SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE KLIPKRAAL WIND ENERGY FACILITY 4, NEAR FRASERBURG, NORTHERN CAPE PROVINCE, SOUTH AFRICA

Avifaunal Specialist Scoping Report

DFFE Reference: TBA
Report Prepared by: **AfriAvian Environmental (Pty) Ltd**
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SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE KLIPKRAAL WIND ENERGY FACILITY 4, NEAR FRASERBURG, NORTHERN CAPE PROVINCE, SOUTH AFRICA

AVIFAUNAL SPECIALIST ASSESSMENT - SCOPING

EXECUTIVE SUMMARY

1. INTRODUCTION

The Southern African Bird Atlas Project (SABAP2) data indicates that a total of 146 bird species could potentially occur within the Broader Area – **Appendix 5** provides a comprehensive list of all the species. Of these, 20 species are classified as priority species for wind energy developments and 9 of these are South African Red List species. Of the 20 priority species, 17 are likely to occur regularly in the Project Area of Impact (PAOI).

2. CONCLUSION AND SUMMARY

2.1 Summary of Findings

2.1.1 Wind Energy Facility

The proposed Klipkraal WEF 4 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 that fall in this category are Ludwig's Bustard, Karoo Korhaan, Double-banded Courser, Grey-winged Francolin, African Rock Pipit, and Spotted Eagle-Owl. Some raptors may also be affected, e.g., Pale Chanting Goshawk which could potentially breed in the small *Vachellia* trees in the drainage lines. Some species may be able to recolonise the area after the completion of the construction phase, but for other species this might only be partially the case.

Bird population densities could decrease 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 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 4 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 most at risk of collision. Verreaux's Eagle might also be at risk to some extent. 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. The turbine rotor swept area should not extend over the buffer zone. (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.	Low
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	Low

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed Mitigation	Overall Impact Significance (Post - Mitigation)
		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).	
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

2.2 The identification of environmental sensitivities: Wind Energy Facility

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

2.2.1 High Sensitivity Zones.

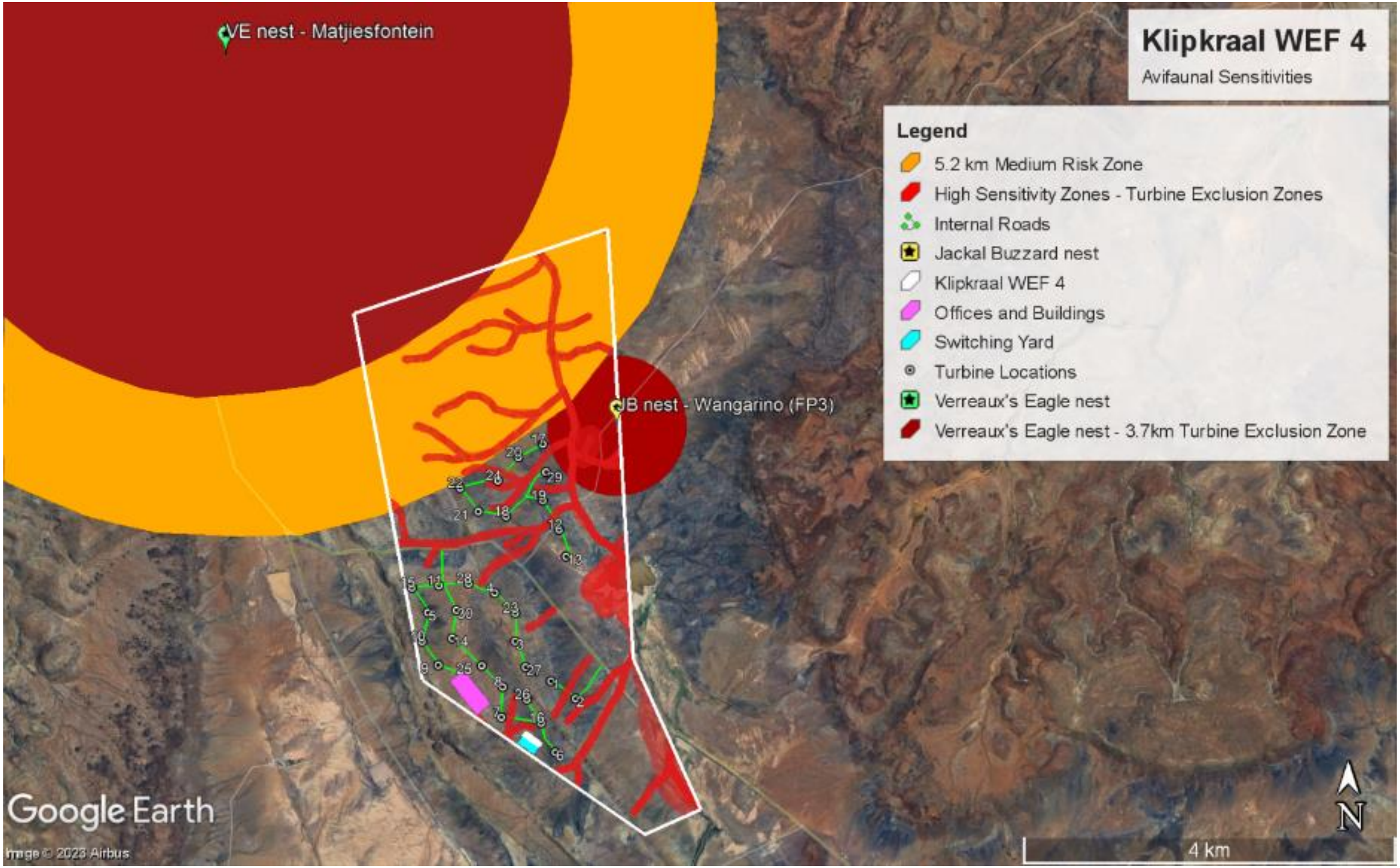
Raptor Nests – A 3.7km turbine exclusion zone should be implemented and maintained around the Verreaux's Eagle nest located at -31.975694° South, 21.682583° East, and an 750m turbine exclusion zone around the Jackal Buzzard nest located at -32.011611° South, 21.727139° East, to reduce the risk of turbine collisions and the risk of displacement due to disturbance. The turbine rotor swept area should also not penetrate these buffer zones.

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. The turbine rotor swept area should also not penetrate these buffer zones.

2.2.2 Medium Sensitivity Zones.

Raptor Nests – A 5.2km medium risk sensitivity zone around the Verreaux's Eagle nest located at -31.975694° South, 21.682583° East. All turbines in the area >3.7km up to 5.2km should be regarded as medium-risk and relocated if possible. Should relocation not be feasible, these turbines should be subject to pro-active mitigation in the form of a proven mitigation methods such as Shutdown on Demand (SDoD), using either bio monitors or an automated system such as IdentiFlight®. If all turbines (and their rotor swept area) are located outside the 5.2km buffer monitoring can be concluded after six surveys i.e. 72hours per vantage point.

See Error! Reference source not found.**(i)** for a map of the avifaunal sensitivities identified for Klipkraal WEF 4.



Figure(i): Proposed no-turbine zones. Avifaunal sensitivities for the Klipkraal WEF 4 project.

2.3 Conclusion and Impact Statement

2.3.1 Wind Energy Facility

The proposed Klipkraal WEF 4 will have a moderate impact on avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation. Any alternative substation and laydown locations will all be situated in essentially the same habitat, i.e., Karoo Scrubland. The habitat is not particularly sensitive, as far as avifauna is concerned. No fatal flaws were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report (**Section 6**) and the EMPr (**Appendix 8**) are strictly implemented.

3. FINAL LAYOUT

The proposed Klipkraal WEF 4 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 assessed as part of the Scoping Phase. The Klipkraal WEF 4 Project Site is approximately 1,340 ha in extent. The final layout and design alternative will be considered and assessed during the EIA Phase. 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 13
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;	Section 6, Appendix 8
l) any conditions for inclusion in the environmental authorisation;	Section 6, Appendix 8
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Appendix 8 and 9
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised;	Section 9

(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;	
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.
Project Area of Impact (PAOI)	An area comprising the proposed Project Site and a 3,5km buffer around the site which has an extent of approximately 11,017 hectares and which includes the Verreaux's Eagle nest (-31.975694°S, 21.682583°E) north of the Project Site
Project Site	The area (land parcels) where the proposed wind farm will be constructed which has an extent of approximately 1,340 hectares.
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
SABAP1	First Southern African Bird Atlas Project
SABAP2	Second Southern African Bird Atlas Project

SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database
WEF	Wind Energy Facility

Insert updated specialist declaration

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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 4.

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 4 will consist of up to 60 turbines with a maximum energy export capacity of approximately 300MW. This will be subject to allowable limits in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) or any other program.

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 1340 hectares (13.4 km^2).
- Bird distribution data was obtained from the Second Southern African Bird Atlas Project (SABAP2) at the University of Cape Town (https://sabap2.birdmap.africa/), to ascertain which species occur within the Broader Area i.e., within a block consisting of 12 pentads (
- **Table** 1 and **Figure 1**). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 9 km. From 2007 to date, a total of 46 full protocol lists (i.e. intensive bird listing surveys lasting a minimum of at least two hours each) have been completed for this area. In addition, 68 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 (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the First Atlas of Southern African Birds (SABAP1) (Harrison *et al.* 1997) and the National Vegetation Map (2018) 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 ©2023) was used to view the Broader Area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind developments 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 monitoring 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 bird species checklists completed for the Broader Area.

Pentad	Full protocol lists	Ad hoc protocol lists
3155_2130	6	15
3155_2135	7	5
3155_2140	0	11
3155_2145	1	4
3200_2130	2	4
3200_2135	1	0
3200_2140	10	9
3200_2145	4	7
3205_2130	1	0
3205_2135	2	3
3205_2140	0	6
3205_2145	12	4
Total	**46**	**68**

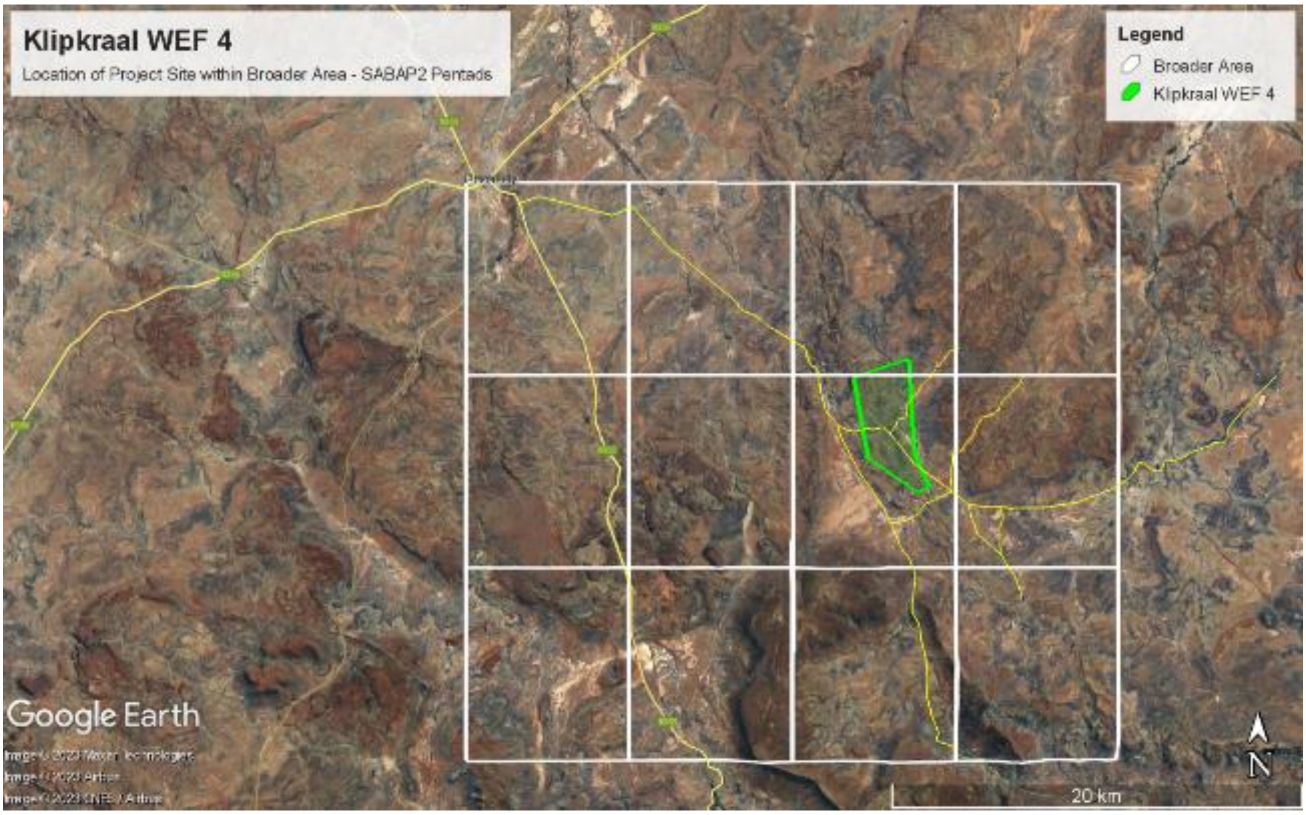

Figure 1: Location of Project Site within Broader Area of 12 SABAP2 Pentads.

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 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 that 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 4 and associated grid connection infrastructure is located approximately 20 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 3**).

Figure 2: Regional Context Map – Location of Klipkraal WEF 4.

3.1.1 WEF

Phases 4 to 5 of the Klipkraal WEF application site incorporates the following farm portions:

- Portion 3 of the Farm Ratelfontein No. 394 (3/394) - C02600000000039400003; and
- Remainder of the Farm Matjiesfontein No. 411 (RE/411) - C02600000000041100000.

The proposed Klipkraal WEF 4 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 4 Project Site is approximately 1340 ha in extent (**Figure 3**). The final layout and design alternative will be considered and assessed as part of the EIA.

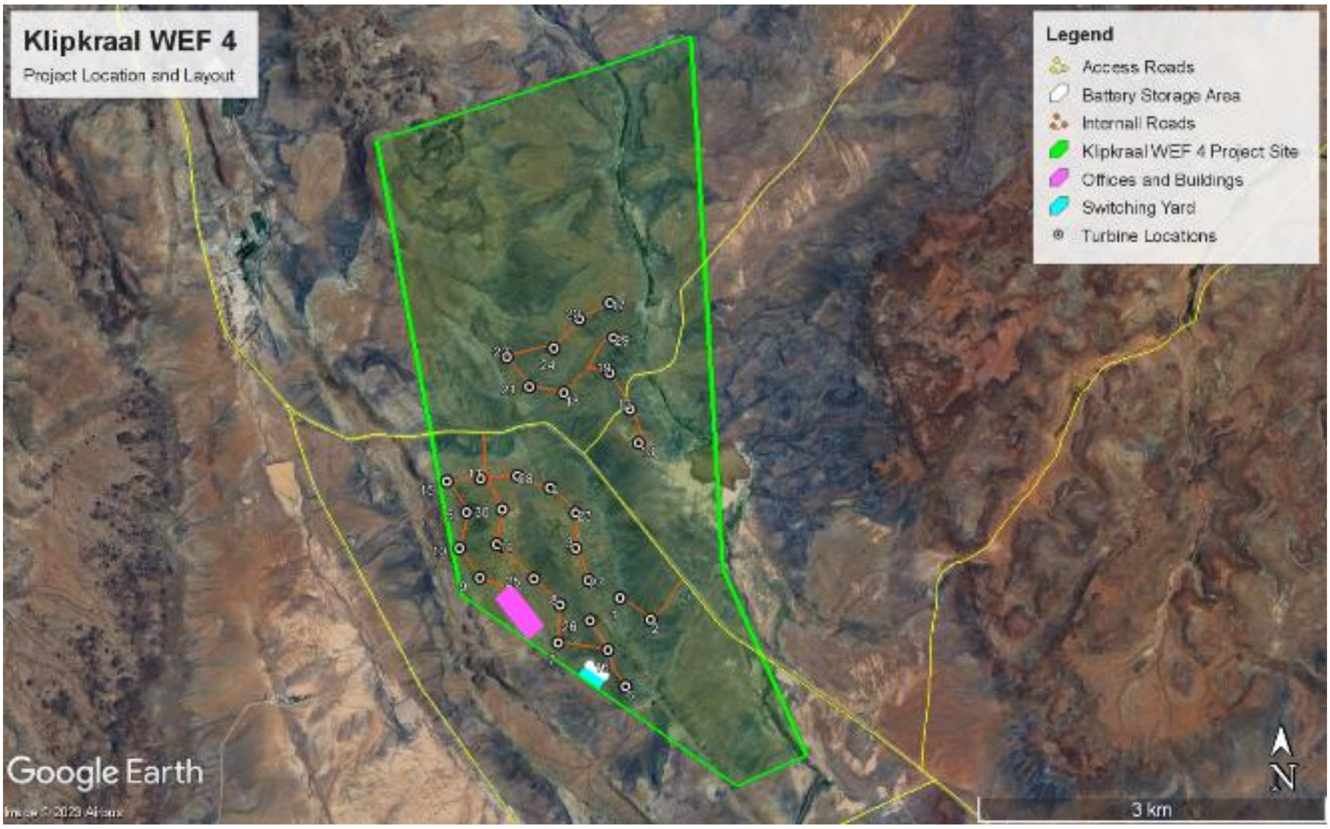

Figure 3: Klipkraal WEF 4 Site Locality and Layout.

3.2 Project Description

The application site assessed during the EIA phase (which incorporates the farm portions / properties listed above) is approximately 1,340 ha in extent.

It is anticipated that the proposed Klipkraal WEF 4 will comprise of up to sixty (60) wind turbines with a maximum total energy generation capacity of up to approximately 300 MW. In summary, the proposed Klipkraal WEF 4 development will include the following components:

<u>Wind Turbines</u>:

- Approximately 60 turbines, between 5MWac and 8MWac, with a maximum export capacity of up to approximately 300MWac. 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 200m;
- Each wind turbine will have a maximum rotor diameter of up to approximately 200m;
- Permanent compacted hardstanding areas / platforms (also known as crane pads) of approximately 100m x 100m (total footprint of approx. 10 000m^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 10m 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 700m^3.

<u>Electrical Transformers:</u>

- Electrical transformers will be constructed near the foot of each respective wind turbine in order to step up the voltage to 66kV.
- 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:

- One 11-66/132-400kV step-up / collector substation, each occupying an area of up to approximately 2ha,
- 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):

- One (1) new 132/400kV Main Transmission Substation (MTS) is being proposed, occupying an area of up to approximately 120ha.
- The proposed MTS will include an Eskom portion and an IPP portion.
- Following construction, the substation will be owned and managed by Eskom. The current applicant will retain control of the 132-400kV and lower voltage components of each MTS, while the 132/400kV voltage components of the 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);
- Each WEF will then connect to the MTS via an up to 400kV powerline;

Battery Energy Storage Systems (BESS):

- One (1) Battery Energy Storage System (BESS) will be constructed for the wind farm and will be located next to the 33-66/132-400kV 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 (or as determined prior to construction).
- 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 prior to construction. This information will be provided to I&AP’s prior to the commencement of construction;

Roads:

- Internal roads with a temporary width of up to approximately 15m will provide access to the location of each wind turbine. These roads will be rehabilitated back to 8m once construction has been completed.
- 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 000m^2 / 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);

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 WEF 4 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 Environment Programme (UNEP), AEWA brings together countries and the	Regional

Convention name	Description	Geographic scope
	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].

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.

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

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, resulting in a high summer aridity index (Mucina & Rutherford 2006). Summers are hot (maximum >30ºC) and winters are cold (minimum close to 0ºC) 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 in the PAOI and 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.
- **Dams and Pans:** The PAOI contains ground dams located in drainage lines, as well as seasonal pans. When these dams and pans fill up after good rains, they contain standing surface water for several months, which attracts birds to bath and drink.
- **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 in the PAOI.

5.3 Important Bird Areas (IBAs)

The Karoo National Park Important Bird Area (IBA) SA102 is the closest IBA and is located approximately 30km 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** sensitivity according to the Terrestrial Animal Species theme (

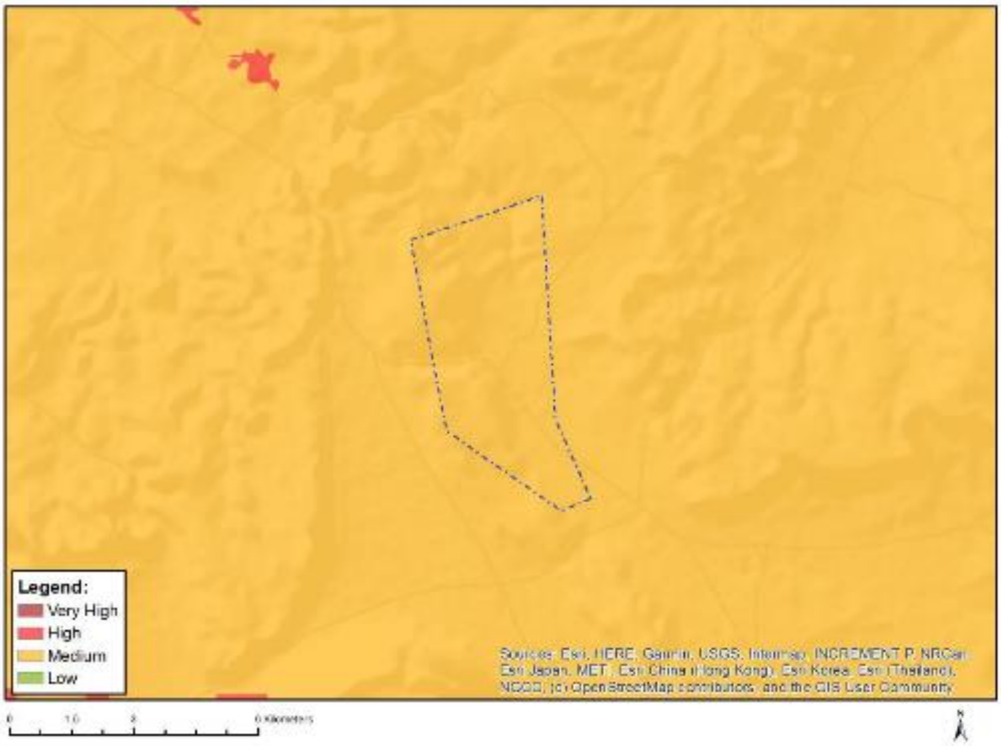

Figure 4**4**)[2]. The **Medium** sensitivity classification is linked to the potential occurrence of Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered).

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 the immediate surrounds. Based on the field surveys to date, a classification of **High** sensitivity for avifauna in the PAOI is suggested.

Refer to **Appendix 7** for the Site Sensitivity Verification Report.

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

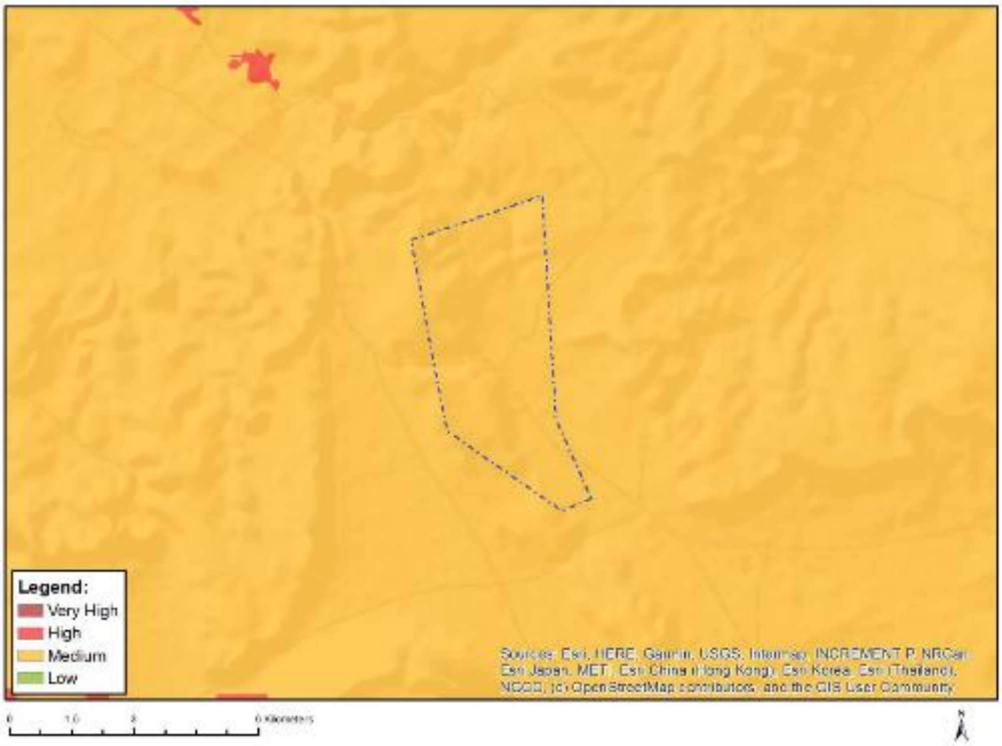

Figure 4: The classification of the PAOI according to the terrestrial animal species theme in the DFFE National Screening Tool. The classification of Medium sensitivity is linked to the potential occurrence of Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered).

5.5 National Protected Areas

The closest protected area to the proposed development area is the Karoo National Park (30km). 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

The Southern African Bird Atlas Project (SABAP2) data indicates that a total of 146 bird species could potentially occur within the Broader Area – **Appendix 5** provides a comprehensive list of all the species. Of these, 20 species are classified as priority species for wind energy developments and 9 of these are South African Red List species. Of the 20 priority species, 17 are likely to occur regularly in the Project Area of Impact (PAOI.

Table 3 below lists all the wind priority sensitive species and the potential impacts on the respective species by the proposed WEF. The following acronyms are used: 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 Conservation Status	Regional Conservation Status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Nama Karoo Shrub	Ridges	Drainage Lines and Boreholes	Dams and Pans	Alien Trees	Collision with turbines	Displacement – habitat transformation	Displacement – disturbance	Powerline – Electrocution MV	Powerline – Collision
African Rock Pipit	*Anthus crenatus*	8,70	1,47	NT	NT		M	x						x	x		
Black Stork	*Ciconia nigra*	-	-	-	VU	x	M				x		x		x	x	x
Blue Crane	*Grus paradisea*	-	-	VU	NT	x	M	x			x		x	x	x		x
Booted Eagle	*Hieraaetus pennatus*	8,70	1,47	-	-	x	M	x	x		x	x	x		x	x	
Common Buzzard	*Buteo buteo*	0,00	1,47	-	-	x	M	x	x		x	x	x			x	
Double-banded Courser	*Rhinoptilus africanus*	2,17	0,00	-	-		L	x					x	x	x		
Greater Flamingo	*Phoenicopterus roseus*	0,00	1,47	-	NT	x	M				x		x				x
Greater Kestrel	*Falco rupicoloides*	0,00	2,94	-	-	x	M	x	x		x	x	x		x	x	
Grey-winged Francolin	*Scleroptila afra*	0,00	0,00	-	-	x	M	x					x	x	x		
Jackal Buzzard	*Buteo rufofuscus*	41,30	23,53	-	-	x	H	x	x		x	x	x		x	x	
Karoo Korhaan	*Eupodotis vigorsii*	73,91	23,53	-	NT	x	H	x					x	x	x		x
Lesser Kestrel	*Falco naumanni*	2,17	5,88	-	-	x	M	x	x		x	x	x			x	
Ludwig’s Bustard	*Neotis ludwigii*	8,70	4,41	EN	EN	x	M	x					x	x	x		x
Martial Eagle	*Polemaetus bellicosus*	8,70	0,00	EN	EN	x	M	x	x		x	x	x		x	x	
Pale Chanting Goshawk	*Melierax canorus*	19,57	8,82	-	-	x	H	x	x	x	x	x	x		x	x	

Species Name	Scientific Name	Full protocol	Ad hoc protocol	Global Conservation Status	Regional Conservation Status	Recorded during monitoring	Likelihood of regular occurrence in PAOI	Nama Karoo Shrub	Ridges	Drainage Lines and Boreholes	Dams and Pans	Alien Trees	Collision with turbines	Displacement – habitat transformation	Displacement – disturbance	Powerline – Electrocution MV	Powerline – Collision
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	-	-	-	-	x	M		x	x	x	x	x		x	x	
Secretarybird	*Sagittarius serpentarius*	-	-	EN	VU	x	M	x			x		x	x	x		x
Spotted Eagle-Owl	*Bubo africanus*	2,17	1,47	-	-		L		x	x		x	x		x	x	x
Verreaux's Eagle	*Aquila verreauxii*	26,09	1,47	-	VU	x	H	x	x		x		x		x	x	x
White Stork	*Ciconia ciconia*	0,00	1,47	-	-	x	M				x		x				x

5.7 Results of Pre-construction Bird Monitoring

An integrated pre-construction monitoring programme was implemented at the five proposed Klipkraal wind energy sites (Klipkraal WEF 1 – 5) across four seasons and six surveys. The monitoring was designed according to the following best practice 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.
- 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.

Wind priority species were identified using the latest (November 2014) BirdLife SA (BLSA) list of priority species for wind farms. The pre-construction monitoring surveys at the proposed Klipkraal WEF 4 site have thus far been conducted during the following periods (with an additional two surveys to be completed during the EIA Phase):

- 15 – 19 February 2022
- 12 – 20 July 2022
- 17 – 22 October 2022
- 10 – 14 January 2023

To gain a more accurate picture of the data collected at the Klipkraal WEF 4 site only, the site's data was extracted from the overall monitoring programme being carried out for the Klipkraal WEF cluster. **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 proposed Klipkraal WEF 4 site and a control area.

5.7.1 Transects

The results of the transect counts conducted at Klipkraal WEF 4 are displayed in **Table 4**:

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

Turbine Site	Number
Species Composition	
All Species	63
Priority Species	2 (3%)
Non-Priority Species	61
Total Count	
Drive transects	793
Walk transects	834
Total	1627
Control Site	**Number**
Species Composition	
All Species	65
Priority Species	7 (11%)
Non-Priority Species	58

Total Count	
Drive transects	1409
Walk transects	958
Total	2367

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

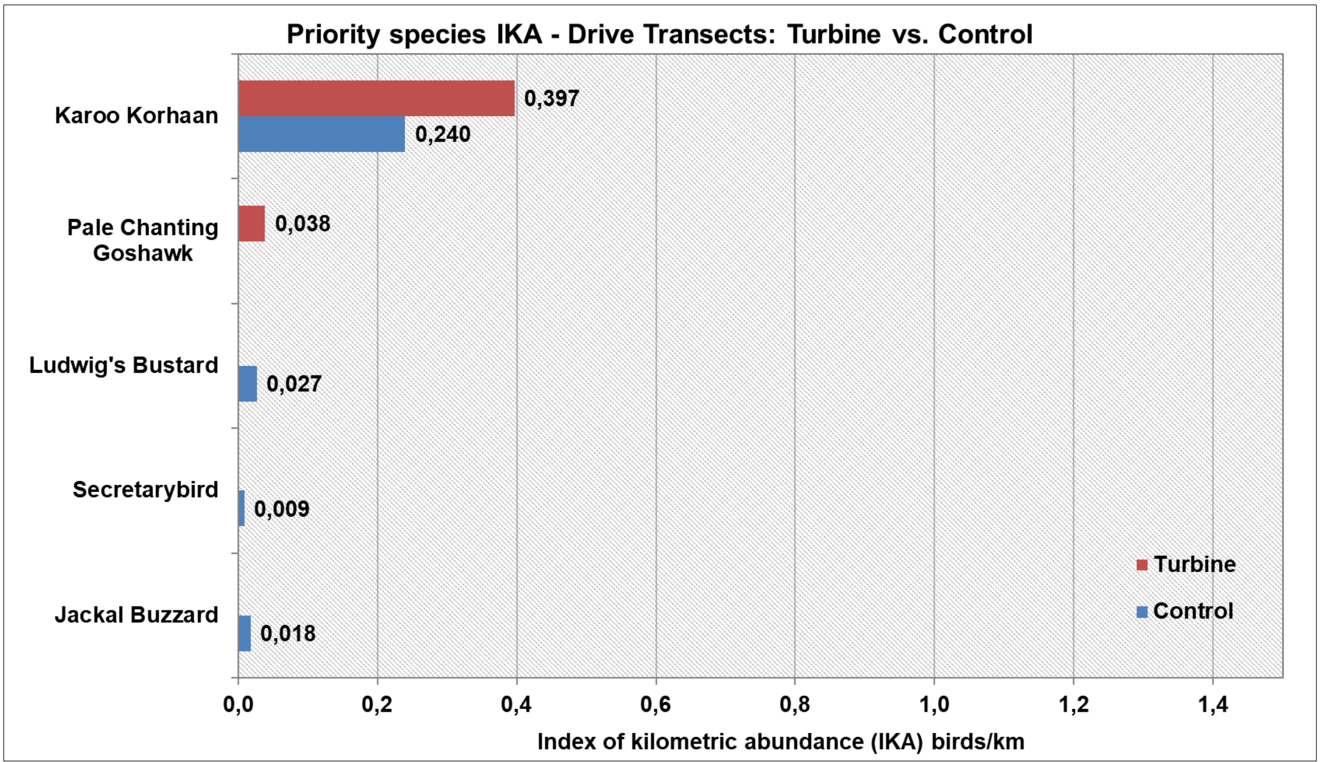

Figure 5: Index of kilometric abundance of priority species recorded at the Klipkraal WEF 4 site and control site through drive transect surveys conducted during pre-construction monitoring.

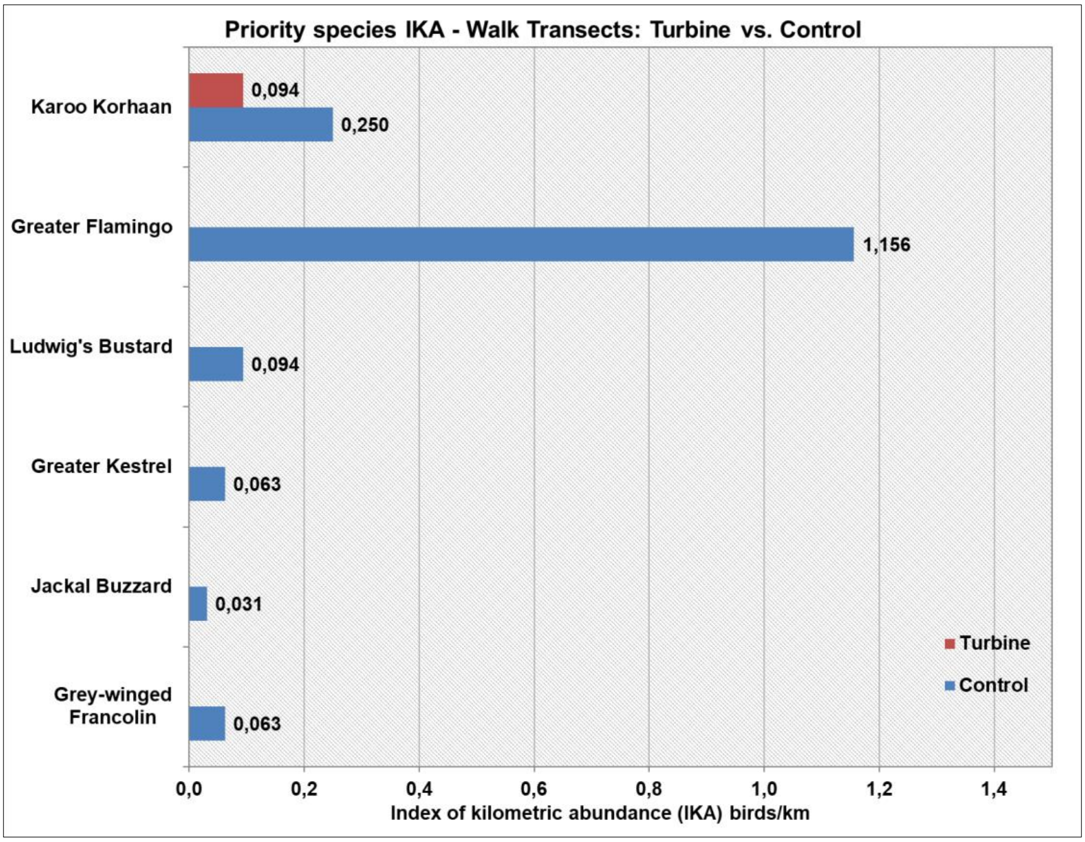

Figure 6: Index of kilometric abundance of priority species recorded at the Klipkraal WEF 4 site and control site through walk transect surveys conducted during pre-construction monitoring.

5.7.2 Focal Points

See **Table 5** below for a summary of the focal point survey data recorded during the pre-construction monitoring at the Klipkraal WEF 4 site.

Table 5: Summary of focal point surveys conducted at the Klipkraal WEF 4 site during the pre-construction monitoring.

Focal Point Description	Survey 1	Survey 2	Survey 3	Survey 4
FP1: Wangarino Farm Dam	No Priority spp	No priority spp	Dam is dry	Dam 50%, no priority spp
FP3: Wangarino Jackal Buzzard (JB) Nest	JBs in vicinity	JBs in vicinity, no nest activity	JBs in vicinity, no breeding	No nest activity, adult seen hunting east of nest
FP6: Matjesfontein Verreaux's Eagle (VE) Nest	NA	Female breeding on nest	VE hunting in vicinity	VEs hunting in Kloof

See **Appendix 3** for the location of the focal points and **Figure 7** for the location of the Verreaux's Eagle nests.

Figure 7: Verreaux's Eagle nests recorded during the pre-construction monitoring near Klipkraal WEF 4.

5.7.3 Incidental Counts

Table 6 provides an overview of the incidental sightings of priority species recorded at the Klipkraal WEF 4 site.

Table 6: Incidental sightings of priority species recoded during all surveys over four seasons at Klipkraal WEF 4 and the Control Site.

Priority Species (Incidentals)		V1	V2	V3	V4	Grand Total
Control Site						
Jackal Buzzard	*Buteo rufofuscus*	0	0	1	0	**1**
Karoo Korhaan	*Eupodotis vigorsii*	0	2	3	1	**6**
Lesser Kestrel	*Falco naumanni*	0	0	0	1	**1**
Verreaux's Eagle	*Aquila verreauxii*	0	0	0	2	**2**
Turbine Site						
African Rock Pipit	*Anthus crenatus*	0	0	3	0	**3**
Jackal Buzzard	*Buteo rufofuscus*	1	1	1	2	**5**
Karoo Korhaan	*Eupodotis vigorsii*	6	2	9	0	**17**
Lesser Kestrel	*Falco naumanni*	0	0	0	3	**3**
Martial Eagle	*Polemaetus bellicosus*	1	0	0	0	**1**
Pale Chanting Goshawk	*Melierax canorus*	1	0	0	1	**2**
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0	1	0	0	**1**
Verreaux's Eagle	*Aquila verreauxii*	2	0	0	2	**4**

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

After four surveys, flight patterns of priority species were recorded at the Klipkraal WEF 4 site for 96 hours (48 hours per VP at this stage) at two vantage points at the development site in three bands (high = above rotor altitude; medium = at rotor altitude; low = below rotor altitude) (**Figure 8**). Approximate flight altitude was visually judged by an observer with the aid of binoculars. Priority species were observed for 1 hour, 10 minutes, and 30 seconds during the surveys. Medium altitude flights (within rotor altitude) were recorded for 38 minutes.

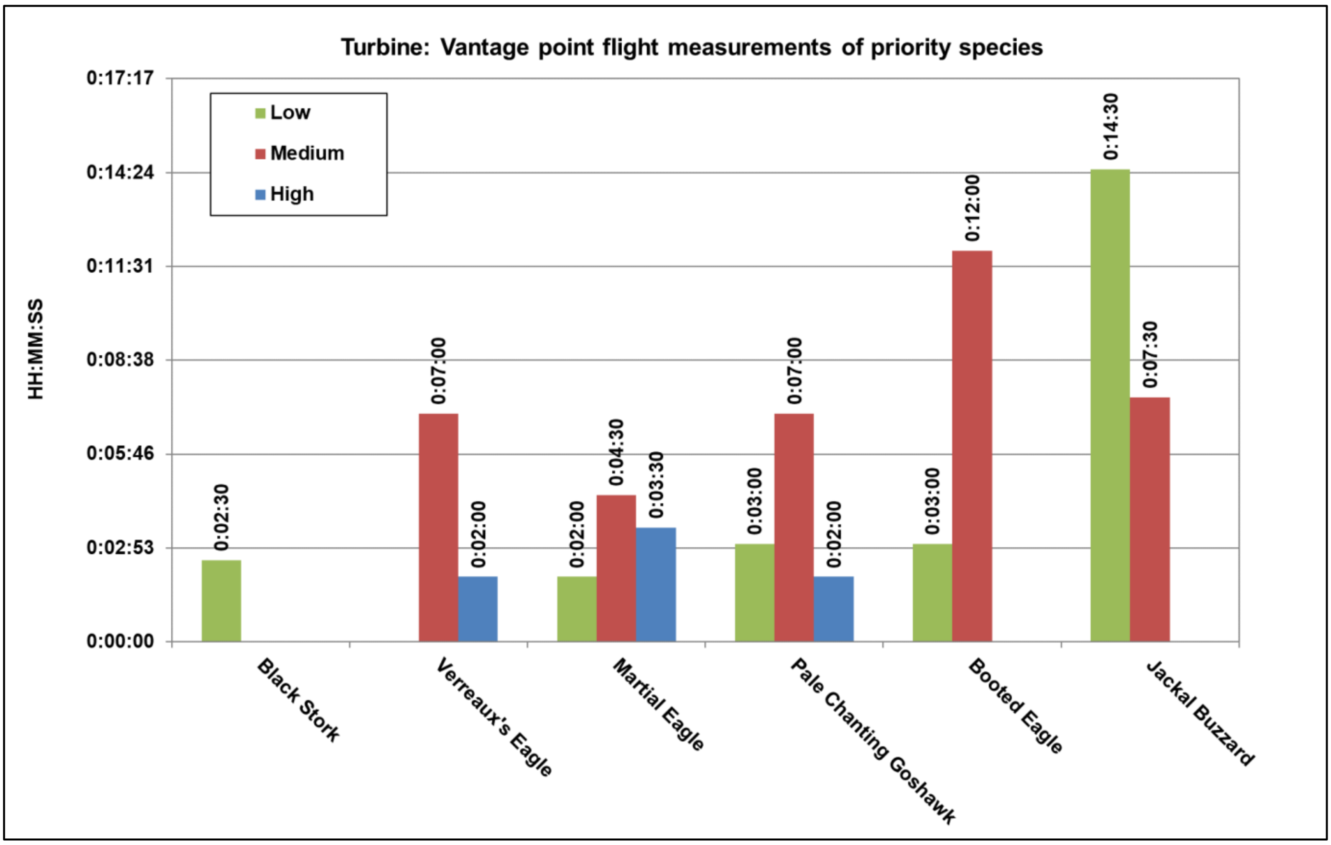

Figure 8: Flight times and altitudes recorded for priority species during the on-site surveys at the Klipkraal WEF 4 site after four surveys.

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

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 9** 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)	Number of Turbines	Site specific collision risk rating
Black Stork		100	60	0,00
Martial Eagle	0,0031	100	60	0,19
Pale Chanting Goshawk	0,0049	70	60	0,20
Jackal Buzzard	0,0052	95	60	0,30
Verreaux's Eagle	0,0049	115	60	0,34
Booted Eagle	0,0083	85	60	0,43
Average	**0,005**	**94**		**0,24**

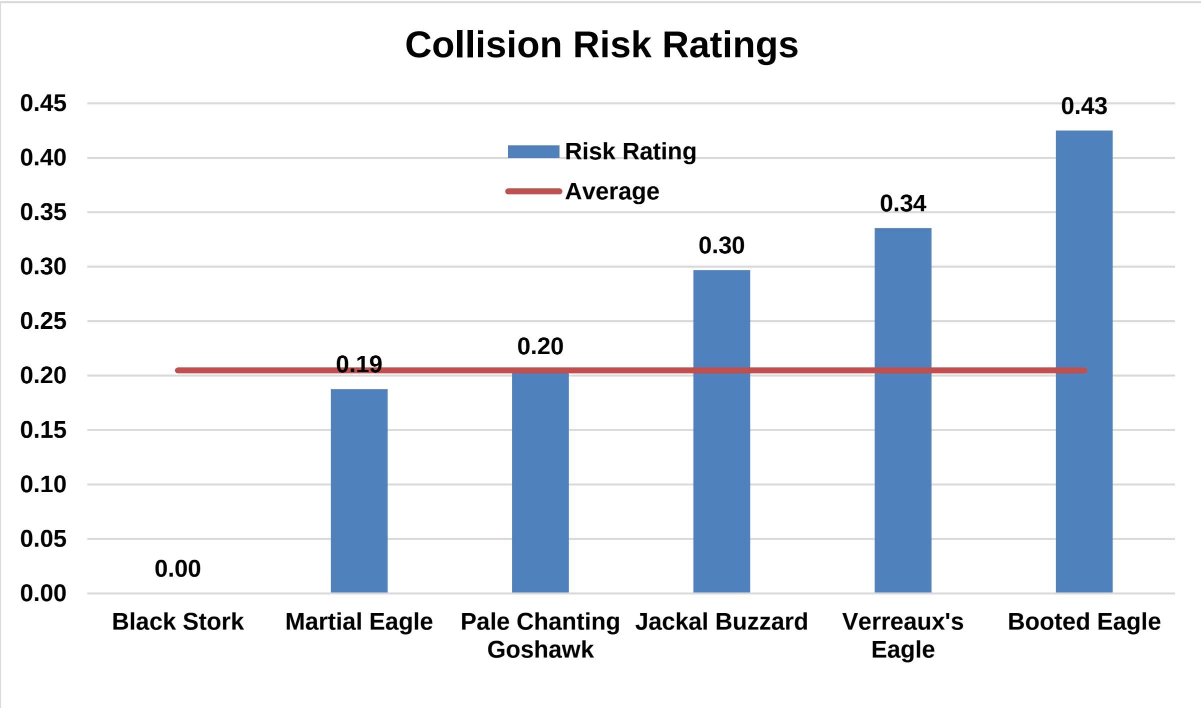

Figure 9: Site specific collision risk rating for priority species. The red line indicates the average collision risk rating for priority species at the proposed Klipkraal WEF 4 site, based on recorded flight behaviour during the pre-construction monitoring surveys (four surveys conducted to date).

[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).

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 4 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, to give an indication where the observed flight activity was most concentrated (**Figures 10 – 14**).

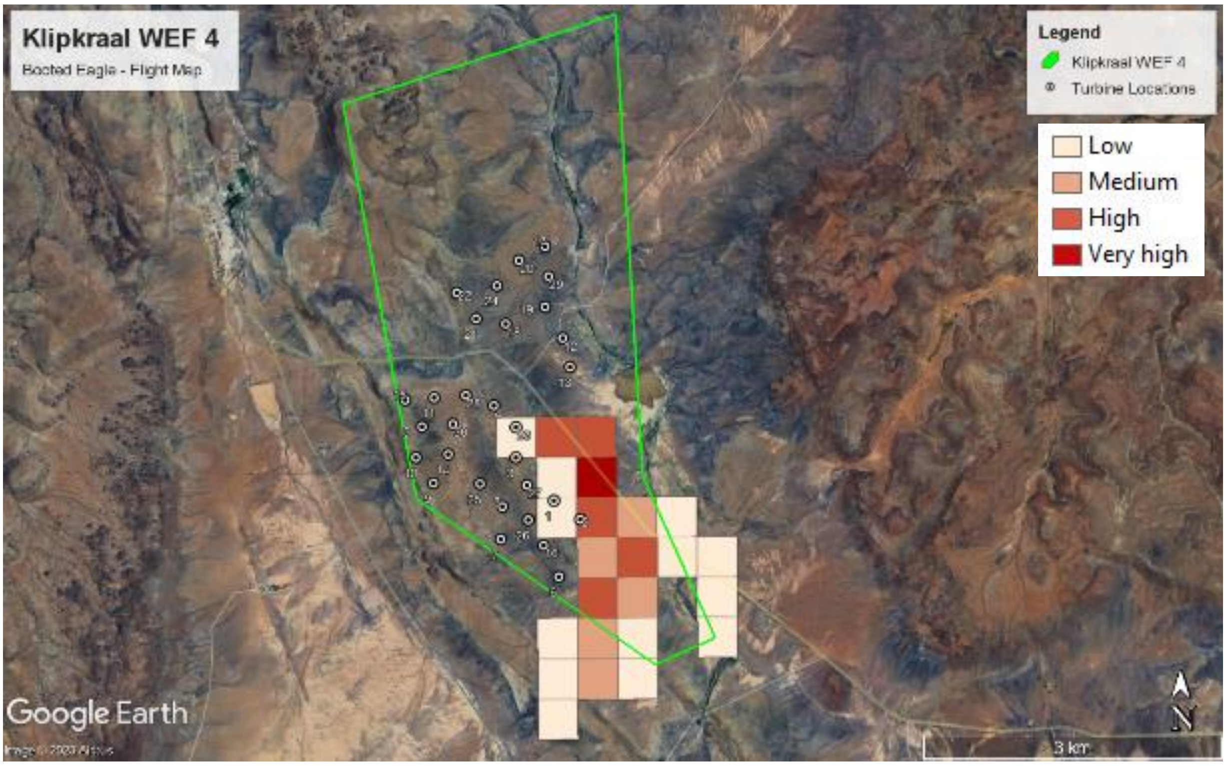

Figure 10: Intensity of flight activity of Booted Eagle.

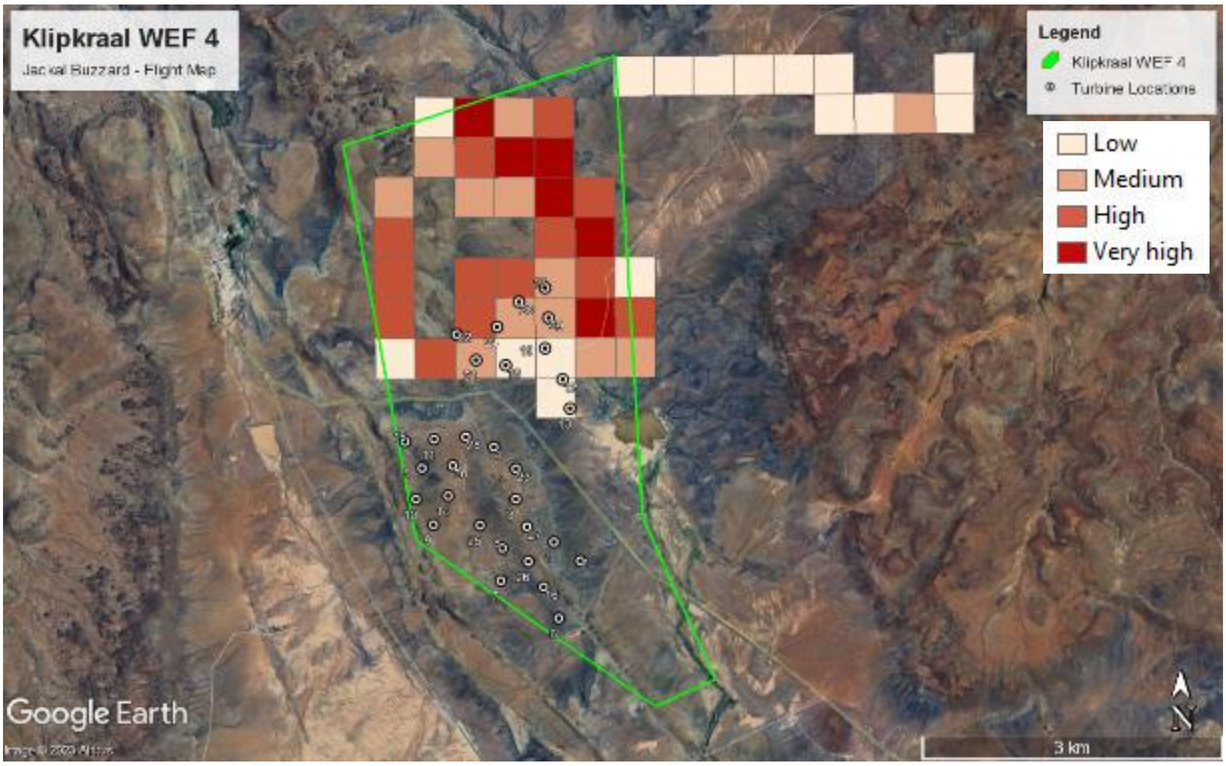

Figure 11: Intensity of flight activity of Jackal Buzzard.

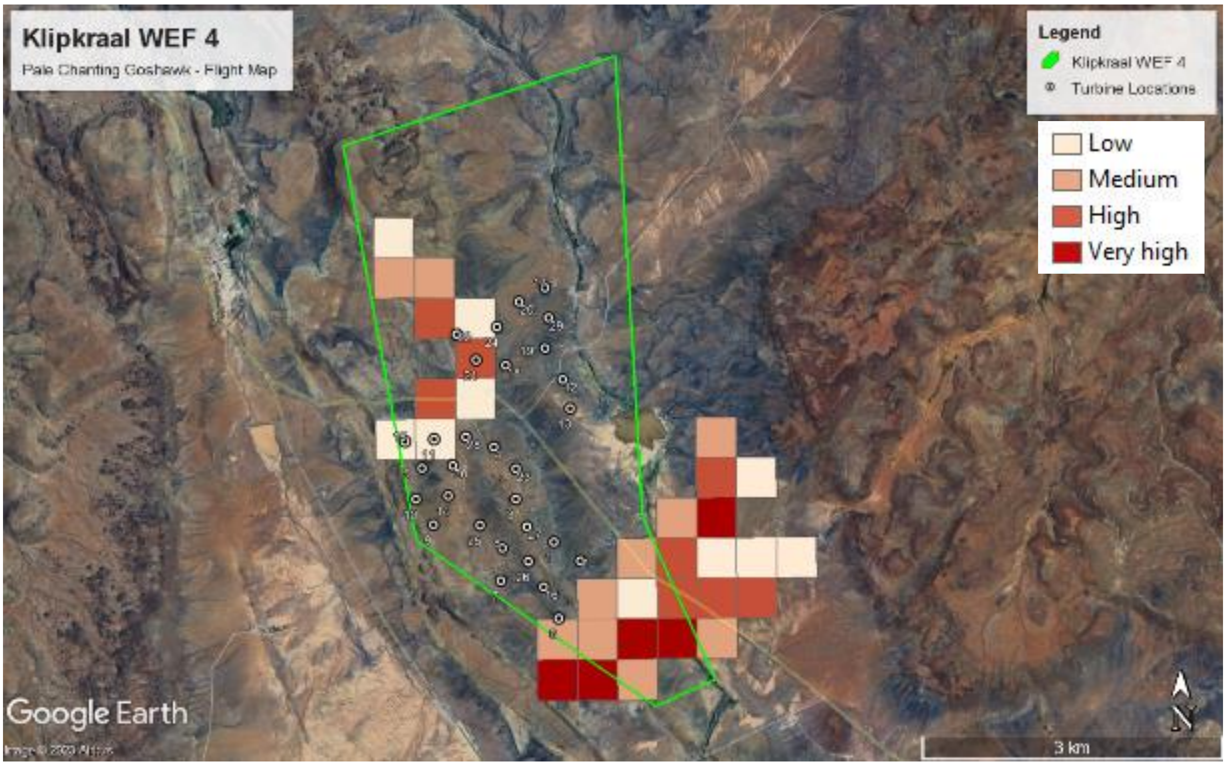

Figure 12: Intensity of flight activity of Pale Chanting Goshawk.

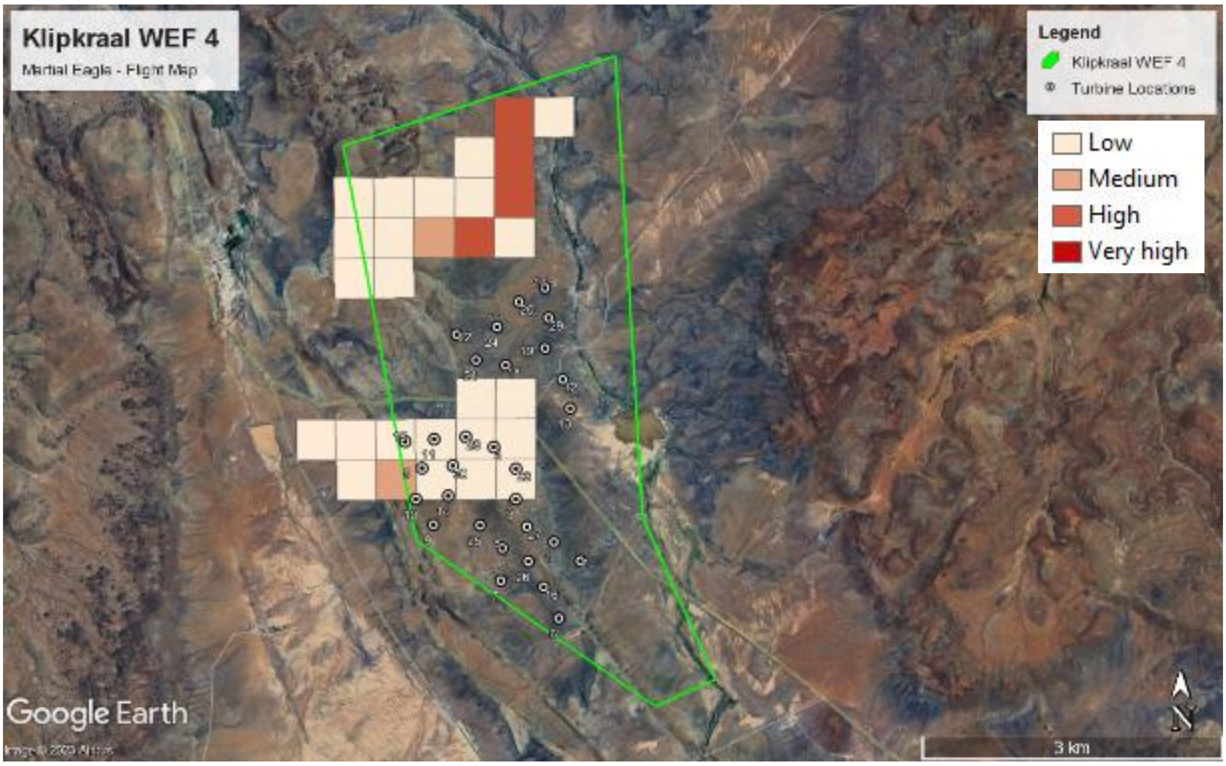

Figure 13: Intensity of flight activity of Martial Eagle.

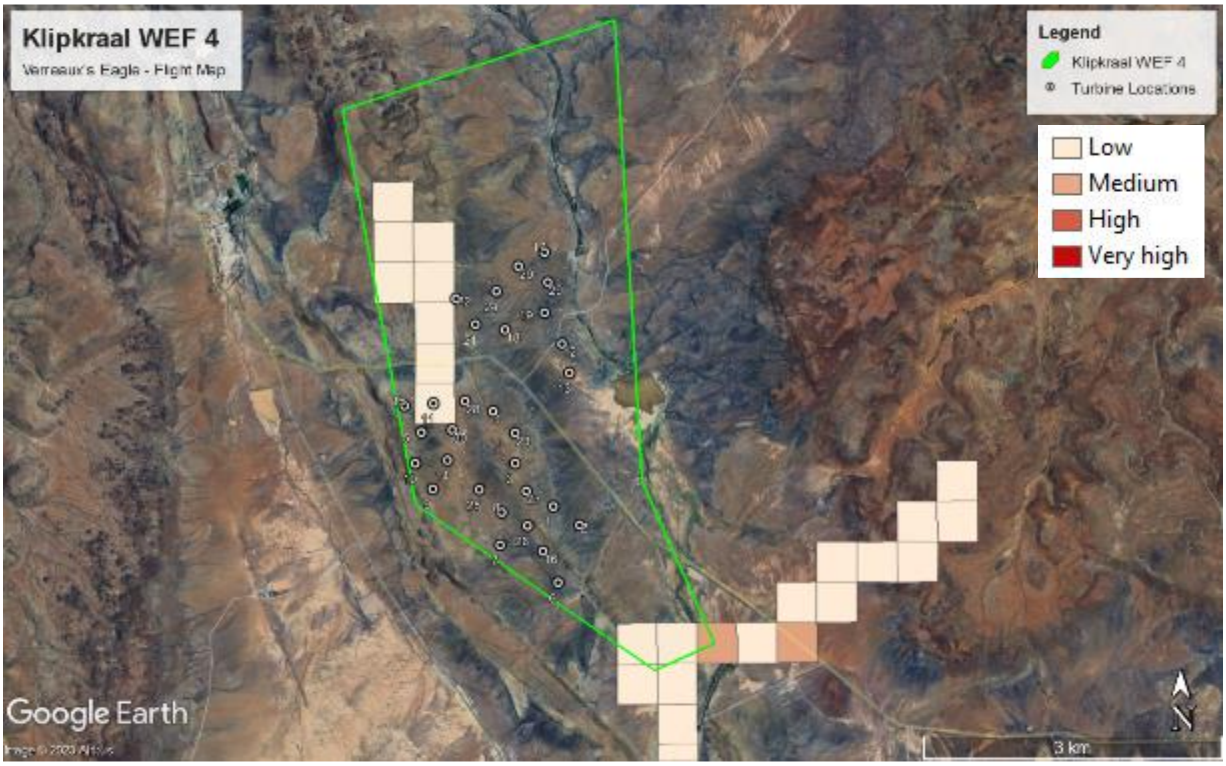

Figure 14: Intensity of flight activity of Verreaux's Eagle.

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

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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.

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 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).

- Sensory 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 that contributes 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 could also be the reason for 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 fatalities were 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 into the PAOI regularly.

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 PAOI
Black Stork[5]	*Ciconia nigra*	-	-	-	VU		M
Blue Crane[6]	*Grus paradisea*	-	-	VU	NT		M
Booted Eagle	*Hieraaetus pennatus*	8,70	1,47	-	-		M
Common Buzzard	*Buteo buteo*	0,00	1,47	-	-		M
Double-banded Courser	*Rhinoptilus africanus*	2,17	0,00	-	-		L
Greater Flamingo	*Phoenicopterus roseus*	0,00	1,47	-	NT		M
Greater Kestrel	*Falco rupicoloides*	0,00	2,94	-	-		M
Grey-winged Francolin	*Scleroptila afra*	0,00	0,00	-	-	x	M
Jackal Buzzard	*Buteo rufofuscus*	41,30	23,53	-	-	x	H
Karoo Korhaan	*Eupodotis vigorsii*	73,91	23,53	-	NT		H
Lesser Kestrel	*Falco naumanni*	2,17	5,88	-	-		M
Ludwig's Bustard	*Neotis ludwigii*	8,70	4,41	EN	EN		M
Martial Eagle	*Polemaetus bellicosus*	8,70	0,00	EN	EN		M
Pale Chanting Goshawk	*Melierax canorus*	19,57	8,82	-	-		H
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0,00	0,00	-	-		M
Secretarybird	*Sagittarius serpentarius*	0,00	0,00	EN	VU		M
Spotted Eagle-Owl	*Bubo africanus*	2,17	1,47	-	-		L
Verreaux's Eagle	*Aquila verreauxii*	26,09	1,47	-	VU		H
White Stork	*Ciconia ciconia*	0,00	1,47	-	-		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 is still

[5] Recorded during pre-construction monitoring.

[6] Recorded during pre-construction monitoring.

using wind farm sites as leks.[7] Research on small grassland species in North America indicates that permanent displacement is uncommon and very species 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 other 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:

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

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
African Rock Pipit	*Anthus crenatus*	8,70	1,47	NT	NT	x	M
Black Stork	*Ciconia nigra*	0,00	0,00	-	VU		M
Blue Crane	*Grus paradisea*	0,00	0,00	VU	NT		M
Booted Eagle	*Hieraaetus pennatus*	8,70	1,47	-	-		M
Double-banded Courser	*Rhinoptilus africanus*	2,17	0,00	-	-		L
Greater Kestrel	*Falco rupicoloides*	0,00	2,94	-	-		M
Grey-winged Francolin	*Scleroptila afra*	0,00	0,00	-	-	x	M
Jackal Buzzard	*Buteo rufofuscus*	41,30	23,53	-	-	x	H
Karoo Korhaan	*Eupodotis vigorsii*	73,91	23,53	-	NT		H
Ludwig's Bustard	*Neotis ludwigii*	8,70	4,41	EN	EN		M
Martial Eagle	*Polemaetus bellicosus*	8,70	0,00	EN	EN		M
Pale Chanting Goshawk	*Melierax canorus*	19,57	8,82	-	-		H
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0,00	0,00	-	-		M
Secretarybird	*Sagittarius serpentarius*	0,00	0,00	EN	VU		M
Spotted Eagle-Owl	*Bubo africanus*	2,17	1,47	-	-		L
Verreaux's Eagle	*Aquila verreauxii*	26,09	1,47	-	VU		H

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 infra-structure, 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
African Rock Pipit	*Anthus crenatus*	8,70	1,47	NT	NT	x	M
Blue Crane	*Grus paradisea*	0,00	0,00	VU	NT		M
Double-banded Courser	*Rhinoptilus africanus*	2,17	0,00	-	-		L
Grey-winged Francolin	*Scleroptila afra*	0,00	0,00	-	-	x	M
Karoo Korhaan	*Eupodotis vigorsii*	73,91	23,53	-	NT		H
Ludwig's Bustard	*Neotis ludwigii*	8,70	4,41	EN	EN		M
Secretarybird	*Sagittarius serpentarius*	0,00	0,00	EN	VU		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
Black Stork	*Ciconia nigra*	0,00	0,00	-	VU		M
Booted Eagle	*Hieraaetus pennatus*	8,70	1,47	-	-		M
Common Buzzard	*Buteo buteo*	0,00	1,47	-	-		M
Greater Kestrel	*Falco rupicoloides*	0,00	2,94	-	-		M
Jackal Buzzard	*Buteo rufofuscus*	41,30	23,53	-	-	x	H
Lesser Kestrel	*Falco naumanni*	2,17	5,88	-	-		M
Martial Eagle	*Polemaetus bellicosus*	8,70	0,00	EN	EN		M
Pale Chanting Goshawk	*Melierax canorus*	19,57	8,82	-	-		H
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0,00	0,00	-	-		M
Spotted Eagle-Owl	*Bubo africanus*	2,17	1,47	-	-		L
Verreaux's Eagle	*Aquila verreauxii*	26,09	1,47	-	VU		H

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[8]:

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
Black Stork	*Ciconia nigra*	0,00	0,00	-	VU		M
Blue Crane	*Grus paradisea*	0,00	0,00	VU	NT		M
Greater Flamingo	*Phoenicopterus roseus*	0,00	1,47	-	NT		M
Karoo Korhaan	*Eupodotis vigorsii*	73,91	23,53	-	NT		H

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

Species name	Scientific name	Full protocol	Ad hoc protocol	Global status	Regional status	Endemic (SA)	Likelihood of regular occurrence in the
Ludwig's Bustard	*Neotis ludwigii*	8,70	4,41	EN	EN		M
Secretarybird	*Sagittarius serpentarius*	0,00	0,00	EN	VU		M
Spotted Eagle-Owl	*Bubo africanus*	2,17	1,47	-	-		L
Verreaux's Eagle	*Aquila verreauxii*	26,09	1,47	-	VU		H
White Stork	*Ciconia ciconia*	0,00	1,47	-	-		M

6.2 The Identification and Assessment of Potential Impacts

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

The impact rating criteria is explained in **Appendix 6**.

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	1	4	2	3	1	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
Construction Phase																				
											control noise and dust should be applied according to current best practice in the industry.									
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 be upgraded. (3) The recommendations of biodiversity specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	1	2	2	2	3	2	20		Low

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,	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																				
											additional measures will have to be implemented which could include shut down on demand or other proven measures.									
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 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	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																				
											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 Environmental Sensitivities

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

6.3.1 High Sensitivity Zones.

Raptor Nests – A 3.7km turbine exclusion zone should be implemented and maintained around the Verreaux's Eagle nest located at -31.975694° South, 21.682583° East, and an 750m turbine exclusion zone around the Jackal Buzzard nest located at -32.011611° South, 21.727139° East, to reduce the risk of turbine collisions and the risk of displacement due to disturbance. The turbine rotor swept area should also not penetrate these buffer zones.

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. <u>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</u>. The turbine rotor swept area should also not penetrate these buffer zones.

6.3.2 Medium Sensitivity Zones.

Raptor Nests – A 5.2km medium risk sensitivity zone around the Verreaux's Eagle nest located at -31.975694° South, 21.682583° East. All turbines in the area >3.7km up to 5.2km should be regarded as medium-risk and relocated if possible. Should relocation not be feasible, these turbines should be subject to pro-active mitigation in the form of a proven mitigation methods such as Shutdown on Demand (SDoD), using either bio monitors or an automated system such as IdentiFlight. If all turbines (and their rotor swept area) are located outside the 5.2km buffer monitoring can be concluded after six surveys i.e. 72hours per vantage point.

See Error! Reference source not found.**15** for a map of the avifaunal sensitivities identified for Klipkraal WEF 4

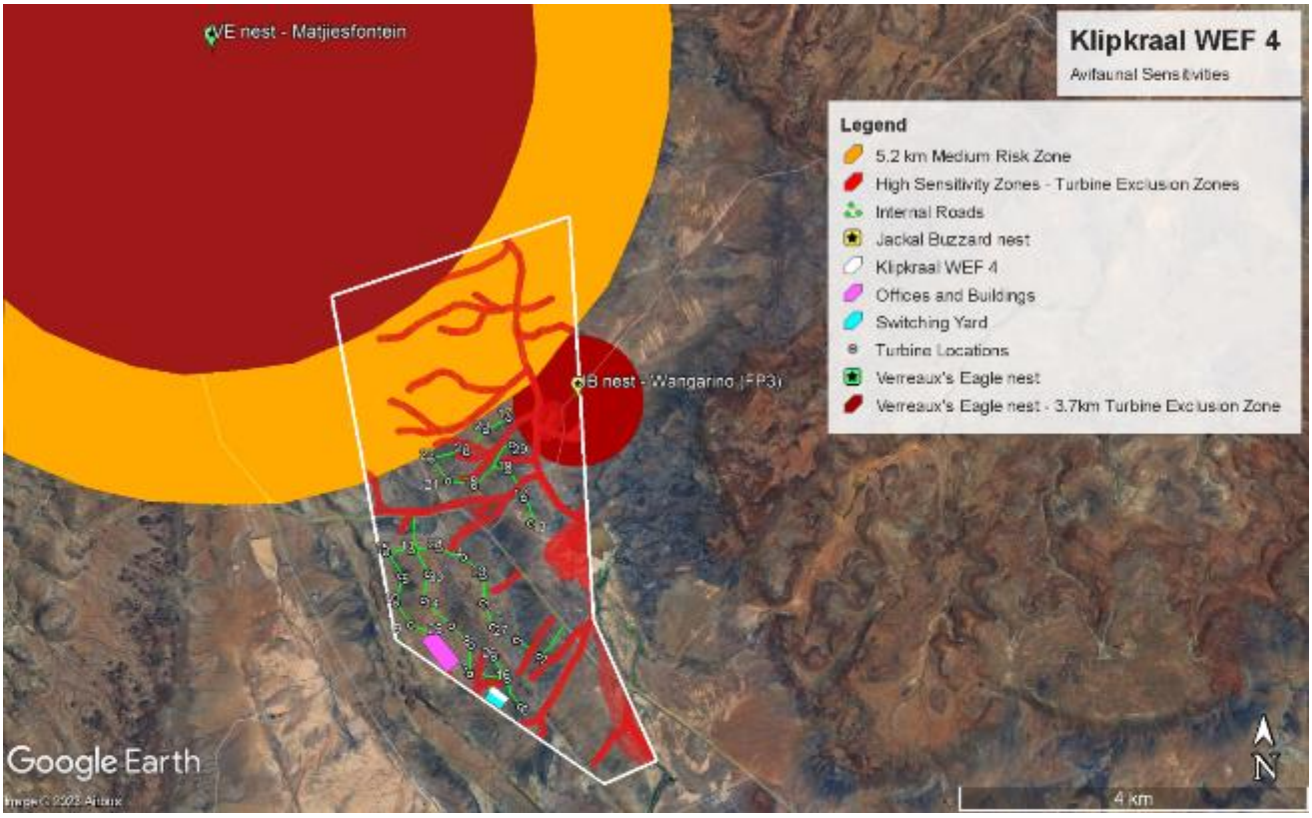

Figure 15: Proposed no-turbine zones. Avifaunal sensitivities for the Klipkraal WEF 4 project.

6.4 Cumulative Impacts

There are no other proposed renewable energy projects within a 35km radius of the proposed Klipkraal WEF Sites (**Figure 15**). The maximum number of wind turbines which are currently proposed for the Klipkraal WEFs (1 – 5) is 240 (up to 40 turbines each for Klipkraal WEF 1–3 and up to 60 turbines each for Klipkraal WEF 4–5). None of these have been constructed to date, and each of the proposed projects 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 unlikely that a total of 240 turbines will be constructed, but due to the possibility that it could happen, the precautionary principle must be applied. The Klipkraal WEF 4 will consist of up to 60 turbines. The 60 turbines of Klipkraal WEF 4 constitute 25% 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 1,603 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 Klipkraal WEF 4, 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 projects. 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 4 amounts to about 0.3% of the total habitat available in the 35km radius. The contribution of the Klipkraal WEF 4 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.

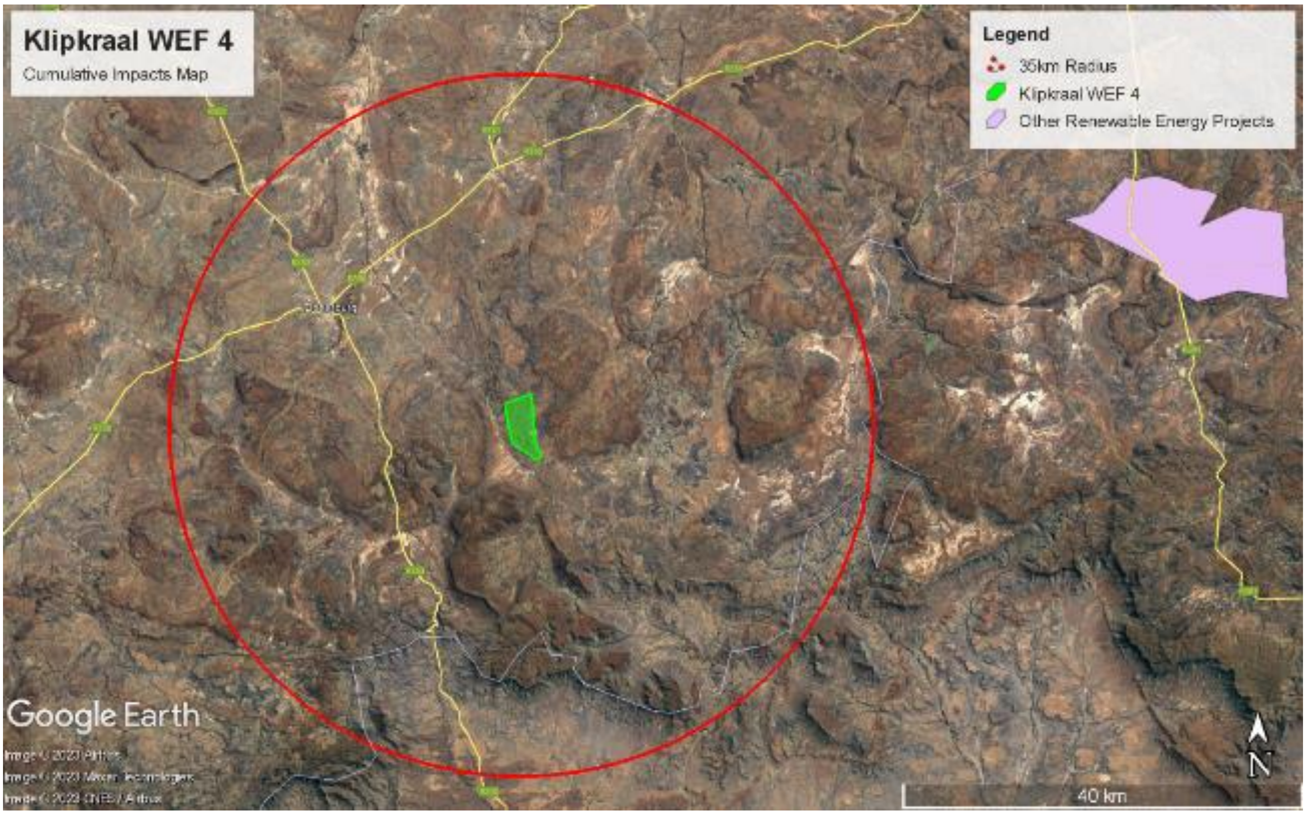

Figure 16: Proposed renewable energy projects within a 35km radius around the proposed Klipkraal WEF 4 site (REEA 2023 Q1).

7. COMPARATIVE ASSESSMENT OF ALTERNATIVES

7.1 Wind Energy Facility

The proposed Klipkraal WEF 4 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 assessed as part of the Scoping Phase. The Klipkraal WEF 4 Project Site is approximately 1,340 ha in extent. The final layout and design alternative will be considered and assessed during the EIA Phase.

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 4 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 that fall in this category are Ludwig's Bustard, Karoo Korhaan, Double-banded Courser, Grey-winged Francolin, African Rock Pipit, and Spotted Eagle-Owl. Some raptors may also be affected, e.g., Pale Chanting Goshawk which could potentially breed in the small *Vachellia* trees in the drainage lines. Some species may be able to recolonise the area after the completion of the construction phase, but for other species this might only be partially the case. Bird population densities could decrease 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. The turbine rotor swept area should not extend over the buffer zone. (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.	Low
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	Low

Nature of impact and Phase	Overall Impact Significance (Pre - Mitigation)	Proposed Mitigation	Overall Impact Significance (Post - Mitigation)
		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).	
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

8.2 Conclusion and Impact Statement

The proposed Klipkraal WEF 4 will have a moderate impact on avifauna which, in most instances, could be reduced to a low impact through appropriate mitigation. Any alternative substation and laydown locations will all be situated in essentially the same habitat, i.e., Karoo Scrubland. The habitat is not particularly sensitive, as far as avifauna is concerned. No fatal flaws were discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report (**Section 6**) and the EMPr (**Appendix 8**) are strictly implemented.

9. FINAL LAYOUT

The proposed Klipkraal WEF 4 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 assessed as part of the Scoping Phase. The Klipkraal WEF 4 Project Site is approximately 1,340 ha in extent. The final layout and design alternative will be considered and assessed during the EIA Phase.

The following environmental sensitivities were identified from an avifaunal perspective for the proposed wind energy facility (**Figure 17**). Mitigation measures to reduce impacts on avifauna are set out in the Environmental Management Programme (EMPr) (**Appendix 8**).

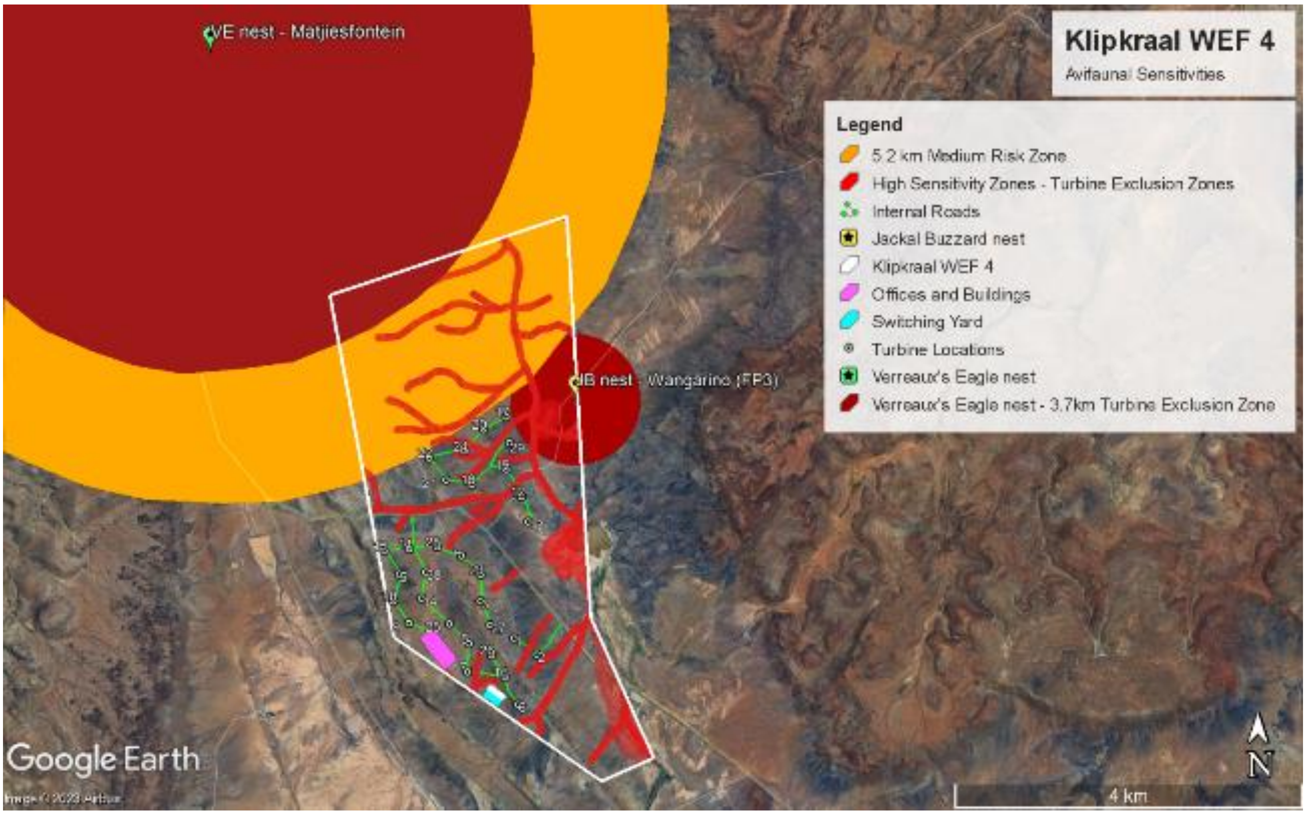

Figure 17: Avifaunal sensitivities for the Klipkraal WEF 4 project.

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.

11. REFERENCES

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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 each proposed Klipkraal WEF phase ***and*** the associated grid connection infrastructure totalling 8 reports to be produced.

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 deliverable will be a final EIA phase report.

Specialists will also be required to update the BA specialist report to address any comments or concerns arising from the public participation process of the BA 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: 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

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	PhD Biological Sciences
Nationality	:	South African
Years of Experience	:	10 years

Key Qualifications

Megan Loftie-Eaton **(**Pr.Sci.Nat) holds a PhD in Biological sciences from the Avian Demography Unit, University of Cape Town, and has more than 10 years experience conducting bird research, atlasing, mapping and environmental assessment consulting. Megan was an assistant researcher on the African Penguin EarthWatch Research Team, conducting population surveys on penguins and other seabirds, sustainable agriculture research, biodiversity surveys and ecological monitoring. She has acted as coordinator, Social media manager and communications officer for various programmes including The Biodiversity and Development Institute (OdonataMAP, Citizen Science Projects), LepiMAP, BirdMAP, ADU and Hoedspruit Hub. She is on the Expert Panel for a virtual museum covering several vertebrate taxa. Megan is also very active with the bird atlasing project, she presented and assessed several atlasing workshops in Africa and Europe. She facilitated an assessed Ecology courses and provided training materials for it. She has been involved in Environmental and specifically Avian assessments since 2020 by conducting fieldwork, completing assessments and acting as an environmental assessment practitioner. She has several additional qualifications, including a FGASA Level 1 Nature guide qualification, a First aid level one qualification, snake and scorpion training courses and a course in humane trapping methods. She completed online global environmental management course, and a NQF level 5 outcomes-based assessment course. Megan is an author or co-author on several scientific papers and currently she operates as an Avifaunal specialist working with Chris van Rooyen Consulting.

Key Project Experience

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

1. Philipstown Kudu Solar Energy Facilities and associated infrastructure
2. Umsobomvu Solar Energy Facilities and associated infrastructure
3. Ezelsjacht Wind Energy Facility and associated infrastructure
4. Heuweltjies en Kraaltjies Wind Energy Facilities and associated infrastructure
5. Mercury Solar Energy Facilities and associated infrastructure
6. Perdekraal East Wind Energy Facility and associated infrastructure
7. Skilpad Solar Energy Facility and associated infrastructure

Other Avifaunal Projects

1. Blue Stone Quarry Wall Restoration, Robben Island, Western Cape, South Africa – Avifaunal Impact Assessment

Professional registrations and 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)

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:

- 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)
  - Species
  - Number of birds
  - 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:
  - 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)
  - Species
  - Number of birds
  - 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 for birds 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.

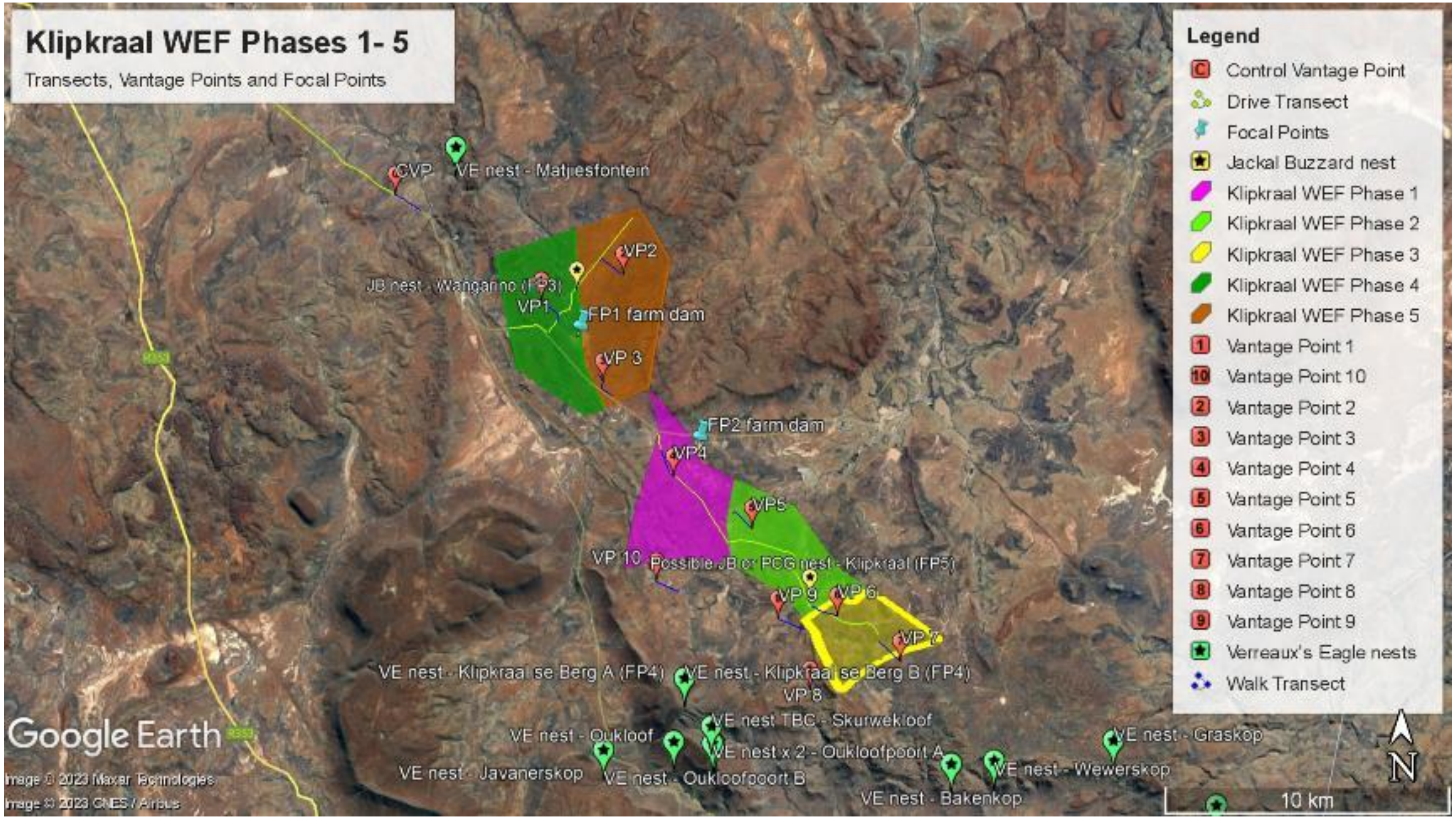

Figure 1: Area where monitoring took place, with position of VPs, FPs, drive transects, walk transects and Klipkraal WEF Phases 1 to 5. The control area is located approximately 3,5 km north-west of the Klipkraal WEF 4 assessment area.

APPENDIX 4: BIRD HABITAT

Figure 1: Large dam in the PAOI (Focal Point 1).

Figure 2: Karoo scrubland habitat in the PAOI (Nama Karoo).

Figure 3: Alien trees in the PAOI.

Figure 4: Drainage line in the PAOI.

APPENDIX 5: SABAP2 SPECIES LIST FOR THE BROADER AREA

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Acacia Pied Barbet	*Tricholaema leucomelas*	19,57	11,76
African Black Swift	*Apus barbatus*	0,00	0,00
African Hoopoe	*Upupa africana*	4,35	1,47
African Pipit	*Anthus cinnamomeus*	13,04	0,00
African Red-eyed Bulbul	*Pycnonotus nigricans*	8,70	0,00
African Reed Warbler	*Acrocephalus baeticatus*	2,17	0,00
African Rock Pipit	*Anthus crenatus*	8,70	1,47
African Sacred Ibis	*Threskiornis aethiopicus*	17,39	4,41
African Spoonbill	*Platalea alba*	8,70	1,47
African Stonechat	*Saxicola torquatus*	4,35	0,00
Alpine Swift	*Tachymarptis melba*	2,17	0,00
Ant-eating Chat	*Myrmecocichla formicivora*	56,52	7,35
Barn Swallow	*Hirundo rustica*	23,91	14,71
Black Stork	*Ciconia nigra*	0,00	0,00
Black-eared Sparrow-Lark	*Eremopterix australis*	15,22	1,47
Black-headed Canary	*Serinus alario*	43,48	4,41
Black-headed Heron	*Ardea melanocephala*	2,17	0,00
Black-necked Grebe	*Podiceps nigricollis*	2,17	0,00
Blacksmith Lapwing	*Vanellus armatus*	23,91	5,88
Black-winged Stilt	*Himantopus himantopus*	2,17	2,94
Blue Crane	*Grus paradisea*	0,00	0,00
Bokmakierie	*Telophorus zeylonus*	60,87	19,12
Booted Eagle	*Hieraaetus pennatus*	8,70	1,47
Brown-throated Martin	*Riparia paludicola*	4,35	0,00
Cape Bunting	*Emberiza capensis*	34,78	7,35
Cape Canary	*Serinus canicollis*	6,52	1,47
Cape Crow	*Corvus capensis*	2,17	0,00
Cape Penduline Tit	*Anthoscopus minutus*	8,70	0,00
Cape Robin-Chat	*Cossypha caffra*	15,22	0,00
Cape Shoveler	*Spatula smithii*	6,52	0,00
Cape Sparrow	*Passer melanurus*	82,61	22,06
Cape Spurfowl	*Pternistis capensis*	2,17	0,00
Cape Teal	*Anas capensis*	4,35	0,00
Cape Turtle Dove	*Streptopelia capicola*	41,30	11,76
Cape Wagtail	*Motacilla capensis*	30,43	5,88
Cape Weaver	*Ploceus capensis*	4,35	0,00
Cape White-eye	*Zosterops virens*	2,17	0,00
Capped Wheatear	*Oenanthe pileata*	23,91	2,94

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Chat Flycatcher	*Melaenornis infuscatus*	28,26	11,76
Chestnut-vented Warbler	*Curruca subcoerulea*	6,52	1,47
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*	10,87	1,47
Common Buzzard	*Buteo buteo*	0,00	1,47
Common Greenshank	*Tringa nebularia*	0,00	1,47
Common Sandpiper	*Actitis hypoleucos*	0,00	1,47
Common Starling	*Sturnus vulgaris*	6,52	1,47
Common Swift	*Apus apus*	15,22	4,41
Common Waxbill	*Estrilda astrild*	17,39	0,00
Crowned Lapwing	*Vanellus coronatus*	13,04	1,47
Desert Cisticola	*Cisticola aridulus*	0,00	0,00
Double-banded Courser	*Rhinoptilus africanus*	2,17	0,00
Dusky Sunbird	*Cinnyris fuscus*	8,70	1,47
Eastern Clapper Lark	*Mirafra fasciolata*	2,17	0,00
Egyptian Goose	*Alopochen aegyptiaca*	39,13	13,24
European Bee-eater	*Merops apiaster*	8,70	1,47
Fairy Flycatcher	*Stenostira scita*	6,52	0,00
Familiar Chat	*Oenanthe familiaris*	30,43	4,41
Fiscal Flycatcher	*Melaenornis silens*	4,35	0,00
Greater Flamingo	*Phoenicopterus roseus*	0,00	1,47
Greater Kestrel	*Falco rupicoloides*	0,00	2,94
Greater Striped Swallow	*Cecropis cucullata*	10,87	2,94
Grey Heron	*Ardea cinerea*	23,91	0,00
Grey Tit	*Melaniparus afer*	28,26	2,94
Grey-backed Cisticola	*Cisticola subruficapilla*	56,52	7,35
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	15,22	8,82
Grey-winged Francolin	*Scleroptila afra*	0,00	0,00
Ground Woodpecker	*Geocolaptes olivaceus*	2,17	0,00
Hadada Ibis	*Bostrychia hagedash*	28,26	4,41
Hamerkop	*Scopus umbretta*	2,17	0,00
Helmeted Guineafowl	*Numida meleagris*	2,17	0,00
House Sparrow	*Passer domesticus*	13,04	4,41
Jackal Buzzard	*Buteo rufofuscus*	41,30	23,53
Karoo Chat	*Emarginata schlegelii*	76,09	38,24
Karoo Eremomela	*Eremomela gregalis*	41,30	5,88
Karoo Korhaan	*Eupodotis vigorsii*	73,91	23,53
Karoo Lark	*Calendulauda albescens*	21,74	4,41
Karoo Long-billed Lark	*Certhilauda subcoronata*	54,35	22,06
Karoo Prinia	*Prinia maculosa*	47,83	7,35

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Karoo Scrub Robin	*Cercotrichas coryphoeus*	58,70	16,18
Karoo Thrush	*Turdus smithi*	2,17	1,47
Kittlitz's Plover	*Charadrius pecuarius*	2,17	1,47
Large-billed Lark	*Galerida magnirostris*	30,43	10,29
Lark-like Bunting	*Emberiza impetuani*	47,83	26,47
Laughing Dove	*Spilopelia senegalensis*	17,39	4,41
Layard's Warbler	*Curruca layardi*	15,22	0,00
Lesser Kestrel	*Falco naumanni*	2,17	5,88
Levaillant's Cisticola	*Cisticola tinniens*	2,17	0,00
Little Swift	*Apus affinis*	10,87	1,47
Long-billed Crombec	*Sylvietta rufescens*	13,04	4,41
Long-billed Pipit	*Anthus similis*	0,00	0,00
Ludwig's Bustard	*Neotis ludwigii*	8,70	4,41
Malachite Sunbird	*Nectarinia famosa*	10,87	7,35
Martial Eagle	*Polemaetus bellicosus*	8,70	0,00
Mountain Wheatear	*Myrmecocichla monticola*	21,74	10,29
Namaqua Dove	*Oena capensis*	52,17	7,35
Namaqua Sandgrouse	*Pterocles namaqua*	43,48	13,24
Namaqua Warbler	*Phragmacia substriata*	6,52	1,47
Nicholson's Pipit	*Anthus nicholsoni*	10,87	1,47
Pale Chanting Goshawk	*Melierax canorus*	19,57	8,82
Pale-winged Starling	*Onychognathus nabouroup*	21,74	7,35
Pied Avocet	*Recurvirostra avosetta*	15,22	4,41
Pied Crow	*Corvus albus*	47,83	25,00
Pied Starling	*Lamprotornis bicolor*	60,87	2,94
Pin-tailed Whydah	*Vidua macroura*	0,00	1,47
Plain-backed Pipit	*Anthus leucophrys*	0,00	0,00
Red-billed Quelea	*Quelea quelea*	2,17	0,00
Red-billed Teal	*Anas erythrorhyncha*	4,35	0,00
Red-capped Lark	*Calandrella cinerea*	6,52	2,94
Red-eyed Dove	*Streptopelia semitorquata*	13,04	1,47
Red-faced Mousebird	*Urocolius indicus*	10,87	0,00
Red-knobbed Coot	*Fulica cristata*	0,00	1,47
Red-winged Starling	*Onychognathus morio*	4,35	0,00
Rock Kestrel	*Falco rupicolus*	32,61	7,35
Rock Martin	*Ptyonoprogne fuligula*	21,74	1,47
Ruff	*Calidris pugnax*	2,17	0,00
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	0,00	0,00
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	6,52	0,00

Species name	Scientific name	SABAP2 Report Rate %	
		Full protocol	Ad hoc protocol
Rufous-eared Warbler	*Malcorus pectoralis*	69,57	29,41
Sabota Lark	*Calendulauda sabota*	6,52	0,00
Secretarybird	*Sagittarius serpentarius*	0,00	0,00
Sickle-winged Chat	*Emarginata sinuata*	47,83	7,35
South African Cliff Swallow	*Petrochelidon spilodera*	0,00	1,47
South African Shelduck	*Tadorna cana*	28,26	13,24
Southern Double-collared Sunbird	*Cinnyris chalybeus*	10,87	0,00
Southern Fiscal	*Lanius collaris*	50,00	10,29
Southern Grey-headed Sparrow	*Passer diffusus*	2,17	0,00
Southern Masked Weaver	*Ploceus velatus*	19,57	1,47
Southern Red Bishop	*Euplectes orix*	2,17	1,47
Speckled Pigeon	*Columba guinea*	45,65	1,47
Spike-heeled Lark	*Chersomanes albofasciata*	41,30	10,29
Spotted Eagle-Owl	*Bubo africanus*	2,17	1,47
Spotted Thick-knee	*Burhinus capensis*	6,52	0,00
Spur-winged Goose	*Plectropterus gambensis*	8,70	0,00
Three-banded Plover	*Charadrius tricollaris*	28,26	2,94
Tractrac Chat	*Emarginata tractrac*	8,70	1,47
Verreaux's Eagle	*Aquila verreauxii*	26,09	1,47
Wattled Starling	*Creatophora cinerea*	8,70	2,94
White Stork	*Ciconia ciconia*	0,00	1,47
White-backed Mousebird	*Colius colius*	30,43	5,88
White-necked Raven	*Corvus albicollis*	23,91	13,24
White-rumped Swift	*Apus caffer*	4,35	1,47
White-throated Canary	*Crithagra albogularis*	32,61	11,76
White-throated Swallow	*Hirundo albigularis*	8,70	1,47
Yellow Canary	*Crithagra flaviventris*	58,70	8,82
Yellow-bellied Eremomela	*Eremomela icteropygialis*	36,96	10,29
Yellow-billed Duck	*Anas undulata*	15,22	1,47
Zitting Cisticola	*Cisticola juncidis*	0,00	0,00

Species Recorded During Pre-Construction Monitoring

Priority Species	Scientific Name	Transects Turbine	Transects Control	Focal Points	Vantage Points	VP Control	Incidentals
Black Stork	*Ciconia nigra*	*			*		
Blue Crane	*Grus paradisea*	*					
Booted Eagle	*Hieraaetus pennatus*				*		*
Common Buzzard	*Buteo buteo*						*
Greater Flamingo	*Phoenicopterus roseus*		*				
Greater Kestrel	*Falco rupicoloides*	*	*		*		
Grey-winged Francolin	*Scleroptila afra*	*	*				
Jackal Buzzard	*Buteo rufofuscus*	*	*	*	*	*	*
Karoo Korhaan	*Eupodotis vigorsii*	*	*		*		*
Lesser Kestrel	*Falco naumanni*					*	*
Ludwig's Bustard	*Neotis ludwigii*	*	*		*		*
Martial Eagle	*Polemaetus bellicosus*				*		*
Pale Chanting Goshawk	*Melierax canorus*	*		*	*		*
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*						*
Secretarybird	*Sagittarius serpentarius*		*				
Verreaux's Eagle	*Aquila verreauxii*			*	*	*	*
White Stork	*Ciconia ciconia*			*			
17		**8**	**7**	**4**	**9**	**3**	**10**

Non-Priority Species	Scientific Name	Transects Turbine	Transects Control	Focal Points
Acacia Pied Barbet	*Tricholaema leucomelas*	*		
African Black Swift	*Apus barbatus*	*		
African Pipit	*Anthus cinnamomeus*	*		
African Rock Pipit	*Anthus crenatus*	*		
African Sacred Ibis	*Threskiornis aethiopicus*	*		*
African Spoonbill	*Platalea alba*	*		*
Alpine Swift	*Tachymarptis melba*		*	
Ant-eating Chat	*Myrmecocichla formicivora*	*	*	
Barn Swallow	*Hirundo rustica*	*	*	
Black-eared Sparrow-lark	*Eremopterix australis*	*		
Black-headed Canary	*Serinus alario*	*	*	

Blacksmith lapwing	*Vanellus armatus*			*	
Bokmakierie	*Telophorus zeylonus*	*	*		
Cape Bunting	*Emberiza capensis*	*	*		
Cape Crow	*Corvus capensis*	*			
Cape Sparrow	*Passer melanurus*	*	*		
Cape Turtle Dove	*Streptopelia capicola*	*	*		
Cape Wagtail	*Motacilla capensis*	*			
Capped Wheatear	*Oenanthe pileata*	*	*		
Chat Flycatcher	*Melaenornis infuscatus*	*	*		
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*	*			
Common Swift	*Apus apus*	*	*		
Common Waxbill	*Estrilda astrild*		*		
Crowned Lapwing	*Vanellus coronatus*	*			
Desert Cisticola	*Cisticola aridulus*		*		
Double-banded Courser	*Rhinoptilus africanus*		*		
Dusky Sunbird	*Cinnyris fuscus*		*		
Egyptian Goose	*Alopochen aegyptiaca*	*	*	*	
European Bee-eater	*Merops apiaster*	*			
Fairy Flycatcher	*Stenostira scita*	*			
Familiar Chat	*Oenanthe familiaris*	*	*		
Fiscal Flycatcher	*Melaenornis silens*		*		
Greater Striped Swallow	*Cecropis cucullata*	*	*		
Grey Heron	*Ardea cinerea*	*			
Grey Tit	*Melaniparus afer*	*	*		
Grey-backed Cisticola	*Cisticola subruficapilla*	*	*		
Grey-backed Sparrow-lark	*Eremopterix verticalis*	*	*		
Hadeda Ibis	*Bostrychia hagedash*	*			
Karoo Chat	*Emarginata schlegelii*	*	*		
Karoo Eremomela	*Eremomela gregalis*	*	*		
Karoo Lark	*Calendulauda albescens*	*	*		
Karoo Long-billed Lark	*Certhilauda subcoronata*	*	*		
Karoo Prinia	*Prinia maculosa*	*	*		
Karoo Scrub Robin	*Cercotrichas coryphoeus*	*	*		
Kittlitz's Plover	*Charadrius pecuarius*			*	
Large-billed Lark	*Galerida magnirostris*	*	*		
Lark-like Bunting	*Emberiza impetuani*	*	*		
Layard's Tit-babbler	*Sylvia layardi*	*	*		
Long-billed Crombec	*Sylvietta rufescens*	*	*		
Long-billed Pipit	*Anthus similis*	*	*		
Malachite Sunbird	*Nectarinia famosa*		*		
Mountain Wheatear	*Myrmecocichla monticola*	*	*		
Namaqua Dove	*Oena capensis*	*	*		
Namaqua Sandgrouse	*Pterocles namaqua*	*	*		
Pale-winged Starling	*Onychognathus nabouroup*	*	*		
Pied Avocet	*Recurvirostra avosetta*			*	

Pied Crow	*Corvus albus*	*	*	*	
Pied Starling	*Lamprotornis bicolor*	*	*		
Plain-backed Pipit	*Anthus leucophrys*	*	*		
Red-billed Quelea	*Quelea quelea*		*		
Red-capped Lark	*Calandrella cinerea*	*			
Rock Kestrel	*Falco rupicolus*	*	*		
Rock Martin	*Ptyonoprogne fuligula*	*			
Rufous-eared Warbler	*Malcorus pectoralis*	*	*		
Sabota Lark	*Calendulauda sabota*	*			
Sickle-winged Chat	*Emarginata sinuata*	*	*		
South African Shelduck	*Tadorna cana*	*	*	*	
Southern Fiscal	*Lanius collaris*	*	*		
Southern Masked Weaver	*Ploceus velatus*		*		
Speckled Pigeon	*Columba guinea*	*	*		
Spike-heeled Lark	*Chersomanes albofasciata*	*	*		
Spotted Thick-knee	*Burhinus capensis*	*			
Spur-winged Goose	*Plectropterus gambensis*	*			
Three-banded Plover	*Charadrius tricollaris*	*		*	
Tractrac Chat	*Emarginata tractrac*		*		
Wattled Starling	*Creatophora cinerea*	*			
White-backed Mousebird	*Colius colius*	*	*		
White-necked Raven	*Corvus albicollis*	*	*		
White-throated Canary	*Crithagra albogularis*	*	*		
White-throated Swallow	*Hirundo albigularis*	*	*		
Yellow Canary	*Crithagra flaviventris*	*	*		
Yellow-bellied Eremomela	*Eremomela icteropygialis*	*	*		
Zitting Cisticola	*Cisticola juncidis*		*		
83	**Subtotal**	**69**	**58**	**9**	
	Grand total	**77**	**65**	**13**	

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

<table>
<tr><th colspan="3">ENVIRONMENTAL PARAMETER</th></tr>
<tr><td colspan="3">A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).</td></tr>
<tr><th colspan="3">ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE</th></tr>
<tr><td colspan="3">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).</td></tr>
<tr><th colspan="3">EXTENT (E)</th></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td>1</td><td>Site</td><td>The impact will only affect the site</td></tr>
<tr><td>2</td><td>Local/district</td><td>Will affect the local area or district</td></tr>
<tr><td>3</td><td>Province/region</td><td>Will affect the entire province or region</td></tr>
<tr><td>4</td><td>International and National</td><td>Will affect the entire country</td></tr>
<tr><th colspan="3">PROBABILITY (P)</th></tr>
<tr><td colspan="3">This describes the chance of occurrence of an impact</td></tr>
<tr><td>1</td><td>Unlikely</td><td>The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).</td></tr>
<tr><td>2</td><td>Possible</td><td>The impact may occur (Between a 25% to 50% chance of occurrence).</td></tr>
<tr><td>3</td><td>Probable</td><td>The impact will likely occur (Between a 50% to 75% chance of occurrence).</td></tr>
<tr><td>4</td><td>Definite</td><td>Impact will certainly occur (Greater than a 75% chance of occurrence).</td></tr>
<tr><th colspan="3">REVERSIBILITY (R)</th></tr>
<tr><td colspan="3">This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.</td></tr>
<tr><td>1</td><td>Completely reversible</td><td>The impact is reversible with implementation of minor mitigation measures</td></tr>
<tr><td>2</td><td>Partly reversible</td><td>The impact is partly reversible but more intense mitigation measures are required.</td></tr>
<tr><td>3</td><td>Barely reversible</td><td>The impact is unlikely to be reversed even with intense mitigation measures.</td></tr>
<tr><td>4</td><td>Irreversible</td><td>The impact is irreversible and no mitigation measures exist.</td></tr>
<tr><th colspan="3">IRREPLACEABLE LOSS OF RESOURCES (L)</th></tr>
<tr><td colspan="3">This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.</td></tr>
<tr><td>1</td><td>No loss of resource.</td><td>The impact will not result in the loss of any resources.</td></tr>
<tr><td>2</td><td>Marginal loss of resource</td><td>The impact will result in marginal loss of resources.</td></tr>
<tr><td>3</td><td>Significant loss of resources</td><td>The impact will result in significant loss of resources.</td></tr>
<tr><td>4</td><td>Complete loss of resources</td><td>The impact is result in a complete loss of all resources.</td></tr>
<tr><th colspan="3">DURATION (D)</th></tr>
</table>

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 1340 hectares (13.4 km^2).
- Bird distribution data was obtained from the Second Southern African Bird Atlas Project (SABAP2) at the University of Cape Town (https://sabap2.birdmap.africa/), 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 × 9 km. From 2007 to date, a total of 46 full protocol lists (i.e. intensive bird listing surveys lasting a minimum of at least two hours each) have been completed for this area. In addition, 68 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 (2022.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation in the WEF application site was obtained from the First Atlas of Southern African Birds (SABAP1) (Harrison *et al.* 1997) and the National Vegetation Map (2018) 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 ©2023) was used to view the Broader Area on a landscape level and to help identify sensitive bird habitat.
- Priority species for wind developments 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 monitoring 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.

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 >30ºC) and winters are cold (minimum close to 0ºC) 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.

- **DFFE Screening Tool**

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

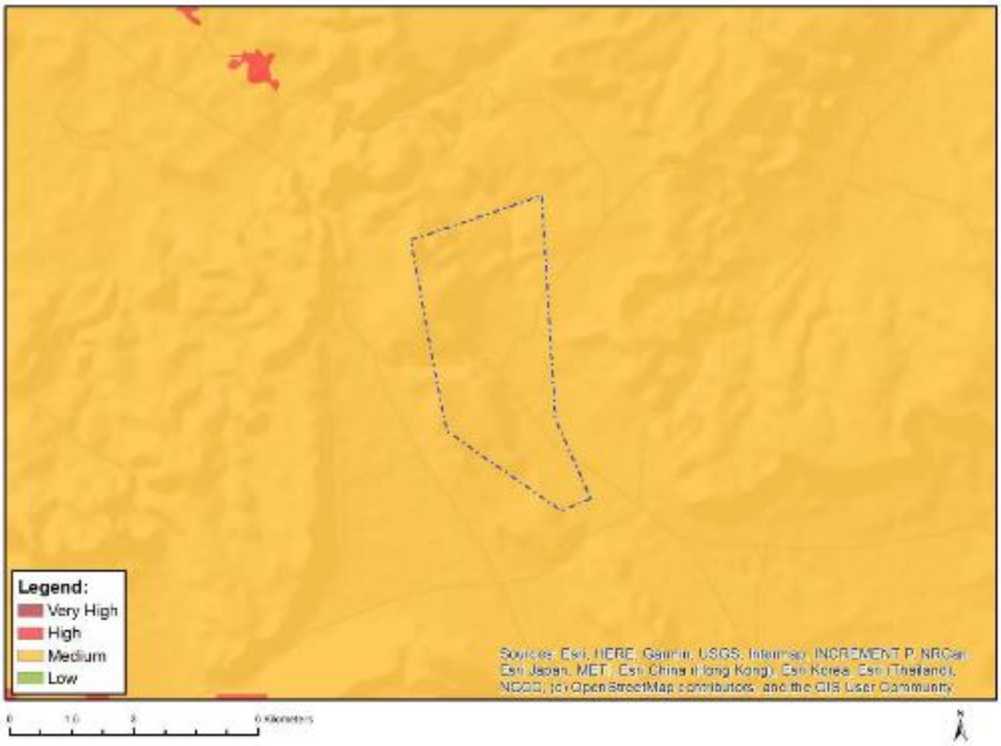

Figure 44)[9]. The **Medium** sensitivity classification is linked to the potential occurrence of Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered).

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 the immediate surrounds. Based on the field surveys to date, a classification of **High** sensitivity for avifauna in the PAOI is suggested.

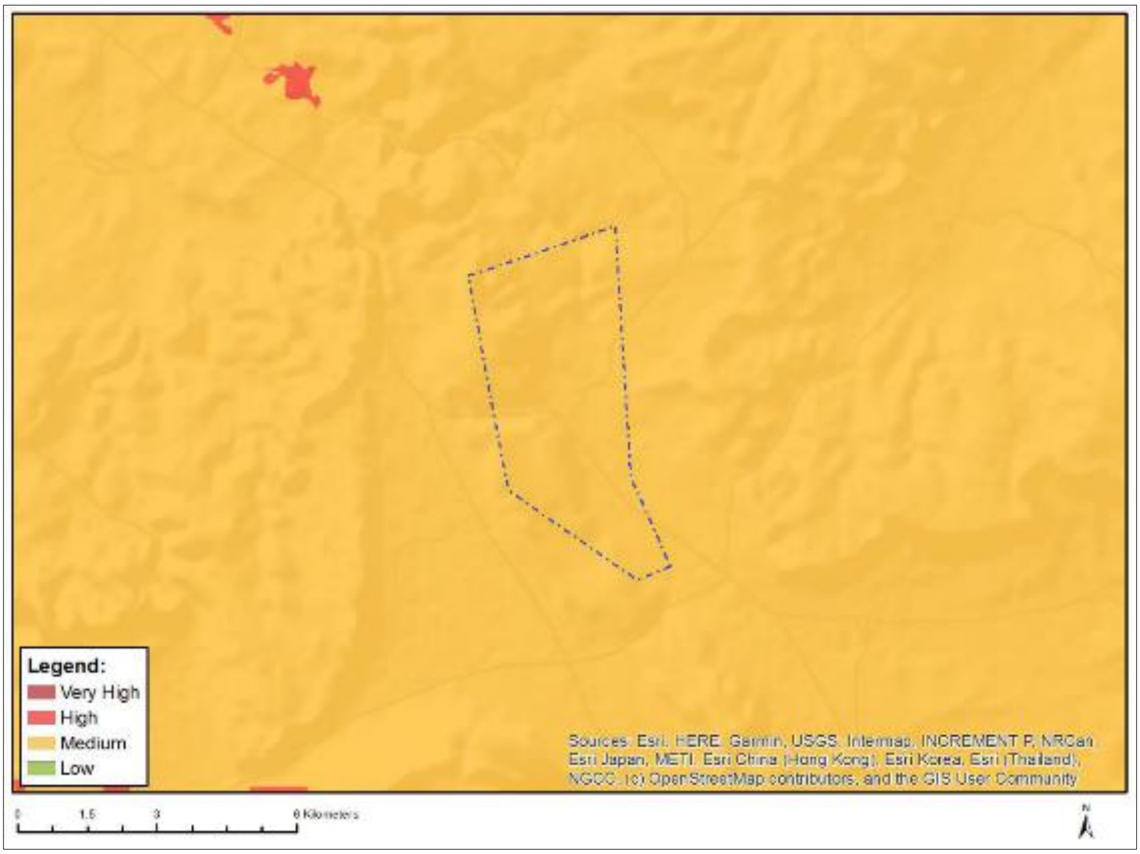

Figure 1: The classification of the PAOI according to the terrestrial animal species theme in the DFFE National Screening Tool. The classification of Medium sensitivity is linked to the potential occurrence Ludwig's Bustard *Neotis ludwigii* (Globally and Regionally Endangered).

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

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

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 the immediate surrounds. Based on the field surveys to date, a classification of **High** sensitivity for avifauna in the PAOI is suggested.

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. A 3.7km turbine exclusion zone should be implemented and maintained around the Verreaux's Eagle nest located at -31.975694° South, 21.682583° East, and an 750m turbine exclusion zone around the Jackal Buzzard nest located at -32.011611° South, 21.727139° East. 2. 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. A 3.7km turbine exclusion zone should be implemented and maintained around the Verreaux's Eagle nest located at -31.975694° South, 21.682583°	1. Design lay-out around the proposed buffer zones	1. Once-off during the planning phase.	1. Project Developer

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		East, and an 750m turbine exclusion zone around the Jackal Buzzard nest located at -32.011611° South, 21.727139° East. The turbine rotor swept area should not extend over the buffer zone. 2. No turbines should be located in the buffer zones around major drainage lines, waterpoints and dams. The turbine rotor swept area should not extend over the buffer zone.		2. As soon as the first turbines start turning.	
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	Prevent unnecessary displacement of priority avifauna by ensuring that contractors are aware of the	A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how	1. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced	1. On a daily basis 2. Monthly 3. Monthly	1. Contractor and ECO

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area.	requirements of the Construction Environmental Management Programme (CEMPr.)	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. 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.	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. 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.	4. Monthly 5. Monthly	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	. 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	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	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.	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*
		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 then repeated in year 5, and again every five years thereafter for the operational lifetime of the facility. 2. A procedure for the immediate removal of carcasses within the development area must be implemented to prevent vultures from being attracted to the area where they could be at risk of collision with the turbines. 3. Shutdown on demand (SDoD) must be implemented on all turbines for White-backed	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 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	4. As and when required, within six months of threshold having been exceeded. 5. Quarterly and annually.	

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		Vulture, Lappet-faced Vulture, Martial Eagle, Verreaux's Eagle and Lanner Falcon, coupled with a carcass removal programme, to limit the risk of collisions with the turbines. The SDoD must be implemented for the first two years of the operational phase to assess the dynamics of the situation, whereafter a decision whether to continue must be taken, based on the frequency of shutdown events.	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 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. 4. Monitor the implementation of noise control mechanisms via site inspections	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***
			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)[10].

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.

4 DURATION

[10] 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.

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.