure phase will be much lower than that of the construction and/or operational phases. This is because:

- Decommissioning activities normally are limited to the daytime period, due to the lower urgency to complete this phase; and
- Decommissioning activities normally use smaller and less equipment, generating less noise than the typical construction or operational phases.

If required, the noise levels for decommissioning can be compared with the daytime construction phase noise level and the noise impact is similar or less.

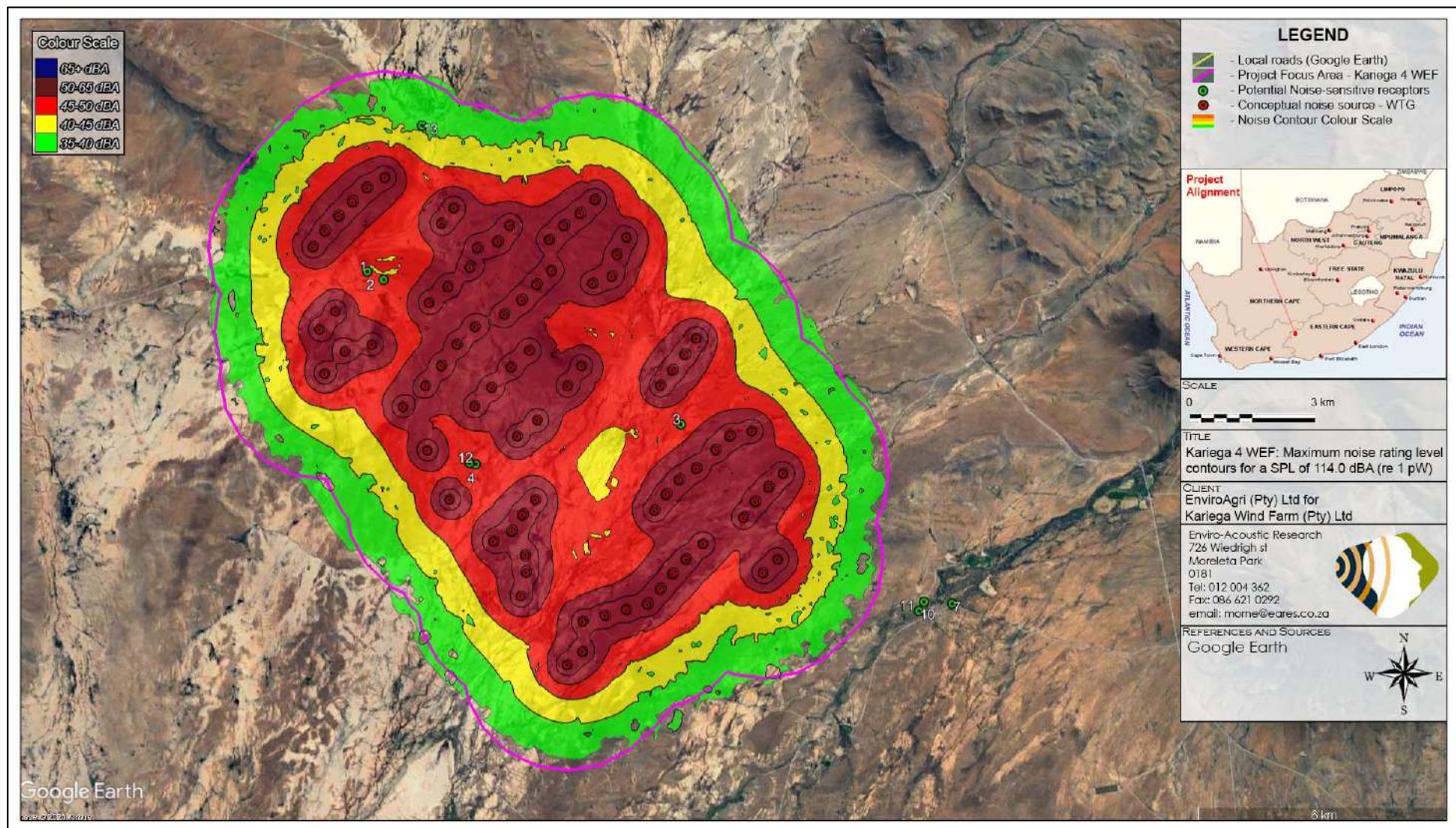


Figure 6-63: Projected future noise rating level contours (worst-case WTG with SPL of 114.0 dBA re 1 pW).

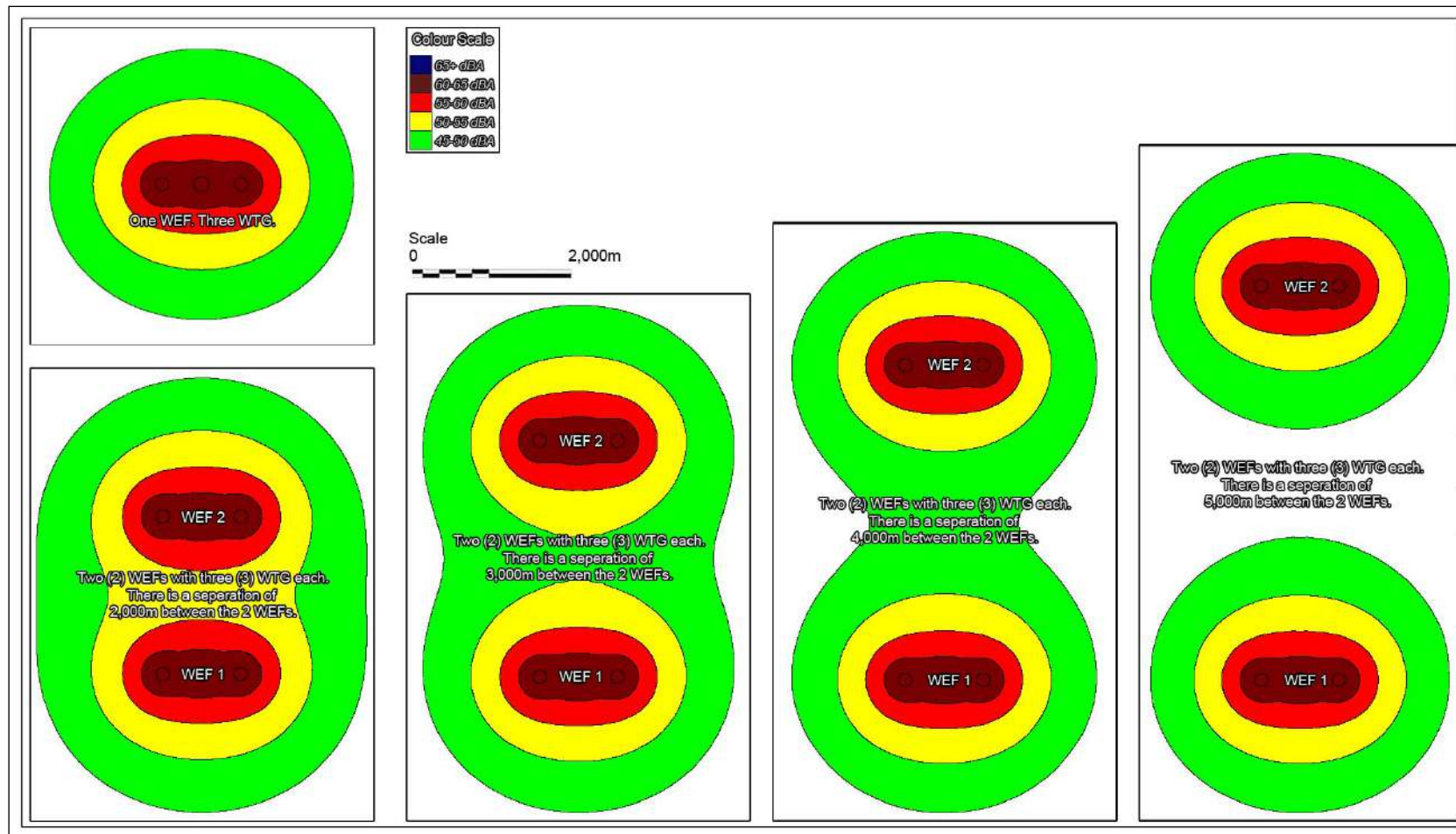


Figure 6-64: Effect of distance between wind turbines – potential cumulative noise.

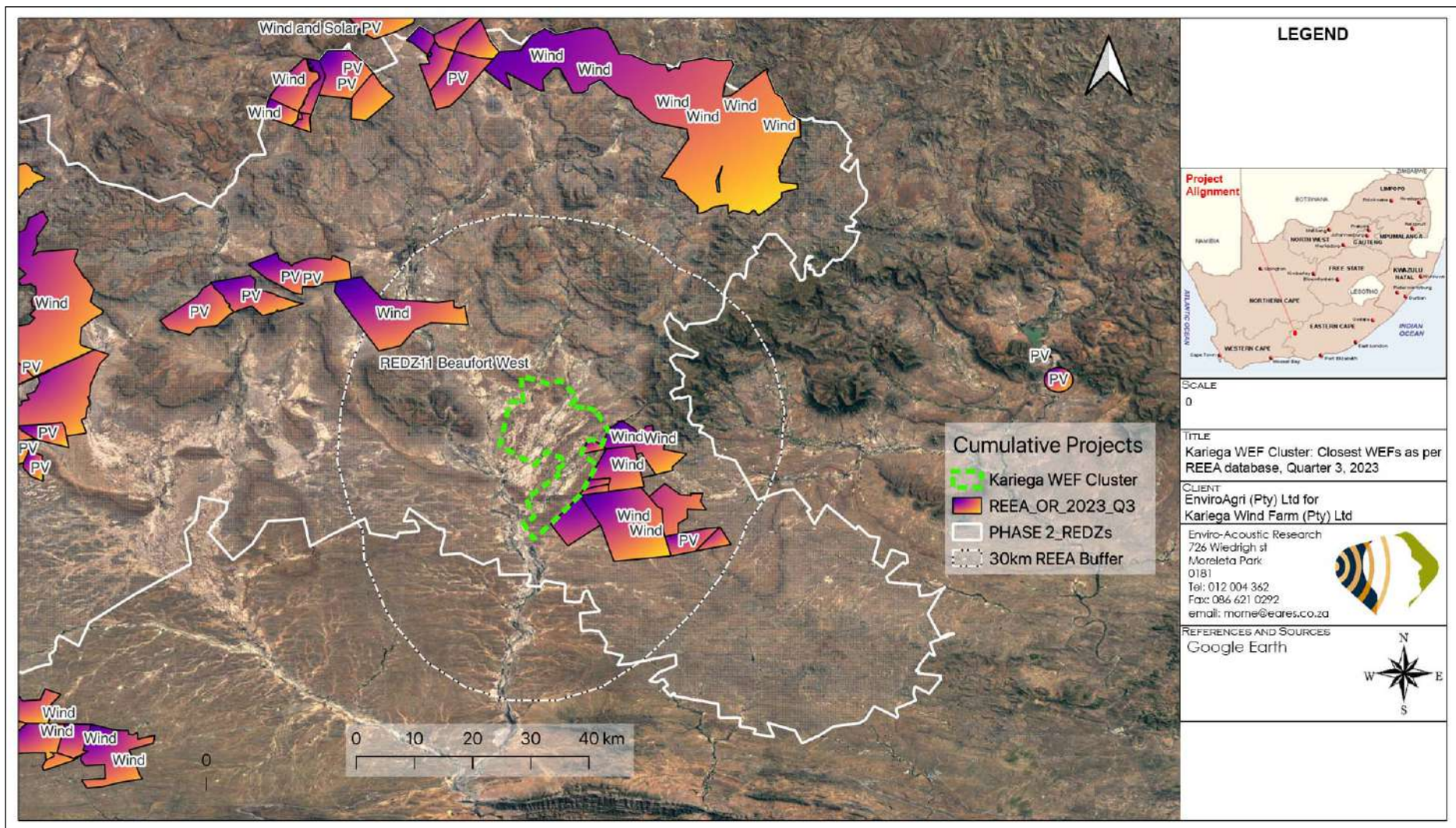
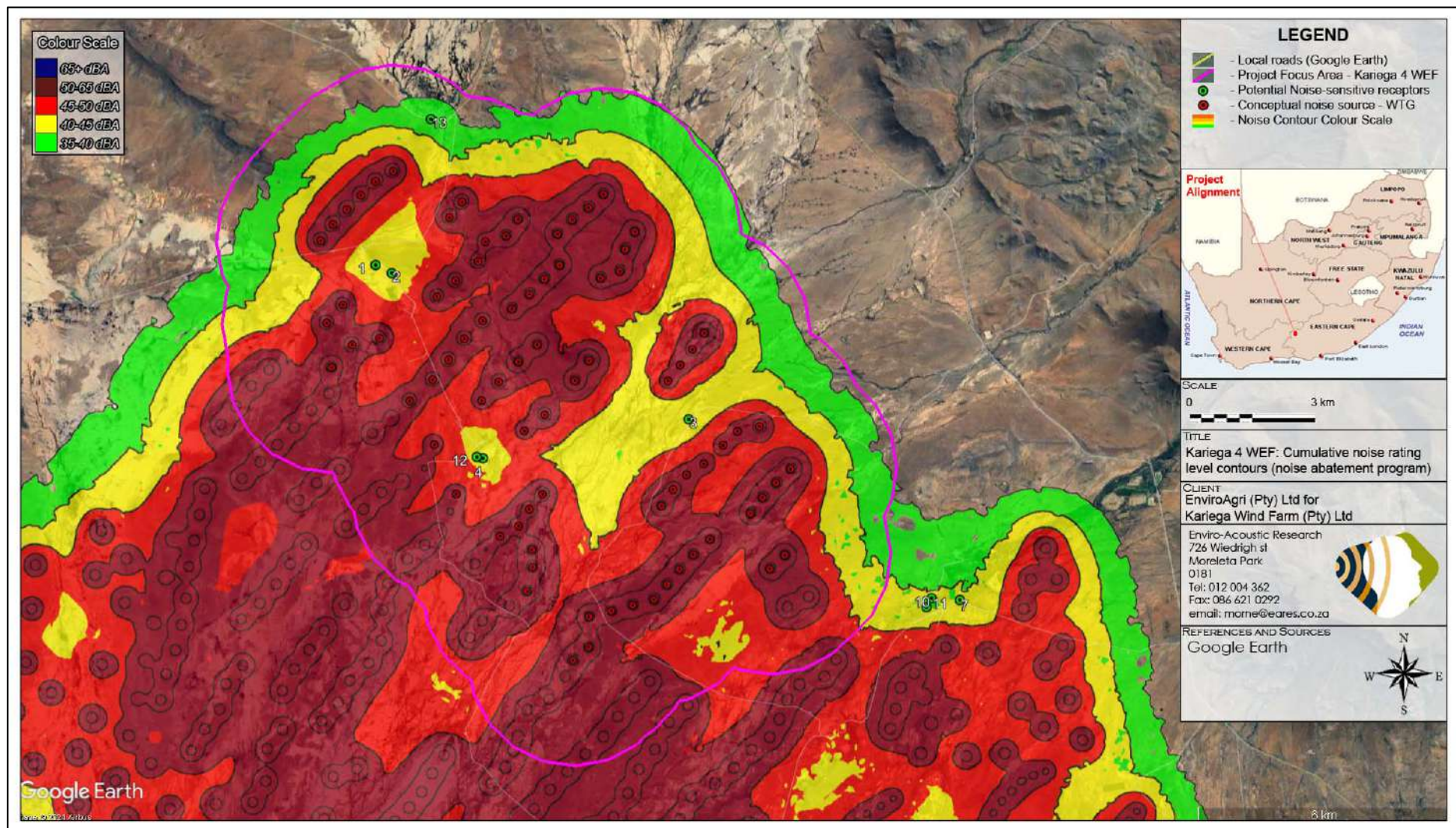


Figure 6-65: Effect of distance between wind turbines – potential cumulative noise.



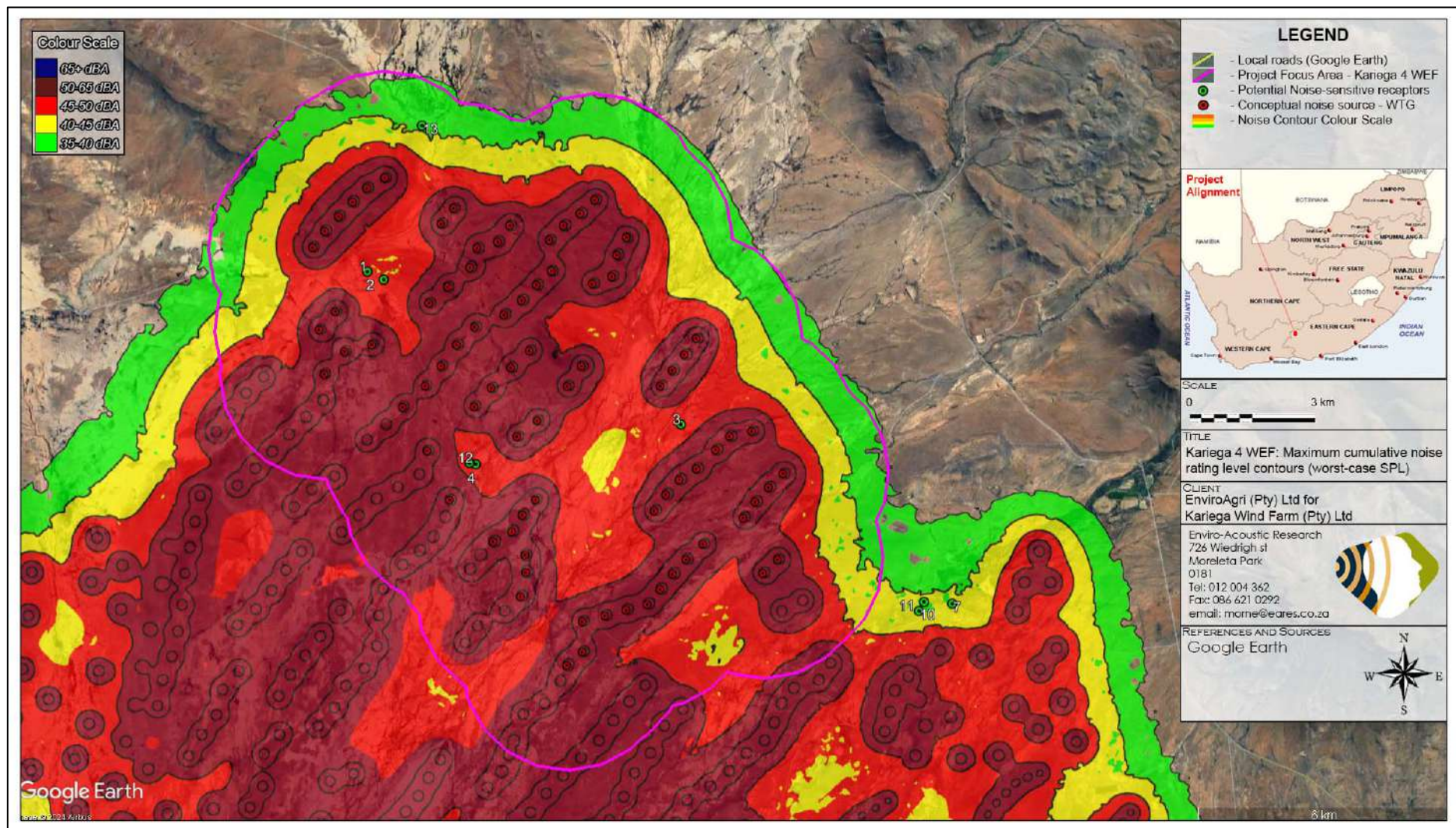


Figure 6-66: Projected future cumulative noise rating level contours (worst-case SPL of 114.0 dBA re 1 pW).

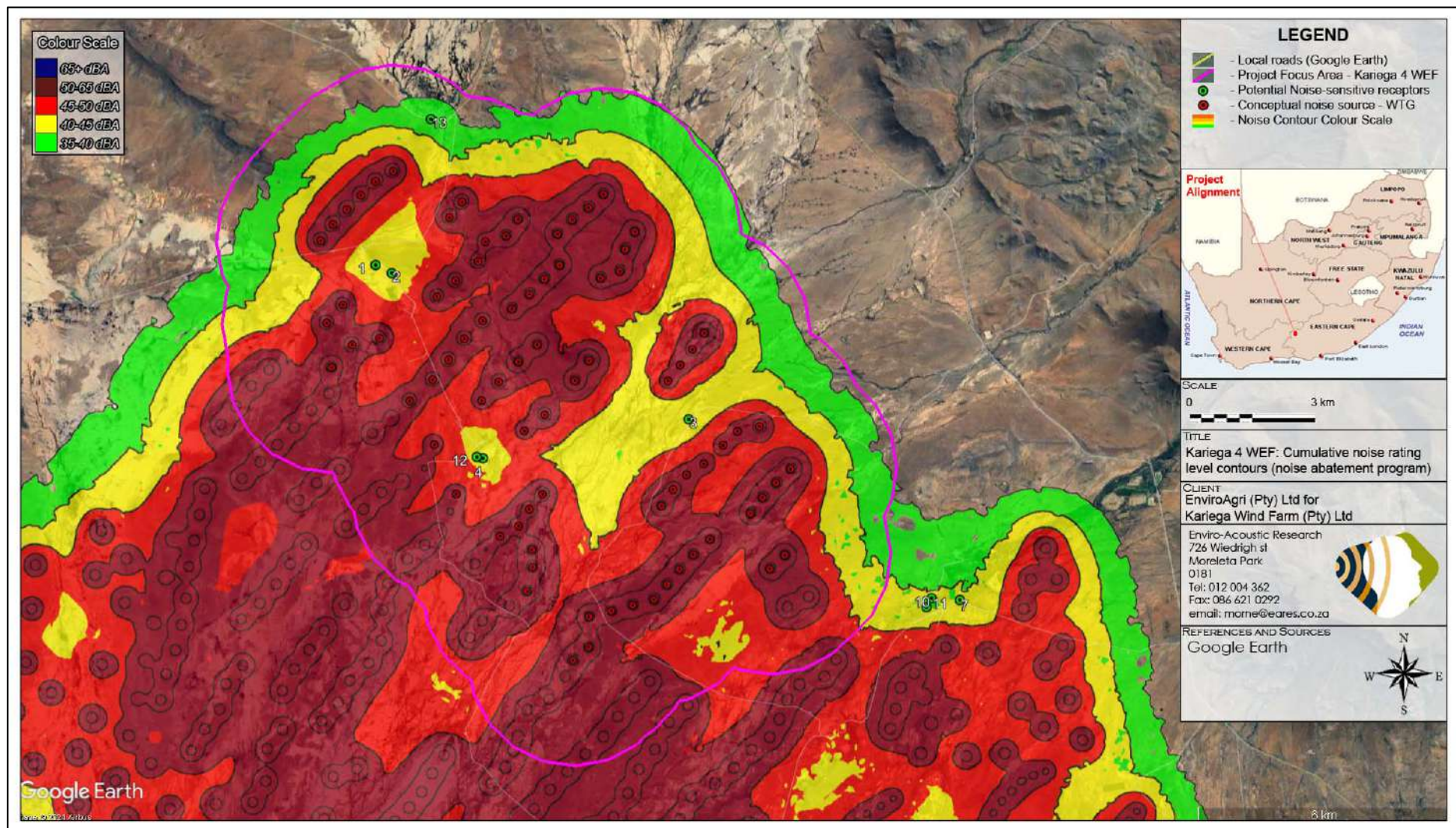


Figure 6-67: Projected future cumulative noise rating level contours for a potential mitigated scenario.

6.7.3 Impact assessment

6.7.3.1 Noises relating to the Planning and Design Phase

Activities that relate to the planning and design phases are normally limited to surveying and site visits by the applicant and specialists. These activities are normally limited to the daytime period, with the activities having temporary noise impacts of a minor consequence. Noises impacts are generally negligible (insignificant) the potential noise impact associated with the planning and design phase will not be considered in this assessment.

However, should the assessment indicate a potential noise impact of medium or high significance for the construction and/or operational phases, appropriate mitigation measures to reduce this noise impact must be designed and/or selected during the planning and design phase.

6.7.3.2 Noises associated with construction activities

The potential noise levels for the various construction activities (as conceptualised) were calculated. The potential significance of the construction noise impacts was:

- estimated per NSR when considering construction activities associated with access roads, with the potential significance of the daytime noise impact summarized in Table 6-66;
- estimated per NSR when considering construction traffic noises, with the potential significance of the daytime noise impact summarized in Table 6-67;
- calculated per NSR with the potential significance of the daytime noise impact summarized in Table 6-68; and,
- calculated per NSR with the potential significance of the night-time noise impacts is summarized in Table 6-69.

6.7.3.3 Noise Impact due to Future Operational Activities

The noise levels associated with the operating WTG was calculated, with the noise levels illustrated in Figure 6-68 for different wind speeds, and illustrated in Figure 6-63 for the worst-case WTG (using a SPL of 114.0 dBA re 1 pW).

The potential significance of operational noise impacts was summarized in Table 6-70 for the daytime period and in Table 6-71 for the night-time period. Noise rating levels as well as the significance of a potential noise impact is calculated per NSR in Appendix E, Table 6 (of the noise specialist report).

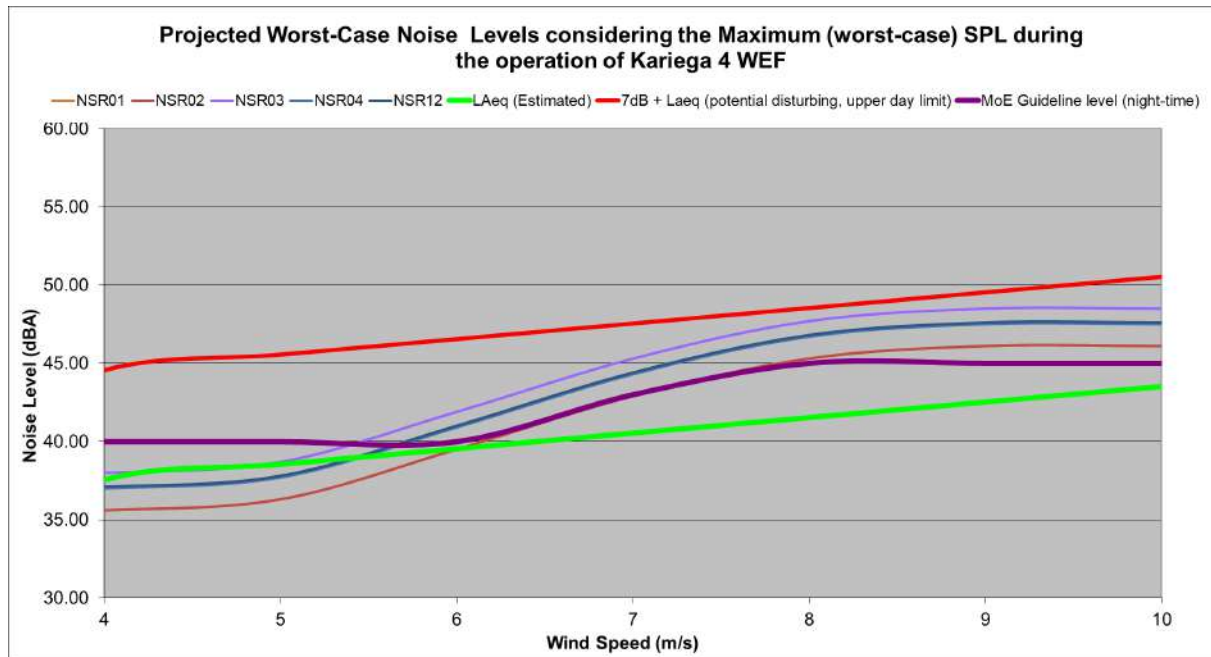


Figure 6-68: Projected noise levels at different wind speeds (worst-case SPL).

6.7.3.4 Potential Decommissioning, Closure and Post-closure Noise Levels

The potential for a noise impact to occur during the decommissioning and closure phase will be much lower than that of the construction and/or operational phases, because:

- Decommissioning activities normally are limited to the daytime period, due to the lower urgency to complete this phase; and
- Decommissioning activities normally use smaller and less equipment, generating less noise than the typical construction or operational phases.

The potential impact for decommissioning activities is summarized in Table 6-72.

6.7.3.5 Cumulative noise impact from other WEFs

There is a very low risk of cumulative noises during the construction phase because it is unlikely that construction activities will take place simultaneously at these different WEFs.

Only NSR04 and NSR12 are located within the area of potential influence of the Kariega 3 WEF and Kariega 4 WEF, and only these NSR may be subject to significant cumulative noises (if the WTG from these two WEFs are operating simultaneously). There is an insignificant cumulative effect at NSR01 and NSR02.

Potential cumulative noise impacts were calculated per NSR with the possible significance of the cumulative noise impact summarized in Table 6-73 (only the night-time period was investigated). While cumulative noises from Kariega 3 WEF will contribute to the noise levels at NSR04 and NSR12, the contribution is low with most of the acoustic energy associated with the Kariega 4 WEF. Noise levels however are higher than 45 dBA during the cumulative phase and mitigation is recommended to reduce the noise level below 45 dBA.

6.7.3.6 Evaluation of Alternatives

Alternative 1: No-go option

The ambient sound levels will remain as is and the area would keep the rural noise character.

Alternative 2: Proposed Renewable Power Generation activities

The proposed renewable energy activities (worst-case evaluated) will slightly raise the noise levels at a few the closest potential NSR. There is no alternative location where the wind farm can be developed as the presence of a viable wind resource determines the viability of a commercial WEF. While the location cannot be moved, the wind turbines within the WEF can be moved around, although this layout is the result of numerous evaluations and modelling to identify the most economically feasible and environmentally sustainable layout.

Considering the ambient sound levels measured on-site, the projected noise rating levels will be slightly elevated at the closest NSR and have a similar or less than the on-site ambient sound levels at NSR located further than 1,000 m from the WTG. It is slightly possible that the noise rating levels could exceed the ambient sound levels during certain periods although it is unlikely to impact on the quality of living (at night) at receptors living further than 1,000 m from WTG.

The project however will greatly assist in the provision of energy, which will allow further economic growth and development in South Africa and locally. The project will generate short and long-term employment and other business opportunities and promote renewable energy in South Africa and locally. People in the area that are not directly affected by increased noises generally have a more positive perception of the renewable projects and understand the need and desirability of the project.

6.7.3.7 Noise Impact Assessment Tables

Table 6-66: Impact Assessment: Construction of access roads.

Project phase	Construction			
Impact title	Increase in daytime ambient sound levels			
Impact description	Increase in noise levels at NSR due to construction of access roads			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Temporary	Impact will last less than 1 month.	Temporary	Impact will last less than 1 month.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minimal - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	While the construction (or upgrading) of the access roads may be very temporary, the resulting noise impact could have a major significance with a slightly detrimental consequence at NSR05 and NSR06 (or NSR07 and NSR10), depending on which access road is used, especially when these roads are close to NSR. Passing of construction traffic (during the construction phase would extend the duration of construction related noises and it is thus recommended that the applicant select appropriate mitigation, such as: • Locating access roads further than 15 m from verified NSR and further than 60 m from verified NSR if these roads may be used during the night-time period; and • Co-ordinating the construction of the access roads (within 60 m from verified NSR) during periods when the dwelling(s) is not occupied (used for residential purposes); and • Permitting only road construction (or upgrading) activities during the daytime period; and • Notifying verified NSR when activities may take place within 100m from residential dwellings.			
Comment on ratings	Daytime ambient sound levels could range from 24 dBA to more than 70 dBA, averaging at 44.7 dBA. Daytime ambient sound levels are thus typical of a rural noise district most of the times, though it is expected that introduced noises will be audible over large distances during quiet periods (during low wind conditions). Access road construction activities will introduce high noise levels on a very temporary basis, and there is a slight potential that NSR may be influenced.			

Table 6-67: Impact Assessment: Construction traffic noises.

Project phase	Construction			
Impact title	Increase in daytime ambient sound levels			
Impact description	Increase in noise levels at NSR due to construction traffic passing NSR			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minor - negative		Minor - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Very Slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	While the construction (or upgrading) of the access roads may be very temporary, the resulting noise impact could be significant and disturbing to NSR07 (or NSR05 and NSR06, depending on route used), especially when these roads are close to NSR. Passing of construction traffic extend the duration of construction related noises, and it is thus recommended that the applicant select appropriate mitigation, such as: •Locating access roads further than 15 m from verified NSR and further than 60 m from verified NSR if these roads may be used during the night-time period; and •Co-ordinating the construction of the access roads (within 60 m from verified NSR) during periods when the dwelling(s) is not occupied (used for residential purposes); and •Permitting only road construction (or upgrading) activities during the daytime period; and •Notifying verified NSR when activities may take place within 100m from residential dwellings.			
Comment on ratings	Daytime ambient sound levels could range from 24 dBA to more than 70 dBA, averaging at 44.7 dBA. Daytime ambient sound levels are thus typical of a rural noise district most of the times, though it is expected that introduced noises will be audible over large distances during quiet periods (during low wind conditions). Construction traffic passing NSR will result in increased noise levels on a short term basis, and though unlikely, some NSR may found the increased noises annoying.			

Table 6-68: Impact Assessment: Daytime WTG construction activities.

Project phase	Construction			
Impact title	Increase in daytime ambient sound levels			
Impact description	Increase in daytime noise levels at NSR due to construction activities in vicinity of NSR			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Low - negative		Low - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minimal - negative		Minimal - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The noise impact would have a minimal significance of a very slightly detrimental consequence on NSR, and additional mitigation is not required or recommended. It is however recommended that the applicant consider: •Minimizing activities when working within 2,000 m from NSR where possible; •Ensuring that construction equipment are maintained and fitted with the appropriate equipment to reduce noise emissions;			
Comment on ratings	Daytime ambient sound levels could range from 24 dBA to more than 70 dBA, averaging at 44.7 dBA. Daytime ambient sound levels are thus typical of a rural noise district most of the times, though it is expected that introduced noises will be audible over large distances during quiet periods (during low wind conditions). Construction activities may at times increase ambient sound levels, especially when noises contain impulsive sounds (such as pile driving or rock breaking), though it is unlikely to influence the quality of living of NSR.			

Table 6-69: Impact Assessment: Night-time WTG construction activities.

Project phase	Construction			
Impact title	Increase in night-time ambient sound levels			
Impact description	Increase in night-time noise levels at NSR due to construction activities in vicinity of NSR			
Impact Assessment	Impact not mitigated			Impact mitigated
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minor - negative		Minimal - negative	
Importance	High	High	Moderate	Moderate
Consequence	Very Slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The significance of the noise impact is minor, with a very slightly detrimental consequence for night-time construction activities. Additional mitigation is not required or recommended. However, night-time construction activities may generate noises that some NSR may find annoying and it is recommended that the applicant consider: •Minimizing night-time activities when working within 2,000 m from NSR where possible; •The applicant must notify the NSR when night-time activities will be taking place within 1,000 m from the NSR; and •The applicant must plan the completion of noisiest activities (such a pile driving, rock breaking and excavation) during the daytime period (even though it is expected that it is highly unlikely that this may take place at night).			
Comment on ratings	Night-time ambient sound levels could range from 21 dBA to more than 60 dBA, averaging at 37.7 dBA. Night-time ambient sound levels are thus typical of a rural to sub-urban noise district most of the times, though it is expected that introduced noises will be audible over large distances during quiet periods (during low wind conditions). Construction activities may at times increase ambient sound levels, especially when noises contain impulsive sounds, though construction noises are unlikely to influence the quality of living of NSR.			

Table 6-70: Impact Assessment: Daytime operation of WTG considering the worst-case SPL.

Project phase	Operation			
Impact title	Increase in daytime ambient sound levels			
Impact description	Increase in daytime noise levels at NSR due to the operation of the WTG			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minor - negative		Minimal - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Very Slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The potential significance of the daytime noise impact was estimated at minimal, with a very slightly detrimental consequence. No additional mitigation is required or recommended for daytime operational activities.			
Comment on ratings	WTG will only operate during period with increased winds, when ambient sound levels are higher than periods with no or low winds. As discussed and motivated in section 6.4 (as illustrated in Figures 4-28 and 4-29), ambient sound levels will likely be higher, with this assessment assuming an ambient sound level of 41.5 dBA (for a 8 m/s wind speed). Numerous WTG of the Kariega 2 WEF operating simultaneously during the day will increase ambient sound levels due to air-borne noise from the WTG. Ambient sound levels are normally higher during the daytime period, with receptors generally more active and distracted which would decrease the probability of an impact occurring (when compared to the night-time period).			

Table 6-71: Impact Assessment: Night-time operation of WTG considering the worst-case SPL.

Project phase	Operation			
Impact title	Increase in night-time ambient sound levels			
Impact description	Increase in night-time noise levels at NSR due to the operation of the WTG			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - Negative		Moderate - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Minor - negative		Minimal - Negative	
Importance	High	High	High	High
Consequence	Very Slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The significance of the noise impact is minor, with the consequence very slightly detrimental. The potential noise impact during the night-time period is low and no additional mitigation is required or recommended.			
Comment on ratings	WTG will only operate during period with increased winds, when ambient sound levels are higher than periods with no or low winds. As discussed and motivated in section 6.4 (as illustrated in Figures 4-28 and 4-29), ambient sound levels will likely be higher, with this assessment assuming an ambient sound level of 41.5 dBA (for a 8 m/s wind speed). Numerous WTG of the Kariega 3 WEF operating simultaneously at night will increase ambient sound levels due to air-borne noise from the WTG. It is expected that the WTG will be audible at NSR up to 2,500m from NSR (for the layout and WTG as assessed).			

Table 6-72: Impact Assessment: Potential Decommissioning Noise Impacts.

Project phase	Decommissioning			
Impact title	Increase in daytime ambient sound levels			
Impact description	Increase in daytime noise levels at NSR due to decommissioning activities in vicinity of NSR			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Low - negative		Low - negative	
Probability	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.	Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.
Significance	Minimal - negative		Minimal - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	There is a very slightly detrimental impact on NSR, and additional mitigation is not required or recommended.			
Comment on ratings	Daytime ambient sound levels could range from 24 dBA to more than 70 dBA, averaging at 44.7 dBA. Daytime ambient sound levels are thus typical of a rural noise district most of the times, though it is expected that introduced noises will be audible over large distances during quiet periods (during low wind conditions). Decommissioning activities may at times increase ambient sound levels, especially when noises contain impulsive sounds, though it is unlikely to influence the quality of living of NSR.			

Table 6-73: Impact Assessment: Potential Cumulative Noise Impacts.

Project phase	Operation			
Impact title	Increase in night-time ambient sound levels due to cumulative effects			
Impact description	Increase in night-time noise levels at NSR due to the operation of the WTG from various WEFs in vicinity of Kariega			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Major - negative		Minimal - Negative	
Importance	High	High	High	High
Consequence	Highly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The significance of potential cumulative night-time noise impact is Major, with the consequence being highly detrimental. The simultaneous operation of the WTG Kariega 3 WEF and Kariega 4 WEF will result in a noise level exceeding 45 dBA (the upper noise limit) at NSR04 and NSR12 (cumulatively raising the noise level at NSR04 and NSR12 higher than 45 dBA, though the noise mainly stem from the operating WTG of Kariega 4 WEF). Mitigation is required and it is recommended that: -the applicant design and implement a noise abatement programme, which may include operating certain wind turbines in a reduced noise emission mode at night (it will be required that the applicant select a WTG that have the capability to operate in a reduced noise emission modes). For this layout, this will require operating a WTG (or using a WTG) with a SPL less than 109.8 dBA (re 1 pW) within 2,500 m of NSR04 and NSR12. This layout and specific details of the selected WTG must be modelled to ensure that noise levels are less than 45 dBA at all NSR (noise levels should be modelled to determine the optimal noise abatement programme for the WTG around of NSR04 and NSR12); or -The applicant can change to layout (as part of a future amendment post EA) to move certain WTG further from verified NSR (the layout should be modelled to ensure that the potential noise levels will be less than 45 at all NSR). It might be required to operate certain WTG in a reduced noise mode; or -The applicant can reduce the number of WTG (as part of a future amendment post EA) located within 2,500m from NSR04 and NSR12 (the layout should be modelled to ensure that the potential noise levels will be less than 45 at all NSR). It might be required to operate certain WTG in a reduced noise mode; or -The applicant can relocate certain of the verified NSR, or reach agreement with the land owner(s) that the structures (or some of the structures) at NSR04 and NSR12 will not be used for permanent residential use if the Kariega 3 WEF and Kariega 4 WEF proceeds.			
Comment on ratings	WTG will only operate during period with increased winds, when ambient sound levels are higher than periods with no or low winds. As discussed and motivated in section 6.4 (as illustrated in Figures 4-28 and 4-29), ambient sound levels will likely be higher, with this assessment assuming an ambient sound level of 41.5 dBA (for a 8 m/s wind speed). Numerous WTG of the Kariega 3 and Kariega 4 WEFs operating simultaneously at night will cumulatively increase ambient sound levels due to air-borne noise from the WTG. It is expected that the WTG will be audible at NSR up to 2,000m from NSR (for the layout and WTG as assessed).			

6.7.4 Conclusion and Recommendations

This Environmental Noise Impact Assessment was undertaken to establish the potential noise impacts of the proposed development, operation and decommissioning of the Kariega 4 WEF (and associated infrastructure) west of Aberdeen in the Eastern Cape Province. It is based on a predictive model to estimate potential noise levels due to the various activities and to assist in the identification of potential issues of concern.

It was determined that the potential noise impacts, without mitigation, would be:

- of a moderate negative significance with a slightly detrimental consequence for the construction of access roads. Mitigation measures are available that could reduce the significance and consequence to a very slight detrimental rating;
- of a minor negative significance with a very slightly detrimental consequence relating to noises from construction traffic;
- of a minimal negative significance with a very slightly detrimental consequence for the daytime construction activities (hard standing areas, excavation and concreting of foundations and the assembly of the WTG and other infrastructure);
- of a minor negative significance with a slightly detrimental consequence for the night-time construction activities (the potential pouring of concrete, erection of WTG). Mitigation measures are available that could reduce the significance and consequence to a very slight detrimental rating;
- of a minor negative significance with a slightly detrimental consequence for daytime operational activities (noises from wind turbines) when considering the worst-case SPL. The slightly detrimental consequence is mainly due to the strict EIA criteria used though mitigation measures are available that could reduce the significance and consequence to a very slight detrimental rating;
- of a moderate negative significance with a moderately detrimental consequence for night-time operational activities (noises from wind turbines) when considering the worst-case SPL. Mitigation measures are available that would reduce the significance of the noise impact to a slightly detrimental consequence if required; and
- of a minimal significance with a very slightly detrimental consequence for potential future decommissioning activities.

There is a major negative significance with a highly detrimental consequence for a cumulative noise impact to occur during the operational phase. Noise levels would be higher than 45 dBA at NSR04 and NSR12 due to cumulative effects from both the Kariega 4 WEF and Kariega 4 WEF operating. The noise levels are mainly linked with operating WTG of the Kariega 4 WEF. Mitigation measures are available and were recommended to reduce the noise level to less than 45 dBA (and reduce the significance of the noise impact to a very slightly detrimental consequence) at all NSR.

Active noise monitoring is recommended because the projected noise levels could be more than 42 dBA (more than 7 dBA of the night-time rating level of a rural noise district) for the layout and WTG as evaluated (noise monitoring will be required for any WTG with an SPL exceeding 106.8 dBA (re 1 pW)).

The WTG layout of the Kariega 4 WEF is considered acceptable for a WTG with a SPL up to 114 dBA (re 1 pW). Should the applicant select a WTG with a higher SPL, additional mitigation might be required to ensure that night-time noise levels are less than 45 dBA at all NSR used for permanent residential use. It is therefore recommended that the proposed Kariega 4 WEF (and associated infrastructure) be authorized.

If the project is to be developed in the future, the final layout and sound power emission levels of the selected WTG must be modelled to ensure the night-time noise levels are less than 45 dBA at verified NSR. Daytime noise levels should be less than 7 dBA from the expected daytime ambient sound levels at the relevant wind speed, with an upper limit of 55 dBA.

It should be noted, if the Kariega 4 WEF are developed with the Kariega 3 WEF, noise levels could exceed 45 dBA at NSR04 and NSR12. The applicant should discuss the noise levels with the developer of the Kariega 4 WEF and appropriate mitigation measures must be selected to ensure that noise levels are less than 45 dBA at night at NSR04 and NSR12.

It is recommended that the applicant re-evaluate the noise impact:

1. should the layout be revised where:

- a. any WTG, located within 2,500 m from any NSR are moved closer;
- b. the number of WTG within 2,500 m from any NSR are increased; and

2. should the applicant make use of a wind turbine with a maximum SPL exceeding 110.5 dBA re 1 pW.

In addition, to ensure that noise does not become an issue for future or current residents or the local community, it is advised that the applicant recommend current landowners that no new residential dwellings be developed within areas enveloped by the 42 dBA noise level contour. Structures located within the 45 dBA noise level contour should not be used for permanent residential use.

6.8 Avifauna (Birds)

The Avifauna Impact Assessment (AIA) was undertaken by Jon Smallie of WildSkies Ecological Services. The applicant refined the developable area based on identified avifaunal constraints and WildSkies undertook the necessary 12 months pre-construction bird monitoring for the developable area (parts of the site were monitored for an additional 6 months). Based on data collected on site during pre-construction bird monitoring, we classified four bird species as being at High risk should the project proceed. High risk species includes the Ludwig's Bustard (Endangered), Southern Black Korhaan (Vulnerable), Karoo Korhaan (Near-threatened), and Blue Crane (Near-threatened). Through a process of redesigning the WEF to avoid area specific sensitivities and density dependent sensitivities, the latest layout of 42 WTG and ancillary infrastructure was configured. It was concluded that the impact significance ratings of the latest design are at acceptable levels post mitigation and the project may be authorised.

The full specialist report is attached hereto as Annexure D 7, Avifauna (Birds) Impact Assessment (2024).

6.8.1 Baseline Description

6.8.1.1 Vegetation and habitat

The proposed project site is comprised mostly of “Upper Karoo Hardeveld”, “Eastern Lower Karoo” and “Southern Karoo Riviere” (Figure 6-69). Effectively, a number of micro habitats are available to birds in the area which includes: man-made dams, wetlands, streams/drainage lines, rocky ridges & small cliffs, limited grassland, Karoo shrubland and small areas of pasture/crops (Figure 6-70).

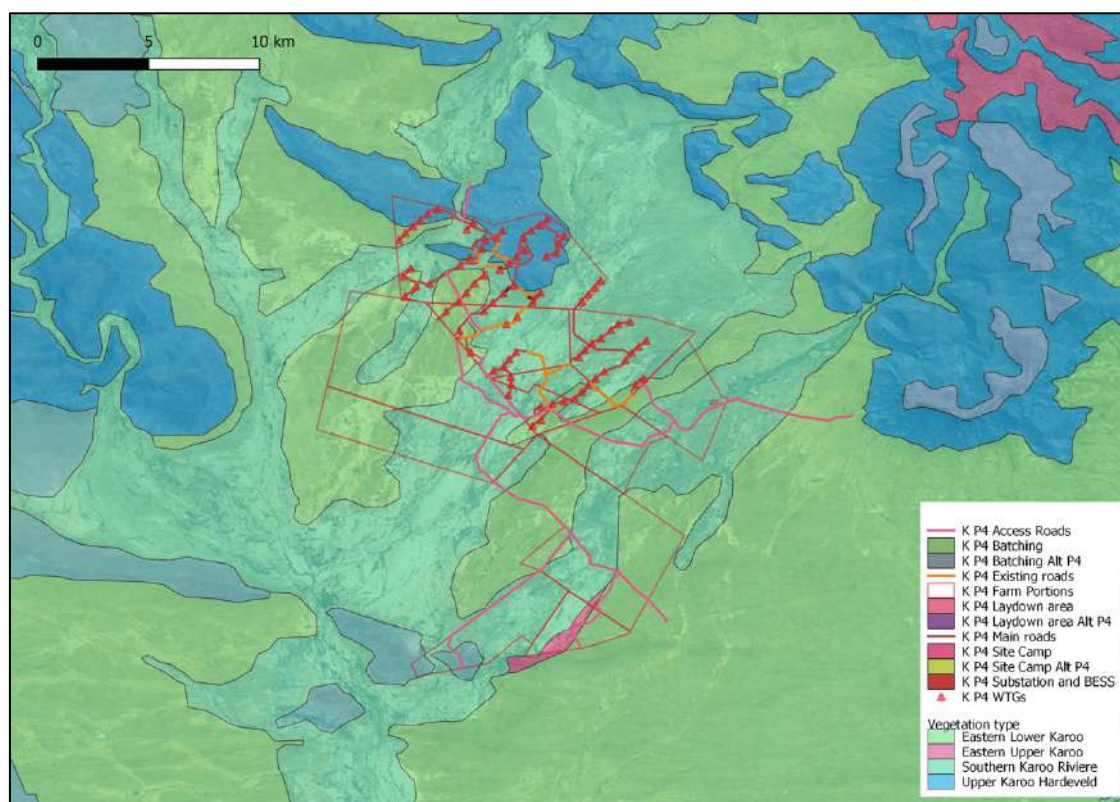


Figure 6-69: Vegetation units present on and surrounding the site (Mucina & Rutherford 2012).



Figure 6-70: Typical micro-habitats available to birds in the study area.

6.8.1.2 Avifaunal Community

Data from the various methodologies have been analysed for the 12-months of pre-construction avifaunal monitoring and are presented for the full site (all four projects) throughout this report. While the spatial scope of our data collection presented here is larger than the developable area of the project alone, the habitat, vegetation and resources concerned from an avian perspective are similar. The excellent mobility of birds warrants a study wider than within the strict boundary of the redesigned project site, and it is our opinion that this approach strengthens our confidence in the findings. We present only the on-site findings and analyses most relevant to the proposed project where it is applicable.

Throughout the year of avifaunal monitoring, observers identified 204 bird species on site across all method. Site visit totals ranged from 95 (August) to 167 (January) species. Thirteen species observed to occur on the site are Red Listed: Martial Eagle, Ludwig's Bustard and Black Harrier are Endangered; Verreaux's Eagle, Lanner Falcon, Secretarybird, Southern Black Korhaan and Burchell's Courser *Cursorius rufus* are Vulnerable; and Blue Crane, Karoo Korhaan *Eupodotis vigorsii*, Sclater's Lark *Spizocorys sclateri*, and Kori Bustard *Ardeotis kori* are Near-Threatened.

6.8.1.3 Small terrestrial bird species

A total of 91 bird species was recorded on the Walked Transects on the site through the year. This included 1 448 records of 4 293 individual birds. Twenty-four kilometres of transects were completed per season for the

first four seasons, and nine kilometres thereafter. An average of 40 birds per walked kilometre was calculated. Table 6-74 shows the data for the full year for the 20 most abundant species. In each case the number of birds, number of records, and number of birds per kilometre of transect are presented. Although the index of birds per kilometre is relatively crude, it will be used primarily to compare the effects of the facility on these species post-construction. If more complex analysis is required during post-construction monitoring to demonstrate effects, the raw data is available for this purpose.

The most abundant species encountered on the Walked Transects were not surprisingly all species already known to be common in the area, such as: Red-billed Quelea *Quelea quelea*; Wattled Starling *Creatophora cinerea*; and Grey-backed Sparrowlark *Eremopterix verticalis*. These three species are very gregarious and were often encountered in large flocks.

Of the 91 species identified on the Walked Transects, none are regionally Red Listed. A number are endemic or near-endemic. These include Black-eared Sparrow-lark *Eremopterix australis*, Large-billed Lark *Galerida magnirostris*, Sickie-winged Chat *Emarginata sinuata*, Fiscal Flycatcher *Melaenornis silens*, Fairy Flycatcher *Stenostira scita*, Black-headed Canary *Serinus alario*, Grey Tit *Melaniparus afer*, Karoo Eremomela *Eremomela gregalis*, Karoo Prinia *Prinia maculosa*, and Cape Clapper Lark *Mirafrapiata*.

The small terrestrial bird community on site is as expected for a semi-arid Nama Karoo area. There are no particularly concerning species present on site that were detected by Walked Transects, although Near-threatened Sclater's Lark have been recorded on site by other methods. This arid-adapted near-endemic species is a nomad in this region and its isolated populations are unpredictable in space and time (Peacock 2012). Sclater's Lark is relatively cryptic and unobtrusive when not calling and is most typically noticed when drinking from a water source.

6.8.1.4 Large terrestrial species & raptors

A total of 12 large terrestrial and raptor species were recorded across the drive transects totalling 345.2 kilometres on the site through the year. This included 203 individual birds from 114 records. The data for the full year collectively are shown in Table 6-75. In each case, the species' regional and global Red List and endemism status are shown. Seven species are regionally Red Listed: Ludwig's Bustard is Endangered; Southern Black Korhaan, Lanner Falcon and Secretarybird are Vulnerable; and Karoo Korhaan, Blue Crane and Kori Bustard are Near-threatened (Taylor *et al.* 2015). In terms of the number of individuals sighted, the most abundant species recorded by this method was the Ludwig's Bustard, with 22 records of a total of 62 birds. Southern Black Korhaan and Karoo Korhaan were the next most abundant. Ludwig's Bustard was often recorded in groups, whilst the two korhaans were recorded singly or in ones and twos.

The large terrestrial birds and raptors are the most important sector of the avifauna on this site, with several regionally Red Listed species included. Most of the priority species for the site come from this sector.

6.8.1.5 Focal Site surveys

Four Verreaux's Eagle nests were located in the broader study area during the screening assessment. These nests and/or territories have proven active and occupied during our monitoring programme. One Martial Eagle nest was located outside the site and has been active. Our last survey found the nest tree has fallen over, but the adult eagles are still in the area and we believe they will probably rebuild a new nest in one of the nearby trees. A Black Harrier nest exists site off site, approximately 15km east of site in the higher lying mountainous area. We monitored this through the programme, and found no breeding activity in 2021, but there was

activity in 2022. A Secretarybird nest found early in the programme was not used during 2021 or 2022 as far as we could tell. The remaining focal sites were a mix of dams and other features such as arable lands.

6.8.1.6 Incidental Observations of target bird species

A total of 30 species were recorded on the site as Incidental Observations, the summary of which is provided in Table 6-76. The most abundant species (by a significant margin) recorded by this method was Karoo Korhaan, with 395 records made of 806 birds. Ludwig's Bustard was the second most abundant species with 188 records of 620 birds. Eleven of the species recorded by this method are regionally Red Listed. These include three Endangered species (Ludwig's Bustard, Martial Eagle and Black Harrier); four Vulnerable species (Verreaux's Eagle, Lanner Falcon, Southern Black Korhaan & Secretarybird); and four Near-threatened species (Blue Crane, Karoo Korhaan, Sclater's Lark & Kori Bustard). Since these data are not the product of systematic data collection methods, they should be used cautiously, and we do not discuss these findings any further here.

6.8.1.7 Bird flight activity on site

A total of 1 224 hours of bird flight observation were completed on site. Overall, 25 target bird species were recorded flying on the site during the Vantage Point surveys. These data are shown in Table 6-77, summarised for the full year. Ten of these 25 species are regionally Red Listed (Taylor *et al.* 2015): Black Harrier, Ludwig's Bustard and Martial Eagle are Endangered; Verreaux's Eagle, Lanner Falcon, Southern Black Korhaan and Secretarybird are all Vulnerable; and Blue Crane, Kori Bustard and Karoo Korhaan are Near-Threatened. Three species are regionally endemic or near-endemic: Southern Black Korhaan, Karoo Korhaan and Jackal Buzzard *Buteo rufofuscus*.

Table 6-77 also presents each species' overall passage rate (birds/hour). The species recorded flying most frequently on site during dedicated Vantage Point sessions was the Ludwig's Bustard, with a passage rate of 0.341 birds per hour. Blue Crane was second most abundant, with 0.219 birds/hour, and Southern Black Korhaan third with 0.109 birds/hour.

6.8.1.8 Estimating turbine collision fatality rates

Crude turbine collision fatality rates were calculated for each bird species to estimate how many bird fatalities could occur at the proposed wind farm once operational. This was based on the species' passage rates (number of birds recorded flying per hour) recorded on site. We expect those species which fly more often to be more susceptible to turbine collision. In order to calculate crude passage rates for each species, we assumed that the 2 km radius around Vantage Points was approximately equal to the maximum distance over which sightings were made, and that the coverage was approximately circular. This meant that at each Vantage Point an area of 12.57km² was sampled ($A=\pi r^2$). Secondly, we assumed that the area of the wind farm directly presenting a collision risk is described by the area of each turbine's rotor zone multiplied by the number of turbines. We assumed a turbine model with a rotor swept area of 31 415.93m² (largest proposed rotor diameter of 200m) and a layout of up to 80 (now 42) turbines. This equates to a wind farm collision risk area of 2.5133km² (80 x 31 415.93m²). Thirdly, we assumed that the survey area around each of the Vantage Points was a representative sample of the area in which built turbines will operate. Fourthly we assumed that species passage rates calculated from our six site visits of sampling can be reasonably extrapolated to annual passage rates (by multiplying hourly passage rates by the number of hours that birds are exposed to collision risk (An online tool (<https://observablehq.com/@dbridges/visualizing-seasonal-daylight>) was used to establish that 4

440 daylight hours will be experienced per year at the site, and this was multiplied by 0.9 to accommodate 10 % turbine downtime). Resident species were assumed to be exposed to risk for 12 months, whereas migrants were exposed for 6 months. We also assumed a 98% avoidance rate for these birds, i.e., 2% of birds passing through the rotor zone would collide with blades (as recommended by Scottish Natural Heritage guidance for species for which no established avoidance rate is available, www.project-gpwind.eu).

We believe that the estimated pre-mitigation fatality rates are over-estimations for the following reasons: no consideration is given to actual turbine locations relative to actual flight path positions (the species average passage rate was applied to the full turbine layout); species flights of all heights above ground were used; a relatively conservative avoidance rate of 98% was used; and these calculations are before any mitigation is applied.

Although the calculations we have made are not a Collision Risk Model (CRM-Scottish Natural Heritage) some of the principles and assumptions made are similar. In South Africa, one of the main reasons CRM is not often used is that we have not established accurate species-specific avoidance rates yet, and the model is so sensitive to these avoidance rates. For example, if we used a 99% avoidance rate it would halve the estimated number of fatalities calculated as described below. Our confidence in these estimates is therefore low, but protocols require us to produce these estimates.

Using the above-described methods, it is estimated that approximately 17.05 bird fatalities could be recorded pre-mitigation at the wind farm per year across the 25 target bird species recorded flying on site (Table 6-78). This includes most importantly the following large terrestrial bird species fatalities:

- 5.44 Ludwig's Bustards
- 3.50 Blue Cranes
- 1.74 Southern Black Korhaans
- 1.71 Karoo Korhaans

We strongly recommend that any opportunity to raise the lower blade tip to at least 50m above ground as this will significantly reduce the bird collision risk. Human caused fatalities of Red Listed or otherwise threatened bird species are always cause for concern and should be avoided as far as possible. It is essential that all mitigation measures recommended in this report be implemented to ensure that these fatality rates are reduced where possible. It is also essential that an adaptive management approach be adopted, ensuring that the wind farm is prepared to respond timeously and effectively if unsustainable impacts are detected.

Table 6-74: Small passerine bird data from Walked Transects for all six site visits for the 20 most abundant species.

				S1		S2		S3		S4		S5		S6	
		# species	94	45		60		52		56		36		38	
		Transect length	105	21		24		21		21		9		9	
Species	Total # Birds	Total # rec	Birds/km	Birds	Rec	Birds	Rec	Birds	Rec	Birds	Rec	Birds	Rec	Birds	Rec
Red-billed Quelea	891	46	8.49	1	1	469	17	136	7	147	11	106	5	32	5
Wattled Starling	531	30	5.06			265	16	7	3	194	7			65	4
Grey-backed Sparrow-Lark	432	99	4.11	126	11	78	30	29	14	30	13	50	7	119	24
Pink-billed Lark	236	43	2.25			30	8	64	15	79	4	21	8	42	8
Lark-like Bunting	204	91	1.94	5	5	105	33	47	29	17	10	21	11	9	3
African Pipit	155	88	1.48	5	5	33	16	33	18	42	30	17	9	25	10
Spike-heeled Lark	132	58	1.26	24	10	16	11	30	16	42	13	11	5	9	3
Black-headed Canary	129	37	1.23			2	1	1	1	114	31	12	4		
Rufous-eared Warbler	124	88	1.18	11	11	11	11	37	25	34	21	11	8	20	12
Eastern Clapper Lark	93	62	0.89	1	1	30	24	5	5	17	12	12	8	28	12
Large-billed Lark	93	72	0.89	7	6	16	14	17	12	25	21	16	10	12	9
Black-eared Sparrow-Lark	89	18	0.85									11	5	78	13
Red-winged Starling	76	4	0.72							17	2	59	2		
Sickle-winged Chat	67	46	0.64	13	9	13	11	19	12	16	10	6	4		
Yellow-bellied Eremomela	56	50	0.53	8	7	7	7	8	7	24	20	6	6	3	3
Pied Crow	55	40	0.52	18	11	9	6	9	7	12	11	5	4	2	1
Desert Cisticola	54	44	0.51			20	13	13	11	11	10	6	6	4	4
Sabota Lark	54	46	0.51	15	13	18	17	10	8	11	8				
Red-capped Lark	51	41	0.49	9	9	14	9	5	3	20	18	1	1	2	1
Speckled Pigeon	49	8	0.47			20	3			1	1	25	3	3	1

*Regional Red List status according to Taylor et al. 2015 – most recent regional conservation status for species

*Global Red List status according to IUCN 2022

EN = Endangered; VU = Vulnerable; NT = Near-threatened; LC = Least Concern

**Endemism – whether the species is endemic (E) or near endemic (NE) to South Africa.

E = Endemic; NE = Near-endemic; SLS = Endemic to South Africa, Lesotho & Swaziland; BNE = Breeding near endemic

Retief et al. 2014 – the species ranking in terms of turbine collision risk – as per Avian Wind Farm Sensitivity Map

(This key applies to all following species tables)

Table 6-75: Summary of large terrestrial & raptor species recorded on the Drive Transects at the site.

			Full year		
		Transect length (km)	345.2		
		# species	12		
Common Name	Red Data (Regional, Global)	Endemism	Birds	Records	Birds/km
Ludwig's Bustard	EN, EN		62	22	0.18
Southern Black Korhaan	VU, VU	E	42	36	0.12
Karoo Korhaan	NT, LC		36	15	0.10
Pale Chanting Goshawk			22	18	0.06
Double-banded Courser			12	8	0.03
Blue Crane	NT, VU		8	5	0.02
Eurasian Hobby			8	1	0.02
Lanner Falcon	VU, LC		5	4	0.01
Kori Bustard	NT, NT		4	2	0.01
South African Shelduck			2	1	0.01
Booted Eagle			1	1	0.00
Secretarybird	VU, VU		1	1	0.00

Table 6-76: Summary of Incidental Observations of relevant bird species on the site.

				Full year	
			# Species	30	
Common Name	Scientific Name	Red Data (Regional, Global)	Endemism	Birds	Records
Karoo Korhaan	<i>Eupodotis vigorsii</i>	NT, LC		806	395
Ludwig's Bustard	<i>Neotis ludwigii</i>	EN, EN		620	188
Blue Crane	<i>Grus paradisea</i>	NT, VU		466	99
Southern Black Korhaan	<i>Afrotis afra</i>	VU, VU	E	186	160
Pale Chanting Goshawk	<i>Melierax canorus</i>			96	82
Double-banded Courser	<i>Rhinoptilus africanus</i>			91	65
Lanner Falcon	<i>Falco biarmicus</i>	VU, LC		61	35
Kori Bustard	<i>Ardeotis kori</i>	NT, NT		29	20
Common Buzzard	<i>Buteo buteo</i>			25	17
Spotted Eagle-Owl	<i>Bubo africanus</i>			15	12
South African Shelduck	<i>Tadorna cana</i>			15	10
Yellow-billed Kite	<i>Milvus aegyptius</i>			14	2
Northern Black Korhaan	<i>Afrotis afraoides</i>			9	7
Verreaux's Eagle	<i>Aquila verreauxii</i>	VU, LC		7	3
Booted Eagle	<i>Hieraeetus pennatus</i>			5	5
Sclater's Lark	<i>Spizocorys sclateri</i>	NT, NT	NE	5	4
Black Harrier	<i>Circus maurus</i>	EN, EN		4	4
Rock Kestrel	<i>Falco rupicolus</i>			4	3
African Fish Eagle	<i>Haliaeetus vocifer</i>			4	4
Martial Eagle	<i>Polemaetus bellicosus</i>	EN, VU		4	4
Blue Korhaan	<i>Eupodotis caerulescens</i>	LC, NT	SLS	4	1
Secretarybird	<i>Sagittarius serpentarius</i>	VU, VU		3	3
Black-winged Kite	<i>Elanus caeruleus</i>			2	2
Eurasian Hobby	<i>Falco subbuteo</i>			2	1
Greater Kestrel	<i>Falco rupicoloides</i>			2	2
Jackal Buzzard	<i>Buteo rufofuscus</i>		NE	1	1
African Harrier-Hawk	<i>Polyboroides typus</i>			1	1
Gabar Goshawk	<i>Micronisus gabar</i>			1	1
Brown Snake Eagle	<i>Circaetus cinereus</i>			1	1
Temminck's Courser	<i>Cursorius temminckii</i>			1	1

Table 6-77: Target bird species recorded during Vantage Point counts at the site.

				Full year		
		# hours		1224		
		# species		25		
Common name	Taxonomic name	Global, regional	Endemic	Birds	Records	Birds /hr
Ludwig's Bustard	<i>Neotis ludwigii</i>	EN, EN		417	186	0.341
Blue Crane	<i>Grus paradisea</i>	NT, VU		268	68	0.219
Southern Black Korhaan	<i>Afrotis afra</i>	VU, VU	E	133	101	0.109
Karoo Korhaan	<i>Eupodotis vigorsii</i>	NT, LC		131	64	0.107
South African Shelduck	<i>Tadorna cana</i>			108	56	0.088
Pale Chanting Goshawk	<i>Melierax canorus</i>			96	76	0.078
Lanner Falcon	<i>Falco biarmicus</i>	VU, LC		68	48	0.056
Common Buzzard	<i>Buteo buteo</i>			18	14	0.015
Rock Kestrel	<i>Falco rupicolus</i>			12	12	0.010
Booted Eagle	<i>Hieraaetus pennatus</i>			12	11	0.010
Kori Bustard	<i>Ardeotis kori</i>	NT, NT		11	10	0.009
Northern Black Korhaan	<i>Afrotis afraoides</i>			10	7	0.008
Verreaux's Eagle	<i>Aquila verreauxi</i>	VU, LC		8	8	0.007
Greater Kestrel	<i>Falco rupicoloides</i>			8	8	0.007
Double-banded Courser	<i>Rhinoptilus africanus</i>			8	7	0.007
Hamerkop	<i>Scopus umbretta</i>			7	5	0.006
Black Harrier	<i>Circus maurus</i>	EN, EN		5	5	0.004
Secretarybird	<i>Sagittarius serpentarius</i>	VU, VU		3	2	0.002
Martial Eagle	<i>Polemaetus bellicosus</i>	EN, VU		3	3	0.002
Eurasian Hobby	<i>Falco subbuteo</i>			3	3	0.002
Black-winged Kite	<i>Elanus caeruleus</i>			2	2	0.002
Jackal Buzzard	<i>Buteo rufofuscus</i>		NE	2	2	0.002
Yellow-billed Kite	<i>Milvus aegyptius</i>			1	1	0.001
Blue Korhaan	<i>Eupodotis caerulescens</i>	LC, NT	SLS	1	1	0.001
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>			1	1	0.001

Table 6-78: Target bird species passage rates and estimated turbine collision fatalities at the site, calculated for up to 80 (now 42) turbines.

Common name	Scientific name	Status	# flights	Birds/hr at VP	Birds/yr at VP	Birds/yr through rotor zone	Ann. Fat. rate (98% avoidance)
			All species		4263.71	852.49	17.05
Ludwig's Bustard	<i>Neotis ludwigii</i>	EN, EN	417	0.341	1361.38	272.20	5.44
Blue Crane	<i>Grus paradisea</i>	NT, VU	268	0.219	874.94	174.94	3.50
Southern Black Korhaan	<i>Afrotis afra</i>	VU, VU, E	133	0.109	434.21	86.82	1.74
Karoo Korhaan	<i>Eupodotis vigorsii</i>	NT, LC	131	0.107	427.68	85.51	1.71
South African Shelduck	<i>Tadorna cana</i>		108	0.088	352.59	70.50	1.41
Pale Chanting Goshawk	<i>Melierax canorus</i>		96	0.078	313.41	62.66	1.25
Lanner Falcon	<i>Falco biarmicus</i>	VU, LC	68	0.056	222.00	44.39	0.89
Common Buzzard	<i>Buteo buteo</i>		18	0.015	29.38	5.87	0.12
Rock Kestrel	<i>Falco rupicolus</i>		12	0.010	39.18	7.83	0.16
Booted Eagle	<i>Hieraaetus pennatus</i>		12	0.010	39.18	7.83	0.16
Kori Bustard	<i>Ardeotis kori</i>	NT, NT	11	0.009	35.91	7.18	0.14
Northern Black Korhaan	<i>Afrotis afraoides</i>		10	0.008	32.65	6.53	0.13
Verreaux's Eagle	<i>Aquila verreauxi</i>	VU, LC	8	0.007	26.12	5.22	0.10
Greater Kestrel	<i>Falco rupicoloides</i>		8	0.007	26.12	5.22	0.10
Double-banded Courser	<i>Rhinoptilus africanus</i>		8	0.007	26.12	5.22	0.10
Hamerkop	<i>Scopus umbretta</i>		7	0.006	22.85	4.57	0.09
Black Harrier	<i>Circus maurus</i>	EN, EN	5	0.004	16.32	3.26	0.07
Secretarybird	<i>Sagittarius serpentarius</i>	VU, VU	3	0.002	9.79	1.96	0.04
Martial Eagle	<i>Polemaetus bellicosus</i>	EN, VU	3	0.002	9.79	1.96	0.04
Eurasian Hobby	<i>Falco subbuteo</i>		3	0.002	4.90	0.98	0.02
Black-winged Kite	<i>Elanus caeruleus</i>		2	0.002	6.53	1.31	0.03
Jackal Buzzard	<i>Buteo rufofuscus</i>	NE	2	0.002	6.53	1.31	0.03
Yellow-billed Kite	<i>Milvus aegyptius</i>		1	0.001	1.63	0.33	0.01
Blue Korhaan	<i>Eupodotis caeruleus</i>	LC, NT, SLS	1	0.001	3.26	0.65	0.01
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>		1	0.001	3.26	0.65	0.01

6.8.1.9 Spatial location of flight records

The spatial location of all target bird species flight records for the full site, for the full year of pre-construction monitoring, can be seen below in Figure 6-71. The flight path data for regionally Red Listed bird species only is presented in Figure 6-72, to eliminate the clutter created by more common species. Figure 6-72 shows a close view of the proposed project. No significant patterns in flight activity are discernible, likely because of the flat topography and uniform habitat on site.

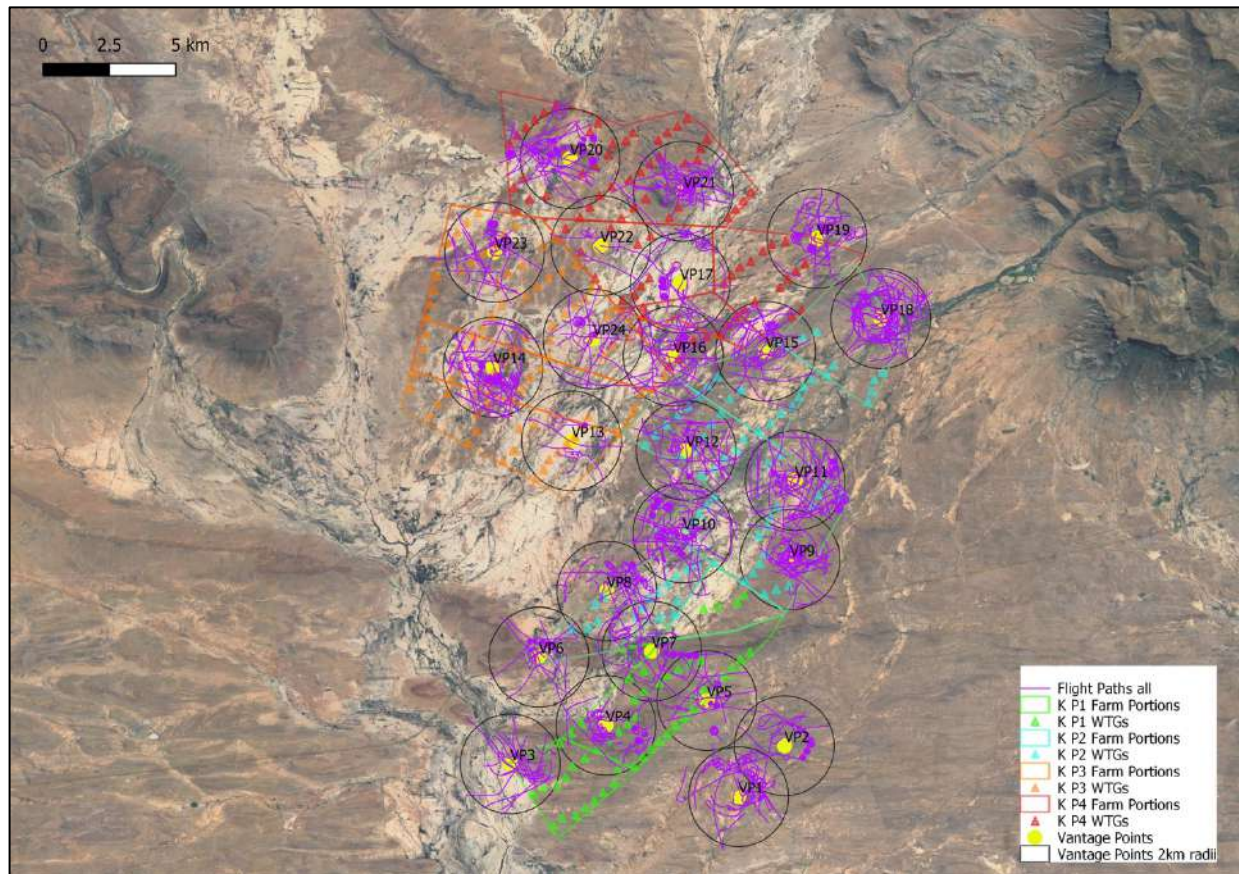


Figure 6-71: Recorded target bird species flight paths at the site (all species, all seasons).

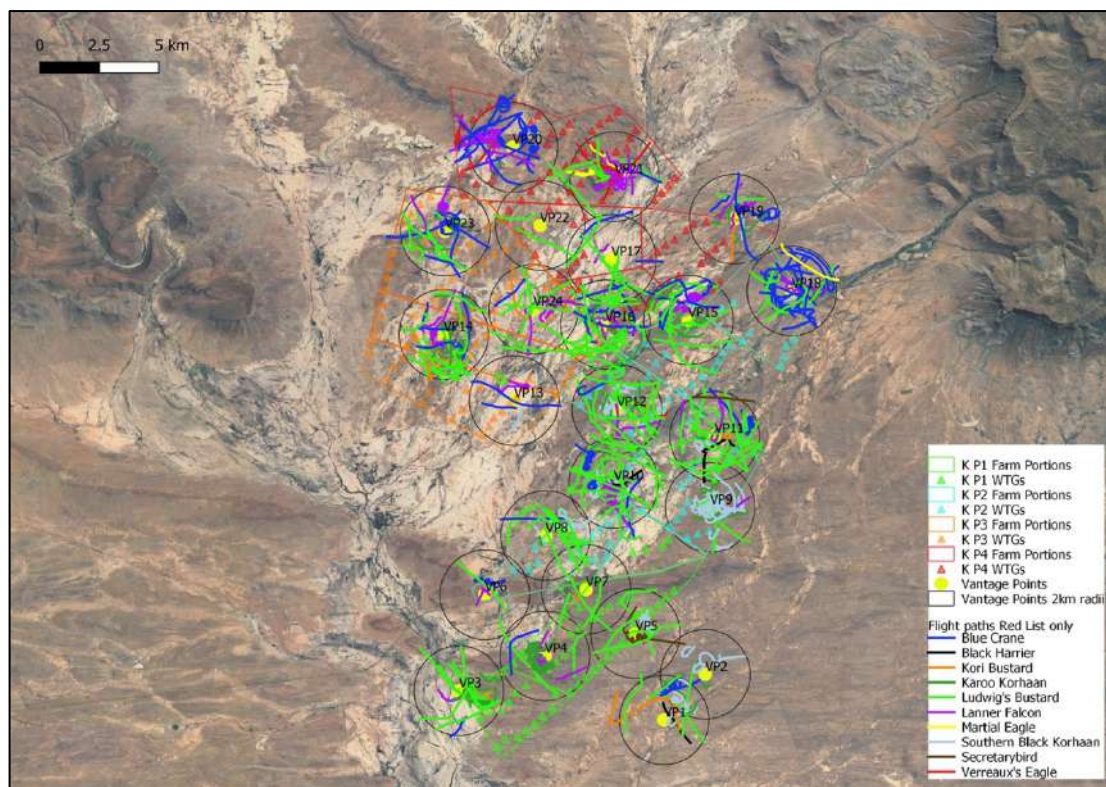


Figure 6-72: Regionally Red Listed species flight paths (full year).

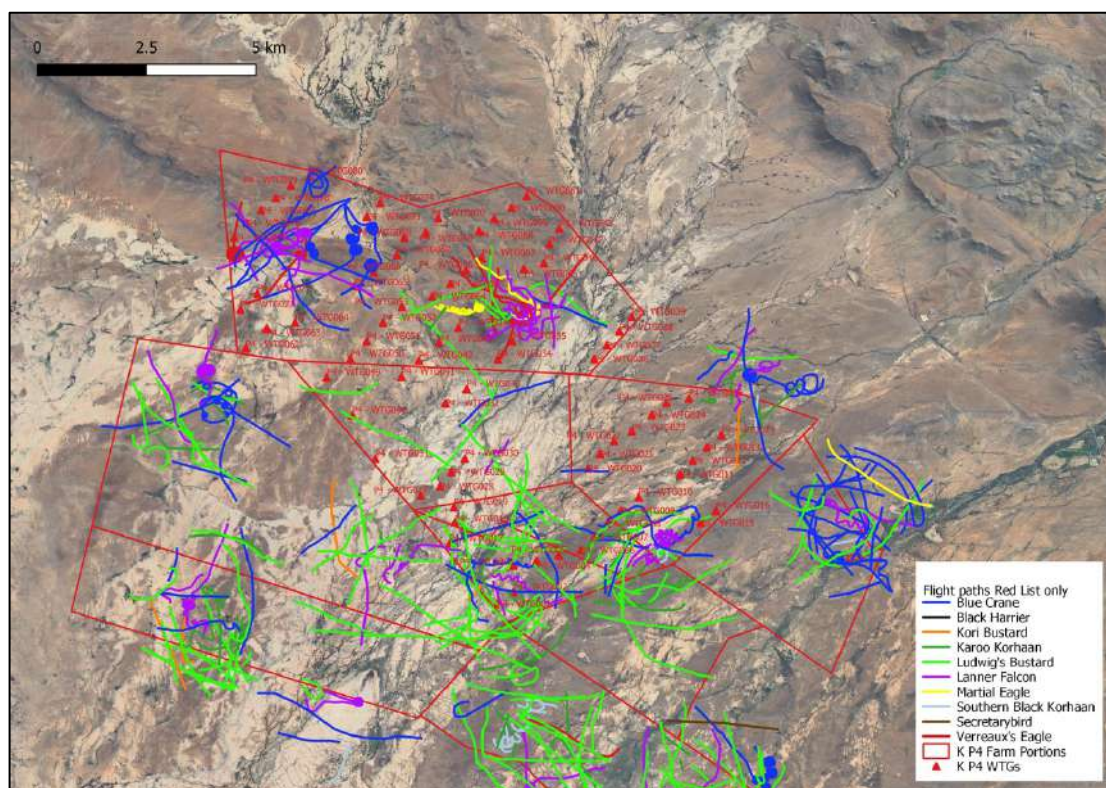


Figure 6-73: Close up view of regionally Red Listed species flight paths (full year).

6.8.2 Site Sensitivity

6.8.2.1 Site Sensitivity Verification (SSV)

We conducted a Site Sensitivity Verification (SSV) exercise for the proposed project. We dispute the Screening Tool finding for the Avian Theme which designates the site as Low sensitivity and concur with the Tool's High sensitivity assessment of the Animal Species Theme for both the highlighted avian SCC species and additional SCC species we recorded on site.

6.8.2.2 National sensitivity

The “Avian Wind Farm Sensitivity map for South Africa” (Retief *et al.* 2011) and the Important Bird & Biodiversity Areas programme data (IBA - Marnewick *et al.* 2015) were consulted to determine the sensitivity of the project in national terms. Figure 6-74 shows the position of the proposed wind farm relative to the avian wind farm sensitivity map and the IBAs. The site falls mostly within the highest categories of sensitivities in terms of avifauna (darker colours indicate higher risk). For a full discussion on the methods used in producing this map see Retief *et al.* (2011, 2014). The site is not located in or close to any IBAs (Marnewick *et al.* 2015). The proposed project falls entirely within a Renewable Energy Development Zone (REDZ) and a Power Corridor. Overall, it is our opinion that the proposed site falls in an area of Medium sensitivity *overall, on a national scale* based on these factors. This statement serves to provide holistic context on the suitability of the location of the development based on the consulted databases and does not consider individual species.

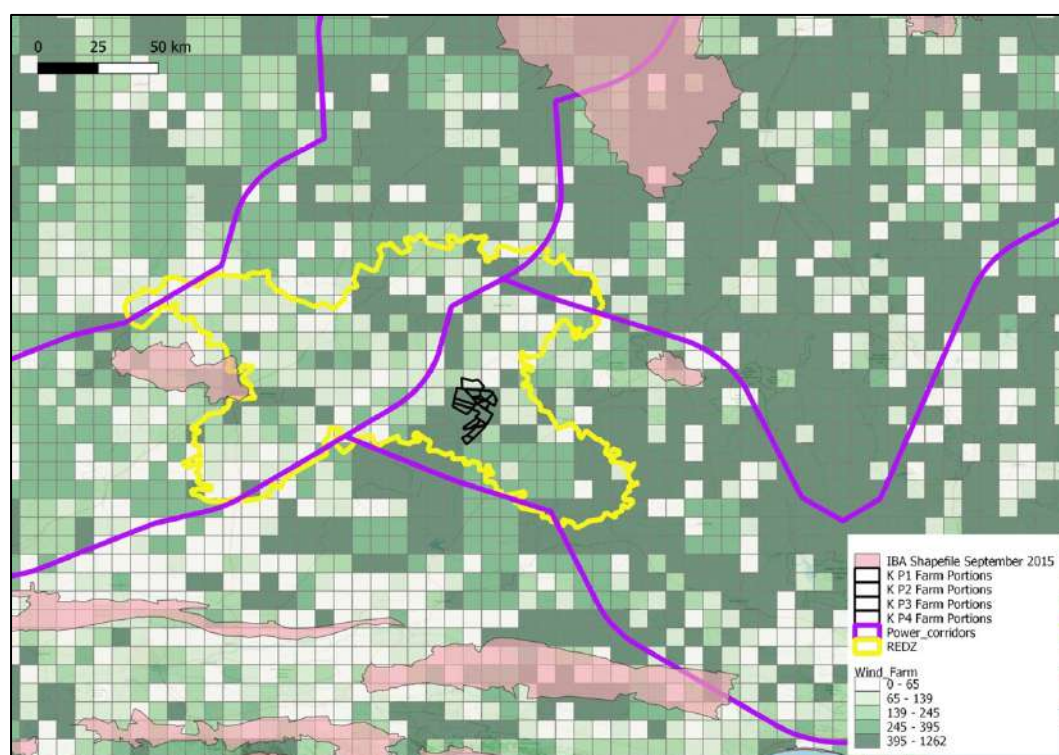


Figure 6-74: The position of the project relative to the Avian wind farm sensitivity map (Retief *et al.* 2011), Important Bird & Biodiversity Areas (Marnewick *et al.* 2015), and Renewable Energy Development Zones (REDZ/2).

6.8.2.3 Site Ecological Importance (SEI)

Site Ecological Importance is derived from combining Biodiversity Importance and Receptor Resilience. Biodiversity Importance is in turn derived from combining Conservation Importance and Functional Integrity.

Conservation Importance (CI) is defined as: *“The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened and Near Threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.”*

Functional integrity (FI) of the receptor (e.g. the vegetation/fauna community or habitat type) is defined here as *A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.”*

Receptor Resilience (RR) is defined as: *‘The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention.’*

In the case of the Kariega site, we score the factors as follows:

1. Conservation Importance as High (*Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km². IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A.*). Black Harrier meets this requirement.
2. Functional Integrity as High (*Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types. Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches. Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential.*)

According to the figure below then this provides a Biodiversity Importance score of ‘High’.

Biodiversity importance		Conservation importance				
		Very high	High	Medium	Low	Very low
Functional integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Figure 6-75: Biodiversity Importance scoring table (extracted from SANBI 2022).

1. The Receptor Resilience is scored as Medium for the Kariega site.

Site ecological importance		Biodiversity importance				
		Very high	High	Medium	Low	Very low
Receptor resilience	Very low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very high	Medium	Low	Very low	Very low	Very low

Figure 6-76: Site Ecological Importance scoring table (extracted from SANBI 2022).

This then produces a Site Ecological Importance of ‘High’ as per the above figure. The recommendation (SANBI 2022) for this class of SEI is: “Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.”

In this case SEI cannot be mapped as birds are mobile and move across the entire site. On site avifaunal sensitivity has instead been mapped below.

6.8.2.4 On-site avifaunal sensitivity

In terms of on-site avifaunal sensitivity, Table 6-79 below summarises the factors considered. The constraints identified were classified according to a four-tier sensitivity classification method (No-Go, High, Medium, and Low).

Table 6-79: Avifaunal Sensitivity mapping factors.

Sensitivity class	Avifaunal factors considered	Recommendation
No-Go areas	Verreaux’s Eagle nest buffers. Four Verreaux’s Eagle nests are known within the area originally screened for the wind farms. Since these nests are a significant distance off site and in steeper topography (the site itself is flat) a circular nest buffer of 5.2km was applied rather than running VERA.	No wind turbines or overhead power lines should be placed within these areas. Other infrastructure such as roads are acceptable in their current positions.
	Martial Eagle nest buffers. Two Martial Eagle nests from two territories occur in the broader study area, which was originally screened. To determine the size of the nest buffers (in the absence of established guidance) we consulted the most recent and comprehensive nest tracking-based study of Martial Eagle breeding ecology that we are aware of (Van Eeden <i>et al.</i> 2017). This study was conducted in the Kruger National Park and	

	determined a mean (n=6) home range size of 108km ² implying a home range radius of 6km if a circular home range is assumed. We have therefore placed a 6km radius circular buffer around the Martial Eagle nesting sites.	
	Black Harrier nest. Although this nest is some distance off site, for transparency we have mapped the 5km buffer around it as per Simmons <i>et al</i> (2020).	
	Ludwig's Bustard Leks. Several lek areas were identified during the course of pre-construction bird monitoring. These areas were identified spatially, by delineating a polygon around the area within which male bustards were recorded displaying. These leks were all on slightly higher topography areas, i.e. low ridge lines. We buffered these polygons by 1km	
	Ludwig's Bustard nest. A nest was found during our monitoring, and we buffered this by 1.5km	
	Secretarybird nest. A Secretarybird nest was buffered by 2.5km	
	Southern Black Korhaan nest. A nest found during monitoring was buffered by 1km.	
	Kori Bustard nest. A nest found during monitoring was buffered by 1km.	
	Dams. Dams are important for general waterfowl, and are life-giving resources, particularly in arid to semi-arid environments. Dams are also important roosting sites for Blue Cranes which sleep at night in the shallows. The dams identified on site (using the SANFEPA shape file) have been buffered by 500m.	
	Arable lands are an important source of food for cranes, particularly during winter. We precautionarily placed a 500m No-go buffer around several arable lands.	
	Wetlands. The National Wetland Map of the National Biodiversity Assessment (2018) was used to map the wetlands on site and these were then buffered by 500m.	
High sensitivity	No areas identified	
Medium sensitivity	The remainder of the site classifies as Medium sensitivity.	Infrastructure may enter these areas if necessary and remaining on existing infrastructure as far as possible (eg. roads).
Low sensitivity	Not applicable	

Figure 6-77 and Figure 6-78 show the above information consolidated into one map. This spatial information has already been considered in designing the current draft turbine layout. The current proposed project layout avoids all the above-described No-Go areas, except for several sections of road which are within buffers. This is acceptable since these roads are placed on existing roads.

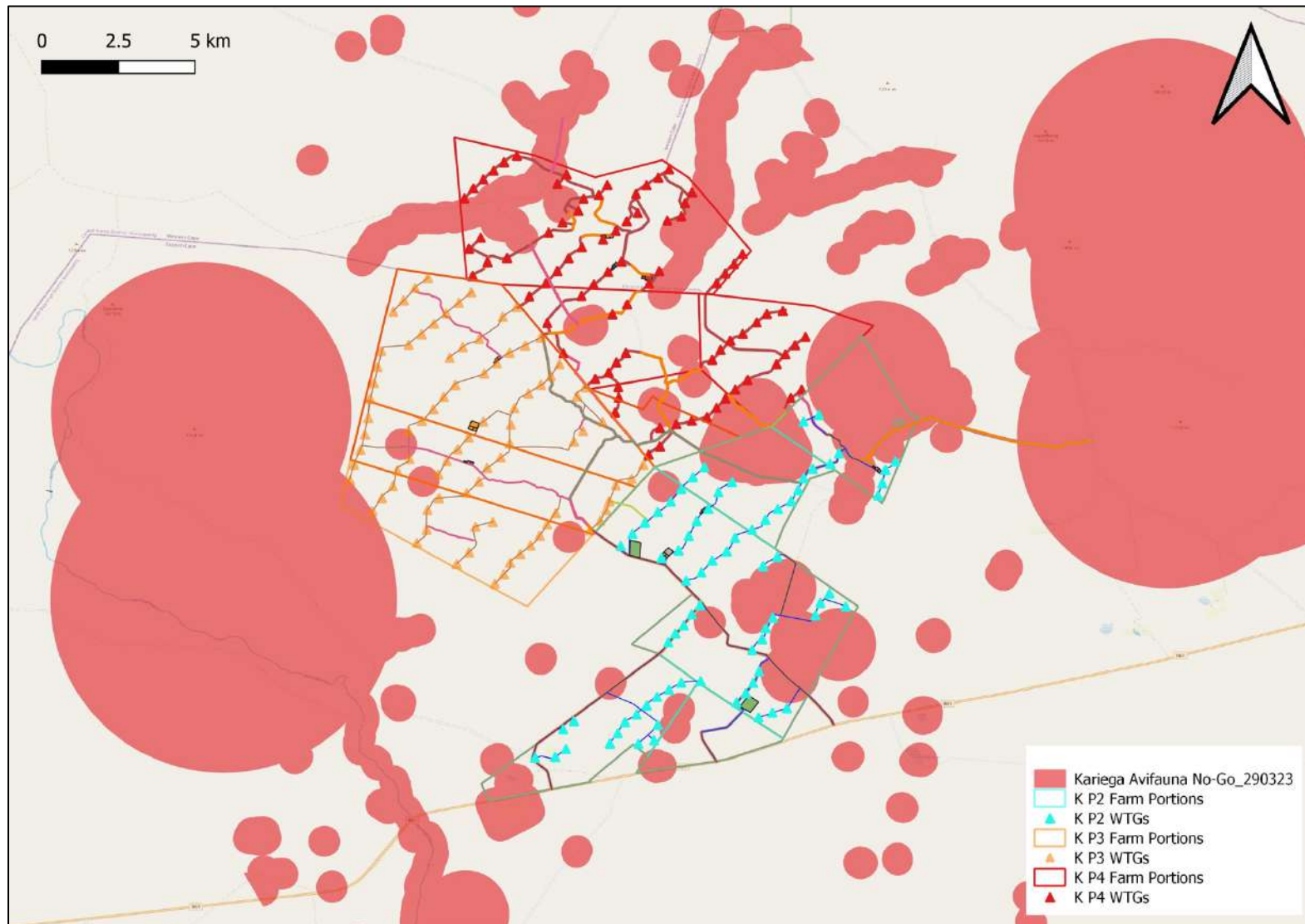


Figure 6-77: The avifaunal sensitivity map for the overall project (four wind farms).

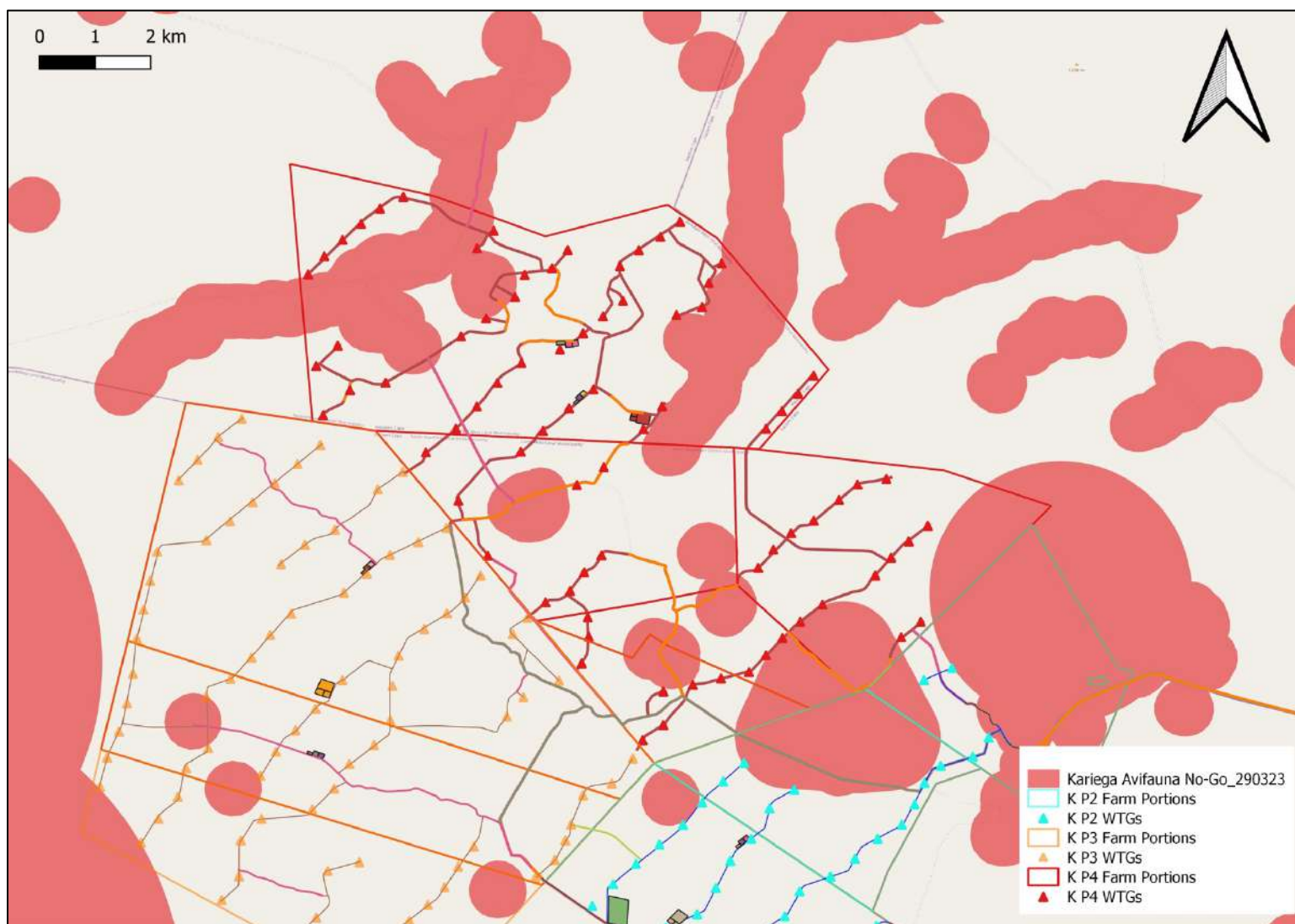


Figure 6-78: The avifaunal sensitivity map for the proposed project.

6.8.3 Impact assessment

The avoidance of avifaunal risk at the proposed project has been an iterative process resulting from ongoing communication between WildSkies and the applicant. The degree to which mitigation or avoidance can make a material difference to avifaunal risk at a wind farm is higher earlier in the project. At this project, a significant amount of avifaunal risk avoidance has already been implemented before the project layout presented for authorisation. The various avoidance measures already applied have been summarised below for the full site of four wind farms:

- Black Harrier nest plus 5km buffer
- Ludwig's Bustard leks plus 1km buffers around outer edges
- Dams plus 500m buffers
- Arable lands plus 500m buffers
- Wetlands plus 500m buffers
- Verreaux's Eagle nests x 4 plus buffers of 5.2km
- Martial Eagle nests x 2 plus buffer of 6km circular radius around nest

Mitigation measures referred to in the in the following tables, i.e. Section 7 of the Avifauna Specialist report, are include in section 6.8.3.5 Impact mitigation measures.

6.8.3.1 Potential Construction Phase Impacts

Two impacts exist for the construction phase of development: bird habitat destruction; and disturbance of birds. These are detailed below:

Table 6-80: Assessment of destruction of habitat during construction.

No.	1 Alternative 1			
Project phase	Construction			
Impact title	Destruction of habitat			
Impact description	Bird habitat is altered or destroyed during the construction of the facility			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - negative		Moderate - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Slightly-detrimental	
Confidence	Virtually certain		Virtually certain	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	Low	Mitigation does not exist; or mitigation may only slightly reduce the significance of impacts.		
Potential mitigation	See Section 7			
Comment on ratings	n/a			

Table 6-81: Assessment of disturbance of birds during construction.

No.	2 Alternative 1			
Project phase	Construction			
Impact title	Disturbance of birds			
Impact description	Birds resident and/or breeding on and near site are disturbed during construction. This may impact on foraging, resting and/or breeding activities			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Short term	Impact will last less than 1 year.	Short term	Impact will last less than 1 year.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Low - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Moderate - negative		Minor - negative	
Importance	Low	Low	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	See Section 7			
Comment on ratings	n/a			

6.8.3.2 Potential Operational Phase impacts

We have identified five main impacts for the operational phase of the project: disturbance of birds; displacement of birds; collision of birds with turbine blades; collision of birds with overhead power lines; and electrocution of birds on overhead power lines. These are described below:

Table 6-82: Assessment of disturbance of birds during operational phase.

No.	3 Alternative 1			
Project phase	Operation			
Impact title	Disturbance of birds			
Impact description	Birds are disturbed during operation of the facility. This may impact on foraging, resting and/or breeding activities			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Minor - negative		Minor - negative	
Importance	Low	Low	Low	Low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigatability	Low	Mitigation does not exist; or mitigation may only slightly reduce the significance of impacts.		
Potential mitigation	See Section 7			
Comment on ratings	n/a			

Table 6-83: Assessment of displacement of birds during operational phase.

No.	4				Alternative 1	
Project phase	Operation					
Impact title	Displacement of birds from site					
Impact description	Birds are displaced from site, which has territorial and energy efficiency implications. Either having to find and secure new territories, or flying further to and from feeding and breeding sites					
Impact Assessment	Impact not mitigated				Impact mitigated	
Nature	Negative				Negative	
Extent	Local	Extending across the site and to nearby settlements.		Local	Extending across the site and to nearby settlements.	
Duration	Long term	Impact will last between 6 and 25 years.		Long term	Impact will last between 6 and 25 years.	
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.		Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	
Magnitude	Moderate - negative				Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.		Likely (>66%)	The impact may occur, but not necessarily proof that it will.	
Significance	Moderate - negative				Moderate - negative	
Importance	Moderate	Moderate		Moderate	Moderate	
Consequence	Slightly-detrimental				Slightly-detrimental	
Confidence	Established, but incomplete				Established, but incomplete	
Reversibility	High	The affected environment may be able to recover from the impact.				
Mitigatability	Low	Mitigation does not exist; or mitigation may only slightly reduce the significance of impacts.				
Potential mitigation	See Section 7					
Comment on ratings	n/a					

Table 6-84: Assessment of bird collision with turbines during operational phase.

No.	5	Alternative 1		
Project phase	Operation			
Impact title	Turbine collision fatality			
Impact description	Birds are killed through collision with turbine blades			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	National	Impacts manifest at a national level / provincial.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	Very high - negative		High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Severe - negative		Major - negative	
Importance	Very high	Very high	High	High
Consequence	Extremely-detrimental		Highly-detrimental	
Confidence	Well established		Well established	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or		
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.		
Potential mitigation	See Section 7			
Comment on ratings	n/a			

Table 6-85: Assessment of collision of birds with overhead lines during operational phase.

No.	6				Alternative 1	
Project phase	Operation					
Impact title	Collision of birds with overhead lines					
Impact description	Birds in flight do not see and consequently collide with overhead power lines					
Impact Assessment	Impact not mitigated			Impact mitigated		
Nature	Negative			Negative		
Extent	Local	Extending across the site and to nearby settlements.		Local	Extending across the site and to nearby settlements.	
Duration	Long term	Impact will last between 6 and 25 years.		Long term	Impact will last between 6 and 25 years.	
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.		Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	
Magnitude	High - negative			Moderate - negative		
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.		Unlikely (>33%)	The impacts occurrence is rare but has happened before.	
Significance	Major - negative			Minor - negative		
Importance	High	High		High	High	
Consequence	Highly-detrimental			Slightly-detrimental		
Confidence	Well established			Select		
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.				
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.				
Potential mitigation	See Section 7					
Comment on ratings	n/a					

Table 6-86: Assessment of bird electrocution on overhead lines during operational phase.

No.	7				Alternative 1	
Project phase	Operation					
Impact title	Bird electrocution on overhead lines					
Impact description	Large birds perching on pylons bridge the critical clearances and short circuit the line thereby being electrocuted					
Impact Assessment	Impact not mitigated				Impact mitigated	
Nature	Negative				Negative	
Extent	Local	Extending across the site and to nearby settlements.		Local	Extending across the site and to nearby settlements.	
Duration	Long term	Impact will last between 6 and 25 years.		Long term	Impact will last between 6 and 25 years.	
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.		Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	
Magnitude	High - negative				Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.		Very unlikely (>10%)	There are reasons that make the impact conceivable, yet improbable.	
Significance	Major - negative				Minimal - negative	
Importance	High	High		High	High	
Consequence	Highly-detrimental				Very slightly-detrimental	
Confidence	Virtually certain				Select	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or				
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.				
Potential mitigation	See Section 7					
Comment on ratings	n/a					

6.8.3.3 Potential Decommissioning Phase impacts

We identify one main impact for the decommissioning phase, disturbance of birds, described below.

Table 6-87: Assessment of disturbance of birds during decommissioning phase.

No.	8				Alternative 1	
Project phase	Decommissioning					
Impact title	Disturbance of birds					
Impact description	Birds resident and/or breeding on and near site are disturbed during construction. This may impact on foraging, resting and/or breeding activities					
Impact Assessment	Impact not mitigated			Impact mitigated		
Nature	Negative			Negative		
Extent	Local	Extending across the site and to nearby settlements.		Local	Extending across the site and to nearby settlements.	
Duration	Short term	Impact will last less than 1 year.		Short term	Impact will last less than 1 year.	
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.		Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	
Magnitude	Moderate - negative			Low - negative		
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.		Unlikely (>33%)	The impacts occurrence is rare but has happened before.	
Significance	Moderate - negative			Minimal - negative		
Importance	Low	Low		Low	Low	
Consequence	Slightly-detrimental			Very slightly-detrimental		
Confidence	Established, but incomplete			Select		
Reversibility	High	The affected environment may be able to recover from the impact.				
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.				
Potential mitigation	See Section 7					
Comment on ratings	n/a					

6.8.3.4 Cumulative Impacts of wind energy facilities on birds in this area

Cumulative projects (Table 6-88 and Figure 6-79) to be considered as part of cumulative impact assessment (existing and proposed renewable energy projects within an approximately 30km range) were received from the EAP.

Table 6-88: Cumulative projects from REEA 2023 Q3 and local verification within 30km range of the proposed Kariëga WEFs.

DFFE Reference no.	Regulation	EIA Process	Project title	App. date	Applicant
12/12/20/2015	2010	Scoping and EIA	Proposed Poortjie Wes Wind Energy Project, Beaufort West, Western Cape Province	2010/08/01	Terra Wind Energy Poortjie Wes (Pty) Ltd
12/12/20/2211	2010	Scoping and EIA	Aberdeen 200MW wind farm west of Aberdeen, Eastern Cape	2011/03/01	Faria Holdings Pty Ltd

DFFE Reference no.	Regulation	EIA Process	Project title	App. date	Applicant
14/12/16/3/3/1/552	2010	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortje Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2014/10/27	BioTherm Energy (Pty) Ltd
14/12/16/3/3/1/552/AM1	2010	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortje Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2014/10/27	BioTherm Energy (Pty) Ltd
14/12/16/3/3/1/552/AM2	2014	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortje Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2015/07/30	BioTherm Energy (Pty) Ltd
14/12/16/3/3/1/552/AM3	2014	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortje Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2016/03/29	BioTherm Energy (Pty) Ltd
14/12/16/3/3/2/756	2010	Scoping and EIA	Camdeboo Wind Energy Facility near Aberdeen Eastern Cape Province	2014/11/07	Aberdeen Wind Farm (Pty) Ltd
12/12/20/2535	2010	Scoping and EIA	Mainstream Aberdeen wind energy facility, Eastern Cape Province	2011/10/20	South African Mainstream Renewable Power Developments (Pty) Ltd
14/12/16/3/3/1/2722	2014	Basic Assessment	Aberdeen 1 Wind Farm	2023	Aberdeen Wind Facility 1 (Pty) Ltd
14/12/16/3/3/1/2723	2014	Basic Assessment	Aberdeen 2 Wind Farm	2023	Aberdeen Wind Facility 2 (Pty) Ltd
14/12/16/3/3/1/2724	2014	Basic Assessment	Aberdeen 3 Wind Farm	2023	Aberdeen Wind Facility 3 (Pty) Ltd

DFFE Reference no.	Regulation	EIA Process	Project title	App. date	Applicant
14/12/16/3/3/1/2851	2014	Basic Assessment	FE Kudu Wind Farm	2023	FE Kudu (Pty) Ltd ²⁹
14/12/16/3/3/1/2835	2014	Basic Assessment	FE Tango Wind Farm	2023	FE Tango (Pty) Ltd

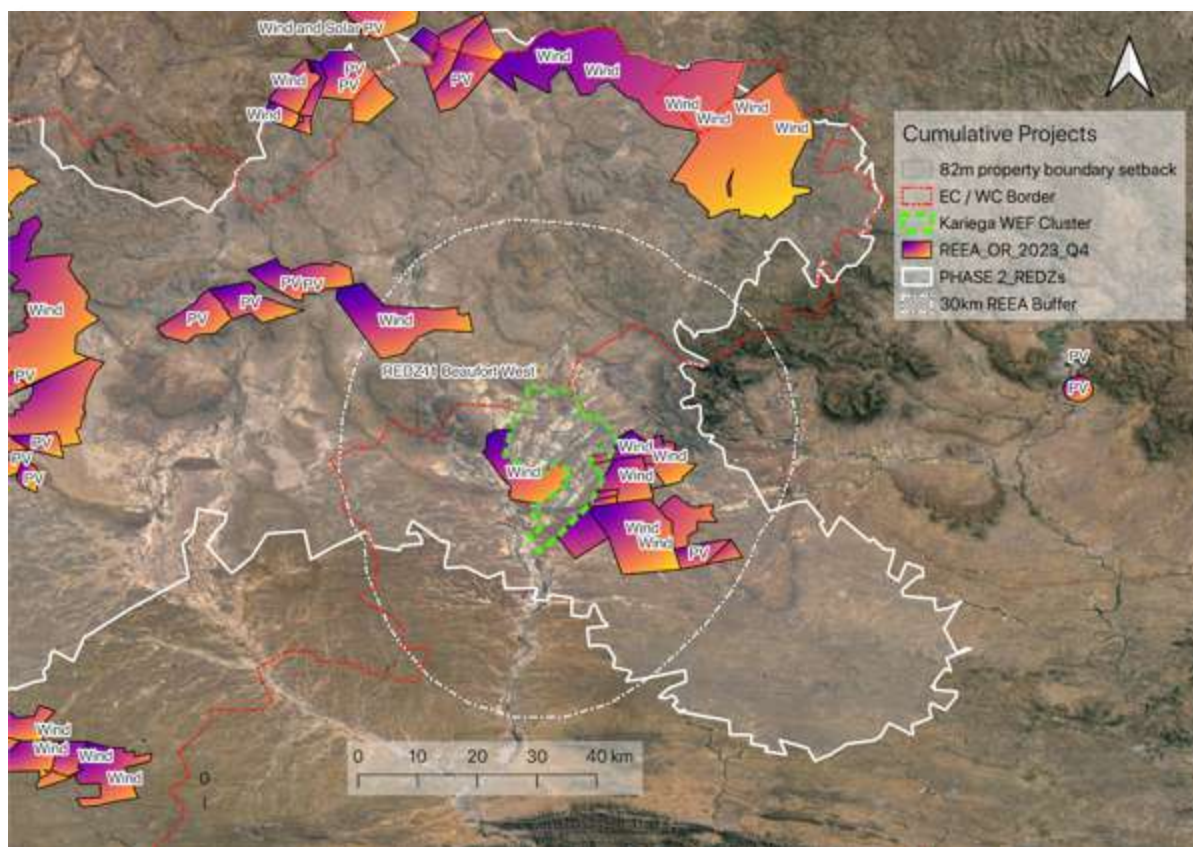


Figure 6-79: Cumulative projects from REEA 2023 Q4 (and authorised Kudu and Tango WEFs) within 30km range of the proposed Kariega WEFs.

A cumulative impact, in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may be significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities (as defined by NEMA EIA Reg 1).

The cumulative impacts of wind energy on avifauna in the Aberdeen area have been carefully assessed according to the guidance in the DEA (DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria); and

²⁹ The Kudu and Tango WEFs EAs early in 2024 and have been added to cumulative impacts. However, they are not currently listed on the REEA 2023 Q3 database.

the IFC guidelines (Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets”.

The Cumulative Impacts have been assessed and populated in a cumulative impact summary table below as per the prescribed methodology.

Table 6-89: Cumulative impacts table.

No.	9			Alternative 1	
Project phase	Construction, Operation & Decommissioning				
Impact title	Cumulative impact on avifauna				
Impact description	Cumulative impact on avifauna through destruction of habitat and bird fatalities through collision with wind turbines				
Impact Assessment	Impact not mitigated			Impact mitigated	
Nature	Negative			Negative	
Extent	National	Impacts manifest at a national level / provincial.		National	Impacts manifest at a national level / provincial.
Duration	Long term	Impact will last between 6 and 25 years.		Long term	Impact will last between 6 and 25 years.
Intensity	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.		High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	Very high - negative			High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.		Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Severe - negative			Major - negative	
Importance	High	High		Low	Low
Consequence	Highly-detrimental			Slightly-detrimental	
Confidence	Established, but incomplete			Established, but incomplete	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.			
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.			
Potential mitigation	See Section 7				
Comment on ratings					

6.8.3.5 Impact mitigation measures

Although extensive avoidance of impacts has already been applied on this project via a Screening and Constraints Phase, it is recommended that the following additional mitigation measures be applied to manage and further reduce the significance of impacts on birds. These mitigation measures apply to the three phases of construction, operation and decommissioning, and in many cases a particular measure applies to more than one of these phases.

- No wind turbines or overhead power lines should be placed within the identified No-Go areas.
- A pre-construction avifaunal walk down should be conducted to identify any sensitivities that may arise between the conclusion of the BA process and the construction phase.
- All human activities associated with construction, operation and decommissioning should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- Existing roads and tracks should be used as far as possible by construction staff.

- Movement of all staff, vehicle and machinery activities should be strictly controlled at all times so as to ensure that the absolute minimum of surface area is impacted.
- Care should be taken not to introduce or propagate alien plant species/weeds during construction.
- Any underground cabling should follow wind farm roads at all times to reduce the impact on the habitat by grouping these linear infrastructures.
- A post-construction inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled and in particular that road and hard stand verges do not provide additional substrate for raptor prey species (particularly small mammals). It is essential that the new wind farm does not create favourable conditions (such as softer ground that is easier to burrow) for such mammals in high-risk areas. We therefore recommend that within the first year of operations a full assessment of this aspect be made by the ornithologist contracted for post-construction monitoring. If such conditions have been created, case-specific solutions will need to be developed and implemented by the wind farm.
- It is strongly recommended that rodenticides not be used at the newly established Operation and Maintenance (O&M) buildings or around auxiliary infrastructure on the project site. While pest control of this nature may be effective, even so-called “environmentally friendly” rodenticides are toxic and pose significant secondary poisoning risk to predatory avifauna, especially owls.
- No internal medium voltage power lines should be overhead. All such cables should be buried along wind farm road verges. Only the 132kV collector lines and grid connection power line should be above ground (and these are not part of this application).
- Any 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 pole design of any overhead power line should be approved by an ornithologist in terms of the electrocution risk it may pose to large birds such as eagles.
- Should more than one power line be constructed in parallel with another either new or pre-existing power line, the pylon structures should be staggered as per Pallett et al. (2022) to increase visibility to large, slow-moving species, especially bustards and cranes.
- The combination of hub height and rotor diameter must be optimised to maximise the lower blade tip height above ground as far as possible. Raising the lower turbine blade tip height higher than the typical 30m above ground will reduce collision risk for cranes, Ludwig’s Bustards, Blue Crane, Karoo Korhaan and Southern Black Korhaan, which typically fly low over the ground.
- One blade on each turbine must be painted from the outset, in line with the SAWEA-BLSA briefing note (Morkel et al, 2023). The South African Civil Aviation Authority (SACAA) has in January 2024 provided a blanket approval for such blade patterning (2 stripes in aviation signal red). The exact design must still be submitted by each project to the SACAA for approval.
- A bird fatality threshold and adaptive management plan should be designed for the project prior to the operational phase. This policy should form an annexure of the operational EMP for the facility. This will be developed once the pre-construction walk down has been undertaken and will thus be appended to the EMP. It is not required that this plan is in place before construction commencement but rather before commencement of operations. This plan should identify the number of bird fatalities of priority species which will trigger a management response, appropriate responses, and timelines for such responses. Fatalities of priority bird species are usually rare events (but with very high

consequence) and it is difficult to analyse trends or statistics related to these fatalities as they occur. It is therefore important to have an adaptive management plan in place proactively to assist management. Note that this adaptive management plan is required in addition to the comprehensive set of mitigation recommended already. The adaptive management plan will detail how the mitigation response will need to be escalated if the existing mitigation is not effective. Should the identified priority bird species fatality thresholds be exceeded in Year 1 (first year of operations from Commercial Operations Date), suitable mitigation measures will need to be implemented. Based on current knowledge, the most appropriate mitigation measure is likely to be an observer or technology led turbine Shutdown on Demand (SDOD) programme. Such a programme should be implemented in accordance with the BirdLife South Africa Handbook on this mitigation measure (in prep). A full detailed method statement or protocol must be designed by an ornithologist. This is a rapidly evolving field of work, and if more appropriate mitigation measures with proven efficacy are available by the time the need arises, these should also be considered. The adaptive management plan should also describe how decisions will be made regarding discontinuing this mitigation if impacts fall within thresholds.

- Any residual impacts during the operational phase after all possible mitigation measures have been implemented will need to be mitigated off site. The need for such an approach will be evaluated annually (starting after year 1 of operations) on the basis of post construction bird fatality monitoring results. The facility will need to address other sources of mortality of priority species in a measurable way so as to compensate for residual effects on the facility itself. This will need to be detailed in a Biodiversity Action Plan compiled by an ornithologist. Since most priority species for this project face considerable threat through overhead power lines across their range, a likely off-site mitigation measure could be the mitigation of power line impacts on Eskom's network. These are measurable and easily mitigated impacts which could result in a no nett loss or even nett gain scenario for priority bird species.
- The “during construction” and “post-construction” monitoring programme outlined in the EMPr should be implemented according to the latest available version of the Best Practice Guidelines at the time (and updated to comply with any updated best practice guideline requirements). The findings from operational phase monitoring should inform an adaptive management programme to mitigate any impacts on avifauna to acceptable levels.

Note: this is a rapidly evolving field and as more wind farms become operational, the learning curve steepens in terms of mitigation of risks to birds. Several new technology options are possibly on the horizon, including blade illumination; radar technology; and acoustic deterrents. The project must keep abreast of these developments and implement if deemed necessary and reasonable as per the adaptive management plan contained in this report.

6.8.4 Conclusion and Recommendations

We draw the following conclusions regarding the avifaunal community and potential impacts of the proposed wind farm:

- Based on data collected on site during pre-construction bird monitoring, we classified four bird species as being at High risk should the project proceed. High risk species include: Ludwig's Bustard (Endangered), Southern Black Korhaan (Vulnerable), Karoo Korhaan (Near-threatened), and Blue Crane (Near-threatened).

Table 6-90: Based on this risk, we assessed the potential impacts on birds and made the following findings (based on updated layout with reduced WTG).

	Version 6 layout		Version 7 layout	
Impact	Significance before mitigation	Significance after mitigation	Significance before mitigation	Significance after mitigation
<u>Construction phase</u>				
Habitat destruction during construction	Moderate negative	Moderate negative	Moderate negative	Moderate negative
Disturbance of birds during construction	Moderate negative	Minor negative	Moderate negative	Minor negative
<u>Operational phase</u>				
Disturbance during operations	Minor negative	Minor negative	Minor negative	Minor negative
Displacement during operations	Moderate negative	Moderate negative	Minor negative	Minor negative
Collision with turbine blades	Severe negative	Major negative	Major negative	Moderate negative
Bird collision with powerlines	Major negative	Minor negative	Major negative	Minor negative
Bird electrocution during operations	Major negative	Minor negative	Major negative	Minor negative
<u>Decommissioning phase</u>				
Disturbance of birds during decommissioning	Moderate negative	Minor negative	Moderate negative	Minor negative
<u>Cumulative impacts</u>				
Habitat destruction & bird fatality through turbine collision	Severe negative	Major negative	Major negative	Moderate negative

In addition to the avoidance measures already implemented for the overall site of four wind farms, several mitigation measures in terms of the developable site area are recommended. These have been included in the EMPr.

The Applicant has redesigned the developable area of the proposed wind farm to avoid the sensitive areas identified through the course of avifaunal studies at the site. Avifaunal impacts were assessed for the first layout presented and were mostly determined to be of Minor or Moderate Negative significance post-mitigation. Cumulative impacts were rated as Major Negative significance pre-mitigation, and Moderate negative significance post mitigation. However, the layout was then updated by increasing the number of turbines by 82% (from 44 to 80). This resulted in an increase in significance for several impacts. Displacement of birds during operations increased from Minor to Moderate Negative significance both pre and post mitigation. Collision of birds with turbines during operations, and cumulative impacts increased to Severe Negative pre mitigation and remains at Major Negative after mitigation. On this basis it was recommend against the authorisation of the project in this form and it was recommended that the number of turbines be reduced significantly for the level of risk to be acceptable. Consequently, the Version 7 layout (the latest layout) reduced the number of turbines to 50 (now 42). On this basis we conclude that the impact significance ratings are reduced to acceptable levels and the project may be authorised.

6.9 Bats

The Bat Impact Assessment (BIA) was undertaken by Caroline Lötter and the team at Inkululeko Wildlife Services (IWS). BIA is based on desktop review work, 12 months of passive acoustic bat activity monitoring in the Kariega 4 WEF site (and on adjoining sites of the Kariega WEF Cluster), multiple site visits to the study area involving, inter alia, extensive ground-truthing of local potential bat important features, and knowledge from long-term bat monitoring conducted previously in the region by IWS team members. Seven bat species were recorded in the study area, viz. the Egyptian Free-tailed Bat, Cape Serotine, Natal Long-fingered Bat, and Mauritian Tomb Bat, which have a High fatality risk of collision with turbines, the Long-tailed Serotine, which has a Medium fatality risk, and the Cape and Geoffrey's horseshoe bats, which have a Low fatality risk. The findings of the BIA concluded that that all turbines and other infrastructure, which coincide with High sensitive areas must be shifted/relocated or dropped and turbines that coincide with Medium-High sensitive areas should be shifted/relocated where possible (as was undertaken in the latest layout). In addition, the feasibility of the prescribed turbine curtailment should be tested prior to finalization of the project. The impact of the prescribed curtailment on the financial feasibility of the wind farm could be explored by using the available weather data from site to obtain estimates of the number of turbine night hours per annum during which curtailment would need to be implemented and, consequently, how much turbine energy production could potentially be lost. The results should be used to ensure that there is adequate financial provision to accommodate curtailment during operation.

The full specialist report is attached hereto as Annexure D 8, Bats Impact Assessment (2024).

6.9.1 Baseline Description

6.9.1.1 Detected and potentially occurring bat species

Based on available species records and published distribution maps, potentially 10 bat species occur in the study area (hereafter referred to as “potentially occurring species”; Table 6-91).

Table 6-91: Detected and potentially occurring bat species in the study area.

FAMILY	SPECIES	COMMON NAME	LIKELIHOOD OF OCCURRENCE ^{1,2,3,4}	RED LIST STATUS		SPECIES OF CONSERVATION CONCERN ^{2,5}	TURBINE FATATLTY RISK ⁷
				Global ⁶	National ⁶		
MOLOSSIDAE	<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	Recorded onsite	LC (U)	LC		High
VESPERTILIONIDAE	<i>Laeophotis capensis</i>	Cape Serotine Bat	Recorded onsite	LC (S)	LC		High
RHINOLOPHIDAE	<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	Recorded offsite	LC (U)	LC		Low
MINIOPTERIDAE	<i>Miniopterus natalensis</i>	Natal Long-fingered Bat	Recorded onsite	LC (U)	LC	Migratory SA endemic	High
RHINOLOPHIDAE	<i>Rhinolophus capensis</i>	Cape Horseshoe Bat	Recorded onsite	LC (S)	LC		Low
VESPERTILIONIDAE	<i>Eptesicus hottentotus</i>	Long-tailed Serotine Bat	Recorded onsite	LC (U)	LC		Medium
EMBALLONURIDAE	<i>Taphozous mauritanus</i>	Mauritian Tomb Bat	Recorded onsite	LC (U)	LC		High
CISTUGIDAE	<i>Cistugo lesueuri</i>	Lesueur's Wing-gland Bat	Recorded offsite	LC (D)	LC	SA endemic	Low
NYCTERIDAE	<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	High	LC (U)	LC		Low
VESPERTILIONIDAE	<i>Myotis tricolor</i>	Temminck's Myotis	Low	LC (U)	LC		Medium-High

Status: D: Decreasing; LC: Least Concern; S: Stable; U: Unknown.

Source: ¹African Chiroptera Report (2020); ²Monadjem *et al.* (2020); ³FAO (2021); ⁴Naturalist (2021); ⁵UCN (2021-1); ⁶Child *et al.* (2016); ⁷MacEwan *et al.* (2020a)

Of these, six bat species were recorded by IWS onsite during the 12-month monitoring campaign (“onsite recorded species”) and one was recorded offsite elsewhere in the Kariega WEF cluster site (offsite recorded species”):

Onsite recorded species:

- Egyptian Free-tailed Bat (*Tadarida aegyptiaca*)
- Cape Serotine (*Laeophotis capensis*)
- Natal Long-fingered Bat (*Miniopterus natalensis*)
- Mauritian Tomb Bat (*Taphozous mauritanus*)
- Long-tailed Serotine (*Eptesicus hottentotus*)
- Cape Horseshoe Bat (*Rhinolophus capensis*)
- Offsite recorded species:

Offsite recorded species:

- Geoffroy’s Horseshoe Bat (*Rhinolophus clivosis*)

Some recorded Molossid calls which could not be reliably identified most likely represent additional calls of the Egyptian Free-tailed Bat.

Of the recorded species, four (viz. the Egyptian Free-tailed Bat, Cape Serotine, Natal Long-fingered Bat, and Mauritian Tomb Bat) have a High fatality risk of collision with turbines and one (viz. the Long-tailed Serotine) has a Medium fatality risk. Of the potentially occurring species, one (viz. Temminck’s Myotis) has a Medium-High fatality risk (MacEwan et al. 2020a).

The following three listed bat species are regarded by IWS as having the highest conservation priority:

- Cape Horseshoe Bat (*Rhinolophus capensis*): Endemic to the southern edge of South Africa and possibly Namibia (Monadjem et al. 2020).
- Lesueur’s Hairy Bat (*Cistugo lesueuri*): Endemic in South Africa, especially the Cape Fold and Drakensberg mountains (Monadjem et al. 2020; IUCN 2021-1).
- Natal Long-fingered Bat (*M. natalensis*): known to roost in large numbers (sometimes hundreds or thousands) and to migrate hundreds of kilometres (Miller-Butterworth et al. 2003; MacEwan et al. 2016).

Of the three priority bat species, the onsite recorded Natal Long-fingered Bat is considered most likely to be potentially impacted by the proposed WEF. The onsite recorded Cape Horseshoe Bat, and Lesueur’s Wing-gland Bat, which has a High potential occurrence, both have a Low Risk of collision with turbines.

6.9.1.2 Bat species composition at different heights and localities

The Egyptian Free-tailed Bat, Cape Serotine, and Natal Long-fingered Bat were recorded at all three monitoring stations. In addition, the Mauritian Tomb Bat was recorded at AB2 and AB4, and the Long-tailed Serotine and Cape Horseshoe Bat were recorded at AB4.

The Egyptian Free-tailed Bat was the dominant species in turbine rotor sweep height, with >96% of recorded calls made by this species between 70 and 116 m a.g.l. The Cape Serotine contributed less than 1.5% to the calls recorded in rotor sweep height during any given season, and the Natal Long-fingered Bat and Mauritian Tomb Bat each contributed less than 1%. These findings suggest that during operation of the WEF, Egyptian Free-tailed Bats will comprise most of the turbine-related bat fatalities. This aligns with the general finding that Egyptian Free-tailed Bat accounted for most of the bat carcasses found at operational WEFs in South Africa (Aronson et al. 2022).

The Egyptian Free-tailed Bat was also the dominant species near (at approximately 10 m above) ground level. However, near ground level, a greater relative (call) abundance of the other five species was recorded, which is a typical occurrence across most of South Africa (MacEwan et al. 2020b). The Cape Serotine contributed up to 14% of the calls recorded near ground level in autumn, while the Natal Long-fingered Bat contributed up to 15% of the calls recorded in winter. The Long-tailed Serotine, Mauritian Tomb Bat, and Cape Horseshoe Bat each contributed less than 1% of the calls recorded in any given season at AB1 and AB4. These findings suggest that a greater diversity (species richness and abundance) of bats will be at risk of fatality from turbines with blades that approach close to ground level.

The species composition of the recorded bat call data was not surprising. The Egyptian Free-tailed Bat, Cape Serotine, and Natal Long-fingered are widespread across South Africa (Monadjem et al. 2020), and the open-air foraging Egyptian Free-tailed Bat is typically more prevalent above the vegetation canopy, whereas calls of the clutter-edge foraging Cape Serotine and Natal Long-fingered Bat are more frequently recorded closer to ground level.

6.9.1.3 Bat activity at different heights and locations

An overall average of 28 bat passes (bp) per night (or 2 bp per hour) at 116 m, 51 bp per night (4 bp per hour) at 70 m, and 60 bat passes (bp) per night (5 bp per hour) near ground level was recorded on site. These results are typical of other WEF sites in South Africa where IWS performed long-term pre-construction monitoring. Bat activity was on average, typically higher near ground level than in rotor sweep height (i.e. ± 60 m a.g.l.; MacEwan et al. 2020b). The activity at 70 m a.g.l. was likely slightly inflated due to some overlap in the detection range of the microphone at 70 m, and those at 116 m and 11 m with, consequently, some duplication of recorded calls between these.

The onsite levels of bat activity are within the analogous average values of bat activity at other WEF sites in the Nama Karoo shrublands ecoregion (Dinerstein et al. 2017), where IWS recorded on average 1 bp per hour (range: 0-4 bp per hour) in rotor sweep (60 m), and 2 bp per hour (range: 1-7 bp per hour) near ground level (MacEwan et al. 2020b). Above-average bat activity was previously recorded at a nearby study site by IWS team members (NSS 2014). In that study and this one, the above-average bat activity was potentially attributable to above-average rainfall and/or the presence of a large regional population.

6.9.1.4 Bat activity during different seasons

At AB1 and AB3, the three microphones recorded highest average bat activity either in spring, summer, or autumn. Near ground level at AB4, high average bat activity was recorded in spring and summer (Figure 6-80). The findings suggest that during operation of the Kariega 4 WEF, most bat fatalities will likely occur during spring, summer, and autumn, based on the assumption that the levels of bat activity in rotor sweep height may be positively related to the numbers of operational bat fatalities (IWS unpubl. data). Most recorded bat fatalities at operational WEFs in South Africa have occurred between February (late summer) and April (autumn) (Aronson et al. 2022). In contrast, less than 5% of recorded bat fatalities at WEFs in South Africa have occurred during winter (Aronson et al. 2022). Similarly, during operation of the proposed WEF, the lowest numbers of bat fatalities are likely to occur during winter, when the lowest levels of activity were recorded at virtually all monitoring locations and heights.

6.9.1.5 Activity of different bat families and species

Onsite bat activity was essentially a reflection of the activity of the predominant Egyptian Free-tailed Bat (the only listed species belonging to the Molossidae family), which exhibited high activity during spring, summer, and

autumn. Vesper bats (represented mostly by the Cape Serotine, and to a small degree by the Long-tailed Serotine) exhibited the greatest activity at AB4, where these bats were most active during summer. The Natal Long-fingered Bat (the only recorded species belonging to the family Miniopteridae) exhibited the greatest activity at AB4 and AB6, where these bats were most active during autumn, winter, and spring (in descending order). The recorded low levels of Natal Long-fingered Bat activity (mostly below 10 bp/night) are not indicative of migration through the site, which would be revealed by high seasonal peaks in the activity peaks of this species. However, since bat migration in South Africa is poorly understood, the possibility of this happening locally in future cannot be ruled out. These results suggest that where bat fatality mitigation may become necessary, turbine curtailment and/or other measures would likely need to be applied during spring, summer, and autumn.

6.9.1.6 Nights when bat activity peaked

Nights when the highest total numbers of bat passes were recorded on site at AB1 and AB3 occurred in spring and late summer. High numbers of passes during a night are indicative of an increase in bat activity and possibly also bat abundance. Across the three monitoring heights at AB1 and AB3, Egyptian Free-tailed Bat activity reached totals of 91-1 109 bp on 31 January 2022 (summer), and 148-504 bp on 16 September 2022 (spring).

There was a comparatively low nightly activity of the other bats species. Near ground level at AB4, Cape Serotine activity peaked up to 133 bp on nights in January-February (summer), and March-April (autumn). Natal Long-fingered Bat activity peaked by no more than 28 bp on nights from March to September (autumn and winter).

On nights when the levels of Egyptian Free-tailed bat activity at 116 m can be almost 14 times higher than the average level of 28 bp per night at 116 m, fatalities will be inevitable without effective mitigation. Pre-emptive, predictive, or smart curtailment could be most effective at mitigating fatalities during peaks in bat activity, with the least impact on the WEF.

6.9.1.7 Key bat activity times

A very similar pattern of Egyptian Free-tailed bat activity between sunset and sunrise was recorded at the two on site monitoring locations and three monitoring heights. Basically, from sunset there was a progressive increase in Egyptian Free-tailed Bat activity until ca. 19:30/20:30. From then, an overall high level of activity was recorded until ca. 02:00/03:00, whereafter activity declined by sunrise. IWS suspects that this may be due to regular foraging over the study area by Egyptian Free-tailed Bats which commute from/to the mountains in the surrounding region. If most of these bats roost locally, their emergence at sunset, and retreat at sunrise, would probably create separate distinctive activity peaks at these times. Due to their protracted night-time activity on site, Egyptian Free-tailed Bats will be at risk of fatality from turbines throughout the night whenever favourable weather, insect, and possible other (e.g. lunar) conditions prevail.

6.9.1.8 Bat activity in relation to weather

The cumulative and percentage bat passes recorded during different wind speeds and atmospheric temperatures in rotor sweep height at AB2 (where a gap in recording occurred during February 2022) and at AB1 and AB3 (where recording was 100% successful).

Based predominantly on the data from AB1 and AB3, most (90% of) bat activity was recorded at 116 m during temperatures warmer than 12°C. Approximately:

- 50% of bat activity was recorded during wind speeds below 6.5 m/s.
- 60% of bat activity was recorded during wind speeds below 8 m/s.
- 70% of bat activity was recorded during wind speeds below 9 m/s.

- 80% of bat activity was recorded during wind speeds below 10.5 m/s.
- 90% of bat activity was recorded during wind speeds below 12 m/s.
- 95% of bat activity was recorded during wind speeds below 13 m/s.

These results indicate that half of the time, bats were active in the study area during wind speeds stronger than 6.5 m/s. Consequently, if the WEF's bat fatality threshold is exceeded during operation and turbine curtailment becomes necessary, only 50% of bat activity would be protected below a cut-in wind speed of 6.5 m/s.

6.9.1.9 Recording success

The recording success of bat monitoring stations AB1-AB6 is shown in Figure 6-80. Within the Kariega 4 WEF site, at the station AB1, recording was 100% successful for the lower microphone (AB1-3 11 m) and upper microphone (AB1-1 116 m), but the middle microphone (AB1-2 70 m) did not record data between April and August 2022. This occurred when the detector's memory cards filled up sooner than anticipated from noise, which emanated it seemed, from a cable connection that was compromised by expansion of the met. mast during hot weather. Recording at the short mast station AB4, was 100% successful. At AB2, located just outside the southern boundary of the site, recording through the three microphones was disrupted in February for approximately 1 month at AB2-1, and three months at AB2-2 and AB2-3 due to damage caused by a lightning strike. Recording through the three microphones at station AB3 was 100% successful. Recording at the short mast station AB5 was almost 100% successful, except for a few nights in March. The remaining short mast station AB6 recorded successfully for 100% of the time. IWS believes that the gaps in recording did not impact the pre-construction bat monitoring in a significant way since at any given time of year, data on bat activity were obtained at each height from at least one, but mostly up to five other locations within the WEF cluster site, and bat activity at the six bat monitoring stations were similar.

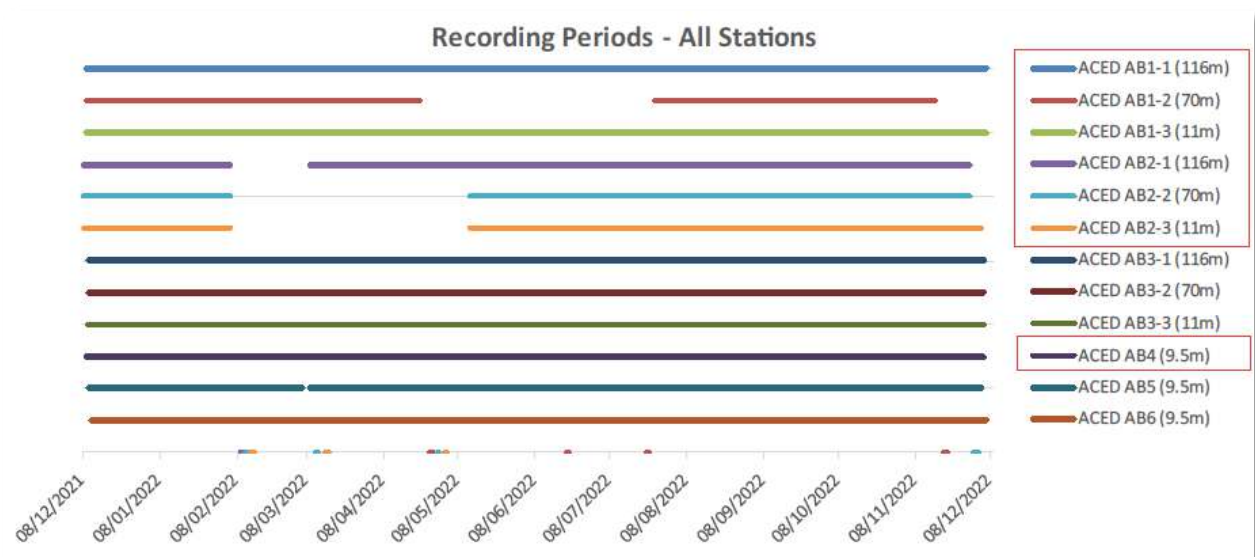


Figure 6-80: Recording success at bat monitoring stations AB1-6. AB1 and AB4 in the Kariega 4 WEF site, and nearby AB2 are outlined in red.

6.9.2 Site Sensitivity

High Bat Sensitive Areas include:

- A small roost of bats (including possibly the endemic Lesueur's Hairy Bat) in the north-western section of the Kariega 4 WEF site, and a 1 km buffer around this, based on the minimum 1 km buffer recommendation in the MacEwan et al. (2020a) guidelines for a small roost of (<50) bats of Species of Conservation Concern.
- Rivers, streams, wetlands, farms dams, and reservoirs, and a 500 m buffer around these, based on: i) the minimum 200 m buffer recommendation in the best practice guidelines by MacEwan *et al.* (2020a) for known and potential bat important features; and additionally ii) the known importance of surface water resources for drinking, foraging, navigation, and movement of bats – especially in arid areas (Serra-Cobo *et al.* 2000; Salata 2012; Sirami *et al.* 2013; Blakey *et al.* 2018); and iii) the recorded onsite levels of bat activity which are slightly higher than the analogous average values of bat activity at other WEF sites in the Nama Karoo shrublands ecoregion (MacEwan *et al.* 2020b).

Medium-High Bat Sensitive Areas include:

- Potential onsite bat roosts (in buildings, and woody vegetation), and a 500 m buffer around these, based on the minimum 500 m buffer recommendation in the MacEwan et al. (2020a) guidelines for a small roost of (<50) bats of Least Concern.
- Secondary drainage lines, and a 200 m buffer around these, based on: i) the possibility that these may be utilized by bats (at certain times at least) for drinking, foraging, navigation, and movement; and ii) the minimum 200 m buffer recommendation in the best practice guidelines by MacEwan et al. (2020a) for known and potential bat important features.

Medium Bat Sensitive Areas include:

- Areas with dolerite which may be associated with karst formations (although no obvious cavities suitable for bat roosting were observed), and a 200 m buffer around these, based on the minimum 200 m buffer recommendation in the best practice guidelines by MacEwan et al. (2020a) for known and potential bat important features.
- Floodplain zones, based on the possibility that these may be utilized by bats at certain times for drinking, foraging, navigation, and movement.

Remaining areas were rated with Low-Medium (not Low) sensitivity owing to the above-average levels of Egyptian Free-tailed Bat activity recorded on site, and previously in the region by IWS.

The locations and species identity of all bat calls recorded during the seasonal driven transects. Most of the calls were recorded in High sensitive areas, which included the buffers around a main onsite drainage area/wash, buildings, and reservoirs with surrounding woody vegetation.

The sensitivity mapping should be interpreted as follows:

High Bat Sensitive Areas represent **No-Go** areas for the construction of WEF infrastructure especially turbines (including all blades plus a 2 m pressure buffer around these), substations, offices, battery energy storage systems, quarries, construction camps, or laydown areas (to avoid disturbing key bat roosting, foraging, and/or commuting habitat, and to avoid high bat fatalities in these areas where high bat activity is anticipated).

Medium-High Bat Sensitive Areas represent areas where the construction of infrastructure and other disturbances should be avoided *where possible* (to avoid areas where bat roosting, foraging, commuting, and/or migration may be concentrated).

In **Medium** Bat Sensitive Areas, disturbances should be minimized.

The layout of the WEF infrastructure should be planned to coincide with **Low-Medium** Bat Sensitive Areas so far as possible.

Sensitivity mapping was based on the desktop review work, the extensive ground-truthing of potential bat important features, and the 12-month passive acoustic bat activity monitoring results, and took into consideration:

- Known and potential bat roosts (NSS 2014).
- Natural and artificial permanent, seasonal, and ephemeral surface water resources (CDNGI 2020).
- Geological layers, such as dolerite, which may be associated with karst formations (CDNGI 2020).
- Riparian and other woody vegetation and tree clumps (Mucina & Rutherford 2018; CDNGI 2020).
- Local buildings, including ruins (CDNGI 2020).
- Buffering of identified bat important features was based on recommendations in the South African guidelines on bat monitoring for proposed wind farms (MacEwan et al. 2020a), and our professional judgement.

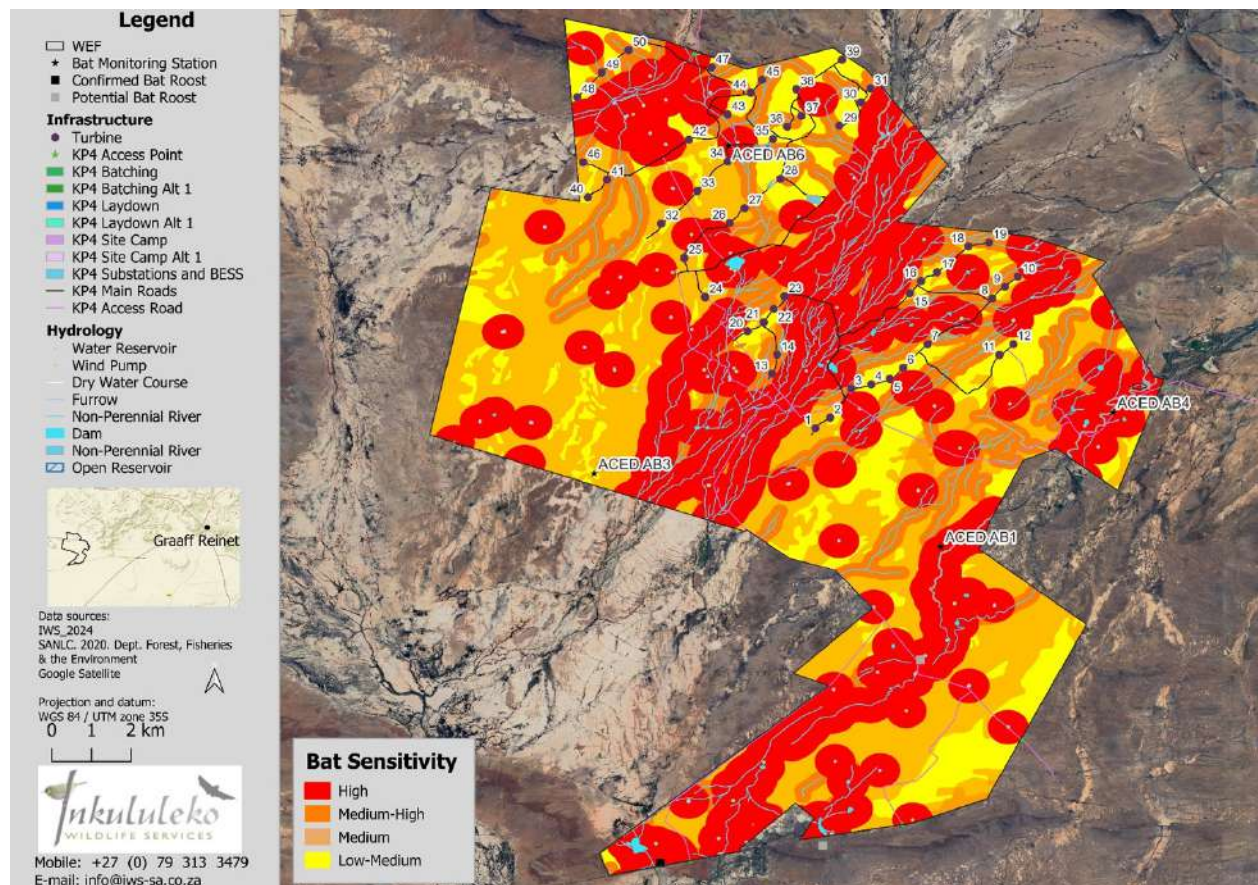


Figure 6-81: Bat sensitivity map for the proposed Kariega 4 WEF.

No turbine, including its full rotor swept area and a 2 m pressure buffer around this, should occur in High sensitive areas. Encroachment of turbines into Medium-High sensitive areas should be avoided so far as possible. Consequently, turbines should be located a minimum of one (100 m) blade length plus 2 m (total = 102 m) away from High sensitive areas, and where possible, from Medium-High sensitive areas.

The latest proposed infrastructure layout for the Kariega 4 WEF is shown in Figure 6-81 in relation to the bat sensitivity layer for the site, and includes a new alternative location for the batching area and excludes 30

previously proposed turbine positions (Table 6-92). Consequently, the WEF now comprises 50 (now 42) turbines and due to this, the total length of the road network has also been reduced. Of the 50 (now 42) proposed turbines, none are positioned within or have blades that will encroach into High sensitive areas, and 28 turbines (56%) are positioned within or have blades that will encroach into Medium-High sensitive areas. Twenty-two turbines (44%) coincide with Medium-Low and/or Medium sensitive areas. The BESS, site camp, and Eskom substation are proposed near to (<15 m from) High sensitive areas. The proposed alternate locations for ancillary infrastructure do not encroach on either High or Medium-High sensitive areas.

Based on this pre-construction bat monitoring study, IWS agrees with the “High” overall sensitivity rating of the site as per the National Screening Tool (Appendix 1). However, this is not due to the presence of only ephemeral drainage lines and wetlands on and near site, but due to: i) the collective presence of these natural and artificial hydrological features – particularly man-made reservoirs and dams, which provide a permanent or seasonal supply of water for bats; as well as ii) the slightly above-average levels of recorded bat activity onsite, relative to other WEF sites in the Nama Karoo shrublands ecoregion.

Table 6-92: Distance of proposed infrastructure from High and Medium-High sensitive areas under the latest layout.

Infrastructure (December 2023 WTG numbering, Rev 6)	Updated layout WTG numbering (April 2024, Rev 7)	Distance from High sensitive areas (m)	Distance from Medium-High sensitive areas (m)
Batching Alternate		630	238
Batching New Alternate		645	242
BESS		14	181
Laydown Area		190	0
Laydown Area Alternate		638	211
Site Camp		71	0
Site Camp Alternate		657	121
Substation		102	416
Substation - Eskom		9	478
T01	T01	366	358
T02	T02	290	364
T04	T03	103	0
T05	T04	283	242
T06	T05	108	408
T07	T06	123	226
T09	T07	177	34
T12	T08	338	14
T13	T09	232	49
T14	T10	107	16
T15	T11	589	146
T16	T12	208	204
T17	T13	110	9
T18	T14	245	0
T21	T15	112	55
T22	T16	217	33
T23	T17	236	236
T25	T18	242	0
T26	T19	450	0
T27	T20	127	108

Infrastructure (December 2023 WTG numbering, Rev 6)	Updated layout WTG numbering (April 2024, Rev 7)	Distance from High sensitive areas (m)	Distance from Medium-High sensitive areas (m)
T28	T21	439	188
T29	T22	242	19
T30	T23	103	0
T31	T24	276	392
T40	T25	225	830
T41	T26	113	53
T42	T27	675	87
T44	T28	722	10
T45	T29	449	0
T47	T30	106	340
T48	T31	109	0
T49	T32	336	327
T51	T33	115	1095
T53	T34	110	137
T55	T35	393	110
T56	T36	625	0
T57	T37	139	72
T58	T38	108	389
T61	T39	831	406
T62	T40	903	340
T63	T41	1223	0
T65	T42	754	304
T67	T43	283	0
T69	T44	519	69
T70	T45	859	0
T71	T46	758	124
T74	T47	108	0
T75	T48	113	287
T77	T49	318	0
T79	T50	437	0

6.9.3 Impact assessment

Updated versions of the IWS (2024) bat impact assessment tables are provided in Table 6-93 to Table 6-97. Without mitigation, the proposed Kariega 4 WEF is now expected to have a moderate (not major) - negative significant potential impact on bat roosts and bat ecosystem services, and a major - negative significant potential impact on bat foraging habitat, and in terms of turbine bat fatalities. With diligent, effective mitigation as updated and described in Table 6-93 to Table 6-97 in the BIA Addendum, the WEF's potential impact on bat roosts and bat ecosystem services could be reduced to minor (not moderate) – negative significance, and the potential impact in terms of bat foraging habitat and bat turbine fatalities could be reduced to moderate – negative significance.

Table 6-93: Roost disturbance or destruction.

No.	1			
Project phase	Construction			
Impact title	Roost disturbance or destruction			
Impact description	During construction of infrastructure for the WEF, potential bat roosts (roosting bats and/or roost sites) in trees, buildings, or elsewhere could be disturbed or destroyed (during possible tree felling, demolition of old buildings, blasting) if overlooked and/or not adequately avoided.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Permanent	Impact may be permanent, or in excess of 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Low - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Moderate - negative		Minor - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Established, but incomplete		Well established	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Avoid High sensitive areas (especially confirmed roosts, and the prescribed buffers around these). Ensure that no proposed turbines (including their full rotor swept areas) encroach on High sensitive areas. Ensure that any new buildings, substation, BESS, construction camp, laydown areas, and possible quarry/ies avoid all High sensitive areas. Minimize disturbance of Medium-High sensitive areas (especially potential roosts, and the prescribed buffers around these). Ensure that no proposed turbines (including their full rotor swept areas) encroach on Medium-High sensitive areas. Minimize the length and breadth of proposed roads to thus minimize the clearing and disturbance of natural areas (including potential bat roosting habitat). Avoid blasting within 2 km of a confirmed roost. Minimize degradation of terrestrial habitat (potential bat roosting habitat) by implementing and maintaining effective invasive alien plant, stormwater, erosion, sediment, and dust control measures. Minimize artificial lighting on site (excluding compulsory civil aviation lighting) - especially high-intensity, steady-burning, sodium vapour, quartz, halogen, and other bright lights at substations, offices, and turbines (to avoid disturbing roosts of certain sensitive bat species). All non-aviation lights should be hooded downward and directed to minimise horizontal and skyward illumination. Where possible, solar-powered motion-sensitive lights should be used.			
Comment on ratings	Bat roosts on site will most likley be disturbed and could even be permanently destroyed during construction particularly where woody vegetation, especially near natural and artificial water resources, is cleared. Roosts which will be impacted in this way will most likely comprise small numbers of Cape Serotines and other Least Concern bat species. With mitigation, chiefly avoidance of the High sensitive buffers around buildings and water resources (where woody vegetation is concentrated), the consequence will only be slightly-detrimental where woody vegetation in less sensitive areas will be cleared.			

Table 6-94: Destruction, degradation, and fragmentation of and displacement from foraging habitat.

No.	2			
Project phase	Construction, Operation & Decommissioning			
Impact title	Destruction, degradation, and fragmentation of and displacement from foraging habitat			
Impact description	Construction of the WEF will cause destruction, degradation, and fragmentation of mostly natural shrubland and trees where, respectively, aerial-foraging, and clutter and clutter-edge foraging bat species are likely to forage. Without careful planning, there could during construction also be destruction or disturbance of dams, reservoirs, drainage lines, and floodplains/wash areas, which provide bats (permanently, seasonally, or occasionally) with essential drinking water, concentrated insect prey, and/or which may represent important beacons or pathways for bat navigation and commuting. Furthermore, during operation, certain bats may be displaced from suitable foraging areas if they avoid the WEF (e.g. due to light pollution or obstruction to movement) or suffer fatality from collision with turbines. Decommissioning activities may similarly disturb habitat that would otherwise be suitable for bat foraging.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Limited	Limited to the site and its immediate surroundings.	Limited	Limited to the site and its immediate surroundings.
Duration	Permanent	Impact may be permanent, or in excess of 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Major - negative		Moderate - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.		
Potential mitigation	Avoid High sensitive areas (especially dams, functional reservoirs, and major drainage lines, and the prescribed buffers around these). Ensure that no proposed turbines (including their full rotor swept areas) encroach on High sensitive areas. Ensure that any new buildings, substation, BESS, construction camp, laydown areas, and possible quarry/ies avoid all High sensitive areas.			
	Minimize disturbance of Medium-High sensitive areas (secondary drainage lines, and the prescribed buffers around these). Ensure that no proposed turbines (including their full rotor swept areas) encroach on Medium-High sensitive areas.			
	Minimize the length and breadth of proposed roads to thus minimize the clearing and disturbance of natural areas (including potential bat foraging habitat).			
	Minimize degradation of terrestrial habitat (potential bat foraging habitat) by implementing and maintaining effective invasive alien plant, stormwater, erosion, sediment, and dust control measures.			
	Minimize artificial lighting on site (excluding compulsory civil aviation lighting) - especially high-intensity, steady-burning, sodium vapour, quartz, halogen, and other bright lights at substations, offices, and turbines (to avoid disturbing certain sensitive bat species). All non-aviation lights should be hooded downward and directed to minimise horizontal and skyward illumination. Where possible, solar-powered motion-sensitive lights should be used.			
	Rehabilitate disturbed terrestrial habitat and water resources (bat foraging habitat). Implement effective rehabilitation of disturbed terrestrial habitat and water resources based on consultation with an appropriate experienced specialist(s). Carefully manage alien vegetation, livestock grazing, and water points.			
Comment on ratings	Bat foraging habitat will most likely be destroyed, degraded, and fragmented, and bats may be displaced, particularly where woody vegetation is cleared, and natural and artificial water resources may be disturbed or destroyed. Although onsite terrestrial vegetation is common and widespread in the region, permanent and seasonal water supplies and distinct drainage lines are more localized and limited. With mitigation, chiefly avoidance of the High sensitive buffers around water resources (where woody vegetation is concentrated), the consequence will only be slightly-detrimental where woody vegetation in less sensitive areas will be cleared, and where ephemeral drainage lines will be intercepted and locally disturbed.			

Table 6-95: Bat fatalities from collision with turbines, and potential population declines.

No.	3			
Project phase	Operation			
Impact title	Bat fatalities from collision with turbines, and potential population declines			
Impact description	During operation of the WEF, there will be inevitable fatality of bats from their collision with turbines, and possible barotrauma. Certain bat species cover large distances, and if the WEF causes fatalities of bats from near and far afield, onsite, local, and possibly even regional bat populations could be impacted. Without mitigation, appreciable bat fatalities are anticipated considering that: i) the most prevalent onsite species all have a High Risk of fatality from turbines; and ii) slightly above-average levels of bat activity were recorded onsite compared to other sites in the Nama Karoo ecoregion.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Major - negative		Moderate - negative	
Importance	High	High	High	High
Consequence	Highly-detrimental		Moderately-detrimental	
Confidence	Well established		Established, but incomplete	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Avoid High sensitive areas (including all confirmed roosts, dams, functional reservoirs, and major drainage lines, and the prescribed buffers around these). Ensure that no proposed turbines (including their full rotor swept areas) encroach on High sensitive areas. Ensure that any new buildings, substation, BESS, construction camp, laydown areas, and possible quarry/ies avoid all High sensitive areas. Minimize disturbance of Medium-High sensitive areas (including all potential roosts, secondary drainage lines, and the prescribed buffers around these). Ensure that no proposed turbines (including their full rotor swept areas) encroach on Medium-High sensitive areas. Minimize artificial lighting on site (excluding compulsory civil aviation lighting) - especially high-intensity, steady burning, sodium vapour, quartz, halogen, and other bright lights at substations, offices, and turbines (to avoid attracting certain insects and bats into the WEF site). All non-aviation lights should be hooded downward and directed to minimise horizontal and skyward illumination. Where possible, solar-powered motion-sensitive lights should be used. Monitor bat fatalities (and ideally also live bat activity) as soon as the first turbine is operational - as per the latest SABAA guideline for this (Aronson <i>et al.</i> 2020 or later) - during the WEF's first two years of operation, and then every fifth year thereafter. The monitoring and data analysis are to be conducted to a high standard so that there is confidence in the estimated numbers of actual bat fatalities. Mitigate bat fatalities adaptively by consulting the latest SABAA guideline for this (Aronson <i>et al.</i> 2020 or later), and the best available relevant scientific information. Adequate financial provision should be made to permit effective monitoring, management, and mitigation of bat fatalities throughout the life of the WEF. If the monitoring and data analysis are poorly performed, and/or if fatalities exceed the WEF's bat fatality threshold (to be calculated as per MacEwan <i>et al.</i> 2018 or later), and unless reliable and comprehensive operational monitoring data and a suitably experienced bat specialist indicate otherwise: Reduce fatalities by implementing curtailment of all problematic turbines below an initial cut-in speed of 6.5 m/s during temperatures of 12 °C or warmer from sunset to sunrise in February, March, April, and September. The 6.5 m/s turbine cut-in speed represents the wind speed associated with approximately 50% of bat activity recorded at 116 m above ground level in 2021/2022 by IWS. Report the annual operational bat monitoring results to SABAA (the South African Bat Assessment Association), EWT (the Endangered Wildlife Trust), and DFFE (the national Department of Forestry, Fisheries, and the Environment). Forward all (live and fatality) bat monitoring data to the database recommended by SABAA to expand the scientific knowledge base for more informed decision making and mitigation.			
Comment on ratings	Bat fatalities may occur throughout the life of the WEF despite mitigation. With mitigation, chiefly avoidance of the High sensitive areas, and proper monitoring and adaptive mitigation of bat fatalities, the consequence will be moderately-detrimental as it is assumed that most fatalities will represent bats from local populations. Effective mitigation should ensure that fatalities do not exceed the calculated bat fatality threshold for the WEF.			

Table 6-96: Decline or loss of bat ecosystem services.

No.	4			
Project phase	Construction, Operation & Decommissioning			
Impact title	Decline or loss of bat ecosystem services			
Impact description	If high bat fatalities lead to declines in certain species populations, the ecosystem services that these populations provide will be compromised. As locally occurring bat species are insectivorous, their eco-services relate to insect (including pest) species predation and population regulation.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minimal - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Implement all measures that have been prescribed to mitigate bat roost disturbance/destruction, bat habitat loss, and bat fatalities.			
Comment on ratings	Although bat fatalities may occur throughout the life of the WEF even with mitigation, bat ecoservices might only be compromised in the short-term, for example, after unanticipated mass mortality events following high rainfall and insect activity. If bat fatalities are largely mitigated, it is assumed that most fatalities will represent bats from local populations and therefore, ecoservices of local bats will mainly be impacted. So long as bat fatalities remain below the fatality threshold, it is presumably unlikely that local bat eco-services would be significantly impacted and, therefore, the consequence of this impact would be very slightly detrimental.			

Table 6-97: Cumulative impact on bats from multiple WEFs in the region.

No.	5			
Project phase	Construction, Operation & Decommissioning			
Impact title	Cumulative impact on bats from multiple WEFs in the region			
Impact description	The potential cumulative impact on bats from the proposed WEF and some other proposed renewable developments in the immediate surrounds is a noteworthy concern . Although presently there are no operational wind farms in the region, known approved wind farms within a 100 km radius of the proposed Kariega WEF cluster site include the Umsinde Emoyeni, Khangela Emoyeni, Ishwati Emoyeni, Victoria West, Poortjie Wes, Kudu, and Tango WEFs. Various other WEFs are proposed in the region of which the Camdeboo, BioTherm Aberdeen, and Mainstream Aberdeen WEFs are known. In addition to these, there are also solar projects proposed in the region, which will impact bats mainly in terms of added terrestrial habitat loss. The location and extent of these renewable energy projects, for which environmental impact assessment applications have been received by the Department of Forestry, Fisheries and the Environment (Renewable Energy EIA Application Map, 2023) is shown in IWS' report.			
Impact Assessment	Overall impact from proposed project, if considered in isolation, WITHOUT MITIGATION		Cumulative impact of known renewable energy projects, within a 100 km radius, WITHOUT MITIGATION	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	National	Impacts manifest at a national level / provincial.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Very high	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will permanently cease.
Magnitude	High - negative		Very high - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Major - negative		Severe - negative	
Importance	High	High	High	High
Consequence	Highly-detrimental		Highly-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Impact Assessment	Overall impact from proposed project, if considered in isolation, WITH MITIGATION		Cumulative impact of known renewable energy projects, within a 100 km radius, WITH MITIGATION	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.
Magnitude	Moderate - negative		High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Very likely (>90%)	There are sound reasons that the impact will occur.
Significance	Moderate - negative		Major - negative	
Importance	Moderate	Moderate	Moderate	Moderate
Consequence	Slightly-detrimental		Moderately-detrimental	
Confidence	Established, but incomplete		Established, but incomplete	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Every WEF project in the region should diligently implement all measures that have been prescribed by the project-specific bat specialists to mitigate bat roost disturbance/destruction, bat habitat loss, and bat fatalities. These measures are likely to be similar to IWS' bat impact mitigation recommendations for the present proposed project.			
Comment on ratings	WITHOUT very diligent monitoring and mitigation of bat fatalities and other impacts (e.g. roost disturbance) at all WEFs in the region, their potential cumulative impact on bat habitats, populations, and ecosystem services was rated with severe negative significance and a highly-detrimental consequence. Only WITH proper bat fatality mitigation using turbine curtailment and other secondary mitigation measures, and diligent bat fatality monitoring and adaptive mitigation, may the cumulative impact of these WEFs on bats be reduced to major negative significance with a moderately-detrimental consequence.			

6.9.4 Conclusion and Recommendations

Under the currently proposed layout, no turbine or other infrastructure encroaches on High sensitive areas. Turbines that coincide with Medium-High sensitive areas should be shifted/relocated where possible. In addition, the feasibility of the prescribed turbine curtailment should be tested prior to finalization of the project - for in case bat fatalities at some point exceed the calculated bat fatality threshold for the WEF. The impact of the prescribed curtailment on the financial feasibility of the wind farm could be explored by using the available weather data from site to obtain estimates of the number of turbine night hours per annum during which curtailment would need to be implemented and, consequently, how much turbine energy production could potentially be lost. The results should be used to ensure that there is adequate financial provision to accommodate curtailment during operation. All IWS' recommended bat impact mitigation measures must be included in the project's Environmental Management Programme.

6.10 Terrestrial Biodiversity (including animals and plants)

The Terrestrial Biodiversity Impact Assessment (TBIA) was undertaken by Brian Colloty of EnviroSci. The findings of the TBIA concluded that most of the anticipated impacts are associated with disturbance during the construction phase, while changes to form and function of the site will be limited in the operational and maintenance phase. It's anticipated that all impacts would be low post mitigation, thus the specialist does not object to the approval of this project. This is on condition of several mitigation measure specifically related to construction phase.

The full specialist report is attached hereto as **Annexure D 9, Terrestrial biodiversity Impact Assessment (2024)**

6.10.1 Baseline Description

The area is characterised by low lying riverine valleys fed by a higher lying plateaus / escarpments and inselbergs (koppies) to the north. It is largely untransformed, other than being used for grazing and the presence of previously cultivated areas near homesteads.

6.10.1.1 Terrestrial Ecosystems

The natural vegetation within the proposed development footprint is located within the Eastern Lower Karoo (NKI2), Upper Karoo Hardeveld (Nku2) and Southern Karoo Riviere(Figure 6-91). These, vegetation units although with limited formal protection were rated as Least Concern in terms of conservation status.

The Southern Karoo Riviere (AZi6) inland saline vegetation unit is associated with the dry alluvial systems (Figure 6-83) that dominate the region. This habitat is sensitive to changes, especially hydrological changes and was thus mapped at a finer scale to include the functional hydrological units of these habitats, so that these would be avoided by the proposed layouts. Also associated with this habitat type are small wind driven hummocks or low sand dune features, most never taller than 50-80cm. This seem be de derived from the dry alluvia within the watercourses that are then blown into the "striated" formations observed. These areas therefore are not associated with any permanent watercourses or flows associated with the adjacent rivers but may contain flows during extreme rainfall events. It is however believed these are man-made based on landowner interaction, to increase the fertility of the soils / water holding capacity to increase the vegetation cover for grazing.

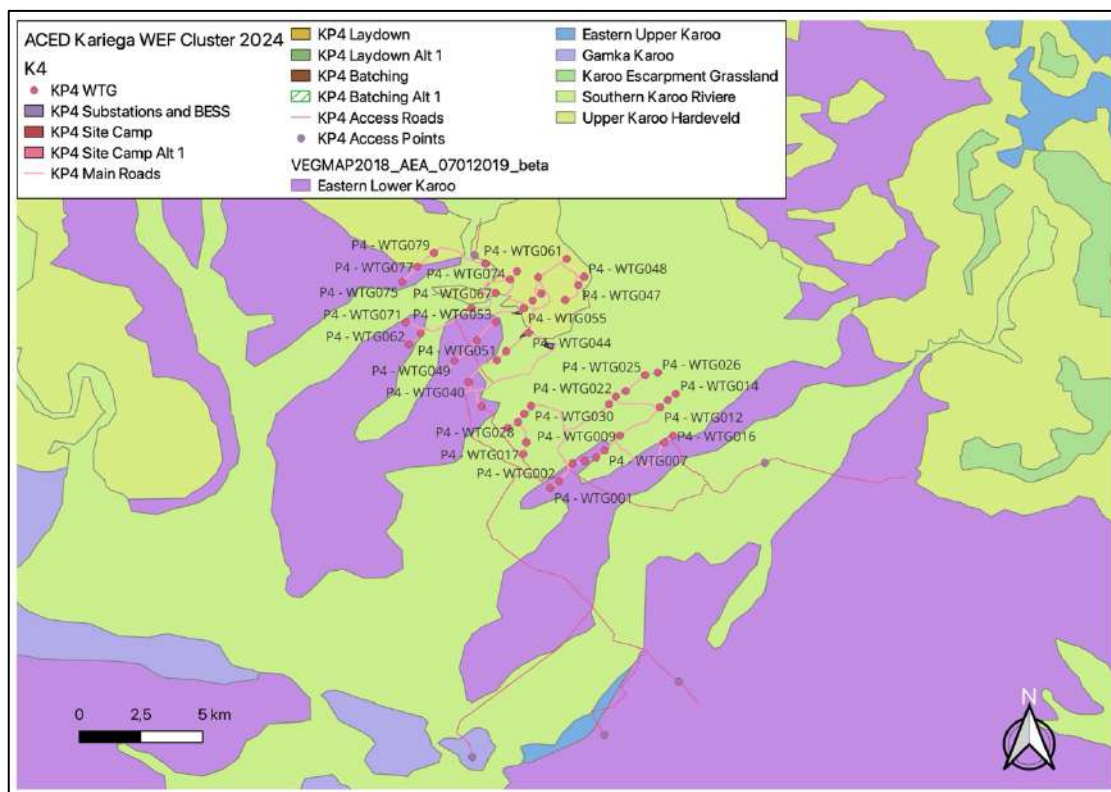


Figure 6-82: The vegetation units as shown in NSBA 2018 vegetation map spatial data (vegmap)



Figure 6-83: A typical transitional area between the alluvial portions of a floodplain and the Eastern Lower Karoo vegetation units.

6.10.1.2 Ecological Processes, Functioning and Drivers

The habitats within the greater region are typically fire and or frost free coupled to a low annual rainfall, which keeps these areas from becoming woody tree dominated. The broader alluvial floodplains, that contain concentrated flows during rainfall events, do however contain riparian thickets (thorn tree dominated areas), which are discussed in more detail in the aquatic assessment.

Currently little occurs in terms of habitat fragmentation, except for naturally occurring low ridges and outcrops, however these areas provide certain microclimates for unique species, most listed or protected.

Thus, the focus of the baseline assessment was to map these habitats or corridors associated with these habitats, so that these then form the No-Go areas, as they provide habitat variability and unique species assemblages when compared to the remaining areas.

6.10.1.3 Species

As of the baseline assessment a species checklist was created using the data sources mentioned earlier, with the exclusion of birds and bats as they are dealt with in separate assessments. Approximately 332 plant, insect, reptile, amphibian, and mammal species are expected to occur within the greater region, with several being observed during the field assessment. A species checklist is included in Appendix E of the Terrestrial Biodiversity report (Annexure D 9, Terrestrial biodiversity Impact Assessment (2024).

This will also include a detailed search for plant species listed in the Screening Tool Report, namely, *Chersobius boulengeri*, *Bunolagus monticularis*, Plants (*Peersia frithii* Sensitive species 1212 *Tridentea virescens* Sensitive species 1039).

The two key species that need to be avoided include the Endangered Riverine rabbit (*Bunolagus monticularis*) and Karoo dwarf tortoise (*Chersobius boulengeri*), and in this regard favoured habitats were inspected and or observed during the study period, which also included several adjacent farms with similar habitat from 2021 – 2023. This information was also compared to observations made during other ecological assessments for adjacent renewable energy projects, which yielded the same results.

Bunolagus monticularis is predominantly a browser and relies on dense riparian vegetation found along seasonal rivers in the Karoo. This includes salt-loving plants such as *Salsola* and *Lycium*. Grasses are included in the diet when these are available in the wet season. Based on then on this information and none being observed in this region, the dense riparian / alluvial areas have been mapped and been avoided, with the development of the wind farm in areas such as that shown (Figure 6-84).

This will also include a detailed search for plant species listed in the Screening Tool Report, namely *Chersobius boulengeri*, *Bunolagus monticularis*, Plants (*Peersia frithii* Sensitive species 1212 *Tridentea virescens* Sensitive species 1039). The two key species that need to be avoided include the Endangered Riverine rabbit (*Bunolagus monticularis*) and Karoo dwarf tortoise (*Chersobius boulengeri*), and in this regard favoured habitats were inspected and or observed during the study period, which also included several adjacent farms with similar habitat from 2021 – 2023. This information was also compared to observations made during other ecological assessments for adjacent renewable energy projects, which yielded the same results. Several other protected species (PNCO) were however recorded and included several succulents and bulb species, such as *Drimia altissima*, *Faucaria*, *Aloe broomii*, *Euphorbia esculenta*, *Brunsvigia radulosa*.



Figure 6-84: A view of a typical Eastern Lower Karoo vegetation unit.



Figure 6-85: A typical transitional area between the alluvial portions of a floodplain and the Eastern Lower Karoo vegetation units.

The following are fauna species that potentially occur within the study area and are listed as protected species (species indicated in **bold** were observed within the study sites during the field visit):

Schedule 1: Specially Protected Fauna as per the PNCO:

- *Felis nigripes* - Black-footed cat/Miersshoottier
- *Felis silvestris* - African wild cat/Afrika wildekat
- *Ictonyx striatus* - Striped polecat/Stinkmuishond
- *Mellivora capensis* - Honey badger/Ratel
- ***Otocyon megalotis* - Bat-eared fox/Bakoovos**
- *Proteles cristatus* – Aardwolf/Maanhaarjakkals
- *Vulpes chama* - Cape fox / Silver jackal Silwervos
- *Orycteropus afer* - Aardvark / Ant-bear Erdvark / Aardvark
- *Atelerix frontalis* – South African hedgehog
- Family: *Chamaeleonidae* - Chamaeleons, all species
- **Family: *Cordylidae* Girdled lizards, all species**

Schedule 2: Protected Species as per the PNCO, lists virtually all indigenous fauna which do not fall under Schedule 1 are classified under then Schedule 2. Except those species classified as pests.

In terms of mammals most rodents, shrews, elephant shrews, bats, hares and rabbits, carnivores such as mongoose, genets, and meerkat, antelope such as klipspringer, steenbok, Mountain reedbuck and duiker are included. In terms of other vertebrates, all tortoises, lizards, most harmless snakes and all frogs are listed under Schedule 2. The full list is contained within the Schedule, and it not repeated here.

In terms of fauna, the following, *inter alia*, are protected and may not be hunted, captured or harmed without a permit:

- All tortoises [1 species observed which include Angulate tortoise (*Chersina angulate*)];
- All lizards;
- All frogs;
- Most snakes [1 species observed Karoo sand snake (*Psammophylax rhombeatus rhombeatus*)],
- All indigenous antelope;
- Aardvark;
- Most small carnivores such as Honey Badger, Cape Fox, Bat-eared Fox;
- Large Grey Mongoose etc.; and
- Most birds except pest species.

Except for the tortoises and snakes, the species listed above typically leave the area once construction commences, thus permits for the relocation of snakes and tortoises must be obtained. The presence of any amphibian species is discussed in the Aquatic Assessment.

6.10.1.4 Conservation Planning

Critical Biodiversity Areas (CBAs)

The various Critical Biodiversity Areas, as well as Ecological Support Areas, as defined by the Eastern Cape Biodiversity Conservation Plan (ECBCP, 2019), where the proposed footprint has avoided all Terrestrial CBAs (Figure 6-86). Similarly, the proposed towers and budlings have also avoided any CBAs identified in the Western Cape Beaufort West Biodiversity Spatial Plan (WCBSP, 2017) (Figure 6-86).

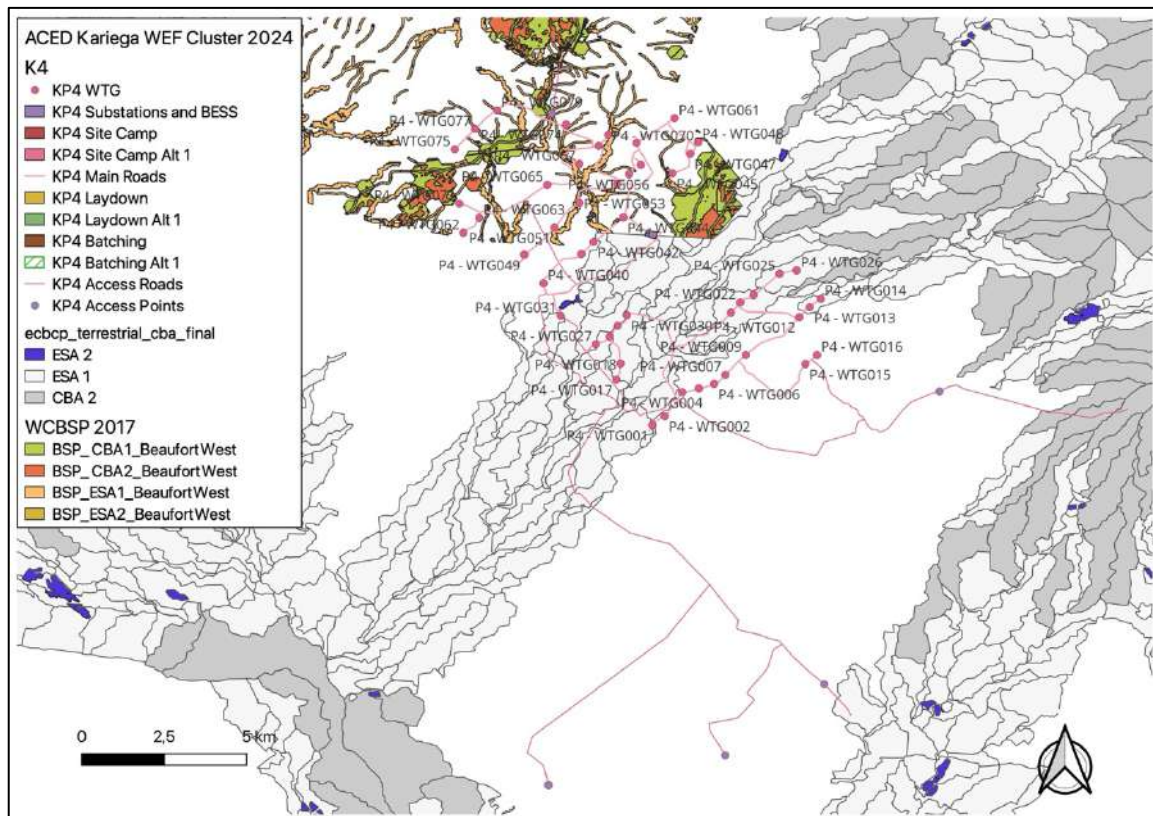


Figure 6-86: ECBCP Terrestrial CBA and ESAs (ECBCP, 2019) and Western Cape Biodiversity Spatial Plan (WCBSP, 2017) layers

Ecological Support Areas (ESAs)

Ecological Support Area, which were considered a High sensitivity area in this assessment were avoided (Figure 6-86).

Protected Areas (PAs)

No Protected areas occur within the development footprint and the closest Potential Expansion Area is located more than 9km to the northeast (Karoo Escarpment Grassland) associated with high elevation grassland areas north of Aberdeen.

6.10.1.5 Key Landscape Features

Strategic Water Source Areas

Not applicable.

Freshwater Ecosystem Priority Area Sub Catchments

The proposed footprint is bisected two subquaternary catchments, one listed as a National Freshwater Ecosystem Priority Area (NFEPA) and the other an Upstream NFEPA. This is discussed in greater detail in the aquatic assessment but is related to the Alluvial systems associated with the Ouplaas River, considered as High Sensitivity habitats in this assessment.

6.10.2 Site Sensitivity

6.10.2.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

While the *Protocol for Specialist Assessment and Minimum Report Content Requirements for the Environmental Impacts on Terrestrial Biodiversity* (Government Gazette 43110, 20 March 2020), superseding the Appendix 6 NEMA requirements, was adhered to. This report thus meets the criteria to fulfil a Terrestrial Biodiversity Specialist Assessment Report as the proposed site contains areas rated as *Very High*, *High*, *Medium* and *Low sensitivity* by the DFFE Screening Tool (See Screening Verification Statement – Appendix C of TBIA) (Figure 6-87, Figure 6-88 and Figure 6-89).

This is due to the presence of:

- Birds rated as High (Assessed in the Avifaunal assessment)
- One reptile (*Chersobius boulengeri*) as Medium
- One mammal (*Bunolagus monticularis*) as High & Medium
- Plants (*Peersia frithii* Sensitive species 1212 *Tridentea virescens*, Sensitive species 1039) rated as Medium. Species 1039 was also rated as High.
- Terrestrial (Critical Biodiversity Area 2, Ecological Support Area 1 and Freshwater Ecosystem Priority Area) rated as Very High

The study area is however not associated within any Strategic Water Resource Areas, Wetland Clusters or Threatened Ecosystems.

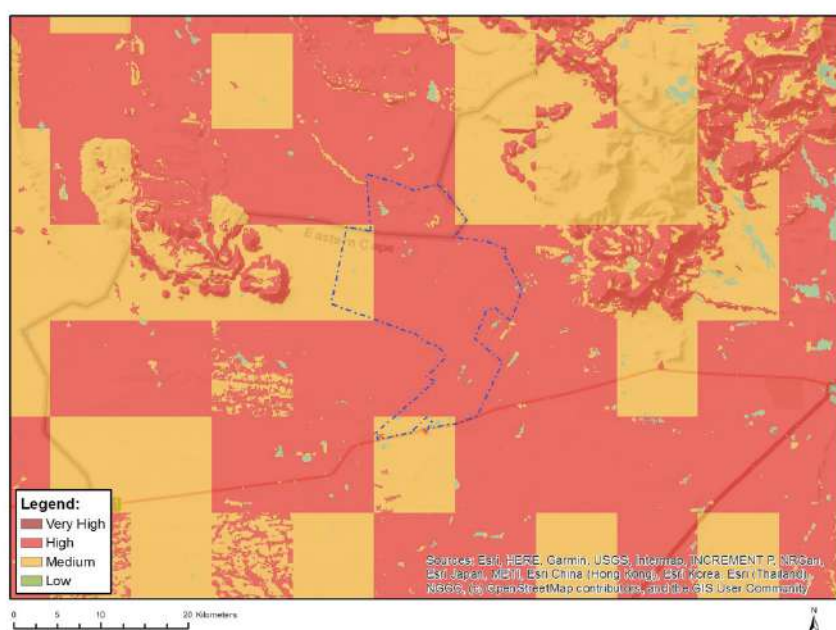


Figure 6-87: Screening tool results for the project area for the Animal Biodiversity theme.

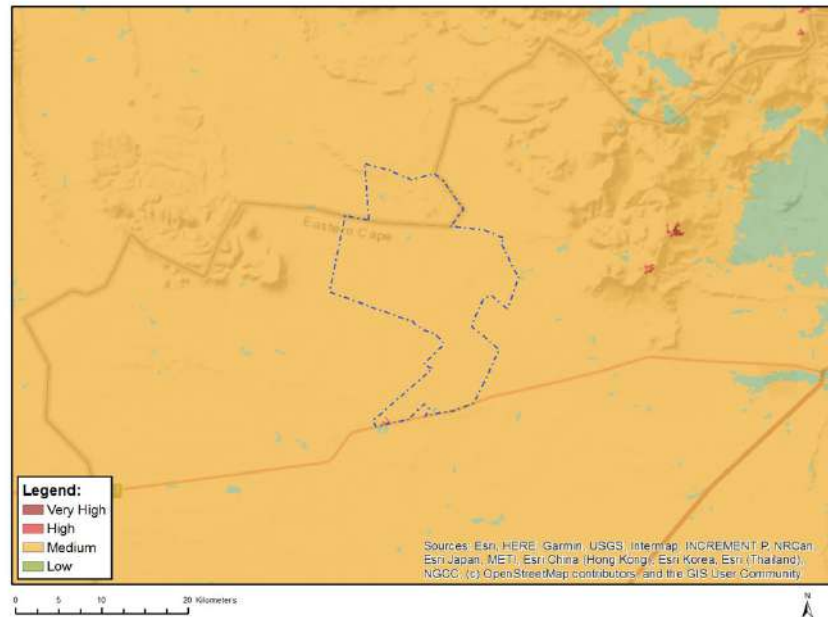


Figure 6-88: Screening tool results for the project area for the Plants Biodiversity theme.

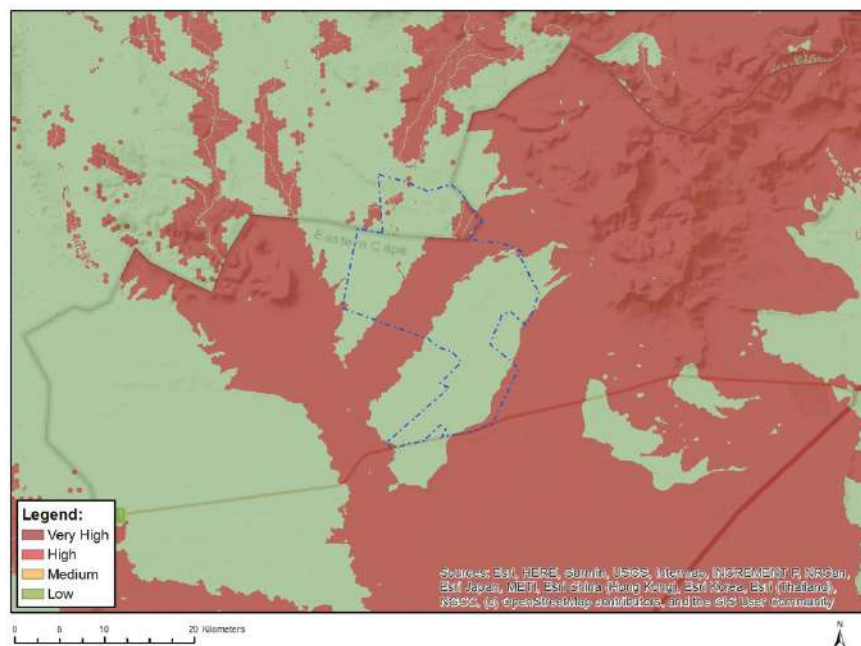


Figure 6-89: Screening tool results for the project area for the Terrestrial Biodiversity theme.

6.10.2.2 Specialist Sensitivity Analysis and Verification

Using the baseline description and field data, while considering the current disturbances and site characteristics, several ecological features were identified, then categorised into one of number pre-determined sensitivity categories to provide protect and/or guide the layout planning and design processes. This was conducted using the Site Ecological Importance (SEI) Protocol as per the SANBI Guidelines.

The SEI protocol used in this assessment, provides a species and habitat ranking approach to assessing the importance and thus indirectly the sensitivity of a particular site. This was adapted from SANBI, 2020 Ver 3.1 2022, and Table 6-98 indicates the Sensitivity Ratings, while Table 6-99 indicates the results, calculated as follows and then summarised spatially in Figure 6-90.

Note SEI is calculated as follows based on the Section 8 of SANBI (2022):

Site Ecological Importance = Biodiversity Importance (BI) + Receptor Resilience (RR)

Where BI = Conservation Importance (CI) + Functional Integrity (FI)

Table 6-98: Species and habitat sensitivity ratings definitions.

Sensitivity Rating	Description
Very High	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very Low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

These proposed constraints / buffers do not include bird and or bat specialist.

Table 6-99: Results of the sensitivity rating / constraints assessment.

Development Component	Habitat Type	Recommended Buffer	Development Acceptability	Sensitivity Rating Override and or caveat ³⁰	Conservation status & Importance	Functional Integrity	SEI
Turbines	Very High / No-go low ridges and rocky areas	25m	No	None	High	High	Very High
	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderated
	Remainder of site	0m	Yes	None	Low	High	Low
Buildings / Substations & BESS	Very High / No-go low ridges and rocky areas	25m	No	None	High	High	Very High
	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderated
	Remainder of site	0m	Yes	None	Low	High	Low
Roads	Very High / No-go low ridges and rocky areas	25m	No	None	High	High	Very High
	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderated
	Remainder of site	0m	Yes	None	Low	High	Low
OHL	Very High / No-go low ridges and rocky areas	25m	No	None	High	High	Very High
	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderated

³⁰ If an impact such as a road or disturbance already occurs within the proposed footprint and / or a technical solution can be provided that would not impact on the form or function of the habitat in question, then sensitivity rating for that particular habitat against the activity can be overridden.

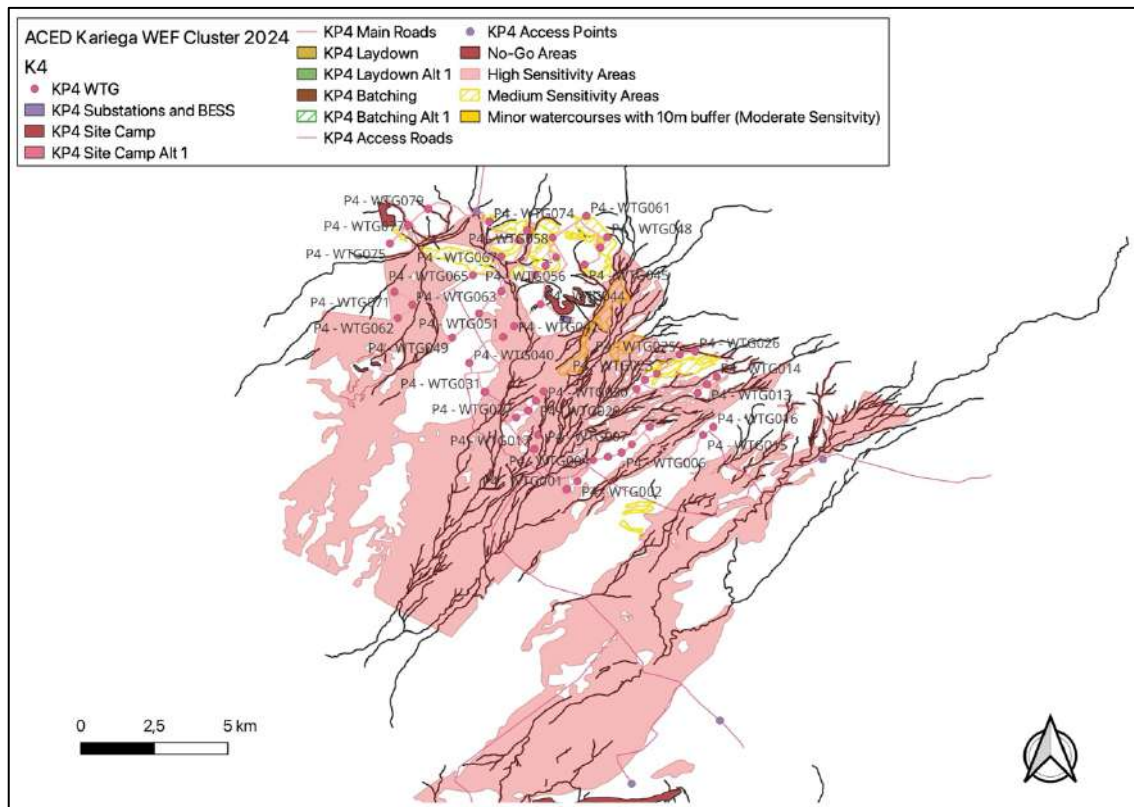


Figure 6-90: The delineated habitats and their respective sensitivity ratings in relation to the proposed layout, where all other areas are rated as LOW

6.10.3 Impact assessment

Due to the nature of the wind farm layout, the overall impacts are typically related to the construction and decommissioning phases of the project, i.e. when the soils are disturbed when the road networks and hard surface areas are developed. It has been assumed that the overhead cable sections will have the poles placed outside of the demarcated water course areas and would thus have less of an impact.

6.10.3.1 Potential Impacts during the Construction Phase

IMPACT 1: Loss of species of special concern – Direct Impact

Several plant Species of Conservation Concern (SCC) within the region have conservation value or are protected by the Provincial bodies of legislation, several listed species were observed within the study area, but could either be avoided during the micro-siting phase post authorisation or through relocation. This latter is only successful if conducted in the spring/summer months for this site, but not seen as a means to mitigate any impacts (Table 6-100).

IMPACT 2: Damage and disturbance of the habitats rated as Very High Sensitivity – Direct Impact

This assessment identified several Very High sensitivity terrestrial environments which the exception of a areas with existing impacts / roads have been avoided. These habitats include any areas that contain rocky ridges or large rocky outcrop areas and alluvial areas. The rationale being that these areas contained the highest prevalence of unique microhabitat within the area, and consequently also contained the highest number of

protected / listed plant species, coupled to the fact that these areas could contain Endangered tortoise and rabbit habitat (Table 6-101).

IMPACT 3 Loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. This in turn could also lead to habitat fragmentation – Direct Impact

Due to the nature of the wind farm layout, the overall impacts are typically related to the construction and decommissioning phases of the project, i.e. when the soils are disturbed when the road networks and hard surface areas are developed. It has been assumed that the overhead cable sections will have the poles placed outside of the demarcated water course areas and would thus have less of an impact (Table 6-102).

IMPACT 4: Displacement of any animals because of any disturbance or habitat loss. This includes animal mortalities related to construction vehicle traffic – Direct Impact

The construction phase has the potential to create animal disturbance either through physical habitat destruction or displacement by plant and vehicle movement. Vehicle movement also result in animal mortalities (Table 6-103).

Table 6-100: Loss of species of special concern (SSC).

No.	1			
Project phase	Construction & Decommissioning			
Impact title	Loss of species of special concern (SSC)			
Impact description	Potential impact on Protected Plant species, observed within the site listed on a Provincial level			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Any remaining species that could not be avoided must then be relocated in a Search and Rescue programme that should be initiated prior to construction. (Note this has not been included as a means to reduce the impact rating) Develop Construction EMP, Monitoring and Rehabilitation Plan			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that is search and rescue is required, then this is conducted in the spring / summer cycle for the region. EnviroSci has now conducted 12 Wind Farm search and rescue programmes in the past 5 years and the success of S&R is highly dependent on the time of year it is conducted.			

Table 6-101: Damage and disturbance of the habitats rated as Very High Sensitivity – Direct Impact.

No.	2			
Project phase	Construction & Decommissioning			
Impact title	Damage and disturbance of the habitats rated as Very High Sensitivity – Direct Impact			
Impact description	Potential impact very sensitive habitats that are also associated with habitat requirements for two Endangered faunal species			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	Regional	Impacts manifest at a regional / municipal level.

Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	A pre-construction walkthrough by a terrestrial specialist is recommended and they can assist with the development of the Construction Rehabilitation and Monitoring plan, coupled to micro-siting of the final layout. Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. 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 footprint during the construction phase			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place, and this should include reptile / tortoise and small mammal monitoring in the pre-commencement and construction phase.			

Table 6-102: Loss of ecosystem services, and or habitats.

No.	3			
Project phase	Construction & Decommissioning			
Impact title	Loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. This in turn could also lead to habitat fragmentation – Direct Impact			
Impact description	The potential impact on ecosystem services still exists, due to clearing of vegetation, however all CBA/ESAs have been avoided. For this purpose, the footprints have avoided high ecological value areas, while keeping the overall footprint condensed			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.

Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High			
Potential mitigation	Develop and implement a Construction Rehabilitation and Monitoring plan post Environmental Authorisation. This plan should include relocation of suitable plant species, but more important protect any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas; and Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re- establishment of plant cover is desirable to prevent erosion.			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place, and this should include reptile / tortoise and small mammal monitoring in the pre-commencement and construction phase.			

Table 6-103: Displacement of any animals because of any disturbance or habitat loss.

No. 4				
Project phase	Construction & Decommissioning			
Impact title	Displacement of any animals because of any disturbance or habitat loss. This includes animal mortalities related to construction vehicle traffic – Direct Impact			
Impact description	The increase in vehicle traffic, and vegetation clearing may result in the direct disturbance of animal habitat and movement			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Major - negative		Minor - negative	
Importance	Very high	Very high	Moderate	Moderate
Consequence	Highly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Clear demarcation during the construction phase of all undisturbed sensitive areas that are not within the direct footprint to ensure that there is no uncontrolled access by construction vehicles and labourers; Educate contractors as to the importance of the undisturbed conservations areas and importance of avoiding them; All vehicles must stick to designated and prepared roads and adhere to the speed limit on site of 40km/hr; Mitigating the risk of poaching by fencing in the accommodation compounds (if present) of the construction crews, to prevent individuals from wandering in the veld after hours; banning the possession of dogs on site by construction and maintenance staff			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place, and this should include reptile / tortoise and small mammal monitoring in the pre-commencement and construction phase.			

6.10.3.2 Potential Impacts during the Operational Phase

IMPACT 5: Potential impact 5: Displacement of any animals which mostly includes animal mortalities related to vehicle traffic - Direct

Although most of the species observed are mobile, the increase in vehicle movement could result in an increase in road mortalities, Table 6-104.

Table 6-104: Displacement of any animals because of any disturbance or habitat loss.

No.	5			
Project phase	Operation			
Impact title	Displacement of any animals because of any disturbance or habitat loss. This includes animal mortalities related to construction vehicle traffic – Direct Impact			
Impact description	The increase in vehicle traffic may result in the direct disturbance of animal habitat and movement			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Major - negative		Minor - negative	
Importance	Very high	Very high	Moderate	Moderate
Consequence	Highly-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	All vehicles must stick to designated and prepared roads and adhere to the speed limit on site of 40km/hr;			
Comment on ratings	The reduction in impact significances post mitigation is dependent on the fact that rehabilitation and monitoring must take place, and this should include reptile / tortoise and small mammal monitoring in the operational phase for the first year of operations, every six months			

6.10.3.3 Cumulative Impacts

When assessing the impacts, it is unlikely that additional large-scale impacts on the environment would occur within the site, this being based on the fact that once stable / vegetated, the works areas would not create any additional disturbances to habitats observed. This is assuming that the mitigation in the construction, operational and decommissioning phases are adhered to.

Therefore, the cumulative assessment considers the various proposed renewable projects that occur within a 30 km radius of this site, namely the proposed such as the AREP Aberdeen Cluster, and their associated grid connections as well as the remainder of the Kariega cluster projects. EnviroSci has assisted with micro-siting these projects, thus understands these developments and the potential impacts and proposed mitigations.

Impact 6: All activities within delineated areas, when combined with present day activities

The cumulative (Table 6-105) impact of the present-day wind farms combined with the proposed project activities that may impact on the respective aquatic systems were considered.

Table 6-105: Cumulative impacts on terrestrial biodiversity.

No.	6			
Project phase	Cumulative impacts			
Impact title	In the assessment of this project, a number of projects have been assessed by the report author within a 35km radius and or other sites were accessed during the course of travelling between the various projects. Projects included the AEP Aberdeen WEF cluster, and the approved Eskom Aberdeen Wind Farm. Of these projects, this report author has been involved in the initial EIA aquatic assessments or has managed / assisted with the associated grid connections these projects (AEP Aberdeen WEF Cluster & Eskom Aberdeen WEF).			
Impact description	All of the projects have indicated that their intention with regard to mitigation, i.e. selecting the best possible sites to minimise the local and regional impacts. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such clearing high sensitivity areas and or impacting sensitive species			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	

Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.
Potential mitigation	The most significant form of mitigation would be to select development options that avoided all features that were rated with a Very High sensitivity, which will not be possible due to the technical constraints of this project. However detailed assessment of the habitats, with differentiation of functional habitat (typically with riparian habitat) was undertaken, and the present layout has avoided these areas within the projects assessed.	
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place.	

6.10.4 Conclusion and Recommendations

The proposed layout has also avoided the majority of the High Sensitivity environments and will only need to span some of the Medium sensitivity aquatic environments (assessed in the Aquatic report). However as most of the infrastructure has through a process of design iteration avoided important terrestrial habitats, no preference is thus given to the alternative Site Camp, Batching from a terrestrial standpoint.

The nature of the wind farm is such that it carries a low to moderate intensity impact on terrestrial resources, with highest number of impacts being associated creation of roads, installation of cables and other infrastructures across the site. The project does however have a small footprint spread out over a large area, allowing for retention of much of the natural area so the ecosystems should remain largely unaffected. This is largely based on the assumption that all Very High sensitivity habitats can be avoided by using the existing tracks and roads shown in this assessment.

In conclusion, most of the anticipated impacts will include disturbance during the construction phase, while changes to form and function of the site will be limited in the operational and maintenance (O&M) phase, and it is anticipated that all these would be Low post mitigation, thus no objection the specialist does not object to the approval of this project.

A key recommendation is that that during the construction mobilisation process, that any additional temporary construction camps, stockpiles and laydown areas are located outside of any delineated Very High systems and within any existing disturbed areas. Toolbox talks as well as induction during the construction and operational phases must include training related to the potential impacts on fauna, and that no driving at night is allowed, but if required visual check must be made to ensure that no fauna will be disturbed or impacted on. Appropriate signage and speed limits (30km/h) must also be in place and enforced.

6.11 Aquatic Biodiversity

The Aquatic Biodiversity Impact Assessment (ABIA) was undertaken by Brian Colloty of EnviroSci. The findings of the ABIA concluded that most of the anticipated impacts are associated with disturbance during the construction phase, while changes to form and function of the site will be limited in the operational and maintenance phase. It's anticipated that all impacts would be low post mitigation, thus the specialist does not object to the approval of this project. This is on condition of several mitigation measure which include among others the strict implementation of a Stormwater Management Plan and Aquatic Rehabilitation and Monitoring plan.

The full specialist report is attached hereto as **Annexure D 10, Aquatic biodiversity Impact Assessment (2024)**.

6.11.1 Baseline Description

The National Wetland Inventory (van Deventer et al., 2018), National Freshwater Ecosystems Priority Atlas (Nel et al. 2011), which is included into the National Biodiversity Assessment (SANBI, 2018), have indicated that several important as well Threatened riverine systems could occur within the greater region, i.e. riverine reaches associated with the Kariega River catchment.

Furthermore, these spatial databases indicated that some of these systems are perennial but having assessed and or travelled through the region for several years, all of the systems would be considered non-perennial or ephemeral based on a high level of confidence.

What is known is that the systems don't contain any wetlands within the study area but are associated with alluvial systems, with and without channels that contain some with riparian thickets (Figure 6-91). No obligate aquatic vegetation was observed, the alluvial systems are colonised by terrestrial plants.



Figure 6-91: Generalised view of the site, with an alluvial system with containing an undefined riparian thicket (i.e., limited zonation, but woody dominated) in the foreground.

6.11.1.1 Aquatic Biodiversity and Ecosystems

Current waterbody inventories (van Deventer et al., 2020), 1: 50 000 topocadastral surveys mapping indicated the potential for several wetlands within the greater study region. These inventories include wetland spatial data based on landcover 2007 data, previous assessments and wetland information retained by the Provincial authorities, combined into one database that formed part of the updated National Spatial Biodiversity Assessment, 2018.

The study area is dominated by two types of natural aquatic features and a small number of artificial barriers associated with catchments and rivers, characterised as follows:

- Ephemeral main water course - alluvial systems with or without riparian vegetation. These range from narrow channels to broad flood plain areas. Of importance are the channel areas with riparian vegetation as these remain functional, i.e., contain flows on a more regular basis, while the sandy alluvial areas, are only active during peak flood events with no permanent aquatic habitat or riparian systems.
- Minor watercourses
- Dams and weirs / berms with no wetland or aquatic features.

The site is situated within the Eastern Lower Karoo (NK12), and the South Karoo Riviere vegetation type (AZi6), associated with an unknown tributary of the Tulpleegte River (L22D) and the Tulpleegte River (L22C) (Figure 6-92).

During the during two detailed site visits in February 2022 and April 2023, all the mainstem systems were visited and groundtruthed in relation to the available aerial imagery to assess the site. Previous visits in the region in 2020/2021 allowed for the inspection of additional areas within the greater region, mostly in winter, however this site-specific assessment in summer after rains, allowed for an improved assessment of the aquatic environments. Several artificial systems such as water inundated borrow-pits and dams are also prevalent in the area (Figure 6-93).

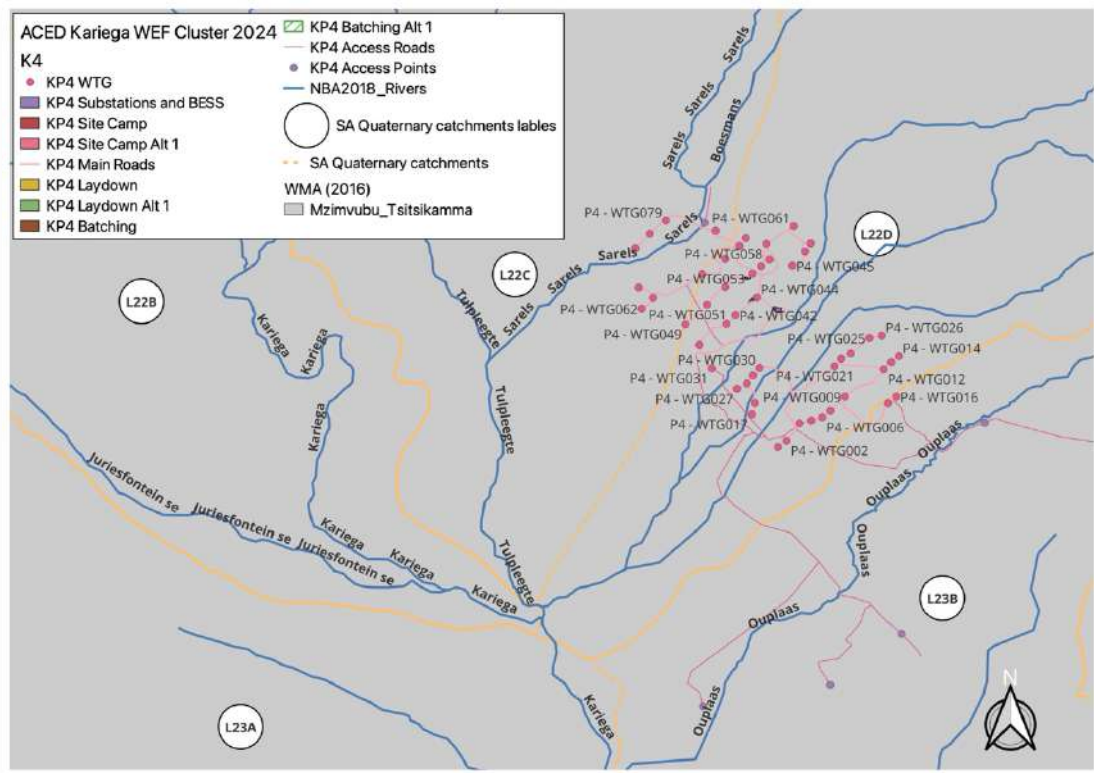


Figure 6-92: Mainstem rivers, quinary catchments and Water Management Areas in relation to the various project components.



Figure 6-93: Borrow-pit with no aquatic vegetation south of the proposed site.

6.11.1.2 Aquatic Species

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 associated plant species observed are listed or protected under any form of legislation. Plant species included the following;

- *Seersia lanceolata*
- *Vachellia karroo*
- *Erianthus capensis*
- *Sporobolus fimbriatus*
- *Cynodon dactylon*
- *Cynodon incompletus*
- *Eragrostis curvula*
- *Erharta calcynia*
- *Merxmuellera disticha*
- *Helictotrichon turgidulum*
- *Jamesbrittenia aurantiaca*
- *Merxmuellera macowanii*
- *Trifolium burchellianum* subsp. *burchellianum*

Similarly, amphibian species are known to occur within the region based on collection data for the region, but little is known of the actual distribution of frogs within the study area. Therefore, based on mapping data contained in Minter et al. (2004) and the FrogMAP spatial database, Table 6-106 indicates the potential frogs known to occur in the area and their preferred habitat, with three frog species being observed during this assessment.

Table 6-106: Potential and observed amphibians within the study area.

FrogMAP. 2019. Animal Demography Unit. Accessed from <http://frogmap.adu.org.za/?sp=400>; on 2022.10.015.

Amphibian taxa	Common Name	Conservation Status (IUCN)	Likelihood of occurring based on previous records and or availability of habitat
<i>Vandijkophrynus gariensis gariensis</i>	Karoo toad	Least Concern	Likely
<i>Cacosternum boettgeri</i>	Common caco	Least Concern	Likely
<i>Cacosternum karooicum</i>	Karoo dainty frog	Least Concern	Unlikely
<i>Strongylopus grayii</i>	Clicking stream frog	Least Concern	Unlikely
<i>Amietia fuscigula</i>	Cape river frog	Least Concern	Unlikely
<i>Xenopus laevis</i>	African clawed toad	Least Concern	Unlikely
<i>Sclerophrys capensis</i>	Raucous toad	Least Concern	Unlikely
<i>Tomopterna delalandii</i>	Cape sand frog	Least Concern	Unlikely

Of interest though is the following data records collected of species observed in the main channel areas of the Gannaleegte / Ouplaas and Kraai river systems. Further substantiated the importance of these habitats as refugia in an arid environment for these amphibians and crab species:

• <i>Amietia poyntoni</i> Channing & Baptista, 2013	Least concern
• <i>Cacosternum boettgeri</i> (Boulenger, 1882)	Least concern
• <i>Poyntonophrynus vertebralis</i> (Smith, 1848)	Least concern
• <i>Pyxicephalus adspersus</i> Tschudi, 1838	Least concern
• <i>Vandijkophrynus gariensis</i> (Smith, 1848)	Least concern
• <i>Schnura senegalensis</i> Rambur, 1842	Least concern
• <i>Triops</i> Schrank, 1803	Not evaluated
• <i>Trithemis arteriosa</i> Burmeister, 1839	Least concern
• <i>Trithemis kirbyi</i> Selys, 1891	Least concern

Of importance is the presence of the African bullfrog (*Pyxicephalus adspersus*), although not considered a species of special concern by the IUCN, locally this species is considered Near Threatened. Based on previous observations, it is likely that this species is present on site, based on observations made for the adjacent wind farm assessments.

6.11.2 Site Sensitivity

All of the systems that were assessed by DWS on a Sub-quaternary (quinary) level within the study area were rated as PES = B or Largely natural to C or Moderately Modified. While these were also rated as High to Moderate / Medium in terms of Ecological Sensitivity and Ecological Importance (DWS, 2014).

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 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.

All of the systems assessed by DWS (2014) on a Subquaternary level within the study area were rated as PES = C or Moderately Modified. While these were also rated as High in terms of Ecological Sensitivity and Low in terms of Ecological Importance respectively.

Based on the information collected during the field investigations, these ratings are verified and upheld for the riverine systems. The High Ecological Sensitivity rating for the natural water sources, is further substantiated by the fact that the affected catchments are included in both the National Freshwater Priority Atlas and the provincial Biodiversity Spatial Plan Ecological Support Areas spatial layers (Figure 6-94 and Figure 6-95).

Overall, these catchment areas and subsequent rivers / watercourses are largely in a natural state with localised impacts in some areas, which include the following:

- Erosion and sedimentation associated with road crossings; and

- Impeded water flow due to several in channel farm dams.

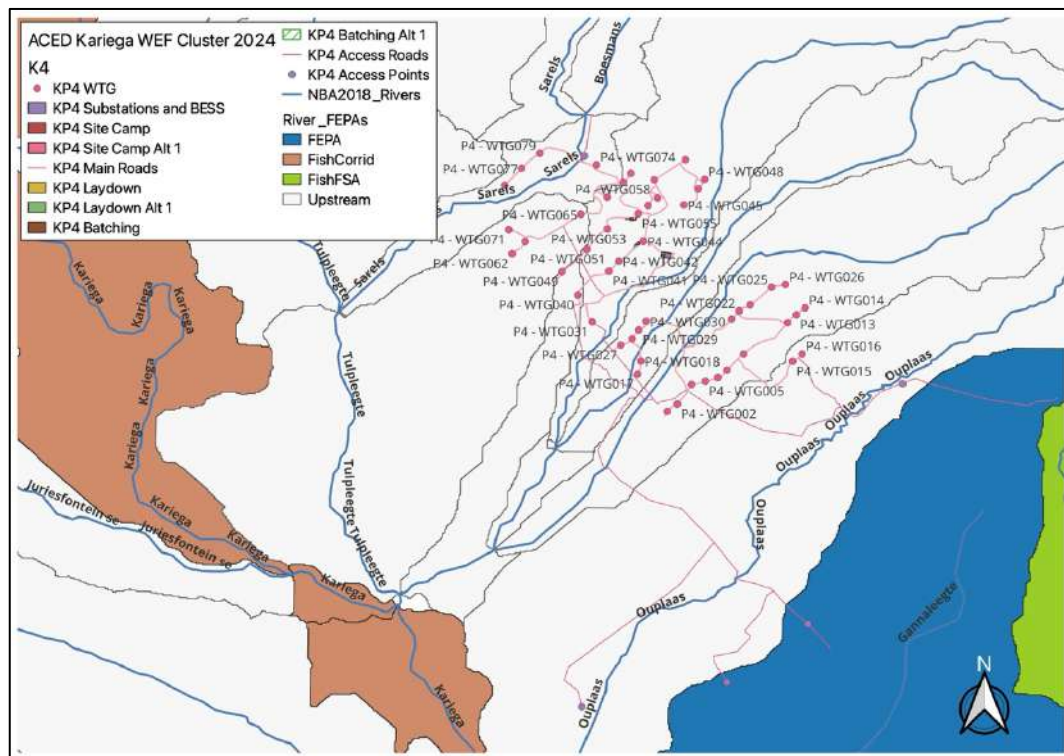


Figure 6-94: The proposed layout in relation to the NFEPA spatial results.

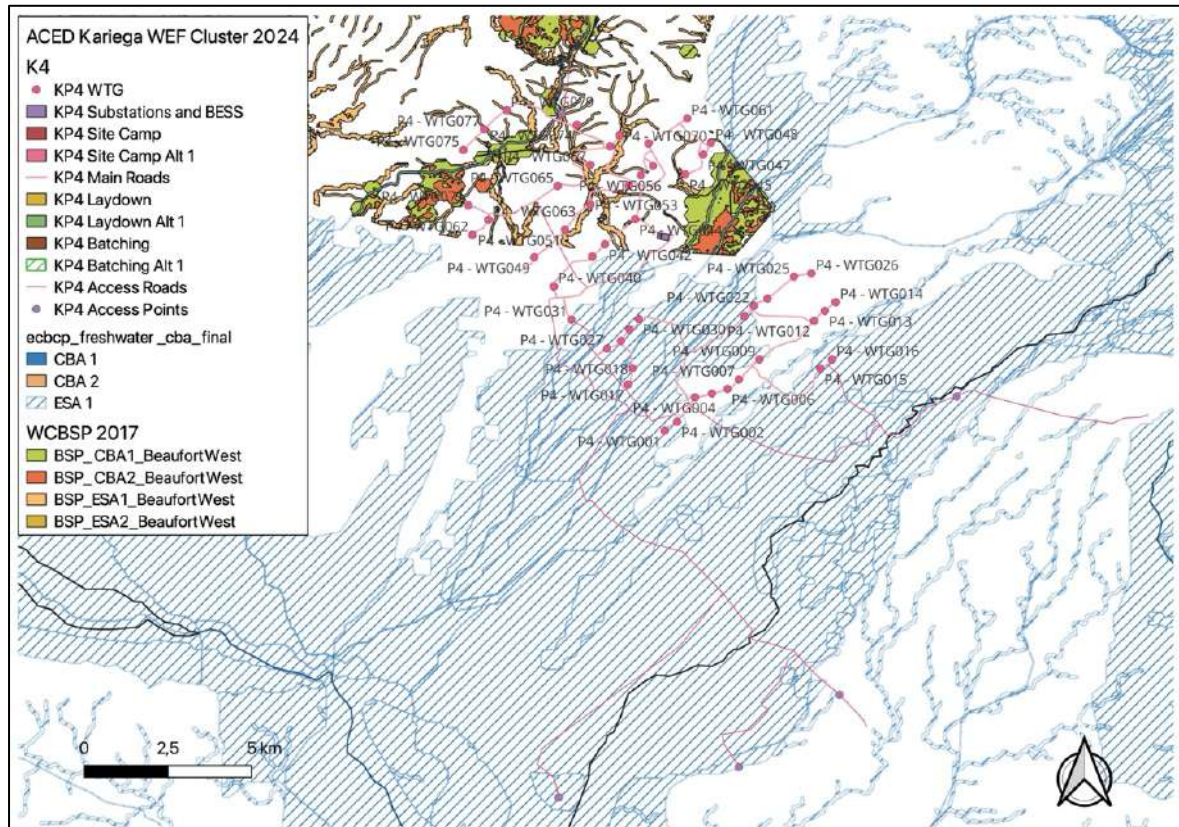


Figure 6-95: Eastern Cape Biodiversity Conservation Plan (2019) and Western Cape Biodiversity Spatial Plan (WCBS, 2017) spatial results in relation to the proposed layout.

6.11.2.1 Sensitivities identified by the National Web-Based Environmental Screening Tool

The DFFE Screening Tool indicates that Very High sensitivity areas (Figure 6-101), linked to known quinary NFEPA, Critical Biodiversity Areas 1, Ecological Support Areas 1, Rivers (Condition Z), Wetlands (rivers), Wetlands Lower Karoo Bioregion (Depression) & Wetlands Lower Karoo Bioregion (Valley Bottom) occur adjacent to the proposed development areas.

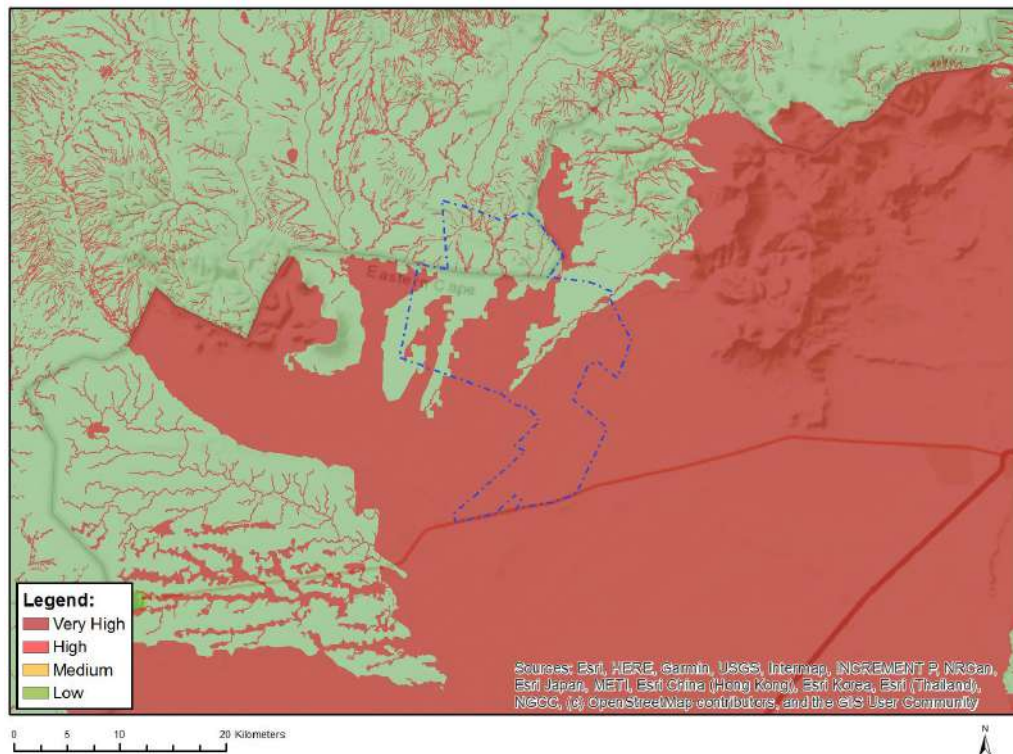


Figure 6-96: The map presented in the National Screening Tool results.

6.11.2.2 Specialist Sensitivity Analysis and Verification

The sensitivity ratings of High (No-Go) and Low were determined through an assessment of the habitat sensitivity and related constraints (Table 6-107). However, these No-Go areas (with buffers) relate in general terms to the project and there are areas where encroachment on these areas could occur (i.e. existing road crossings within systems) and is considered acceptable since these areas have already been impacted.

These proposed constraints / buffers do not include bird and or bat specialist buffers / constraints as their buffers along aquatic features are at times far larger around aquatic features, than those required for the known aquatic species within this region.

Table 6-107: Results of the sensitivity rating / constraints assessment.

Development Component	Habitat Type	Recommended Buffer	Development Acceptability	Sensitivity Rating Override and or caveat ³¹	Conservation status & Importance	Functional Integrity	SEI
Turbines	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary	10m	Yes	None	Moderate	High	Moderate

³¹ if an impact such as a road or disturbance already occurs within the proposed footprint and / or a technical solution can be provided that would not impact on the form or function of the habitat in question, then sensitivity rating for that particular habitat against the activity can be overridden.

Development Component	Habitat Type	Recommended Buffer	Development Acceptability	Sensitivity Rating Override and or caveat ³¹	Conservation status & Importance	Functional Integrity	SEI
	alluvial habitats						
	Remainder of site	0m	Yes	None	Low	High	Low
Buildings / Substations & BESS	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderate d
	Remainder of site	0m	Yes	None	Low	High	Low
Roads	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderate d
	Remainder of site	0m	Yes	None	Low	High	Low
OHL	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderate d
	Remainder of site	0m	Yes	None	Low	High	Low
Underground cables	High Sensitivity Alluvial floodplains	25m	Yes, if footprint is located outside of functional watercourse / channel with or without riparian vegetation	None	High	High	High
	Medium sensitivity secondary alluvial habitats	10m	Yes	None	Moderate	High	Moderate d
	Remainder of site	0m	Yes	None	Low	High	Low

In summary, structures such as WTGs, buildings, substations and Battery Energy Storage System (BESS), must be placed outside of the High Sensitivity habitats, while remaining structures (underground cables, roads and transmission lines) could cross or span the Low Sensitivity areas. Noting that Low Sensitivity can also = High or Medium sensitivity areas but with existing impacts e.g., current roads, farm tracks of previously disturbed areas. Should any of the structures not be able to avoid these areas, due to technical constraints, then a particular focus should be placed on addressing these footprints or access, post authorisation. The proposed activities in relation to the delineated systems and the respective sensitivity ratings are indicated in Figure 6-97.

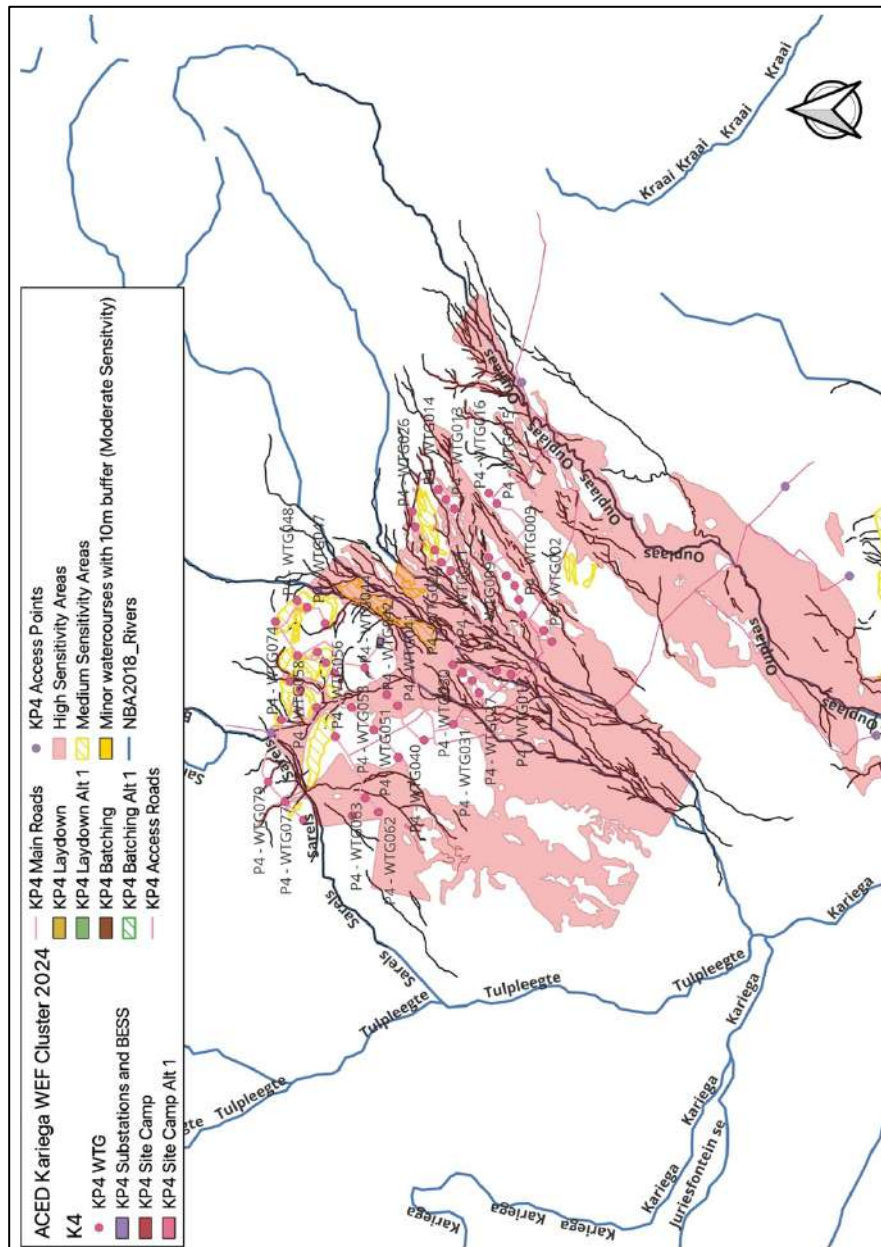


Figure 6-97: The delineated waterbodies and their respective sensitivity ratings in relation to the proposed layout inclusive of the respective buffers, where all artificial systems were rated as LOW.

When compared to the results of the National Screening Tool results in relation to the receiving environment, the proposed layout (towers, roads and buildings) has avoided any areas that would be considered, as Very High sensitivity (Figure 6-97), either by complete avoidance or by making use of existing access roads within these areas. Similarly, the proposed layout has also avoided the majority of the High Sensitivity environments and will only need to span some of the Medium sensitivity aquatic environments.

6.11.3 Impact assessment

Due to the nature of the wind farm layout, the overall impacts are typically related to the construction and decommissioning phases of the project, i.e. when the soils are disturbed when the road networks and hard surface areas are developed. It has been assumed that the overhead cable sections will have the poles placed outside of the demarcated water course areas and would thus have less of an impact.

The potential impacts identified during the assessment are:

6.11.3.1 No-Go Option

With regard the No-Go option it is assumed that the site would continue to degrade due to the prevalence of grazing and or erosion within the water courses. This would continue into the long-term with a Low intensity that would impact on the regional scale due to loss of important habitat. Little in the way of mitigation could be proposed due to the social needs

6.11.3.2 Impact assessment

The proposed project was assessed against the aquatic habitat sensitivity, and it was determined that the following impacts need to be assessed.

Impact 1: Loss of High Sensitivity systems, through physical disturbance, as the proposed layout is located within these areas inclusive of the associated buffers (Figure 6-97, Table 6-109).

Impact 2: Loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. This in turn could also lead to habitat fragmentation – Direct Impact (Table 6-110).

Impact 3: Impact on all watercourse through the possible increase in surface water runoff on riparian form and function through hydrological changes, with a potential increase in sedimentation and erosion (Table 6-111).

Impact 4: Risks on the aquatic environment due to water quality impacts (Table 6-112).

Impact 5: Impact of National Ecosystem Priority Areas (NEPAs) (Table 6-113).

Impact 6: Cumulative impacts (Table 6-114).

Table 6-108: The following direct impacts were then assessed, which are aligned with those contained in the Biodiversity Assessment Protocol and assessed against the layout.

Biodiversity Assessment Protocol Impacts found applicable to this project	Impacts assessed in this report below
Fragmentation (physical loss of ecological connectivity and or CBA corridors)	Impact 1, 2 & 3
Changes in numbers and density of species	Impact 1 & 2
Faunal and vegetation communities inhabiting the site	Impact 1, 2 & 5
Hydrological regime or Hydroperiod changes (Quantity changes such as abstraction or diversion)	Impact 3
Streamflow regulation	Impact 3
Erosion control	Impact 3
Water quality changes (increase in sediment, organic loads, chemicals or eutrophication)	Impact 4
Cumulative Impacts	Impact 6

Table 6-109: Damage and disturbance of the habitats rated as High Sensitivity associated with aquatic / alluvial features.

No.	1
Project phase	Construction & Decommissioning
Impact title	Damage and disturbance of the habitats rated as High Sensitivity associated with aquatic / alluvial features– Direct Impact

Impact description	Potential impact very sensitive habitats that are also associated with habitat requirements for two Endangered faunal species (Riverine Rabbit & Bullfrog)			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	It is recommended that development of the Construction Rehabilitation and Monitoring plan, is provided prior to construction. Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. 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 footprint during the construction phase			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place, and this should include amphibian and small mammal monitoring in the pre-commencement and construction phase.			

Table 6-110: Loss of ecosystem services, and or habitats that would result in habitat fragmentation.

No.	2			
Project phase	Construction & Decommissioning			
Impact title	Loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. This in turn could also lead to habitat fragmentation – Direct Impact			
Impact description	The potential impact on ecosystem services still exists, due to clearing of vegetation, however all CBAs have been avoided. For this purpose, the footprints have avoided high ecological value areas, while keeping the overall footprint condensed			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	It is recommended that development of the Construction Rehabilitation and Monitoring plan, is provided prior to construction. This plan should include relocation of suitable plant species, but more important protect any topsoil stores and promote the collection of vegetative material and propagules / seed to assist with the revegetation of the site. Where possible, temporary construction lay-down or assembly areas should be sited on transformed areas. Rapid regeneration of plant cover must be encouraged by setting aside topsoil during earthmoving and replacing onto areas where the re- establishment of plant cover is desirable to prevent erosion.			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place, and this should include amphibian and small mammal monitoring in the pre-commencement and construction phase.			

Table 6-111: Impact on all watercourse through the possible increase in surface water runoff.

No.	3			
Project phase	Construction, Operational & Decommissioning			
Impact title	Impact on all watercourse through the possible increase in surface water runoff on riparian form and function through hydrological changes, with a potential increase in sedimentation and erosion			
Impact description	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 the aquatic systems, which are currently ephemeral, i.e. aquatic vegetation species composition changes, which then results in habitat change / loss.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	It is recommended that development of the Construction Rehabilitation and Monitoring plan, is provided prior to construction. Where large cut and fill areas are required these must be stabilised and rehabilitated during the construction process, to minimise erosion and sedimentation. 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 footprint during the construction phase 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).			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place, and this should include amphibian and small mammal monitoring in the pre-commencement and construction phase.			

Table 6-112: Impact on localised surface water quality.

No.	4			
Project phase	Construction, Operational & Decommissioning			
Impact title	Impact on localised surface water quality			
Impact description	During both preconstruction, construction and, to a limited degree, the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities, as well as maintenance activities, could be washed downslope via the watercourses.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	• Strict use and management of all hazardous materials used on site. • Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.) within demarcated / bunded areas • Containment of all contaminated water by means of careful run-off management on site. • Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility. These regularly maintained. • Appropriate waste management and disposal.			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that strict waste / spillage control will be exercised on site by the EO/ESO.			

Table 6-113: Impacts on FEPA quinary catchment and Ecological Support Areas.

No.	5			
Project phase	Construction & Decommissioning			
Impact title	A small portion of the site falls within a FEPA quinary catchment and Ecological Support Areas. Although the development would potentially have negative impacts on the riparian environment through disturbance and changes to water quality downstream of the site as a result of erosion, pollution and other forms of disturbance and associated degradation of the freshwater ecosystems of the site, these negative impacts can be well-mitigated.			
Impact description	Most of the site is relatively flat with the result that water erosion risk is relatively low, while wind-erosion potential is moderate but can be effectively reduced through dust suppression during construction. The development footprint, which is estimated at having less than 0.5% of the extent of the FEPA which is over 50 000ha. As a result, with the effective implementation of mitigation and avoidance, it is unlikely that the development would significantly compromise the long-term ecological integrity and associated ecosystem services of the affected FEPA.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The most significant form of mitigation would be to select development options that avoided all aquatic features that were rated with a High sensitivity, which will not be possible due to the technical constraints of this project. However detailed assessment of the habitats, with differentiation of functional watercourse habitat (typically with riparian habitat) was undertaken, and the present layout has avoided these areas, by being located within the sandy alluvial areas. This would then also minimise any additional risk to the FEPA. If possible, that size of blade laydowns, hardstands must also be limited to reduce the overall footprint, which should be achievable as the areas are flat, thus cut/fill embankments to create level areas should also minimal. It is further recommended that a comprehensive rehabilitation / monitoring plan be implemented from the project onset i.e., during the detailed design phase prior to construction, to ensure a net benefit to the environment within all areas that will remain undisturbed. This must apply to any temporary laydown, crane pads etc, to minimise footprints.			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place.			

Table 6-114: Cumulative impacts on aquatic biodiversity.

No.	6			
Project phase	Cumulative impacts			
Impact title	In the assessment of this project, several projects have been assessed by the report author within a 35km radius and or other sites were accessed during travelling between the various projects. Projects included the AEP Aberdeen WEF cluster, and the approved Eskom Aberdeen Wind Farm Of these projects, this report author has been involved in the initial EIA aquatic assessments or has managed / assisted with the associated grid connections these projects (AEP Aberdeen WEF Cluster & Eskom Aberdeen WEF).			
Impact description	All of the projects have indicated that their intention with regard to mitigation, i.e. selecting the best possible sites to minimise the local and regional impacts or improving the drainage or hydrological conditions within these rivers, and therefore the cumulative impact could be seen as a net benefit. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such as stormwater management, and that flows within these systems are sporadic.			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Moderate - negative		Minor - negative	
Importance	High	High	Moderate	Moderate
Consequence	Moderately-detrimental		Slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.		
Mitigatability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	The most significant form of mitigation would be to select development options that avoided all aquatic features that were rated with a High sensitivity, which will not be possible due to the technical constraints of this project. However detailed assessment of the habitats, with differentiation of functional watercourse habitat (typically with riparian habitat) was undertaken, and the present layout has avoided these areas within the projects assessed.			
Comment on ratings	The reduction in impact significance post mitigation is dependent on the fact that rehabilitation and monitoring must take place.			

6.11.4 Conclusion and Recommendations

When compared to the results of the National Screening Tool results in relation to the receiving environment, the proposed layout (towers, roads and buildings) has avoided any areas that would be considered, as Very High sensitivity, either by complete avoidance or by making use of existing access roads within these areas. Similarly, the proposed layout has also avoided the majority of the Medium sensitivity aquatic environments.

However as most of the infrastructure has through a process of design iteration avoided important aquatic habitats, no preference is thus given to the alternative Site Camp, Batching from an aquatic standpoint.

The nature of the wind farm is such that it carries a low to moderate intensity impact on aquatic resources, with highest number of impacts being associated creation of roads, installation of cables and other infrastructures across the site. The project does however have a small footprint spread out over a large area, allowing for retention of much of the natural area so the ecosystems should remain largely unaffected.

In conclusion, most of the anticipated impacts will include disturbance during the construction phase, while changes to form and function of the site will be limited in the operational and maintenance (O&M) phase, and it is anticipated that all these would be Low post mitigation, thus no objection the specialist does not object to the approval of this project.

- A key recommendation is that that during the construction mobilisation process, that the temporary construction camps, stockpiles and laydown areas are located outside of any delineated aquatic systems and within any existing disturbed areas.
- It is recommended that development of the Construction Rehabilitation and Monitoring plan, is provided prior to construction.

6.12 Heritage, including Archaeology, Palaeontology and Cultural Landscape

The Heritage Impact Assessment (HIA) was undertaken by Jenna Lavin of Cedar Tower Services (CTS) which includes a Palaeontology Assessment from John Almond of Natura Viva and Cultural Landscape Study by Sarah Winter. Based on the desktop mapping and assessment of potential heritage resources and receptors, and subsequent fieldwork, the principle of a WEF in the proposed location was found to be acceptable from a cultural landscape perspective. There are no red flags, which identify the project to be a fatal flaw from a cultural landscape perspective. There are limited impacts anticipated to archaeological and palaeontological heritage from this proposed development and as such, the principle of a renewable energy facility in this location is supported from a heritage perspective provided that the infrastructure is in areas able to tolerate the impact of the high degree of change from a cultural landscape perspective.

The full specialist report is attached hereto as **Annexure D 11, Heritage Impact Assessment, including Archaeology, Palaeontology and Cultural Landscape (2024)**.

6.12.1 Baseline Description

The area proposed for the Kariega Wind Energy Facility Projects is located approximately 35km west of Aberdeen in the Eastern Cape and is located within the identified Beaufort West REDZ. With its numerous examples of Victorian architecture, it is one of the architectural conservation areas of the Karoo. The town is some 55 km south-west of Graaff-Reinet, 155 km east-south-east of Beaufort West and 32 km south of the Camdeboo Mountains. Laid out on the farm Brakkefontein as a settlement of the Dutch Reformed Church in 1856, it became a municipality in 1858. It is named after Aberdeen in Scotland, birthplace of the Reverend Andrew Murray of Graaff-Reinet, relieving minister. Aberdeen is filled with examples of Victorian architecture, and the Steeple of the Dutch Reformed Church, with its 50 metre Tower, is the highest in South Africa. There is a Local Authority Nature Reserve found here, as well as The Fonteinbos Nature Reserve, which is both beautiful and functional, as its natural spring (Die Oog) supplies the entire town and its agricultural sector with its water.

6.12.1.1 Historic settlement and the Cultural Landscape (Winter, S. et al. 2021)

The name Karoo has its roots in the Khoe word meaning “place of great dryness”. The archaeology shows the area as well-used on a seasonal and nomadic basis with water sources providing sites suited to the needs of hunter-gather San people and pastoralist-herder Khoe people (Anderson 1985: 8). The name Camdeboo (Qamdobowa in isiXhosa) is thought to have evolved from a phonetically similar Khoe word possibly meaning “green hollow” to describe the plains after seasonal rain storms.

The late 18th century frontier of the colony was edged by two vast administrative regions, the District of Stellenbosch (1679) and the District of Graaff-Reinet (1786). European settlement came slowly to the central Karoo, with the push north by trekboere taking place in the mid- to late-1700s. Like the Khoe, their lifestyle was semi-nomadic, following transhumance routes and taking temporary ownership of land through a system of renewable permits for loan farms. This was a period of uneasy co-habitation between the trekboere, and the San, Khoe and Xhosa alienated from their preferred grazing to the south and east. Further expansion was fiercely opposed by the San, who resisted alienation from water sources, until they were forcibly suppressed in the 1790s.

British colonial rule from 1806 brought a new landownership policy of perpetual quitrent, imposing “settled agriculture”. This dispossessed Khoe, Xhosa and many of the poorer trekboere who were unable to fit the legal system and were pushed beyond the Great Escarpment or subjugated to a life of labour. Wealthy farming burghers, merchants and government officials took over land suitable for sheep farming (Anderson 1985, Guelke Shell 1992).

The 1820s to 1860s shows a steady pattern of Karoo land grants, with the later ones in more remote areas often formalising the rights of a pre-existing land user.

Aberdeen town was established on the farm Brakkefontein, which had been an early grant for the area, signed over in 1817 by the British Governor Lord Charles Somerset. In 1855 the farm was bought by the Graaff-Reinet Dutch Reform church to provide for its congregation, growing because of the Marino wool export boom which began in the 1840s. Work began on the Cape Gothic-style Dutch Reform church in 1855 (completed in 1907). Built to seat 2000, it is notable for the unusual height of its steeple, over 50m, which acts as a landmark in the mostly flat landscape. The Methodist church was completed in 1883 and is a simple stone rectangular building, with buttresses and arch top windows. The bell tower is topped with a belfry of cast iron lacework.

The invention of the ground water pump, the “windmill” (late 1880s) allowed year-round access to water for irrigation and stock and became an identifying feature of the Karoo landscape. By the 1900s the area was well established for wool, mohair and tobacco production.

The South African War (1899-1902) had a negative social impact on the Aberdeen area, pitting families aligned with the Colonial government against those with Boer Republic sympathies, with 139 “Cape Rebels” recorded. However, it was not a significant military base, nor the site of major battles and little tangible evidence remains.

Provisional research suggests that the farms affected by the proposed development fall into the mid-19th century period of quitrent grants. In all cases, it is possible that the farm was in use prior to the grant and may have had early structures for shelter/habitation and animal management. However, it is probable that permanent habitation followed later once water management systems, such as the groundwater wind pumps, were readily available.

Surveyor annotations on the early survey diagrams for the affected farms indicate roads, water features, houses and dams. Cadastral meeting points are occasionally identified by “bush”, indicating the rarity of taller vegetation clusters and their capacity to serve as landmark features.

6.12.1.2 Archaeology (Levin, J., 2024)

Very few heritage assessments have been completed within close proximity to the area proposed for development. According to Nilssen (2014, SAHRIS NID 504763), “The Karoo houses a long and rich archaeological record dating from the earliest stages of Stone Age technology that are over a million years old, to the historic period that consists of the last few hundred years of human occupation (see Nilssen 2011 and references therein). Archaeological sites include caves and rock shelters, open air artefact scatters, rock engravings and historic structures with their associated cultural materials.” According to the ACO (2013, SAHRIS NID 503074), “Because of the scarcity of caves and shelters, more than 90% of Karoo archaeological sites are open sites of stone artefacts, ostrich eggshell fragments and occasionally, pottery. Bone remains are rarely preserved. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape. Where definable scatters of Early and Middle Stone Age material occur, they are considered to be significant heritage sites.

More intensive occupation of the Karoo started around 13 000 years ago during the Later Stone Age, which is essentially the heritage of Khoisan groups who lived throughout the region. The legacy of the San includes numerous open sites while traces of their presence can also be found in most large rock shelters, often in the form of rock art. They frequently settled a short distance from permanent water sources (springs or waterholes) and made use of natural shelters such as rock outcrops or large boulders or even large bushes. In the Great Karoo, natural elevated features such as dolerite dykes and ridges played a significant role in San settlement patterns” and as such, this broader area is renowned for its well-preserved rock art and other artefacts from this time, including rock engravings and rock gongs. It is likely that similar archaeological heritage exists within the areas proposed for development and as such, impact to these resources must be assessed.

A Heritage Impact Assessment was completed in 2013 for the proposed Aberdeen WEF located immediately north of the area proposed for development (Booth and Sanker, SAHRIS NID 251161). The findings of this assessment therefore provide an indication of the kinds of heritage resources likely to be present within this proposed development area. Booth and Sanker (2013) noted that “Surface scatters of predominantly Middle Stone Age stone artefacts were observed over most of the area proposed for the development, these included isolated as well as dense occurrences. Eight areas / sites have been identified that comprise relatively dense scatters of stone artefacts over large areas with several micro-sites within the demarcated sites. It was observed that denser distributions of stone artefacts occurred in the north and central areas of the study area, filtering out towards the south. No associated archaeological material or organic remains were documented with the stone artefact surface scatters. An historical stonewalling farmstead complex is situated adjacent to one of the proposed access roads. The complex comprised the remains of the house and two kraals. Packed stones were identified in the south-central area. The packed stone may resemble a kraal that has now collapsed. Fragments of glass and pottery were found within this area, as well as a No. 2 Musket Eley bullet casing associated with the Second Anglo-Boer War.”

A recent archaeological assessment of an adjacent project was completed by CTS Heritage in 2022. This assessment noted that its findings “should be understood in conjunction with the findings made by Booth to the north of the R61 for the Eskom WEF (not built yet) in 2013. Given the lack of natural rock shelters on the landscape and absence of dolerite boulders favoured by rock engravers during the Later Stone Age, the vast majority of the observations consisted of open air scatters of Middle and Later Stone Age artefact scatters. The MSA material found clearly spanned a very wide period as many examples of early MSA artefacts were found along with diagnostic pieces such as blade flakes, blanks, unifacial points, radial cores and bifacially retouched flakes. Locally abundant raw materials were extensively utilised as siltstones and hornfels contributed most of the stone used to make artefacts as well as a smaller but significant percentage of chert, particularly in the LSA assemblages. The artefacts are spread thinly but widely throughout the area with no particular focal points other than the slightly elevated ridges that are no more than 10-20m higher than the surrounding landscape.” All of the resources identified by CTS Heritage (2022) and Booth and Sanker (2013) have been mapped relative to the proposed development in Figure 6-101 below.

6.12.1.3 Palaeontology (Almond, J., 2023)

According to the SAHRIS Palaeosensitivity Map (Figure 6-103), the area proposed for development is underlain by sediments of very high paleontological sensitivity. According to the extract from the Council for GeoSciences Map 3122 for Victoria West, the development area is underlain by the Abrahamskraal and Teekloof Formations, both of the Adelaide Subgroup of the Beaufort Group of sediments. According to the SAHRIS Fossil Heritage Browser and the Palaeotechnic Report for the Western Cape (Almond and Pether, 2008), the Beaufort Group sediments are known to preserve diverse terrestrial and freshwater tetrapods of Tapinocephalus to Lystrosaurus Biozones (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways) and sparse vascular plants (Glossopteris Flora, including petrified wood).

A Palaeontological Impact Assessment was completed in 2014 for the proposed Aberdeen WEF located immediately north of the area proposed for development (Almond, SAHRIS NID 251166). The findings of this assessment therefore provide an indication of the kinds of palaeontological resources likely to be present within this proposed development area. Almond (2014) noted that “The entire wind farm study area is underlain at depth by fluvial sediments assigned to the lowermost part of the Teekloof Formation (Lower Beaufort Group) that are of Late Permian age (c. 260 million years old). The mudstone-rich succession of the Hoedemaker Member represented here is associated with moderately diverse fossil biotas of the Tropidostoma Assemblage Zone that include a range of mammal-like reptiles, true reptiles, fish, amphibians as well as plants and trace fossils. To the author’s knowledge there are no previously identified fossil vertebrate finds within the study area, although a small lizard-like specimen was apparently found (probably preserved within a palaeocalcrete nodule) among surface gravels along its northern margin (Mnr Loots, pers. comm., Nov. 2014). The only fossil material recorded during the present field assessment

comprises sparse blocks of well-preserved silicified wood that occur widely among surface gravels through much of the study area. Most of the fossil wood specimens have probably been downwasted from channel sandstones within the Hoedemaker Member itself, but some cherty fossil wood clasts may have been introduced from elsewhere within fluvial gravels. The general lack of fossil records in the Aberdeen vlaktes may well be due, in large part, to very low levels of bedrock exposure in this low-relief area, as well as due to local development of cleavage, near-surface calcrete veining and weathering. It is concluded that, while there is a significant chance that fossil vertebrate remains will be disturbed, destroyed or sealed-in by the proposed wind energy facility development, these are best mitigated by applying a chance find procedure. The operational and decommissioning phases of the wind farm are unlikely to involve further adverse impacts on local palaeontological heritage, however.”

A recent PIA was completed for an adjacent WEF development by Almond (2022). Almond (2022) concluded that “Most of the low-relief WEF Cluster project area is covered by a blanket of Late Caenozoic superficial deposits, including alluvial gravels and sands, eluvial and colluvial surface gravels, calcrete hard pans, pan sediments and gravelly to sandy soils. Apart from the abundant reworked fossil wood blocks and very rare bones reworked from the Permian bedrocks, no fossils of Caenozoic age have been recorded within these younger sediments.

Given the rarity of significant vertebrate and other fossil finds, the overall palaeosensitivity of the Aberdeen WEF Cluster project area is assessed as LOW. The provisional Medium to Very High Palaeosensitivity mapped here by the DFFE Screening Tool is accordingly contested. The potential for occasional fossil vertebrate sites of Very High palaeosensitivity cannot be entirely excluded, however. The distribution of such sites is largely unpredictable, and they are best mitigated through a Chance Fossil Finds protocol.” Based on the known paleontological sensitivity of this area, it is very likely that activities associated with the development of the proposed WEF will negatively impact on significant fossil heritage.

6.12.2 Site Sensitivity

6.12.2.1 Cultural Landscape and the Built Environment

The overall landscape of the project area is a vast, open plain framed by distant views towards mountain backdrops. It is characteristic of the semi-arid conditions and remote settlement qualities of the Karoo landscape with evidence of human occupation spanning the pre-colonial, earlier and later colonial periods. It demonstrates a shift in patterns of land ownership, settlement and use over time within the context of a harsh natural environment. The overall scenic aesthetic quality of the landscape lies in its expansiveness and sense of remoteness.

The immediate study area is representative of the transition between the Koup Vlake and the Camdeboo Plains with prominent views across a flat open plain towards the “Sleeping Giant” in the east and the Oorlogspoortberg in the west.

The R61 is a historical scenic route traversing a representative remote karoo landscape and connecting the towns of Beaufort West and Aberdeen.

The Camdeboo Plains possess local historical, aesthetic architectural and social significance. Of particular heritage significance is the town of Aberdeen, which is worthy of Grade IIIA heritage status in terms of the following:

- Historical value dating to the mid-19th century and including its local role in the South African War.
- Architectural and aesthetic value in terms of its street pattern, streetscape and townscape, concentration of conservation worthy buildings, and its relationship with its setting, notably its mountain backdrop to the north.
- Cultural landscape value as providing a focal and destination point within a vast open flat landscape and at the intersection of two regional routes.

The cultural landscape of the immediate study area has historical value in terms of forming part of a pattern of land grants dating to the 19th century with many of the farms having been in the same family for generations. Underlying this pattern of land grants is a pattern of pre-colonial and early colonial occupation and use. Natural features and patterns of use contribute to landscape character (topographical features, water courses, routes, farmsteads, stone kraals, graves and grazing lands). There is also an inherent logic in the manner in which settlement patterns have occurred over time in relation to topography, river courses and movement routes.

The patterns of settlement occupying the flat open plains and forming part of the immediate study area contrasts with the pattern of settlement hugging the foot slopes and valleys of the surrounding mountains with their access to mountain springs and location overlooking the lands.

A characteristic feature of the cultural landscape is the use of local stone in the vernacular-built form including kraal walling and farm buildings.

While the cultural landscape in its entirety is not worthy of formal protection in terms of the NHRA, it possesses conservation-worthy landscape elements for historical, architectural, aesthetic (visual, place making) and social reasons.

Various Landscape Elements of Cultural Value have been identified within the area proposed for development (Figure 6-98, Figure 6-99 and Figure 6-100):

- Topographical Features
 - A sense of topographical containment to the north, east and west of the project area.
 - Wolwekop peak situated just north of the R61 near the Murraysburg secondary road. This is a distinctive landmark feature.
 - Camdeboo Mountains and the “Sleeping Giant” formation framing the views westwards.
 - The Oorlogspoortberg framing views westwards.
- Water courses and infrastructure
 - A network of periodical water courses traversing the project area and informing the pattern of settlement.
 - Dams, wind pumps and water furrows.
- Planting Patterns
 - Clumps of trees typically are found around homesteads as shelter from the sun/wind and as place-making elements.
 - Scenic and historic routes
 - The R61 as a regional linkage route of some scenic value with dramatic views towards the mountain backdrop of the Camdeboo Mountains.
 - The Murraysburg Road of local historical scenic value.
 - The combination of the intersection of the R61 and the Murraysburg Road, change in topography and the landmark qualities of the Wolwekop providing a threshold condition.
- Settlements
 - Aberdeen town of suggested Grade IIIA heritage value and situated approximately 35 km east of the project area.
 - A number of farmsteads and stone kraals situated within or adjacent to the proposed WEF of mostly Grade IIIC heritage value with some of Grade IIIB heritage value.
 - The collection of graves on the farm Kalgat and their association with the South African War.

Figure 6-98: Cultural Landscape Elements Map from Winter et al. 2022 (Appendix 3) reflecting an older layout for Kariega WEF Cluster.

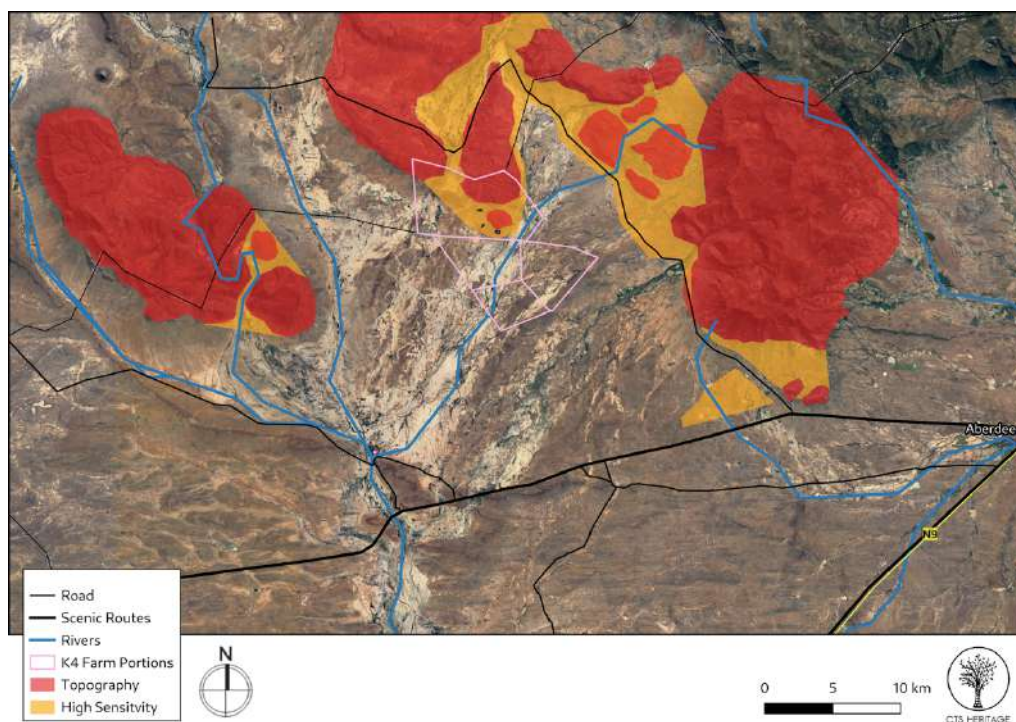


Figure 6-99: Map of high-level cultural landscape elements that impact the proposed development area.

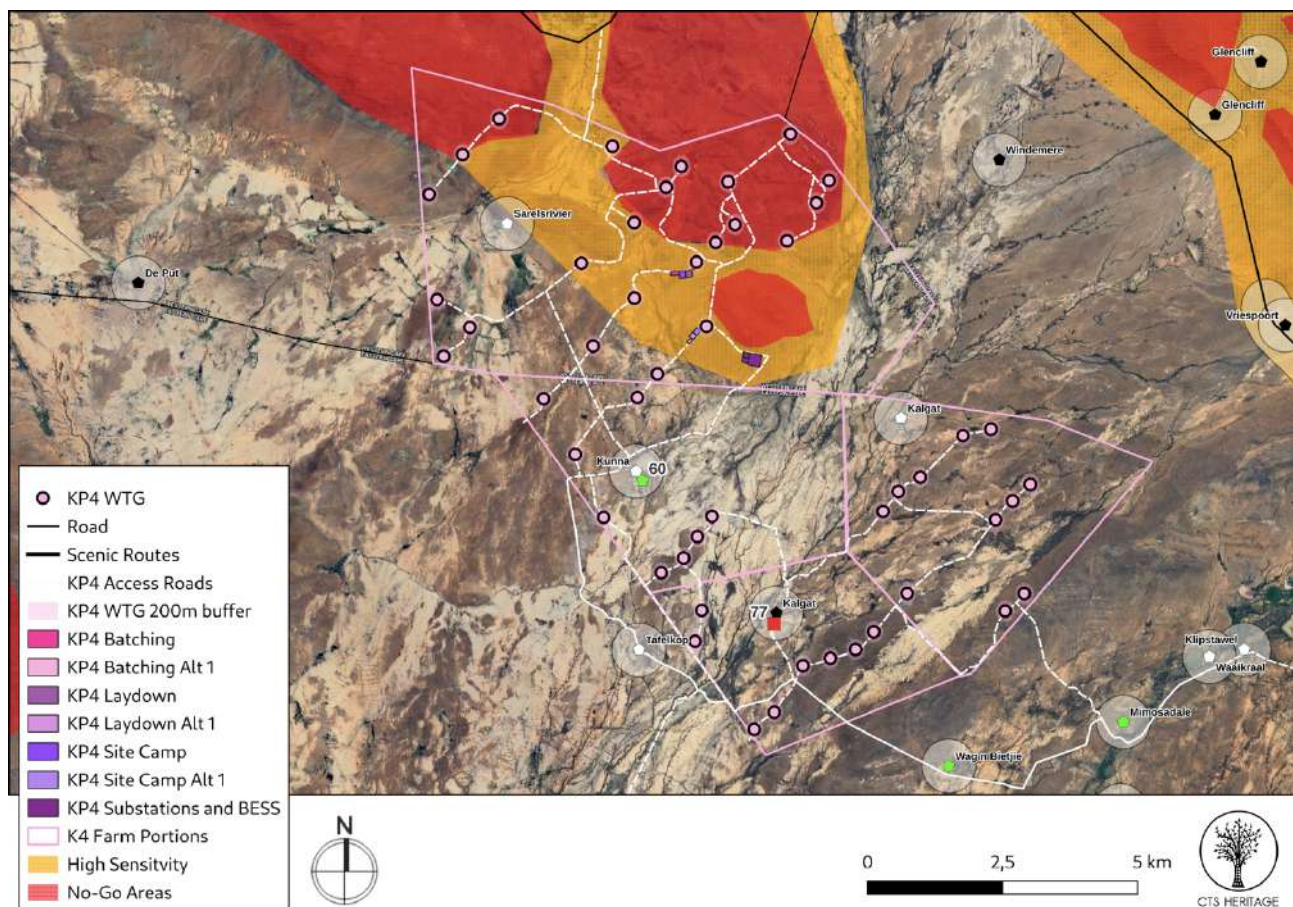


Figure 6-100: Map of landscape elements within the proposed development area.

6.12.2.2 Archaeology

A number of field assessments have now been completed for various WEFs west of Aberdeen by CTS Heritage (2022) and by Booth (2013). Given the lack of natural rock shelters on the landscape and absence of dolerite boulders favoured by rock engravers during the Later Stone Age, the vast majority of the observations consisted of open air scatters of Middle and Later Stone Age artefact scatters. The MSA material found clearly spanned a very wide period of time as many examples of early MSA artefacts were found along with diagnostic pieces such as blade flakes, blanks, unifacial points, radial cores and bifacially retouched flakes. Locally abundant raw materials were extensively utilised as siltstones and hornfels contributed most of the stone used to make artefacts as well as a smaller but significant percentage of chert, particularly in the LSA assemblages. The artefacts are spread thinly but widely throughout the area with no particular focal points other than the elevated ridges.

The historic to modern farming use of the landscape has contributed to the built environment pattern of settlement in the area with typical Karoo werfs, many now ruined, dotting the landscape (Table 6-115). A number of farm dams and interlinking furrows have been made since the 1950s by using earthmoving equipment to push up dirt banks along the watercourses. The Kunna werf lies outside the study area but has South African War graves while the Tafelkop and Sarelsrivier werfs were found to have no buildings of heritage significance and date to the mid 20th century onwards. These werfs are well away from the footprints outlined for turbines and new access roads (Figure 6-101).

Table 6-115: Artefacts identified during the field assessment development area.

POINT	Description	Type	Period	Density/m ²	Co-ordinates		Grading	Mitigation
060	The ruins of an old mud house	Ruin	Historic	n/a	-32.3584929	23.62078828	IIIC	No impact anticipated
077	Anglo-boer war grave site	Grave	Historic	n/a	-32.38226409	23.64672991	IIIA	100m Buffer

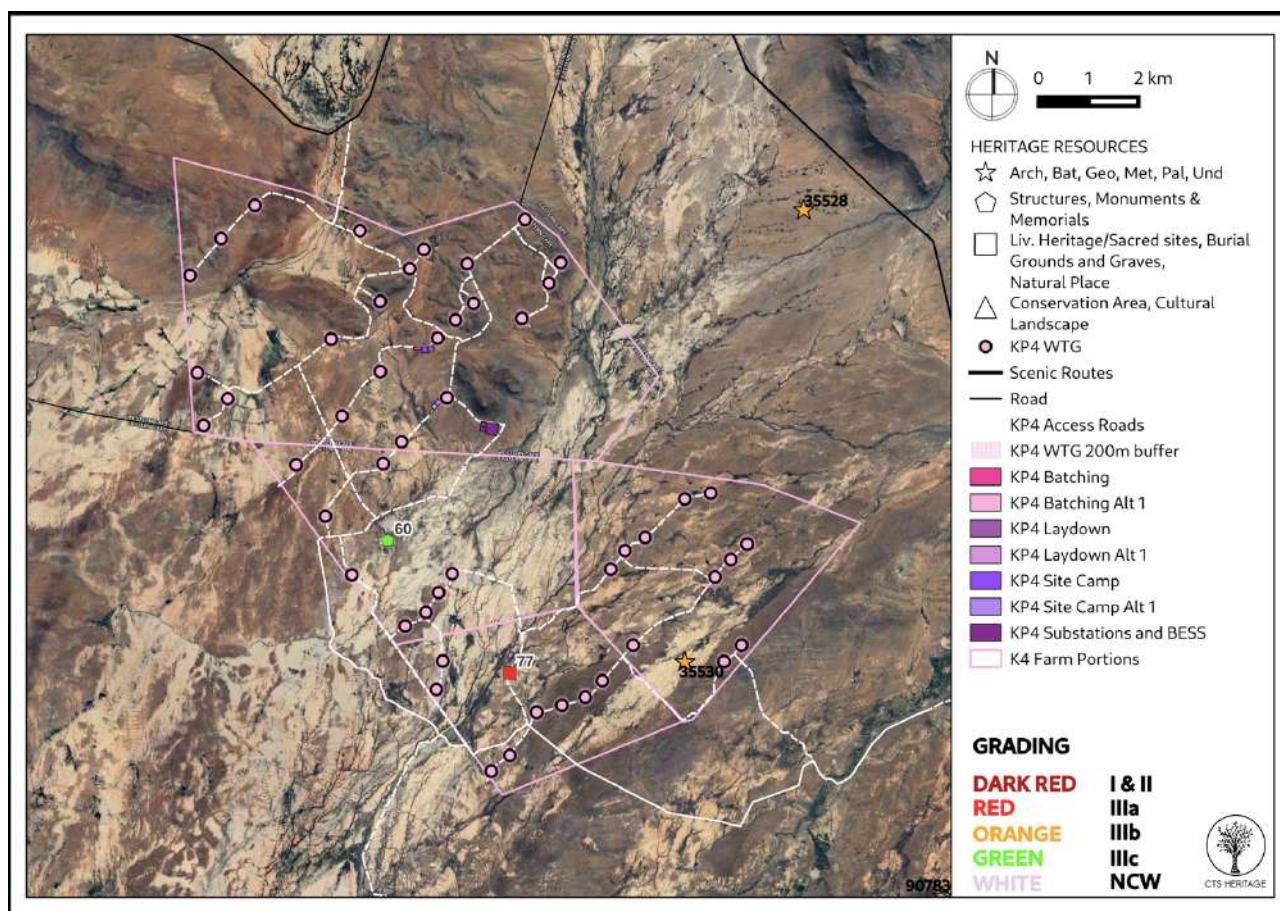


Figure 6-101: Map of archaeological heritage resources within the proposed development area.

6.12.2.3 Palaeontology

The combined Kariëga WEF Cluster project area is underlain at depth by potentially fossiliferous continental (fluvial / lacustrine) bedrocks of the Lower Beaufort Group (Adelaide Subgroup) (Figure 6-102). These bedrocks belong to the upper part of the Middle Permian Abrahamskraal Formation (probably Moordenaars and Karelskraal Member equivalents) as well as the lower part of the Late Permian Teekloof Formation (Poortjie Member); the published 1: 250 000 geological map requires revision in this respect. There are no historical records of fossil vertebrates from this area; this is largely due to the extremely poor levels of bedrock exposure in the low-relief Aberdeen Vlaktes region. During the recent 4-day palaeontological field assessment only a couple of closely-spaced occurrences of fossil vertebrates were recorded, both from superficial gravels rather than in situ. They include a concentration of bone chunks of a large-bodied tetrapod on Farm RE/91 which is interpreted to include cranial and post-cranial remains of a tapinocephalid dinocephalian as well as a jaw fragment of a smaller therapsid (probably therocephalian). The former would support recent re-assignment of the bedrocks here to the Tapinocephalus

Assemblage Zone. These fossil vertebrate sites have been adequately sampled and do not require further mitigation.

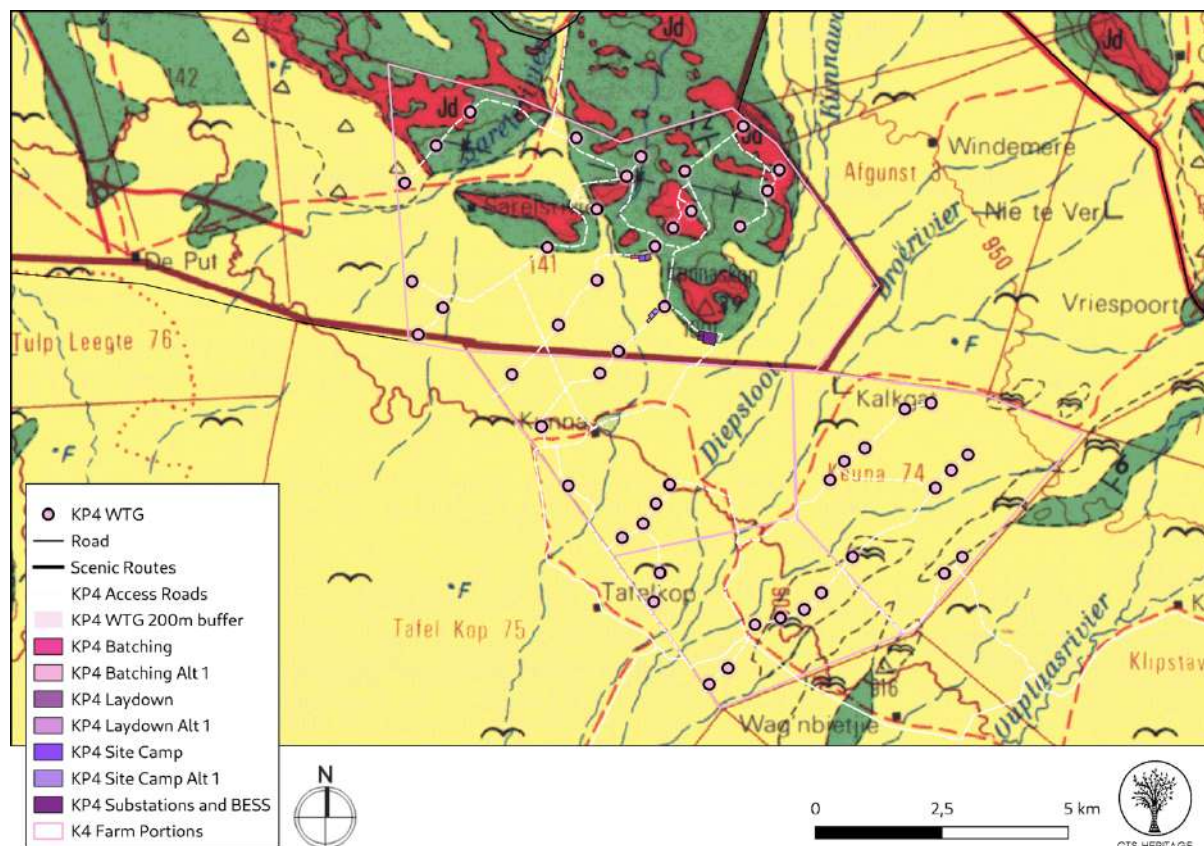


Figure 6-102: Geology Map. Extract from the CGS 3222 Beaufort West Map indicating that the development area for the WEF development is underlain by sediments of Pt: Poortjie Member of the Teekloof Formation of the Adelaide Subgroup and Jd: Jurassic Dolerite as well as Qc: Quaternary Sands for Kariega 4 WEF

A background scatter of petrified (silicified) wood blocks reworked from the Lower Beaufort Group bedrocks occurs within surface gravels and sands of eluvial and alluvial origin in several parts of the WEF cluster project area, especially where bedrocks occur near-surface; only a small sample of occurrences have been recorded here. Scatters of sizeable blocks of silicified wood occur within superficial sands on Farm 1/158 where they appear to have weathered-out of a nearby koffiekliip-rich channel sandstone within the upper Abrahamskraal Formation (Figure 6-103). Much of the fossil wood material is poorly preserved and of limited scientific value. However, a small minority of blocks show well-developed seasonal growth rings and excellent preservation of the original woody fabric; these are potentially identifiable and may be of biostratigraphic and palaeoecological interest.

Well-developed lenses of breccio-conglomerates as well as koffiekliip lenses and some wacke beds associated with Poortjie Member channel sandstone units on Farms RE/141 and RE/75 include locally abundant, rusty-brown moulds of woody plant axes. Colluvial / eluvial gravel aprons downslope commonly contain blocks of poorly-preserved silicified wood. These occurrences may reflect widespread denudation and incision of the Main Karoo Basin in late Middle Permian times; deforestation of riverine woodland triggered by intense drought may have fed large volumes of dead wood into river channels via flash flooding and bank collapse.

Most of the low-relief WEF Cluster project area in the Aberdeen Vlaktes is covered by a blanket of Late Caenozoic superficial deposits, including alluvial gravels and sands, eluvial and colluvial surface gravels, calcrete hard pans, pan sediments and gravelly to sandy soils. Apart from the abundant reworked fossil wood blocks and very rare bones described earlier, no fossils of Caenozoic age have been recorded within these younger sediments.

In terms of the heritage resources identified in the palaeontological field assessment, see Table 6-116 below.

Table 6-116: Palaeontological observations made during the field assessment for the proposed Grid Connection Infrastructure.

POINT ID	Description	Co-ordinates		Grading	Mitigation
264	Surface gravels overlying upper Abrahamskraal Fm on lower N slopes of Kunaskop. Poorly preserved blocks of rusty-brown silicified wood - probably downwasted from lower Poortjie Member channel sandstones upslope.	- 32.324791	23.645866	IIIC	NA
268	Surface gravels overlying upper Abrahamskraal Fm (Karelskraal Mb) on upper N slopes of Kunaskop. Poorly preserved blocks of rusty-brown silicified wood - probably downwasted from lower Poortjie Member channel sandstones upslope.	- 32.332461	23.652851	IIIC	NA
270	Kranz of pale brown, friable, medium-grained, medium-bedded, tabular lower Poortjie Member channel sandstones. Lenses of ferruginised basal channel breccia of reworked mudclasts, calcrete concretions and locally abundant rusty moulds of woody plant axes.	-32.331926°	23.652961°	IIIC	NA
271	Grey-green siltstone with possible load balls beneath incised base of lower Poortjie Member channel sandstones. Lenses of abundant rusty moulds of woody plant axes.	-32.332163°	23.652880°	IIIC	NA
272 and 273	Lower Poortjie Member thick (c. 1m), pebbly, ferruginised basal channel breccias and friable brown sandstones with abundant rusty-hued moulds of woody plant axes, sometimes contorted.	- 32.331926°	23.652961°	IIIC	NA
303	Farm 2/72 Reworked alluvial and coluvial gravels, dominated by rounded dolerite boulders and cobbles, with occasional small blocks of silicified fossil wood. Proposed Field Rating IIIC. No recommended mitigation.	-32.37233	23.67507	IIIC	NA
315	Farm RE/72 Isolated small block of silicified wood among LSA stone artefacts, low stone structures on crest of ridge – possibly a manuport. Proposed Field Rating IIIC. No recommended mitigation.	-32.38163	23.69617	IIIC	NA
316	Farm RE/73 Isolated small block (c. 9 cm long) of reworked silicified wood among sheetwashed surface gravels within <i>brak-koll</i> on alluvial <i>vlaktes</i> . Proposed Field Rating IIIC. No recommended mitigation.	-32.40382	23.67507	IIIC	NA

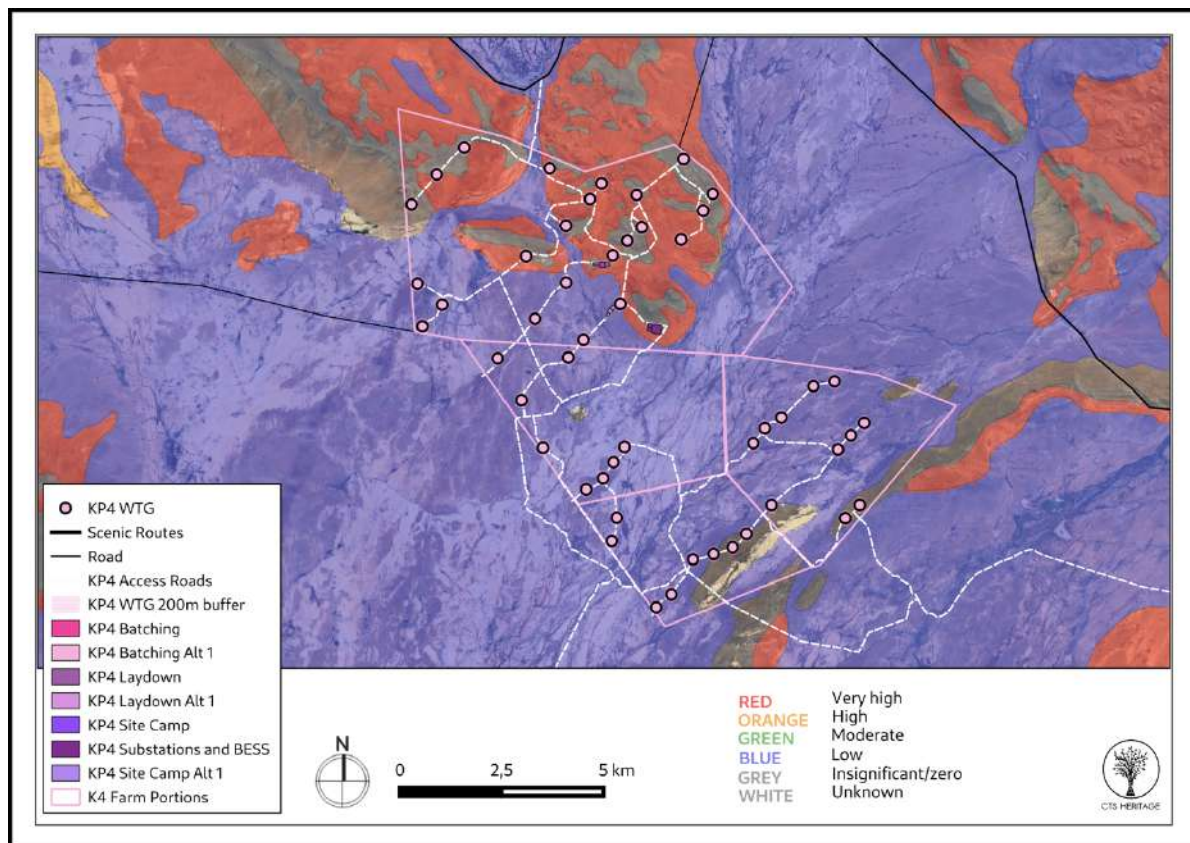


Figure 6-103: Palaeontological sensitivity of the proposed development area of the Kariega WEF Cluster.

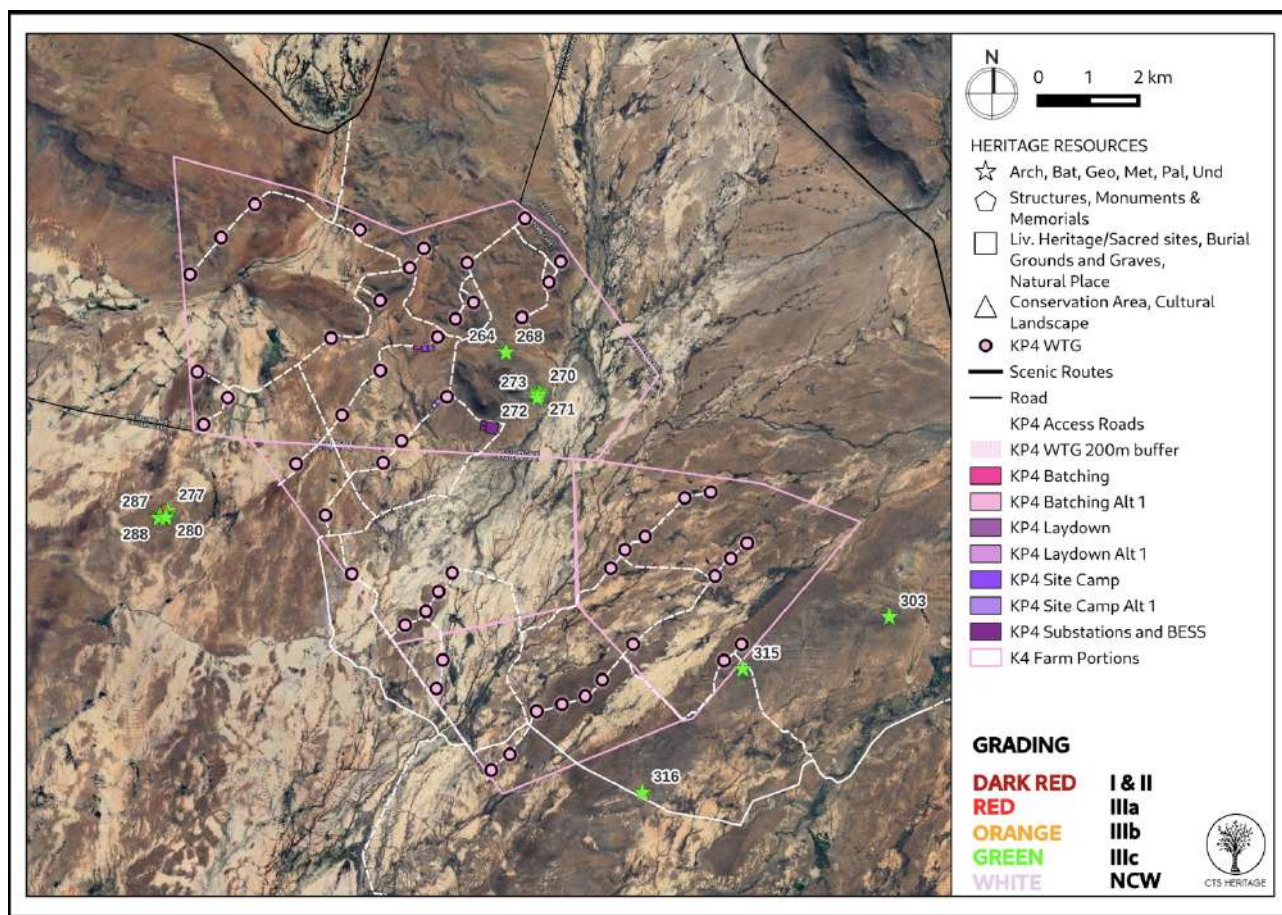


Figure 6-104: Map of palaeontological heritage resources within the proposed development area.

6.12.3 Impact assessment

Due to the nature of heritage resources, impacts to archaeological and palaeontological heritage resources are unlikely to occur during the planning, operational and decommissioning phases of the project. Potential impacts to the cultural landscape throughout the operational phase are discussed in the section below that deals with cumulative impacts. The impacts discussed here for archaeology and palaeontology pertain to the construction phase of the project. The impacts discussed here for the cultural landscape pertain to all phases of the project.

6.12.3.1 Cultural Landscape

The principle of a WEF in the proposed location is acceptable from a cultural landscape perspective (Table 6-117). There are no red flags, which identify the project to be a fatal flaw from a cultural landscape perspective. At a regional scale, the project is located to the west of the Camdeboo Mountains and the distinctive Camdeboo Plains and at considerable distance from the cluster of Nature Reserves around Graaff-Reinet. At a local scale, the project is located away from major scenic topographical features and beyond 35km from the town of Aberdeen. At a site scale, there are several sensitive heritage receptors from a cultural landscape perspective, which influence the location of certain wind turbines.

- Grave site (Grade IIIA)
- Historical farmsteads (Grade IIIB and IIIC)
- The R61
- The Kunaskop topographical feature

- A sense of topographical containment to the north, east and west of the project area.

No direct impact is anticipated to any known historical farmsteads, graves or scenic routes as a result of this proposed development. Based on the layout provided (April 2024), a number of the proposed turbines are located within areas of very high cultural landscape sensitivity. Turbines proposed in front of the Kunaskop disrupt the significance of this topographic feature. Additionally, turbines located on the northern slopes of the development area negatively impact on the sense of topographical containment to the north, east and west of the project area. It is recommended that a number of these turbines are removed to mitigate this negative impact (Figure 6-100).

Table 6-117: Impact table for Cultural Landscape Heritage Resources impacted by the Kariega 4 WEF.

Table 6-117: Impact table for Cultural Landscape Heritage Resources Impacted by the Kariega 4 WEF				
No.	1 Kariega 4 WEF			
Project phase	Construction, Operation and Decommissioning			
Impact title	Negative Impacts to the Cultural Landscape			
Impact description	The broader context of the area proposed for development has cultural significance that may be impacted by the proposed development			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		High - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	Likely (>66%)	The impact may occur, but not necessarily proof that it will.
Significance	Moderate - negative		Moderate - negative	
Importance	High	High	High	High
Consequence	Moderately-detrimental		Moderately-detrimental	
Confidence	Well established		Well established	
Reversibility	Medium	The affected environment may only recover from the impact with significant intervention or over long time period.		
Mitigatability	Low	Mitigation does not exist; or mitigation may only slightly reduce the significance of impacts.		
Potential mitigation	Setback from the N9 and the R61 by at least 1km on either side. Avoid steep or elevated topography, ridgelines or koppies Setback from graded resources and farmstead settlements IIIB and IIIC, by 500m. Setback from farmsteads forming part of the settlement pattern by at least 500m			
Comment on ratings	The cultural value of the pristine Karoo Landscape is very high and the location of the proposed development will impact this significance. It is acknowledged that there are several WEFs authorised in the area. Once the first WEF is constructed the area will no longer be pristine which to me is quite important from a cultural landscape perspective.			

6.12.3.2 Archaeology

The area proposed for development is located on the flat floodplains lying between a series of significant topographical features, as well as on some of these topographic features. In the flatter floodplains, the proposed development will not have a substantial negative impact on most of the archaeological resources identified. The majority of the lithic material identified in the field assessment is of low significance (not conservation-worthy)(Table 6-118), and even though the resources may be destroyed during construction, the impact is

inconsequential. No mitigation is required for archaeological material recorded in the footprint areas of the proposed development.

Despite the high number of observations of artefacts located within the flatter floodplains, these resources are common and representative of similar scatters across widespread areas of the Karoo. Despite the very high numbers of observations made, the archaeological material is ubiquitous across the entire floodplain area and in general, the results of this assessment indicate that the archaeological sensitivity of this part of the development area is low.

Some of the proposed development is located within areas of more significant topography which are dominated by Jurassic Dolerite outcrops. As noted in the desktop assessment, in the Karoo, these dolerite outcrops are known to be associated with higher numbers of observations of rock engravings, rock gongs and associated archaeological heritage. In the Great Karoo, natural elevated features such as dolerite dykes and ridges played a significant role in San settlement patterns and as such, are often associated with higher densities of significant archaeological heritage. As such, these topographical features and their associated dolerite outcrops are of HIGH archaeological sensitivity. It is recommended that these areas mapped in RED in (Figure 6-100) are excluded from the development.

Only one structure of heritage significance that was identified in the field assessment falls within the area proposed for the development of Kariega WEF 4. Site 060 is located within the development area and represents a small mud ruin structure. No direct impact to this site is anticipated based on the current layout.

Importantly, two overlapping grade IIIB archaeological sites identified by Bandama and Chirikure (2014) and described as both “Low density scatter of lithics with a large hand axe” (SAHRIS ID 35529) and “A low/medium density scatter of stone tools that include flakes and debitage” (SAHRIS Site ID 35530) are located within the development area. No direct impact is anticipated based on the layouts provided; however a no-go buffer of at least 100m is recommended for this site to ensure their conservation.

Additionally, a burial ground associated with the Anglo-Boer War is located within the development area (Site 077). This site is graded IIIA due to its high levels of local social and spiritual significance. No direct impact is anticipated based on the current layout nevertheless, a no development buffer of 100m is recommended for implementation around this site.

Table 6-118: Impact table for Archaeological Heritage Resources impacted by the Kariega 4 WEF.

No.	2				Kariega WEF 4	
Project phase	Construction					
Impact title	Destruction of significant archaeological heritage					
Impact description	The area proposed for development is known to conserve heritage resources of archaeological significance that may be impacted by the proposed development					
Impact Assessment	Impact not mitigated				Impact mitigated	
Nature	Negative				Negative	
Extent	Limited	Limited to the site and its immediate surroundings.		Limited	Limited to the site and its immediate surroundings.	
Duration	Permanent	Impact may be permanent, or in excess of 25 years.		Permanent	Impact may be permanent, or in excess of 25 years.	
Intensity	Very High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.		Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.	
Magnitude	High - negative				High - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.		Likely (>66%)	The impact may occur, but not necessarily proof that it will.	
Significance	Major - negative				Moderate - negative	
Importance	High	High		High	High	
Consequence	Highly-detrimental				Moderately-detrimental	
Confidence	Virtually certain				Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.				
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.				
Potential mitigation	Removal of turbines of areas of high topographic sensitivity (Figure 6)					
Comment on ratings	Some significant archaeological resources were identified within the development area					

Palaeontology

Most of the low-relief WEF Cluster project area is covered by a blanket of Late Caenozoic superficial deposits, including alluvial gravels and sands, eluvial and colluvial surface gravels, calcrete hard pans, pan sediments and gravelly to sandy soils. Apart from the abundant reworked fossil wood blocks and very rare bones reworked from the Permian bedrocks, no fossils of Caenozoic age have been recorded within these younger sediments. Given the rarity of significant vertebrate and other fossil finds, the overall palaeosensitivity of the Kariega WEF Cluster project area near Aberdeen is assessed as LOW. The provisional Medium to Very High Palaeosensitivity mapped within portions of the project area by the DFFE Screening Tool is accordingly contested. The potential for occasional fossil vertebrate sites of Very High palaeosensitivity cannot be entirely excluded, however. The distribution of such sites is largely unpredictable and they are best mitigated through a Chance Fossil Finds protocol.

The impact significance of the proposed Kariega WEF Cluster is assessed as LOW (Table 6-119). None of the recorded fossil sites lies directly within the provisional project footprint. The WEF projects are not fatally flawed and there are no objections on palaeontological heritage grounds to their authorization. This assessment applies equally to all four of the proposed wind energy facilities (Kariega WEFs 1-4), including all infrastructure components and layout options currently under consideration. Based on the sparse fossil remains reported in the few available palaeontological impact studies for renewable energy projects in the wider region (e.g. Almond 2014, 2022a, 2022b), cumulative impacts resulting from the four Kariega WEF developments, the adjoining Aberdeen WEF Cluster and the Poortjie Renewable Energy Facility some 35 km to the NW of the present study area are likely to be of LOW impact significance.

The rare, recorded fossil vertebrate sites have already been sampled, lie outside the WEF project layouts, and do not require mitigation. Mitigation of the recorded fossil wood sites is not recommended here, given the abundance

and widespread occurrence of the material; the known sites are not directly threatened by WEF development. However, it is recommended that a representative sample of well-preserved fossil wood material from the WEF Cluster project area is collected by a suitably qualified palaeontologist for curation in an approved fossil collection (e.g. Evolutionary Studies institute, Wits University, Johannesburg), once the development is authorised and before the Construction Phase.

The Environmental Control Officer (ECO) / Environmental Site Officer (ESO) responsible for the developments should be made aware of the possibility of important fossil remains (vertebrate bones, teeth, burrows, petrified wood, plant-rich horizons etc.) 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 such as vertebrate bones, teeth and well-preserved petrified logs should be safeguarded and reported at the earliest opportunity to the relevant provincial heritage resources authority. This is so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist (See tabulated Chance Fossil Finds Procedure in Appendix 2 to the PIA). The specialist involved would require a fossil collection permit from ECPHRA (Eastern Cape) and to submit a Work Plan for approval by HWC. Fossil material must be curated in an approved repository (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA (2013). These recommendations must be included in the EMP for the proposed renewable energy development.

Table 6-119: Impact table for Palaeontological Heritage Resources impacted by the Kariaga 4 WEF.

No.	3				Kariaga WEF 4	
Project phase	Construction					
Impact title	Destruction of significant palaeontological heritage					
Impact description	The area proposed for development is known to conserve heritage resources of palaeontological significance that may be impacted by the proposed development					
Impact Assessment	Impact not mitigated				Impact mitigated	
Nature	Negative				Negative	
Extent	Limited	Limited to the site and its immediate surroundings.			Limited	Limited to the site and its immediate surroundings.
Duration	Permanent	Impact may be permanent, or in excess of 25 years.			Permanent	Impact may be permanent, or in excess of 25 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.			Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	High - negative				Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.			About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the project.
Significance	Moderate - negative				Minor - negative	
Importance	High	High			High	High
Consequence	Moderately-detrimental				Slightly-detrimental	
Confidence	Well established				Well established	
Reversibility	Low	The affected environment may not be able to recover from the impact - permanently modified.				
Mitigatability	Medium	Mitigation exists and may notably reduce significance of impacts.				
Potential mitigation	The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities					
Comment on ratings	Some highly significant palaeontological resources were identified within the development area, and the geology underlying the development area is very sensitive for impacts to significant fossils					

Cumulative Impacts

The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect the same environment. It is important to note that the cumulative impact assessment for a particular project, like what is being done here, is not the same as an assessment of the impact of all surrounding projects. The cumulative assessment for this project is an assessment only of the impacts associated with this project, but seen in the context of all surrounding impacts. It is concerned with this project's contribution to the overall impact, within the context of the overall impact. But it is not simply the overall impact itself.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

In REDZ areas, there is a reasonable expectation that the cultural landscape of an area will be changed to be dominated, or at least heavily altered, by renewable energy development. In fact, this is the intention of the REDZ areas. This proposed development is located within the Beaufort West REDZ.

In terms of cumulative impacts to heritage resources, impacts to archaeological and palaeontological resources are sufficiently dealt with on a case-by-case basis. The primary concern from a cumulative impact perspective would be to the cultural landscape. The cultural landscape is defined as the interaction between people and the places that they have occupied and impacted. In some places in South Africa, the cultural landscape can be more than 1 million years old where we find evidence of Early Stone Age archaeology (up to 2 million years old), Middle Stone Age archaeology (up to 200 000 years old), Later Stone Age archaeology (up to 20 000 years old), evidence of indigenous herder populations (up to 2000 years old) as well as evidence of colonial frontier settlement (up to 300 years old) and more recent agricultural layers.

Modern interventions into such landscapes, such as renewable energy development, constitute an additional layer onto the cultural landscape which must be acceptable in REDZ areas. The primary risk in terms of negative impact to the cultural landscape resulting from renewable energy development lies in the eradication of older layers that make up the cultural landscape. There are various ways that such impact can be mitigated.

In terms of impacts to heritage resources, it is preferred that this kind of infrastructure development is concentrated in one location and is not sprawled across an otherwise wilderness and agricultural landscape. The proposed development is therefore unlikely to result in unacceptable risk or loss, nor will the proposed development result in a complete change to the sense of place of the area or result in an unacceptable increase in impact due to its location as one of many renewable energy facilities in this area. Furthermore, this development is located within the Beaufort West REDZ, an area that has been pre-identified as suitable for renewable energy development and as such, cumulative impact is expected in this area.

The principle of a WEF in the proposed location is acceptable from a cultural landscape perspective. There are no red flags, which identify the project to be a fatal flaw from a cultural landscape perspective. The recommendations made above in terms of the anticipated impacts to the cultural landscape will assist in mitigating the cumulative impact of this proposed WEF.

6.12.4 Conclusion and Recommendations

The site forms part of an intact cultural landscape representative of the Central Plateau of the Great Karoo possessing heritage value for historical, aesthetic, architectural, social and scientific reasons. Based on the desktop mapping and assessment of potential heritage resources and receptors, and subsequent fieldwork, the principle of

a WEF in the proposed location is acceptable from a cultural landscape perspective. There are no red flags, which identify the project to be a fatal flaw from a cultural landscape perspective.

At a regional scale, the project is located to the south of the Great Escarpment, to the west of the distinctive Camdeboo Plains and at considerable distance from the cluster of Nature Reserves around Graaff Reinet. The site possesses several landscape elements contributing to a composite cultural landscape including topographical features, open plains, water features, historic scenic routes and farmsteads. Various buffers are recommended to mitigate anticipated negative impacts to these significant cultural landscape elements.

Importantly, based on the layout provided (April 2024), a number of the proposed turbines are located within areas of very high cultural landscape sensitivity. Turbines proposed in front of the Kunaskop disrupt the significance of this topographic feature. Additionally, turbines located on the northern slopes of the development area negatively impact on the sense of topographical containment to the north, east and west of the project area. It is recommended that a number of these turbines are removed to mitigate this negative impact (Figure 6-98).

There are limited impacts anticipated to archaeological and palaeontological heritage from this proposed development and as such, the principle of a renewable energy facility in this location is supported from a heritage perspective provided that the infrastructure is located in areas able to tolerate the impact of the high degree of change from a cultural landscape perspective. As such, various turbines are recommended to be relocated away from areas of high archaeological and cultural landscape sensitivity (Figure 6-98).

Based on the outcomes of this report, it is not anticipated that the proposed development of the Kariega 4 Wind Energy Facility will negatively impact on significant heritage resources on condition that the following recommendations are implemented:

Western Cape

Based on the outcomes of this report, it is not anticipated that the proposed development of the Kariega 4 Wind Energy Facility will negatively impact on significant heritage resources on condition that the following recommendations are implemented:

- Avoid steep or elevated topography, ridgelines or koppies
- The turbines identified in (Figure 6-98) must be relocated outside of the high sensitivity area mapped therein
- The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and HWC must be alerted immediately to determine an appropriate way forward.

Eastern Cape

Based on the outcomes of this report, it is not anticipated that the proposed development of the Kariega 4 Wind Energy Facility will negatively impact on significant heritage resources on condition that the following recommendations are implemented:

- Avoid steep or elevated topography, ridgelines or koppies

-
- The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities
 - Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed development, work must cease in the vicinity of the find and HWC must be alerted immediately to determine an appropriate way forward.

6.13 Traffic

The Traffic Impact Assessment (TIA) was undertaken by Iris Wink of iWink Consulting (Pty) Ltd. The TIA considers factors such as extent of the transport study and study area; trip generation for the facility during construction and operation; traffic impact on external road network; accessibility and turning requirements; national and local haulage routes; assessment of internal roads and site access, freight requirements and permitting needed for abnormal loads; as well as traffic accommodation during construction. The TIA found that the proposed development of the Kariega 4 WEF and associated infrastructure is supported from a transport perspective, provided that the recommendations and mitigations contained in this report are adhered to.

The full specialist report is attached hereto as **Annexure D 12, Traffic Impact Assessment (2024)**.

6.13.1 Baseline Description

The site is located approximately 35 km east of Aberdeen in the Eastern Cape Province.

6.13.1.1 Route for Components manufactured within South Africa

In South Africa, more than half (52%) of the manufacturing industry's national workforce resides in three metros - Johannesburg, Cape Town, Gqeberha and eThekweni. It is therefore anticipated that elements that can be manufactured within South Africa will be transported to the site from the Cape Town, Johannesburg, Gqeberha or Pinetown/Durban areas. Components will be transported to site using appropriate National and Provincial routes. It is expected that the components will generally be transported to site with normal heavy load vehicles.

- Route from Cape Town Area to Site – Locally sourced materials and equipment
 - Cape Town has a large manufacturing sector located throughout the metro. The proposed industrial hubs being considered to source the required materials and components is currently unknown. With quite an extensive and widespread industrial market, a specific route to the site cannot be considered at this point in time, but it is expected that a majority of the route length will be similar to the routes considered for the haulage of imported materials and equipment (approximately 560 km via the N1). No road limitations envisaged along the route for normal load freight (see Figure 6-105).
- Route from Johannesburg Area to Site – Locally sourced materials and equipment
 - If components from Johannesburg are considered, normal loads from Johannesburg to the site can be transported via the route as shown in Figure 6-106 below. No road limitations are envisaged along the route for normal load freight. The distance from the Johannesburg area to the site is approximately 920 km via the N1.
- Route from Pinetown / Durban to Site - Locally sourced materials and equipment
 - Normal loads can transport elements via two potential routes from Durban and Pinetown to the site. No road limitations are envisaged along the route for normal load freight. The shortest distance from Pinetown to the site is approximately 1 000 km via the R56 as shown in Figure 6-107 below.
- Route from Gqeberha area to site
 - If loads are transported from the Gqeberha area to site, several routes to site are available. One possible route is shown in Figure 6-108 via the R338 and R75 with a travel distance of approximately 300km.

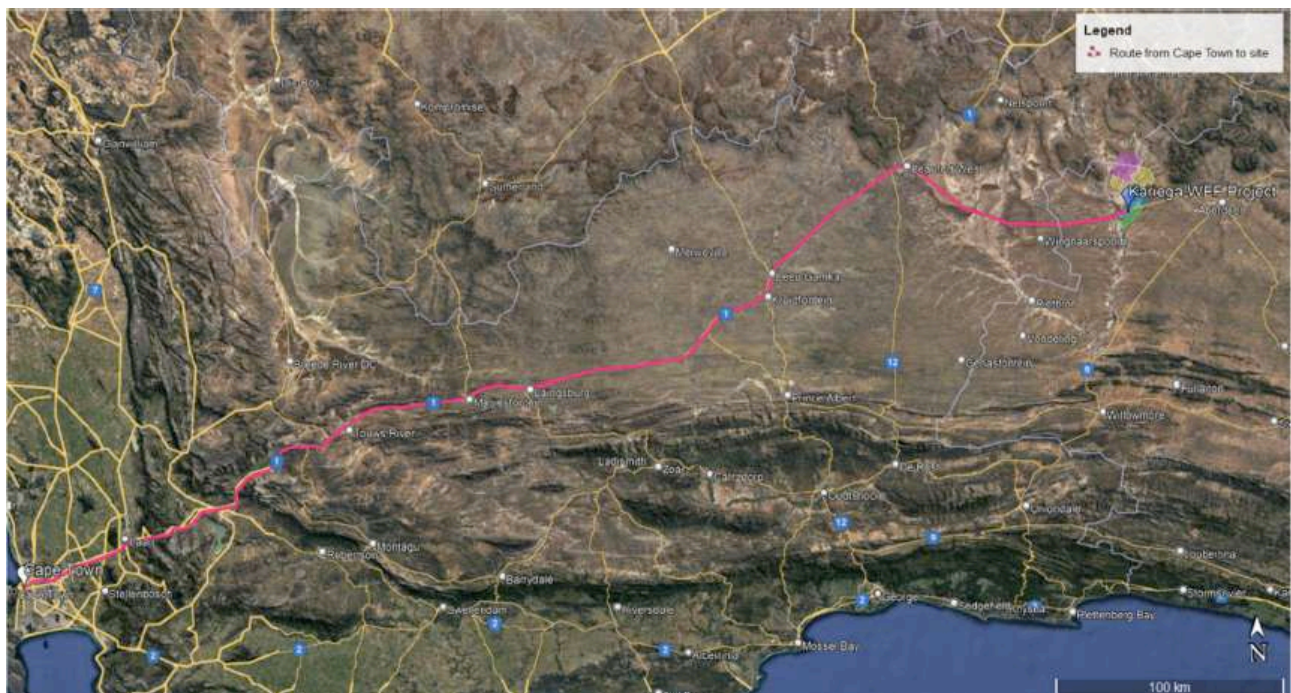


Figure 6-105: Route from Cape Town to Kariega WEF project site.

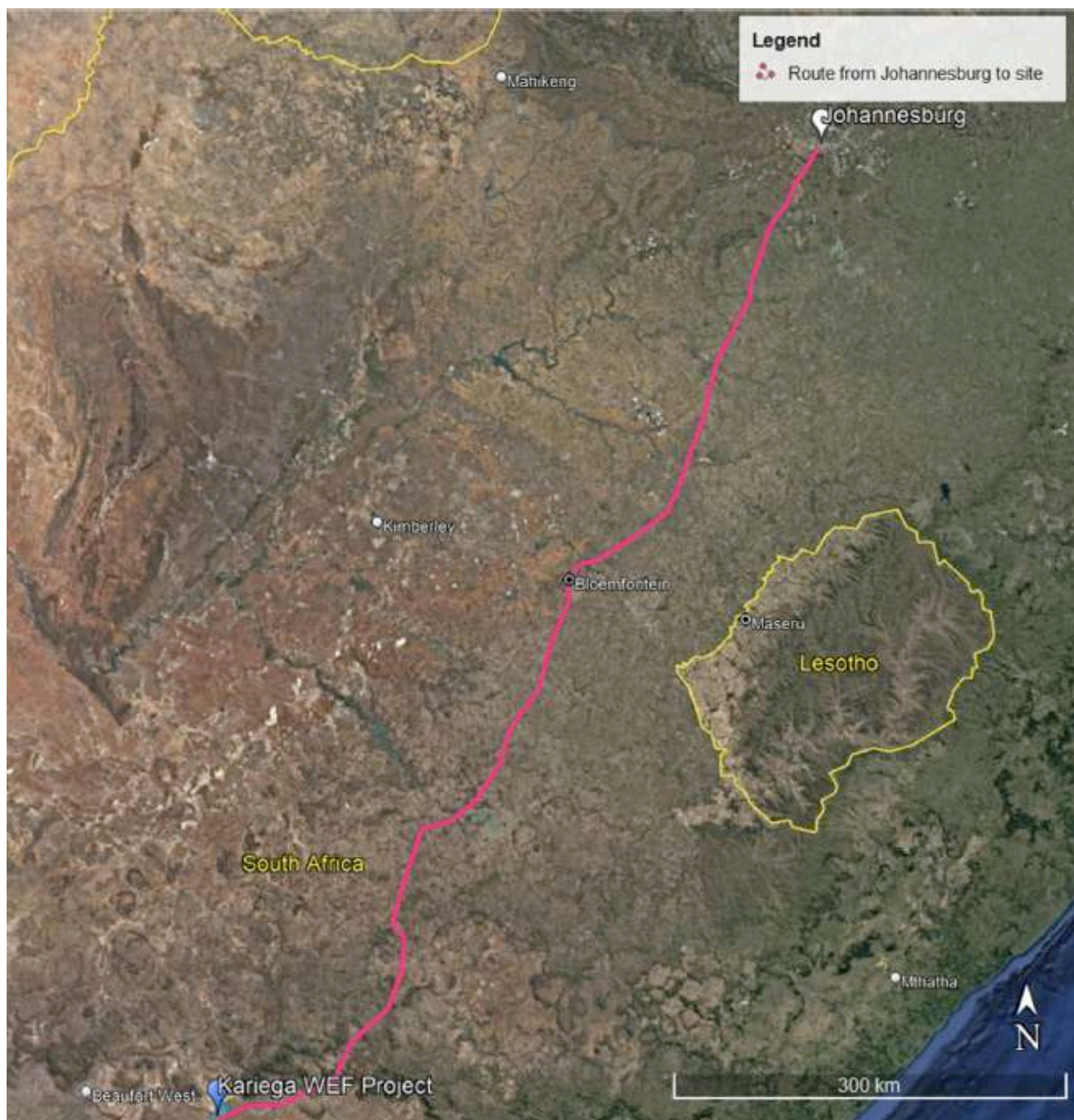


Figure 6-106: Route from Johannesburg to the project site.



Figure 6-107: Route from Pinetown to the project site.

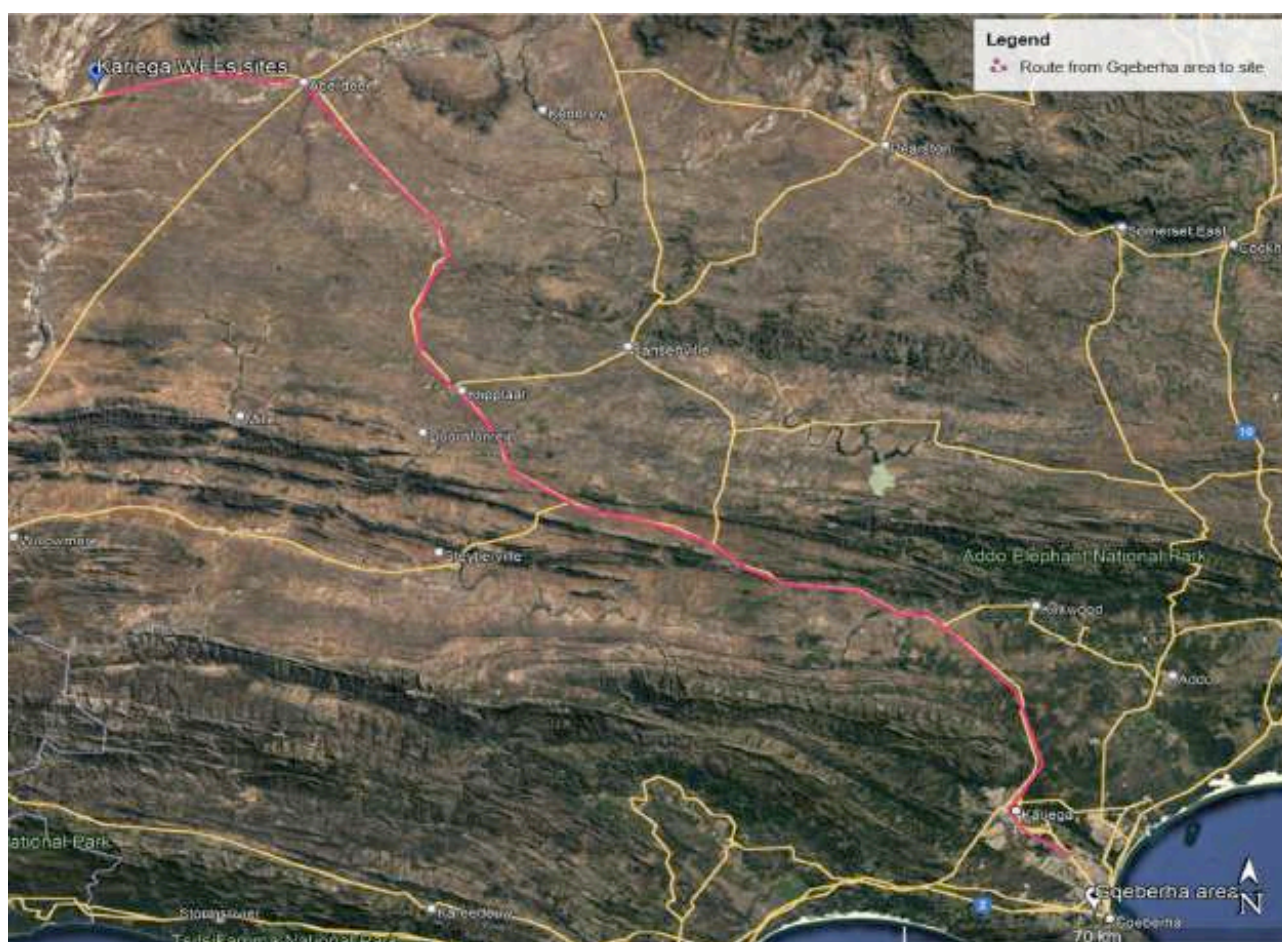


Figure 6-108: Route from Gqeberha to project site.

6.13.1.2 Surrounding road network

The proposed Kariega 4 WEF site is located near Aberdeen in the Eastern Cape. The road classification of the surrounding road network as per the Road Infrastructure Strategic Framework for South Africa (RISFSA) is shown in Figure 6-109 (sourced from the Eastern Cape Road Asset Management System).

The R61 can be classified as a Rural Class 2 routes, which are major arterial roads that typically carry inter-regional traffic between:

- Smaller cities and medium to large towns (population typically greater than about 25 000);
- Smaller border posts;
- Class 1 and other Class 2 routes;
- Important regions, transport nodes and commercial areas that generate large volumes of freight and other traffic such as seaports and international airports.
- Smaller centres than the above when travel distances are relatively long (longer than 200 km).

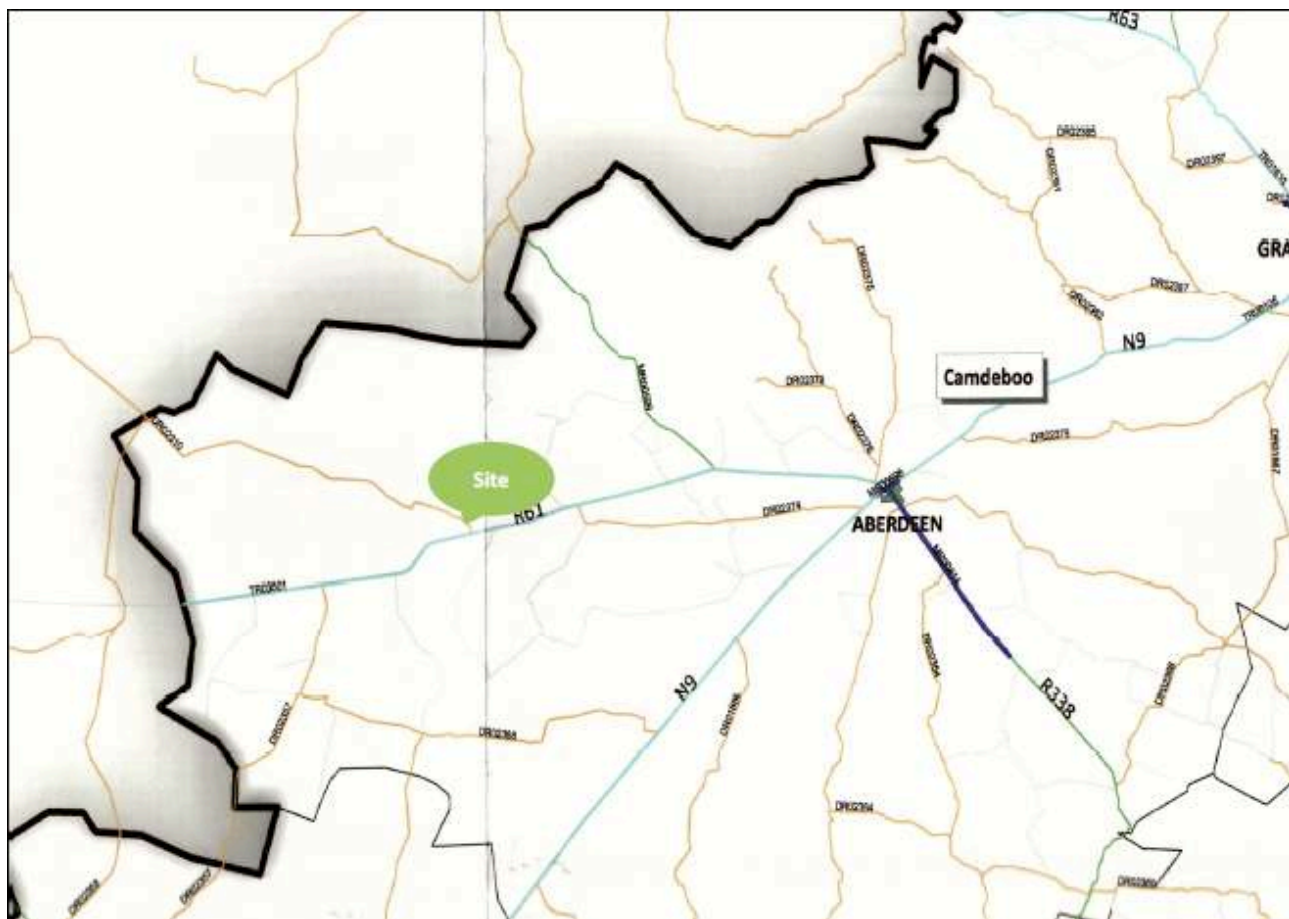


Figure 6-109: Road network in vicinity of project site.

6.13.1.3 Proposed Access Points

Several access points were initially assessed, and three access points were eventually chosen and further discussed in this chapter for their suitability in regard to sight distances, minimum access spacing requirements and road safety principles (see Figure 6-110):

- Main Access;

- Access 2;
- Access 3;
- Access 4; and
- Access 5.

As the R61 is a Class 2 road, a minimum access spacing of 800 m should be kept. The spacing between the Main access and Access 2 will be around 5.5km and between Access 2 and 3 approximately 4km. The turn-off on the R61 towards Access 4 is located approximately 16km from Access 3. The access spacings would therefore be sufficient.

The access points to the site will need to be able to cater for construction and abnormal load vehicles. A minimum road width of 8 m is recommended for the access points and the internal roads can have a minimum width of 5 m. The radius at the access point needs to be large enough to allow for all construction vehicles to turn safely.

It is recommended that the site access be security controlled and security staff be stationed on site at the access during construction. A minimum stacking distance of 25 m needs to be kept between the road edge of the external road and the access boom.

All road markings and signage need to be in accordance with the South African Road Traffic Signs Manual (SARTSM). In accordance with the TRH17 Guidelines for the Geometric Design of Rural Roads, the shoulder sight distance for a stop-controlled condition on a road with a speed limit of 100km/h, i.e. the R61, needs to be a minimum of 420m for the largest vehicle (5m set back from the intersecting road).

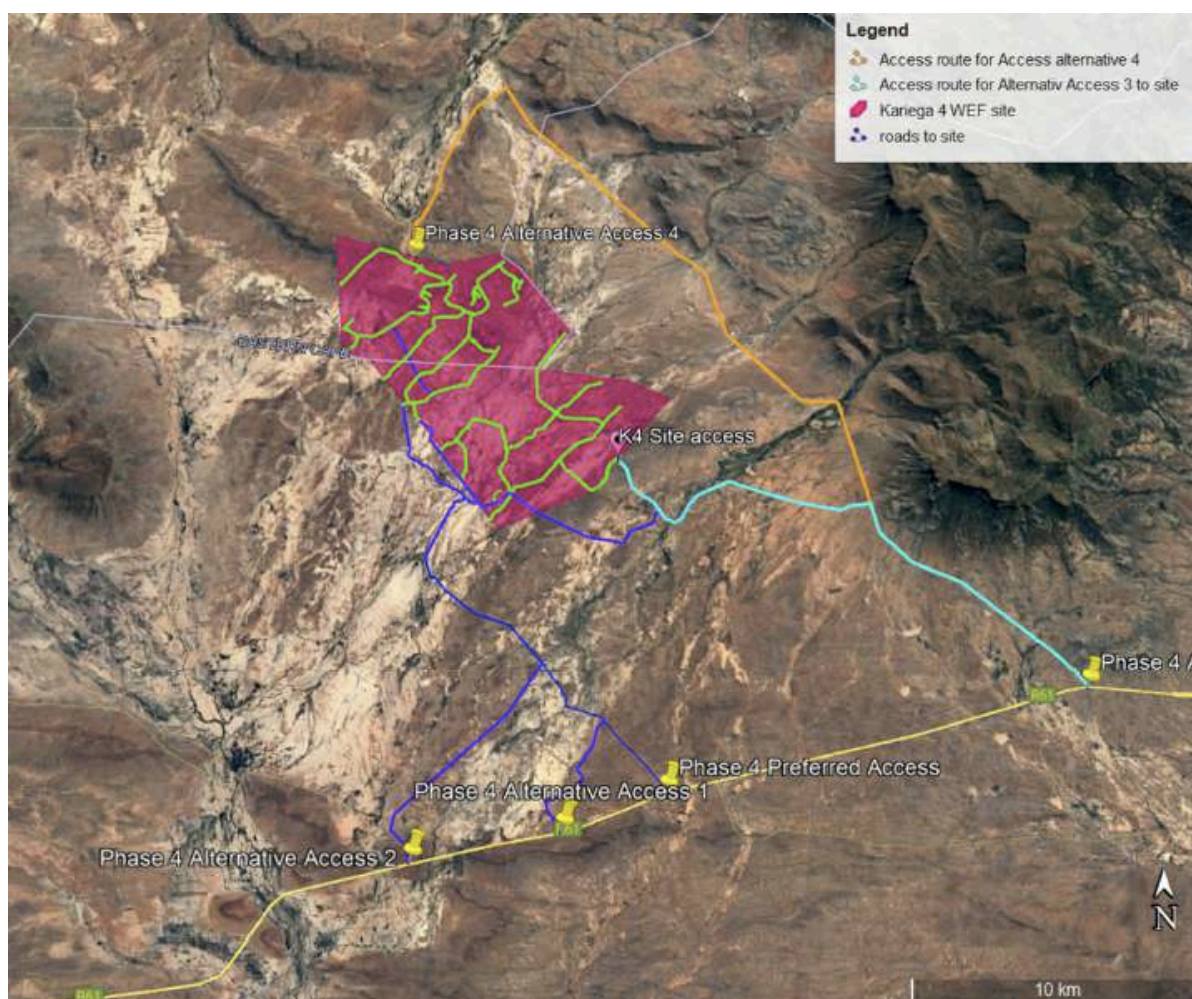


Figure 6-110: Aerial View of Access Points for Kariega 4 WEF.

6.13.1.4 Internal Roads

The geometric design and layout for the internal roads from the access points needs to be established at detailed design stage. Existing structures and services, such as drainage structures, signage, street lighting and pipelines will need to be evaluated if impacting on the roads. It needs to be ensured that gravel sections remain in good condition and will need to be maintained during the additional loading of the construction phase and then reinstated after construction is completed.

The geometric design constraints encountered due to the terrain should be taken into consideration by the geometric designer. Preferably, the internal roads need to be designed with smooth, relatively flat gradients (recommended to be no more than 8%) to allow a larger transport load vehicle to ascend to the respective laydown areas.

6.13.1.5 Transportation of Materials, Plant and People to the proposed site

It is assumed that the materials, plant, and workers will be sourced from the surrounding towns as far as possible, as for example from Aberdeen.

6.13.1.6 Public Transport and Non-Motorised Transport

In terms of the National Land Transport Act (NLTA) (Act No.5 of 2009), the assessment of available public transport services is included in this report. The following comments are relevant in respect to the public transport availability for the proposed development.

Non-motorised transportation (NMT) is a dominant mode of transportation, with private cars and minibus/taxis being the second-most used mode of transport, followed by buses. Currently, there are no known future planned public transport facilities in the vicinity of the site. However, generally the developer of a large-scale project, such as many renewable energy projects, will provide shuttle buses or similar for workers during the construction phase.

6.13.2 Site Sensitivity

The potential risks/impacts to the surrounding environment expected to be generated from the development traffic is traffic congestion and associated noise, dust, and exhaust pollution. This will be true for the construction, operation, and decommissioning phase. It must be noted that significance of the impact is expected to be higher during the construction and decommissioning phase because these phases generate the highest development traffic.

6.13.2.1 Construction phase

This phase includes the transportation of people, construction materials and equipment to the site. This phase also includes the construction of the WEF, including construction of footings, roads, excavations, trenching, and ancillary construction works. This phase will temporarily generate the most development traffic.

Nature of impact:

The nature of the impact expected to be generated at this stage would be traffic congestion and delays on the surrounding road network as well as the associated noise, dust, and exhaust pollution due to the increase in traffic.

Estimated peak hour traffic generated by Kariega 4 WEF:

- Material delivery: This includes heavy vehicles for the transport of building materials such as reinforced concrete materials for foundations, gravel material for roadworks, brickwork material for buildings, fencing material, etc. The major trip generation activities are assumed to result from the construction of turbine foundations and road material delivery.
- Heavy vehicles (turbine foundations): Based on similar studies, typically 87 trips per 500 m³ foundation is estimated, which results in a total of 6960 trips and then on average 17 daily trips for the foundation material delivery (based on a construction period of 18 months).
- Heavy vehicle (road layer works): Assuming a typical 0.2 m gravel wearing course and a 10 m road width, 2 m² of gravel wearing course is assumed for the purpose of the trip estimate.
- Typically, 1 trip/6 m³ can be assumed for material delivery. With an estimated 127 km road length, 107 daily trips are estimated for road material delivery.
- Heavy vehicles (laydown area material): 1 trip/6 m³ is assumed. With an envisaged 90 000 m² of laydown and assembly areas, crane hard stands, etc. and an assumed 0.2 m gravel wearing course, an average of 8 daily trips for laydown area material delivery is estimated. With a total of 132 daily trips and 30% of daily traffic occurring during the peak period, 40 peak hour trips are assumed for material delivery.

It must also be noted that vehicle trips from material delivery vary depending on the construction task/program, fuel supply arrangements, as well as distance from the material source to the site. Project planning can be used to reduce material delivery during peak hours.

- Construction machinery:
 - This includes cranes for turbine assembly, heavy vehicles required for earthworks and roadworks. These vehicles are expected to have negligible traffic impact as they will arrive on site in preparation for construction. Once on site, these vehicles will produce internal site traffic with minimal effect on the external road network.
- Component delivery trips:
 - The blades: For this project a maximum rotor diameter of 200 m is assumed (i.e., 100 m blades). As a worst-case scenario, it is assumed that the blades will be transported separately (i.e., three (3) trips per turbine or 150 trips for 50 wind turbines).
 - The nacelle: one (1) abnormal load trip per turbine (i.e., 50 trips for 50 turbines)
 - The turbine hub and rotor unit: one (1) abnormal load trip per turbine (i.e., 50 trips for 50 turbines)
 - Tower sections:
 - Import of turbine pylons: If the turbine tower sections will be imported and transported to site, it is estimated that for a maximum hub height of 200 metres, ten (10) tower sections are required. Each tower section is transported separately on a low-bed trailer (i.e., 10 abnormal load trips per turbine or 500 trips for 50 turbines). Total abnormal loads per turbine (turbine components are manufactured on site): 5 trips per turbine (i.e., 250 trips for 50 turbines). Total abnormal loads per turbine (turbine pylon sections to be imported): 15 trips per turbine (i.e., 750 trips for 50 turbines). In addition to the turbine component delivery trips, one (1) abnormal load is estimated for each transformer, resulting in a total of up to 50 transformers if one transformer will be installed at each turbine. The abnormal load trips are highly depended on project planning and abnormal load permitting. These trips are not necessarily concentrated to the peak hours. Therefore, the exact number of peak hour vehicle trips generated by abnormal load vehicles is unknown at this stage.
- Construction workers trips:
 - The number of construction personnel is affected by project programming, however, the estimate from experience with similar developments is at 300 workers.
 - It is further assumed that approximately 50% (max 150) will be low skilled workers (construction labourers, security staff etc.), ~30% (max 90) semi-skilled workers (drivers, equipment operators etc.) and approximately 20% (max 60) skilled personnel (engineers, land surveyors, project managers etc.).
 - Typically, contractors arrange transportation for site workers. Assuming the low skilled and semi-skilled labourers can commute by bus with a 60-passenger capacity, around four (4) busses can be assumed for low skilled and semi-skilled labourers. The skilled labourers are conservatively assumed to travel by passenger car (60 trips).

- For rural environments it is further estimated that the peak hour trips are around 30% of the average daily traffic (i.e., 19 peak hour trips).

6.13.2.2 Operational Phase

This phase includes the operation and maintenance of the WEF throughout its life span.

Nature of impact:

The nature of the impact expected to be generated at this stage would be traffic congestion and delays on the surrounding road network, and the associated noise, dust, and exhaust pollution due to the operational traffic trips.

Estimated peak hour traffic generated by the site:

- Trips generated by staff traveling to the site:
- The number of permanent staff expected for the operational phase is still unknown. Based on similar studies it can be estimated that approximately 30 full-time employees will be stationed on site.
- Assuming 30% of trips occur during the peak hour, approximately 9 peak hour trips are estimated for the operational phase.
- It is thus not envisaged that the generated operation traffic will go beyond 50 peak hour trips. The operational peak hour trips generated by staff are expected to be low and will have a negligible impact on the external road network.

6.13.2.3 Decommissioning phase

This phase will have similar impacts and generated trips as the Construction Phase.

6.13.2.4 Cumulative Impacts

To assess a cumulative impact, it is generally assumed that all currently approved and authorized projects within a 30 km radius would be constructed at the same time.

This is a precautionary approach as in reality; these projects would be subject to a highly competitive bidding process and not all the projects may be selected to enter into a Power Purchase Agreement.

Even if all the facilities are constructed and/or decommissioned at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

The construction and decommissioning phases of a renewable energy project are the only significant traffic generators. The duration of these phases is short term, i.e., the potential impact of the traffic generated during the construction and decommissioning phases on the surrounding road network.

6.13.3 Impact assessment

6.13.3.1 Potential Impact during the Construction Phase

The construction phase will generate traffic including transportation of people, construction materials, water, and equipment (abnormal trucks transporting turbine components). It is therefore expected that both these phases are similar in nature of the traffic demand expected. The exact number of trips generated will be determined by appointed the haulage company. Based on the high-level screening of impacts, a moderate significance rating can be expected during the construction stage (see Table 6-120).

Nature of the impact:

- Temporary increase in traffic, noise and dust pollution associated potential traffic
- Potential damage to road surfaces caused by construction vehicles

Table 6-120: Traffic, construction and decommissioning phase impacts.

Kariega 3 WEF only				
Project phase	Construction & Decommissioning			
Impact title	Development traffic impact / Noise and dust pollution / Potential damage to road surfaces caused by construction vehicles			
Impact description	Temporary increase in construction vehicle trips on external road network and noise&dust pollution levels			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	National	Impacts manifest at a national level / provincial.	National	Impacts manifest at a national level / provincial.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.	Low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are slightly affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Likely (>66%)	The impact may occur, but not necessarily proof that it will.	About as likely as not (33-66%)	The impact has occurred before and could occur in the lifetime of the
Significance	Moderate - negative		Minor - negative	
Importance	Moderate	Moderate	Low	Low
Consequence	Slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigability	Medium	Mitigation exists and may notably reduce significance of impacts.		
Potential mitigation	Maintenance of haulage routes, design and maintenance of internal routes, dust suppression close to communities. Stagger turbine component and materials delivery to site. Reduce construction period if possible. Stagger construction of turbines. The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network. Staff and general trips should occur outside of peak traffic periods as far as possible. Monitor road surface, especially at bends, to address any road surface damage early on.			
Comment on ratings	The rating of moderate negative significance prior to mitigation is agreed with. With the above mitigation measures, the impact can be reduced.			

6.13.3.2 Potential Impact (Operation Phase)

Nature of the impact

- Noise and dust pollution associated potential traffic

The traffic generated during this phase will have a nominal impact on the surrounding road network (see Table 6-121). The following items need to be clarified:

- The number of permanent employees
- Water source to be clarified – borehole or transported to site
- Size of water tankers if water is to be delivered on site

Table 6-121: Traffic, operational phase impacts.

Table 3: 227: Water Operations: Traffic Impacts:

Kariega 3 WEF only				
Project phase	Operation			
Impact title	Traffic Impact due to maintenance and staff trips			
Impact description	Traffic Impact due to maintenance and staff trips for the length of operation			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Local	Extending across the site and to nearby settlements.	Local	Extending across the site and to nearby settlements.
Duration	Long term	Impact will last between 6 and 25 years.	Long term	Impact will last between 6 and 25 years.
Intensity	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.	Very low	Impacts affect the environmental in such a way that natural, cultural and/or social functions and processes are not affected.
Magnitude	Moderate - negative		Moderate - negative	
Probability	Unlikely (>33%)	The impacts occurrence is rare but has happened before.	Unlikely (>33%)	The impacts occurrence is rare but has happened before.
Significance	Minimal - negative		Minimal - negative	
Importance	Very low	Very low	Very low	Very low
Consequence	Very slightly-detrimental		Very slightly-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigability	High	Mitigation exists and will considerably reduce the significance of impacts.		
Potential mitigation	Staff and general maintenance trips to occur outside peak traffic periods as much as possible. Reduce trips due to water transport to site.			
Comment on ratings	The rating of minimal negative significance prior to mitigation is agreed with. With the above mitigation measures, the impact can be further reduced.			

6.13.3.3 Cumulative Impacts

To assess a cumulative impact, it is generally assumed that all wind farms within a 30 km radius, currently proposed and authorized, would be constructed at the same time. This is the precautionary approach as in reality; these projects would be subject to a highly competitive bidding process and not all the projects may be selected to enter into a Power Purchase Agreement. Even if all the facilities are constructed and/or decommissioned at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

The construction and decommissioning phases of a WEF are the only significant traffic generators. The duration of these phases is short term, i.e., the potential impact of the traffic generated during the construction and decommissioning phases on the surrounding road network is temporary and WEFs, when operational, do not add any significant traffic to the road network.

At the time of preparing this report, the projects listed in Table 6.1 were considered in the cumulative impact assessment (see Table 6-122).

Nature of the impact

- Temporary increase in traffic
- Noise and dust pollution associated potential traffic
- Potential damage to road surfaces caused by construction vehicles

Table 6-122: Traffic Cumulative impacts.

Cumulative Impact				
Project phase	Construction & Decommissioning			
Impact title	Cumulative traffic impacts due to further authorized developments in the area			
Impact description	Additional Traffic Impact due to all authorized renewable energy projects being developed at the same time			
Impact Assessment	Impact not mitigated		Impact mitigated	
Nature	Negative		Negative	
Extent	Regional	Impacts manifest at a regional / municipal level.	Regional	Impacts manifest at a regional / municipal level.
Duration	Medium term	Impact will last between 1 and 5 years.	Medium term	Impact will last between 1 and 5 years.
Intensity	High	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes will temporarily or permanently cease.	Medium	Impacts affect the environment in such a way that natural, cultural and/or social functions and processes are moderately altered.
Magnitude	High - negative		Moderate - negative	
Probability	Very likely (>90%)	There are sound reasons that the impact will occur.	Likely (>66%)	
Significance	Major - negative		Moderate - negative	
Importance	High	High	High	
Consequence	Highly-detrimental		Moderately-detrimental	
Confidence	Well established		Well established	
Reversibility	High	The affected environment may be able to recover from the impact.		
Mitigability	Medium	Mitigation exists and may notably reduce significance of impacts.		
Potential mitigation	Maintenance of haulage routes, design and maintenance of internal routes, dust suppression close to communities. Stagger turbine component and materials delivery to site for the different approved projects. Reduce construction periods if possible. Stagger construction of turbines in agreement between the project developers, if possible. The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network. Staff and general trips should occur outside of peak traffic periods if possible.			
Comment on ratings	The rating if high negative significance prior to mitigation is agreed with. With the above mitigation measures, the impact can be reduced to moderate significance.			

6.13.4 Conclusion and Recommendations

The potential traffic and transport related impacts for the construction, operation and decommissioning phases of the proposed Kariega 4 WEF project were identified and assessed.

- The main impact on the external road network will be during the construction phase. This phase is temporary in comparison to the operational period. The number of abnormal loads vehicles was estimated and to be found to be able to be accommodated by the road network including the recommended mitigation measures.
- The traffic generated during the construction phase, although significant, will be temporary and impacts are considered to be of medium negative impact. However, after mitigation a rating of minor negative impact can be given.
- During operation, it is expected that maintenance and security staff will periodically visit the facility. The generated trips can be accommodated by the external road network and the impacts are rated minor negative.
- The traffic generated during the decommissioning phase will be similar to or even less than the construction phase traffic and the impact on the surrounding road network will also be considered to be of minor negative impact with mitigation.

- The other projects within a 30 km radius from the project site as listed in this report were taken into consideration for the cumulative impact. Mitigation measures would be important and can reduce the impact. The cumulative impact can then be rated as moderate negative.

The potential mitigation measures mentioned in the construction and decommissioning phases are:

- The delivery of components to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- Dust suppression of gravel roads located within the site boundary, including the main access road to the site and the site access roads, during the construction phase, if required.
- Regular maintenance of gravel roads located within the site boundary, including the access roads to the site, by the Contractor during the construction phase and by the Owner/Facility Manager during the operational phase, if required.
- Monitoring and addressing any damage to the section of the R61 close to the site caused by construction vehicles.
- The use of mobile batch plants and quarries near the site would decrease the traffic impact on the surrounding road network, if available and feasible.
- Staff and general trips should occur outside of peak traffic periods as far as possible.
- Vehicular movements within the site boundary are the responsibility of the respective Contractor and the Contractor must ensure that all construction road traffic signs and road markings (where applicable) are in place.
- If required, low hanging overhead lines (lower than 5.1m) e.g., Eskom and Telkom lines, along the proposed routes will have to be moved (to be arranged by the haulage company and communicated beforehand with the service provider of the OHL) to accommodate the abnormal load vehicles. The Contractor and the Developer are to ensure that the haulage company is aware of this requirement.
- The haulage company is to provide evidence to the Contractor and the Developer that any affected overhead lines have been moved or raised.
- The preferred route should be surveyed by the developer to identify problem areas (e.g., intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, which may require modification). After the road modifications have been implemented, it is recommended to undertake a “dry-run” with the largest abnormal load vehicle, prior to the transportation of any components, to ensure that delivery will occur without disruptions. This process is to be undertaken by the haulage company transporting the components and the contractor, who will modify the road and intersections to accommodate abnormal vehicles. The “dry-run” should be undertaken within the same month that components are expected to arrive. The haulage company is to provide evidence that the route has been surveyed and deemed acceptable for the transportation of the abnormal load.
- The Contractor needs to ensure that any gravel sections of the haulage routes (i.e., the site access road and the main access road to the site) remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.
- Design and maintenance of internal roads. The internal gravel roads will require grading with a grader to obtain a camber of between 3% and 4% (to facilitate drainage) and regular maintenance blading will also be required. The geometric design of these gravel roads needs to be confirmed at detailed design stage. This process is to be undertaken by a civil engineering consultant or a geometric design professional.
- For upgraded or newly constructed site and access roads, it needs to be ensured that all bellmouths and radii of bends can accommodate the largest construction vehicle. The dimensions will be communicated as part of the detail design stage as per Geometric Design Standard guideline.



The construction and decommissioning phases of a wind energy facility are the only significant traffic generators and therefore noise and dust pollution will be higher during these phases. The duration of these phases is of temporary nature, i.e., the impact of the solar power facility on the external traffic on the surrounding road network is temporary and solar facilities, when operational, do not add any significant traffic to the road network.

The proposed development of the Kariega 4 WEF and associated infrastructure is supported from a transport perspective, provided that the recommendations and mitigations contained in this report are adhered to.

A Traffic Management Plan (TMP) will need to be provided at start of construction and start of operational phase, respectively, giving directive on the following items:

- Preliminary Transport Requirements
- Transport Coordinator
- Stakeholder Engagement
- Licensing
- Construction Staff
- Inspection of all routes by haulage company
- Maintenance of roads
- Maintenance of vehicles
- Signage
- Speed limits
- Abnormal loads

The potential impacts associated with the proposed Kariega 4 WEF, and associated infrastructure are acceptable from a transport perspective.

7 ENVIRONMENTAL IMPACT STATEMENT

The potential impacts associated with the proposed WEF on key sensitivities as identified by the DFFE screening tool and verified by specialists are summarised in Table 7-1 and impact ratings provide in Table 7-2. With mitigation measures in place as set out in chapter 6 post mitigation impacts are anticipated to be minimal to moderate negative significance. Two impacts remain major negative post mitigation: 1. Is the visual impact which will result in the change to rural karoo landscape to wind farm landscape due to the presence of large and moving/ static turbines and this coincided with the cumulative intervisibility during the day of all the Kariega WEF projects as well as the other wind farms to the southeast. This is not seen as a project flaw since the project is situated within a landscape located within the REDZ11 area and with RE supported by local planning. 2. The cumulative impact of known renewable energy projects within a 100km radius of the project may result in major negative impact post mitigation on bats. Without diligent monitoring and mitigation of bat fatalities and other impacts at all WEFs in and around the Beaufort West REDZ 11, their potential cumulative impact on bat habitats, populations, and ecosystem services (with proper bat fatality mitigation using turbine curtailment and other secondary mitigation measures, and diligent bat fatality monitoring and adaptive mitigation, may the cumulative impact of these WEFs on bats) may be major negative significance with a moderately-detrimental consequence. This was not seen as a project flaw given that mitigation measures are strictly enforced by the Kariega WEF cluster.

The final preferred alternatives (where applicable) are provided in Table 7-3. One change to the layout has been made from the dBAR to the fBAR which was dropping two turbines, no. 30, 31, 37, 38, 39, 44, 45 and 50 due to heritage considerations. These changes have been brought on in the fBAR maps in this section. The applicant will apply for relaxation of setback from this Eskom Gamma Grassridge 765kV powerline servitude for turbine no. 1, 2, 3, 4, 5, 6 and 11. If the relaxation is not granted turbine 1, 2, 3, 4, 5 and 11 will not be constructed (turbine 6 can be moved within the assed buffer to avoid the three times tip height safety set back). The process of granting the relaxation is on hold due to complexities with the permitting of the Eskom Gamma Grassridge 765kV powerline which received Environmental Authorisation in 2008 but has subsequently lapsed (~2023) and Eskom is currently applying for the Environmental Authorisation through a Basic Assessment process. Only once the Basic Assessment process in concluded will the relaxation application be finalised since the route might still change (even though the servitudes have been proclaimed). These changes will have no impact on the outcome or findings of the fBAR.

Cumulative impact maps (Figure 7-1, Figure 7-2, Figure 7-3, Figure 7-4, Figure 7-5, Figure 7-6 and Figure 7-7) show the main sensitivities associated with the proposed development site is provided at the end of this chapter.

Table 7-1: Summary of the impacts have been assessed as part of the Kariega fBAR.

Social (impact range post mitigation - Major positive to Minor negative)
Socio-economic impacts during the construction phase include the creation of employment and business opportunities, and opportunity for skills development and on-site training. Whilst potential negative impacts are associated with presence of construction workers on local communities, influx of jobseekers, risks to livestock and farming infrastructure theft, increase risk of grass fires associated with construction related activities. Moreover, nuisance impacts, such as noise, dust, and safety, associated with construction related activities and vehicles may also transpire. Socio-economic impacts during the operational phase include the establishment of infrastructure to improve energy security and support the renewable sector and the creation of employment opportunities. Benefits will also come to the affected landowners and socio-economic contributions to community development. On the negative side visual impacts and associated impacts on sense of place, property

values and tourism could be expected. Socio-economic impacts during the decommissioning phase include loss of permanent jobs and economic opportunities associated with decommissioning. On a socio-economic front much can be done in terms of increasing the benefits of the project to the local community given the magnitude of the proposed development and positive engagement throughout the projected phases must be actively promoted by the applicant.

Agricultural (impact range post mitigation - Moderate positive to Minor negative)

The potential impact on agriculture during construction, operation and decommissioning include occupation of land by the development infrastructure and soil erosion and degradation. On the positive side increased financial security for farming operations and improved security against stock theft and other crime due to the presence of security infrastructure and security personnel is expected. It's expected that landowners will be better off due to these developments with little adverse impacts on agriculture. Developing renewable energy projects on low potential agricultural land is seen as a positive since it means these projects are occupying higher value agricultural land in other areas.

Geotechnical (impact range post mitigation - Major positive to moderate negative)

In term of geotechnical impacts these include negative impacts associated with construction phase soil disturbance, degradation by removal, mixing, compaction, etc due to the construction of infrastructure.

Soil degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement) as well as erosion by wind and/or water of loosened soil in construction areas can be expected if not mitigated.

Further impacts to be managed in terms of geotechnical impacts include siltation of watercourses due to erosion from site and dust pollution due to wind erosion from site. On the positive side during the operational phase reduction in the in extraction of non-renewable energy sources, such as coal, uranium, etc. due to the provision of renewable energy from the project. In terms of geotechnical work, the detailed design will need to be informed by further flood line assessments to ensure stormwater is managed appropriately on site and infrastructure is design as such as not the exacerbate potential negative impacts as associated with watercourses.

Visual landscape (impact range post mitigation – Minor positive negative to major negative)

Typical negative construction phase impacts associated with the visual landscape includes wind-blown dust from loss of vegetation and moving vehicles which goes along with topsoil loss/ sterilisation. Moreover, visual impacts include intrusion by buildings (BESS, CTF, substation, site camp, batching areas), structures (turbines and roads), finishings and fencing. In steep sloped areas cut and fills may have negative impacts. At high security lights may be seen from far. During the operational phase the turbines and specifically the movement of turbines blades in the landscape may be perceived negatively. Security Light Spillage at night may must also be mitigated as not to have significant negative impacts on people in the area. Also at night, aircraft warning lights may hold a specifically negative impacts and if not mitigated. The visual specialist advocated for full AWL mitigation to be a condition of environmental authorisation. During decommissioning abandoned old structures may have a negative impact if not removed, but if this is done correctly there may be a net positive impact since the visually intrusive structures such as abandoned old tower structures and blades are removed. Furthermore, decommissioning will likely see similar potential impacts as with the construction phase such as windblown dust from moving vehicles. Importantly, the cumulative effects of intervisibility of wind farm during the day and night. Specific to visual mitigation is dealing with lights at night and AWL mitigation to be a condition of environmental authorisation and must be included in the facility design for all infrastructure components.

Shadow flicker (impact range post mitigation - minimal negative)

The shadow flicker effects generated from the rotating turbine blades during operation on adjacent receptors i.e. occupied dwellings is mitigated by the current layouts. Six labour tenant dwellings and one owner dwelling were identified within the project area but located outside the expected 1km SF impact area where the Magnitude of the Impact is likely to be Low without mitigation, and Very Low with mitigation. As SF impact assessment is new in the South Africa context, the intensity of the SF impact to rural occupants is untested and as such Operation Phase investigation is recommended to confirm the consequence. This investigation should be undertaken one year after operation phase commencement around the dates of the 21st June and the 22nd December.

Noise (impact range post mitigation - Minor negative to minimal negative)

The potential negative noise impacts during construction phase include increase in noise levels at NSR due to construction of access roads, traffic, and construction activities. During operation impacts such as operation of wind turbines near NSR could have negative impact if not mitigated. Similar to construction phase decommissioning phase impacts are associated with increase in day time noise levels at NSR due to activities near NSR.

It is recommended that the applicant re-evaluate the noise impact: 1. should the layout be revised where: a. any WTG, located within 2,500 m from any NSR are moved closer; b. the number of WTG within 2,500 m from any NSR are increased; and 2. should the applicant make use of a wind turbine with a maximum SPL exceeding 110.5 dBA re 1 pW. Active noise monitoring is also recommended because the projected noise levels are more than 42 dBA (more than 7 dBA of the night-time rating level of a rural noise district) for the layout and WTG as evaluated (noise monitoring will be required for any WTG with an SPL exceeding 107.3 dBA (re 1 pW)).

Avifauna (Birds) (impact range post mitigation - Moderate negative to minimal negative)

In terms of impact on birds potential negative construction phase impacts include destruction of habitat and disturbance of birds. The potential negative operational phase impacts include disturbance and displacement of birds as well as bird collision with turbines and electrocution on overhead lines. The main impact during decommissioning would be disturbance of birds. Importantly, cumulative impacts of disturbance, displacement and bird collision with turbines from all WEFs in the area may hold significant detrimental impacts if not mitigated. A pre-construction avifaunal walk down should be conducted to identify any sensitivities that may arise between the conclusion of the BA process and the construction phase. A post-construction inspection must be conducted by an avifaunal specialist to confirm that all aspects have been appropriately handled. One blade on each turbine must be painted from the outset, in line with the SAWEA-BLSA briefing note (Morkel et al, 2023). A bird fatality threshold and adaptive management plan should be designed for the project prior to the operational phase and a “during construction” and “post-construction” monitoring programme outlined in Appendix 7 of the specialist report (included in EMPr), should be implemented according to the latest available version of the Best Practice Guidelines at the time.

Bats (impact range post mitigation - Major negative to Minor negative)

Potential negative construction phase impacts on bats include roost disturbance or destruction, destruction, degradation, and fragmentation of and displacement from foraging habitat and consequent decline or loss of bat ecosystem services. During the operational phase impacts include destruction, degradation, and fragmentation of and displacement from foraging habitat and importantly bat fatalities from collision with turbines, and potential population declines which could result in a decline or loss of bat ecosystem services. Similar to the construction phase during decommissioning impacts on bats include destruction, degradation, and fragmentation of and displacement from foraging habitat and decline or loss of bat ecosystem services. Cumulative impact on bats from multiple WEFs in the region are a potential significant issue during each phase and must be mitigated by each WEF. The blades of one turbine in the layout still encroaches about 46m into a

high sensitivity area and this turbine will be moved at least 48m southwest to avoid this area which will be within the 200m assessment buffer of the turbine.

Monitor bat fatalities (and live bat activity) as soon as the first turbine is operational (i.e. when blades begin spinning, regardless of grid connection) - as per the latest SABAA guideline for this and applicable international guidance - during the WEF's first two years of operation, and then every fifth year thereafter is required. This may result in curtailment of certain turbines as described in the specialist report. The specialist advocated that the feasibility of the prescribed turbine curtailment should be tested prior to finalization of the project - for in case bat fatalities at some point exceed the calculated bat fatality threshold for the WEF. The impact of the prescribed curtailment on the financial feasibility of the wind farm could be explored by using the available weather data from site to obtain estimates of the number of turbine night hours per annum during which curtailment would need to be implemented and, consequently, how much turbine energy production could potentially be lost. The results should be used to ensure that there is adequate financial provision to accommodate curtailment during operation.

Terrestrial biodiversity (impact range post mitigation - Minor negative)

In terms of impacts on terrestrial biodiversity including plants and animals in general the potential negative construction phase impacts include loss of species of special concern, damage and disturbance of the habitats rated as very high sensitivity, loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. On site activities may also result in the displacement of animals because of any disturbance and/or habitat loss. Potential negative operation phase impacts include displacement of animals which mostly includes animal mortalities related to vehicle traffic. Cumulative impact of all activities within delineated areas, when combined with present day activities could result in negative impact in each project phase. The impacts on terrestrial biodiversity must be mitigated by implementation of the EMP with oversight of an experienced ESO/ECO. The implementation of a season appropriate search and rescue programme as well as 12-month post construction monitoring is also seen as pivotal in ensuring successful mitigation of impacts.

Aquatic biodiversity (impact range post mitigation - Minor negative)

Potential negative construction (and similarly decommissioning) phase impacts associated with aquatic biodiversity include the loss of high sensitivity systems, through physical disturbance, as the proposed layout is located within these areas inclusive of the associated buffers. Also of note is the potential of loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. This in turn could also lead to habitat fragmentation. Given the location of the project site the impact on watercourse through the possible increase in surface water runoff on riparian form and function through hydrological changes, with a potential increase in sedimentation and erosion is a risk. Moreover, during these large-scale projects there is also a risk of impact on the aquatic environment due to water quality impacts, i.e. pollution and sedimentation. This impact may be carried over into areas which are National Ecosystem Priority Areas (NEPAs). Potential negative operation phase impacts include impact on all watercourse through the possible increase in surface water runoff on riparian form and function through hydrological changes, with a potential increase in sedimentation and erosion. There is also a risk of water quality impacts during operation. Cumulative impacts during each phase represent a potential significant impact if WEFs in the area don't individually mitigate their impact on aquatic biodiversity and systems. Mitigation measures are similar to that of terrestrial biodiversity but includes the requirement to address any points of erosion that should be stabilised immediately using gabions and reno mattress as required during construction. Moreover, no activities should take place outside of the demarcated servitude, to prevent additional cumulative impacts on these systems and monthly monitoring for 6 months post construction and

where any unstable soils occur, these must be protected with temporary stabilisation dependent on the scale of the impact.

Cultural Heritage, including archaeology and Palaeontology (impact range post mitigation - Moderate negative to Minor negative)

Potential negative construction phase impacts on cultural Landscape Heritage Resources include the broader context of the area proposed for development that has cultural significance that may be impacted by the proposed development and cumulative impacts for renewable projects in the area. In terms of Archaeological Heritage Resources, the area proposed for development is known to conserve heritage resources of archaeological significance that may be impacted by the proposed development. Similarly, destruction of significant palaeontological heritage during construction may happen if the chance find procedures are not implemented as mitigant. Operation and decommissioning phase impacts are mostly associated with Cultural Landscape Heritage Resources in terms of the broader context of the area proposed for development. In terms of mitigation a turbine setback from the N9 and the R61 by at least 1km on either side has already been implemented. A Chance Fossil Finds Procedure must be implemented for the duration of construction activities and any evidence of archaeological sites or remains, fossils, burials or other categories of heritage resources are found during the proposed development, work will cease in the vicinity of the find and ECPHRA will be alerted immediately to determine an appropriate way forward. Importantly, based on the layout provided (April 2024), a number of the proposed turbines are located within areas of very high cultural landscape sensitivity. Turbines proposed in front of the Kunaskop disrupt the significance of this topographic feature. Additionally, turbines located on the northern slopes of the development area negatively impact on the sense of topographical containment to the north, east and west of the project area. The recommended have been removed to mitigate this negative impact (Figure 6-98). ECPHRA has requested that a study on ephemeral sites in the Camdeboo be compiled as part of the Phase 1b (before development starts) or as a Phase 2 (Phase 2a report) because no permit will be necessary. The Heritage consultant is engaging with ECPHRA on this matter and as it stands this study is a minimum requirement for development to commence, notably it has been indicated by ECPHRA and the Heritage consultant that this study will have no bearing on the feasibility of the Kariaga WEF cluster or outcome of the Impact Assessment process concluded.

Traffic (impact range post mitigation - Moderate negative to Minimal negative)

In terms of traffic impacts during the construction and decommissioning phase impacts the temporary increase in traffic, noise and dust pollution as well as potential damage to road surfaces caused by construction vehicles are considered negative impacts. Potential negative operation phase impacts include noise and dust pollution associated with traffic. Traffic mitigation measures are included in the EMPr whilst a detailed Traffic Management Plan (TMP) will need to be provided at start of construction and start of operational phase, respectively. This plan must be annexed to the EMPr and will be audited as part of the high level TMP currently included in the EMPr.



Table 7-2: Summary of the potential impacts associated with the proposed Kariaga 4 WEF.

Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Social Employment and business creation opportunities during the construction phase	Creation of employment and business opportunities, and opportunity for skills development and on-site training.	Minor (+)	Moderate (+)				
Social Impacts on family structures and social networks	Impacts on family structures and social networks associated with the presence of construction workers	Moderate (-)	Minor (-)				
Social Impact of influx of job seekers	Potential impacts on family structures, social networks and community services associated with the influx of job seekers	Minor (-)	Minor (-)				
Social Impact on safety of farmers and farm workers, livestock and damage to farm infrastructure	Risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the presence of construction workers on site	Minor (-)	Minor (-)				
Social Impact of grass fires on farming operations	Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires	Minor (-)	Minor (-)				
Social Nuisance related construction impacts	Potential noise, dust and safety impacts associated with construction related activities	Minor (-)	Minor (-)				
Social Loss of farmland	Loss of farmland due establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the project etc.	Moderate (-)	Minor (-)				
Social Improve energy security and support renewable energy	Development of infrastructure to improve energy security and support the renewable sector			Major (+)	Major (+)		
Social Employment and business opportunities	Creation of employment and business opportunities associated with the operational phase			Minor (+)	Moderate (+)		
Social Income for affected landowners	Generate additional income for affected landowners to reduce vulnerability of farming to climate change etc.			Moderate (+)	Major (+)		



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Social Socio-economic development opportunities	Socio-economic development opportunities and investment linked to revenue from renewable energy project			Moderate (+)	Major (+)		
Social Visual impact on sense of place	Visual impact on sense of place associated with renewable energy facility			Moderate (-)	Moderate (-)		
Social Impact on property values	Impact on property values associated with visual impacts			Minor (-)	Minor (-)		
Social Impact on tourism	Impact on tourism associated with visual impacts			Minor (-)	Minor (-)		
Social Cumulative impact on sense of place	Cumulative impact on sense of places associated with one or more renewable energy facilities			Moderate (-)	Moderate (-)		
Social Cumulative impact on local services and accommodation	Cumulative impact on local services and accommodation			Moderate (-)	Minor (-)		
Social Cumulative impact on local economy	Creation of socio-economic opportunities associated with establishment of numerous renewable energy facilities in the DBNLM			Moderate (+)	Major (+)		
Social Impact of decommissioning	Loss of jobs and economic opportunities associated with decommissioning					Minor (-)	Minor (-)
Agriculture Occupation of land by the development infrastructure	Agricultural land directly occupied by the development infrastructure will become restricted for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime. As discussed above, the small and widely distributed nature of the agricultural footprint of the facility means that only an insignificant proportion of the available agricultural land is impacted in this way	Minor (-)	Minor (-)	Minor (-)	Minor (-)	Minor (-)	Minor (-)
Agriculture Soil erosion and degradation	Erosion can occur because of the alteration of the land surface run-off characteristics, predominantly through the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations.	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)		
Agriculture Increased financial security for farming operations	Reliable and predictable income will be generated by the farming enterprises through the lease of the land to the energy facility. This is likely to increase their cash flow and financial security and could improve farming operations and productivity through increased investment into farming.	Moderate (+)	Moderate (+)	Moderate (+)	Moderate (+)		



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Agriculture Improved security	Improved security against stock theft and other crime due to the presence of security infrastructure and security personnel at the energy facility.			Moderate (+)	Moderate (+)		
Agriculture Cumulative agricultural impacts.	Cumulative agricultural impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present or reasonably foreseeable future activities that will affect agricultural production.	Minor (-)	Minor (-)	Minor (-)	Minor (-)	Minor (-)	Minor (-)
Geotechnical Soil degradation	Construction phase soil disturbance, degradation by removal, mixing, compaction, etc due to the construction of infrastructure.	Moderate (-)	Moderate (-)				
Geotechnical Soil degradation	Construction phase degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement).	Minor (-)	Minor (-)				
Geotechnical Soil erosion	Construction phase erosion by wind and/or water of loosened soil in construction areas.	Moderate (-)	Moderate (-)				
Geotechnical Siltation	Degradation of watercourses due to siltation (silt-loading) due to erosion from site.	Moderate (-)	Moderate (-)				
Geotechnical Dust pollution	Dust pollution due to wind erosion from site.	Minor (-)	Minor (-)				
Geotechnical Reduced demand for non-renewable energy sources	Reduction in the in extraction of non-renewable energy sources, such as coal, uranium, etc. due to the provision of renewable energy from the project			Major (+)	Major (+)		
Visual Wind-blown dust	Windblown dust and dust from moving vehicles have the potential to become a significant nuisance factor to local farms around the site and along the access roads.	Minimal (-)	Minimal (-)				
Visual Topsoil loss	Topsoil excavated from the site should be stockpiled and utilised for rehabilitation of the site after construction.	Minor (-)	Minor (-)				
Visual Buildings, structures and finishing	Buildings painted bright colours can increase the visual presence of the structures in a rural landscape, creating higher levels of visual contrast and attracting the attention of the casual observer.	Minor (-)	Minor (-)				
Visual Litter	Litter has the potential to degrade landscape character and can be contained by fencing around the construction camp/ laydown.	Minor (-)	Moderate (-)				
Visual Security Fencing	Long fencing lines has the potential to be visually dominating, degrading the rural landscape sense of place.	Moderate (-)	Minor (-)				
Visual Soil Erosion	In areas where construction has taken place on steeper slopes, soil erosion measures need to be implemented.	Minor (-)	Minimal (-)				
Visual Security Light Spillage at night	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.	Moderate (-)	Minimal (-)				



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Visual Un-necessary roads	Unnecessary roads have the potential to create a visual disturbance long after the usage as past.	Minor (-)	Minimal (-)				
Visual Construction of turbines	The construction of turbines usually requires a number of large cranes that are very visible in the regional landscape.	Moderate (-)	Moderate (-)				
Visual Laydown, Site Camp and Batching	Construction of the Preferred Alternative for the Laydown, Site Camp and Batching Plant.	Minor (-)	Minor (-)	Minor (-)	Minor (-)		
Visual BESS & Substation Infrastructure	Construction of the BESS and Substation	Minor (-)	Minor (-)	Minor (-)	Minor (-)		
Visual Soil sterilisation by compaction	Compaction of larger areas can result in soil sterilisation and landscape degradation post construction.	Minor (-)	Minimal (-)	Minor (-)	Minimal (-)		
Visual Static and moving white turbines with red or black single blade tip colour.	Change to rural karoo landscape to wind farm landscape due to the presence of large and moving/ static turbines.			Major (-)	Major (-)		
Visual Aircraft Warning Lights at Night.	AWL lights at night have the potential to significantly detract from the ‘dark-sky’ sense of place of the rural landscape.			Major (-)	Moderate (-)		
Visual Security Light Spillage at night.	Light spillage from security lighting of structures can significantly increase the visual impact of a project in a rural landscape in a dark-sky context.			Major (-)	Moderate (-)		
Visual Old turbine blade dumping	The dumping of old turbine blades on site has the potential to significantly degrade the local landscape character.			Moderate (-)	Minimal (-)		
Visual Abandoning of old structures	Old, unused structures have the potential to significantly degrade the landscape character.					Moderate (-)	Minor (+)
Visual Abandoning of old towers and blades.	Old towers have the potential to significantly degrade the landscape character.					Major (-)	Minor (+)
Visual Cumulative, intervisibility during the day	Intervisibility during the day of all the Kariega WEF projects as well as the other wind farms to the southeast.	Major (-)	Major (-)	Major (-)	Major (-)	Major (-)	Major (-)



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Visual Cumulative, AWL intervisibility during the night	Intervisibility of the AWL during the night of all the Kariega WEF projects as well as the other wind farms to the southeast.	Major (-)	Moderate (-)	Major (-)	Moderate (-)	Major (-)	Moderate (-)
Shadow Flicker Shadow Flicker	The shadow flicker effects generated from the rotating turbine blades on adjacent receptor occupied dwellings.			Minimal (-)	Minimal (-)		
Noise Increase in daytime ambient sound levels	Increase in noise levels at NSR due to construction of access roads.	Moderate (-)	Minimal (-)				
Noise Increase in daytime ambient sound levels	Increase in noise levels at NSR due to traffic.	Minor (-)	Minor (-)				
Noise Increase in daytime ambient sound levels	Increase in daytime noise levels at NSR due to construction near NSR.	Minimal (-)	Minimal (-)				
Noise Increase in night-time ambient sound levels	Increase in night-time noise levels at NSR due to construction near NSR.	Minor (-)	Minimal (-)				
Noise Increase in daytime ambient sound levels	Increase in daytime noise levels at NSR due to operation of wind turbines near NSR.			Minor (-)	Minimal (-)		
Noise Increase in night-time ambient sound levels	Increase in night-time noise levels at NSR due to operation of wind turbines near NSR.			Moderate (-)	Minor (-)		
Noise Increase in daytime ambient sound levels	Increase in daytime noise levels at NSR due to decommissioning activities near NSR.					Minimal (-)	Minimal (-)
Noise Cumulative increase in night-time ambient sound levels	Increase in night-time noise levels at NSR due to operation of wind turbines near NSR from various WEFs in the vicinity of Kariega.					Major (-)	Minor (-)
Avifauna Destruction of habitat	Bird habitat is altered or destroyed during the construction of the facility.	Moderate (-)	Moderate (-)				
Avifauna Disturbance of birds	Birds resident and/or breeding on and near site are disturbed during construction. This may impact on foraging, resting and/or breeding activities.	Moderate (-)	Minor (-)				



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Avifauna Disturbance of birds	Birds disturbed during operation of the facility. This may impact on foraging and /or breeding activities.			Minor (-)	Minor (-)		
Avifauna Displacement of birds from site	Birds are displaced from site, which has territorial and energy efficiency implications. Either having to find and secure new territories, or flying further to and from feeding and breeding sites.			Minor (-)	Minor (-)		
Avifauna Turbine collision fatality	Birds are killed through collision with turbine blades.			Major (-)	Moderate (-)		
Avifauna Collision of birds with overhead lines	Birds in flight do not see overhead powerlines and may consequently collide with overhead powerlines.			Major (-)	Minor (-)		
Avifauna Birds electrocution on overhead lines	Large birds perching on pylons bridge the critical clearances and short circuit the line thereby being electrocuted.			Major (-)	Minimal (-)		
Avifauna Disturbance of birds	Birds resident and/or breeding on and near site are disturbed during decommissioning. This may impact on foraging, resting and/or breeding activities.					Moderate (-)	Minimal (-)
Avifauna Cumulative impact on avifauna	Cumulative impact on avifauna through destruction of habitat and bird fatalities through collision with wind turbines.	Major (-)	Moderate (-)	Major (-)	Moderate (-)	Major (-)	Moderate (-)
Bats Roost disturbance or destruction	During construction of infrastructure for the WEF, potential bat roosts (roosting bats and/or roost sites) in trees, buildings, or elsewhere could be disturbed or destroyed (during possible tree felling, demolishing of old buildings, blasting) if overlooked and /or not adequately avoided.)	Moderate (-)	Minor (-)				
Bats Destruction, degradation, and fragmentation of and displacement from foraging habitat	Destruction, degradation, and fragmentation of and displacement from foraging habitat	Major (-)	Moderate (-)	Major (-)	Moderate (-)	Major (-)	Moderate (-)
Bats Bat fatalities from collision with turbines, and potential population declines.	Bat fatalities from collision with turbines, and potential population declines			Major (-)	Moderate (-)		
Bats Decline or loss of bat ecosystem services	Decline or loss of bat ecosystem services	Moderate (-)	Minimal (-)	Moderate (-)	Minimal (-)	Moderate (-)	Minimal (-)
Bats	Cumulative impact on bats from multiple WEFs in the region	Major (-)	Moderate (-)	Major (-)	Moderate (-)	Major (-)	Moderate (-)



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Cumulative impact on bats from multiple WEFs in the region							
Bats Cumulative impact of known renewable energy projects within a 100km radius	Cumulative impact of known renewable energy projects within a 100km radius	Severe (-)	Major (-)	Severe (-)	Major (-)	Severe (-)	Major (-)
Terrestrial Biodiversity Loss of species of special concern (SSC)	Potential impact on Protected Plant species, observed within the site listed on a Provincial level	Moderate (-)	Minor (-)			Moderate (-)	Minor (-)
Terrestrial Biodiversity Damage and disturbance of the habitats rated as Very High Sensitivity	Potential impact very sensitive habitats that are also associated with habitat requirements for two Endangered faunal species	Moderate (-)	Minor (-)			Moderate (-)	Minor (-)
Terrestrial Biodiversity Loss of ecosystem services, and or habitats	Loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. This in turn could also lead to habitat fragmentation	Moderate (-)	Minor (-)			Moderate (-)	Minor (-)
Terrestrial Biodiversity Displacement of any animals because of any disturbance or habitat loss.	Displacement of any animals because of any disturbance or habitat loss. This includes animal mortalities related to construction vehicle traffic.	Major (-)	Minor (-)			Major (-)	Minor (-)
Terrestrial Biodiversity Displacement of any animals because of any disturbance or habitat loss	Displacement of any animals because of any disturbance or habitat loss. This includes animal mortalities related to construction vehicle traffic			Major (-)	Minor (-)		
Terrestrial Biodiversity Cumulative impacts on terrestrial biodiversity	All of the projects have indicated that their intention with regard to mitigation, i.e. selecting the best possible sites to minimise the local and regional impacts. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such clearing high sensitivity areas and or impacting sensitive species.	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)
Aquatic Biodiversity Damage and disturbance of the habitats rated as High Sensitivity associated with aquatic / alluvial features.	Damage and disturbance of the habitats rated as High Sensitivity associated with aquatic / alluvial features– Direct Impact Potential impact very sensitive habitats that are also associated with habitat requirements for two Endangered faunal species (Riverine Rabbit & Bullfrog)	Moderate (-)	Minor (-)			Moderate (-)	Minor (-)



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Aquatic Biodiversity Loss of ecosystem services, and or habitats that would result in habitat fragmentation.	Loss of ecosystem services, and or habitats that would result in habitat fragmentation, especially those included in any Biodiversity Conservation plans as Critical Biodiversity areas or Ecological Support Areas. This in turn could also lead to habitat fragmentation. The potential impact on ecosystem services still exists, due to clearing of vegetation, however all CBAs have been avoided. For this purpose, the footprints have avoided high ecological value areas, while keeping the overall footprint condensed	Moderate (-)	Minor (-)			Moderate (-)	Minor (-)
Aquatic Biodiversity Impact on all watercourse through the possible increase in surface water runoff	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 the aquatic systems, which are currently ephemeral, i.e. aquatic vegetation species composition changes, which then results in habitat change / loss.	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)
Aquatic Biodiversity Impact on localised surface water quality.	During both preconstruction, construction and, to a limited degree, the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities, as well as maintenance activities, could be washed downslope via the watercourses.	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)
Aquatic Biodiversity Impacts on FEPA quinary catchment and Ecological Support Areas.	A small portion of the site falls within a FEPA quinary catchment and Ecological Support Areas. Although the development would potentially have negative impacts on the riparian environment through disturbance and changes to water quality downstream of the site as a result of erosion, pollution and other forms of disturbance and associated degradation of the freshwater ecosystems of the site, these negative impacts can be well-mitigated.	Moderate (-)	Minor (-)			Moderate (-)	Minor (-)
Aquatic Biodiversity Cumulative impacts on aquatic biodiversity.	All of the projects have indicated that their intention with regard to mitigation, i.e. selecting the best possible sites to minimise the local and regional impacts or improving the drainage or hydrological conditions within these rivers, and therefore the cumulative impact could be seen as a net benefit. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects such as stormwater management, and that flows within these systems are sporadic.	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)	Moderate (-)	Minor (-)
Heritage Negative Impacts to the Cultural Landscape	The broader context of the area proposed for development has cultural significance that may be impacted by the proposed development.	High (-)	High (-)	High (-)	High (-)	High (-)	High (-)
Heritage Destruction of significant archaeological heritage	The area proposed for development is known to conserve heritage resources of archaeological significance that may be impacted by the proposed development.	High (-)	Moderate (-)				



Impact title	Impact description	Construction		Operation		Decommissioning	
		Significance pre- and post-mitigation					
		pre	post	pre	post	pre	post
Heritage Destruction of significant palaeontological heritage	The area proposed for development is known to conserve heritage resources of palaeontological significance that may be impacted by the proposed development.	Minor (-)	Minor (-)				
Traffic Construction and Decommissioning phase traffic impacts	Temporary increase in traffic, noise and dust pollution associated potential traffic Potential damage to road surfaces caused by construction vehicles.	Moderate (-)	Minor (-)			Moderate (-)	Minor (-)
Traffic Traffic Impact due to maintenance and staff trips	Traffic Impact due to maintenance and staff trips for the length of operation.			Minimal (-)	Minimal (-)		
Traffic Cumulative construction and decommissioning phase traffic impacts	Additional Traffic Impact due to all authorized renewable energy projects being developed at the same time.	Major (-)	Moderate (-)			Major (-)	Moderate (-)

Table 7-3: Technical details for Kariega 4 WEF.

Component	Description
Turbines	- Up to 42 turbines - Up to 420 MW total generation capacity - Up to 10MW each - Hub height (HH) up to 150m (tower) - Rotor diameter (RD) up to 200m (consists of rotor and three blades) - Includes nacelle and generator This is the maximum specification for assessment purposes and depends on technology available at the time of construction.
	- Turbine foundations - Up to 30 m in diameter - Up to ~3 m deep



	▪ Construction (disturbance) footprint of approximately 32 m x 32 m= 1024m². ▪ Total turbine footprint ~4,3ha (1024m²x42 turbines)
Access roads & Site roads	○ Crane Hardstands (permanent) ▪ Up to 150m X 100m= 15000m² ▪ Total crane hardstand footprint ~63ha (42 turbines) ○ Temporary laydown/ assembly areas (temporary, construction phase) ▪ Up to 150m X 15m ▪ Total Temporary laydown/ assembly areas footprint ~9,45ha (2250m²x42 turbines) The exact position and orientation of the hardstands and laydowns will be determined during the detailed design / micro siting of infrastructure. ○ Five Potential access points are proposed: ▪ K4 Access 1, 32°30'57.74"S; 23°36'33.12"E (Directly from R61) ▪ K4 Access 2, 32°30'23.39"S; 23°39'58.74"E (Directly from R61) ▪ K4 Access 3 (main), 32°29'0.33"S; 23°41'53.55"E (via R61 over Farm RE/4/92) ▪ K4 Access 4, 32°23'19.89"S; 23°44'8.61"E (via R61, Aberdeen/Murraysburg road and over Farm 1/72, Farm 1/95, Farm 5/72) ▪ K4 Access 5, 32°17'57.50"S; 23°36'36.33"E (via R61, Aberdeen/Murraysburg road and over Farm RE/140 and Farm RE/139) One or all access points may be utilised, given the extent of the site. ○ Access roads and internal site roads ▪ Road width of 15-20m wide • 12m road surface width, 1m for side drains either side, 6m one side of the road surface for MV cable trenches and associated disturbance (topsoil, subsoil and vehicle movement). • Existing roads ±66km • Total ±126 km (31km shared with Kariaga 2 and 49km shared with Kariaga 3) • Total road footprint ~252ha (126km x 20m width) ▪ Post construction roads will be rehabilitated down to 5-10m width • 8m wide road surface, 1m side drain either side



	• Total road footprint ~126ha (126km x 10m width) ○ All roads will have a gravel wearing course (imported from offsite borrow pits) ○ Where possible, existing tracks will be followed. ○ All roads associated with the WEF will remain indefinitely and be available for use by landowner post construction. ○ Turning areas ▪ Required to allow heavy and abnormal vehicles to turn safely. ▪ Strategic points on site and at end of roads ▪ To be identified during detailed design / micro siting
Substation and O&M Complex	○ On-site Substation and O&M Building (preferred alternative) ▪ Up to ~1 ha ▪ Up to 132kV ▪ Includes site office, workshop, parking, storeroom and ablution facilities ○ Substation – Eskom (preferred alternative) ▪ Up to ~1 ha
Battery Energy Storage System	Battery Energy Storage System (BESS) Areas ○ Up to ~5ha (Adjacent O&M Complex) ○ Lithium-Ion Battery ▪ Export Capacity of up to 250MW ▪ Storage Capacity 1000MWh ▪ Storage duration 4hrs
MV Collector cables	Medium Voltage (MV) cables ○ up to 33kV ○ From each turbine to the on-site substation and BESS ○ Underground parallel to the roads within the road reserve (no additional footprint, no overhead MV)



Construction Laydown area & Site Camp	○ Laydown area (preferred alternative) ▪ ~1ha per phase ○ Site camp (preferred alternative) ▪ ~1ha per phase The site camp and adjacent laydown area will include temporary site offices, stores, workshops, turbine storage areas, fuel storage, worker mess and ablution facilities etc. These areas will be rehabilitated after construction. <u>Two alternative locations</u> assessed.
Batching plant and stockpile area	○ Concrete batch plant (temporary, construction phase) (<u>Alternative 2 batching site, is the preferred alternative</u>) ▪ 0,5ha per phase ▪ include cement silos, stockpile areas, parking and turning areas, quality test area, and the batch plant itself. ▪ Batching areas situated adjacent laydown area
Water and Electricity (Construction)	○ Construction period (18-24 months) water requirement. ▪ 5 to 30 kℓ per day ▪ used for road construction; hardstand compaction; concrete foundations; cleaning equipment and dust suppression. ○ Operational phase (approximately 25 years) water requirement. ▪ About 8kℓ per month for 11 months of the year. ▪ Approximately 3780kℓ (30kℓ/km of road, 126 km) for 1 month of the year for annual road maintenance (grading and compacting of the roads). ▪ Water header tanks will be used to provide potable water. ▪ Potable water will be sourced from the property, or from the municipality or neighbouring farmers Trucked to site as required during the construction and operational phases. ○ Sanitation on site during the construction and operational phases ▪ Portable toilets and conservancy/septic tanks. ▪ Wastewater to be collected at regular intervals. ▪ Transported to Municipal Wastewater Treatment Works; or ▪ Treated on site and with treated water used for dust suppression and roadworks.



	Electricity for construction could be obtained from temporary diesel generators and possibly small scale mobile photovoltaic units.

7.1.1 No-go alternative

The no-go alternative implies that the *status quo* of the site would be maintained, i.e. none of the negative or positive impacts and outcomes of the proposed WEF would be realised. In context of the specific development there are already several RE facilities authorised in the area and thus many impacts associated with landscape scale changes will likely happen in any case. Moreover, the opportunity cost of the development in a REDZ will be lost since the area has a proven wind resource. Given this final Basic Assessment indicates that the negatives associated with the proposed WEF are acceptable in comparison to the positives, relinquishing this opportunity will in fact be negative and thus the no-go will have a negative long-term impact.

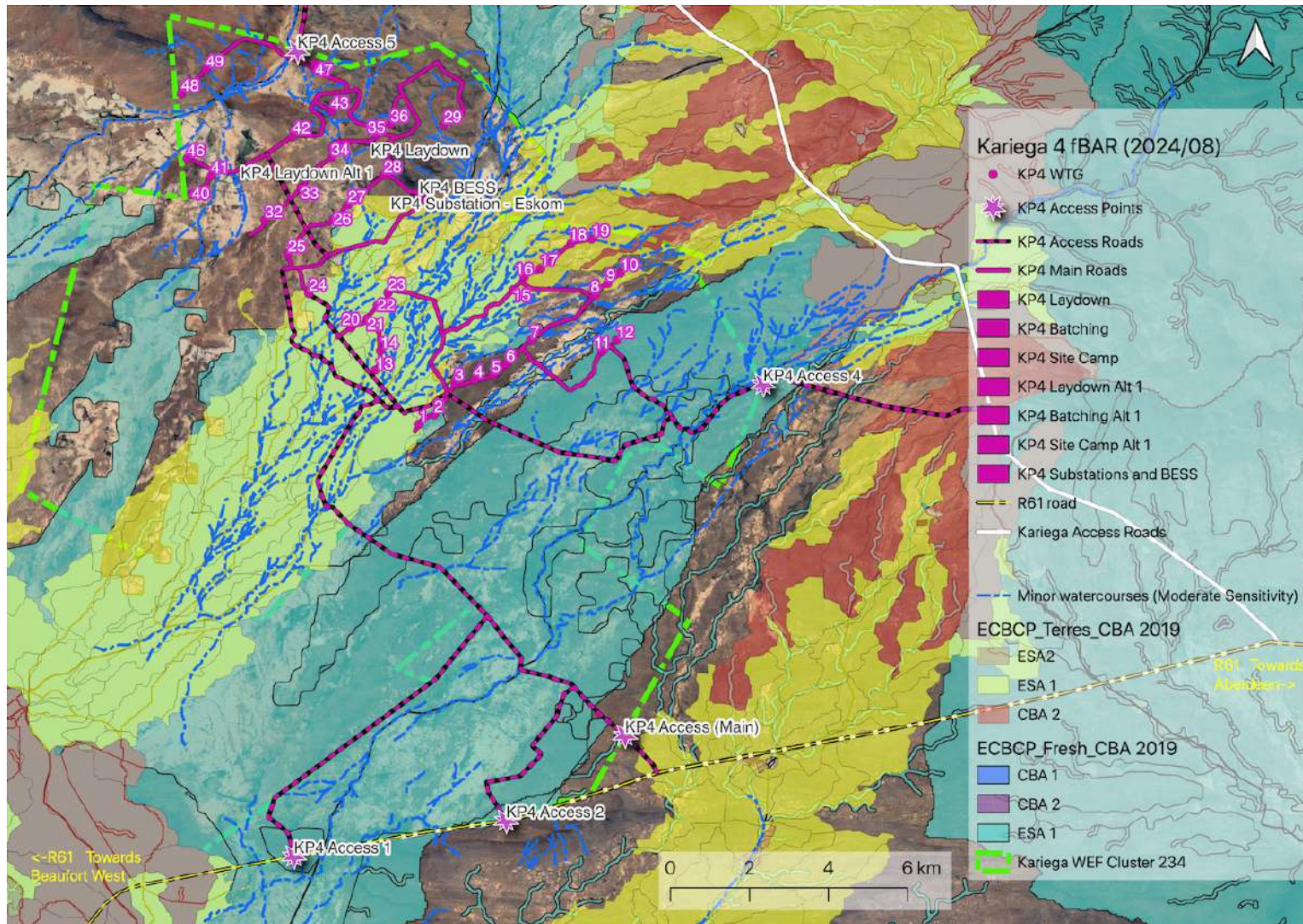


Figure 7-1: Combined sensitivity map terrestrial and aquatic biodiversity planning features.

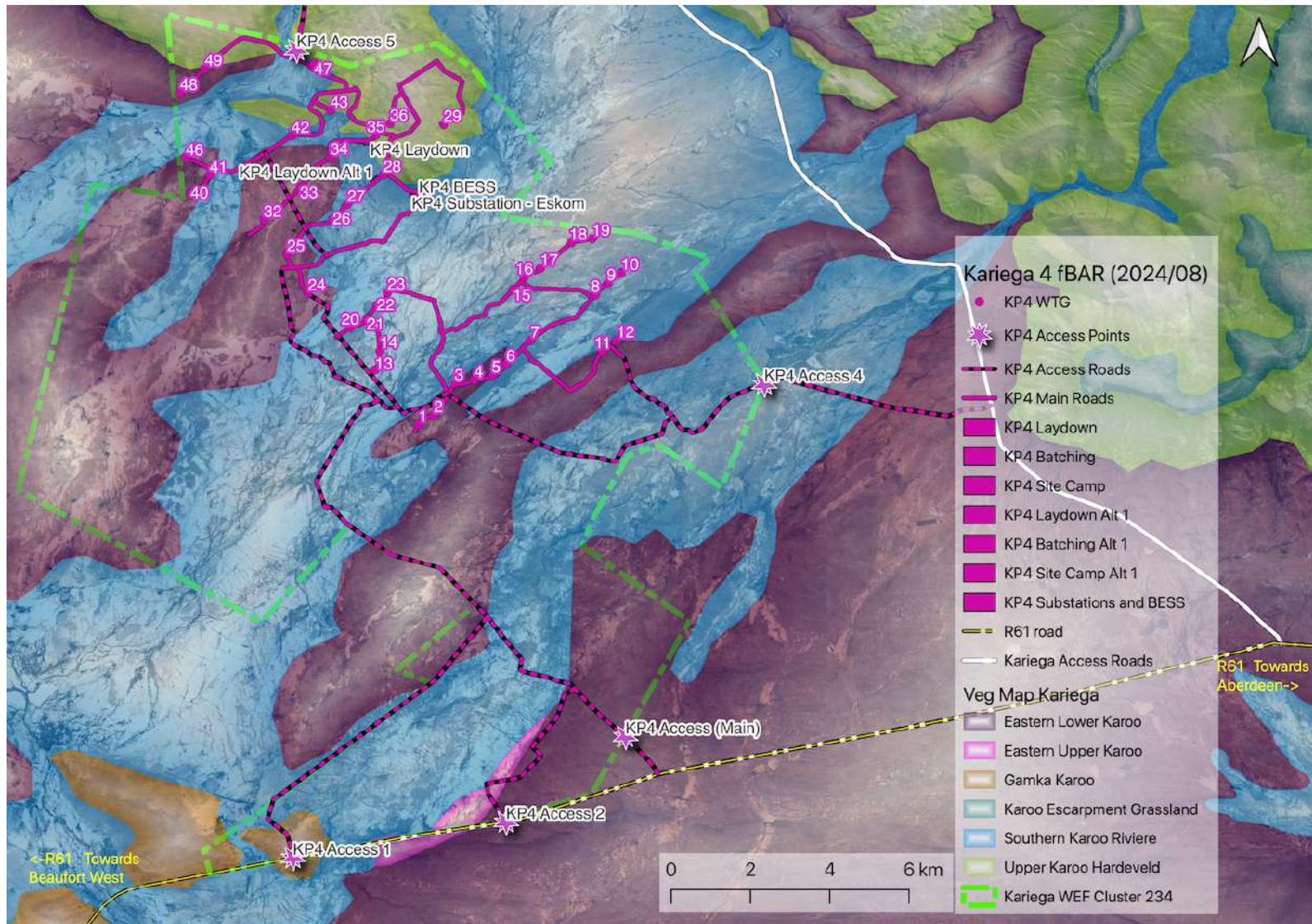


Figure 7-2: Combined sensitivity map vegetation types.

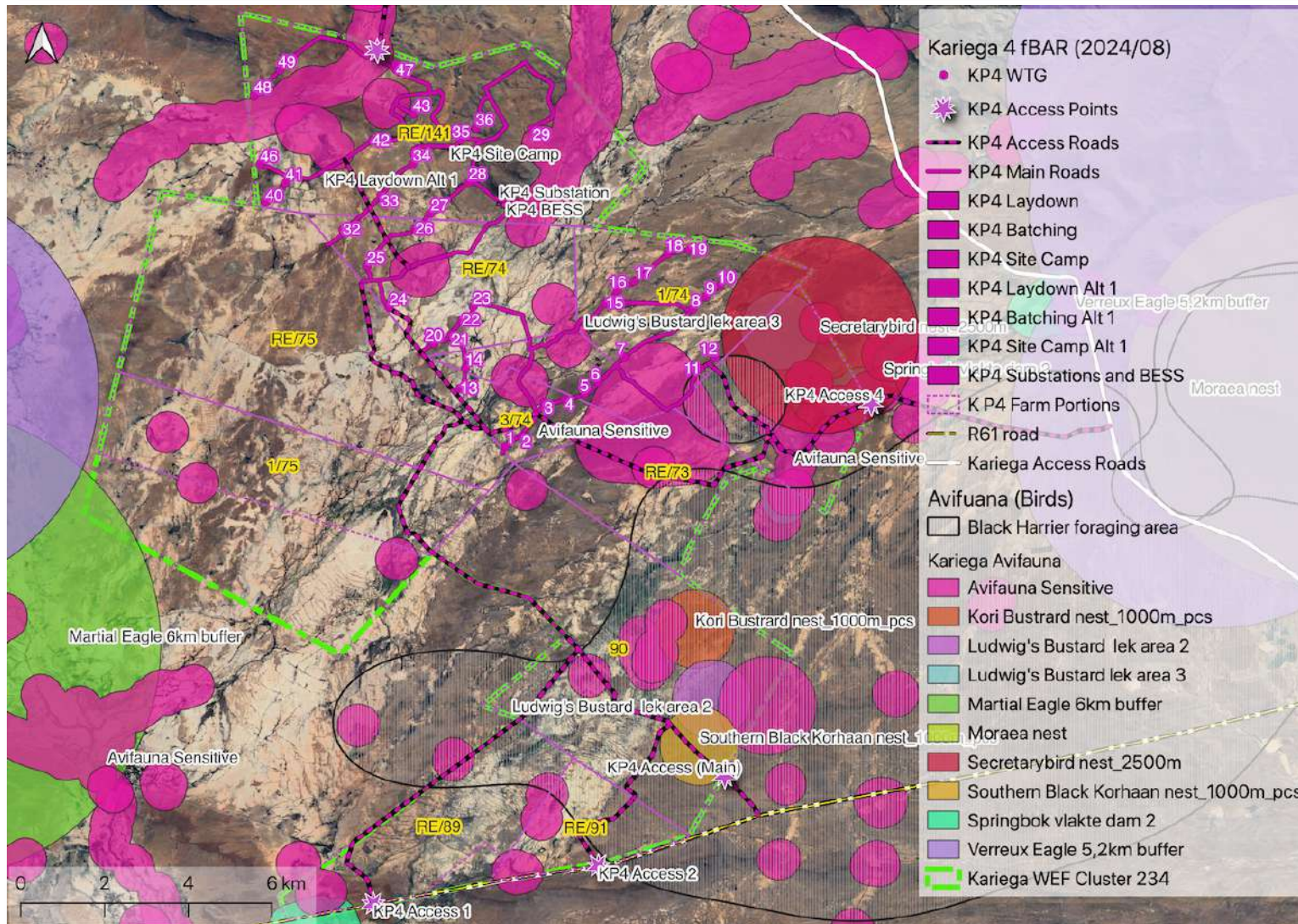


Figure 7-3: Combined sensitivity map birds (avifauna).

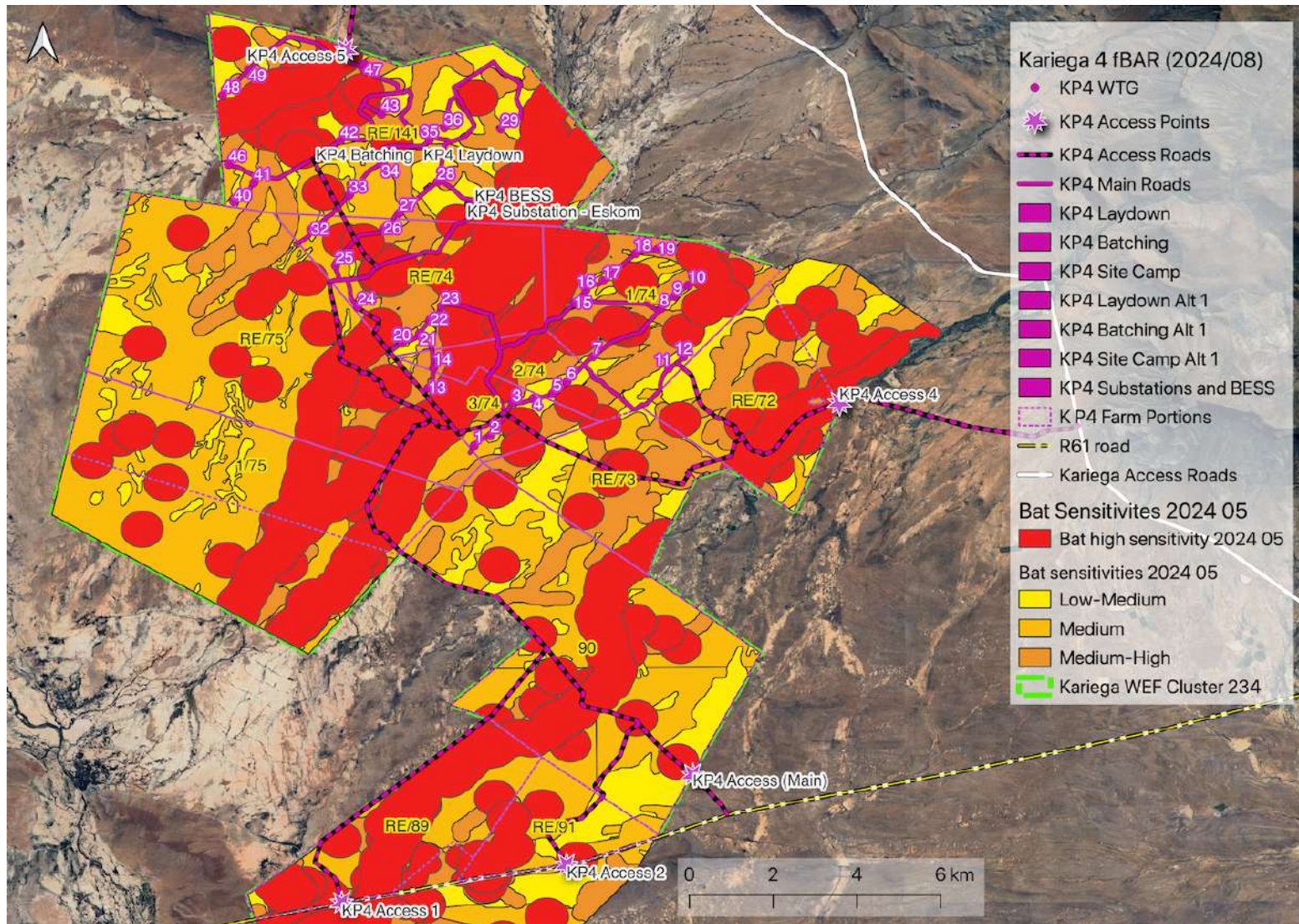


Figure 7-4: Combined sensitivity map bats.

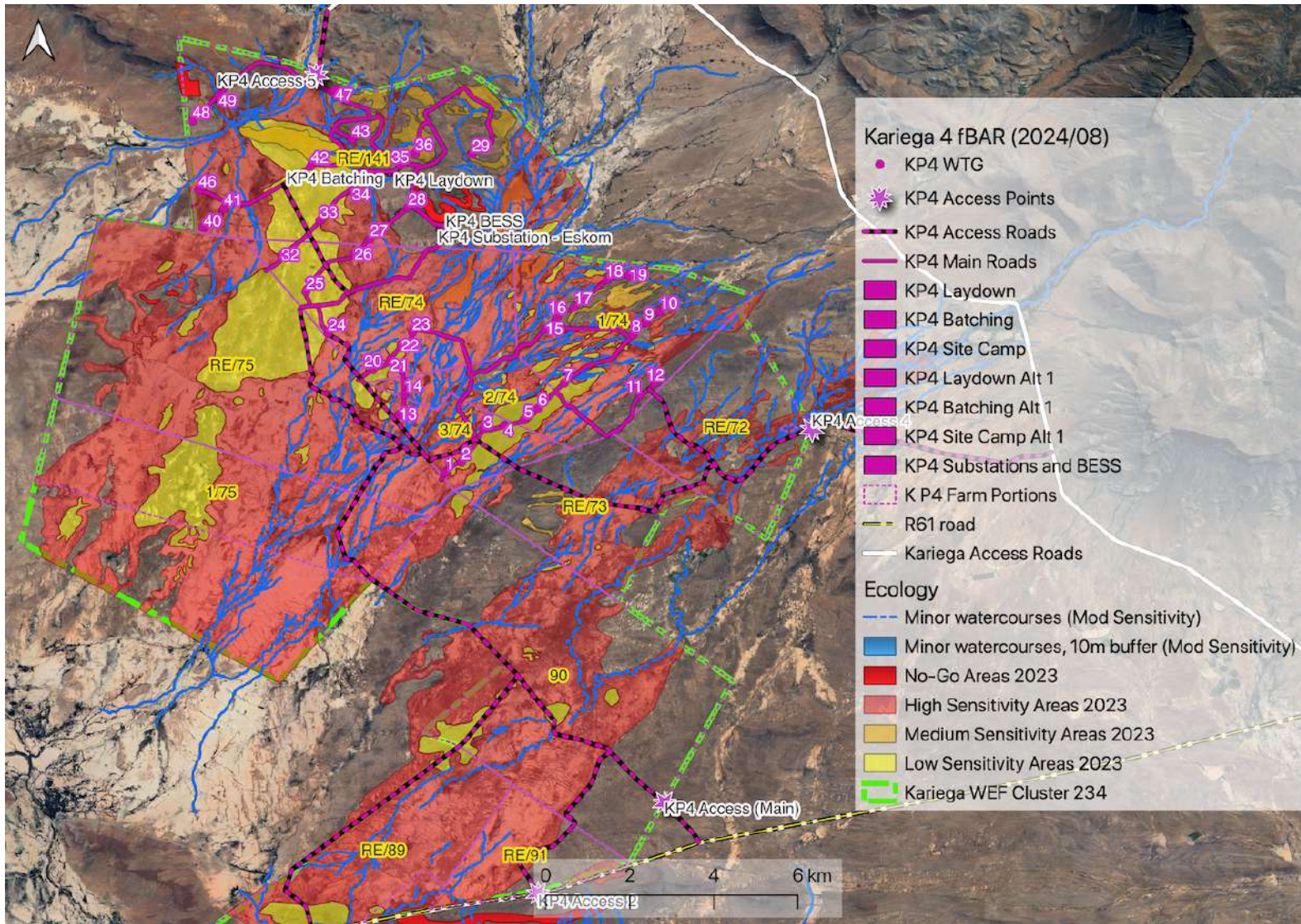


Figure 7-5: Combined sensitivity map terrestrial and aquatic ecology.

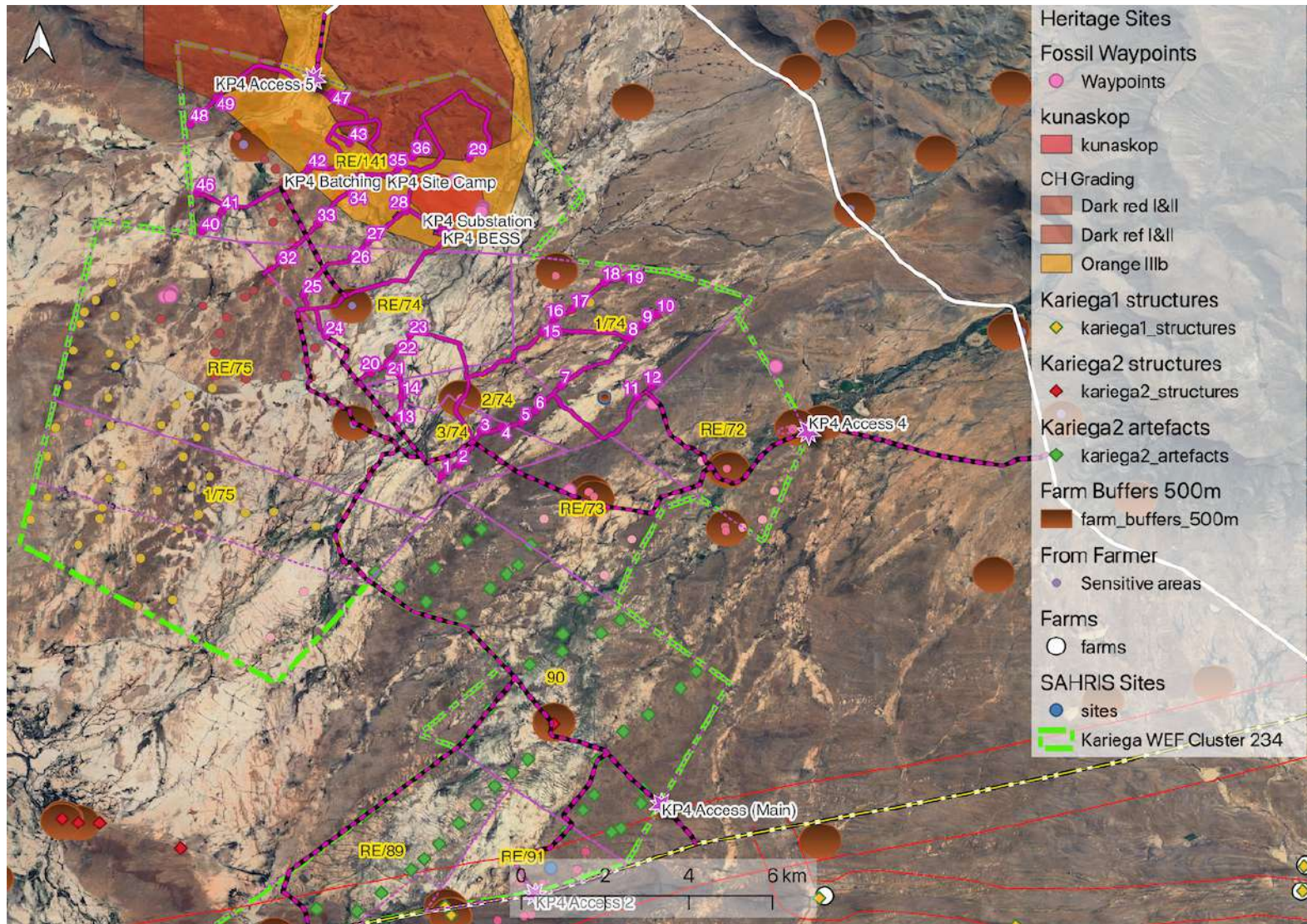


Figure 7-6: Combined sensitivity map for heritage including archaeology, palaeontology and cultural landscape.

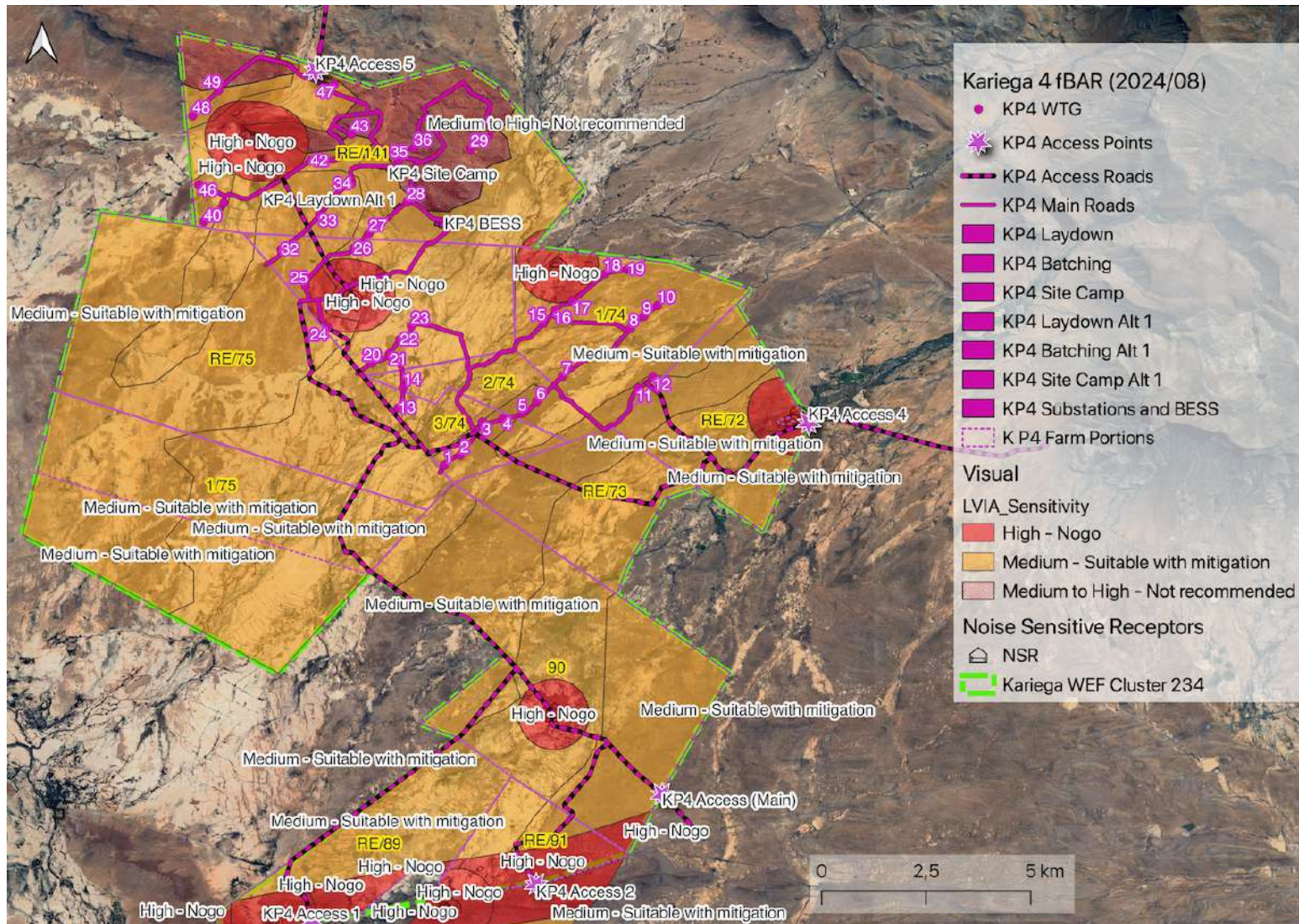


Figure 7-7: Combined sensitivity map visual and noise.

8 CONCLUSIONS AND WAY FORWARD

The draft BAR was updated following the 31-day public comment period. All comments received on the draft BAR was collated, responded to, and included in the Public Participation Report (**Annexure C, PPP**). The final BAR was updated to address the received comments and include changes where required. This final BAR will be submitted to the DFFE for review and decision-making (for 57 days) whereby an Environmental Authorisation would be granted or refused. All registered I&APs will be notified of the outcome. As per the requirements of NEMA, this BA has reviewed the array of potential environmental impacts associated with the proposed substation. The Environmental Authorisation period required is 10 years given that the project may be bid as part of a REIPPP bid window and the potential phased nature of construction in terms of the Kariega WEF cluster which include Kariega 2 and 3 WEFs.

Based on the information presented within this fBAR and associated annexures, including the assessment of project specific and cumulative impacts, it is recommended that the proposed WEF be granted a positive Environmental Authorisation. The WEF site has gone through numerous assessments and refinements therefore the confidence in this assessment and the outcome thereof is high. Moreover, the level of residual impact directly related to the activity assessed is acceptable post mitigation. We also request that the layout in terms of the allocated buffers and EMPr be approved as final, provided the Environmental Authorisation is granted. The final detailed design layout map will be provided to DFFE prior to construction with the notification of commencement of construction and appointment of the ECO.

9 REFERENCES AND RESOURCES

- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998.
- Agricultural Resources Act, 1983 (Act No. 43 of 1983).
- Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J & de Villiers, M.S. (Eds). 2014. Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland. Suricata 1. South African Biodiversity Institute, Pretoria.
- BGIS (Biodiversity GIS). (2022). <http://bgis.sanbi.org/>
- BODATSA-POSA. 2021. Plants of South Africa - an online checklist. POSA ver. 3.0. <http://newposa.sanbi.org/>. (Accessed: April 2021).
- Boycott, R. and Bourquin, R. 2000. The Southern African Tortoise Book – A Guide to Southern African Tortoises, Terrapins and Turtles. Revised Edition. Hilton. 228 pages.
- Branch, W.R. 1998. Field Guide to Snakes and Other Reptiles of Southern Africa. Struik, Cape Town.
- Chief Directorate National Geo-Spatial Information, varying dates. 1:50 000 Topographical Maps and Data.
- Crop Estimates Consortium, 2019. Field Crop Boundary data layer, 2019. Pretoria. Department of Agriculture, Forestry and Fisheries.
- DEA&DP, 2011. Provincial Government of the Western Cape. Guideline on Generic Terms of Reference for EAPS and Project Schedules.
- Department of Agriculture Forestry and Fisheries (DAFF), 2018. Long-term grazing capacity map for South Africa developed in line with the provisions of Regulation 10 of the Conservation of Agricultural Resources Act, Act no 43 of 1983 (CARA), available on Cape Farm Mapper. Available at: <https://gis.elsenburg.com/apps/cfm/>
- Department of Agriculture, Forestry and Fisheries, 2017. National land capability evaluation raster data layer, 2017. Pretoria.
- Department of Energy. 2010. Integrated Resource Plan. Department of Energy, Pretoria, South Africa.
- Department of Energy. 2015. State of Renewable Energy in South Africa. Department of Energy, Pretoria, South Africa
- Department of Environmental Affairs. 2015. EIA Guideline for Renewable Energy Projects, Department of Environmental
- 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. Updated with amendments in 2007.
- DFFE, 2018. National Land-cover Database 2018 (NLC2018).
- DFFE, 2021. South African Protected Areas Database (SAPAD_OR_2021_Q1).
- DFFE, 2021. South African Renewable Energy EIA Application Database (REEA_OR_2021_Q1).
- Du Preez, L. & Carruthers, V. (2009) A Complete Guide to the Frogs of Southern Africa. Struik Nature, Cape Town.
- Endangered Wildlife Trust. 2014. Central incident register for powerline incidents. Unpublished data.
- EWT. 2016. Mammal Red List 2016. www.ewt.org.za
- Fish, L., Mashau, A.C., Moeah, M.J. & Nembudani, M.T. (2015). Identification Guide to Southern African Grasses: An Identification Manual with Keys, Descriptions, and Distributions. SANBI, Pretoria.
- Germishuizen, G. and Meyer, N.L. (eds) (2003). Plants of southern Africa: an annotated checklist. Strelitzia 14, South African National Biodiversity Institute, Pretoria.
- Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol 1 & 2. BirdLife South Africa, Johannesburg.
- IUCN. 2016. The IUCN Red List of Threatened Species.. Online. www.iucnredlist.org [Accessed on 8 October 2022].
- 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.
- Macfarlane, D.M. & 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.
- Meteoblue. 2024. Climate Aberdeen (Eastern Cape, South Africa , Eastern Cape, South Africa, 32.48°S 24.07°E, 750masl). (Online). https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/Aberdeen_south-africa_972549 [Accessed 16 February 2024].
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended.
- Mucina, L and Rutherford, M.C (eds). 2010. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- National Botanical Institute (NBI), 2004. Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)
- National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended.
- National Water Act, 1998 (Act No. 36 of 1998), as amended
- Nel JL, Murray KM, Mahery AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.
- Oberholzer, B. 2005. Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs and Development.
- Ollis DJ, Snaddon CD, Job NM, 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 Biodiversity Institute, Pretoria.
- Pool-Stanvliet, R., Duffell-Canham, A., Pence, G. & Smart, R. 2017. The Western Cape Biodiversity Spatial Plan Handbook. Stellenbosch: CapeNature.
- Raimonde, D. 2009. Red list of South African Plants. SANBI, Pretoria.
- SADAP (South Africa Protected Areas Database) and SACAD (South Africa Conservation Areas Database) (2021). <http://egis.environment.gov.za>
- SANBI-BGIS. 2017. Technical guidelines for CBA Maps: Guidelines for developing a map of Critical Biodiversity Areas & Ecological Support Areas using systematic biodiversity planning.
- Schulze, R.E. 2009. SA Atlas of Climatology and Agrohydrology, available on Cape Farm Mapper. Available at: <https://gis.elsenburg.com/apps/cfm/>
- South African National Biodiversity Institute. 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.
- The Environmental Impact Assessment Amendment Regulations. In Government Gazette Nr. 33306, 18 June 2010.
- Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P.-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Terera, F. and Van der Colff D. 2019. South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. <http://hdl.handle.net/20.500.12143/6230>.



-
- Van Rooyen, C.S. & Ledger, J.A. 1999. Birds and utility structures: Developments in southern Africa. Pp 205-230, in Ferrer, M. & G.F.M. Janns. (eds.). Birds and Powerlines. Quercus, Madrid (Spain). Pp 238.
- World Atlas. 2016. The most dependent countries on fossil fuels. Available: <http://www.worldatlas.com/articles/countries-the-most-dependent-on-fossil-fuels.html> [Accessed 12 April 2022].



10 ANNEXURES

Annexure A, Details of the EAP (CV)

Stand-alone document

Annexure A1, Details of EAP-Dirk Pretorius CV

Annexure A2, Undertaking under oath or affirmation by the EAP



Annexure B, Correspondence with DFFE

Stand-alone document

Annexure B1, Correspondence with DFFE

Annexure B2, Pre-application meeting form & DFFE response

Annexure B3, DFFE comment dBAR 14-12-16-3-3-1-3019



Annexure C, Public Participation
Stand-alone document

Annexure C, PPP

Annexure C 1, PPP Report incl. I&AP

Annexure C 2, CRR



Annexure D, Specialist reports

Stand-alone documents

Annexure D 1, Social Impact Assessment (2024)

Annexure D 2, Agricultural Compliance Statement (2024)

Annexure D 3, Geotechnical Assessment (2024)

Annexure D 4, Visual Impact Assessment (2024)

Annexure D 5, Flicker Impact Assessment (2024)

Annexure D 6, Noise Impact Assessment (2024)

Annexure D 7, Avifauna (Birds) Impact Assessment (2024)

Annexure D 8, Bats Impact Assessment (2024)

Annexure D 9, Terrestrial biodiversity Impact Assessment (2024)

Annexure D 10, Aquatic biodiversity Impact Assessment (2024)

Annexure D 11, Heritage Impact Assessment, including Archaeology, Palaeontology and Cultural Landscape (2024)

Annexure D 12, Traffic Impact Assessment (2024)



Annexure E, Screening Tool Reports

Stand-alone documents (Substation and site verification)

Annexure E1, DFFE Screening Tool Report

Annexure E2, DFFE Screening tool site verification



Annexure F, Project coordinates



[Annexure G, EMPr](#)
Stand-alone document

Annexure G1, EMPr Kariega 4 WEF

Annexure G2, EMPr Substation and BESS



Annexure H, Site photographs
Stand-alone document



Annexure I, Cumulative Projects within 30km

Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed Kariega 4 WEF.

Capture from DFFE data as per REEA 2023 Q3 indicated below.

DFFE Reference no.	Regulation	EIA Process	Project title	App. date	Applicant
12/12/20/2015	2010	Scoping and EIA	Proposed Poortjie Wes Wind Energy Project, Beaufort West, Western Cape Province	2010/08/01	Terra Wind Energy Poortjie Wes (Pty) Ltd
12/12/20/2211	2010	Scoping and EIA	Aberdeen 200MW wind farm west of Aberdeen, Eastern Cape	2011/03/01	Faria Holdings Pty Ltd
14/12/16/3/3/1/552	2010	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortjie Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2014/10/27	BioTherm Energy (Pty) Ltd
14/12/16/3/3/1/552/AM1	2010	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortjie Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2014/10/27	BioTherm Energy (Pty) Ltd
14/12/16/3/3/1/552/AM2	2014	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortjie Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2015/07/30	BioTherm Energy (Pty) Ltd
14/12/16/3/3/1/552/AM3	2014	Amendment	Aberdeen Pv/Cpv Solar Energy Facility (Up To 20mw) On Portion 1 Of The Farm Wildebeest Poortjie Near Aberdeen, Camdeboo Municipality, Eastern Cape Province.	2016/03/29	BioTherm Energy (Pty) Ltd
14/12/16/3/3/2/756	2010	Scoping and EIA	Camdeboo Wind Energy Facility near Aberdeen Eastern Cape Province	2014/11/07	Aberdeen Wind Farm (Pty) Ltd
12/12/20/2535	2010	Scoping and EIA	Mainstream Aberdeen wind energy facility, Eastern Cape Province	2011/10/20	South African Mainstream Renewable Power Developments (Pty) Ltd
14/12/16/3/3/1/2722	2014	Basic Assessment	Aberdeen 1 Wind Farm	2023	Aberdeen Wind Facility 1 (Pty) Ltd
14/12/16/3/3/1/2723	2014	Basic Assessment	Aberdeen 2 Wind Farm	2023	Aberdeen Wind Facility 2 (Pty) Ltd
14/12/16/3/3/1/2724	2014	Basic Assessment	Aberdeen 3 Wind Farm	2023	Aberdeen Wind Facility 3 (Pty) Ltd



14/12/16/3/3/1/2851	2014	Basic Assessment	FE Kudu Wind Farm	2023	FE Kudu (Pty) Ltd ³²
14/12/16/3/3/1/2835	2014	Basic Assessment	FE Tango Wind Farm	2023	FE Tango (Pty) Ltd

³² The Kudu and Tango WEFs have received their EAs early in 2024 and must be added to cumulative impacts. However, they are not currently listed on the REEA 2023 Q3 database.



Annexure J, Other authorisations, Permits and confirmations

Annexure J1, SAHRA Comment

Pending



Annexure J2, Water Services Approval, Water Service Act and Water Supply By-Law



Annexure J3, CAA
SAWEA Blade Patterning Exemption (Jan 2024)



Annexure J5, Land Claims Clearance



Annexure K1, WEFs in South Africa



Annexure L, Kariaga 4 Map Book