SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE KLIPKRAAL WIND ENERGY FACILITY 3, NEAR FRASERBURG, NORTHERN CAPE PROVINCE, SOUTH AFRICA

Avifaunal Specialist Assessment Report

DFFE Reference: TBA
Report Prepared by: Chris van Rooyen Consulting
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SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE KLIPKRAAL WIND ENERGY FACILITY 3, NEAR FRASERBURG, NORTHERN CAPE PROVINCE, SOUTH AFRICA

AVIFAUNAL SPECIALIST ASSESSMENT

EXECUTIVE SUMMARY

1. INTRODUCTION

It is estimated that a total of 127 bird species could potentially occur in the broader area of the proposed Klipkraal Wind Energy Facility 3. Of these, 16 species are classified as priority species for wind developments.

2. CONCLUSION AND SUMMARY

2.1 Summary of Findings

2.1.1 Wind Energy Facility

The proposed Klipkraal WEF 3 will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities during the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collision mortality caused by the wind turbines in the operational phase.
- Electrocution on the 33kV MV overhead lines (if any) in the operational phase.
- Collisions with the 33kV MV overhead lines (if any) in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

2.1.1.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase.

It is inevitable that a measure of displacement will take place for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species the most, as this could temporarily disrupt their reproductive cycle. Species which fall in this category are Ludwig's Bustard, Jackal Buzzard, Karoo Korhaan, Double-banded Courser, Grey-winged

Francolin, Pale Chanting Goshawk, African Rock Pipit, and Spotted Eagle-Owl. Some raptors might also be affected, e.g., Pale Chanting Goshawk which could potentially breed in the small *Vachellia* trees in the drainage lines. Some species might be able to recolonise the area after the completion of the construction phase, but for some species this might only be partially the case, resulting in lower densities than before once the WEF is operational, due to the disturbance factor of the operational turbines. The impact is rated as **medium** but could be mitigated to **low** levels.

2.1.1.2 Displacement due to habitat transformation in the construction phase.

The network of roads is likely to result in significant habitat fragmentation, and it could impact on the density of several species, particularly larger terrestrial species such as Ludwig's Bustard, Karoo Korhaan, and raptors like Martial Eagle. However, given the expected density of the proposed turbine layout and associated road infra-structure, it is not expected that any priority species will be permanently displaced from the development site. The building infrastructure and substations will all be situated in the same habitat, i.e., Karoo scrub. The habitat is not particularly sensitive, as far as avifauna is concerned, therefore the impact of the habitat transformation will be low given the extent of available habitat and the size of the physical project footprint. The impact is rated as **low** both pre- and post-mitigation.

2.1.1.3 Collision mortality caused by the wind turbines in the operational phase.

The proposed Klipkraal WEF 3 will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species i.e., Karoo Korhaan and Ludwig's Bustard, although generally they seem to not be as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Of all the priority species likely to occur regularly at the project site, soaring species, i.e., raptors such as Martial Eagle, Pale Chanting Goshawk, Lanner Falcon, Booted Eagle, and Greater Kestrel are the most at risk of collision. Verreaux's Eagle might also be at risk to some extent, although the species is unlikely to venture regularly within the PAOI. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

2.1.1.4 Electrocution on the 33kV MV overhead lines (if any) in the operational phase.

While the intention is to place the 33kV reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the poles could potentially pose an electrocution risk to raptors, including Red Data species such as Martial Eagle. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

2.1.1.5 Collisions with the 33kV MV overhead lines (if any) in the operational phase.

While the intention is to place the 33kV reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the line could potentially pose a collision risk to various species, particularly large terrestrial species including Red Data species such as Ludwig's Bustard, Karoo Korhaan, and various waterbirds when the dams are full, and the drainage lines contain water. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

2.1.1.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The impact is likely to be similar in nature to the construction phase.

Table 1 summarises the expected impacts of the proposed WEF and proposed mitigation measures per impact.

Table 1: Overall Impact Significance for the WEF (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre -Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry.	Low
Construction: Displacement due to habitat transformation	Low	(1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. (2) Construction of new roads should only be considered if existing roads cannot be upgraded. (3) The recommendations of the biodiversity specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	Low
Operational: Collisions with the turbines	Medium	(1) No turbines should be located in the buffer zones around major drainage lines, waterpoints and dams. (2) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015) to assess collision rates. (3) If at any time estimated collision rates indicate unacceptable mortality levels of priority species, i.e., if it exceeds the mortality threshold determined by the avifaunal specialist after consultation with other avifaunal specialists and BirdLife South Africa, additional measures will have to be implemented which could include shut down on demand or other proven measures. (4) It is recommended that all turbines must have 1/3 of one blade painted in signal red as a pre-cautionary measure. It is acknowledged that blade painting as a	Low

Nature of impact and Phase	Overall Impact Significance (Pre -Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
		mitigation strategy is still in an experimental phase in South Africa, but research indicates that it has a very good chance of reducing raptor mortality, based on research conducted in Norway. If this is done as part of the blade manufacturing process, the costs will be negligible.	
Operational: Electrocutions on the 33kV MV network	Medium	(1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015).	Low
Operational: Collisions with the 33kV MV network	Medium	Bird flight diverters must be installed on all the overhead line sections for the full span length according to the latest Eskom standard.	Low
Decommissioning: Displacement due to disturbance	Medium	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry.	Low

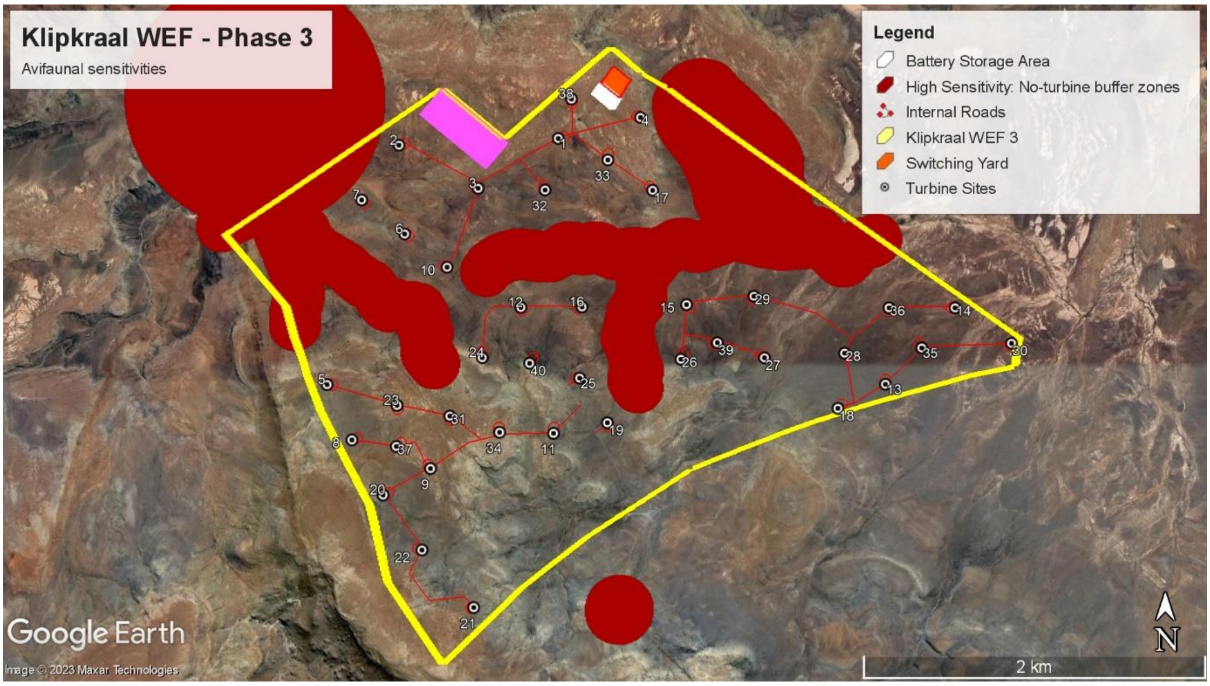
3.2 The identification of environmental sensitivities: Wind Energy facility

The following environmental sensitivities were identified from an avifaunal perspective for the proposed wind energy facility:

3.2.1 High sensitivity No-turbine buffer: Surface water.

Included in this category are areas within 200m of pans and earth dams, and 150m from all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon, Black Stork, Blue Crane and Verreaux's Eagle, and many non-priority species, including several waterbirds. Drainage lines when flowing attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Wind turbines that are placed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds.

See **Error! Reference source not found.**(i) for a map indicating the No-turbine buffers.



Figure(i): Proposed no-turbine zones.

3.3 Conclusion and Impact Statement

3.3.1 Wind Energy Facility

The proposed Klipkraal WEF 3 will have a moderate impact on avifauna which, in most instances, and could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report and the EMPr are strictly implemented.

4. FINAL LAYOUT

The final Klipkraal WEF 3 layout, including the location of the on-site switching yard, the BESS, the site offices and buildings, the internal roads, and the turbines, has been determined. The Klipkraal WEF 3 project site is approximately 799ha in extent. The final layout and design alternative was considered and assessed as part of the EIA. Mitigation measures to reduce impacts on avifauna are set out in the Environmental Management Programme (EMPr) (**Appendix 8**).

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 10
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Appendix 7
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7
g) an identification of any areas to be avoided, including buffers;	Section 7
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 7
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 9
k) any mitigation measures for inclusion in the EMPr;	To be included in EIA Report

l) any conditions for inclusion in the environmental authorisation;	To be included in EIA Report
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	To be included in EIA Report
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	All sections

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Glossary of Terms

Definitions	
Broader Area	A consolidated data set for a total of 12 pentads where the application sites are located.
Wind Priority Species	Priority species for wind development were identified from the most recent (November 2014) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al.* 2012).

List of Abbreviations

BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
DFFE	Department of Forestry, Fisheries, and the Environment
EGI	Electricity Grid Infrastructure
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
HV	High voltage
IBA	Important Bird Area
IKA	Index of Kilometric Abundance
IUCN	International Union for Conservation of Nature
kV	Kilovolt
MV	Medium voltage
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
OHL	Overhead line
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
SABAP 1	South African Bird Atlas 1
SABAP 2	South African Bird Atlas 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute

SAPAD	South Africa Protected Areas Database
WEF	Wind Energy Facility

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED KLIPKRAAL WIND FARM 1, 2 AND 3, NEAR FRASERBURG AND BEAUFORT WEST IN THE NORTHERN AND WESTERN CAPE PROVINCES: AVIFAUNAL ASSESSMENT

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447, Pretoria, 0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House, 473 Steve Biko Road, Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 2	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003			
Physical address:	6 Pladda Drive, Plettenberg Bay			
Postal address:	PO Box 2676, Fourways, 2122			
Postal code:	2055		Cell:	0824549570
Telephone:	0824549570		Fax:	
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Christiaan Stephanus van Rooyen, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Name of Company: Afrimage Photography t/a Chris van Rooyen Consulting

20 January 2023

Date

Details of Specialist, Declaration and Undertaking Under Oath

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3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Christiaan Stephanus van Rooyen, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting

Name of Company

20 January 2023

Date

NS NGCANGA

Constable

Signature of the Commissioner of Oaths

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
2023 -01- 20
PLETTENBERGBAAI
SOUTH AFRICAN POLICE SERVICE

2023-01-20

Date

Details of Specialist, Declaration and Undertaking Under Oath

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PROPOSED CONSTRUCTION OF THE KLIPKRAAL WIND ENERGY FACILITY 3, NEAR FRASERBURG, NORTHERN CAPE PROVINCE, SOUTH AFRICA

1. INTRODUCTION

Aura Development Company (Pty) Ltd (hereafter referred to as 'Aura'), has appointed SiVEST Environmental (hereafter referred to as 'SiVEST') to undertake the required EIA processes for the proposed construction of five (5) wind farms and their associated infrastructure [including substations and Battery Energy Storage Systems (BESS)] on several properties, the majority being adjacent to one another, near the town of Fraserburg in the Northern Cape Province of South Africa. The proposed wind farms make up a larger wind energy facility (WEF) (with associated BESS) which will be referred to as the Klipkraal WEF. It should be noted that the proposed wind farm projects form part of separate EIA applications. This report pertains to Klipkraal WEF 3.

Grid connection infrastructure for the respective wind farm projects will be subject to a separate Basic Assessment (BA) Process, as contemplated in terms of regulation 19 and 20 of the 2014 EIA Regulations (as amended), which is being undertaken in parallel to the separate EIA processes for each respective wind farm project. It should be noted that one (1) BA process will ultimately be undertaken for the proposed Grid Connection Infrastructure project encompassing all five (5) WEF's.

The overall objective of the proposed wind farm projects is to generate electricity by means of renewable energy technologies, capturing wind energy to feed into the national grid, which will be procured under either the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), other government run procurement programmes, any other program it intends to supply power to or for sale to private entities, if required. To further ensure efficient power delivery, the facility will also incorporate the use of storage technologies like batteries (i.e., BESS).

Klipkraal Wind Energy Facility 3 will consist of up to 40 turbines with a maximum energy export capacity of approximately 240MW.

In terms of the Environmental Impact Assessment (EIA) Regulations, which were published on 04 December 2014 [GNR 982, 983, 984 and 985) and amended on 07 April 2017 [promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017], various aspects of the proposed development are considered listed activities under GNR 327 and GNR 324 which may have an impact on the environment and therefore require authorisation from the National Competent Authority (CA), namely the Department of Environment, Forestry and Fisheries (DEFF), prior to the commencement of such activities.

Specialist studies have been commissioned to assess and verify the project under the new Gazetted specialist protocols.

1.1 Terms of Reference

The terms of reference for this avifaunal specialist report are the following:

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts;
- Assess and evaluate the potential impacts;
- Give a considered opinion whether the project is fatally flawed from an avifaunal perspective; and
- If not fatally flawed, recommend mitigation measures to reduce the expected impacts.

For the general Terms of Reference for all specialist report, please see **Appendix 1.**

1.2 Specialist Credentials

Please see **Appendix 2** for Specialist CVs

1.3 Assessment Methodology

The following methods and sources were used to compile this report:

- The project area of impact (PAOI) of the proposed WEF was defined as the proposed Project site which has an extent of approximately 799 hectares.
- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town (https://sabap2.birdmap.africa/), as a means to ascertain which species occur within the broader area i.e. within a block consisting of 12 pentads (Table 1). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 29 full protocol lists (i.e. surveys lasting a minimum of two hours each) have been completed for this area. In addition, 39 ad hoc protocol lists (i.e. surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2021.3) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2018 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).

- Satellite imagery (Google Earth ©2022) was used to view the broader area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind development were identified from the most recent (November 2014) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al.* 2012).
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed site relative to National Protected Areas.
- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the project area of impact (PAOI).
- The primary source of information on avifaunal diversity, abundance, and flight patterns at the site were the results of a pre-construction programme conducted over four seasons at the five proposed Klipkraal WEF application sites. The primary methods of data capturing were walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see **Appendix 3** for a detailed explanation of the monitoring methods).

Table 1: The number of SABAP2 lists completed for the broader area

Pentad	Number of full protocol lists	Ad hoc protocol lists
3155_2140	0	6
3155_2145	1	3
3155_2150	2	1
3200_2140	5	6
3200_2145	3	2
3200_2150	0	1
3205_2140	0	5
3205_2145	6	2
3205_2150	2	2
3210_2140	0	1
3210_2145	2	6
3210_2150	8	4
Total	29	39

2. ASSUMPTIONS AND LIMITATIONS

This study made the basic assumption that the sources of information used are reliable and accurate. The following must be noted:

- The SABAP2 dataset for the broader area is a relatively comprehensive but not complete dataset and provides a reasonable snapshot of the avifauna which could occur at the proposed site. For purposes of completeness, the list of species that could be encountered was therefore supplemented with personal observations, general knowledge of the area, and the first round of results of the pre-construction monitoring.
- Conclusions in this study are based on experience of these and similar species at wind farm developments in different parts of South Africa. However, bird behaviour can never be predicted with absolute certainty.

- To date, only one peer-reviewed scientific paper has been published on the impacts wind farms have on birds in South Africa (Perold *et al*. 2020). The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation."
- According to the specifications received from the applicant, the 33kV medium-voltage lines will be buried next to the roads where practically feasible. It was therefore assumed that there could be 33kV overhead lines which could pose an electrocution risk to priority species.

3. TECHNICAL DESCRIPTION

3.1 Project Location

The proposed Klipkraal WEF 3 and associated grid connection infrastructure Site is located approximately 35.5 km south-east of Fraserburg in the Karoo Hoogland Local Municipality, in the Namakwa District Municipality, Northern Cape Province (**Error! Reference source not found. and 2**).

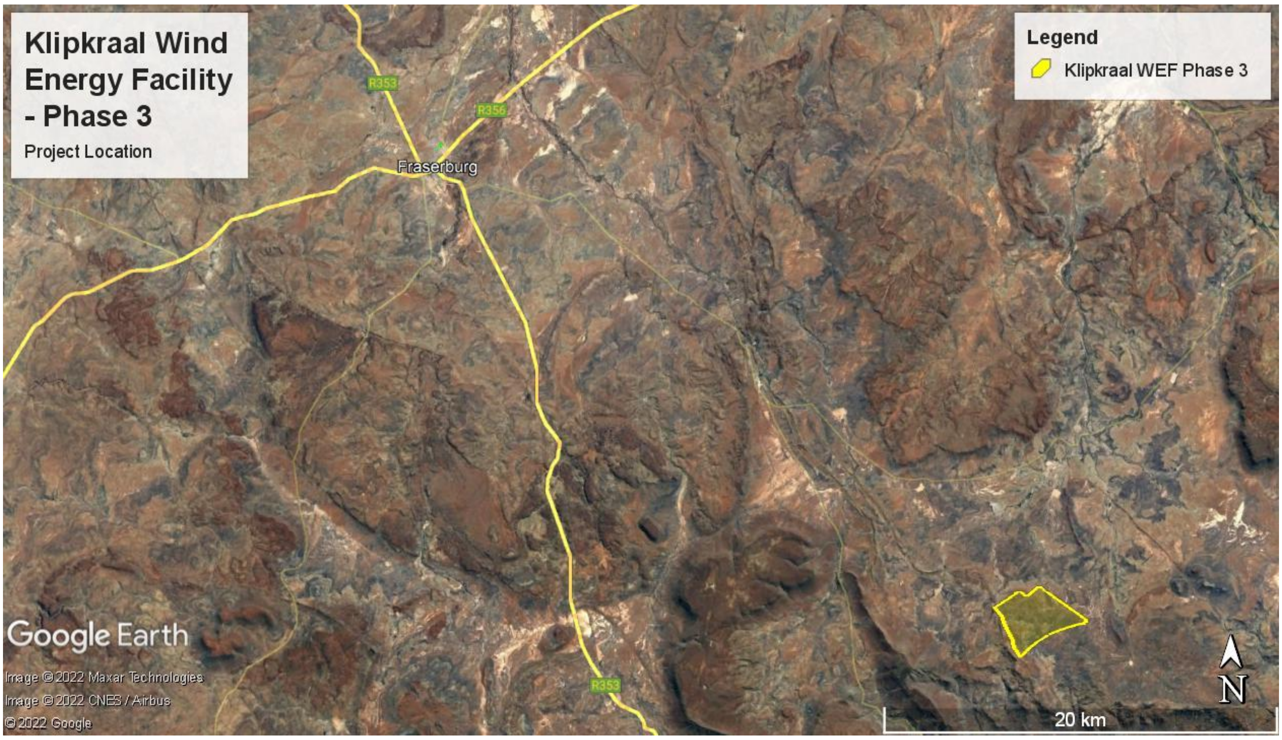

Figure 1: Regional Context Map – Location of Klipkraal WEF 3.

3.1.1 WEF

Phases 1 to 3 of the Klipkraal WEF application site incorporates the following farm portions:

Remainder of the Farm Matjesfontein No. 409 (RE/409) - C02600000000040900000
Remainder of the Farm Klipfontein No. 447 (RE/44) - C02600000000044700000
Portion 1 of the Farm Klipfontein No. 447 (1/447) - C02600000000044700001

The final Klipkraal WEF 3 layout, including the location of the on-site switching yard, the BESS, the site offices and buildings, the internal roads, and the turbines, has been determined. The Klipkraal WEF 3 project site is approximately 799ha in extent (**Figure 2**). The final layout and design alternative was considered and assessed as part of the EIA.

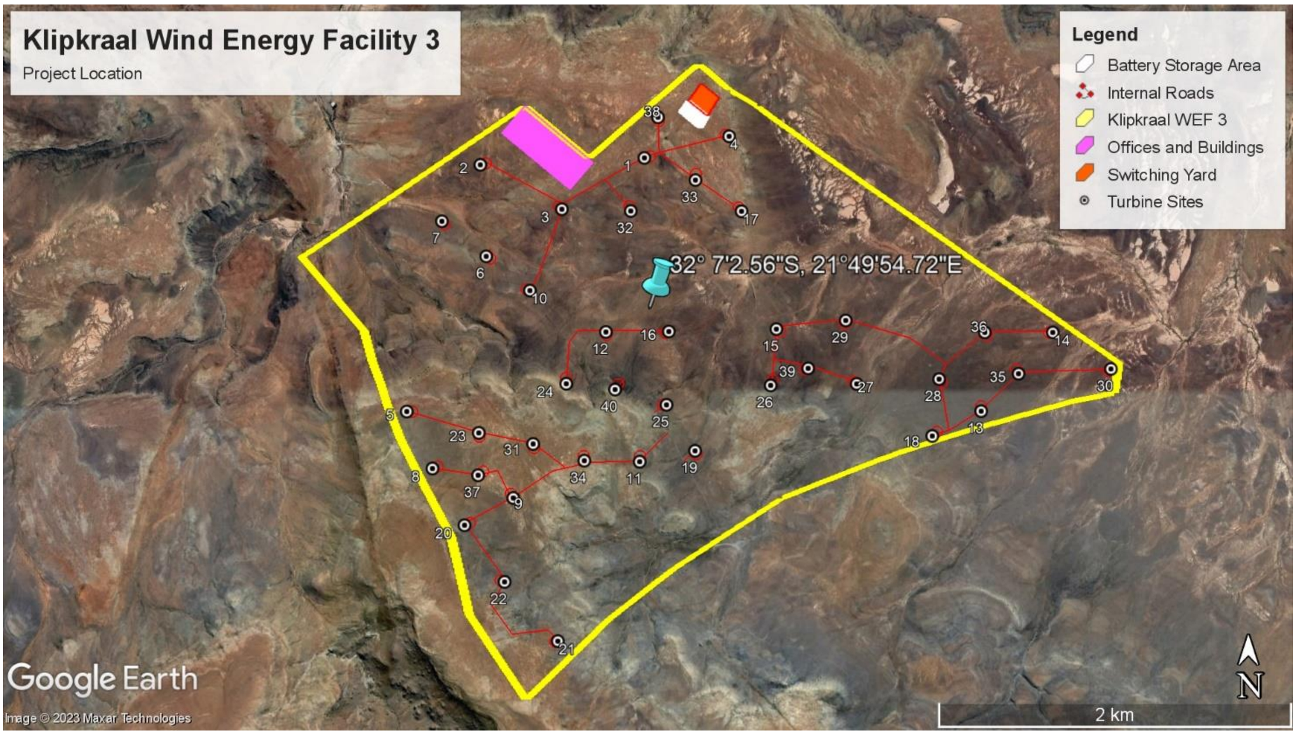

Figure 2: Klipkraal WEF 3 Site Locality.

3.2 Project Description

The application site assessed during the EIA phase (which incorporates the farm portions / properties listed above) is approximately 799 ha in extent.

It is anticipated that the proposed Klipkraal WEF 3 will comprise up to forty (40) wind turbines with a maximum total energy generation capacity of up to approximately 240 MW. In summary, the proposed Klipkraal 3 WEF development will include the following components:

Wind Turbines:

- Approximately 40 turbines, between 5MW and 8MW, with a maximum export capacity of up to approximately 240MW. This will be subject to allowable limits in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or any other program.
- The final number of turbines and layout of the wind farm will, however, be dependent on the outcome of the Specialist Studies in the EIA phase of the project;
- Each wind turbine will have a maximum hub height of up to approximately 140m;
- Each wind turbine will have a maximum rotor diameter of up to approximately 130m;
- Permanent compacted hardstanding areas / platforms (also known as crane pads) of approximately 90m x 50m (total footprint of approx. 4500m^2) per wind turbine during construction and for on-going maintenance purposes for the lifetime of the proposed wind farm projects. This will however depend on the physical size of the wind turbine;
- Each wind turbine will consist of a foundation (i.e. foundation rings) which may vary in depth, from approximately 3m and up to 5m or greater, depending on the physical size of each wind turbine. It should be noted that the foundation can be up to as much as approximately 600m^3;

Electrical Transformers:

- Electrical transformers will be constructed near the foot of each respective wind turbine in order to step up the voltage to 33kV.
- The typical footprint of the electrical transformers is up to approximately 10m x 10m, but can be up to 20m x 20m at certain locations;

Step-up / Collector Substations:

- New 33/132kV step-up / collector substations, each occupying an area of up to approximately 1.5ha, for each wind farm being proposed [i.e. one (1) substation per phase].
- The proposed substation will include an Eskom portion and an Independent Power Producer (IPP) portion, hence the substation has been included in this EIA and in the grid connection infrastructure BA (separate application - substations, switching stations and power lines) to allow for handover to Eskom.
- Following construction, the substation will be owned and managed by Eskom. The current applicant will retain control of the medium voltage components (i.e. 33kV components) of the substation, while the high voltage components (i.e. 400kV components) of the substation will likely be ceded to Eskom shortly after the completion of construction;

Main Transmission Substations (MTS):

- Two (2) new 132/400kV Main Transmission Substations (MTS) are being proposed, occupying an area of up to approximately 16ha each
- The proposed MTS will include an Eskom portion and an IPP portion. However, a separate substation has also been included in each respective wind farm EIA and in the grid connection infrastructure BA to allow for handover to Eskom.
- Following construction, the substations will be owned and managed by Eskom. The current applicant will retain control of the 132kV and lower voltage components of each MTS, while the 132/400kV voltage components of each MTS will likely be ceded to Eskom shortly after the completion of construction;

Electrical Infrastructure:

- The wind turbines will be connected to the proposed substation via medium voltage (i.e. 33kV) cables.
- These cables will be buried along access roads wherever technically feasible, however, the cables can also be overhead (if required);

Battery Energy Storage Systems (BESS):

- A Battery Energy Storage System (BESS) will be constructed for each respective wind farm [i.e. one (1) BESS per phase] and will be located next to the 33/132kV step-up / collector substations which form part of the respective wind farms, or in between the wind turbines
- It is anticipated that the type of technology will be either Lithium Ion or Sodium-Sulphur.
- It is also anticipated at this stage that the batteries to be used in the BESS will already be assembled prior to delivery and come as 'plug and play' modular units
- These batteries are not considered hazardous goods as they will be storing 'energy'.
- The size, storage capacity and type of technology will be determined / confirmed during the EIA processes, including the applicant's preferred technology type.

Roads:

- Internal roads with a width of up to approximately 5m will provide access to each wind turbine.
- Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Existing site roads may also be upgraded using temporary concrete stones in order to accommodate for the heavy loads.
- Turns will have a radius of up to 50m for abnormal loads (especially turbine blades) to access the various wind turbine positions.

Site Access:

- The proposed wind farm application site will be accessed via existing gravel roads from the R353 Regional Route;

Temporary Staging Areas:

- A temporary staging area will be required for the wind farm and will be located both at the foot of each wind turbine and at the storage facility (i.e. turbine development area) to allow for working requirements.
- One (1) temporary staging area per wind turbine / range of wind turbines will be required.
- Temporary staging areas will cover an area of up to approximately 100m x 100m (10 000m2 / 1ha) each;

Temporary Construction Camps:

- One (1) temporary construction camp will be required during the construction phase for the wind farm.
- This area will be used as a permanent maintenance area during the operational phase.
- The combined Temporary Construction Camp / Permanent Maintenance Area will cover an area of up to approximately 2.25ha.
- A cement batching plant as well as a chemical storage area will fall within the Temporary Construction Camp and Permanent Maintenance Area.
- The Temporary Construction Camp and Permanent Maintenance Area will be strategically placed within the proposed wind farm site and will avoid all high sensitivity and/or 'no-go' areas;

Offices, Accommodation, a Visitors' Centre and Operation & Maintenance (O&M) Buildings:

- An office (including ablution facilities), accommodation (including ablution facilities), a Visitors' Centre and an Operation & Maintenance (O&M) building will be required and will occupy areas of up to approximately 100m x 100m (i.e. 1ha).
- Each wind farm (i.e. each phase) will have its own O&M building and Office, however, the Accommodation and Visitors' Centre will be centralised locations which will be shared between certain wind farm projects (i.e. shared between certain phases which will be confirmed at a later stage);

Septic Tank and Soak-Away Systems:

- The proposed wind farm will consist of a septic tank and soak-away system.
- This will be required for construction as well as long term use.
- The septic tank and soak-away system will be placed 100m or more from water resource (which includes boreholes);

Wind Measuring Lattice Masts:

- Two (2) wind measuring lattice masts (approximately 120m in height) have already been strategically placed within the wind farm application sites in order to collect data on wind conditions.
- Two (2) additional wind measuring lattice masts may be installed within the wind farm application sites. This will be confirmed at a later stage, prior to the respective application forms being submitted.

Fencing:

- Fencing will be required and will surround the wind farm.
- The maximum height of the fencing as well as the area which the fencing will cover will be confirmed during the detailed design phase, prior to construction commencing.
- Fences will however be constructed according to specifications recommended by the Ecologist and Avifauna specialist (as per the EMPr);

Temporary Infrastructure to Obtain Water from Available Local Sources:

- Temporary infrastructure to obtain water from available local sources will be required
- New or existing boreholes, including a potential temporary above ground pipeline (approximately 50cm in diameter) for each wind farm, to feed water to the sites are being proposed.
- Water will potentially be stored in temporary water storage tanks.

Temporary Containers:

- Temporary containers of up to approximately $80m^3$ will be required for the storage of fuel on-site during the construction phase of the wind farm.
- The chemical storage area will fall within the Temporary Construction Camp and permanent Maintenance Area.

3.3 Layout alternatives

3.3.1 Wind Energy Facility

No other activity or site alternatives are being considered. Renewable Energy development in South Africa is highly desirable from a social, environmental and development point of view and a wind energy facility is considered suitable for this site due to the high wind resource in this area.

The choice of technology selected for the Klipkraal 3 WEF is based on environmental constraints and technical and economic considerations. No other technology alternatives are being considered as wind energy facilities are more suitable for the site than other forms of renewable energy due to the high wind resource.

The size of the wind turbines will depend on the development area and the total generation capacity that can be produced as a result. The choice of turbine to be used will ultimately be determined by technological and economic factors at a later stage.

The final design and layout alternative was assessed as part of the EIA. These include alternatives for the Substation locations and for the construction / laydown areas.

3.3.2 No-go Alternative

The ‘no-go’ alternative is the option of not undertaking the proposed WEF and / or grid connection infrastructure projects. Hence, if the ‘no-go’ option is implemented, there would be no development. This alternative would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

4. LEGAL REQUIREMENT AND GUIDELINES

Error! Reference source not found. below lists agreements and conventions which South Africa is party to, and which is directly relevant to the conservation of avifauna (BirdLife International 2020).

Table 2: Agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations	Regional

Convention name	Description	Geographic scope
	Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

4.1 National legislation

4.1.1 Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

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

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

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

4.1.2 The National Environmental Management Act (Act No. 107 of 1998) (NEMA)

The National Environmental Management Act (Act No. 107 of 1998) (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out several guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020) is applicable in all cases except for wind developments. In the case of wind energy developments, the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species where the output is 20MW or more (Government Gazette No 43110, 20 March 2020) is applicable[1].

[1] This is only the case with developments in Renewable Energy Development Zones (REDZ).

4.1.3 *The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)*

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

4.2 Provincial legislation

4.2.1 *Northern Cape Nature Conservation Act No 9 of 2009*

The current legislation applicable to the conservation of fauna and flora in the Northern Cape is the Northern Cape Nature Conservation Act No 9 of 2009. It provides for the sustainable utilisation of wild animals, aquatic biota and plants; the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; describes offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; provides for the issuing of permits and other authorisations; and provides for matters connected therewith.

4.3 Best Practice Guidelines

The South African “Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy projects in southern Africa” (Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2011) are followed for this study. This document was published by the Endangered Wildlife Trust (EWT) and Birdlife South Africa (BLSA) in March 2011, and subsequently revised in 2011, 2012 and 2015.

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Natural environment

The PAOI is located in the Nama Karoo Biome in the Upper Karoo Bioregion. The Nama Karoo is classified as arid, and it covers an extensive part of the south-central plateau of South Africa - an area of 248,284 km^2 (Mucina & Rutherford 2006). The biome is characterized by low rainfall (between 70 and 500 mm per year) falling mostly in late summer (Mucina and Rutherford, 2006) resulting in a high summer aridity index (Mucina & Rutherford 2006). Summers are hot (maximum >30^oC) and winters are cold (minimum close to 0^oC) and frost is common. The vegetation of the Nama-Karoo is dominated by chamaephytes (low-growing shrubs) and hemicryptophytes (graminoids) in a grassy, dwarf shrubland.

The primary vegetation types in the PAOI are Eastern Upper Karoo and Western Upper Karoo (Mucina & Rutherford 2006). The habitat is characterized as grassy Karoo with *Eragrostis lehmanniana* and *Aristida congesta* dominating. Dominant shrubs are asteraceous in the genera *Eriocephalus*, *Pentzia* and *Pteronia*. Grasses are more common on ridges and hills. The flood plains have a short, dense scrubveld. Water courses tend to have *Vachellia karroo* (sweet thorn) trees present.

5.2 Modified environment

Whilst the distribution and abundance of the bird species in the broader area are mostly associated with natural vegetation, as this comprises virtually all the habitat, it is also necessary to examine the few external modifications to the environment that have relevance for birds.

The following avifaunal-relevant anthropogenic habitat modifications were recorded within the broader area:

- **Drainage lines and boreholes:** The land use in the broader area is mostly small stock and game farming. In this arid environment, surface water is a big draw card for birds which use it to bath and drink. Drainage lines and associated boreholes provide important habitat for priority species.
- **Agriculture:** The broader contains some agricultural fields and activities (sheep farming). The fields are mainly grains and lucerne grown as feed for sheep, these fields will attract large seed-eating birds, like Blue Cranes and Ludwig's Bustard as well as the raptors that prey on the smaller seed-eating passerine birds.
- **Alien trees:** The broader area is generally devoid of trees, except for isolated clumps of trees at homesteads and boreholes, where a mixture of alien and indigenous trees is growing. The trees could attract a variety of bird species for purposes of nesting and roosting.

Appendix 4 provides a photographic record of the habitat at the application site.

5.3 Important Bird Areas (IBAs)

The Karoo National Park Important Bird Area (IBA) SA102 is the closest IBA and is located approximately 19.5km south-east of the PAOI at its closest point (Marnewick *et al.* 2015). The development is not expected to have any impact on the avifauna in this IBA due to the distance from the development area.

5.4 The DFFE National Screening Tool

5.4.1 Wind Energy Facility

According to the DFFE national screening tool, the habitat within the PAOI is classified as **Medium** according to the Terrestrial Animal Species theme (see

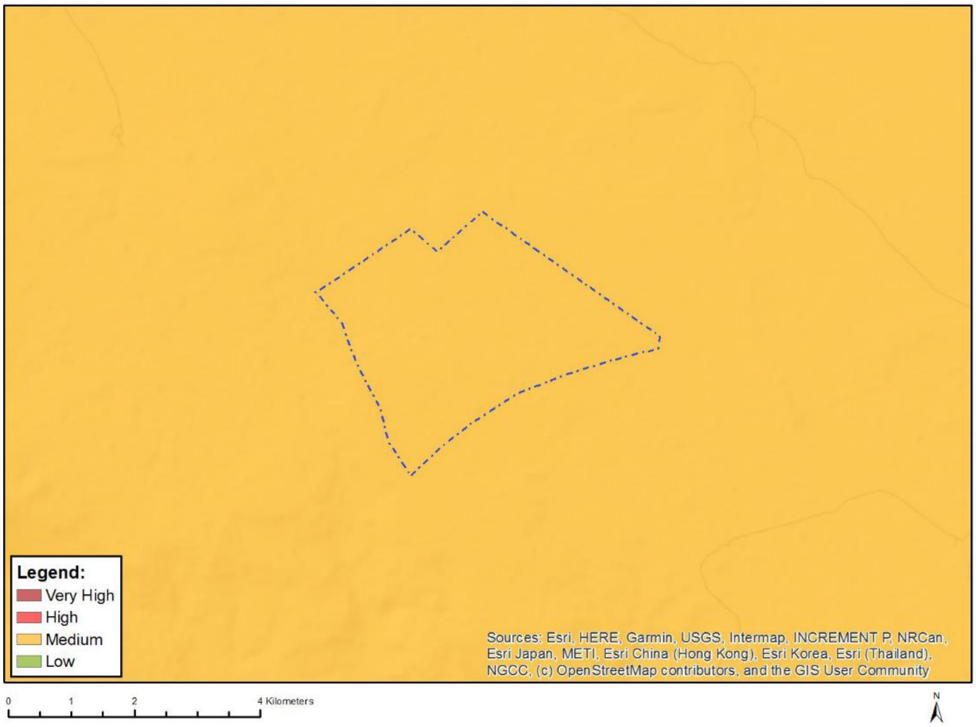

Figure 3**3**)[2]. The classification of **Medium** in the Terrestrial Animal Species theme is linked to the potential presence of species of conservation concern (SCC), namely Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered).

The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the integrated pre-construction monitoring programme, with observations of Ludwig's Bustard, Karoo Korhaan, Martial Eagle, Verreaux's Eagle and Black Stork recorded within the PAOI and its immediate surrounds. Based on the field surveys to date, a classification of **High** sensitivity for avifauna in the screening tool is therefore appropriate.

See **Appendix 7** for the SSV report.

[2] The Wind Theme is only applicable to sites within Renewable Energy Development Zones (REDZ).

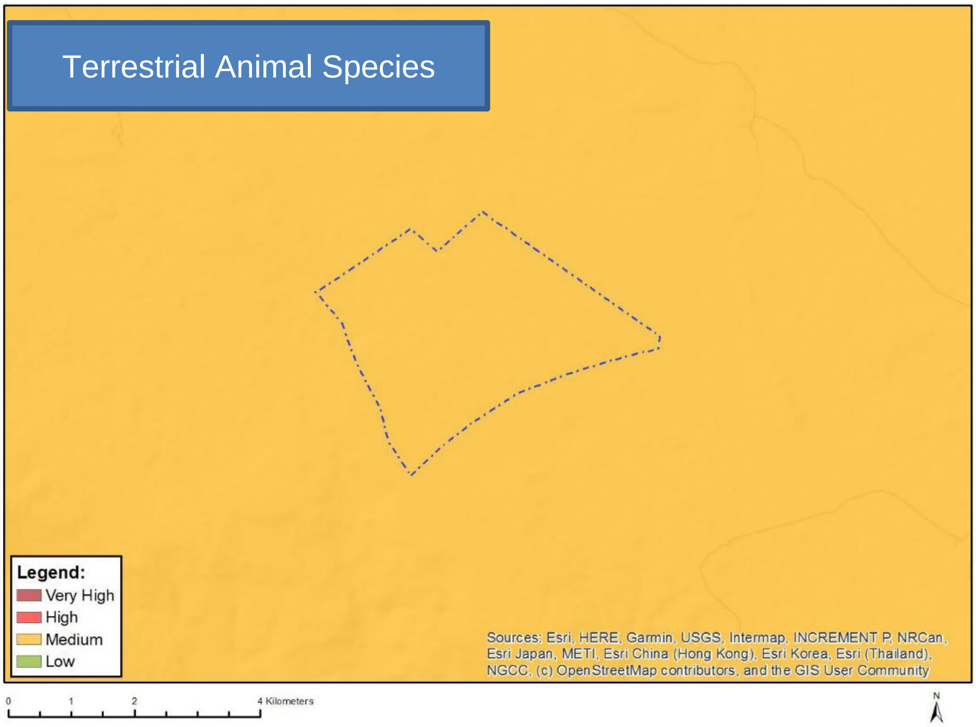

Figure 3: The classification of the PAOI according to the avian theme for terrestrial animal species theme in the DFFE National Screening Tool. The classification of Medium in the Terrestrial Animal Species theme is linked to the potential presence of species of conservation concern (SCC), namely Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered).

5.5 National Protected Areas

The closest protected area to the proposed development area is the Karoo National Park (19.5km). The avifauna in this protected area are not expected to be impacted by the proposed development due to the distance from the PAOI.

5.6 Avifauna in the study area

It is estimated that a total of 127 bird species could potentially occur in the broader area. Please refer to Appendix 5 which provides a comprehensive list of all the species in the broader area. Of these, 16 species are classified as priority species for wind developments.

Table 3 below lists all the wind priority sensitive species and the potential impacts on the respective species by the proposed WEF.

EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, H = High, M = Medium, L = Low

Table 3: Wind energy priority species recorded in the broader area.

Species name	**Scientific name**	**Full protocol**	**Ad hoc protocol**	**Global Red Data Status**	**Regional Red Data Status**	**Endemic (SA)**	**Recorded during monitoring**	**Likelihood of regular occurrence in PAOI**	**Nama Karoo shrub**	**Ridges**	**Drainage lines and boreholes**	**Agriculture**	**Alien trees**	**Collision with turbines**	**Displacement - habitat transformation**	**Displacement - disturbance**	**Powerline - Electrocution MV**	**Powerline - Collision**
Common Buzzard	*Buteo buteo*	3,45	0,00	-	-			L	x		x	x	x	x	x		x	
Jackal Buzzard	*Buteo rufofuscus*	27,59	23,08	-	-	x	x	H	x	x	x	x	x	x	x	x	x	
Double-banded Courser	*Rhinoptilus africanus*	3,45	0,00	-	-			L	x					x	x	x		
Blue Crane	*Grus paradisea*	0,00	2,56	VU	NT		x	L	x			x		x	x	x		x
Booted Eagle	*Hieraaetus pennatus*	10,34	2,56	-	-		x	M	x	x	x	x	x	x	x		x	
Martial Eagle	*Polemaetus bellicosus*	10,34	0,00	EN	EN			M	x		x	x	x	x	x		x	
Verreaux's Eagle	*Aquila verreauxii*	37,93	12,82	-	VU		x	M	x	x	x		x	x	x		x	
Spotted Eagle-Owl	*Bubo africanus*	10,34	0,00	-	-			M	x		x	x	x	x	x	x	x	
Lanner Falcon	*Falco biarmicus*	0,00	2,56	-	VU			L	x	x	x	x	x	x	x		x	
Grey-winged Francolin	*Scleroptila afra*	6,90	2,56	-	-	x	x	M		x				x	x	x		
Pale Chanting Goshawk	*Melierax canorus*	13,79	12,82	-	-		x	H	x		x	x	x	x	x	x	x	
Greater Kestrel	*Falco rupicoloides*	3,45	0,00	-	-		x	M	x				x	x	x	x	x	
Karoo Korhaan	*Eupodotis vigorsii*	58,62	20,51	-	NT		x	H	x					x	x	x		x
African Rock Pipit	*Anthus crenatus*	13,79	0,00	NT	NT	x		M		x					x	x		
Black Stork	*Ciconia nigra*	0,00	0,00	-	VU		x	L		x	x		x	x			x	
Ludwig's Bustard	*Neotis ludwigii*	0,00	0,00	EN	EN		x	M	x			x		x	x	x		x

5.7 Results of pre-construction bird monitoring

An integrated pre-construction monitoring programme over four seasons was implemented at the five proposed Klipkraal wind energy sites.

The monitoring was designed according to the following best practice guidelines (hereafter referred to as the VE guidelines):

- Ralston-Patton, S & Murgatroyd, M. 2021. *Verreaux's Eagle and Wind Farms. Guidelines for impact assessment, monitoring, and mitigation*. BirdLife South Africa. November 2021. Second edition (Klipkraal 1 – 3)
- Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa.* Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa (Klipkraal 5 – 6).

Wind priority species were identified using the latest (November 2014) BirdLife SA (BLSA) list of priority species for wind farms. The surveys of the pre-construction monitoring programme at the proposed Klipkraal WEF sites were conducted during the following periods:

- 15 – 19 February 2022
- 09 – 14 May 2022
- 12 – 20 July 2022
- 17 – 22 October 2022
- 26 – 31 December 2022
- 10 – 14 January 2023

Table 4Error! Reference source not found., Error! Reference source not found. and **Error! Reference source not found.** below present the results of the pre-construction monitoring conducted at the five potential WEF sites and control area.

5.7.1 Transects

The results of the transect counts are displayed in **Table 4**:

Table 4: The results of the transect counts at the WEF and Control Sites

Turbine Site	Number
Species composition	
All Species	77
Priority Species (10%)	8 (10%)
Non-Priority Species	69
Total count	
Drive transects	1327
Walk transects	2791
	4118

Control Site	Number
Species composition	
All Species	65
Priority Species (5%)	7 (11%)
Non-Priority Species	58
Total count	
Drive transects	1409
Walk transects	958
	2367

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each priority species recorded during transect surveys conducted at the five WEF sites over four seasons (see **Figures 4 and 5** below).

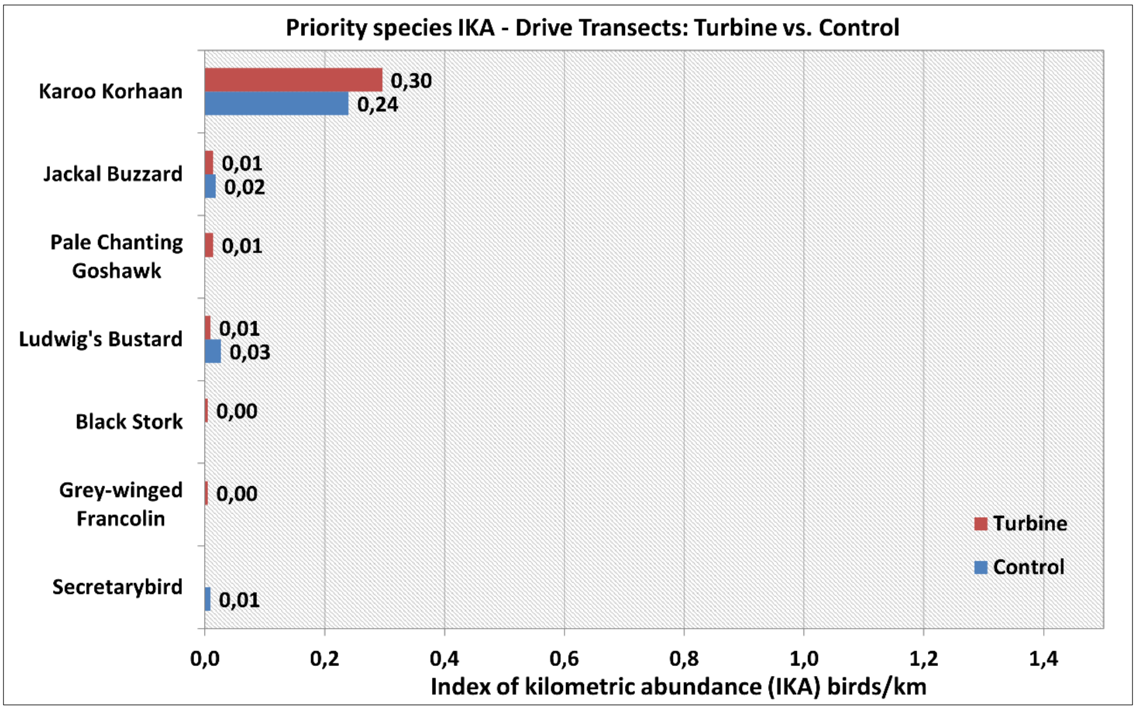

Figure 4: Index of kilometric abundance of priority species recorded at the five WEF sites and control site through drive transect surveys conducted during pre-construction monitoring.

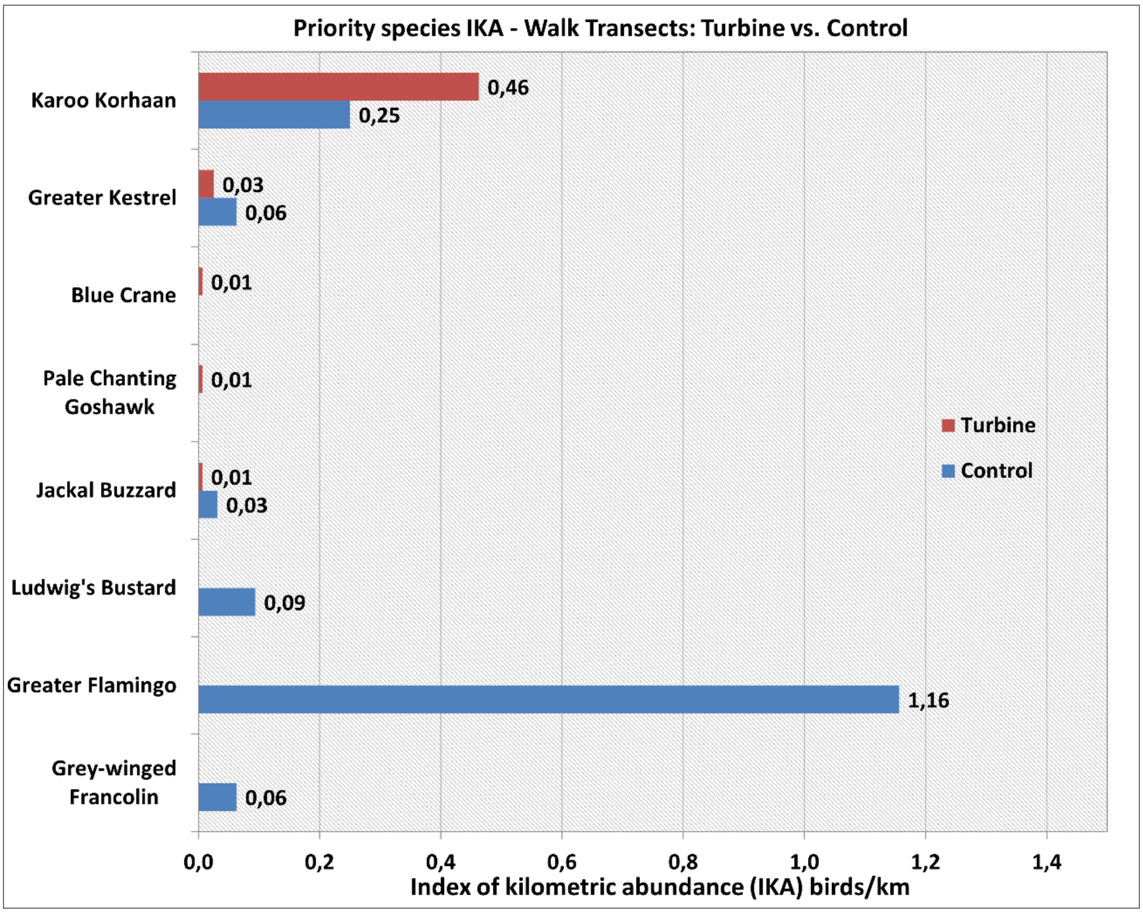

Figure 5: Index of kilometric abundance of priority species recorded at the five WEF sites through walk transect surveys conducted during pre-construction monitoring.

5.7.2 Focal points

See **Table 5** below for a summary of the focal point survey data recorded during the pre-construction monitoring.

Table 5: Summary of focal point surveys at the five WEF sites during the pre-construction monitoring

Focal Point description	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6
FP1: Wangarino farm dam	No Priority species	Not visited	No priority species	Dam is dry	Dam 70%, White Storks seen resting at dam	Dam 50%, no priority species
FP2: Farm dam	No Priority species	No Priority species	No priority species	Dam is dry	Dam 60%, no priority species	Dam 50%, no priority species
FP3: Wangarino Jackal Buzzard (JB) nest	JBs in vicinity	Not visited	JBs in vicinity, no nest activity	JBs in vicinity, no breeding	2 adults and juvenile at nest	No nest activity, adult seen hunting east of nest
FP4: Klipkraal Verreaux's Eagle (VE) nest	2 VE adults and 1 subadult in vicinity	2 VE adults hunting - not	1 Adult hunting, Female	2 Adult hunting, with juvenile	No eagles seen	2 adults flying in vicinity of nest

Focal Point description	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6
		breeding yet	probably breeding			
FP5: Klipkraal Jackal Buzzard /PCG nest	PCG hunting in area	No raptors in vicinity	No raptors in vicinity	No raptors in vicinity - pied crows	Nest taken over by crows	Nest taken over by crows
FP6: Matjesfontein Verreaux's Eagle nest	NA	NA	Female breeding on nest	VE hunting in vicinity	VEs hunting in Kloof	VEs hunting in Kloof

See **Appendix 3** for the location of the focal points and **Figure 6** for the location of the Verreaux's Eagle nests.

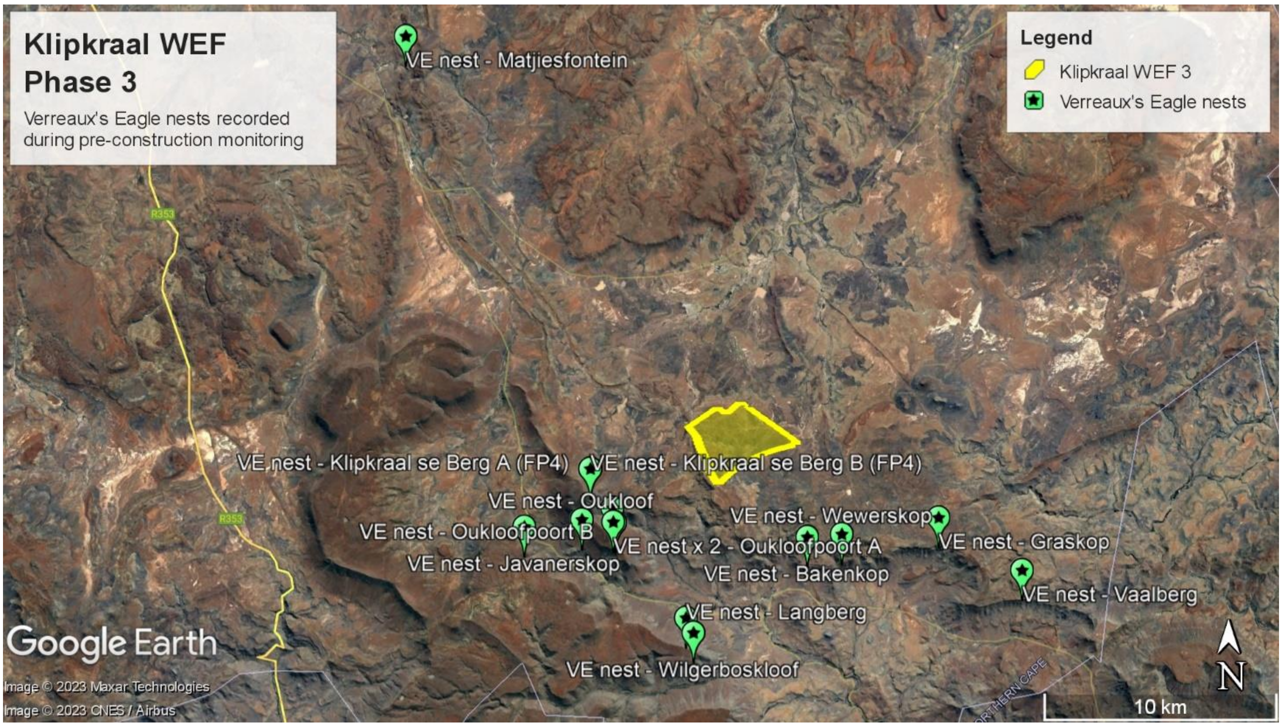

Figure 6: Verreaux's Eagle nests recorded during the pre-construction monitoring at Klipkraal WEF.

5.7.3 Incidental counts

Table 6 provides an overview of the incidental sightings of priority species recorded at the five Klipkraal WEF sites.

Table 6: Incidental sightings of priority species during all surveys over four seasons.

Priority Species (Incidentals)		Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	Grand Total
Booted Eagle	*Hieraaetus pennatus*	0	0	0	0	2	0	**2**
Common Buzzard	*Buteo buteo*	0	0	0	0	1	0	**1**
Jackal Buzzard	*Buteo rufofuscus*	1	0	1	2	6	2	**12**
Karoo Korhaan	*Eupodotis vigorsii*	6	8	4	12	11	1	**42**
Lesser Kestrel	*Falco naumanni*	0	0	0	0	4	4	**8**
Ludwig's Bustard	*Neotis ludwigii*	0	27	0	0	0	0	**27**
Martial Eagle	*Polemaetus bellicosus*	1	0	0	0	0	0	**1**
Pale Chanting Goshawk	*Melierax canorus*	1	2	0	0	1	1	**5**
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0	0	1	0	0	0	**1**
Verreaux's Eagle	*Aquila verreauxii*	2	0	0	0	3	4	**9**

See **Appendix 5** for a list of all species recorded during the pre-construction monitoring at the five WEF sites over four seasons.

5.7.4 Vantage point observations

To date, flight patterns of priority species have been recorded at the five WEF sites for 576 hours (72 hours per VP at Klipkraal 1- 3 and 48 hours per VP at Klipkraal 4 - 5) at 10 vantage points at the development sites in three bands (high = above rotor altitude; medium = at rotor altitude; low = below rotor altitude) (**Figure 7**). Approximate flight altitude was visually judged by an observer with the aid of binoculars. Priority species were observed for 6 hours, 04 minutes, and 15 seconds during the surveys. Medium altitude flights (within rotor altitude) were recorded for 02 hours and 44 minutes.

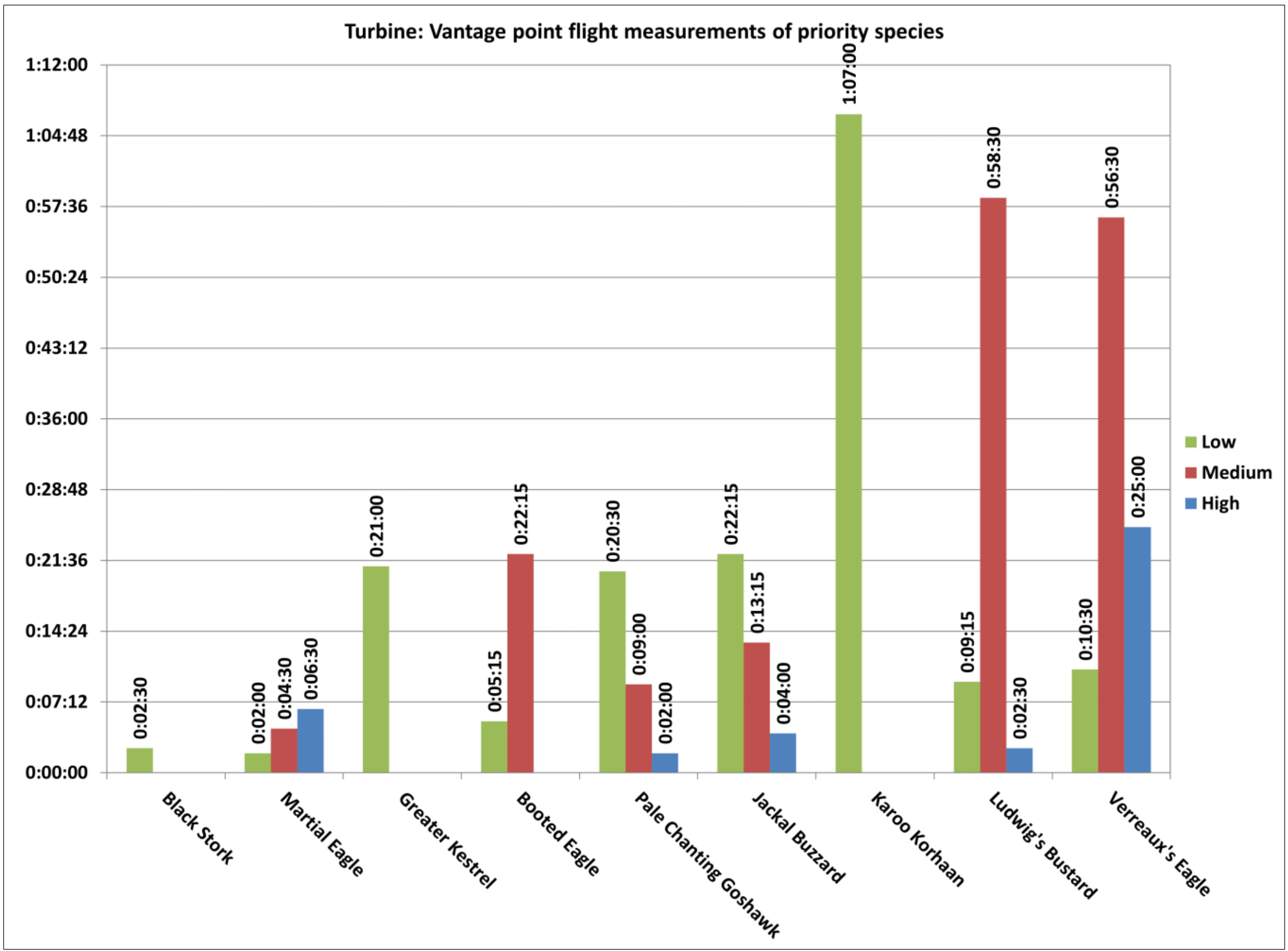

Figure 7: Flight times and altitudes recorded for priority species during the on-site surveys at the five WEF sites over four seasons.

5.7.5 Site specific collision risk rating

A site-specific collision risk rating for each priority species recorded during VP watches was calculated to give an indication of the likelihood of an individual of the specific species to collide with the turbines at these sites. This was calculated while considering the following factors:

- The duration of rotor altitude flights
- The susceptibility to collisions, based on morphology (size) and behaviour (soaring, predatory, ranging behaviour, flocking behaviour, night flying, aerial display, and habitat preference) using the ratings for priority species in the Avian Wind Farm Sensitivity Map of South Africa (Retief *et al*. 2012); and
- The number of turbines

This was done in order to gain a better understanding of which species are likely to be most at risk of collision. The formula used is as follows[3]:

[3] It is important to note that the formula does not incorporate avoidance behaviour. This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of bird flights will successfully avoid the turbines (SNH 2010).

Duration of rotor altitude flights (in decimal hours) x collision ratings in the Avian Wind Farm Sensitivity Map x number of turbines ÷100.

The results are presented in **Table 7** and **Figure 8** below.

Table 7: Site-specific collision risk rating

Species	Duration of medium height flights (hr)	Collision rating: Avian Wind Farm Sensitivity Map (Retief *et al*. 2012)	Site specific collision risk rating
Karoo Korhaan	0,0000	65	0,00
Black Stork	0,0000	100	0,00
Greater Kestrel	0,0000	57	0,00
Martial Eagle	0,0031	100	0,63
Pale Chanting Goshawk	0,0063	70	0,88
Jackal Buzzard	0,0092	95	1,75
Booted Eagle	0,0155	85	2,63
Ludwig's Bustard	0,0406	85	6,91
Verreaux's Eagle	0,0392	115	9,02
Average	**0.0127**	**85.7**	**2.42**

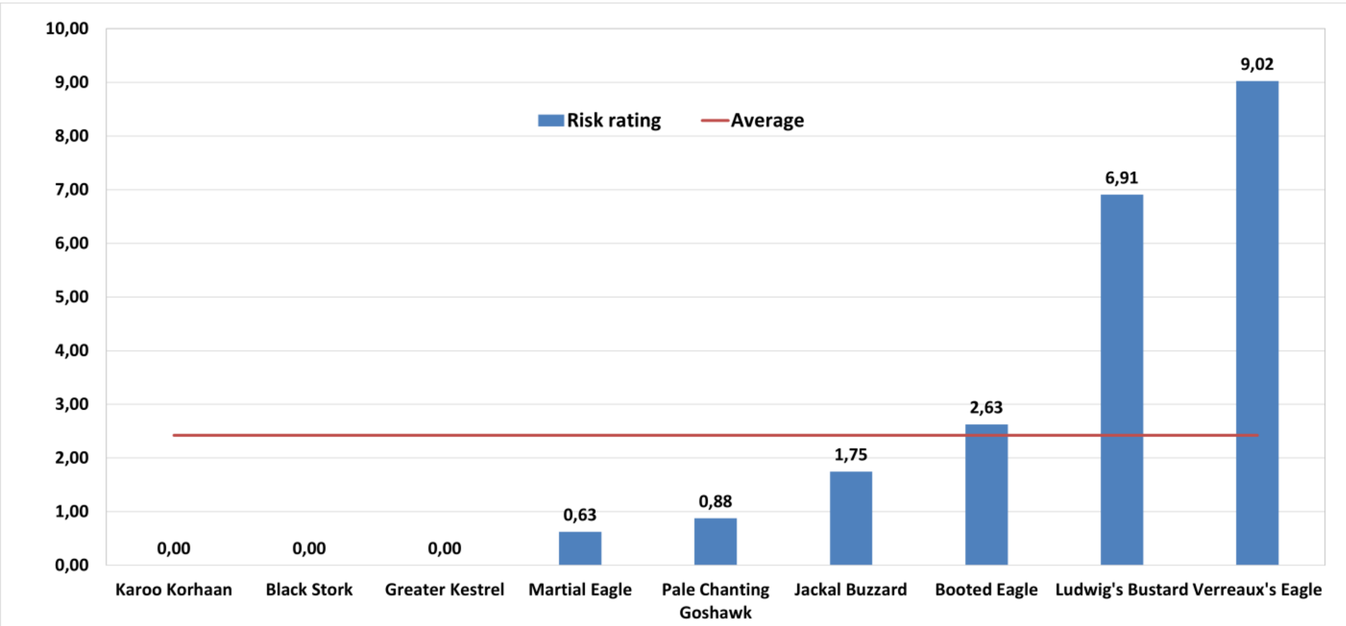

Figure 8: Site specific collision risk rating for priority species. The red line indicates the average collision risk rating for priority species at the proposed WEF sites, based on recorded flight behaviour during the pre-construction monitoring surveys over four seasons.

5.7.6 Spatial distribution of flights at turbine area

Flight maps were prepared for the species with higher-than-average collision risk indices, indicating the spatial distribution of flights observed over the Klipkraal WEF 3 site. This was done by overlaying a 400m x 400m grid over the survey area. Each grid cell was then given a weighting score (Very High; High; Medium; Low) taking into account the flight intensity i.e. the duration and distance of individual flight lines through a grid cell and the number of individual birds associated with each flight crossing the grid cell, in order to give an indication where the observed flight activity was most concentrated (**Figures 9 - 14**).

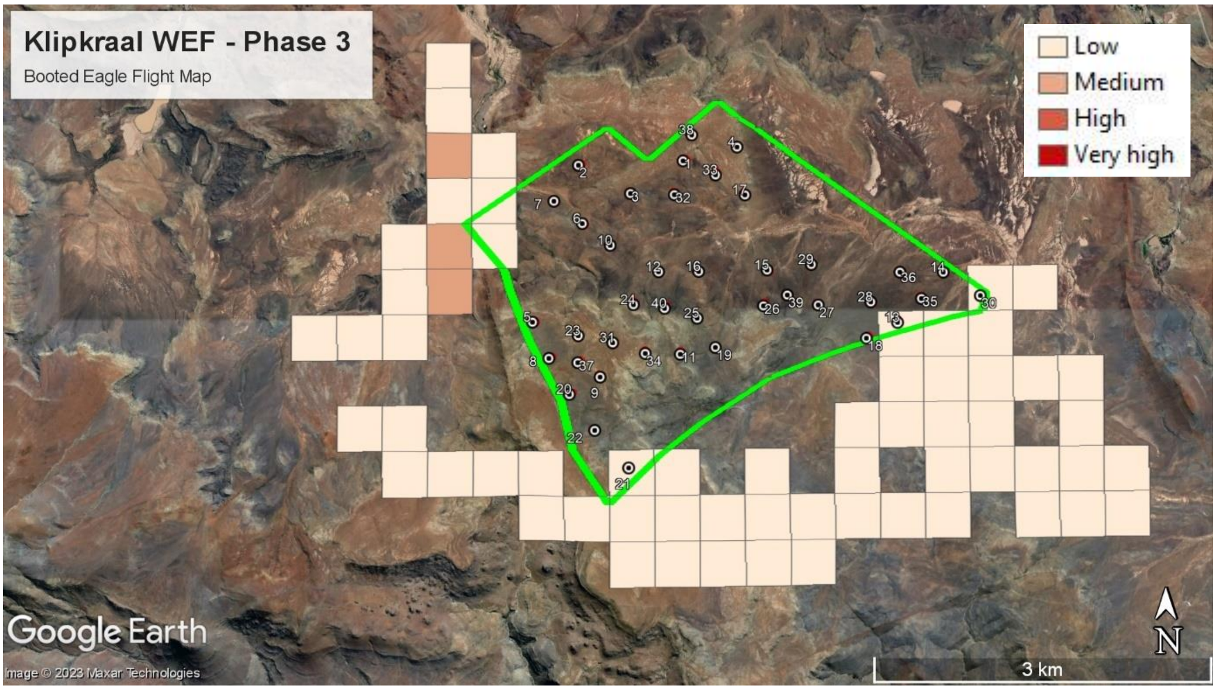

Figure 9: Intensity of flight activity of Booted Eagle over four seasons of monitoring.

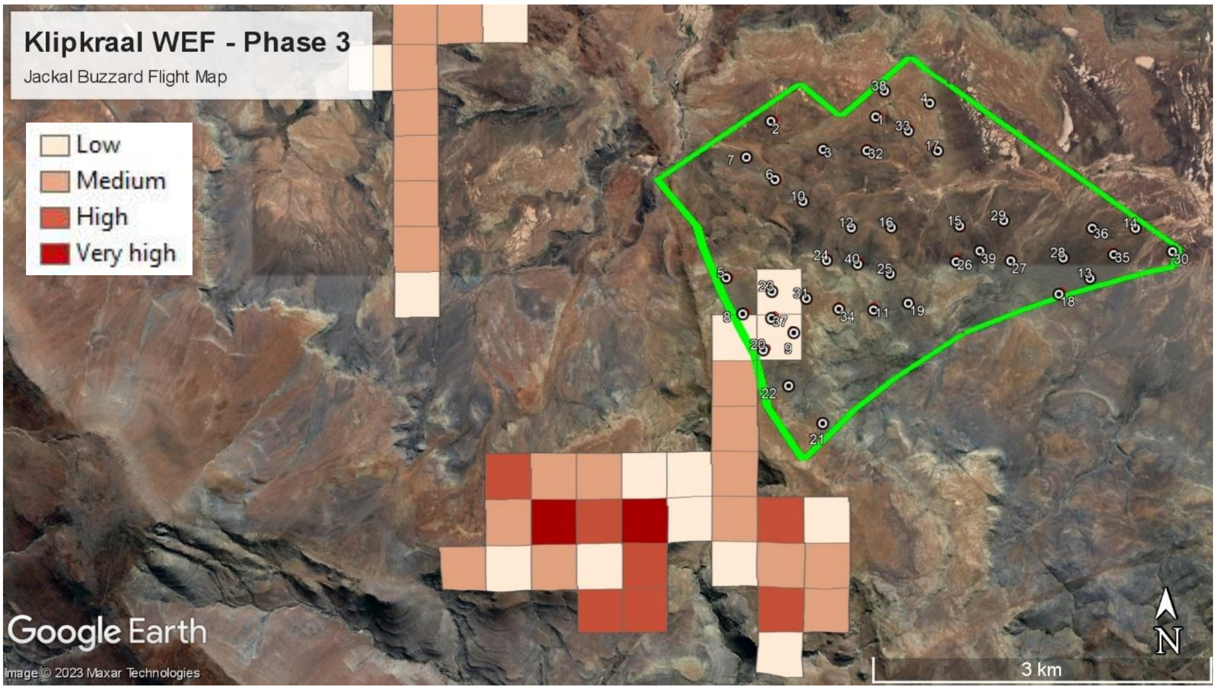

Figure 10: Intensity of flight activity of Jackal Buzzard over four seasons of monitoring.

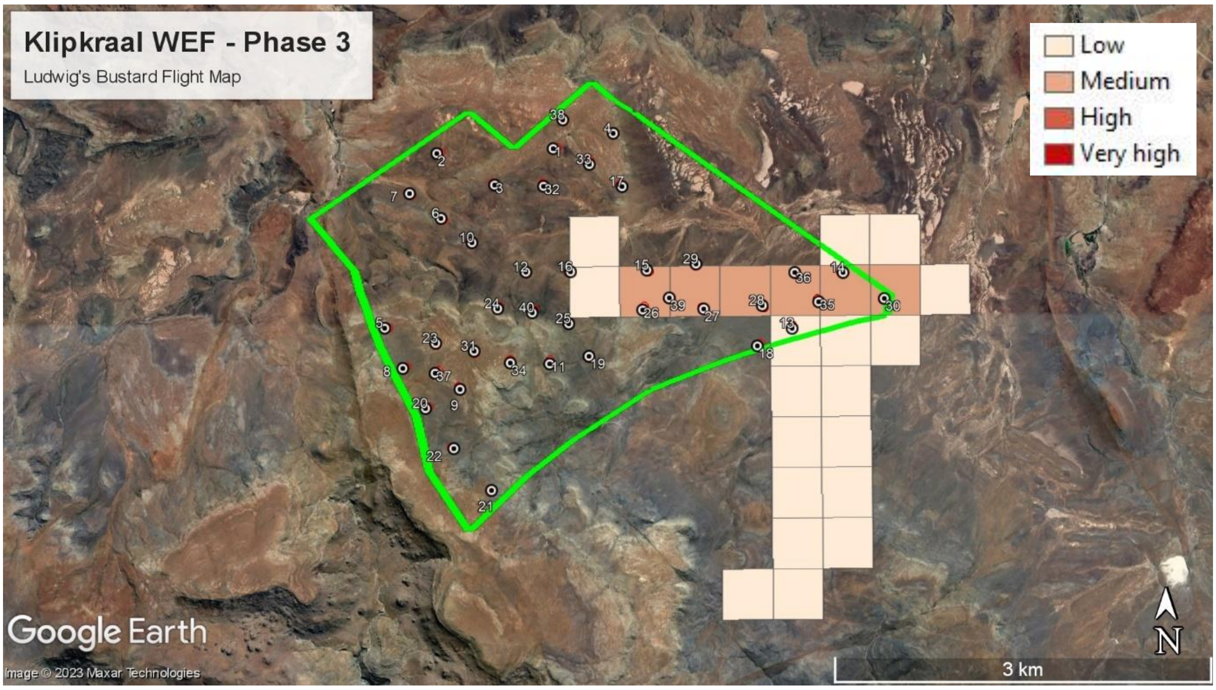

Figure 11: Intensity of flight activity of Ludwig's Bustard over four seasons of monitoring.

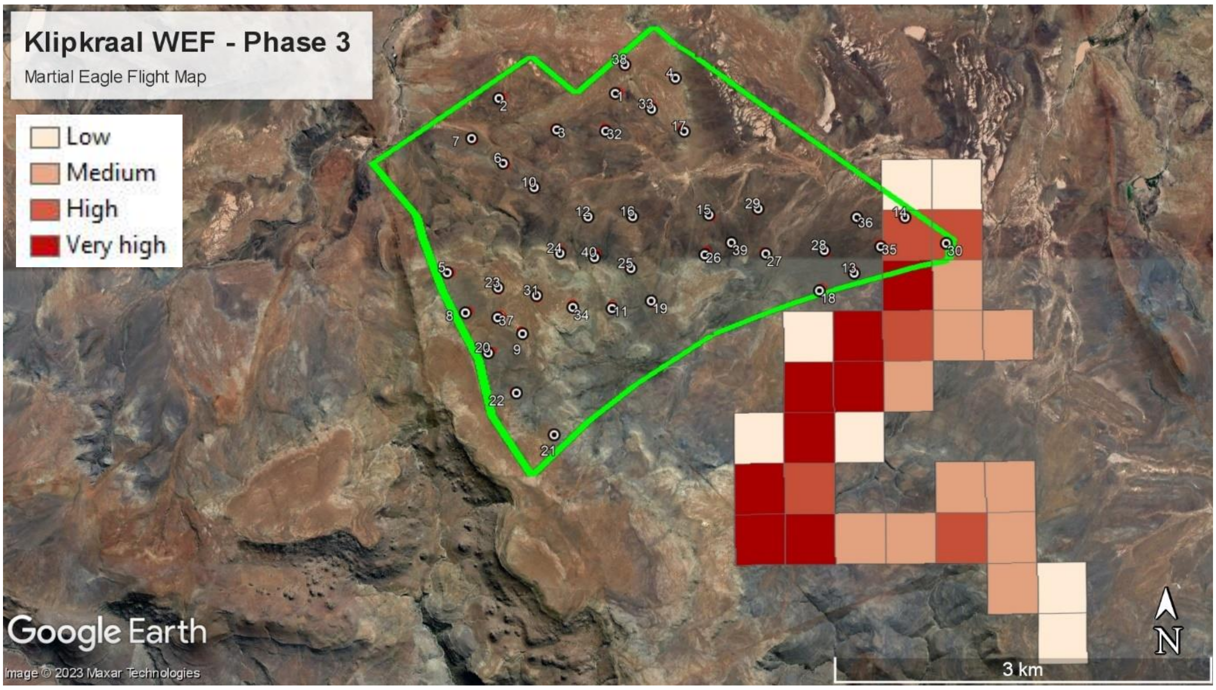

Figure 12: Intensity of flight activity of Martial Eagle over four seasons of monitoring.

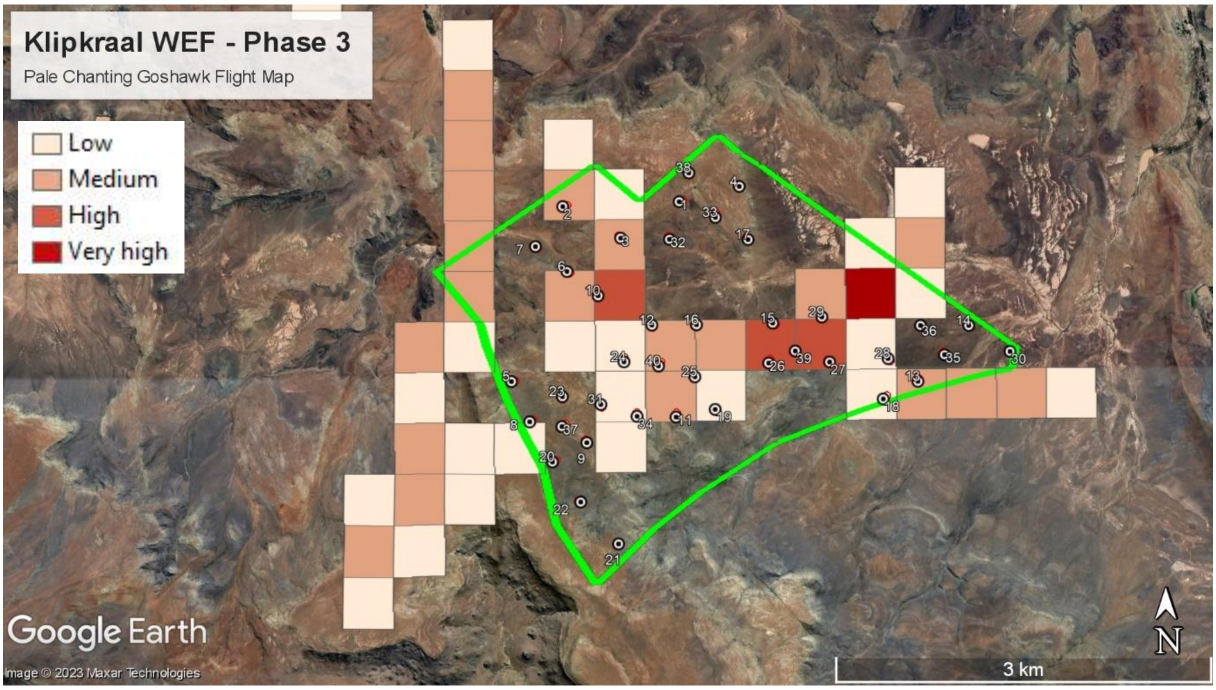

Figure 13: Intensity of flight activity of Pale Chanting Goshawk over four seasons of monitoring.

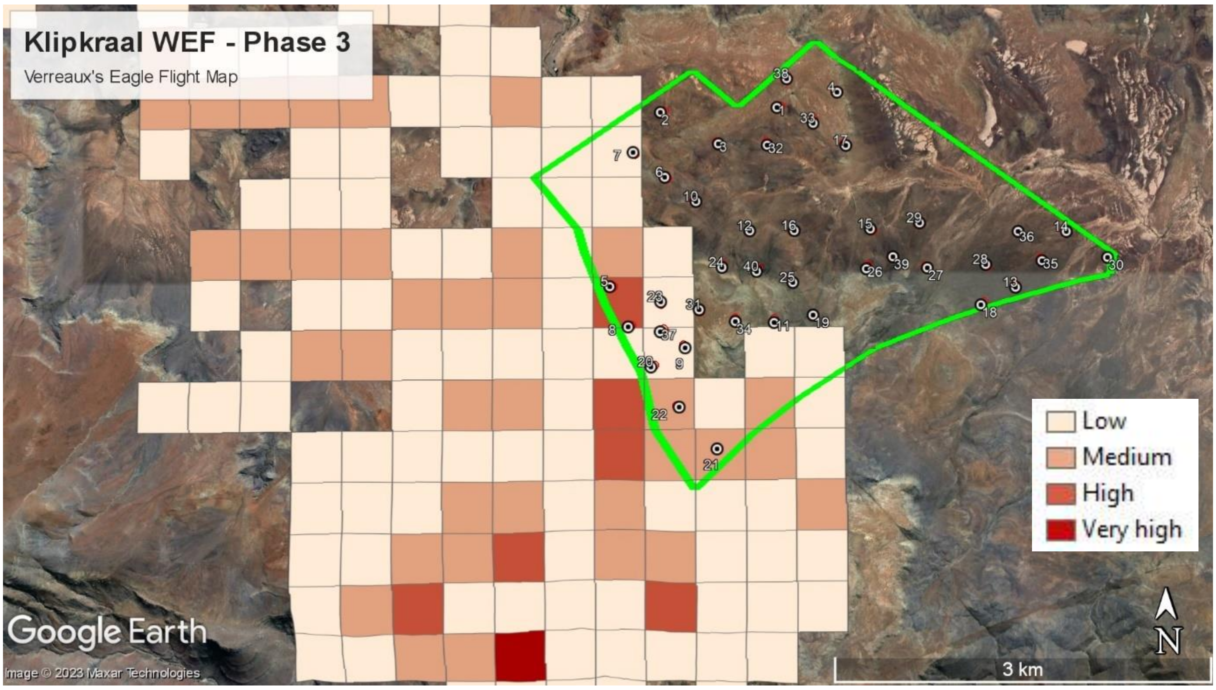

Figure 14: Intensity of flight activity of Verreaux's Eagle over four seasons of monitoring.

6. SPECIALIST FINDINGS AND ASSESSMENT OF IMPACTS

6.1 Wind Energy Facility (WEF)

The effects of a wind farm on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present. With so many variables involved, the impacts of each wind farm must be assessed individually. The principal areas of concern with regard to effects on birds are listed below. Each of these potential effects can interact with each other, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss or displacement causes a reduction in birds using an area which might then reduce the risk of collision):

- Mortality due to collisions with the wind turbines
- Displacement due to disturbance during construction and operation of the wind farm
- Displacement due to habitat change and loss at the wind farm
- Mortality due to electrocution on the electrical infrastructure

It should be noted that the assessment is made on the *status quo* as it is currently on site. The possible change in land use in the broader PAOI is not taken into account because the extent and nature of future developments (not only wind energy development) are unknown at this stage. It is however highly unlikely that the land use will change in the foreseeable future due to climatic limitations.

6.1.1 *Collision mortality on wind turbines*[4]

Wind energy generation has experienced rapid worldwide development over recent decades as its environmental impacts are considered to be relatively lower than those caused by traditional energy sources, with reduced environmental pollution and water consumption (Saidur *et al.*, 2011). However, bird fatalities due to collisions with wind turbines have been consistently identified as a main ecological drawback to wind energy (Drewitt and Langston, 2006).

Collisions with wind turbines appear to kill fewer birds than collisions with other man-made infrastructures, such as power lines, buildings or even traffic (Calvert *et al.* 2013; Erickson *et al.* 2005). Nevertheless, estimates of bird deaths from collisions with wind turbines worldwide range from 0 to almost 40 deaths per turbine per year (Sovacool, 2009). The number of birds killed varies greatly between sites, with some sites posing a higher collision risk than others, and with some species being more vulnerable (e.g. Hull *et al.* 2013; May *et al.* 2012a). These numbers may not reflect the true magnitude of the problem, as some studies do not account for detectability biases such as those caused by scavenging, searching efficiency and search radius (Bernardino *et al.* 2013; Erickson *et al.* 2005; Huso and Dalthorp 2014). Additionally, even for low fatality rates, collisions with wind turbines may have a disproportionate effect on some species. For long-lived species with low productivity and slow maturation rates (e.g. raptors), even low mortality rates can have a significant impact at the population level (e.g. Carrete *et al.* 2009; De Lucas *et al.* 2012a; Drewitt and Langston, 2006). The situation is even more critical for species of conservation concern, which sometimes are most at risk (e.g. Osborn *et al.* 1998).

High bird fatality rates at several wind farms have raised concerns among the industry and scientific community. High profile examples include the Altamont Pass Wind Resource Area (APWRA) in California because of high fatality of Golden eagles (*Aquila chrysaetos*), Tarifa in Southern Spain for Griffon vultures (*Gyps fulvus*), Smøla in Norway for White-tailed eagles (*Haliaatus albicilla*), and the port of Zeebrugge in Belgium for gulls (*Larus* sp.) and terns (*Sterna* sp.) (Barrios and Rodríguez, 2004; Drewitt and Langston, 2006; Everaert and Stienen, 2008; May *et al.* 2012a; Thelander *et al.* 2003). Due to their specific features and location, and characteristics of their bird communities, these wind farms have been responsible for a large number of fatalities that culminated in the deployment of additional measures to minimize or compensate for bird collisions. However, currently, no simple formula can be applied to all sites; in fact, mitigation measures must inevitably be defined according to the characteristics of each wind farm and the diversity of species occurring there (Hull *et al.* 2013; May *et al.* 2012b). An understanding of the factors that explain bird collision risk and how they interact with one another is therefore crucial to proposing and implementing valid mitigation measures.

Species-specific factors

- Morphological features

Certain morphological traits of birds, especially those related to size, are known to influence collision risk with structures such as power lines and wind turbines. Janss (2000) identified weight, wing length, tail length and total bird length as being collision risk determinant. Wing loading (ratio of body weight to wing area) and aspect ratio (ratio of wingspan squared to wing area) are particularly relevant, as they influence flight type and thus collision

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[4] This section is based largely on a (2014) review paper by Ana Teresa Marques, Helena Batalha, Sandra Rodrigues, Hugo Costa, Maria João Ramos Pereira,Carlos Fonseca, Miguel Mascarenhas, Joana Bernardino. *Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies*. Biological Conservation 179 (2014) 40– 52.

risk (Bevanger, 1994; De Lucas *et al.* 2008; Herrera-Alsina *et al.* 2013; Janss, 2000). Birds with high wing loading, such as the Griffon Vulture (*Gyps fulvus*), seem to collide more frequently with wind turbines at the same sites than birds with lower wing loadings, such as Common Buzzards (*Buteo buteo*) and Short-toed Eagles (*Circaetus gallicus*), and this pattern is not related with their local abundance (Barrios and Rodríguez, 2004; De Lucas *et al.* 2008). High wing-loading is associated with low flight manoeuvrability (De Lucas *et al.* 2008), which determines whether a bird can escape an encountered object fast enough to avoid collision.

Information on the wing loading of the priority species potentially occurring regularly at the WEF was not available at the time of writing. However, based on general observations, and research on related species, it can be confidently assumed that priority species that could potentially be vulnerable to wind turbine collisions due to morphological features (high wing loading) are bustards, making them less manoeuvrable (Keskin *et al.* 2019).

- Sensorial perception

Birds are assumed to have excellent visual acuity, but this assumption is contradicted by the large numbers of birds killed by collisions with man-made structures (Drewitt and Langston, 2008; Erickson *et al.* 2005). A common explanation is that birds collide more often with these structures in conditions of low visibility, but recent studies have shown that this is not always the case (Krijgsveld *et al.* 2009). The visual acuity of birds seems to be slightly superior to that of other vertebrates (Martin, 2011; McIsaac, 2001). Unlike humans, who have a broad horizontal binocular field of 120°, some birds have two high acuity areas that overlap in a very narrow horizontal binocular field (Martin, 2011). Relatively small frontal binocular fields have been described for several species that are particularly vulnerable to power line collisions, such as vultures (Gyps sp.) cranes and bustards (Martin and Katzir, 1999; Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Furthermore, for some species, their high-resolution vision areas are often found in the lateral fields of view, rather than frontally (e.g. Martin et.al, 2010; Martin, 2012, 2011; O'Rourke *et al.* 2010). Finally, some birds tend to look downwards when in flight, searching for conspecifics or food, which puts the direction of flight completely inside the blind zone of some species (Martin et.al, 2010; Martin, 2011).

Some of the regularly occurring priority species at the proposed WEF have high resolution vision areas found in the lateral fields of view, rather than frontally, e.g., the bustards and korhaans. The exceptions to this are the priority raptors which all have wider binocular fields, although as pointed out by Martin (2011, 2012), this does not necessarily result in these species being able to avoid obstacles better.

- Phenology

Recent studies have shown that, within a wind farm, raptor collision risk and fatalities are higher for resident than for migrating birds of the same species. An explanation for this may be that resident birds generally use the wind farm area several times while a migrant bird crosses it just once (Krijgsveld *et al.* 2009). However, other factors like bird behaviour are certainly relevant. Katzner *et al.* (2012) showed that Golden Eagles performing local movements fly at lower altitudes, putting them at a greater risk of collision than migratory eagles. Resident eagles flew more frequently over cliffs and steep slopes, using low altitude slope updrafts, while migratory eagles flew more frequently over flat areas and gentle slopes where thermals are generated, enabling the birds to use them to gain lift and fly at higher altitudes.

South Africa is at the end of the migration path for summer migrants; therefore, the phenomenon of migratory flyways where birds are concentrated in large numbers for a limited period of time, e.g. the African Rift Valley

or Mediterranean Red Sea flyways, is not a feature of the landscape. The migratory priority species which could occur at the proposed WEF with some regularity, e.g., Booted Eagle, will behave much the same as the resident birds once they arrive in the area. The same is valid for local migrants such as the Ludwig's Bustard. It is expected that, for the period when they are present, these species will be exposed to the same risks as resident species.

- Bird behaviour

Flight type seems to play an important role in collision risk, especially when associated with hunting and foraging strategies. Kiting flight (hanging in the wind with almost motionless wings), which is used in strong winds and occurs in rotor swept zones, has been highlighted as a factor explaining the high collision rate of Red-tailed Hawks *Buteo jamaicensis* at APWRA (Hoover and Morrison, 2005), and could also be a factor in contributing to the high collision rate for Jackal Buzzards in South Africa (Ralston-Paton & Camagu 2019). The hovering behaviour exhibited by Common Kestrels *Falco tinnunculus* when hunting may also explain the fatality levels of this species at wind farms in the Strait of Gibraltar (Barrios and Rodríguez, 2004). This may also explain the high mortality rate of Rock Kestrels *Falco rupicolus* at wind farms in South Africa (Ralston-Paton & Camagu 2019). Kiting and hovering are associated with strong winds, which often produce unpredictable gusts that may suddenly change a bird's position (Hoover and Morrison, 2005). Additionally, while birds are hunting and focused on prey, they might lose track of wind turbine positions (Krijgsveld *et al.* 2009; Smallwood *et al.* 2009). In the case of raptors, aggressive interactions may play an important role in turbine fatalities, in that birds involved in these interactions are momentarily distracted, putting them at risk. At least one eye-witness account of a Martial Eagle getting killed by a turbine in South Africa in this fashion is on record (Simmons & Martins 2016)

Social behaviour may also result in a greater collision risk with wind turbines due to a decreased awareness of the surroundings. Several authors have reported that flocking behaviour increases collision risk with power lines as opposed to solitary flights (e.g. Janss, 2000). However, caution must be exercised when comparing the particularities of wind farms with power lines, as some species appear to be vulnerable to collisions with power lines but not with wind turbines, e.g. indications are that bustards, which are highly vulnerable to power line collisions, are not prone to wind turbine collisions – a Spanish database of over 7000 recorded turbine collisions contains no Great Bustards *Otis tarda* (A. Camiña 2012a). Similarly, in South Africa, only two bustard collisions with wind turbines have been reported to date, both Ludwig's Bustards (Ralston-Paton & Camagu 2019). No Denham's Bustards *Neotis denhami* turbine fatalities have been reported to date, despite the species occurring at several wind farm sites.

The priority species which could occur with some regularity at the proposed WEF can be classified as either terrestrial species, soaring species or occasional long-distance fliers. Terrestrial species spend most of the time foraging on the ground. They do not fly often and when they do, they generally fly for short distances at low to medium altitude. At the application site, Ludwig Bustard, Karoo Korhaan, Blue Crane, Grey-winged Francolin and Double-banded Courser are included in this category. Occasional long-distance fliers generally behave as terrestrial species but can and do undertake long distance flights on occasion. Species in this category are Ludwig's Bustard and Blue Crane. Soaring species spend a significant time on the wing in a variety of flight modes including soaring, kiting, hovering and gliding at medium to high altitudes. At the project site, these include all the raptors and storks which could occur i.e., Lanner Falcon, Booted Eagle, Martial Eagle, Greater Kestrel, Pale Chanting Goshawk, Verreaux's Eagle and Black Stork. Based on the time spent potentially flying at rotor height, soaring species are likely to be at greater risk of collision.

- Avoidance behaviours

Two types of avoidance have been described (Furness *et al.*, 2013): 'macro-avoidance' whereby birds alter their flight path to keep clear of the entire wind farm (e.g. Desholm and Kahlert, 2005; Plonczkier and Simms, 2012; Villegas-Patraca *et al.* 2014), and 'micro-avoidance' whereby birds enter the wind farm but take evasive actions to avoid individual wind turbines (Band *et al.* 2007). This may differ between species and may have a significant impact on the size of the risk associated with a specific species. It is generally assumed that 95-98% of birds will successfully avoid the turbines (SNH 2010).

It is anticipated that most birds at the proposed WEF will avoid the wind turbines, as is generally the case at all wind farms (SNH 2010). Exceptions already mentioned are raptors that engage in hunting which might serve to distract them and place them at risk of collision, birds engaged in display behaviour or inter- and intraspecific aggressive interaction. Complete macro-avoidance of the wind farm is unlikely for any of the priority species likely to occur at the proposed WEF.

- Bird abundance

Some authors suggest that fatality rates are related to bird abundance, density or utilization rates (Carrete *et al.* 2012; Kitano and Shiraki, 2013; Smallwood and Karas, 2009), whereas others point out that, as birds use their territories in a non-random way, fatality rates do not depend on bird abundance alone (e.g. Ferrer *et al.* 2012; Hull *et al.* 2013). Instead, fatality rates depend on other factors such as differential use of specific areas within a wind farm (De Lucas *et al.* 2008). For example, at Smøla, White-tailed Eagle flight activity is correlated with collision fatalities (Dahl *et al.* 2013). In the APWRA, Golden Eagles, Red-tailed Hawks and American Kestrels (*Falco spaverius*) have higher collision fatality rates than Turkey Vultures (*Cathartes aura*) and Common Raven (*Corvus corax*), even though the latter are more abundant in the area (Smallwood *et al.* 2009), indicating that fatalities are more influenced by each species' flight behaviour and turbine perception. Also, in southern Spain, bird fatality was higher in the winter, even though bird abundance was higher during the pre-breeding season (De Lucas *et al.* 2008).

The abundance of priority species at the proposed WEF will fluctuate depending on the season of the year, and especially in response to rainfall e.g., Ludwig's Bustard and Blue Crane.

Site-specific factors

- Landscape features

Susceptibility to collision can also heavily depend on landscape features at a wind farm site, particularly for soaring birds that predominantly rely on wind updrafts to fly. Some landforms such as ridges, steep slopes and valleys may be more frequently used by some birds, for example for hunting or during migration (Barrios and Rodríguez, 2004; Drewitt and Langston, 2008; Katzner *et al.* 2012; Thelander *et al.* 2003). In APWRA, Red-tailed Hawk fatalities occur more frequently than expected by chance at wind turbines located on ridge tops and swales, whereas Golden Eagle fatalities are higher at wind turbines located on slopes (Thelander *et al.* 2003). Other birds may follow other landscape features, such as peninsulas and shorelines, during dispersal and migration periods. Kitano and Shiraki (2013) found that the collision rate of White-tailed Eagles along a coastal cliff was extremely high, suggesting an effect of these landscape features on fatality rates.

The PAOI does not contain many landscape features as it is situated on a plateau. Bordering the PAOI to the south-west is a series of rugged mountains. The most significant landscape features at the PAOI from a

collision risk perspective are the ground dams, and the drainage lines (when flowing). Surface water attracts many birds, including Red Listed species such as Martial Eagle, Lanner Falcon, Black Stork, Blue Crane and Verreaux's Eagle.

- Flight paths

For territorial raptors like Golden Eagles (and Verreaux's Eagles – see Ralston-Patton 2017)), foraging areas are preferably located near to the nest, when compared to the rest of their home range. For example, in Scotland 98% of Golden Eagle movements were registered at ranges less than 6 km from the nest, and the core areas were located within a 2 - 3 km radius (McGrady *et al.* 2002). These results, combined with the terrain features selected by Golden Eagles to forage such as areas close to ridges, can be used to predict the areas used by the species to forage (McLeod *et al.* 2002), and therefore provide a sensitivity map and guidance to the development of new wind farms (Bright *et al.* 2006).

The only distinctive potential flight paths identified at the PAOI are the drainage lines, which may serve as a flight path for waterbirds when they flow. However, they are dry most of the time.

- Food availability

Factors that increase the use of a certain area or that attract birds, like food availability; also play a role in collision risk. For example, the high density of raptors at the APWRA and the high collision fatality due to collision with turbines is thought to result, at least in part, from high prey availability in certain areas (Hoover and Morrison, 2005; Smallwood *et al.* 2001). This may be particularly relevant for birds that are less aware of obstructions such as wind turbines while foraging (Krijgsveld *et al.* 2009; Smallwood *et al.* 2009). It is speculated that the mortality of three Verreaux's Eagles in 2015 at a wind farm site in South Africa may have been linked to the availability of food (Smallie 2015).

The current very low levels of bird activity at the proposed WEF could be partially attributed to the lack of food, brought about by the drought conditions which were prevalent during the pre-construction monitoring so far. This could change significantly if the site experiences average to above average rainfall for a number of years, which would result in better foraging conditions.

- Summary

The proposed WEF will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species i.e., mostly bustards such as Karoo Korhaan, although generally seem to be not as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Soaring priority species, i.e., raptors such as Martial Eagle, Pale Chanting Goshawk, Lanner Falcon, Booted Eagle and Greater Kestrel are most at risk of all the priority species likely to occur regularly at the project site. Verreaux's Eagle might also be at risk to some extent, although the species is unlikely to venture regularly into the PAOI.

In summary, the following priority species could be at risk of collisions with the turbines:

EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, H = High, M = Medium, L = Low

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status	Endemic (SA)	Likelihood of regular occurrence in the PAOI
Common Buzzard	*Buteo buteo*	3,45	0,00	-	-		L
Jackal Buzzard	*Buteo rufofuscus*	27,59	23,08	-	-	x	H
Double-banded Courser	*Rhinoptilus africanus*	3,45	0,00	-	-		M
Blue Crane	*Grus paradisea*	0,00	2,56	VU	NT		L
Booted Eagle	*Hieraaetus pennatus*	10,34	2,56	-	-		M
Martial Eagle	*Polemaetus bellicosus*	10,34	0,00	EN	EN		M
Verreaux's Eagle	*Aquila verreauxii*	37,93	12,82	-	VU		M
Spotted Eagle-Owl	*Bubo africanus*	10,34	0,00	-	-		M
Lanner Falcon	*Falco biarmicus*	0,00	2,56	-	VU		L
Grey-winged Francolin	*Scleroptila afra*	6,90	2,56	-	-	x	M
Pale Chanting Goshawk	*Melierax canorus*	13,79	12,82	-	-		H
Greater Kestrel	*Falco rupicoloides*	3,45	0,00	-	-		M
Karoo Korhaan	*Eupodotis vigorsii*	58,62	20,51	-	NT		H
Black Stork	*Ciconia nigra*	0,00	0,00	-	VU		L
Ludwig's Bustard	*Neotis ludwigii*	0,00	0,00	EN	EN		M

6.1.2 Displacement due to disturbance

The displacement of birds from areas within and surrounding wind farms due to visual intrusion and disturbance in effect can amount to habitat loss. Displacement may occur during both the construction and operation phases of wind farms and may be caused by the presence of the turbines themselves through visual, noise and vibration impacts, or as a result of vehicle and personnel movements related to site maintenance. The scale and degree of disturbance will vary according to site- and species-specific factors and must be assessed on a site-by-site basis (Drewitt & Langston 2006).

Unfortunately, few studies of displacement due to disturbance are conclusive, often because of the lack of before-and-after and control-impact (BACI) assessments. Indications are that Great Bustard *Otis tarda* could be displaced by wind farms up to one kilometre from the facility (Langgemach 2008). An Austrian study found displacement for Great Bustards up to 600m (Wurm & Kollar as quoted by Raab *et al.* 2009). However, there is also evidence to the contrary; information on Great Bustard received from Spain points to the possibility of continued use of leks at operational wind farms (Camiña 2012b). The same situation seems to prevail at wind farms in the Eastern Cape where Denham's Bustard are still using wind farm sites as leks.[5] Research on small grassland species in North America indicates that permanent displacement is uncommon and very species

[5] Personal communication by Wessel Rossouw, bird monitor based in Jeffreys Bay, from on personal observations in the Kouga municipal area.

specific (e.g. see Stevens et.al 2013, Hale et.al 2014). There also seems to be little evidence for a persistent decline in passerine populations at wind farm sites in the UK (despite some evidence of turbine avoidance), with some species, including Skylark, showing increased populations after wind farm construction (see Pierce-Higgins et. al 2012). Populations of Thekla Lark *Galerida theklae* were found to be unaffected by wind farm developments in Southern Spain (see Farfan *et al*. 2009).

The consequences of displacement for breeding productivity and survival are crucial to whether or not there is likely to be a significant impact on population size. However, studies of the impact of wind farms on breeding birds are also largely inconclusive or suggest lower disturbance distances, though this apparent lack of effect may be due to the high site fidelity and long life-span of the breeding species studied. This might mean that the true impacts of disturbance on breeding birds will only be evident in the longer term, when new recruits replace existing breeding birds. Few studies have considered the possibility of displacement for short-lived passerines (such as larks), although Leddy *et al.* (1999) found increased densities of breeding grassland passerines with increased distance from wind turbines, and higher densities in the reference area than within 80m of the turbines. A review of minimum avoidance distances of 11 breeding passerines were found to be generally <100m from a wind turbine ranging from 14 – 93m (Hötker *et al.* 2006). A comparative study of nine wind farms in Scotland (Pearce-Higgens *et al.* 2009) found unequivocal evidence of displacement: Seven of the 12 species studied exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with equivocal evidence of turbine avoidance in a further two. No species were more likely to occur close to the turbines. Levels of turbine avoidance suggest breeding bird densities may be reduced within a 500m buffer of the turbines by 15–53%, with Common Buzzard *Buteo buteo*, Hen Harrier *Circus cyaneus*, Golden Plover *Pluvialis apricaria*, Snipe *Gallinago gallinago*, Curlew *Numenius arquata* and Wheatear *Oenanthe oenanthe* most affected. In a follow-up study, monitoring data from wind farms located on unenclosed upland habitats in the United Kingdom were collated to test whether breeding densities of upland birds were reduced as a result of wind farm construction or during wind farm operation. Red Grouse *Lagopus lagopus scoticus*, Snipe *Gallinago gallinago* and Curlew *Numenius arquata* breeding densities all declined on wind farms during construction. Red Grouse breeding densities recovered after construction, but Snipe and Curlew densities did not. Post-construction Curlew breeding densities on wind farms were also significantly lower than reference sites. Conversely, breeding densities of Skylark *Alauda arvensis* and Stonechat *Saxicola torquata* increased on wind farms during construction. Overall, there was little evidence for consistent post-construction population declines in any species, suggesting that wind farm construction can have greater impacts upon birds than wind farm operation (Pierce-Higgens *et al.* 2012).

It is inevitable that a measure of displacement will take place for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species the most, as this could temporarily disrupt their reproductive cycle. Species which fall in this category are Ludwig's Bustard, Karoo Korhaan, Double-banded Courser, Grey-winged Francolin and Spotted Eagle-Owl. Some raptors might also be affected, e.g., Pale Chanting Goshawk which could potentially breed in the small *Vachellia* trees in the drainage lines. Some species might be able to recolonise the area after the completion of the construction phase, but for some species this might only be partially the case, resulting in lower densities than before once the WEF is operational, due to the disturbance factor of the operational turbines.

In summary, the following priority species are expected to be vulnerable to displacement due to disturbance:

EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, H = High , M = Medium, L = Low

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status	Endemic (SA)	Likelihood of regular occurrence in the PAOI
Jackal Buzzard	*Buteo rufofuscus*	27,59	23,08	-	-	x	H
Double-banded Courser	*Rhinoptilus africanus*	3,45	0,00	-	-		M
Blue Crane	*Grus paradisea*	0,00	2,56	VU	NT		L
Spotted Eagle-Owl	*Bubo africanus*	10,34	0,00	-	-		M
Grey-winged Francolin	*Scleroptila afra*	6,90	2,56	-	-	x	M
Pale Chanting Goshawk	*Melierax canorus*	13,79	12,82	-	-		H
Greater Kestrel	*Falco rupicoloides*	3,45	0,00	-	-		M
Karoo Korhaan	*Eupodotis vigorsii*	58,62	20,51	-	NT		H
African Rock Pipit	*Anthus crenatus*	13,79	0,00	NT	NT	x	M
Ludwig's Bustard	*Neotis ludwigii*	0,00	0,00	EN	EN		M

6.1.3 Displacement due to habitat loss

The scale of permanent habitat loss resulting from the construction of a wind farm and associated infrastructure depends on the size of the project but, in general, it is likely to be small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total PAOI (Fox *et al.* 2006 as cited by Drewitt & Langston 2006), though effects could be more widespread where developments interfere with hydrological patterns or flows on wetland or peatland sites (unpublished data). Some changes could also be beneficial. For example, habitat changes following the development of the Altamont Pass wind farm in California led to increased mammal prey availability for some species of raptor (for example through greater availability of burrows for Pocket Gophers *Thomomys bottae* around turbine bases), though this may also have increased collision risk (Thelander *et al.* 2003 as cited by Drewitt & Langston 2006).

However, the results of habitat transformation may be more subtle, whereas the actual footprint of the wind farm may be small in absolute terms, the effects of the habitat fragmentation brought about by the associated infrastructure (e.g. power lines and roads) may be more significant. Sometimes Great Bustard can be seen close to or under power lines, but a study done in Spain (Lane *et al.* 2001 as cited by Raab *et al.* 2009) indicates that the total observation of Great Bustard flocks was significantly higher further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard generally avoid the immediate proximity of roads within a 500m buffer. Bidwell (2004) found that Blue Cranes select nesting sites away from roads. This means that power lines and roads also cause loss and fragmentation of the habitat used by the population in addition to the potential direct mortality. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al.* 2010). It has been shown that fragmentation of natural grassland in Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Alan *et al.* 1997).

Marques *et al.* (2021) reviewed 71 peer-reviewed studies on displacement and compiled: (1) information on the geographical areas, type of wind farm, study design and bird groups studied; and (2) the evidence of displacement effects on different bird groups. They found that most studies have been conducted in Europe and North America, particularly in agricultural areas. About half of the studies did not find any effects, for wind farms both on land and at sea, while many studies (40.6%) found displacement effects, and a small proportion (7.7%) detected attraction, i.e., an increased abundance of birds around the wind farms. Relevant to this project, they found that waterfowl and raptors were significantly affected.

The network of roads is likely to result in significant habitat fragmentation, and it could have an effect on the density of several species, particularly larger terrestrial species such as Ludwig's Bustard and Karoo Korhaan, and raptors. Given the current density of the proposed turbine layout and associated road infrastructure, it is not expected that any priority species will be permanently displaced from the PAOI. The alternative substation locations are likely to be all situated in essentially the same habitat, i.e., Karoo scrub. The habitat is not particularly sensitive, as far as avifauna is concerned, therefore any of the alternative locations should be acceptable. The same goes for any alternative laydown and compound areas.

In summary, the following priority species are expected to be vulnerable to displacement due to habitat transformation:

EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, H = High, M = Medium, L = Low

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status	Endemic (SA)	Likelihood of regular occurrence in the PAOI
Common Buzzard	*Buteo buteo*	3,45	0,00	-	-		L
Jackal Buzzard	*Buteo rufofuscus*	27,59	23,08	-	-	x	H
Double-banded Courser	*Rhinoptilus africanus*	3,45	0,00	-	-		M
Blue Crane	*Grus paradisea*	0,00	2,56	VU	NT		L
Booted Eagle	*Hieraaetus pennatus*	10,34	2,56	-	-		M
Martial Eagle	*Polemaetus bellicosus*	10,34	0,00	EN	EN		M
Verreaux's Eagle	*Aquila verreauxii*	37,93	12,82	-	VU		M
Spotted Eagle-Owl	*Bubo africanus*	10,34	0,00	-	-		M
Lanner Falcon	*Falco biarmicus*	0,00	2,56	-	VU		L
Grey-winged Francolin	*Scleroptila afra*	6,90	2,56	-	-	x	M
Pale Chanting Goshawk	*Melierax canorus*	13,79	12,82	-	-		H
Greater Kestrel	*Falco rupicoloides*	3,45	0,00	-	-		M
Karoo Korhaan	*Eupodotis vigorsii*	58,62	20,51	-	NT		H
African Rock Pipit	*Anthus crenatus*	13,79	0,00	NT	NT	x	M

Ludwig's Bustard	*Neotis ludwigii*	0,00	0,00	EN	EN		M

6.1.4 Electrocution on the 33kV medium voltage network

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2000). The electrocution risk is largely determined by the design of the electrical hardware.

While the intention is to place the 33kV reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the poles could potentially pose an electrocution risk to raptors.

In summary, the following priority species are expected to be vulnerable to electrocution:

EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, H = High, M = Medium L = Low

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status	Endemic (SA)	Likelihood of regular occurrence in the PAOI
Common Buzzard	*Buteo buteo*	3,45	0,00	-	-		L
Jackal Buzzard	*Buteo rufofuscus*	27,59	23,08	-	-	x	H
Booted Eagle	*Hieraaetus pennatus*	10,34	2,56	-	-		M
Martial Eagle	*Polemaetus bellicosus*	10,34	0,00	EN	EN		M
Verreaux's Eagle	*Aquila verreauxii*	37,93	12,82	-	VU		M
Spotted Eagle-Owl	*Bubo africanus*	10,34	0,00	-	-		M
Lanner Falcon	*Falco biarmicus*	0,00	2,56	-	VU		L
Pale Chanting Goshawk	*Melierax canorus*	13,79	12,82	-	-		H
Greater Kestrel	*Falco rupicoloides*	3,45	0,00	-	-		M
Black Stork	*Ciconia nigra*	0,00	0,00	-	VU		L

6.1.5 Collisions with the 33kV medium voltage network

While the intention is to place the 33kV reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the line could potentially pose a collision risk to various species. In summary, the following priority species could be vulnerable to collisions with the 33kV medium voltage lines[6]:

EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern, H = High, M = Medium, L = Low

Species name	**Scientific name**	**Full protocol**	**Ad hoc protocol**	**Global status**	**Regional status**	**Endemic (SA)**	**Likelihood of regular occurrence in the PAOI**
Blue Crane	*Grus paradisea*	0,00	2,56	VU	NT		L
Karoo Korhaan	*Eupodotis vigorsii*	58,62	20,51	-	NT		H
Ludwig's Bustard	*Neotis ludwigii*	0,00	0,00	EN	EN		M

6.2 The identification and assessment of potential impacts: Wind Energy Facility

The potential impacts on avifauna identified during the pre-construction monitoring study are listed and assessed in the tables below.

The impact criteria are explained in **Appendix 6**.

[6] These include both wind and powerline priority species.

6.2.1 Construction Phase

- Displacement of priority species due to disturbance associated with the construction of the wind turbines and associated infrastructure.
- Displacement of priority species due to habitat transformation associated with the construction of the wind turbines and associated infrastructure.

Table 8: Rating of impacts: Construction Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Avifauna	Displacement due to disturbance associated with the construction of the wind turbines and associated infrastructure.	1	4	2	3	1	3	33		Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry.	1	4	2	3	1	2	22		Low
Avifauna	Displacement due to habitat transformation associated with the construction of the wind turbines and associated infrastructure.	1	3	2	2	3	2	22		Low	(1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. (2) Construction of new roads should only be considered if existing roads cannot	1	2	2	2	3	2	20		Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
											be upgraded. (3) The recommendations of biodiversity specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.									

6.2.2 Operational Phase

- Mortality due to collisions with the wind turbines.
- Mortality due to electrocutions on the overhead sections of the internal 33kV cables.
- Mortality due to collisions with the overhead sections of the internal 33kV cables.

Table 9: Rating of impacts: Operational Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operation Phase																				
Avifauna	Mortality of priority species due to collisions with the wind turbines.	2	3	2	3	3	3	39		Medium	(1) No turbines should be located in the buffer zones around major drainage lines, waterpoints and dams. (2) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015) to assess collision rates. (3) If at any time estimated collision rates indicate unacceptable mortality levels of priority species, i.e., if it exceeds the mortality threshold determined by the avifaunal specialist after consultation with other avifaunal specialists and BirdLife South Africa, additional measures will have to be implemented which could include shut down on demand or other proven measures.	2	2	2	2	3	2	22		Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operation Phase																				
											(4) It is recommended that all turbines must have 1/3 of one blade painted in signal red as a pre-cautionary measure. It is acknowledged that blade painting as a mitigation strategy is still in an experimental phase in South Africa, but research indicates that it has a very good chance of reducing raptor mortality, based on research conducted in Norway. If this is done as part of the blade manufacturing process, the costs will be negligible.									
Avifauna	Mortality of priority species due to electrocutions on the overhead sections of the internal 33kV cables.	2	3	1	3	3	2	24		Medium	(1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively	2	2	1	2	3	1	10		Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operation Phase																				
											for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015).									
Avifauna	Mortality due to collisions with the overhead sections of the internal 33kV cables.	2	3	2	3	3	2	26		Medium	Bird flight diverters should be installed on all the overhead line sections for the full span length according to the applicable Eskom standard at the time.	2	1	1	2	3	1	9		Low

6.2.3 Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning (dismantling) of the wind turbines and associated infrastructure.

Table 10: Rating of impacts: Decommissioning Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Decommissioning Phase																				
Avifauna	Displacement due to disturbance associated with the dismantling of the wind turbines and associated infrastructure.	1	4	1	2	1	2	18		Low	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry.	1	3	1	2	1	2	16		Low

6.3 The identification of environmental sensitivities: Wind Energy facility

The following environmental sensitivities were identified from an avifaunal perspective for the proposed wind energy facility:

6.3.1 High sensitivity No-turbine buffer: Surface water.

Included in this category are areas within 200m of pans and earth dams, and 150m from all major drainage lines. Surface water in this arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon, Black Stork, Blue Crane and Verreaux's Eagle, and many non-priority species, including several waterbirds. Drainage lines when flowing attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Wind turbines that are placed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds.

See **Error! Reference source not found.** 15 for a map indicating the No-turbine buffers.

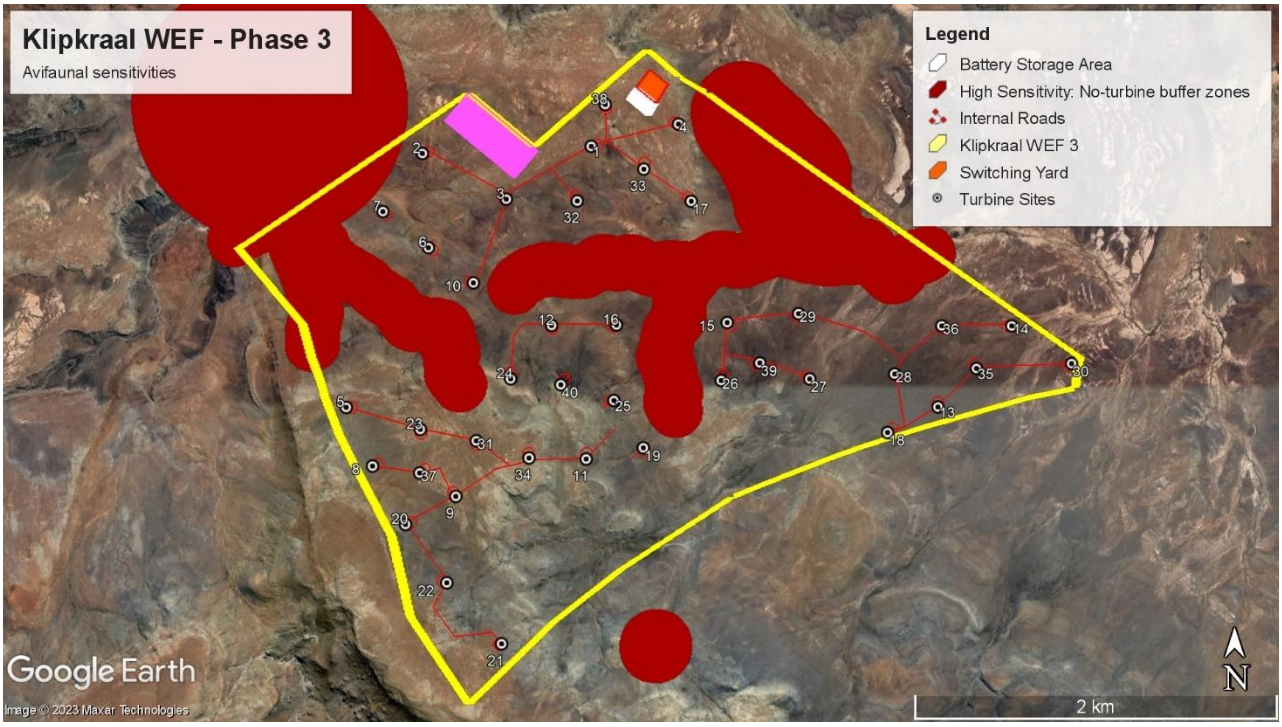

Figure 15: Proposed no-turbine zones. Avifaunal sensitivities for the Klipkraal WEF 3 project.

6.4 Cumulative impacts

There are no other proposed renewable energy projects within a 35km radius of the proposed Klipkraal WEF development (**Figure 16**). The maximum number of wind turbines which are currently proposed for the Klipkraal WEFs (1 – 5) is 200. None of these have been constructed to date, and each of the proposed project must still be subject to a competitive bidding process where only the most competitive projects will obtain a power purchase agreement required for the project to proceed to construction. It is therefore unlikely that a total of 200 turbines will actually be constructed, but due to the possibility that it could happen, the precautionary principle must be applied, and it must be assumed that it will be the case. The Klipkraal WEF 3 will consist of up to 40 turbines. The 40 turbines of Klipkraal WEF 3 constitute 20% of the total number of planned turbines. As such, its contribution to the total number of turbines, and by implication the cumulative impact of all the planned turbines, is moderate. The density of planned turbines in the 35km radius equates to 1 turbine per 1 924 ha, which is low, therefore the cumulative impact of all the planned turbines within the 35km radius is also considered to be low at this stage, as far as potential mortality of avifauna due to turbine collisions are concerned.

The total affected land parcel area where turbines are planned, including the Klipkraal WEF 3, adds up to approximately 6339 ha, which constitutes about 1.6% of the total area (approximately 384,800 ha) of similar habitat available to birds in the 35km radius around the project. The potential cumulative displacement impact due to habitat transformation, of the planned Klipkraal WEFs 1 – 5 at the time of writing, is therefore still relatively low within the area contained in the 35km radius. The affected land parcel area of the proposed Klipkraal WEF 3 amounts to about 0.2% of the total habitat available in the 35km radius. The contribution of the Klipkraal WEF 3 to the cumulative impact of all the renewable energy facilities is therefore very low as far as potential displacement of priority species due to habitat transformation is concerned. The cumulative impact of all the planned renewable energy facilities in this area is assessed to be **low** pre-mitigation and post-mitigation.

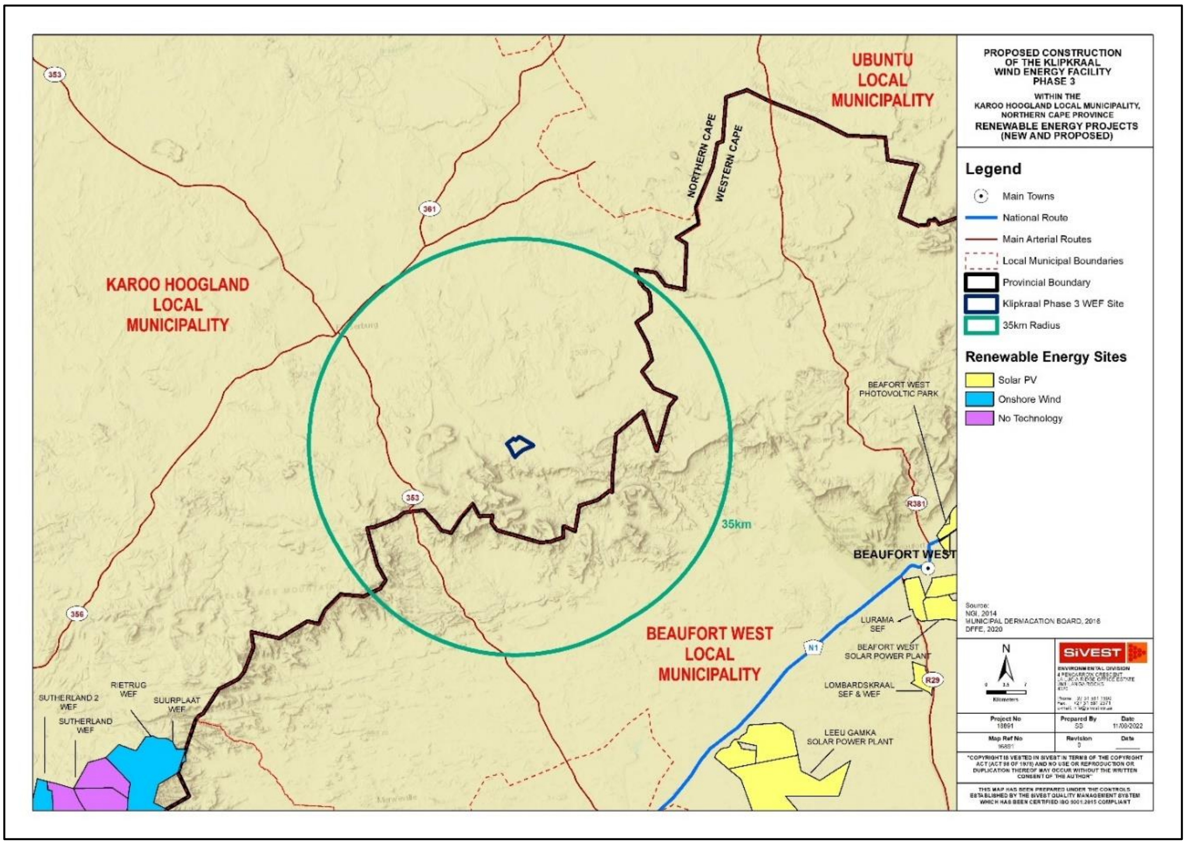

Figure 16: Proposed renewable energy projects within a 35km radius around the proposed Klipkraal WEF 3 site.

7. COMPARATIVE ASSESSMENT OF ALTERNATIVES

7.1 Wind Energy Facility

The final Klipkraal WEF 3 layout, including the location of the on-site switching yard, the BESS, the site offices and buildings, the internal roads, and the turbines, has been determined. The Klipkraal WEF 3 project site is approximately 799ha in extent. The final layout and design alternative was considered and assessed as part of the EIA.

7.2 No-Go Alternative

7.2.1 Wind Energy Facility

The no-go alternative will result in the current *status quo* being maintained as far as the avifauna is concerned. The low human population in the area is definitely advantageous to sensitive avifauna, especially Red Data species. The no-go option would eliminate any additional impact on the ecological integrity of the proposed PAOI as far as avifauna is concerned.

8. CONCLUSION AND SUMMARY

8.1 Summary of Findings

The proposed Klipkraal WEF 3 will have several potential impacts on priority avifauna. These impacts are the following:

- Displacement of priority species due to disturbance linked to construction activities in the construction phase.
- Displacement due to habitat transformation in the construction phase.
- Collision mortality caused by the wind turbines in the operational phase.
- Electrocution on the 33kV MV overhead lines (if any) in the operational phase.
- Collisions with the 33kV MV overhead lines (if any) in the operational phase.
- Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

8.1.1 Displacement of priority species due to disturbance linked to construction activities in the construction phase.

It is inevitable that a measure of displacement will take place for all priority species during the construction phase, due to the disturbance factor associated with the construction activities. This is likely to affect ground nesting species the most, as this could temporarily disrupt their reproductive cycle. Species which fall in this category are Ludwig's Bustard, Jackal Buzzard, Karoo Korhaan, Double-banded Courser, Grey-winged

Francolin, Pale Chanting Goshawk, African Rock Pipit, and Spotted Eagle-Owl. Some raptors might also be affected, e.g., Pale Chanting Goshawk which could potentially breed in the small *Vachellia* trees in the drainage lines. Some species might be able to recolonise the area after the completion of the construction phase, but for some species this might only be partially the case, resulting in lower densities than before once the WEF is operational, due to the disturbance factor of the operational turbines. The impact is rated as **medium** but could be mitigated to **low** levels.

8.1.2 Displacement due to habitat transformation in the construction phase.

The network of roads is likely to result in significant habitat fragmentation, and it could impact on the density of several species, particularly larger terrestrial species such as Ludwig's Bustard, Karoo Korhaan, and raptors like Martial Eagle and several other non-threatened raptors. However, given the expected density of the proposed turbine layout and associated road infra-structure, it is not expected that any priority species will be permanently displaced from the development site. The building infrastructure and substations will all be situated in the same habitat, i.e., Karoo scrub. The habitat is not particularly sensitive, as far as avifauna is concerned, therefore the impact of the habitat transformation will be low given the extent of available habitat and the size of the physical project footprint. The impact is rated as **low** both pre- and post-mitigation.

8.1.3 Collision mortality caused by the wind turbines in the operational phase.

The proposed Klipkraal WEF will pose a collision risk to several priority species which could occur regularly at the site. Species exposed to this risk are large terrestrial species i.e., Karoo Korhaan and Ludwig's Bustard, although generally they seem to not be as vulnerable to turbine collisions as was originally anticipated (Ralston-Paton & Camagu 2019). Of all the priority species likely to occur regularly at the project site, soaring species, i.e., raptors such as Martial Eagle, Pale Chanting Goshawk, Lanner Falcon, Booted Eagle, and Greater Kestrel are the most at risk of collision, and also the non-raptorial Black Stork. Verreaux's Eagle might also be at risk to some extent, although the species is unlikely to venture regularly within the PAOI. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

8.1.4 Electrocution on the 33kV MV overhead lines (if any) in the operational phase.

While the intention is to place the 33kV reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the poles could potentially pose an electrocution risk to raptors, including Red Data species such as Martial Eagle and Verreaux's Eagle. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

8.1.5 Collisions with the 33kV MV overhead lines (if any) in the operational phase.

While the intention is to place the 33kV reticulation network underground where possible, there are areas where the lines might have to run above ground, for technical reasons. In these instances, the line could potentially pose a collision risk to various species, particularly large terrestrial species including Red Data species such as Ludwig's Bustard, Karoo Korhaan, and various waterbirds when the dams are full, and the drainage lines contain water, e.g. Blue Crane. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

8.1.6 Displacement of priority species due to disturbance linked to dismantling activities in the decommissioning phase.

The impact is likely to be similar in nature to the construction phase.

Table 11 summarises the expected impacts of the proposed WEF and proposed mitigation measures per impact.

Table 11: Overall Impact Significance for the WEF (Pre- and Post-Mitigation)

Nature of impact and Phase	Overall Impact Significance (Pre -Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
Construction: Displacement due to disturbance	Medium	(1) Construction activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry.	Low
Construction: Displacement due to habitat transformation	Low	(1) Removal of vegetation must be restricted to a minimum and must be rehabilitated to its former state where possible after construction. (2) Construction of new roads should only be considered if existing roads cannot be upgraded. (3) The recommendations of the biodiversity specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	Low
Operational: Collisions with the turbines	Medium	(1) No turbines should be located in the buffer zones around major drainage lines, waterpoints and dams. (2) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015) to assess collision rates. (3) If at any time estimated collision rates indicate unacceptable mortality levels of priority species, i.e., if it exceeds the mortality threshold determined by the avifaunal specialist after consultation with other avifaunal specialists and BirdLife South Africa, additional measures will have to be implemented	Low

Nature of impact and Phase	Overall Impact Significance (Pre -Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
		which could include shut down on demand or other proven measures. (4) It is recommended that all turbines must have 1/3 of one blade painted in signal red as a pre-cautionary measure. It is acknowledged that blade painting as a mitigation strategy is still in an experimental phase in South Africa, but research indicates that it has a very good chance of reducing raptor mortality, based on research conducted in Norway. If this is done as part of the blade manufacturing process, the costs will be negligible.	
Operational: Electrocutions on the 33kV MV network	Medium	(1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al.* 2015).	Low
Operational: Collisions with the 33kV MV network	Medium	Bird flight diverters must be installed on all the overhead line sections for the full span length according to the latest Eskom standard.	Low
Decommissioning: Displacement due to disturbance	Medium	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary	Low

Nature of impact and Phase	Overall Impact Significance (Pre -Mitigation)	Proposed mitigation	Overall Impact Significance (Post - Mitigation)
		disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry.	

8.2 Conclusion and Impact Statement

The proposed Klipkraal WEF will have a moderate impact on avifauna which, in most instances, and could be reduced to a low impact through appropriate mitigation. No fatal flaws were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report and the EMPr (**Appendix 8**) are strictly implemented.

9. FINAL LAYOUT

The final Klipkraal WEF 3 layout, including the location of the on-site switching yard, the BESS, the site offices and buildings, the internal roads, and the turbines, has been determined. The Klipkraal WEF 3 project site is approximately 799ha in extent. The final layout and design alternative was considered and assessed as part of the EIA. Mitigation measures to reduce impacts on avifauna are set out in the Environmental Management Programme (EMPr) (**Appendix 8**).

The following environmental sensitivities were identified from an avifaunal perspective for the proposed wind energy facility (**Figure 17**):

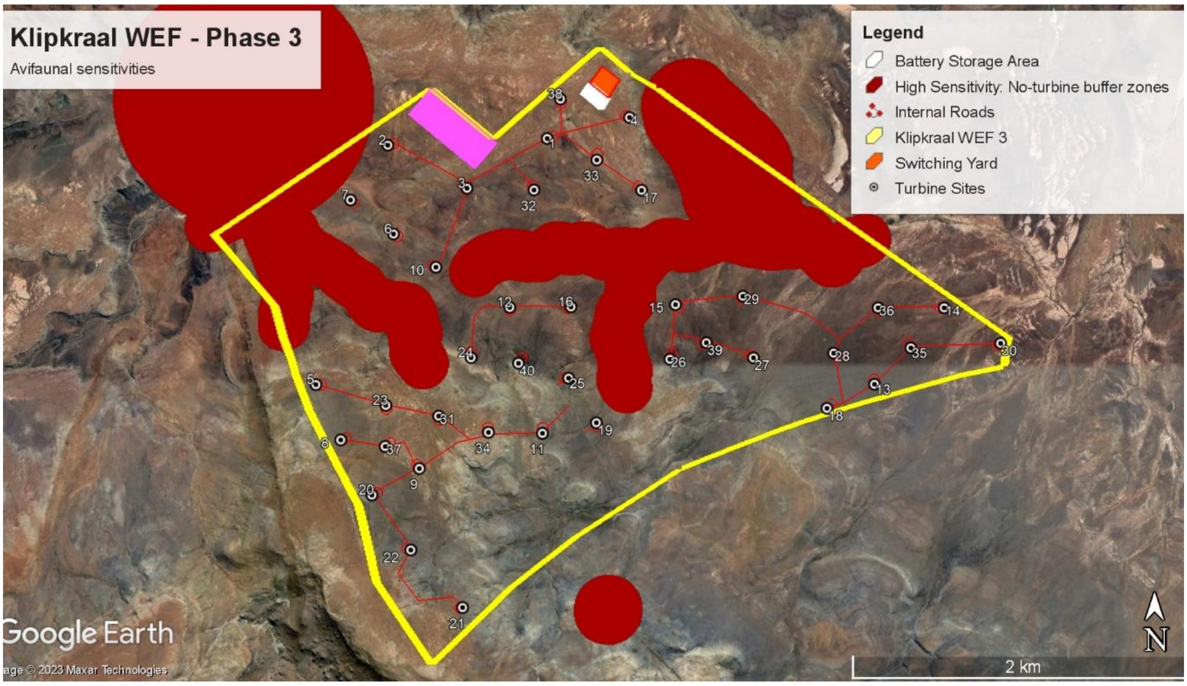

Figure 17: Avifaunal sensitivities for the Klipkraal WEF 3 project.

10. POST CONSTRUCTION MONITORING

The new procedures and minimum criteria for reporting on identified environmental themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA came into force in March 2020. According to these regulations, a detailed post-construction monitoring programme must be included as part of the bird specialist study. See **Appendix 9** for a proposed programme.

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APPENDIX 1: TERMS OF REFERENCE

SPECIALIST REPORT REQUIREMENTS

1.1 Site Sensitivity Verification and Reporting

The requirements for Specialist Studies being undertaken in support of applications for Environmental Authorisation are specified in **Appendix 6** of the 2014 NEMA EIA Regulations (as amended), as well as the Assessment Protocols that were published on 20 March 2020, in Government Gazette 43110, GN 320. These protocols stipulate the 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, when applying for EA.

The Assessment Protocols as per GN320 are as follows:

- **PART A:** This relates to the Site Sensitivity Verification (SSV) and Reporting requirements where a Specialist Assessment is required but no specific Assessment Protocol has been prescribed. In this instance, specialist assessment must comply with **Appendix 6** of the 2014 NEMA EIA Regulations (as amended). However, the current use of the land and the environmental sensitivity of the site under consideration as identified by the DFFE Screening Tool must be verified and confirmed and an SSV report must be compiled and included as an appendix to the Specialist Assessment. Where there are no sensitivity layers on the Screening Tool for a particular Specialist Assessment, then this must be stated in the actual Specialist Assessment and in the accompanying SSV report.
- **PART B:** This relates to the Site Sensitivity Verification (SSV) and Reporting requirements where a Specialist Assessment is required and a specific Assessment Protocol has been prescribed. The following Assessment Protocols are relevant to the proposed project:
    - Agriculture
    - Terrestrial Biodiversity
    - Aquatic Biodiversity
    - Avifauna
    - Civil Aviation
    - Defence
    - Noise Assessment
    - Terrestrial Plant Species
    - Terrestrial Animal Species

1.2 Specialist Assessment Reports / Compliance Statements

Specialists are requested to provide ***one (1)*** scoping phase report and / or compliance statement that provides an assessment of the proposed Klipkraal WEF ***and*** the associated grid connection infrastructure (132kV overhead power line on-site switching / collector substation). The report should however include separate assessment and impact rating chapters/sections for the WEF and the grid connection proposals respectively.

During the EIA phase, specialists will be required to update the scoping phase specialist report to provide a review of their findings in accordance with revised site layouts and to address any comments or concerns arising from the public participation process.

The specialist assessment reports and / or compliance statements should include the following sections:

1.2.1 Project Description

The specialist report must include the project description as provided above.

1.2.2 Terms of Reference

The specialist report must include an explanation of the terms of reference (TOR) applicable to the specialist study. Where relevant, a table must be provided at the beginning of the specialist report, listing the requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations, 2014 (as amended) and cross referencing these requirements with the relevant sections in the report. An MS Word version of this table will be provided by SiVEST.

1.2.3 Legal Requirements and Guidelines

The specialist report must include a thorough overview of all applicable best practice guidelines, relevant legislation, prescribed Assessment Protocols and authority requirements.

1.2.4 Methodology

The report must include a description of the methodology applied in carrying out the specialist assessment.

1.2.5 Specialist Findings / Identification of Impacts

The report must present the findings of the specialist studies and explain the implications of these findings for the proposed development (e.g. permits, licenses etc.). This section of the report should also identify any sensitive and/or 'no-go' areas on the PAOI or within the power line assessment corridors. These areas must be mapped clearly with a supporting explanation provided.

This section of the report should also specify if any further assessment will be required.

1.2.6 Environmental Impact Assessment

The impacts (both direct and indirect) of the proposed WEF and the proposed grid connection infrastructure (during the Construction, Operation and Decommissioning phases) are to be assessed and rated *separately* according to the methodology developed by SiVEST. Specialists will be required to make use of the impact rating matrix provided (in Excel format) for this purpose, and *separate tables* must be provided for the WEF and for the grid connection infrastructure respectively. **Please note that the significance of Cumulative Impacts should also be rated in this section.** Both the methodology and the rating matrix will be provided by SiVEST.

Please be advised that this section must include mitigation measures aimed at minimising the impact of the proposed development.

1.2.7 Input to The Environmental Management Programme (EMPr)

The report must include a description of the key monitoring recommendations for each applicable mitigation measure identified for each phase of the project for inclusion in the Environmental Management Programme (EMPr) or Environmental Authorisation (EA).

Please make use of the Impact Rating Table (in Excel format) for each of the phases i.e. Design, Construction, Operation and Decommissioning.

1.2.8 Cumulative Impact Assessment

Cumulative impact assessments must be undertaken for the proposed WEF and associated grid connection infrastructure to determine the cumulative impact that will materialise if other Renewable Energy Facilities (REFs) and large scale industrial developments are constructed within 35kms of the proposed development.

The cumulative impact assessment must contain the following:

- A cumulative environmental impact statement noting whether the overall impact is acceptable; and
- A review of the specialist reports undertaken for other REFs and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered.

In order to assist the specialists in this regard, SiVEST will provide the following documentation/data:

- A summary table listing all REFs identified within 35kms of the proposed WEF;
- A map showing the location of the identified REFs; and
- KML files.

It should be noted that it is the specialist's responsibility to source the relevant EIA / BA reports that are available in the public domain. SiVEST will assist, where possible.

1.2.9 No Go Alternative

Consideration must be given to the “no-go” option in the EIA process. The “no-go” option assumes that the site remains in its current state, i.e. there is no construction of a WEF and associated infrastructure in the proposed project area and the status quo would be preserved.

1.2.10 Comparative Assessment of Alternatives

As mentioned, alternatives for the Substation location, construction / laydown area and power line route alignment have been identified. These alternatives are being considered as part of the EIA / BA processes and as such specialists are required to undertake a comparative assessment of the alternatives mentioned above as per the latest table provided by SiVEST.

1.2.11 Conclusion / Impact Statement

The conclusion section of the specialist report must include an Impact Statement, indicating whether any fatal flaws have been identified and ultimately whether the proposed development can be authorised or not (i.e. whether EA should be granted / issued or not).

1.2.12 Executive Summary

Specialists must provide an Executive Summary summarising the findings of their report to allow for easy inclusion in the EIA / BA reports.

1.2.13 Specialist Declaration of Independence

A copy of the Specialist Declaration of Interest (DoI) form, containing original signatures, must be appended to all Draft and Final Reports. This form will be provided to the specialists. *Please note that the undertaking / affirmation under oath section of the report must be signed by a Commissioner* of Oaths.

APPENDIX 2: SPECIALIST CV

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	26 years

Key Experience

Chris van Rooyen has twenty-six years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies and avifaunal monitoring for wind-powered generation facilities:

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)

20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring project
24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring
25. Namies – Aggenys Wind Energy Project – 12-month bird monitoring
26. Pofadder - Wind Energy Project – 12-month bird monitoring
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12-month bird monitoring
28. Waaihoek – Utrecht Wind Energy Project – 12-month bird monitoring
29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Maralla Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
46. Dassieklip Wind Energy Facility 3 years post-construction monitoring (Biotherm)
47. Loeriesfontein 2 Wind Energy Facility 2 years post-construction monitoring (Mainstream)
48. Khobab Wind Energy Facility 2 years post-construction monitoring (Mainstream)
49. Excelsior Wind Energy Facility 18 months construction phase monitoring (Biotherm)
50. Boesmansberg Wind Energy Facility 12-months pre-construction bird monitoring (juwi)
51. Mañhica Wind Energy Facility, Mozambique, 12-months pre-construction monitoring (Windlab)
52. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
53. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO).
54. Klipkraal and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
55. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
56. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
57. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
58. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
59. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
60. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
61. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
62. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
63. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)

64. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
65. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
66. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)
67. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
68. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
69. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape
4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Namakwa Solar Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape
13. ABO Vryburg 1,2,3 Solar PV Project, Vryburg, North-West
14. NamPower CSP Facility near Arandis, Namibia
15. Dayson Klip PV Facility near Upington, Northern Cape
16. Geelkop PV Facility near Upington, Northern Cape
17. Oya PV Facility, Ceres, Western Cape
18. Vrede and Rondawel PV Facilities, Free State
19. Kolkies & Sadawa PV Facilities, Western Cape
20. Leeuwbosch PV1 and 2 and Wildebeeskuil PV1 and 2 Facilities, North-West
21. Kenhardt PV 3,4 and 5, Northern Cape
22. Wittewal PV, Grootfontein PV and Hoekdoornen PV Facilities, Touws River, Western Cape

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)

20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV

74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV
94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV

129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

Bird Impact Assessment Studies for the following residential and industrial developments:

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra –"Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works, Gauteng.
11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng
25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Curriculum vitae: Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	24 years

Key Qualifications

Albert Froneman (*Pr.Sci.Nat*) has more than two decades of experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

Key Project Experience

Renewable Energy Facilities – avifaunal monitoring projects in association with Chris van Rooyen Consulting

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oysterbay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project
6. Laingsburg Spitskopvlakte Wind Energy Project – 12-months preconstruction avifaunal monitoring project
7. Loeriesfontein Wind Energy Project Phase 1, 2 & 3 – 12-months preconstruction avifaunal monitoring project
8. Noupoort Wind Energy Project – 12-months preconstruction avifaunal monitoring project
9. Vleesbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
10. Port Nolloth Wind Energy Project – 12-months preconstruction avifaunal monitoring project
11. Langhoogte Caledon Wind Energy Project – 12-months preconstruction avifaunal monitoring project
12. Lunsklip – Stilbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
13. Indwe Wind Energy Project – 12-months preconstruction avifaunal monitoring project
14. Zeeland St Helena bay Wind Energy Project – 12-months preconstruction avifaunal

monitoring project

15. Wolseley Wind Energy Project – 12-months preconstruction avifaunal monitoring project
16. Renosterberg Wind Energy Project – 12-months preconstruction avifaunal monitoring project
17. De Aar – North (Mulilo) Wind Energy Project – 12-months preconstruction avifaunal monitoring project (2014)
18. De Aar – South (Mulilo) Wind Energy Project – 12-months bird monitoring
19. Namies – Aggenys Wind Energy Project – 12-months bird monitoring
20. Pofadder - Wind Energy Project – 12-months bird monitoring
21. Dwarsrug Loeriesfontein - Wind Energy Project – 12-months bird monitoring
22. Waaihoek – Utrecht Wind Energy Project – 12-months bird monitoring
23. Amathole – Butterworth Wind Energy Project – 12-months bird monitoring & EIA specialist study
24. De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
25. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
26. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
27. Aletta Wind Energy Facility 12-month bird monitoring (Biotherm)
28. Maralla Wind Energy Facility 12-month bird monitoring (Biotherm)
29. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
30. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
31. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
32. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
33. KurumanWind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
34. Mañhica Wind Energy Facility 12-month bird monitoring & EIA specialist study (Windlab)
35. Klipheuwel-Dassiefontein Wind Energy Facility, Caledon, Western Cape – Operational phase bird monitoring – Year 5 (Klipheuwel-Dassiefontein Wind Energy Facility)
36. Kwagga Wind Energy Facility, Beaufort West, 12-months pre-construction monitoring (ABO)
37. Pienaarspoort Wind Energy Facility, Touws River, Western Cape, 12-months pre-construction monitoring (ABO). Klipkraal and 2 Wind Energy Facilities, Beaufort West, Western Cape, 12 months pre-construction monitoring (Genesis Eco-energy)
38. Duiker Wind Energy Facility, Vredendal, Western Cape 12 months pre-construction monitoring (ABO)
39. Perdekraal East Wind Energy Facility, Touws River, Western Cape, 18 months construction phase monitoring (Mainstream).
40. Swellendam Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Veld Renewables)
41. Lombardskraal Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (Enertrag SA)
42. Mainstream Kolkies & Heuweltjies Wind Energy Facilities, Western Cape, 12-month pre-construction monitoring (Mainstream)
43. Great Karoo Wind Energy Facility, Northern Cape, 12-month pre-construction monitoring (African Green Ventures).
44. Mpumalanga & Gauteng Wind and Hybrid Energy Facilities (6x), pre-construction monitoring (Enertrag SA)
45. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (Enertrag SA)
46. Dordrecht Wind Energy Facilities, Eastern Cape, Screening Report (ACED)
47. Nanibees North & South Wind Energy Facilities, Northern Cape, Screening Report (juwi)
48. Kappa Solar PV facility, Touwsrivier, Western Cape, pre-construction monitoring (Veroniva)
49. Sutherland Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
50. Pofadder Wind Energy Facility, Northren Cape, Screening Report (Atlantic Energy)

51. Haga Haga Wind Energy Facility, Eastern Cape, Amendment Report (WKN Windcurrent)
52. Banken Wind Energy Facility, Northern Cape, Screening Report (Atlantic Energy)
53. Hartebeest Wind Energy Facility, Western Cape, 12-month pre-construction monitoring (juwi).
54. Iphiko Wind Energy facilities, Laingsburg, Western Cape, screening and pre-construction monitoring (G7 Energies)
55. Kangnas Wind Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
56. Perdekraal East Wind Energy Facility, Northern Cape, Operational Phase 2 years avifaunal monitoring (Mainstream)
57. Aberdeen 1, 2 & Aberdeen Kudu (3&4) Wind Energy Facilities, Eastern Cape, 12- month pre-construction monitoring (Atlantic Renewable Energy Partners)
58. Loxton / Beaufort West Wind Energy Facilities, Northern Cape, 12-month pre-construction monitoring (Genesis Eco-Energy Developments)
59. Ermelo & Volksrust Wind Energy Facilities, Northern Cape, Screening Report (WKN Windcurrent)
60. Aardvark Solar PV facility, Copperton, Northern Cape, 12-month pre-construction monitoring (ABO)
61. Bestwood Solar PV facility, Kathu, Northern Cape, pre-construction monitoring (AMDA)
62. Boundary Solar PV facility, Kimberley, Northern Cape, Site sensitivity verification (Atlantic Renewable Energy Partners)
63. Excelsior Wind Energy Facility, Swellendam, Western Cape, Operational Phase 2 years avifaunal monitoring & implementation of Shut Down on Demand (SDOD) pro-active mitigation strategy (Biotherm)
64. De Aar cluster Solar PV facilities, De Aar, Western Cape, Site sensitivity verification (Atlantic Renewable Energy Partners)
65. Rinkhals Solar PV facilities, Kimberley, Northern Cape, Pre-construction monitoring (ABO)
66. Kolkies Sadawa Solar PV facilities, Touwsrivier, Western Cape, pre-construction monitoring (Mainstream)
67. Leeudoringstad Solar PV facilities, Leeudoringstad, North West, Pre-construction monitoring (Upgrade Energy)
68. Noupoort Umsobomvu Solar PV facilities, Noupoort, Northern Cape, Pre-construction monitoring (EDF Renewables)
69. Oya Solar PV facilities, Matjiesfontein, Western Cape, pre-construction monitoring (G7 Energies)
70. Scafell Solar PV facilities, Sasolburg, Free state, pre-construction monitoring (Mainstream)
71. Vrede & Rondawel Solar PV facilities, Kroonstad, Free state, pre-construction monitoring (Mainstream)
72. Gunstfontein Wind Energy Facilities, Sutherland, Northern Cape, additional pre-construction monitoring (ACED)
73. Ezelsjacht Wind Energy Facility, De Doorns, Western Cape, pre-construction monitoring (Mainstream)
74. Klipkraal Wind Energy Facility Phase 1, Fraserburg, Northern Cape, avifaunal screening (Klipkraal WEF)
75. Pofadder Wind Energy Facility, Pofadder, Northern Cape, pre-construction monitoring (Atlantic Renewable Energy Partners)

Bird Impact Assessment studies and / or GIS analysis:

1. Aviation Bird Hazard Assessment Study for the proposed Madiba Bay Leisure Park adjacent to Port Elizabeth Airport.
2. Extension of Runway and Provision of Parallel Taxiway at Sir Seretse Khama Airport, Botswana Bird / Wildlife Hazard Management Specialist Study
3. Maun Airport Improvements Bird / Wildlife Hazard Management Specialist Study
4. Bird Impact Assesment Study - Bird Helicopter Interaction – The Bitou River, Western Cape Province South Africa
5. Proposed La Mercy Airport – Bird Aircraft interaction specialists study using bird detection radar to assess swallow flocking behaviour
6. KwaZulu Natal Power Line Vulture Mitigation Project – GIS analysis
7. Perseus-Zeus Powerline EIA – GIS Analysis
8. Southern Region Pro-active GIS Blue Crane Collision Project.
9. Specialist advisor ~ Implementation of a bird detection radar system and development of an airport wildlife hazard management and operational environmental management plan for the King Shaka International Airport
10. Matsapha International Airport – bird hazard assessment study with management recommendations
11. Evaluation of aviation bird strike risk at candidate solid waste disposal sites in the Ekurhuleni Metropolitan Municipality
12. Gateway Airport Authority Limited – Gateway International Airport, Polokwane: Bird hazard assessment; Compile a bird hazard management plan for the airport
13. Bird Specialist Study - Evaluation of aviation bird strike risk at the Mwakirunge Landfill site near Mombasa Kenya
14. Bird Impact Assessment Study - Proposed Weltevreden Open Cast Coal Mine Belfast, Mpumalanga
15. Avian biodiversity assessment for the Mafube Colliery Coal mine near Middelburg Mpumalanga
16. Avifaunal Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
17. Avifaunal Impact Assessment Study (with specific reference to African Grass Owls and other Red List species) Stone Rivers Arch
18. Airport bird and wildlife hazard management plan and training to Swaziland Civil Aviation Authority (SWACAA) for Matsapha and Sikhupe International Airports.Bird Impact Assessment Study - Proposed 60 year Ash Disposal Facility near to the Kusile Power Station
19. Avifaunal pre-feasibility assessment for the proposed Montrose dam, Mpumalanga
20. Bird Impact Assessment Study – Proposed ESKOM Phantom Substation near Knysna, Western Cape
21. Habitat sensitivity map for Denham's Bustard, Blue Crane and White-bellied Korhaan in the Kouga Municipal area of the Eastern Cape Province
22. Swaziland Civil Aviation Authority – Sikhuphe International Airport – Bird hazard management assessment
23. Avifaunal monitoring – extension of Specialist Study - SRVM Volspruit Mining project – Mokopane Limpopo Province
24. Avifaunal Specialist Study – Meerkat Hydro Electric Dam – Hope Town, Northern Cape
25. The Stewards Pan Reclamation Project – Bird Impact Assessment study
26. Airports Company South Africa – Avifaunal Specialist Consultant – Airport Bird and Wildlife Hazard Mitigation
27. Strategic Environmental Assessment For Gas Pipeline Development, CSIR
28. Avifaunal Specialist Assessment - Proposed monopole telecommunications mast – Roodekrans, Roodepoort, Gauteng (Enviroworks)
29. Gromis-Nama-Aggeneis 400kv Ipp Integration: Environmental Screening - Avifaunal

Specialist Desktop Study

30. Melkspruit - Rouxville 132kV Distribution Line - Avifaunal Amendment and Walk-through Report
31. Gamma - Kappa 2nd 765kV transmission line – Avifaunal impact assessment GIS analysis

Geographic Information System analysis & maps

1. ESKOM Power line Makgalakwena EIA – GIS specialist & map production
2. ESKOM Power line Benficosa EIA – GIS specialist & map production
3. ESKOM Power line Riversong EIA – GIS specialist & map production
4. ESKOM Power line Waterberg NDP EIA – GIS specialist & map production
5. ESKOM Power line Bulge Toulon EIA – GIS specialist & map production
6. ESKOM Power line Bulge DORSET EIA – GIS specialist & map production
7. ESKOM Power lines Marblehall EIA – GIS specialist & map production
8. ESKOM Power line Grootpan Lesedi EIA – GIS specialist & map production
9. ESKOM Power line Tanga EIA – GIS specialist & map production
10. ESKOM Power line Bokmakierie EIA – GIS specialist & map production
11. ESKOM Power line Rietfontein EIA – GIS specialist & map production
12. Power line Anglo Coal EIA – GIS specialist & map production
13. ESKOM Power line Camcoll Jericho EIA – GIS specialist & map production
14. Hartbeespoort Residential Development – GIS specialist & map production
15. ESKOM Power line Mantsole EIA – GIS specialist & map production
16. ESKOM Power line Nokeng Flourspar EIA – GIS specialist & map production
17. ESKOM Power line Greenview EIA – GIS specialist & map production
18. Derdepoort Residential Development – GIS specialist & map production
19. ESKOM Power line Boynton EIA – GIS specialist & map production
20. ESKOM Power line United EIA – GIS specialist & map production
21. ESKOM Power line Gutshwa & Malelane EIA – GIS specialist & map production
22. ESKOM Power line Origstad EIA – GIS specialist & map production
23. Zilkaatsnek Development Public Participation –map production
24. Belfast – Paarde Power line - GIS specialist & map production
25. Solar Park Solar Park Integration Project Bird Impact Assessment Study – avifaunal GIS analysis.
26. Kappa-Omega-Aurora 765kV Bird Impact Assessment Report – Avifaunal GIS analysis.
27. Gamma – Kappa 2nd 765kV – Bird Impact Assessment Report – Avifaunal GIS analysis.
28. ESKOM Power line Kudu-Dorstfontein Amendment EIA – GIS specialist & map production.
29. Proposed Heilbron filling station EIA – GIS specialist & map production
30. ESKOM Lebatlhane EIA – GIS specialist & map production
31. ESKOM Pienaars River CNC EIA – GIS specialist & map production
32. ESKOM Lemara Phiring Ohrigstad EIA – GIS specialist & map production
33. ESKOM Pelly-Warmbad EIA – GIS specialist & map production
34. ESKOM Rosco-Bracken EIA –GIS specialist & map production
35. ESKOM Ermelo-Uitkoms EIA – GIS specialist & map production
36. ESKOM Wisani bridge EIA – GIS specialist & map productionCity of Tswane – New bulkfeeder pipeline projects x3Map production
37. ESKOM Lebohang Substation and 132kV Distribution Power Line Project Amendment GIS specialist & map production
38. ESKOM Geluk Rural Powerline GIS & Mapping
39. Eskom Kimberley Strengthening Phase 4 Project GIS & Mapping
40. ESKOM Kwaggafontein - Amandla Amendment Project GIS & Mapping
41. ESKOM Lephalale CNC – GIS Specialist & Mapping
42. ESKOM Marken CNC – GIS Specialist & Mapping

43. ESKOM Lethabong substation and powerlines – GIS Specialist & Mapping
44. ESKOM Magopela- Pitsong 132kV line and new substation – GIS Specialist & Mapping
45. Vlakfontein Filling Station – GIS Specialist & Mapping - EIA
46. Prieska – Hoekplaas Solar PV & BESS - GIS Specialist & Mapping – EIA
47. Mulilo Total Hydra Storage (MTHS) De Aar - GIS Specialist & Mapping – EIA
48. Merensky Uchoba Powerline, Steelpoort - GIS Specialist & Mapping – EIA
49. Douglas Solar Part 2 Amendment – grid connection - GIS Specialist & Mapping – EIA

Professional affiliations

- South African Council for Natural Scientific Professions (SACNASP) registered Professional Natural Scientist (reg. nr 400177/09) – specialist field: Zoological Science. Registered since 2009.
- Southern African Wildlife Management Association - Member
- Zoological Society of South Africa – Member

Curriculum Vitae - Megan Loftie-Eaton

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Mobile: 076 590 1511
E-mail: meg.loftie.eaton@gmail.com

INTRODUCTION

Megan is passionate about biodiversity conservation and a firm believer in the power of citizen science and getting the public involved in nature conservation. She is a great lover of the outdoors and has spent a big chunk of her childhood and adult life camping in the African bush. Megan is a registered Professional Natural Scientist with the South African Council of Natural Scientific Professionals (SACNASP) in the field of Ecology, and she is a member of the Zoological Society of Southern Africa (ZSSA). Megan is also an Environmental Assessment Practitioner and assists with Environmental Impact Assessments (EIA's), Basic Assessments (BA's) and provides specialist input within the avifaunal and ecological fields. She obtained her BSc in Environmental & Conservation Sciences with distinction through the University of Alberta in Edmonton, Canada. After moving back to South Africa in 2011 she went on to complete her MSc in Zoology (2014) at the University of Cape Town, and her PhD in Biological Sciences (2018), looking at the impacts of bush encroachment on bird distributions in the savanna biome of South Africa. Megan has conducted avifaunal field surveys and has experience with conducting avifaunal impact assessments

FORMAL EDUCATION

UNIVERSITY OF CAPE TOWN – (PhD – Biological Sciences)
- Completed PhD in Biological Sciences, Animal Demography Unit, Department of Biological Sciences, UCT (December 2018) Thesis: The impacts of bush encroachment on bird distributions in the Savanna Biome of South Africa

UNIVERSITY OF CAPE TOWN – (MSc - Zoology)
- Completed MSc in Zoology, Animal Demography Unit, Department of Biological Sciences, UCT (June 2014)

UNIVERSITY OF ALBERTA – (BSc in Environmental and Conservation Sciences)
- Completed with Distinction. June 2011

PROFESSIONAL REGISTRATIONS AND INDUSTRY AFFILIATIONS

- **Professional Natural Scientist in Ecology (Member #135161)** registered with the South African Council for Natural Scientific Professions (SACNASP)
- **Environmental Assessment Practitioner (Number 2021/3690)** registered with the Environmental Assessment Practitioners Association of South Africa (EAPASA)
- **Member** of the Zoological Society of Southern Africa (ZSSA)

EXPERIENCE AND QUALIFICATIONS

2022-2023:
- Environmental Assessment Practitioner for Resource Management Services, Durbanville
- Avifaunal Impact Assessment assistant with Chris van Rooyen Consulting
- Citizen Science Projects Coordinator and Social Media Manager at The Biodiversity and Development Institute

2021:
- Environmental Assessment Practitioner for Resource Management Services, Durbanville (Part-time)
- Completed Avifaunal Impact Assessment for Robben Island Museum (Blue Stone Quarry Wall Restoration)
- Conducted avifaunal field work for proposed wind farms near Laingsburg, Karoo
- OdonataMAP (African Atlas of Odonata) Project Coordinator and Social Media Manager at The Biodiversity and Development Institute (contracted by the Freshwater Research Centre)
- Senior Environmental Consultant with Terramanzi Group Pty Ltd.
- SACNASP Registered Professional Natural Scientist in Ecology (Member #135161)

2020:
- Senior Environmental Consultant with Terramanzi Group Pty Ltd.

- Completed Global Environmental Management - an online course authorized by Technical University of Denmark (DTU) and offered through Coursera
- Ecologist and Researcher (contracted by Hoedspruit Hub) for Kruger To Canyons Biosphere Reserve, conducting sustainable agriculture research in the village of Phiring, Limpopo as part of the "Agroecology as a Climate Change Adaptation Strategy" output of the Dinkwanyane Water Stewardship Project

2019:
- Participated in the Karkloof 50 Miler trail run, where I placed third, and raised funds (R30,000) for ReWild NPC (a wildlife rehabilitation and conservation organization)
- OdonataMAP (African Atlas of Odonata) Project Coordinator at The Biodiversity and Development Institute (contracted by the Freshwater Research Centre)
- Ecologist and Researcher and Social Media Manager at Hoedspruit Hub
- Communications, Social Media, and Citizen Science Project Coordinator at The Biodiversity & Development Institute - ongoing
- Organized, planned, and orchestrated the Hoedspruit Hub's Open Day event
- Obtained qualification for NQF Level 5, Unit Standard 115753, Conduct Outcomes-based Assessment through Ndzalama Training (PtY) Ltd

2017-2018:
- Completed contract projects for the Hoedspruit Hub's Agroecology Division in partnership with Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ). I built, installed, and provided training materials for pollinator stations, artificial bat roosts and earthworm composting bins
- Awarded PhD in Biological Sciences, University of Cape Town (December 2018)
- Ecologist for WildArk on Pridelands Conservancy (Hoedspruit, Limpopo), conducting biodiversity surveys and ecological monitoring, as well as creating content for WildArk's social media
- Project coordinator and communications officer of the Atlas of African Odonata (OdonataMAP), Animal Demography Unit (funded by JRS Biodiversity Foundation).
- Facilitated and assessed a four-day Ecology Course for students at Tsakane Conservation in Balule Nature Reserve (Limpopo Province, South Africa) as part of the EcoLife student programme (University of Pretoria)
- Presented several biodiversity mapping and bird atlasing workshops (SABAP2, Southern African Bird Atlas Project) across South Africa, Nigeria, Tanzania, and Europe (Poland, Finland, Germany)

2016-2018:
- Presented and assessed bird atlasing (http://sabap2.adu.org.za/) and BioMAPping (http://vmus.adu.org.za) workshops to field guide students at Bushwise Field Guide Training Academy, Limpopo Province, South Africa
- Attended a Snake Awareness and Venomous Snake Handling Course as well as an Introductory Course to Scorpions (accredited by FGASA and HPCSA), hosted by the African Snakebite Institute in Hoedspruit (12-13 November 2016)

2014−2018:
- Completed doctoral (PhD) studies in Biological Sciences at the University of Cape Town (Animal Demography Unit). Research title: The impacts of bush encroachment on bird distributions in the savanna biome of South Africa
- Project coordinator and communications officer of the Atlas of African Lepidoptera (LepiMAP): LepiMAP is a project aimed at determining the distribution and conservation priorities of butterflies and moths on the African continent. It is a joint project of the Animal Demography Unit (Department of Biological Sciences, University of Cape Town) and LepSoc, The Lepidopterists' Society of Africa
- BirdMAP Assistant: helping with the Animal Demography Unit's bird atlas project in African countries north of South Africa, assisting the project teams in Kenya, Nigeria, Zimbabwe, Namibia, Zambia and Rwanda with everything from observer queries to social media aspects

2014:
- Obtained MSc in Zoology through the Department of Biological Sciences, University of Cape Town. Thesis title: Geographic Range Dynamics of South Africa's Bird Species. PDF of thesis: http://adu.org.za/pdf/Loftie-Eaton_M_2014_MSc_thesis.pdf.
- Attended an International Wildlife Trapping Course in Hoedspruit, South Africa to learn about humane live capture methods of mammals for research purposes

2013:
- Started coordinating LepiMAP, The Atlas of African Lepidoptera

- Obtained FGASA (Field Guides Association of Southern Africa) Level One Nature Guide qualification (membership number 18574) through Ulovane Environmental Training in South Africa. Obtained First Aid Level One qualification

2011–2018:
- Social Media Manager for the Animal Demography Unit
- Data technician for the ADU's Virtual Museum. I am on the Expert Panel for the MammalMAP, FrogMAP, ReptileMAP, and BirdPix citizen science projects. The Expert Panel has the important task of identifying the records submitted to the Virtual Museum

2011:
- Assistant Researcher on the African Penguin EarthWatch Research Team on Robben Island, South Africa. Conducted population surveys on penguins and other seabirds to determine their breeding success and survival - http://earthwatch.org/expeditions/south-african-penguins
- Obtained BSc in Environmental and Conservation Sciences, with Distinction, through the Faculty of Agriculture, Life and Environmental Sciences, University of Alberta, Edmonton, Canada. Major: Conservation Biology

2009:
- Attended an International Conservation Field School course in Botswana (through my studies at the University of Alberta). We covered a broad range of topics including ecotourism, wildlife conservation and socioeconomics in Africa

APPENDIX 3: PRE-CONSTRUCTION MONITORING PROTOCOL

Objectives

The objective of the pre-construction monitoring at the proposed Klipkraal Wind Energy Facility Phases 1 - 5 (WEF) is to gather baseline data over a period of four seasons on the following aspects pertaining to avifauna:

- The abundance and diversity of birds at the wind farm sites and a suitable control site to measure the potential displacement effect of the wind farm.
- Flight patterns of priority species at the wind farm sites to assess the potential collision risk with the turbines.

Methods

An integrated pre-construction monitoring programme over four seasons was implemented at the five proposed Klipkraal wind energy sites.

The monitoring was designed according to the following best practice guidelines (hereafter referred to as the VE guidelines):

- Ralston-Patton, S & Murgatroyd, M. 2021. *Verreaux's Eagle and Wind Farms. Guidelines for impact assessment, monitoring, and mitigation*. BirdLife South Africa. November 2021. Second edition (Klipkraal 1 – 3)
- Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa.* Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa (Klipkraal 5 – 6).

Wind priority species were identified using the latest (November 2014) BirdLife SA (BLSA) list of priority species for wind farms. The surveys of the pre-construction monitoring programme at the proposed Klipkraal WEF sites were conducted during the following periods:

- 15 – 19 February 2022
- 09 – 14 May 2022
- 12 – 20 July 2022
- 17 – 22 October 2022
- 26 – 31 December 2022
- 10 – 14 January 2023

Monitoring was conducted in the following manner:

- Two (2) drive transects were identified totalling 18.3km on the development sites and one drive transect in the control site, with a total length of 9.4km.

- Two monitors travelling slowly (± 10km/h) in a vehicle record all birds on both sides of the transect. The observers stop at regular intervals (every 500m) to scan the environment with binoculars. Drive transects are counted three times per sampling session.
- In addition, ten (10) walk transects of 1km each were identified. The transects are counted four (4) times per survey. All birds are recorded during walk transects.
- The following variables were recorded:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Estimated distance from transect
    - Wind direction
    - Wind strength (estimated Beaufort scale)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and
    - Co-ordinates (priority species only)

The aim with drive transects is primarily to record large priority species (i.e. raptors and large terrestrial species), while walk transects are primarily aimed at recording small passerines. The objective of the transect monitoring is to gather baseline data on the use of the site by birds to measure potential displacement by the wind farm activities.

- Ten (10) vantage points (VPs) were identified from which the majority of the wind turbine buildable area can be observed, to record the flight altitude and patterns of priority species. One (1) VP was also identified on the control site. The following variables were recorded for each flight:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Wind direction
    - Wind strength (estimated Beaufort scale 1-7)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Flight altitude (high i.e. >300m; medium i.e. 30m – 300m; low i.e. <30m)
    - Flight mode (soar; flap; glide; kite; hover) and
    - Flight time (in 15 second intervals).

The objective of vantage point counts is to measure the potential collision risk with the turbines.

A total of six (6) focal points (FPs) of bird activity were identified and monitored during the pre-construction surveys. The focal points are as follows:

- FP 1: Farm dam
- FP 2: Farm dam
- FP 3: Jackal Buzzard nest Wangarino
- FP 4: Verreaux's Eagle nests A and B Klipkraal
- FP 5: Jackal Buzzard/Pale Chanting Goshawk nest Klipkraal
- FP 6: Matjesfontein Verreaux's Eagle nest

Figure 1 below indicates the proposed turbine and control areas where monitoring was implemented.

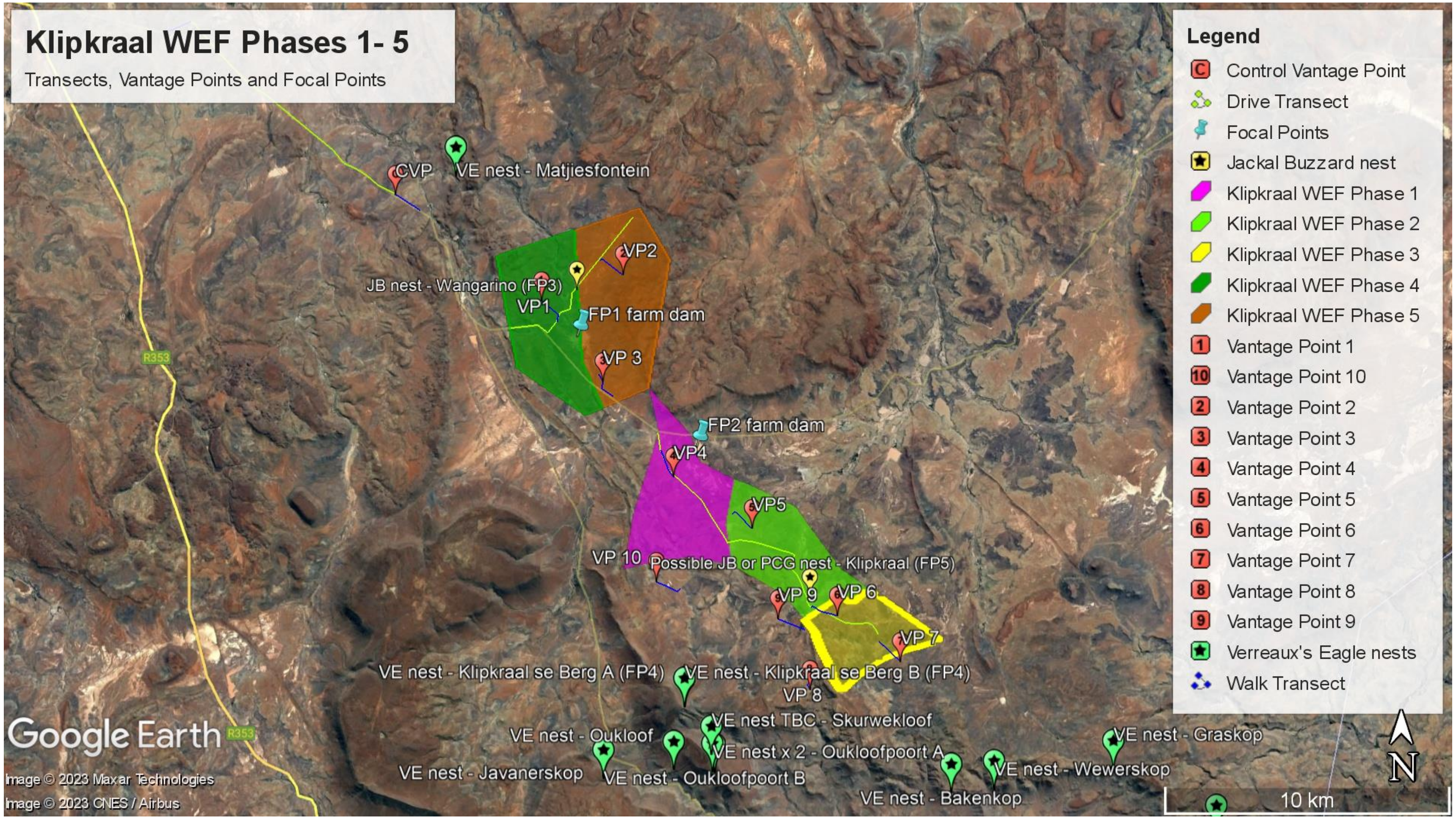

Figure 1: Area where monitoring took place, with position of VPs, FPs, drive transects, walk transects and Klipkraal WEF Phases 1 to 5. The control area is located approximately 11km north-west of the Klipkraal WEF 3 assessment area.

APPENDIX 4: BIRD HABITAT

Figure 1: Karoo scrubland habitat in the PAOI.

Figure 2: Borehole in the PAOI.

Figure 4: View – Vantage Point 8.

APPENDIX 5: SABAP2 SPECIES LIST FOR THE BROADER AREA

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Bokmakierie	*Telophorus zeylonus*	65,52	23,08
Hamerkop	*Scopus umbretta*	10,34	0,00
Pied Avocet	*Recurvirostra avosetta*	6,90	0,00
Acacia Pied Barbet	*Tricholaema leucomelas*	41,38	12,82
Pririt Batis	*Batis pririt*	17,24	2,56
European Bee-eater	*Merops apiaster*	10,34	0,00
Southern Red Bishop	*Euplectes orix*	0,00	2,56
African Red-eyed Bulbul	*Pycnonotus nigricans*	34,48	5,13
Cape Bunting	*Emberiza capensis*	58,62	17,95
Lark-like Bunting	*Emberiza impetuani*	62,07	17,95
Common Buzzard	*Buteo buteo*	3,45	0,00
Jackal Buzzard	*Buteo rufofuscus*	27,59	23,08
Black-headed Canary	*Serinus alario*	62,07	12,82
Black-throated Canary	*Crithagra atrogularis*	3,45	0,00
White-throated Canary	*Crithagra albogularis*	41,38	12,82
Yellow Canary	*Crithagra flaviventris*	48,28	17,95
Ant-eating Chat	*Myrmecocichla formicivora*	44,83	7,69
Familiar Chat	*Oenanthe familiaris*	51,72	7,69
Karoo Chat	*Emarginata schlegelii*	75,86	35,90
Sickle-winged Chat	*Emarginata sinuata*	51,72	5,13
Grey-backed Cisticola	*Cisticola subruficapilla*	34,48	12,82
Levaillant's Cisticola	*Cisticola tinniens*	0,00	2,56
Double-banded Courser	*Rhinoptilus africanus*	3,45	0,00
Blue Crane	*Grus paradisea*	0,00	2,56
Long-billed Crombec	*Sylvietta rufescens*	37,93	0,00
Cape Crow	*Corvus capensis*	6,90	2,56
Pied Crow	*Corvus albus*	20,69	15,38
Diederik Cuckoo	*Chrysococcyx caprius*	6,90	0,00
Jacobin Cuckoo	*Clamator jacobinus*	3,45	0,00
Cape Turtle Dove	*Streptopelia capicola*	58,62	12,82
Laughing Dove	*Spilopelia senegalensis*	27,59	7,69
Namaqua Dove	*Oena capensis*	48,28	7,69
Red-eyed Dove	*Streptopelia semitorquata*	3,45	2,56
Rock Dove	*Columba livia*	3,45	0,00
Booted Eagle	*Hieraaetus pennatus*	10,34	2,56
Martial Eagle	*Polemaetus bellicosus*	10,34	0,00
Verreaux's Eagle	*Aquila verreauxii*	37,93	12,82
Spotted Eagle-Owl	*Bubo africanus*	10,34	0,00
Karoo Eremomela	*Eremomela gregalis*	37,93	0,00

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Yellow-bellied Eremomela	*Eremomela icteropygialis*	37,93	2,56
Lanner Falcon	*Falco biarmicus*	0,00	2,56
Southern Fiscal	*Lanius collaris*	55,17	12,82
Chat Flycatcher	*Melaenornis infuscatus*	13,79	5,13
Fairy Flycatcher	*Stenostira scita*	37,93	7,69
Fiscal Flycatcher	*Melaenornis silens*	31,03	7,69
Spotted Flycatcher	*Muscicapa striata*	3,45	0,00
Grey-winged Francolin	*Scleroptila afra*	6,90	2,56
Egyptian Goose	*Alopochen aegyptiaca*	27,59	10,26
Pale Chanting Goshawk	*Melierax canorus*	13,79	12,82
Grey Heron	*Ardea cinerea*	34,48	2,56
African Hoopoe	*Upupa africana*	10,34	0,00
African Sacred Ibis	*Threskiornis aethiopicus*	13,79	0,00
Hadada Ibis	*Bostrychia hagedash*	31,03	7,69
Greater Kestrel	*Falco rupicoloides*	3,45	0,00
Rock Kestrel	*Falco rupicolus*	37,93	7,69
Brown-hooded Kingfisher	*Halcyon albiventris*	3,45	0,00
Malachite Kingfisher	*Corythornis cristatus*	3,45	0,00
Karoo Korhaan	*Eupodotis vigorsii*	58,62	20,51
Blacksmith Lapwing	*Vanellus armatus*	6,90	7,69
Crowned Lapwing	*Vanellus coronatus*	13,79	0,00
Karoo Lark	*Calendulauda albescens*	13,79	2,56
Karoo Long-billed Lark	*Certhilauda subcoronata*	62,07	23,08
Large-billed Lark	*Galerida magnirostris*	31,03	5,13
Red-capped Lark	*Calandrella cinerea*	6,90	5,13
Spike-heeled Lark	*Chersomanes albofasciata*	44,83	7,69
Brown-throated Martin	*Riparia paludicola*	3,45	0,00
Rock Martin	*Ptyonoprogne fuligula*	31,03	15,38
Red-faced Mousebird	*Urocolius indicus*	27,59	7,69
White-backed Mousebird	*Colius colius*	37,93	17,95
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	3,45	0,00
Common Ostrich	*Struthio camelus*	3,45	0,00
Speckled Pigeon	*Columba guinea*	62,07	5,13
African Pipit	*Anthus cinnamomeus*	27,59	2,56
African Rock Pipit	*Anthus crenatus*	13,79	0,00
Nicholson's Pipit	*Anthus nicholsoni*	20,69	5,13
Three-banded Plover	*Charadrius tricollaris*	27,59	5,13
Karoo Prinia	*Prinia maculosa*	65,52	15,38
White-necked Raven	*Corvus albicollis*	37,93	17,95
Cape Robin-Chat	*Cossypha caffra*	37,93	12,82
Namaqua Sandgrouse	*Pterocles namaqua*	37,93	12,82

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Karoo Scrub Robin	*Cercotrichas coryphoeus*	75,86	17,95
South African Shelduck	*Tadorna cana*	20,69	17,95
Red-backed Shrike	*Lanius collurio*	3,45	0,00
Cape Sparrow	*Passer melanurus*	82,76	23,08
House Sparrow	*Passer domesticus*	17,24	2,56
Southern Grey-headed Sparrow	*Passer diffusus*	6,90	0,00
Black-eared Sparrow-Lark	*Eremopterix australis*	20,69	0,00
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	0,00	2,56
African Spoonbill	*Platalea alba*	10,34	0,00
Cape Spurfowl	*Pternistis capensis*	3,45	0,00
Pale-winged Starling	*Onychognathus nabouroup*	58,62	23,08
Pied Starling	*Lamprotornis bicolor*	51,72	2,56
Red-winged Starling	*Onychognathus morio*	24,14	2,56
Wattled Starling	*Creatophora cinerea*	10,34	0,00
Little Stint	*Calidris minuta*	0,00	2,56
Dusky Sunbird	*Cinnyris fuscus*	24,14	5,13
Malachite Sunbird	*Nectarinia famosa*	17,24	5,13
Southern Double-collared Sunbird	*Cinnyris chalybeus*	27,59	2,56
Barn Swallow	*Hirundo rustica*	31,03	7,69
Greater Striped Swallow	*Cecropis cucullata*	31,03	2,56
South African Cliff Swallow	*Petrochelidon spilodera*	3,45	0,00
Alpine Swift	*Tachymarptis melba*	3,45	0,00
Common Swift	*Apus apus*	3,45	2,56
Little Swift	*Apus affinis*	17,24	0,00
White-rumped Swift	*Apus caffer*	13,79	2,56
Spotted Thick-knee	*Burhinus capensis*	3,45	0,00
Karoo Thrush	*Turdus smithi*	31,03	5,13
Cape Penduline Tit	*Anthoscopus minutus*	3,45	0,00
Grey Tit	*Melaniparus afer*	41,38	0,00
Cape Wagtail	*Motacilla capensis*	34,48	10,26
African Reed Warbler	*Acrocephalus baeticatus*	10,34	0,00
Chestnut-vented Warbler	*Curruca subcoerulea*	34,48	5,13
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*	10,34	7,69
Layard's Warbler	*Curruca layardi*	37,93	5,13
Namaqua Warbler	*Phragmacia substriata*	31,03	0,00
Rufous-eared Warbler	*Malcorus pectoralis*	75,86	23,08
Willow Warbler	*Phylloscopus trochilus*	6,90	0,00
Common Waxbill	*Estrilda astrild*	13,79	2,56
Cape Weaver	*Ploceus capensis*	3,45	0,00
Southern Masked Weaver	*Ploceus velatus*	27,59	5,13
Capped Wheatear	*Oenanthe pileata*	3,45	2,56

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Mountain Wheatear	*Myrmecocichla monticola*	41,38	15,38
Cape White-eye	*Zosterops virens*	27,58	0,00
Cardinal Woodpecker	*Dendropicos fuscescens*	13,79	0,00
Ground Woodpecker	*Geocolaptes olivaceus*	17,24	0,00
Black Stork	*Ciconia nigra*	0,00	0,00
Ludwig's Bustard	*Neotis ludwigii*	0,00	0,00

APPENDIX 6: ASSESSMENT CRITERIA

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in **Table 1**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

The impact assessment must take account of the nature, scale and duration of effects on the environment and whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the various project stages, as follows:

- Planning;
- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		

This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

APPENDIX 7: SITE SENSITIVITY VERIFICATION WEF

RECONNAISSANCE REPORT (IN TERMS OF PART B OF THE ASSESSMENT PROTOCOLS PUBLISHED IN GN 320 ON 20 MARCH 2020 AND GN 43855 ON 30 OCTOBER 2020)

Introduction

In accordance with Appendix 6 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations of 2014, a reconnaissance visit has been undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (Screening Tool).

Site Sensitivity Verification

The following methods and sources were used to compile this report:

- The project area of impact (PAOI) of the proposed WEF was defined as the proposed Project site which has an extent of approximately 1,188 hectares.
- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town (https://sabap2.birdmap.africa/), as a means to ascertain which species occur within the broader area i.e. within a block consisting of 12 pentads. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2007 to date, a total of 29 full protocol lists (i.e. surveys lasting a minimum of two hours each) have been completed for this area. In addition, 39 ad hoc protocol lists (i.e. surveys lasting less than two hours but still yielding valuable data) have been completed.
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the (2021.3) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the Atlas of Southern African Birds 1 (SABAP 1) (Harrison *et al.* 1997) and the National Vegetation Map (2018 beta2) from the South African National Biodiversity Institute website (Mucina & Rutherford 2006 & http://bgisviewer.sanbi.org).
- The Important Bird Areas of Southern Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2022) was used to view the broader area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind development were identified from the most recent (November 2014) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief *et al.* 2012).
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the proposed

site relative to National Protected Areas.

- The DFFE National Screening Tool was used to determine the assigned avian sensitivity of the project area of impact (PAOI).
- The primary source of information on avifaunal diversity, abundance, and flight patterns at the site were the results of a pre-construction programme conducted over four seasons at the proposed five Klipkraal WEF application sites. The primary methods of data capturing were walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings.

Outcome Of Site Reconnaissance

- **Natural environment**

The PAOI is located in the Nama Karoo Biome in the Upper Karoo Bioregion. The Nama Karoo is classified as arid and it covers an extensive part of the south-central plateau of South Africa - an area of 248,284 km^2 (Mucina & Rutherford 2006). The biome is characterized by low rainfall (between 70 and 500 mm per year) falling mostly in late summer (Mucina and Rutherford, 2006) resulting in a high summer aridity index (Mucina & Rutherford 2006). Summers are hot (maximum >30^{o}C) and winters are cold (minimum close to 0^{o}C) and frost is common. The vegetation of the Nama-Karoo is dominated by chamaephytes (low-growing shrubs) and hemicryptophytes (graminoids) in a grassy, dwarf shrubland.

The primary vegetation types in the PAOI are Eastern Upper Karoo and Western Upper Karoo (Mucina & Rutherford 2006). The habitat is characterized as grassy Karoo with *Eragrostis lehmanniana* and *Aristida congesta* dominating. Dominant shrubs are asteraceous in the genera *Eriocephalus*, *Pentzia* and *Pteronia*. Grasses are more common on ridges and hills. The flood plains have a short, dense scrubveld. Water courses tend to have *Vachellia karroo* (sweet thorn) trees present. In this arid environment, surface water is a big draw card for birds which use it to bath and drink. Drainage lines and associated boreholes provide important habitat for priority species.

- **DFFE Screening Tool**

The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the integrated pre-construction monitoring programme, with observations of Ludwig’s Bustard, Karoo Korhaan, Martial Eagle, Verreaux’s Eagle and Black Stork recorded within the PAOI and its immediate surrounds. Based on the field surveys to date, a classification of **High** sensitivity for avifauna in the screening tool is therefore appropriate.

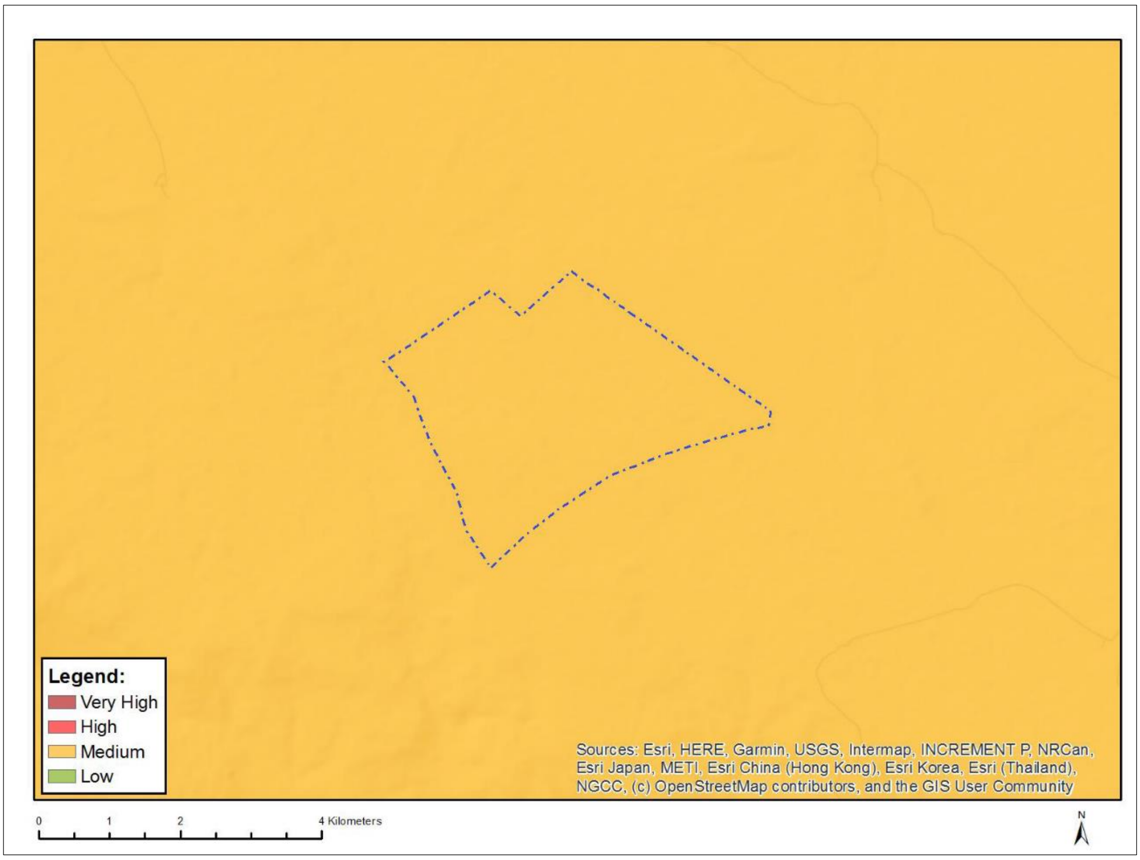

Figure 1: The classification of the PAOI according to the terrestrial animal species theme in the DFFE National Screening Tool[7]. The classification of Medium in the Terrestrial Animal Species theme is linked to the potential presence of species of conservation concern (SCC), namely Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered).

Conclusion

The PAOI contains confirmed habitat for species of conservation concern (SCC) as defined in the Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species (Government Gazette No 43855, 30 October 2020). The occurrence of SCC was confirmed during the integrated pre-construction monitoring programme, with observations of Ludwig's Bustard, Karoo Korhaan, Martial Eagle, Verreaux's Eagle and Black Stork recorded within the PAOI and its immediate surrounds. Based on the field surveys to date, a classification of **High** sensitivity for avifauna in the screening tool is suggested.

[7] The Wind Theme is only applicable to developments in a Renewable Energy Development Zone (REDZ)

APPENDIX 8: ENVIRONMENTAL MANAGEMENT PLAN FOR THE WEF

Environmental Management Programme: WEF

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
AVIFAUNA: DISPLACEMENT DUE TO DISTIURBANCE AND HABITAT TRANSFORMATION					
Displacement of priority avifauna due to disturbance and habitat transformation	Prevent mortality of priority avifauna	1. All surface water (pans and dams) should be buffered by 200m and rivers by 150m (no turbine zones) to prevent displacement of priority avifauna.	Design lay-out around the proposed buffer zones	Once-off during the planning phase.	Project Developer
AVIFAUNA: MORTALITY DUE TO COLLISIONS WITH THE TURBINES					
Mortality of priority avifauna due to collisions with the wind turbines	Prevent mortality of priority avifauna	1. Based on the results of the pre-construction monitoring, a 750m turbine exclusion zone must be implemented around the Jackal Buzzard nest (FP5). 2. It is recommended that all turbines must have 1/3 of one blade painted in signal red as a pre-cautionary measure. It is acknowledged that blade painting as a mitigation strategy is still in an experimental phase in South Africa, but research indicates that it has a very good chance of reducing raptor	1. Design lay-out around the proposed buffer zones	1. Once-off during the planning phase. 2. As soon as the first turbines start turning.	1. Project Developer

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		mortality, based on research conducted in Norway. If this is done as part of the blade manufacturing process, the costs will be negligible.			
AVIFAUNA: MORTALITY DUE TO ELECTROCUTION					
Electrocution of raptors on the internal 33kV poles	Prevent mortality of priority avifauna	1. A raptor-friendly pole design must be used, and the pole design must be approved by the avifaunal specialist.	Design engineers to consult with avifaunal specialist on the final design of the poles.	Once-off during the planning phase.	Project Developer

Management Plan for the Construction Phase (Including pre- and post-construction activities)

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: DISPLACEMENT DUE TO DISTURBANCE					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of priority avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following:	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the	1. On a daily basis 2. Monthly 3. Monthly 4. Monthly 5. Monthly	

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		1. No off-road driving. 2. Maximum use of existing roads. 3. Measures to control noise and dust according to latest best practice. 4. Restricted access to the rest of the property. 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation and rehabilitation of the footprint.	impacts relating to off-road driving. 3. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.		1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

AVIFAUNA: DISPLACEMENT DUE TO HABITAT TRANSFORMATION					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance and the presence of the wind turbines and associated infrastructure.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented according to the recommendations of the biodiversity/vegetation specialist.	1. Ensure that all the recommendations for mitigation from the biodiversity/vegetation specialist, including rehabilitation of disturbed areas, are strictly implemented.	1. Appointment of specialist to coordinate and monitor the rehabilitation of the vegetation.	1. Once-off	1. Wind farm operator

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: MORTALITY DUE TO COLLISIONS WITH THE WIND TURBINES					
Bird collisions with the wind turbines	Prevention of priority species collision mortality on the wind turbines.	1. Formal live-bird monitoring and carcass searches should be implemented at the start of the operational phase, as per the most recent edition of the Best Practice Guidelines at the time (Jenkins *et al*. 2015) to assess collision rates. The exact time when operational monitoring should commence, will depend on the construction schedule, and should commence when the first turbines start operating. The Best Practice Guidelines require that, as an absolute minimum, operational monitoring should be undertaken for the first two (preferably three) years of operation, and	1. Appoint Avifaunal Specialist to compile operational monitoring plan, including live bird monitoring and carcass searches. 2. Implement operational monitoring plan. 3. Engage with the landowner to design and implement an effective system to locate a carcass promptly and ensure the immediate removal of the carcass before it can attract vultures. 4. Appoint a team of suitably qualified, trained, dedicated, and resourced team of observers	1. Once-off 2. Years 1,2, 5 and every five years after that for the duration of the operational lifetime of the facility. 3. Before the first turbines start turning. 4. As and when required, within six months of threshold having been exceeded. 5. Quarterly and annually	1. Wind farm operator 2. Wind farm operator 3. Wind farm operator 4. Wind farm operator/avifaunal specialist 5. Wind farm operator/avifaunal specialist

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		then repeated in year 5, and again every five years thereafter for the operational lifetime of the facility.	to be present on site for all daylight hours throughout the year. It is absolutely essential that passionate, hardworking staff are hired for this role. This team must be stationed at observation points with full visible coverage of all turbine locations. The observers must detect incoming priority bird species, track their flights, judge when they enter a turbine proximity threshold, and alert the control room to shut down the relevant turbine until the risk has reduced. 5. A full detailed method statement must be designed		

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			by an avifaunal specialist prior to the commercial operations date (COD) and must be in place by the time that the wind farm starts operating. 6. Compile quarterly and annual progress reports detailing the results of the operational monitoring and progress with any recommended mitigation measures.		

AVIFAUNA: MORTALITY DUE TO COLLISIONS AND ELECTROCUTIONS ON THE 33KV NETWORK					
Bird electrocutions on the overhead sections of the internal 33kV cables	Prevention of electrocution mortality on the overhead sections of the 33kV internal cable network.	1. Conduct regular inspections of the overhead sections of the internal reticulation network to look for carcasses.	1. Carcass searchers under the supervision of the Avifaunal Specialist. 2. Design and implement mitigation measures if mortality thresholds are exceeded. 3. Compile quarterly and annual progress reports detailing the results of the operational monitoring and progress with any recommended mitigation measures.	1. At least once every two months. 2. As and when required, within six months of threshold having been exceeded. 3. Quarterly and annually	1. Operations Manager/Avifaunal specialist 2. Wind farm operator/Avifaunal specialist 3. Wind farm operator/Avifaunal specialist

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
AVIFAUNA: DISPLACEMENT DUE TO DISTURBANCE ASSOCIATED WITH THE DISMANTLING ACTIVITIES					
The noise and movement associated with the de-commissioning activities at the WEF footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the EMPr.	A site-specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the EMPr and should apply good environmental practice during construction. The EMPr must specifically include the following: 1. No off-road driving. 2. Maximum use of existing roads. 3. Measures to control noise and dust according to latest best practice. 4. Restricted access to the rest of the property. 5. Strict application of all recommendations in the biodiversity/vegetation specialist report pertaining to the limitation of the footprint.	1. Implementation of the EMPr. Oversee activities to ensure that the EMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify.	1. On a daily basis 2. Monthly 3. Monthly 4. Monthly 5. Monthly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO 6. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the footprint area is demarcated and that construction personnel are made aware of these demarcations. 6. Monitor via site inspections and report non-compliance.		

APPENDIX 9: OPERATIONAL MONITORING PLAN – WEF

1 INTRODUCTION

The avifaunal post-construction monitoring at the proposed WEF must be conducted in accordance with the latest version (2015) of the *Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* (Jenkins *et al*. 2015)[8].

2 AIM OF POST-CONSTRUCTION MONITORING

The avifaunal post construction monitoring aims to assess the impact of the WEF by comparing pre- and post-construction monitoring data and to measure the extent of bird fatalities caused by the WEF. Post-construction monitoring is therefore necessary to:

- Confirm as far as possible what the actual impacts of the WEF are on avifauna; and
- Determine what mitigation is required if need be (adaptive management).

The proposed post-construction monitoring can be divided into three categories:

- Habitat classification
- Quantifying bird numbers and movements (replicating baseline pre-construction monitoring)
- Quantifying bird mortalities.

Post-construction monitoring will aim to answer the following questions:

- How has the habitat available to birds in and around the WEF changed?
- How has the number of birds and species composition changed?
- How have the movements of priority species changed?
- How has the WEF affected priority species' breeding success?
- How many birds collide with the turbines? And are there any patterns to this?
- What mitigation is necessary to reduce the impacts on avifauna?

3 TIMING

Post-construction monitoring should commence as soon as possible after the first turbines become operational to ensure that the immediate effects of the facility on resident and passing birds are recorded, before they have time to adjust or habituate to the development. However, it should be borne in mind that it is also important to obtain an understanding of the impacts of the facility as they would be over the lifespan of the facility. Over time the habitat within the WEF may change, birds may become habituated to, or learn to avoid the facility. It is therefore necessary to monitor over a longer period than just an initial one year.

[8] Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Produced by the Wildlife & Energy Programme of the Endangered Wildlife Trust & BirdLife South Africa.

4 DURATION

Monitoring should take place in Year 1 and 2 of the operational phase, and then repeated in Year 5 and every five years after that. After the first year of monitoring, the programme should be reviewed in order to incorporate significant findings that have emerged. This may entail the revision of the number of turbines to be searched, and the size of the search plots, depending on the outcome of the first year of monitoring. If significant impacts are observed, i.e., exceeding predetermined thresholds, and mitigation is required, the matter should be taken up with the operator to discuss potential mitigation. In such instances the scope of monitoring could be reduced to focus only on the impacts of concern.

5 HABITAT CLASSIFICATION

Any observed changes in bird numbers and movements at a WEF may be linked to changes in the available habitat. The avian habitats available must be mapped at least once a year (at the same time every year), using the same methods which were used during pre-construction.

6 BIRD NUMBERS AND MOVEMENTS

In order to determine if there are any impacts relating to displacement and/or disturbance, all methods used to estimate bird numbers and movements during baseline monitoring must be applied as far as is practically possible in the same way to post-construction work in order to ensure maximum comparability of these two data sets. This includes sample counts of small terrestrial species, counts of large terrestrial species and raptors, focal site surveys and vantage point surveys according to the current best practice.

7 COLLISIONS

The collision monitoring must have three components:

- Experimental assessment of search efficiency and scavenging rates of bird carcasses on the site.
- Weekly searches in the immediate vicinity of the wind farm turbines for collision casualties.
- Estimation of collision rates.

8 SEARCHER EFFICIENCY AND SCAVENGER REMOVAL

The value of surveying the area for collision victims is only valid if some measure of the accuracy of the survey method is developed. The probability of a carcass being detected and the rate of removal/decay of the carcass must be accounted for when estimating collision rates and when designing the monitoring protocol. This must be done in the form of searcher and scavenger trails at least twice a year.

9 COLLISION VICTIM SURVEYS

9.1 Aligning search protocols

The search protocol must be agreed upon between the bat and bird specialists to constitute an acceptable compromise between the current best practice guidelines for bird and bat monitoring.

Searches must begin as early in the mornings as possible to reduce carcass removal by scavengers. A carcass searcher must walk in straight line transects, 6 m apart, covering 3 m on each side. A team of searchers and one supervisor must be trained to implement the carcass searches. The searchers must have a vehicle available for transport per site. The supervisor must assist with the collation of the data at each site and to provide the data to the specialist in electronic format on a weekly basis. The specialists must ensure that the supervisor is completely familiar with all the procedures concerning the management of the data. The following must be loaded on a cloud server on a weekly basis for the avifaunal specialist to access:

- Carcass fatality data (hardcopy and scans as well as data entered into Excel spreadsheets);
- Pictures of any carcasses, properly labelled
- GPS tracks of the search plots walked; and
- Turbine search interval spreadsheets.

When a carcass is found, it must be bagged, labelled, and kept refrigerated for species confirmation when the specialist visits the site.

9.2 Estimation of collision rates

Observed mortality rates need to be adjusted to account for searcher efficiency and scavenger removal. There have been many different formulas proposed to estimate mortality rates. The available methodologies must be investigated, and an appropriate method will be applied. The current method which is used widely is the GenEst method.

10 DELIVERABLES

10.1 Annual report

An operational monitoring report must be completed at the end of each year of operational monitoring. As a minimum, the report must attempt to answer the following questions:

- How has the habitat available to birds in and around the WEF changed?
- How has the number birds and species composition changed?
- How have the movements of priority species changed?
- How has the WEF affected priority species' breeding success?
- What are the likely drivers of any changes observed?
- How many, and which species of birds collided with the turbines and
- associated infrastructure? And are there any patterns to this?
- What is the significance of any impacts observed?
- What mitigation measures are required to reduce the impacts?

10.2 Quarterly reports

Concise quarterly reports must be provided with basic statistics and any issues that need to be addressed.