PROPOSED CONSTRUCTION OF THE PROPOSED EZELSJACHT 140MW WIND ENERGY FACILITY (WEF), LOCATED NEAR DE DOORNS, WESTERN CAPE PROVINCE

Avifaunal Specialist Scoping Report

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AVIFAUNAL SPECIALIST SCOPING ASSESSMENT

EXECUTIVE SUMMARY

1 INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd ("Mainstream") is proposing to develop the Ezelsjacht 140 megawatts (MW) Wind Energy Facility (WEF), Battery Energy Storage (BESS) and their supporting infrastructure. The overall objective of the proposed development is to generate electricity by means of renewable energy technologies capturing wind energy to feed into the national grid.

A total of 190 bird species have been detected during SABAP2 observations and/or during pre-construction monitoring, and so could potentially occur in the broader area – see Appendix 6. Of this total, 24 are wind priority species, and 10 are Red List species. Of the 24 wind priority species, 19 are likely to occur regularly in the Project area of Impact (PAOI).

2 SUMMARY OF FINDINGS

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

- Displacement 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 due to disturbance linked to dismantling activities in the decommissioning phase.

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

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 Blue Crane, Double-banded Courser, Grey-winged Francolin Southern Black Korhaan, and Spotted Eagle-Owl. Extensive searches for breeding Black Harriers (another ground-nesting species) were conducted, but none were found. Avifaunal specialists working on a neighbouring property to the west of the proposed Ezelsjacht site were also consulted on potential Black Harrier nests, but they confirmed the absence of any nests.

Some raptors might also be affected, such as Black-winged Kite and Pale Chanting Goshawk which could potentially breed in the small trees along the ephemeral drainage lines. Some species might be able to recolonise the area after the completion of the construction phase, although it cannot be assumed that population densities will recover to pre-construction levels, due to the disturbance factor of the operational turbines. The pre-mitigation impact is rated as **medium** but can be mitigated to **low** levels.

2.2 Displacement due to habitat transformation in the construction phase.

The network of roads is likely to result in significant habitat fragmentation, and it could influence the density of several species, particularly terrestrial species such as Blue Crane, Double-banded Courser, Grey-winged Francolin, Southern Black Korhaan. Additionally, raptors are also vulnerable to habitat transformation/fragmentation, due in part to loss of breeding/roosting habitats, as well as reduced ecological carrying capacity of preferred prey items. 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 by habitat transformation within the PAOI. The building infrastructure and substation location are likely to be all situated in essentially the same habitat, namely Renosterveld low fynbos shrubland, and should have a small footprint size. The habitat classified as Least Concern and 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. The pre-mitigation impact is rated as **low**, and can be further reduced **to very low** levels.

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

The proposed Ezelsjacht WEF will pose a significant collision risk to several priority species which could occur regularly at the site. Priority species exposed to this risk are large terrestrial species which are likely to regularly occur within the POAI, namely Black Stork, Blue Crane, Southern Black Korhaan, and to a lesser extent Grey-winged Francolin. Several soaring species are also likely to regularly occur within the PAOI, namely Black Harrier, Black-chested Snake Eagle, Black-winged Kite, Booted Eagle, Jackal Buzzard, Lanner Falcon, Martial Eagle, Pale Chanting Goshawk, Rufous-breasted Sparrowhawk, Secretarybird, and Verreaux's Eagle. Other soaring species such as Black Sparrowhawk, Common Buzzard , and Greater Kestrel are less common. The mountainous topography affords numerous slope-soaring and slope-kiting opportunities which will increase the vulnerability of these species to wind turbines. The pre-mitigation impact is rated as **high**, and can be reduced to **medium** levels.

2.4 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 **high** pre-mitigation and **low** post-mitigation.

2.5 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 Southern Black Korhaan, and various waterbirds when the dams are full, and the drainage lines contain water, such as Black Stork and Blue Crane. The impact is rated as **medium** pre-mitigation and **low** post-mitigation.

2.6 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.

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

Summary Table 1: Impact assessment and recommended mitigations per impact

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. (3) Construction-related activity should be limited as far as possible within the buffer zones surrounding the observed nests for Martial Eagle, Verreaux's Eagle, and Booted Eagle/Jackal Buzzard.	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 biodiversity specialist studies must be strictly implemented, especially as far as limitation of the activity footprint is concerned.	Very low -
Operational: Collisions with the turbines	High -	(1) No turbines should be located in the turbine exclusion zone buffers around confirmed nests for Martial Eagle, Verreaux's Eagle, and Booted Eagle/Jackal Buzzard	Medium -

Nature of impact and phase	Overall impact significance (pre - mitigation)	Proposed mitigation	Overall impact significance (post - mitigation)
		within the PAOI. No turbines should likewise be constructed in turbine exclusion zones where high Black Harrier flight activity was recorded. (2) No turbines should be in the turbine exclusion zones associated with surface water and water points. Turbine construction should also be excluded within the buffers associated with ephemeral/non-perennial streams and wetlands as indicated by the aquatic specialist. (3) Construction of turbines should be limited as far as possible within 3.7-5.2km medium risk sensitivity zone buffers around confirmed Verreaux's Eagle nests within the PAOI. If turbines are to be constructed in these medium risk sensitivity areas, proactive mitigation following approved procedures are required (e.g., shutdown on command – SDoD). (4) Based on the recorded flight activity of several SCC at the project site, including Verreaux's Eagle, Black Harrier and Martial Eagle, during the of pre-construction monitoring, all the areas within the project site that fall outside the designated buffer zones should be classified as medium risk. SDoD is therefore recommended for all areas outside designated buffer zones. (5) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Windfarm Guidelines at the time to assess collision rates.	

Nature of impact and phase	Overall impact significance (pre - mitigation)	Proposed mitigation	Overall impact significance (post - mitigation)
Operational: Electrocutions on the 33kV MV network	High -	1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Windfarm Guidelines.	Very low -
Operational: Collisions with the 33kV MV network	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.	Low -
Decommissioning: Displacement due to disturbance	Medium -	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. (2) Measures to control noise and dust should be applied according to current best practice in the industry.	Low -

3 The IDENTIFICATION OF ENVIRONMENTAL SENSITIVITIES: WIND ENERGY FACILITY

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

3.1 High sensitivity turbine exclusion zones

3.1.1 Martial Eagle (5.0km), Verreaux's Eagle (3.7km), Booted Eagle/Jackal Buzzard (750m) nest buffers, and Black Harrier high flight activity zones.

Breeding Verreaux's Eagles largely forage within 3.7km of their nest (Brink, 2020), with turbine collision risk potential falling substantially further away from the nest, becoming a negligible concern after 8km (Murgatroyd et al., 2021). Breeding Martial Eagle forage generally forage within 5.39 km of their nests (Brink, 2020).No turbines should be constructed within 5km of the Martial Eagle nests, 3.7km of the Verreaux's Eagle nests, and 750m of the Booted Eagle/Jackal Buzzard nest observed within the PAOI. No turbines should likewise be constructed in turbine exclusion zones where high Black Harrier flight activity was recorded during the pre-construction monitoring. The blade swept area of the turbine rotors should be placed beyond these buffer zones. This is in following recommendations outlined in the VE Guidelines, Windfarm Guidelines and Black Harrier Guidelines (see Section 4.3).

3.1.2 Buffers around surface water dams and reservoirs (100m), and drainage lines and wetlands (25m)

An exclusion zone precluding wind turbine development should be implemented within a 100 m buffer around permanent surface water sites (artificial dams, boreholes, and reservoirs) as well as within a 25m buffer around drainage lines and wetlands (as per aquatic specialist recommendations). The blade swept area of the turbine rotors should be placed beyond these buffer zones. Surface water in this arid habitat is crucially important for priority avifauna, including several Red List species such as Black Harrier, Black Stork, Blue Crane, Lanner Falcon, Martial Eagle, Secretarybird, and Verreaux's Eagle. Wind turbines that are placed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing. A turbine exclusion buffer zone as indicated by the aquatic specialist around non-perennial drainage lines and wetlands should be demarcated as high sensitivity risk zones from where turbines should be excluded. When flowing, drainage lines are conduits for heightened bird flight paths, attraction points for bathing and drinking. Wind turbines that are placed near drainage lines and wetlands therefore pose a collision risk to priority bird species.

3.2 Medium sensitivity limited infrastructure and/or pro-active mitigation zones

3.2.1 Verreaux's Eagle nest secondary buffer (3.7-5.2km).

The latest VE guidelines recommend that, if 3.7km-radius circular buffers are selected, an additional buffer between 3.7-5.2km of the nest sites should be demarcated as medium sensitivity risk zones from where turbines should be relocated if possible. Should relocation not be feasible, these turbines should be subject to pro-active mitigation in the form of a proven mitigation method such as Shutdown on Demand (SDoD), using either biomonitors or an automated system such as IdentiFlight (Ralston-Paton and Murgatroyd, 2021).

3.2.2 Areas outside of designated buffer zones

Based on the recorded flight activity of several SCC at the project site, including Verreaux's Eagle, Black Harrier and Martial Eagle, during the of pre-construction monitoring, all the areas within the project site that fall outside the designated buffer zones should be classified as medium risk. SDoD is therefore recommended for all areas outside designated buffer zones.

See **Error! Reference source not found.**(i) for a map indicating the avifaunal sensitivity zones.

4 CONCLUSION AND IMPACT STATEMENT

The proposed Ezelsjacht WEF will have a **low to high impact** on priority avifauna which could be reduced to a very **low to medium impact** through appropriate mitigation. No fatal flaws are expected to be discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

5 FINAL LAYOUT

The final layout is yet to be determined. The Ezelsjacht WEF project site is approximately 5 544 hectares in extent. Design and layout alternatives will be considered and assessed as part of the EIA. These will include alternatives for the substation locations and for the construction/laydown area.

Figure i: Proposed avifaunal buffer zones

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 7)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 7	Section of Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 10
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Appendix 8
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7
g) an identification of any areas to be avoided, including buffers;	Section 7
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 7
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 9
k) any mitigation measures for inclusion in the EMPr;	To be included in EIA Report

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

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Glossary of Terms

Definitions	
Wind priority species	Priority species for wind development were identified from the most recent (2017) list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Retief et al. 2012).
Project Site	The area covered by the land parcels where the project will be located, totalling approximately 5 544 hectares. This is where the actual development will be located (i.e., the footprint containing the wind turbines and associated infrastructure).
Project area of impact (PAOI)	The primary impact zone of the wind energy facility, comprising a 5km buffer around the Project Site totalling approximately 30 422 hectares, including but extending beyond the project site.
Pentad	A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km.
Broader area	A consolidated data set for a total of 9 pentads where the application sites are located.

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
PAOI	Project area of Impact
REDZ	Renewable Energy Development Zone
SABAP 1	South African Bird Atlas 1
SABAP 2	South African Bird Atlas 2
SACNASP	South African Council for Natural and Scientific Professions
SANBI	South African Biodiversity Institute
SAPAD	South Africa Protected Areas Database
SDoD	Shutdown on Demand
WEF	Wind Energy Facility

PROPOSED CONSTRUCTION OF THE PROPOSED EZELSJACHT 140MW WIND ENERGY FACILITY (WEF), LOCATED NEAR DE DOORNS, WESTERN CAPE PROVINCE.

1. INTRODUCTION

South Africa Mainstream Renewable Power Developments (Pty) Ltd (“Mainstream”) is proposing to develop the Ezelsjacht 140 megawatts (MW) Wind Energy Facility (WEF), Battery Energy Storage (BESS) and their supporting grid infrastructure, as a subproject of the “Ezelsjacht Renewable Energy Facilities”. The overall objective of the proposed development is to generate electricity by means of renewable energy technologies capturing wind energy to feed into the national grid.

The proposed Ezelsjacht WEF is located approximately 11 km south-east of the town De Doorns, within the Cape Winelands District Municipality of the Western Cape Province. The site proposed for the WEF component of the renewable energy facility falls within both the Breede Valley and Langeberg Local Municipalities.

In addition to the infrastructure mentioned above, the renewable energy facilities will also potentially include energy storage infrastructure if it is deemed economically feasible to do so. This will consist of an area for a Battery Energy Storage System (BESS), covering an extent of up to approximately 5 hectares (ha). Currently, the battery technologies being considered are either Solid State Batteries or Redox Flow Batteries. Please refer Section 3.2 for technical details of the infrastructure associated with the WEF.

The proposed renewable energy development requires Environmental Authorisations (EAs) from the National Department of Forestry, Fisheries, and the Environment (DFFE). However, the provincial authority (the Western Cape Department of Environmental Affairs and Development Planning - WC DEADP) will also be consulted. Further details of the required legislated process to be followed is provided in Section 2 below.

1.1 Terms of Reference

The terms of reference for this scoping 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
- 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 Specialist CVs.

1.3 Assessment Methodology

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

- The project site concerns the land properties upon which the development will occur, occupying an extent of approximately 5 544 hectares.
- The project area of impact (PAOI) of the proposed WEF was defined as a 5km buffer zone around surrounding the land parcels making up the project site, with an extent of approximately 30 422 hectares.
- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town, to ascertain which species occurs within the broader area of four pentad grid cells each within which the proposed projects are situated (see Error! Reference source not found.). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. To get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 9 pentads which intersect with the development area, hereafter referred to as '**the broader area'**, detailed in **Table 1** below. From 2007-present, a total of 82 full protocol lists (i.e., surveys of at least two hours each) have been completed for this area. In addition, 60 *ad hoc* protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed. The SABAP2 data was therefore regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during the site surveys and general knowledge of the area and bird and habitat associations.
- Priority species for wind development were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Ralston-Paton et al., 2017; Retief et al., 2012).
- The national threatened status of all wind 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 (2022.1) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation habitat ecotypes within the PAOI was obtained from the National Vegetation Map (2018) from the South African National Biodiversity Institute (SANBI) BGIS map viewer (http://bgisviewer.sanbi.org/) (Mucina & Rutherford, 2006; SANBI, 2018). The PAOI is the area where the primary impacts on avifauna are expected and includes the land parcels where the project will be located.
- Avifaunal habitat usage within the PAOI by birds was informed by the Atlas of Southern African Birds 1 (SABAP 1) (Harrison et al., 1997a, 1997b).
- Land-cover and land-use within the PAOI was determined using the 2018 South African national land-cover surveys jointly conducted by the Department of Environmental Affairs, and the Department of Rural Development and Land Reform (DEA & DALRRD, 2019).
- The Important Bird Areas of Southern Africa (Marnewick et al., 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2022) was used to view the PAOI and broader area on a landscape level and to help identify sensitive bird habitat.
- The 2022 South Africa Protected Areas Database compiled by the Department of Environment, Forestry and Fisheries (DFFE) was used to identify Nationally Protected Areas, National Protected Areas Expansion Strategy (NPAES) near the PAOI (DFFE, 2022).
- The Department of Forestry, Fisheries, and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the PAOI.
- Data collected during previous site visits to the broader area was also considered as far as habitat classes and the occurrence of priority species are concerned.
- The following sources were used to determine the investigation protocol that is required for the site:
    - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).

- BirdLife South Africa's (BLSA) 'Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa' (Jenkins et al., 2015) – hereafter referred to as the 'Windfarm Guidelines' – were consulted to determine the level of survey effort that is required.
    - The latest best practice guidelines for monitoring Verreaux's Eagle (Ralston-Paton, 2017; Ralston-Paton and Murgatroyd, 2021) - hereafter referred to as 'VE Guidelines' - and for monitoring Black Harrier (Simmons et al., 2019) – hereafter referred to as 'BH Guidelines'. We consulted the latter two guidelines as the expected regular occurrence of Verreaux's Eagle, Marital Eagle, and Black Harrier at the site would necessitate that the protocols for these species be considered.
- The primary source of information on avifaunal diversity, abundance, and flight patterns at the site were the results of a pre-construction programme currently being conducted over four seasons at the proposed Ezelsjacht WEF application sites. The primary methods of data capturing are walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see Appendix 4 for a detailed explanation of the monitoring methods).

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

Pentad	Number of full protocol lists	Ad hoc protocol lists
3325_1945	6	9
3325_1950	10	7
3325_1955	2	2
3330_1945	11	5
3330_1950	16	7
3330_1955	6	8
3335_1945	5	2
3335_1950	14	13
3335_1955	12	7
Total	82	60

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 to date (five surveys).
- Conclusions in this scoping report 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 (Ferrer et al., 2012).
- Despite the growing body of peer reviewed literature investigating the collision risks of birds with wind turbines and overhead powerlines in South Africa (see Section 8), relevant information for many individual species remains limited.
- To date, only one peer-reviewed scientific paper has been published on the impacts wind farms have on birds in South Africa (Perold et al., 2020). The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international

endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "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 Ezelsjacht WEF is located approximately 11 km south-east of the town De Doorns, within the Cape Winelands District Municipality of the Western Cape Province. The site proposed for the WEF component of the renewable energy facility falls within both the Breede Valley and Langeberg Local Municipalities (see **Figure 2 and** Error! Reference source not found.).

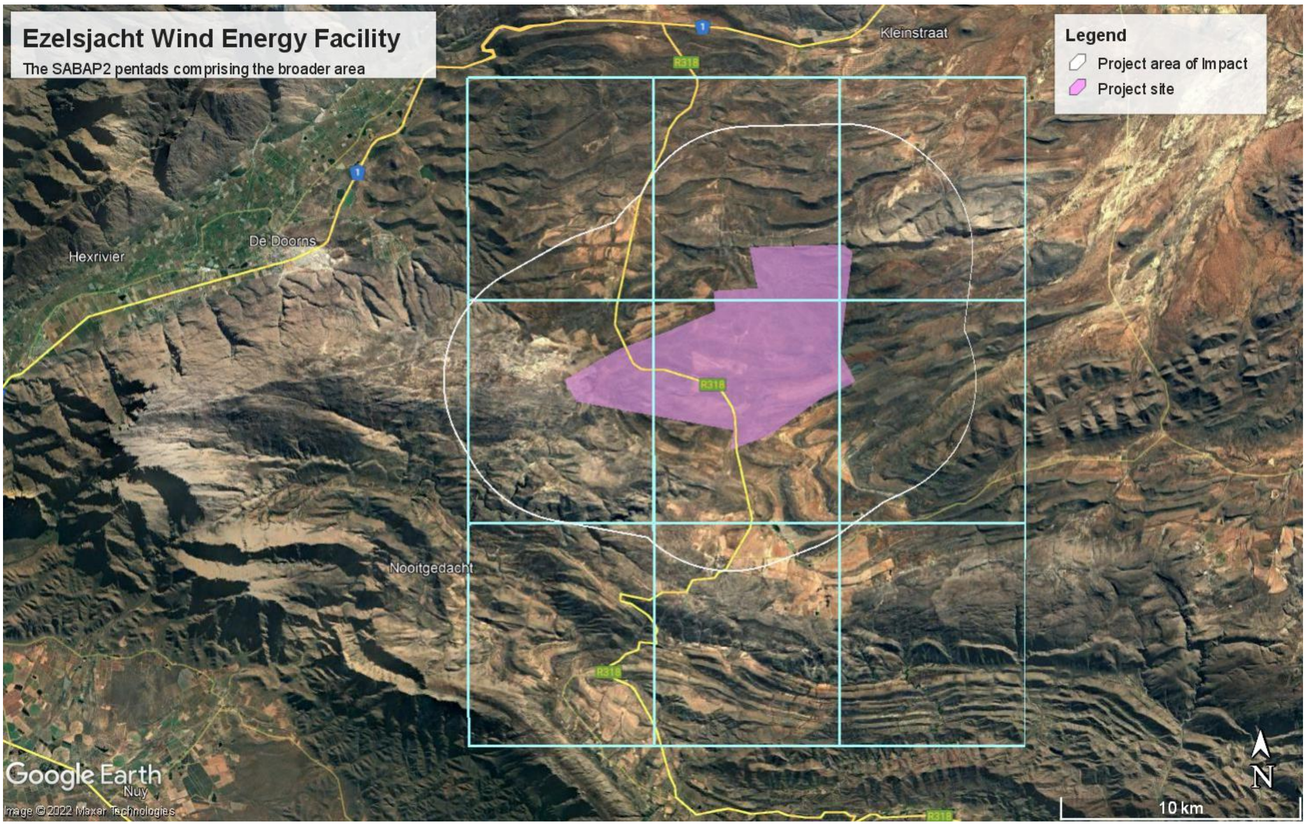


Figure 1: The SABAP 2 pentads that comprise the broader area (blue grid)

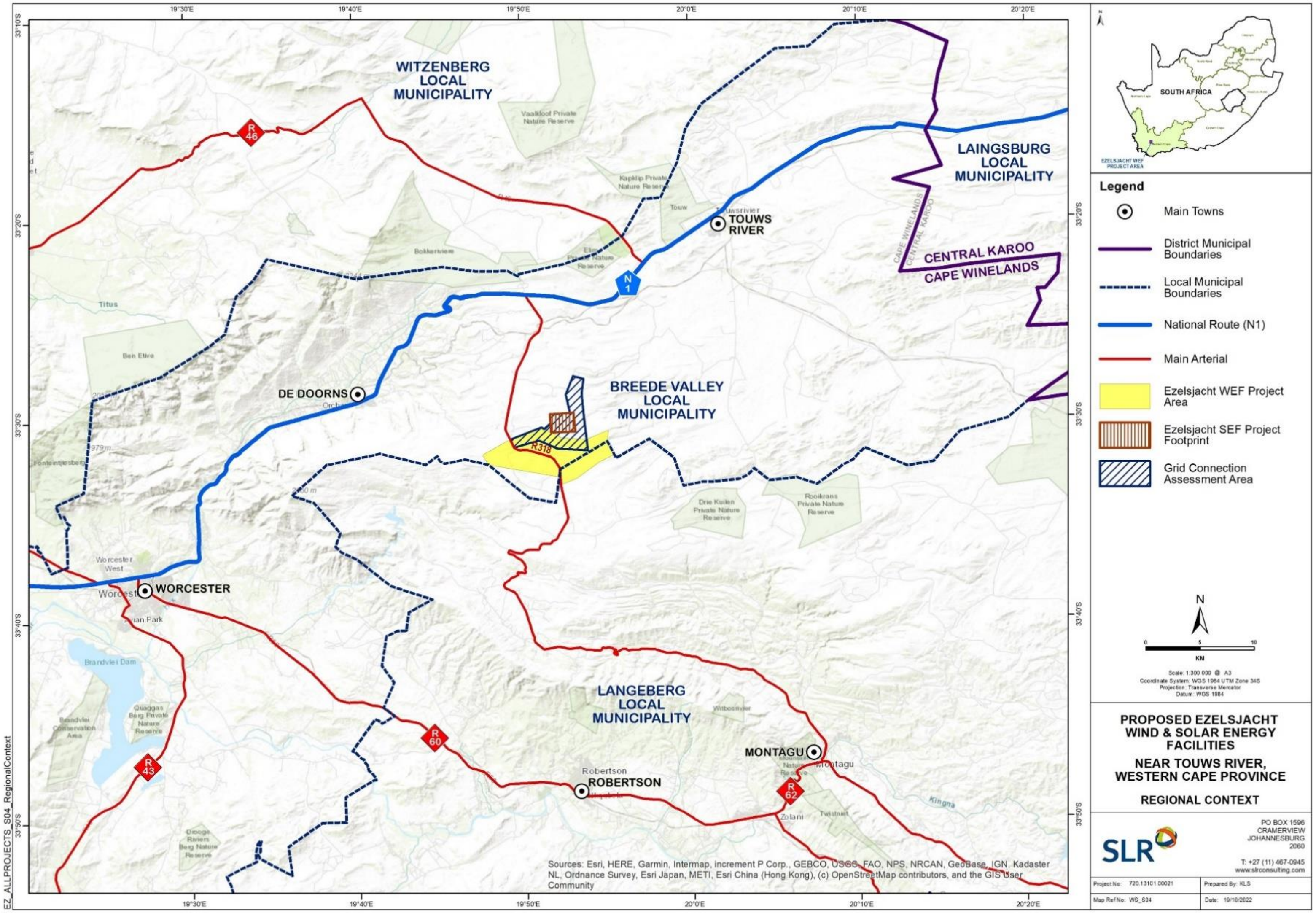


Figure 2: Regional context map – location of the Ezelsjacht WEF

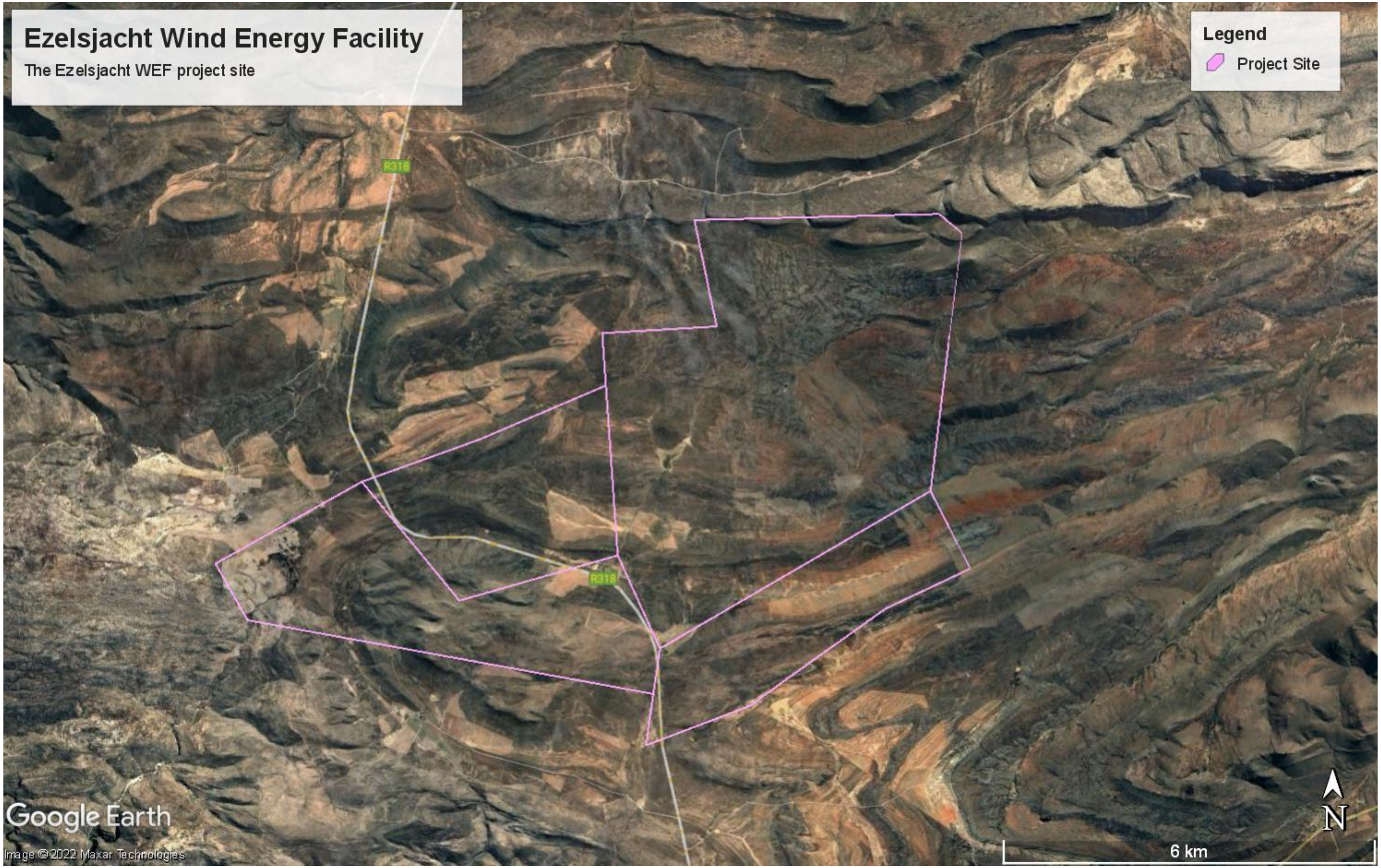


Figure 3: The land parcels that constitute the Project Site

3.1.1 *Wind Energy Facility*

The proposed project (including site area and powerline corridors) will be located on the following properties / farm portions (named and detailed in **Table 2** below , and mapped in Error! Reference source not found. above):

Table 2: Farm properties within which the Ezelsjacht Wind Energy Facility will fall

Farm name	Erf. No.	Portions	SG codes
Die Braak	7	1	C05000000000000700001
Ezelsjacht	171	0	C08500000000017100000
Zout Rivers	170	0	C08500000000017000000
Ratelbosch	149	6	C08500000000014900006

The Ezelsjacht WEF project site is approximately 5 544 hectares in extent (**Error! Reference source not found.**) with a project area of impact entailing a 5km buffer zone around the project site of approximately 25950 hectares. Design and layout alternatives will be considered and assessed as part of the EIA. These include alternatives for the substation locations and for the construction / laydown area.

3.2 Project Description

The application site assessed during the scoping phase (which incorporates the farm portions / properties listed above) is approximately 5 544 hectares in extent, with a project area of impact entailing a 5km buffer zone around the project site of approximately 30 422 hectares.

At this stage it is proposed that the WEF component of the renewable energy facilities will consist of up to 35 wind turbine generators (WTG), with a hub height and rotor diameter of approximately 200 m respectively. The WEF will also include internal and/or access roads (with a width of up to 7 and 12 m during construction), a construction laydown area/camp, Operation & Maintenance (O&M) Building and 33/132kV Independent Power Producer (IPP) portion of the substation, amongst other associated infrastructure which is still to be confirmed. As mentioned, the WEF will have a generation capacity of up to 140MW.

Wind Turbines

- Approximately 35 turbines, between 5MW and 8MW, with a maximum export capacity of up to approximately 140MW. 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 0.7 hectares 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 circular foundation (i.e., foundation rings) with diameters of up to 20m, and with a varying depth of up to 5m, depending on the physical size of each wind turbine.

Electrical Transformers

- Electrical transformers will be located adjacent to the foot of each wind turbine to step up the voltage to between 11kV and 33kV.
- The typical footprint of the electrical transformers will be up to approximately 2m x 2m.

Step-up / Collector Substations

- One on-site 33kV/132kV shared step up/collector substation with IPP portion (33/132kV transformer) and Eskom portion (132kV switching portion), 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 applicant will retain control of the IPP portion (i.e., 33/132kV components) of the substation.

Electrical Infrastructure

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

Battery Energy Storage Systems (BESS)

- One (1) Battery Energy Storage System (BESS) will be constructed for the wind farm and will be located next to the IPP portion / yard of the shared on-site the 33/132kV substation which form part of the respective wind farms, or in between the wind turbines.
- The BESS will cover an area of 5 hectares.
- The storage capacity will be approx. 500MWh and the type of technology will be determined during the EIA as either solid state or redox flow.
- These batteries are not considered hazardous goods as they will be storing 'energy'.

Site Access and roads

- Access to the site will be off the R318 Regional Route and existing access roads will be utilised as far as possible. The width of the access roads will be approximately 12m wide.

Temporary Staging Areas

- A temporary laydown or staging area will be required for the wind farm and will be located on the site identified for the substation.
- The temporary staging area will cover an area of up to approximately 3 hectares.

Temporary Construction Camps:

- It should be noted that no construction camps will be required to house workers overnight.

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

- Operations and Maintenance Building (including ablution facilities) will be required and will occupy areas of up to approximately 5 hectares

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, and will be constructed using galvanized steel to a height of 1.8m
- Additional specifications to the fencing should follow recommendations from the Ecologist and Avifauna specialist (as per the EMPr).

<u>Temporary 7 Infrastructure to Obtain Water from Available Local Sources</u>

- Temporary & permanent infrastructure to obtain water from available local sources will be required. Water may also be obtained from onsite boreholes and from the nearby towns.
- Water will potentially be stored in temporary water storage tanks.
- The necessary approvals from the Department of Water and Sanitation (DWS) will be applied for separately (should this be required); and

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

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

Design and layout alternatives will be considered and assessed as part of the EIA. These include alternatives for the substation locations and for the construction / laydown area.

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 FRAMEWORK

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.

Table 3: 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 wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
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	Global

Convention name	Description	Geographic scope
	conservation and wise use of wetlands and their resources.	
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

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

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

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

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

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

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

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

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

4.2 Provincial legislation

4.2.1 *Western Cape Nature Conservation Laws Amendment Act, 2000*

The current legislation applicable to the conservation of fauna and flora in the Western Cape is the Western Cape Nature Conservation Laws Amendment Act of 2000. This statute provides for the amendment of various laws on nature conservation to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board, which includes various regulations pertaining to wild animals, including avifauna.

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 et al., 2015) is followed for this study – hereafter referred to as the 'Windfarm Guidelines.' The originally version of this document was jointly published by the Endangered Wildlife Trust (EWT) and Birdlife South Africa (BLSA) in March 2011, and subsequently revised in 2011, 2012 and 2015.

Additionally, we consulted the latest best practice guidelines for monitoring Verreaux's Eagle (Ralston-Paton, 2017; Ralston-Paton and Murgatroyd, 2021) - hereafter referred to as the 'VE Guidelines' – as well as the latest best practice guidelines for monitoring Black Harrier (Simmons et al., 2019) – hereafter referred to as the 'BH Guidelines.'

We consulted the latter two guidelines as the expected regular occurrence of Verreaux's Eagle, Marital Eagle, and Black Harrier at the site would necessitate that the protocols for these species be considered.

5. DESCRIPTION OF THE RECEIVING ENVIRONMENT

5.1 Important Bird Areas (IBAs)

The Langeberg Mountains IBA SA113) (29km south) and Anysberg Nature Reserve IBA SA108 (29km southeast) respectively are the closest IBAs to the Ezelsjacht WEF PAOI (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.

5.2 National Protected Areas

There are seven national protected areas located close to (with 10km) of the Ezelsjacht WEF PAOI (DFFE, 2022):

1. Matroosberg Mountain Catchment Area (0km, overlaps with the western portions of the PAOI).
2. Langeberg Mountain Catchment Area (3km southeast).
3. Drie Kuilen Private Nature Reserve (3km east).
4. Bokkeriviere Provincial Nature Reserve (8.5km north).
5. Elim Private Nature Reserve (9km north).
6. Aquila Private Game Reserve (9.5km North)
7. Rooikrans Private Nature Reserve (9.5 km east).

The Mountain Catchment Areas and Provincial Nature Reserves constitute part of the Hex River Conservation Area managed by Cape Nature. Cape Nature highlight Verreaux's Eagle (Globally Least Concern, Regionally Vulnerable) as a Focal Conservation Target species (Cape Nature, 2021).

Drie Kuilen Private Nature Reserve, certified as a conservation stewardship site by Cape Nature, is also stated to include conserve Verreaux's Eagle and (Globally Vulnerable, Regionally Neat Threatened), among other wind priority bird species (https://www.driekuilen.co.za/about). Aquila Private Game Reserve is not stated to consciously conserve Red List/wind priority avifauna (https://www.aquilasafari.com/wildlife-and-conservation/). No avifaunal conservation information could be procured for Elim Private Nature Reserve and Rooikrans Private Nature Reserve.

Verreaux's Eagle and Blue Crane are a recognised wind priority species with an observed presence within the PAOI (see Sections 5.6 and 5.7). It is therefore anticipated that Verreaux's Eagle could potentially be impacted by the Ezelsjacht WEF.

5.3 The DFFE National Screening Tool

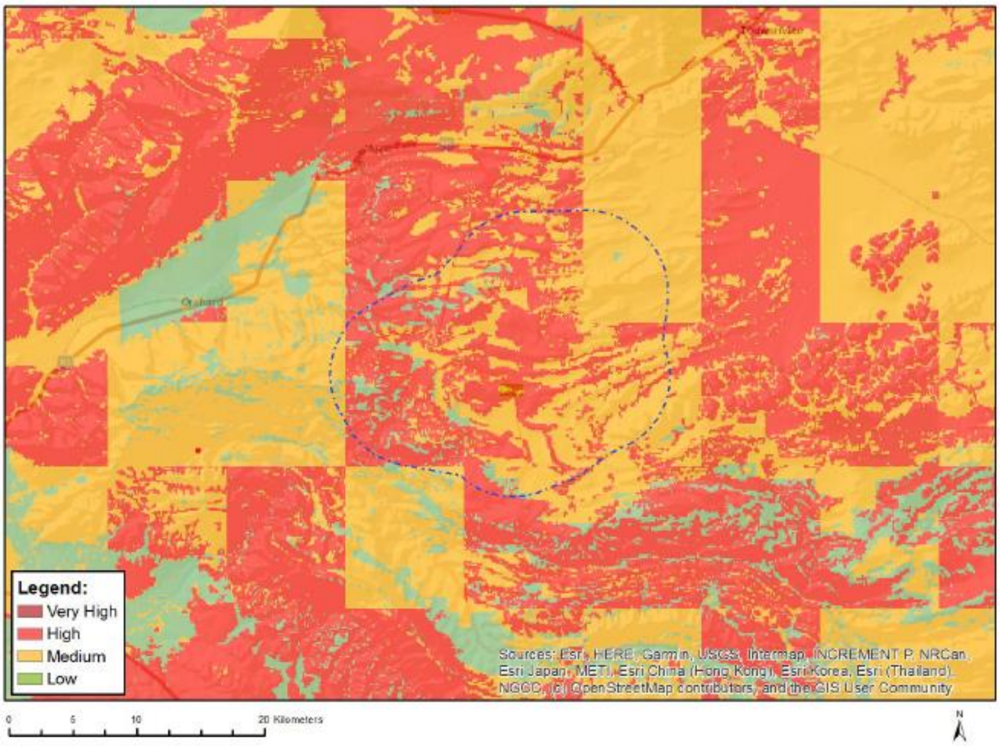
According to the DFFE national screening tool, the habitat within the PAOI is classified as **High Sensitivity** according to the Terrestrial Animal Species theme (see **Error! Reference source not found.**)[2]. The classification of **High Sensitivity** in the Terrestrial Animal Species theme is linked to the potential presence of species of conservation concern (SCC), namely Black Harrier (Globally Endangered, Regionally Endangered), Martial Eagle (Globally Endangered, Regionally Endangered), Southern Black Korhaan (Globally Vulnerable, Regionally Vulnerable), and Verreaux's Eagle (Globally Least Concern, Regionally Vulnerable). Additionally, **Medium sensitivity** is linked to these same species, except for Martial Eagle.

The PAOI contains confirmed habitat for the 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 the above four SCC recorded during pre-construction monitoring. Other Red List species were also during preconstruction monitoring include Black Stork (Globally Least Concern, Regionally Vulnerable), Blue Crane (Globally Vulnerable, Regionally Near Threatened), Lanner Falcon (Globally Least Concern, Regionally Vulnerable), Secretarybird (Globally Endangered, Regionally Vulnerable).

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

Based on the field surveys to date, a classification of **High** sensitivity for avifauna in the screening tool is therefore appropriate.

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Circus maurus
High	Aves-Polemaetus bellicosus
High	Aves-Afrotis afra
High	Aves-Aquila verreauxii
Low	Subject to confirmation
Medium	Aves-Circus maurus
Medium	Aves-Afrotis afra
Medium	Aves-Aquila verreauxii
Medium	Insecta-Aloeides caledoni
Medium	Mammalia-Bunolagus monticularis

See Appendix 8 for the SSV report.

5.4 Physical landscape (terrain and hydrology), climate, and biome characteristics

The Ezelsjacht WEF PAOI is situated within mountainous terrain, with rugged slopes, ridges and ravines present throughout the PAOI. The Project Site itself positioned with comparably gentler slopes within a broad valley between mountains flanking the PAOI.

There are numerous minor drainage lines intersecting the PAOI, which largely originate from the local mountains. Most of these drainage lines, however, are non-perennial streams. Only one perennial river is present within the PAOI – the west-flowing Keurboskloof River which ostensibly originates from the north-westernmost portions of the PAOI (note: this river does not intersect the Project Site itself).

The PAOI has drier Mediterranean climate seasonality, experiencing warm, dry summers and mildly cold, wet winters (https://www.meteoblue.com/, accessed October 2022). The mean temperatures range 33°C (January) to 5°C (July). The mean annual precipitation is 267 mm. Rainfall seasonality is relatively low within the PAOI, ranging from 14mm during the drier summer months to 35mm during the late autumn/winter months.

The PAOI is situated in at a transition zone between two bioregions within the Fynbos Biome (SANBI, 2018). The Southern Fynbos Bioregion – comprising North- and South Langeberg Sandstone Fynbos – is present over the western portions of the PAOI, while Western Fynbos-Renosterverld Bioregion – largely comprising Matjiesfontein Shale Renosterveld with Matjiesfontein Quartzite along ridgeline slopes (Rebelo et al., 2006; SANBI, 2018).

Renosterveld vegetation is the dominant natural habitat over much of the PAOI (Rebelo et al., 2006; SANBI, 2018), and this is characterized as "open to medium dense leptophyllous shrubland with a medium dense matrix of short divaricate shrubs, dominated by renosterbos" (Rebelo et al., 2006). The North- and South Langeberg Sandstone Fynbos which occupy the western portions of the PAOI are characterised by "proteoid and resitoid fynbos, with ericacesous fynbos at higher altitudes and asteraceous fynbos on lower slopes" (Rebelo et al., 2006).

Both bioregions within the PAOI form part of the Cape Floristic Region, a recognised Centre of Endemism within South Africa (Van Wyk & Smith, 2001).

5.5 Bird habitat classes

While the dominant vegetation, topography, and hydrology largely explain the distribution and abundance of the bird species within the PAOI, it is also important to examine the modifications which have changed the natural landscape, and which may impact the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types and are determined by a host of factors such as land use and man-made infrastructure.

The following six habitat classes were identified as relevant to priority bird species in the PAOI (Harrison et al., 1997a, 1997b). See Appendix 5 for photographs of the habitat classes.

5.5.1 Fynbos and Renosterveld

Despite variation in plant species composition across, the fynbos and renosterveld bioregions and ecotypes within the PAOI are characterised by similar vegetation structure and are collectively classified as Low Fynbos Shrubland according to the official 2018 national land-cover census (DEA & DALRRD, 2019): natural, low (0.2-

2m canopy height) woody shrubland comprising Fynbos (and Karoo-type) vegetation communities, where the total plant canopy cover is typically dominant over any adjacent bare ground exposure.

This low fynbos shrubland habitat has ostensibly remained intact across most the PAOI, in part due to the mountainous terrain precluding landscape transformation for viable economic use; along shallower slopes within the valley, this habitat class has been more extensively replaced by agriculture (DEA & DALRRD, 2019).

Pockets of grass species-dominated communities appear present on certain mountain slopes in the PAOI – mostly within the Southern Fynbos Bioregion – and very minor fragments contiguous of contiguous thicket/woodland appear present along the ravine slopes and alongside some waterbodies, however, these habitats can be both subsumed within the dominant low fynbos shrubland.

The low fynbos shrubland within the PAOI likely attracts a range of fynbos avifauna, especially montane fynbos bird species.

5.5.2 Agriculture

Commercial agriculture has replaced much of the indigenous renosterveld and fynbos at lower elevations and gentler slopes within the PAOI. Most of this agriculture is non-irrigated cereal croplands (wheat/barley), although there are pivot irrigation schemes and fruit orchards as well. Cereal croplands within the Western Cape can attract priority bird species primarily present in grassland habitats. Fallow fields have afforded opportunities for the re-establishment of secondary (disturbed) renosterveld/fynbos communities.

5.5.3 Artificial dams and waterpoints

There are numerous small artificial dams and waterpoints (boreholes and reservoirs) within the PAOI. The artificial dams are constructed along the non-perennial streams present within the PAOI, and likely serve to store the infrequent water from these drainage lines. Additionally, there are artificial furrows and irrigation canals dug from different dams and water points to agricultural fields. Surface water is a notable attraction for many priority bird species, including raptors, which use these locations as opportunities to bath and drink. Blue Cranes also use artificial dams to roost in.

5.5.4 Drainage lines and herbaceous wetlands

There is an extensive network of non-perennial drainage lines throughout the PAOI, and only one perennial drainage (Keurboskloof River) at the north-western extent of the PAOI. Herbaceous wetlands are established along certain drainage lines, particularly along the gentler slopes within the valley of the central PAOI. These drainage lines provide temporary drinking/bathing opportunities for many bird species, and the herbaceous wetlands provide potential foraging, roosting, and perhaps breeding opportunities for certain priority bird species.

5.5.5 Mountain ridges

The mountain ridges and rugged hills within the PAOI include sections of exposed rocky cliffs which are attractive nest sites for many priority species, particularly raptors. Additionally, these terrain features also provide opportunities for slope-soaring and -kiting, and behavior in which certain priority raptor species are known to engage.

5.5.6 Alien trees

Small stands of alien tree species are established within the PAOI, serving as wind breaks next to agricultural lands and around homesteads. Some of the drainage lines also have alien trees growing alongside, some of which were originally planted to protect earth-embankment dams. Alien tree stands occupy too small an area within the PAOI to have been detected by official land-cover surveys, yet do still provide nesting and roosting opportunities for certain priority bird species.

5.5.7 Overhead high voltage powerlines

The Boskloof-Quarry Traction 1 132kV OHL reticulation powerline intersects the northern and north-western portions of the PAOI, affording roosting and breeding opportunities for several priority bird species.

Appendix 5 provides the photographic records of the relevant habitats with the Ezelsjacht WEF PAOI.

5.6 Avifauna in the study area

A total of 190 bird species have been detected during SABAP2 observations and/or during pre-construction monitoring, and so could potentially occur in the broader area – see Appendix 6. Of this total, 24 are wind priority species, and 10 are Red List species. Of the 24 wind priority species, 19 are likely to occur regularly in the PAOI (see **Table 4**).

Table 4 below lists all the wind priority sensitive species and the potential impacts on the respective species by the proposed WEF.

Table 4: The wind priority bird species likely to occur within the PAOI, and the associated potential impacts of the proposed Ezelsjacht WEF to which these species are vulnerable.

Red List status: EN = Endangered, VU = Vulnerable, NT = Near threatened, LC = Least Concern

Occurrence likelihood: L = Low, M = Medium; H = High

Species name	Scientific name	SABAP 2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status	Wind priority	Recorded during monitoring	Likelihood of regular occurrence in the PAOI	Renosterveld/Fynbos	Agriculture	Dams and boreholes	Drainage lines and wetlands	Mountains	HV lines	Alien trees	Wind Collision with turbines	Wind Displacement - habitat transformation	Wind Displacement - disturbance (breeding)	Powerline - Electrocution MV 33kV	Powerline - Collision 33kV
African Fish Eagle	*Haliaeetus vocifer*	2.44	0	-	-	x	x	M			x				x	x	x	x	x	
African Harrier-Hawk	*Polyboroides typus*	4.88	3.33	-	-	x	x	M							x	x	x	x	x	
Agulhas Long-billed Lark	*Certhilauda brevirostris*	1.22	0	-	NT	x		L		x						x	x	x		
Black Harrier	*Circus maurus*	18.3	1.67	EN	EN	x	x	H	x	x	x	x				x	x	x	x	
Black Sparrowhawk	*Accipiter melanoleucus*	1.22	0	-	-	x		L		x	x				x	x	x	x	x	
Black Stork	*Ciconia nigra*	0	0	-	VU	x	x	M			x	x	x		x	x		x	x	x
Black-chested Snake Eagle	*Circaetus pectoralis*	0	0	-	-	x	x	M	x	x	x			x	x	x	x	x	x	
Black-winged Kite	*Elanus caeruleus*	13.4	0	-	-	x	x	M	x	x				x	x	x	x	x	x	
Blue Crane	*Grus paradisea*	43.9	21.7	VU	NT	x	x	H		x	x	x				x	x	x		x
Booted Eagle	*Hieraaetus pennatus*	23.2	23.3	-	-	x	x	H	x		x		x	x	x	x	x	x	x	
Common Buzzard	*Buteo buteo*	3.66	1.67	-	-	x		L	x	x	x			x	x	x	x		x	
Double-banded Courser	*Rhinoptilus africanus*	0	0	-	-	x	x	M	x	x						x	x	x		
Greater Flamingo	*Phoenicopterus roseus*	1.22	0	-	NT	x		L			x					x				x

Species name	Scientific name	SABAP 2 Full protocol reporting rate	SABAP2 Ad hoc protocol reporting rate	Global status	Regional status	Wind priority	Recorded during monitoring	Likelihood of regular occurrence in the PAOI	Renosterveld/Fynbos	Agriculture	Dams and boreholes	Drainage lines and wetlands	Mountains	HV lines	Alien trees	Wind Collision with turbines	Wind Displacement - habitat transformation	Wind Displacement - disturbance (breeding)	Powerline - Electrocution MV 33kV	Powerline - Collision 33kV
Greater Kestrel	*Falco rupicoloides*	1.22	0	-	-	x		L	x	x				x	x	x	x	x	x	
Grey-winged Francolin	*Scleroptila afra*	15.9	1.67	-	-	x	x	H	x	x			x			x	x	x		
Jackal Buzzard	*Buteo rufofuscus*	40.2	16.7	-	-	x	x	H	x	x	x		x	x	x	x	x	x	x	
Lanner Falcon	*Falco biarmicus*	4.88	0	-	VU	x	x	M	x	x	x		x	x	x	x	x	x	x	
Martial Eagle	*Polemaetus bellicosus*	7.32	0	EN	EN	x	x	M	x		x			x	x	x	x	x	x	
Pale Chanting Goshawk	*Melierax canorus*	50	16.7	-	-	x	x	H	x	x	x			x	x	x	x	x	x	
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	3.66	3.33	-	-	x	x	M		x	x				x	x	x	x	x	
Secretarybird	*Sagittarius serpentarius*	1.22	0	EN	VU	x	x	M	x	x	x				x	x	x	x	x	x
Southern Black Korhaan	*Afrotis afra*	35.4	20	VU	VU	x	x	H	x	x						x	x	x		x
Spotted Eagle-Owl	*Bubo africanus*	8.54	0	-	-	x	x	M	x	x	x				x	x	x	x	x	x
Verreaux's Eagle	*Aquila verreauxii*	30.5	6.67	-	VU	x	x	H	x		x		x	x	x	x	x	x	x	x

5.7 Results of pre-construction bird monitoring

The monitoring was designed according to the following the Windfarm Guidelines, VE Guidelines, and BH Guidelines for monitoring avifauna, detailed in Section 4.3.

Priority species for wind development (wind priority species) were identified from the latest updated BirdLife South Africa list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Ralston-Paton et al., 2017; Retief et al., 2012)

The first five of six surveys of the pre-construction monitoring programme at the proposed Ezelsjacht WEF were conducted during the following periods:

- 01July - 06 July 2021
- 29 September - 10 October 2021
- 04 January – 09 January 2022
- 04 March – 11 March 2022
- 01 May – 06 May 2022

See Appendix 4 for the detailed survey methodology employed during preconstruction monitoring.

5.7.1 Walk- and Drive Transects

Table 5Error! Reference source not found., **Figure 4**, and **Figure 5** below present the results of the pre-construction monitoring conducted at the proposed WEF site and control area to date. See Appendix 4 for a map of walk and drive transects surveyed during preconstruction monitoring.

Table 5: The results of the transect counts at the WEF Turbine Site and Control Site

Turbine site	
Species richness	
All Species	71
Priority Species	10
Non-Priority Species	61
Bird abundane	
Drive transects	1520
Walk transects	2215
Total	3735
Control site	
Species richness	
All Species	65
Priority Species	6
Non-Priority Species	59
Bird abundance	
Drive transects	929
Walk transects	963

Total	1892

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each priority species recorded during transects for the pre-construction survey at the proposed WEF turbine site (see **Figure 4** and **Figure 5** below).

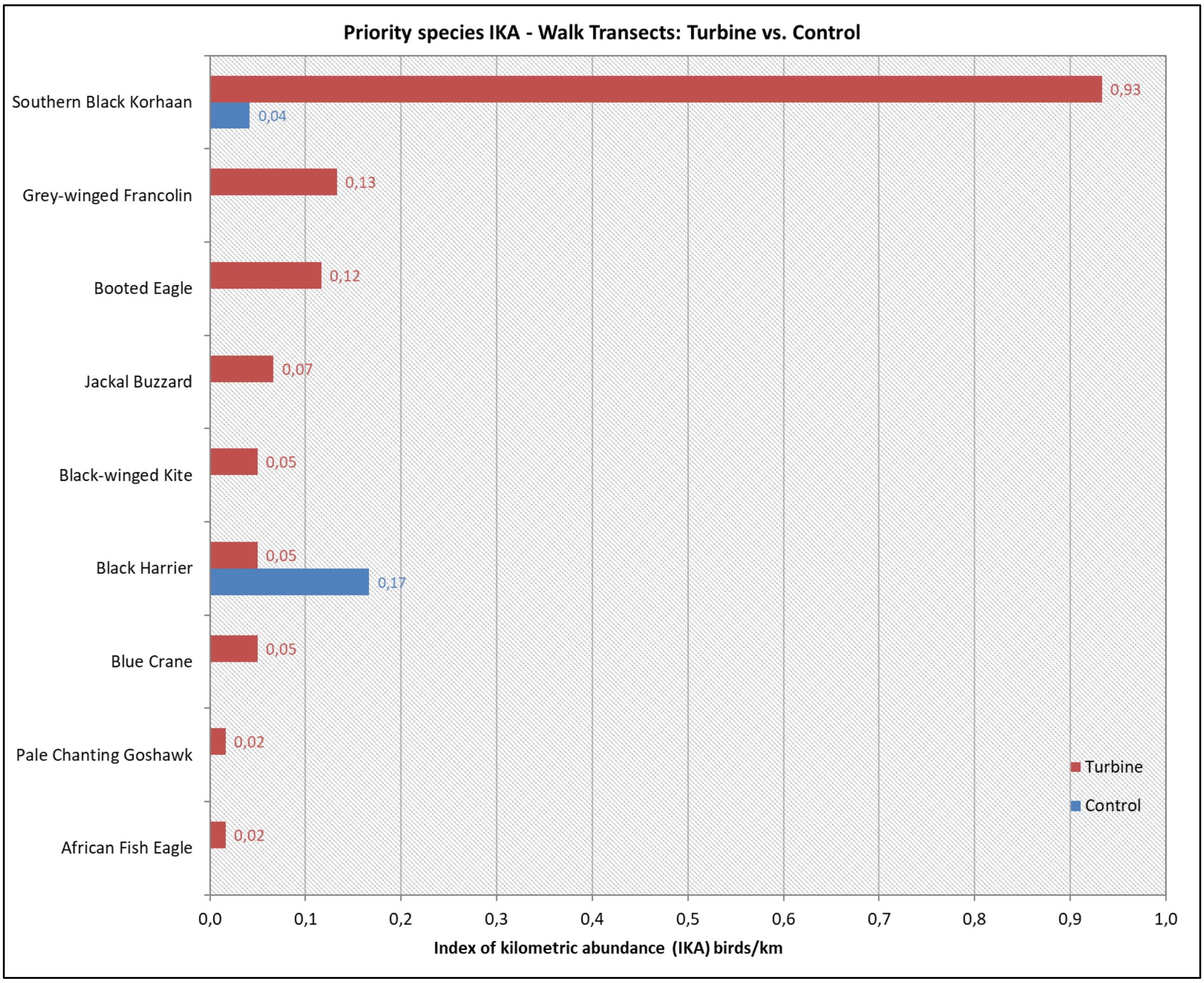


Figure 4: Index of kilometric abundance of priority species recorded at the proposed WEF site through walk transect surveys conducted during pre-construction monitoring.

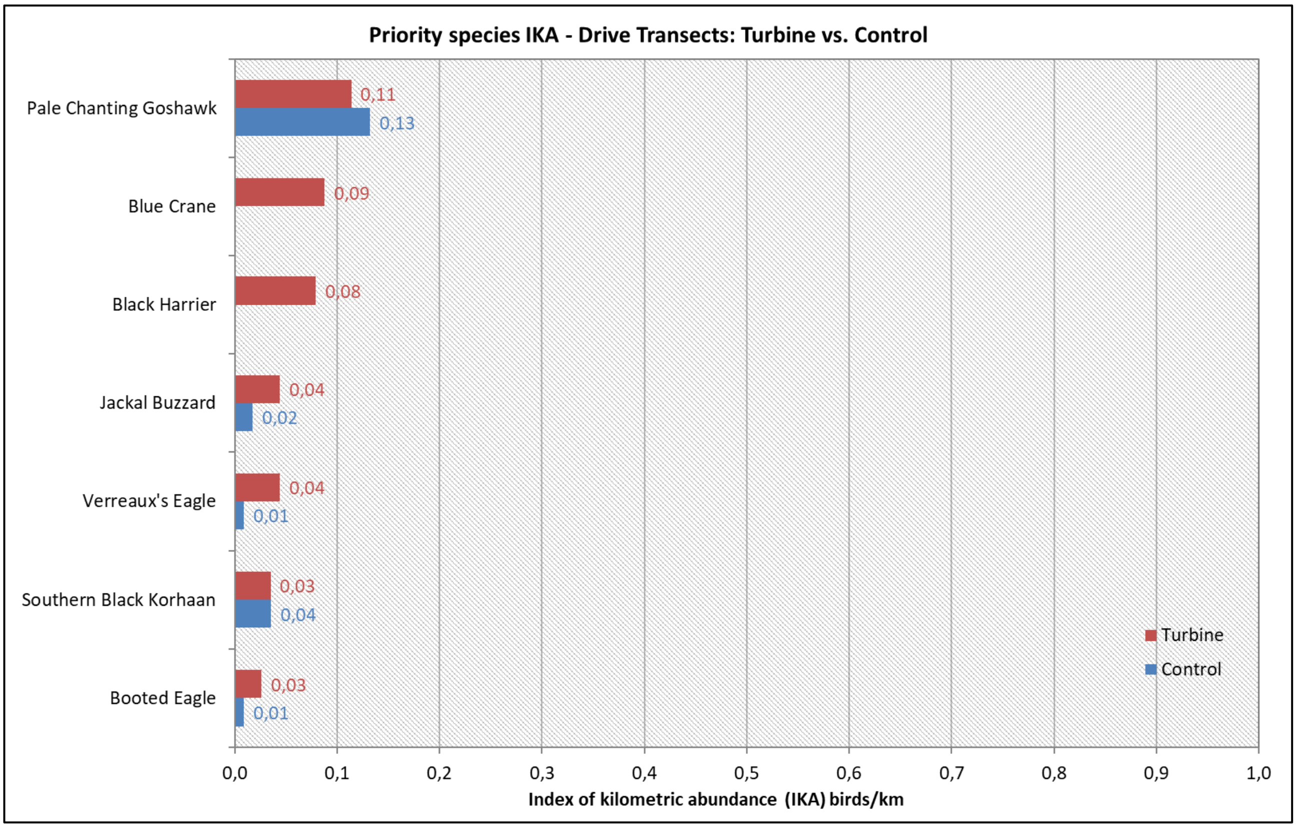


Figure 5: Index of kilometric abundance of priority species recorded at the proposed WEF site and control site through drive transect surveys conducted during pre-construction monitoring.

5.7.2 Focal points

See **Table 6** below for a summary of the focal point survey data recorded to date. See Appendix 4 for a map of focal points. Refer to Error! Reference source not found. for a map of Verreaux's Eagle nests, Martial Eagle nests, and Jackal Buzzard/Booted Eagle nests surveyed during preconstruction monitoring.

Table 6: Summary of focal point surveys at the proposed Ezelsjacht WEF site during the pre-construction monitoring

SURVEY 1: 01 to 06 July 2021				
FP	Description	Survey	Territory active?	Notes
FP1	Dam	1	n/a	Several non-priority species were observed.
FP2	Dam	1	n/a	Several non-priority species were observed.
FP3	Verreaux's Eagle (Skulpiesberg) nest on a cliff	1	?	No activity observed but nest is in good condition. Regular flight activity recorded over the site.
FP4	Martial Eagle (Ratelbosch) nest on a powerline	1	No?	No activity or sign of recent occupation, but nest structurally intact.

FP5	Jackal Buzzard or Booted Eagle (Tafelberg) nest	1	No	No activity or sign of recent occupation.
FP6	Dam	1	n/a	50 Blue cranes were observed roosting in the dam.
SURVEY 2: 29 September to 10 October 2021				
FP	Description	Survey	Territory active?	Notes
FP1	Dam	2	n/a	Several non-priority species were observed.
FP2	Dam	2	n/a	Several non-priority species were observed.
FP3	Verreaux's Eagle (Skulpiesberg) nest on a cliff	2	?	No activity observed during this survey.
FP4	Martial Eagle (Ratelbosch) nest on a powerline	2	No?	No activity or sign of recent occupation.
FP5	Jackal Buzzard or Booted Eagle (Tafelberg) nest	2	No	No activity or sign of recent occupation.
FP6	Dam	2	n/a	No Blue cranes observed on the dam. Two Blue cranes were observed on a smaller dam to the west.
SURVEY 3: 04 to 09 January 2022				
FP	Description	Survey	Territory active?	Notes
FP1	Dam	3	n/a	Several non-priority species were observed.
FP2	Dam	3	n/a	Several non-priority species were observed.
FP3	Verreaux's Eagle (Skulpiesberg) nest on a cliff	3	?	No activity observed during this survey.
FP4	Martial Eagle (Ratelbosch) nest on a powerline	3	No?	Nest appears to be unused over an extended period. No signs of recent activity.
FP5	Jackal Buzzard or Booted Eagle (Tafelberg) nest	3	No	No activity or sign of recent occupation.
FP6	Dam	3	n/a	Not inspected
SURVEY 4: 04 to 11 March 2022				
FP	Description	Survey	Territory active?	Notes
FP1	Dam	4	n/a	Dam level was low. Water level is maintained by a trickle of water from a nearby borehole. Several non-priority species were observed.
FP2	Dam	4	n/a	Dam level was low, only slightly shallower compared to the last survey. Several non-priority species were observed.
FP3	Verreaux's Eagle (Skulpiesberg) nest on a cliff	4	?	A large Verreaux's Eagle nest observed from a few kilometres away due to restricted access. Two

				adult Verreaux's Eagles were observed within 100 metres of the nest. They may have roosted there overnight.
FP4	Martial Eagle (Ratelbosch) nest on a powerline	4	?	Nest appears to be unused over an extended period. Some Martial Eagles were observed to the south of the nest several times during this survey. The eagles may have an alternative nest in the vicinity.
FP5	Jackal Buzzard or Booted Eagle (Tafelberg) nest	4	No	No activity or sign of recent occupation.
FP6	Dam	4	n/a	Not inspected
SURVEY 5: 01 to 06 May 2022				
FP	Description	Survey	Territory active?	Notes
FP1	Dam	5	n/a	Dam level was significantly higher compared to the previous survey. Several non-priority species were observed.
FP2	Dam	5	n/a	Dam level was significantly higher compared to the previous survey. Several non-priority species were observed.
FP3	Verreaux's Eagle (Skulpiesberg) nest on a cliff	5	?	A large Verreaux's Eagle nest observed from a few kilometres away due to restricted access. Two adult Verreaux's Eagles were observed soaring within 500 metres of the nest with one landing on cliffs several hundred metres from the nest.
FP4	Martial Eagle (Ratelbosch) nest on a powerline	5	?	Nest appears to be unused over an extended period. An alternative Martial Eagle nest was found in poplar trees to the south of the site, see FP7.
FP5	Jackal Buzzard or Booted Eagle (Tafelberg) nest	5	No.	No activity or sign of recent occupation.
FP6	Dam	4	n/a	Not inspected
FP7	Martial Eagle (Leeuwenboschfontein) nest in poplar tree stand	5	?	Nest possibly active due to eagles frequently observed to the south of the site. A possible sign of occupation observed namely scat but difficult to find potential prey remains due to tree leaves covering the ground. A large pile of branches under the nest suggests the nest may have been active for some time. The trees are well secluded

				with minimal disturbance due to a lack of road access.

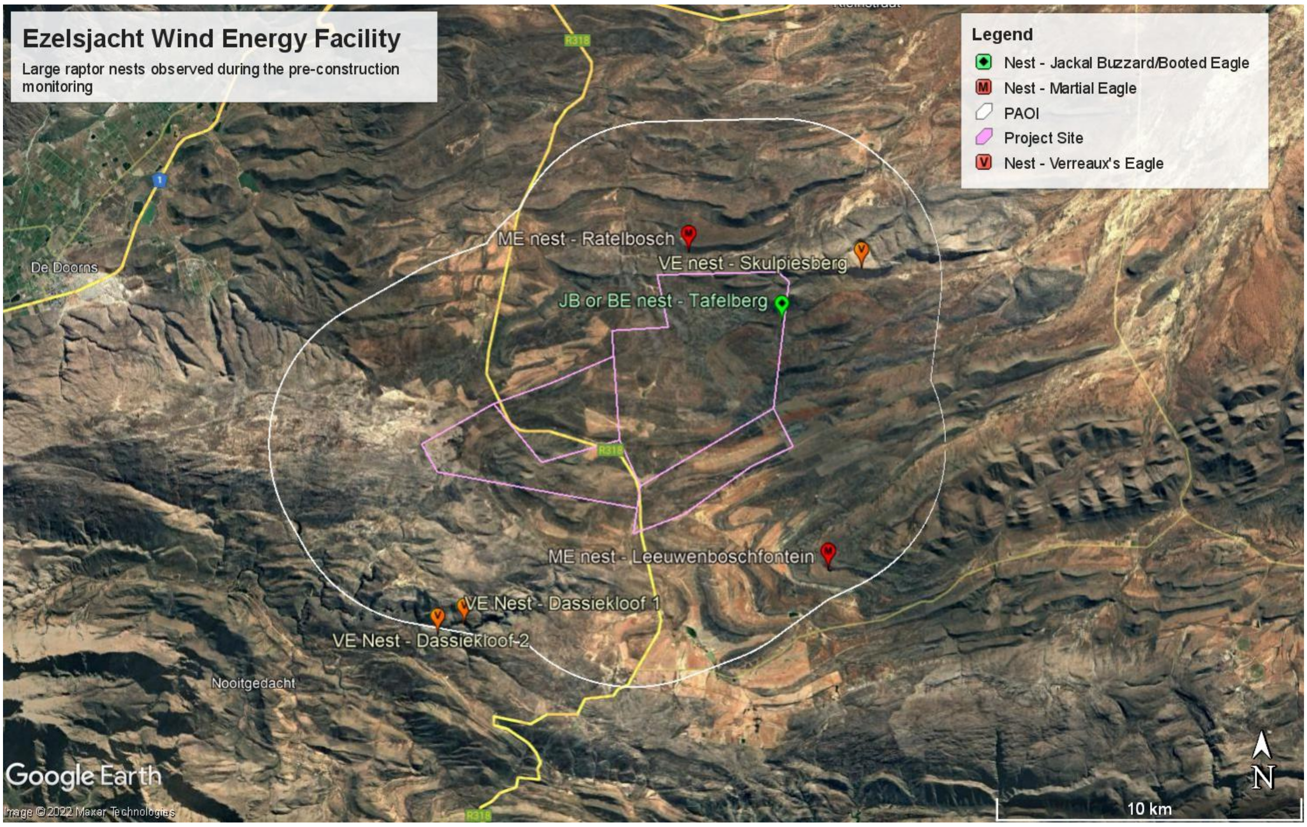


Figure 6: Raptor nests recorded during the pre-construction monitoring

5.7.3 Incidental counts

Table 7 provides an overview of the incidental sightings of priority species recorded thus far at the five WEF sites.

Table 7: Incidental sightings of priority species during the first five survey periods (V1-V5) during pre-construction monitoring at the proposed Ezelsjacht WEF

Priority Species	Scientific name	V1	V2	V3	V4	V5	Total
Blue Crane	*Grus paradisea*	82	32	27	20	56	**217**
Southern Black Korhaan	*Afrotis afra*	15	11	8	9	4	**47**
Grey-winged Francolin	*Scleroptila afra*	19	16	4	5	0	**44**
Pale Chanting Goshawk	*Melierax canorus*	9	0	13	5	7	**34**
Jackal Buzzard	*Buteo rufofuscus*	5	9	5	3	1	**23**
Black Harrier	*Circus maurus*	0	8	5	2	0	**15**
Booted Eagle	*Hieraaetus pennatus*	0	2	6	1	0	**9**
Spotted Eagle-Owl	*Bubo africanus*	0	1	3	2	3	**9**
Verreaux's Eagle	*Aquila verreauxii*	0	1	2	1	3	**7**
Martial Eagle	*Polemaetus bellicosus*	0	0	1	1	1	**3**

Black-winged Kite	*Elanus caeruleus*	0	0	0	1	0	**1**
Lanner Falcon	*Falco biarmicus*	0	0	1	0	0	**1**

See Appendix 6 for a list of all species recorded during the pre-construction monitoring at the proposed WEF site so far.

5.7.4 Vantage point observations

To date, flight patterns of priority species have been recorded for 360 hours (12 hours per VP) at 3 vantage points (Survey 1) and 6 vantage points (Surveys 2, 3, 4 and 5) at the proposed Ezelsjacht WEF site in three bands [low =below rotor altitude (<30m); medium = at rotor altitude (30-300m); high = above rotor altitude (>300m)]. Approximate flight altitude was visually judged by an observer with the aid of binoculars. Priority species were observed for a combined 47 hours 2 minutes and 32 seconds during the five surveys to date.

Figure 7 presents the data gathered so far during vantage point watches at the proposed WEF site.

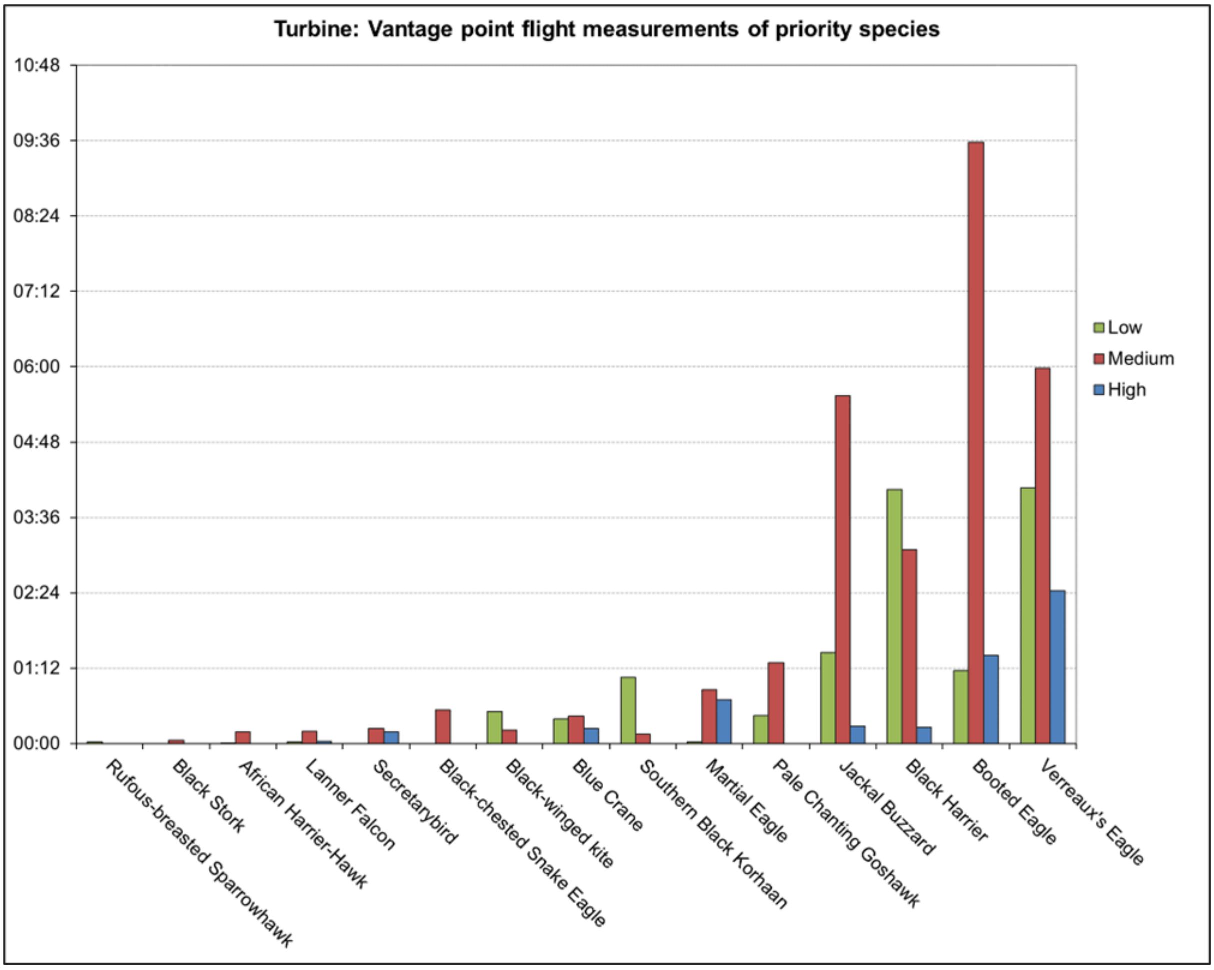


Figure 7: Flight time and altitude recorded for all individuals of priority species to date (five surveys) at the development site (360 hours of observation). Time is indicated in hours: minutes: seconds. Flight altitude is indicated as low (green = below rotor altitude), medium (red = within rotor altitude) and high (blue = above rotor altitude).

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6. SPECIALIST FINDINGS AND ASSESSMENT OF IMPACTS

6.1 Wind Energy Facility (WEF)

The impacts wind farms have on bird populations are dependent upon range of factors, including the specification of the development, the local/regional topography, the habitats affected, the abundance, species diversity, and characteristics of birds present.
Potential impacts can be:

- discrete – acting in isolation of other impacts (i.e., priority species response to wind farms are idiosyncratic).
- cumulative – exacerbating other the severity of other impacts (i.e., wind turbines and overhead powerlines may pose similar collision risks to a given bird population).
- counter-active – reducing the severity of other impacts (i.e., bird population reduction through habitat loss lowers collision mortality rates)

The multi-faceted impacts that wind farms have on bird populations necessitates that new developments should be assessed on a case-by-case basis. The major concerns surrounding the impacts of wind farms on birds are detailed below:

- 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 collision and/or electrocution on the medium voltage overhead lines
- Mortality due to collisions with the medium voltage overhead lines

It should be noted that environmental impact assessments are localised to the contemporary pre-construction conditions of a given development sites. Impacts to the regional landscape are not considered as 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[3]

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 major ecological drawback to wind energy (Drewitt & Langston, 2006).

Collisions with wind turbines kill fewer birds than collisions with other man-made infrastructure, such as power lines, buildings or even traffic (Erickson et al., 2005). Nevertheless, estimates of bird deaths from collisions with wind turbines worldwide range from 0-40 deaths per turbine per year (Sovacool, 2013). Bird mortality rates vary across sites, as do the number of sensitive bird species impacted (Hull et al., 2013; May, 2015). Estimated mortalities are likely lower than true number of bird deaths from wind farm infrastructure, given that studies may

[3] 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.

fail to account for detection biases caused by scavenging, searching efficiency and search radius (Bernardino et al., 2013; Erickson et al., 2005; Huso et al., 2015, 2021). Additionally, even for low mortality rates, collisions with wind turbines may disproportionately affect certain species. For long-lived species with low reproductivity and slow maturation rates (e.g. raptors), even low mortality rates can have a significant impact at the population level (Carrete et al., 2009; De Lucas et al., 2008; Drewitt & Langston, 2006). The situation is even more critical for species of conservation concern and those with restricted distribtuions, which sometimes are most at risk (Osborn et al., 1998).

High bird mortality rates at several wind farms have raised concerns among the industry and scientific community. High profile examples include the Altamont Pass Wind Resource Area (APWRA) in California because of high fatality of Golden eagles (*Aquila chrysaetos*), Tarifa in Southern Spain for Griffon vultures (*Gyps fulvus*), Smøla in Norway for White-tailed eagles (*Haliaatus albicilla*), and the port of Zeebrugge in Belgium for gulls (*Larus* spp.) and terns (*Sterna* spp.) (Barrios & Rodríguez, 2004; Drewitt & Langston, 2006; Huso et al., 2015; Stienen et al., 2008; Thelander et al., 2003). Due to their specific features and location, and characteristics of their bird communities, these wind farms have been responsible for many 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; Marques et al., 2014) 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. In southern Africa, vultures – followed by larger eagle species – are highlighted as being especially susceptible to collisions with wind turbines (McClure et al., 2021).

The following sections details avifaunal and environmental and characteristics which contribute towards turbine collision mortalities in birds.

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 wing span 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 & 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 PAOI was not available at the time of writing. However, based on general observations, and research on related species, it can be confidently assumed that regularly occurring priority species that could potentially be vulnerable to wind turbine collisions due to morphological features (high wing loading) are Blue Cranes, and Southern Black Korhaans – and to a lesser extent Grey-winged Francolin, making them less manoeuvrable (Keskin et al., 2019).

- Sensorial perception

Birds are widely assumed to have excellent visual acuity, slightly superior to that of other vertebrates (Martin et al., 2010; McIsaac, 2001; Mitkus et al., 2018). Despite this, birds incur high collision-related mortalities from conspicuous man-made structures (Drewitt & Langston, 2006; Erickson et al., 2005).
Low visibility weather obscuring these structures was previously believed to increase avian collision risks; however, recent studies suggest this may not always the case (Guichard, 2017; Krijgsveld et al., 2009; May et al., 2015; Mitkus et al., 2018).

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 et al., 2010, 2012; Mitkus et al., 2018). Relatively small frontal binocular fields have been described for several species that are particularly vulnerable to power line collisions, such as vultures (*Gyps* spp.) cranes and bustards (Martin, 2011; Martin et al., 2010, 2012; Martin & Katzir, 1999). Relatedly, many bird species may have high resolution vision areas are often found in the lateral, rather than frontal, fields of view (Martin, 2011; Martin et al., 2010, 2012; O'Rourke et al., 2010; Päckert et al., 2012). 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).

Some of the regularly occurring priority species at the PAOI have high resolution vision areas found in the lateral fields of view, rather than frontally, e.g., the bustards and cranes. The exceptions to this are the priority raptors which all have wider binocular fields, although as pointed out by (Martin et al., 2010), this does not necessarily result in these species being able to avoid obstacles better.

- Phenology

Turbine collision mortalities within raptors may be higher for resident than for migratory birds of the same species/taxon group. This disparity is possible due to resident birds frequenting areas occupied by wind farms more readily that migratory birds, which typically cross these wind farms *en route* to destinations further afield (Krijgsveld et al., 2009). However, factors like bird behaviour remain 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 (Martín et al., 2018), such as the African Rift Valley or Mediterranean Red Sea flyways, is not a feature of the landscape. The only migratory priority species observed within the broader area, albeit irregularly (see **Table 4**), will is Common Buzzard, which is expected to behave much the same as the resident birds once they arrive in the area. The same is valid for local migrants such as the Black Harrier and Booted Eagle. 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, California (Hoover & Morrison, 2005), and could also be a factor in contributing to the high collision rate for Jackal Buzzards in South Africa (Ralston-Patton & 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 & Rodríguez, 2004). This may also explain the high mortality rate of Rock Kestrels *Falco rupicolus* at wind farms in South Africa (Ralston-Patton & Camagu, 2019). Kiting and hovering are associated with strong winds, which often produce unpredictable gusts that may suddenly change a bird's position (Hoover & 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 (Carrete et al., 2012; Janss, 2000), and territoriality and courtship displays may override aversion to wind turbines (Walker et al., 2005). 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, *personal communications*, 12 April 21012). Similarly, in South Africa, very few bustard collisions with wind turbines have been reported to date, all Ludwig's Bustards (Ralston-Patton & 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 PAOI 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 PAOI, Double-banded Courser, Grey-winged Francolin, and Southern Black Korhaan fall into this category. Occasional long-distance fliers generally behave as terrestrial species but can and do undertake long distance flights. Species in this category are Black Stork, Blue Crane, and Secretarybird. 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 PAOI, these include all the raptors which could occur regularly, such as African Fish Eagle, African Harrier Hawk, Black Harrier, Black-chested Snake Eagle, Black-winged Kite, Jackal Buzzard, Lanner Falcon, Martial Eagle, Pale Chanting Goshawk, Rufous-chested Sparrowhawk, and Verreaux's Eagle. Based on the time spent potentially flying at rotor height, soaring species are likely to be at greater risk of collision.

- Avoidance behaviours

Three types of avoidance have been described (Cook et al., 2018; May, 2015):

- Macro-avoidance' or displacement, whereby the density of birds reduced around a wind farm due to long-term disturbance (Desholm & Kahlert, 2005; Furness et al., 2013; Plonczkier & Simms, 2012; Villegas-Patraca et al., 2014; Walker et al., 2005).
- 'Meso-avoidance' or anticipatory/impulsive evasion, whereby flying birds anticipate a perceived threat from a wind farm, or segments thereof and alter their flight paths to avoid these threats (Desholm & Kahlert, 2005; Healy & Braithwaite, 2010; Mueller & Fagan, 2008)
- 'Micro-avoidance' or escape, whereby birds in close proximity to the rotor swept zone perform last-second evasion manoeuvres, possibly reflexively, away from the rotors (Everaert, 2014; Frid & Dill, 2002; Mueller & Fagan, 2008).

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 (Scottish Natural Heritage, 2010).

It is anticipated that most birds at the PAOI will avoid the wind turbines, as is generally the case at all wind farms (Scottish Natural Heritage, 2010). Exceptions already mentioned are raptors that engage in hunting behaviour *which may serve to distract them and place them at risk of collision, birds engaged in display behaviour or inter- and intraspecific aggressive interaction. It is unlikely that the entire regional/local population of each priority species present around the proposed WEF will engage in complete meso- and macro-avoidance strategies of the wind energy infrastructure.*

- Bird abundance

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

The abundance of regularly occurring priority species at the PAOI will fluctuate depending on the seasonality and rainfall e.g., Blue Crane, Black Harrier, and Booted Eagle.

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 & Rodríguez, 2004; Drewitt & Langston, 2008; Healy & Braithwaite, 2010; Katzner et al., 2012; Thelander et al., 2003). In South Africa, Verreaux's Eagle is expected to incur higher fatality rates from at higher elevations and along steeper slopes (Murgatroyd et al., 2021). In Lesotho, Bearded Vultures preferentially forage upper mountain slopes and high ridges which are favourable sites for wind turbine construction (Rushworth & Krüger, 2014).

In APWRA, California, 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 & 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 mountainous topography within the PAOI, including within the comparatively gentler Project Site, provides opportunities for slope-kiting and -soaring opportunities by many of the raptors which regularly occur within the PAOI, and so these are the most significant landscape features from a collision risk perspective. Among these raptors are the Red List species Lanner Falcon, Martial Eagle, and Verreaux's Eagle.

Additionally, cereal agriculture and fallow fields within the PAOI points for Red List species such as Black Harrier, Blue Crane, Grey-winged Francolin, Secretarybird, and Southern Black Korhaan (prefers fynbos habitats).

A final significant landscape features at the PAOI from a collision risk perspective are the ground dams, and the non-perennial drainage lines (when flowing). Surface water attracts many birds, including Red Listed species such as Black Harrier, Black Stork, Blue Crane, Lanner Falcon, Martial Eagle, and Verreaux's Eagle.

- Flight paths

The foraging behaviour of breeding, or otherwise territorial, raptors is often constrained to the vicinity closes to the nest/home range (Watson et al., 2018). 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, 2008).

There are relatively few telemetry studies the foraging behaviour of breeding raptors in South Africa. Breeding Verreaux's Eagles largely forage within 3.7km of their nest (Brink, 2020), with turbine collision risk potential falling substantially further away from the nest, becoming a negligible concern after 8km (Murgatroyd et al., 2021). Breeding African Crowned Eagles demonstrate more restrictive foraging behaviour largely confined to 1.62km of their nest, whereas breeding Martial Eagle forage generally forage within 5.39km of their nests (Brink, 2020). Male Black Sparrowhawks have been observed to display year-round territoriality, mostly foraging within 2.27 (breeding) and 2.43km (non-breeding) of the nest (Brink, 2020; Sumasgutner et al., 2016). The home range size for foraging female Long-crested Eagles in KwaZulu-Natal undergo substantial contractions to within a close vicinity of the nest (<25ha for one observed female) during the breeding season (Maphalala et al., 2020). Breeding Black Harrier pairs forage further afield (within 7.1–33.4km of their nests) (Garcia-Heras et al., 2019), as do Bearded Vultures (10km of their nests), and especially Lappet-faced Vultures (110.98km of their nest) (Brink, 2020).

Within the PAOI, there are two Martial Eagle nests (-33.566795°S, 19.936419°E; -33.473392°S, 19.887225°E) together with three Verreaux's Eagle nests (-33.478181°S, 19.948129°E; -33.582826°S, 19.807925°E; -33.585774°S, 19.798555°E). As discussed above, breeding Martial Eagle are likely to confine most foraging to within 5.39km of the active nest, and breeding Verreaux's Eagle are most likely to forage within 3.7km for the nest.

Additionally, there is one Booted Eagle or Jackal Buzzard nest (-33.493918°S, 19.920024°E) observed in the PAOI. The airspace around these nests likely experiences similarly heightened flight activity from the breeding raptor pair.

Another 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, California, 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 & Morrison, 2005; Smallwood et al., 2009). 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 density of large raptor nests observed within the PAOI strongly indicated high availability of prey animals for raptors, including the regularly occurring Red List species: Black Harrier, Lanner Falcon, Martial Eagle, Secretarybird, and Verreaux's Eagle.

The presence of grassland-affiliated bird species, such as Blue Crane, within the PAOI could be linked to grassland-analogous availability, which is influenced by the extent of livestock grazing and resumption of cereal agriculture.

Additionally, the extensive network of non-perennial drainage lines indicates that optimally wet conditions (i.e., above average rainfall) may afford better foraging opportunities for several priority species, and improve the wetland habitats for regularly occurring priority species such as Black Stork.

- Summary

The proposed Ezelsjacht WEF will pose a significant collision risk to several priority species which could occur regularly at the site. Priority species exposed to this risk are large terrestrial species which are likely to regularly occur within the POAI, namely Black Stork, Blue Crane, Southern Black Korhaan, and to a lesser extent Grey-winged Francolin.

Several soaring species are also likely to regularly occur within the PAOI, namely Black Harrier, Black-chested Snake Eagle, Black-winged Kite, Booted Eagle, Jackal Buzzard, Lanner Falcon, Martial Eagle, Pale Chanting Goshawk, Rufous-breasted Sparrowhawk, Secretarybird, and Verreaux's Eagle. Other soaring species such as Black Sparrowhawk, Common Buzzard , and Greater Kestrel are less common.

The mountainous topography affords numerous slope-soaring and slope-kiting opportunities which will increase the vulnerability of these species to wind turbines.

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

Species Name	Global Status	Regional Status	Occurrence Likelihood
African Fish Eagle	Least Concern	Least Concern	Medium
African Harrier-Hawk	Least Concern	Least Concern	Medium
Agulhas Long-Billed Lark	Least Concern	Near Threatened	Low
Black Harrier	Endangered	Endangered	High
Black Sparrowhawk	Least Concern	Least Concern	Low
Black Stork	Least Concern	Vulnerable	Medium
Black-Chested Snake Eagle	Least Concern	Least Concern	Medium
Black-Winged Kite	Least Concern	Least Concern	Medium
Blue Crane	Vulnerable	Near Threatened	High
Booted Eagle	Least Concern	Least Concern	High
Common Buzzard	Least Concern	Least Concern	Low
Double-Banded Courser	Least Concern	Least Concern	Medium
Greater Flamingo	Least Concern	Near Threatened	Low
Greater Kestrel	Least Concern	Least Concern	Low
Grey-Winged Francolin	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	High
Lanner Falcon	Least Concern	Vulnerable	Medium
Martial Eagle	Endangered	Endangered	Medium
Pale Chanting Goshawk	Least Concern	Least Concern	High

Rufous-Breasted Sparrowhawk	Least Concern	Least Concern	Medium
Secretarybird	Endangered	Vulnerable	Medium
Southern Black Korhaan	Vulnerable	Vulnerable	High
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Verreaux's Eagle	Least Concern	Vulnerable	High

6.1.2 Displacement due to disturbance

The displacement of birds away from areas in and around wind farms due to visual intrusion and airspace disturbance can be considered functional habitat loss. This disturbances can be detrimental to migratory bird population if wind farms disrupt migration routes (Marques et al., 2020, 2021), or if impact the breeding productivity and population sizes of species which undergo macro-avoidance of wind farms (see Section 8.1.1.5). Displacement may occur during both the construction and operation phases of wind farms, manifesting from turbines themselves through visual, noise and vibration impacts, as well as vehicle and personnel movements related to site construction and maintenance (Campedelli et al., 2014; May, 2015). Disturbance magnitude varies across sites and species, necessitating assessments on a site-by-site basis (Dohm et al., 2019; Drewitt & Langston, 2006). A recent meta-analysis study found that of long-term studies into avian displacement around wind farms found that half ~50% of studies reported limited displacement from wind turbines, 46% reported a decrease in some bird populations, and 7.7% found an increased abundance of certain species around wind farms (Marques et al., 2021). Unfortunately, few studies provide comprehensive before-and-after and control-impact (BACI) assessments, limiting current inferential power.

The operational phase is thought to impose the greatest displacement threat to bird populations, although these impacts may in temporary (Dohm et al., 2019; Pearce-Higgins et al., 2012). Local raptor populations around wind farms may rebound within 7-8 years post-construction (Dohm et al., 2019). Bustards may retain high affinity for historic lek sites (courtship display areas) on wind farms, as has been document in Great Bustard in Spain (A. Camiña, *personal communications*, 17 November 2012) and Denham's Bustard in South Africa (Ralston-Paton et al., 2017). It should be noted that Great Bustard elsewhere in Europe can be displaced by 0.6km [Wurm & Kollar (2000), as quoated by Raab et al. (2009)] to 1km (Langgemach, 2008) of an operational wind farm, although Denham's Bustards populations do not appear to be displaced by wind farms in South Africa (Ralston-Paton et al., 2017). It should be noted that for raptors and large terrestrial species, site-fidelity and species longevity may mask short- and medium-term impacts that wind farms may have on these species, and that the true impact severity may only manifest in the long-term – such as through diminishing recruitment of new individuals over the course of multiple generations (Ferrer et al., 2012; Santos et al., 2020).

The limited research into shorter-lived bird species around wind farms may offer insights into the long-term response of birds more generally. Leddy et al., (1999) reported increased densities of breeding grassland passerines with increased distance (>80m) from wind turbines, and review study by (Hötker et al. (2006) found that the minimum avoidance distances of eleven breeding passerines species ranged 14–93m of wind turbines. However, Hale et al. (2014) and Stevens et al. (2013) found limited evidence for permanent displacement of grassland passerines in North America. Passerine resilience to wind farms is further observed in the UK in species such Skylark (despite some evidence of turbine avoidance) (Pearce-Higgins et al., 2012), and Thekla Lark populations in Southern Spain (Farfán et al., 2009). Across nine wind farms in Scotland, seven out of twelve birds species across a range of taxa exhibited significantly lower frequencies of occurrence close to the turbines, after accounting for habitat variation, with demonstrable turbine avoidance behaviour in a further two species (Pearce-Higgins et al., 2009). No species preferentially occurred close to the turbines, and breeding pair densities decreased 15-53% within 500m of wind turbines for several species. Follow-up monitoring reported breeding densities of certain species (such as Red Grouse) recovered post-construction, whereas others (such as Snipe and Curlew) did not. Conversely, breeding densities of certain species (such as Skylark and Stonechat) increased on wind farms during construction.

Species response to wind farm construction and operation appears highly idiosyncratic, and although the local populations of many bird species may recover, the long-term impacts of wind farms on bird populations remains to be better elucidated.

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, Blue Crane, Double-banded Courser, Grey-winged Francolin Southern Black Korhaan, and Spotted Eagle-Owl. Extensive searches for breeding Black Harriers were conducted, but none were found. Avifaunal specialists working on a neighbouring property to the west of the proposed Ezelsjacht site were also consulted on potential Black Harrier nests, but they confirmed the absence of any nests.

Some raptors might also be affected, such as Black-winged Kite and Pale Chanting Goshawk which could potentially breed in the small trees along the ephemeral drainage lines.

Some species might be able to recolonise the area after the completion of the construction phase, although it cannot be assumed that population densities will recover to pre-construction levels, 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:

Species Name	Global Status	Regional Status	Occurrence Likelihood
African Fish Eagle	Least Concern	Least Concern	Medium
African Harrier-Hawk	Least Concern	Least Concern	Medium
Agulhas Long-Billed Lark	Least Concern	Near Threatened	Low
Black Harrier	Endangered	Endangered	High
Black Sparrowhawk	Least Concern	Least Concern	Low
Black Stork	Least Concern	Vulnerable	Medium
Black-Chested Snake Eagle	Least Concern	Least Concern	Medium
Black-Winged Kite	Least Concern	Least Concern	Medium
Blue Crane	Vulnerable	Near Threatened	High
Booted Eagle	Least Concern	Least Concern	High
Double-Banded Courser	Least Concern	Least Concern	Medium
Greater Kestrel	Least Concern	Least Concern	Low
Grey-Winged Francolin	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	High
Lanner Falcon	Least Concern	Vulnerable	Medium
Martial Eagle	Endangered	Endangered	Medium
Pale Chanting Goshawk	Least Concern	Least Concern	High
Rufous-Breasted Sparrowhawk	Least Concern	Least Concern	Medium
Secretarybird	Endangered	Vulnerable	Medium
Southern Black Korhaan	Vulnerable	Vulnerable	High
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Verreaux's Eagle	Least Concern	Vulnerable	High

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 development site [Fox et al. (2006) as cited by Drewitt & Langston (2006)], with a further 3-14% of airspace altered by turbines (Marques et al., 2020) (see Section 8.2). The effects of habitat loss 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 transformation following the development of the Altamont Pass Wind Farm in California led to increased mammal prey availability for some species of raptor, such as higher abundance of Pocket Gophers *Thomomys bottae* burrows around turbine bases), although this may also have increased collision risk ([Thelander et al., (2003) as cited by Drewitt & Langston (2006)].

Despite overall habitat loss resulting from wind farm development may be limited, the associated infrastructure such as roads and powerlines fragment previously continuous tracts of habitat. Beyond the increased mortality risks to local bird populations posed by such infrastructure, the resulting habitat fragmentation can degrade adjacent habitats, potentially changing the way birds interact with the immediate (Fletcher et al., 2018). It remains disputed whether habitat fragmentation is always an environmental detriment (Fahrig et al., 2019), yet the effects of this landscape change have been observed in bird species vulnerable to wind farms. Lane et al. (2001) noted that Great Bustard flocks in Spain were significantly larger further from power lines than at control points. Shaw (2013) found that Ludwig's Bustard in South Africa generally avoid the immediate proximity of roads within a 500m buffer. Bidwell (2004) found that Blue Cranes in South Africa select nesting sites away from roads.

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 physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab et al., 2011). 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 (Allan et al., 1997).

These above considerations are especially relevant for the Fynbos Biome within which the PAOI is situated. The Fynbos Biome supports a high diversity of highly endemic taxa, including birds, yet retains only 67% of its 1750 extent (Skowno et al., 2021), of which extant lowland tracts are degraded. Fortunately, the floral ecotypes the PAOI are all classified as Least Concern (SANBI, 2018), likely owing to the rugged terrain impeding landscape transformation.

It is not anticipated that the above listed priority species will be adversely affected by minimal habitat loss habitat loss anticipated the PAOI. It should be noted, however, that Black Harrier and Southern Black Korhaan (and Agulhas Long-billed Lark which is less likely to occur in the PAOI) are largely endemic/breeding endemics to the Fynbos Biome, although can tolerate degradation of natural habitat (Taylor et al., 2015), and Agulhas Long-billed Lark has benefitted from the transformation of its natural habitat to agricultural fields (Evans, 2021).

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 terrestrial species such as Blue Crane, Double-banded Courser, Grey-winged Francolin, Southern Black Korhaan. Additionally, raptors are also vulnerable to habitat transformation/fragmentation, due in part to loss of breeding/roosting habitats, as well as reduced ecological carrying capacity of preferred prey items. 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 by habitat transformation within the PAOI. The building infrastructure and substation location are likely to be all situated in essentially the same habitat, namely Renosterveld low fynbos shrubland, and should have a small footprint size. The habitat is ubiquitous in the PAOI, 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:

Species Name	Global Status	Regional Status	Occurrence Likelihood
African Fish Eagle	Least Concern	Least Concern	Medium
African Harrier-Hawk	Least Concern	Least Concern	Medium
Agulhas Long-Billed Lark	Least Concern	Near Threatened	Low
Black Harrier	Endangered	Endangered	High
Black Sparrowhawk	Least Concern	Least Concern	Low
Black-Chested Snake Eagle	Least Concern	Least Concern	Medium
Black-Winged Kite	Least Concern	Least Concern	Medium
Blue Crane	Vulnerable	Near Threatened	High
Booted Eagle	Least Concern	Least Concern	High
Common Buzzard	Least Concern	Least Concern	Low
Double-Banded Courser	Least Concern	Least Concern	Medium
Greater Kestrel	Least Concern	Least Concern	Low
Grey-Winged Francolin	Least Concern	Least Concern	High
Jackal Buzzard	Least Concern	Least Concern	High
Lanner Falcon	Least Concern	Vulnerable	Medium
Martial Eagle	Endangered	Endangered	Medium
Pale Chanting Goshawk	Least Concern	Least Concern	High
Rufous-Breasted Sparrowhawk	Least Concern	Least Concern	Medium
Secretarybird	Endangered	Vulnerable	Medium
Southern Black Korhaan	Vulnerable	Vulnerable	High
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Verreaux's Eagle	Least Concern	Vu	High

6.1.4 <u>*Electrocution on the 33kV medium voltage network*</u>

Electrocution refers to instances where birds perch, or attempt to perch, upon electrical structure in a manner that physically bridges the air gap between live components and/or live and earthed components, causing a fatal electrical short circuit through the birds (Bevanger, 1994; van Rooyen, 2000). The electrocution risk is largely determined by the design of the electrical hardware, with medium voltage electricity poles posing a potential electrocution risk to raptors (Cole & Dahl, 2013; Haas et al., 2006; Loss et al., 2014).

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:

Species Name	Global Status	Regional Status	Occurrence Likelihood
African Fish Eagle	Least Concern	Least Concern	Medium
African Harrier-Hawk	Least Concern	Least Concern	Medium
Black Harrier	Endangered	Endangered	High
Black Sparrowhawk	Least Concern	Least Concern	Low
Black Stork	Least Concern	Vulnerable	Medium
Black-Chested Snake Eagle	Least Concern	Least Concern	Medium
Black-Winged Kite	Least Concern	Least Concern	Medium
Booted Eagle	Least Concern	Least Concern	High
Common Buzzard	Least Concern	Least Concern	Low
Greater Kestrel	Least Concern	Least Concern	Low
Jackal Buzzard	Least Concern	Least Concern	High
Lanner Falcon	Least Concern	Vulnerable	Medium
Martial Eagle	Endangered	Endangered	Medium
Pale Chanting Goshawk	Least Concern	Least Concern	High
Rufous-Breasted Sparrowhawk	Least Concern	Least Concern	Medium
Secretarybird	Endangered	Vulnerable	Medium
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Verreaux's Eagle	Least Concern	Vulnerable	High

6.1.5 Collisions with the 33kV medium voltage network

Transmission line collisions arguably pose the greatest threat to birds in southern Africa (van Rooyen, 2004), including in the Overberg near the PAOI (Shaw et al., 2010). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures (Shaw et al., 2010; van Rooyen, 2004). These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (van Rooyen, 2004).

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[4]:

Species Name	Global Status	Regional Status	Occurrence Likelihood
Black Stork	Least Concern	Vulnerable	Medium
Blue Crane	Vulnerable	Near Threatened	High
Greater Flamingo	Least Concern	Near Threatened	Low
Secretarybird	Endangered	Vulnerable	Medium
Southern Black Korhaan	Vulnerable	Vulnerable	High
Spotted Eagle-Owl	Least Concern	Least Concern	Medium
Verreaux's Eagle	Least Concern	Vulnerable	High

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

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

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

Please Note: this is a preliminary scoping phase assessment and may be revised based on the final conclusions made at end the 12 months pre-construction monitoring.

The impact criteria are explained in Appendix 7.

6.2.1 Construction Phase

- Displacement of priority species due to disturbance associated with the construction of the wind turbines and associated infrastructure (see **Table 8**).
- Displacement of priority species due to habitat transformation associated with the construction of the wind turbines and associated infrastructure (see **Table 9**).

Table 8: Impact assessment and recommended mitigations for the displacement of priority species due to disturbance associated with the construction phase

Issue	Displacement due to disturbance associated with the construction of the wind turbines and associated infrastructure	
Description of Impact		
Disturbances, dust unsettling, and noise pollution during the construction phase may displace priority bird species, resulting in temporary/long-term local population reductions of these species (see Section 6.1.2.)		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short-term	Very short-term
Extent	Local	Site
Consequence	Medium	Very low
Probability	Probable	Probable
Significance	Medium -	Low -
Degree to which impact can be reversed	There is a potential of reversibility for this impact, especially if the recommended mitigation measures are followed.	
Degree to which impact may cause irreplaceable loss of resources	Species of conservation concern may be displaced from breeding/roosting/foraging habitats; it is possible that such local population reductions may not recover for the foreseeable future.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
Mitigation actions		

The following measures are recommended:	(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. (3) Construction-related activity should be limited as far as possible within the buffer zones surrounding the observed nests for Martial Eagle, Verreaux's Eagle, and Booted Eagle/Jackal Buzzard.	
Monitoring		
The following monitoring is recommended:	Operational phase monitoring should be implemented according to the Wind Guidelines for a minimum of two years, and then every fifth year after that for the lifetime of the facility.	
Cumulative impacts		
Nature of cumulative impacts	Repeated successive displacement of priority birds through construction-related disturbance within a 30km radius of the Project Site (see Error! Reference source not found.) may cause regional-scale population reductions in these species. Mitigation measures should reduce the severity of disturbance, and allow priority species to largely remain within the regional area.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 9: Impact assessment and recommended mitigations for the displacement of priority species due to habitat transformation associated with the construction of the wind turbines and associated infrastructure.

Issue	Displacement of priority species due to habitat transformation associated with the construction of the wind turbines and associated infrastructure.	
Description of Impact		
Construction of the WEF and associated infrastructure could result in the loss, fragmentation, and degradation of habitats used by priority species for foraging, roosting, and/or breeding.		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Very low
Duration	Short-term	Short-term
Extent	Local	Site
Consequence	Low	Very low
Probability	Probable	Probable
Significance	Low -	Very low -
Degree to which impact can be reversed	The impact can be reversed by following the mitigation measure below, and through rehabilitation of lost habitat.	

Degree to which impact may cause irreplaceable loss of resources	Species of conservation concern may be displaced from breeding/roosting/foraging habitats; it is possible that such local population reductions may not recover for the foreseeable future.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
Mitigation actions		
The following measures are recommended:	(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.	
Monitoring		
The following monitoring is recommended:	Operational phase monitoring should be implemented according to the Wind Guidelines for a minimum of two years, and then every fifth year after that for the lifetime of the facility.	
Cumulative impacts		
Nature of cumulative impacts	The repeated transformation and fragmentation of habitats utilised by priority species due to related developments within a 30km radius of the Project Site (see Error! Reference source not found.) will reduce the ecological carrying capacity of regional natural habitats resulting in population reductions of priority species. However, the extent of habitat transformation from related regional development is relatively restricted, and so the cumulative impacts are not anticipated to result in substantial habitat loss, especially when following the recommended mitigations.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Low -	Very Low -

6.2.2 Operational Phase

- Priority species mortality due to collisions with the wind turbines (see **Table 10**).
- Priority species mortality due to electrocutions on the overhead sections of the internal 33kV cables (see **Table 11**).
- Priority species mortality due to collisions with the overhead sections of the internal 33kV cables (see **Table 12**).

Table 10: Impact assessment and recommended mitigations for the priority species mortality due to collisions with the wind turbines.

Issue	Priority bird species mortality due to collisions with the wind turbines.	
Description of Impact		
Bird collisions with wind turbines pose mortality risks for bird species, especially wind priority species.		

Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Medium
Duration	Long-term	Long-term
Extent	National	National
Consequence	High	High
Probability	Probable	Possible
Significance	High -	Medium -
Degree to which impact can be reversed	The reversibility of this impact is highly species dependent. For many priority bird species, population sizes and range extents can recover on their own. However, for Red List species within the PAOI, especially Endangered species, reversing this impact would require proactive conservation efforts to recover population sizes, and compensation for local/regional population displacements.	
Degree to which impact may cause irreplaceable loss of resources	Turbine collision-related mortalities can result in the significant population reduction and displacement of wind priority species, including several Red Data list species. Given the multiple priority species are highly mobile/migratory, the mortalities due to the Ezelsjacht WEF can impact ecosystems at a national and potentially international scape. Locally/regionally, turbine-related mortalities can result in the loss of Martial Eagle (Endangered) Verreaux's Eagle (Vulnerable), and Booted Eagle (Least Concern)/Jackal Buzzard (Least Concern) from documented nest sites in/around the PAOI.	
Degree to which impact can be mitigated	It is unlikely that turbine collision related avifaunal mortalities can be avoided, and the mitigation recommendations herein can only partially ameliorate the severity of this impact risk.	
Mitigation actions		
The following measures are recommended:	(1) No turbines should be located in the turbine exclusion zone buffers around confirmed nests for Martial Eagle, Verreaux's Eagle, and Booted Eagle/Jackal Buzzard within the PAOI. No turbines should likewise be constructed in turbine exclusion zones where high Black Harrier flight activity was recorded. (2) No turbines should be in the turbine exclusion zones associated with surface water and water points. Turbine construction should also be excluded within the buffers associated with ephemeral/non-perennial streams and wetlands as indicated by the aquatic specialist. (3) Construction of turbines should be limited as far as possible within 3.7-5.2km medium risk sensitivity zone buffers around confirmed	

	Verreaux's Eagle nests within the PAOI. If turbines are to be constructed in these medium risk sensitivity areas, proactive mitigation following approved procedures are required (e.g., shutdown on command – SDoD). (4) Based on the recorded flight activity of several SCC at the project site, including Verreaux's Eagle, Black Harrier and Martial Eagle, during the of pre-construction monitoring, all the areas within the project site that fall outside the designated buffer zones should be classified as medium risk. SDoD is therefore recommended for all areas outside designated buffer zones. (5) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Windfarm Guidelines at the time to assess collision rates. (6) 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.	
Monitoring		
The following monitoring is recommended:	Operational phase monitoring should be implemented according to the Wind Guidelines for a minimum of two years, and then every fifth year after that for the lifetime of the facility.	
Cumulative impacts		
Nature of cumulative impacts	There are no other WEF developments officially declared within a 30km of the Ezelsjacht WEF, and so turbine collision risks are currently localised to this development (see Error! Reference source not found.). Solar energy facility developments and electrical grid infrastructure within the 30km radius may contributed to, and exacerbate the priority species mortalities at the Ezelsjacht WEF. The Ezelsjacht WEF may be the most prominent mortality risk to priority bird species among related developments within a 30km radius.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	High -	Medium -

Table 11: Impact assessment and recommended mitigations for the priority species mortality due to electrocutions on the overhead sections of the internal 33kV cables

Issue	Priority bird species mortality due to electrocutions on the overhead sections of the internal 33kV cables.	
Description of Impact		
Bird electrocutions with overhead sections of internal 33kV lines pose mortality risks for priority bird species.		
Type of Impact	Direct	

Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Very low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	High	Low
Probability	Probable	Conceivable
Significance	High -	Very low -
Degree to which impact can be reversed	The reversibility of this impact is highly species dependent. For many priority bird species, population sizes and range extents can recover on their own. However, for Red List species within the PAOI, especially Endangered species, reversing this impact would require proactive conservation efforts to recover population sizes, and compensation for local/regional population displacements. The species most vulnerable to electrocution within the PAOI are the larger raptors, such as the Red List species Martial Eagle and Verreaux's Eagle.	
Degree to which impact may cause irreplaceable loss of resources	Electrocution-related mortalities can cause priority bird species population reduction, although to a lesser degree than collision-related moralities with wind turbines and reticulation lines. Mortalities of Red List species present within the PAOI, especially Endangered species, can exacerbate national and international conservations for these bird species.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per recommended mitigation measures below.	
Mitigation actions		
The following measures are recommended:	(1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Windfarm Guidelines.	
Monitoring		
The following monitoring is recommended:	Operational phase monitoring should be implemented according to the Wind Guidelines for a minimum of two years, and then every fifth year after that for the lifetime of the facility.	

Cumulative impacts		
Nature of cumulative impacts	There is approximately 350km of overhead high voltage powerlines within the 30km radius of the Ezelsjacht WEF (not shown in Error! Reference source not found.), and so the lengthwise contribution of overhead powerlines by the project is comparatively minor. However, the heightened density of overhead powerlines within this 30km radius zone poses an increasing risk for priority avifauna, although this the risk of electrocution-related mortality is moderately low, especially if appropriate mitigation measures are employed.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

Table 12: Impact assessment and recommended mitigations for the priority species mortality due to collisions with the overhead sections of the internal 33kV cables

Issue	Priority species mortality due to collisions with the overhead sections of the internal 33kV cables.	
Description of Impact		
Bird collisions with overhead sections of internal 33kV reticulation lines pose mortality risks for priority bird species.		
Type of Impact	Direct	
Nature of Impact	Negative	
Phases	Operation	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	High	Very low
Duration	Long-term	Long-term
Extent	Local	Local
Consequence	Medium	Low
Probability	Probable	Conceivable
Significance	Medium -	Low -
Degree to which impact can be reversed	The reversibility of this impact is highly species dependent. For many priority bird species, population sizes and range extents can recover on their own. However, for Red List species within the PAOI, especially Endangered species, reversing this impact would require proactive conservation efforts to recover population sizes, and compensation for local/regional population displacements. The species most at sensitive to this risk are larger terrestrial Red List species such as Southern Black Korhaan, as well as Red List waterbirds when the dams are full, and the drainage lines contain water, such as Black Stork and Blue Crane.	
Degree to which impact may cause irreplaceable loss of resources	Collision-related mortalities from overhead powerlines can cause priority bird species population reduction.	

	Mortalities of Red List species present within the PAOI, especially Endangered species, can exacerbate national and international conservations for these bird species.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per recommended mitigation measures below.	
Mitigation actions		
The following measures are recommended:	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.	
Monitoring		
The following monitoring is recommended:	Operational phase monitoring should be implemented according to the Wind Guidelines for a minimum of two years, and then every fifth year after that for the lifetime of the facility.	
Cumulative impacts		
Nature of cumulative impacts	There is approximately 350km of overhead high voltage powerlines within the 30km radius of the Ezelsjacht WEF (not shown in Error! Reference source not found.), and so the lengthwise contribution of overhead powerlines by the project is comparatively minor. However, the heightened density of overhead powerlines within this 30km radius zone increases the powerline collision-morality risk for priority avifauna, although this risk can be ameliorated following the recommended mitigation measures.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

6.2.3 *Decommissioning Phase*

- Displacement due to disturbance associated with the decommissioning (dismantling) of the wind turbines and associated infrastructure (see **Table 13**).

Table 13: Impact assessment and recommended mitigations for the displacement of priority species due to disturbance associated with the decommissioning (dismantling) of the wind turbines and associated infrastructure

Issue	Displacement due to disturbance associated with the decommissioning (dismantling) of the wind turbines and associated infrastructure.	
Description of Impact		
Disturbances, dust unsettling, and noise pollution during the construction phase may displace priority bird species, resulting in temporary/long-term local population reductions of these species (see Section 6.1.2.)		
Type of Impact	Indirect	
Nature of Impact	Negative	
Phases	Construction	
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low

Duration	Short-term	Very short-term
Extent	Local	Site
Consequence	Medium	Very low
Probability	Probable	Probable
Significance	Medium -	Low -
Degree to which impact can be reversed	There is a potential of reversibility for this impact, especially if the recommended mitigation measures are followed.	
Degree to which impact may cause irreplaceable loss of resources	Species of conservation concern may be displaced from breeding/roosting/foraging habitats; it is possible that such local population reductions may not recover for the foreseeable future.	
Degree to which impact can be mitigated	There is significant scope for mitigation as per the recommended mitigation measures below.	
Mitigation actions		
The following measures are recommended:	(1) Dismantling activity should be restricted to the immediate footprint of the infrastructure as far as possible. (2) Access to the remainder of the area should be strictly controlled to prevent unnecessary disturbance of priority species. 3) Measures to control noise and dust should be applied according to current best practice in the industry.	
Monitoring		
The following monitoring is recommended:	Operational phase monitoring should be implemented according to the Wind Guidelines for a minimum of two years, and then every fifth year after that for the lifetime of the facility.	
Cumulative impacts		
Nature of cumulative impacts	Repeated successive displacement of priority birds through infrastructural decommission-related disturbance within a 30km radius of the Project Site may cause regional-scale population reductions in these species. Mitigation measures should reduce the severity of disturbance, and allow priority species to largely remain within the regional area.	
Rating of cumulative impacts	**Without Mitigation**	**With Mitigation**
	Medium -	Low -

6.3 The identification of environmental sensitivities: Wind Energy facility

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

6.2.4 <u>High sensitivity turbine exclusion zones: Martial Eagle (5.0km), Verreaux's Eagle (3.7km), and Booted Eagle/Jackal Buzzard (750m) nest buffers, and Black Harrier flight activity zones</u>

Breeding Verreaux's Eagles largely forage within 3.7km of their nest (Brink, 2020), with turbine collision risk potential falling substantially further away from the nest, becoming a negligible concern after 8km (Murgatroyd et al., 2021). Breeding Martial Eagle forage generally forage within 5.39 km of their nests (Brink, 2020).No turbines should be constructed within 5km of the Martial Eagle nests, 3.7km of the Verreaux's Eagle nests, and 750m of the Booted Eagle/Jackal Buzzard nest observed within the PAOI. No turbines should likewise be constructed in turbine exclusion zones where high Black Harrier flight activity was recorded during the pre-construction monitoring. This is in following recommendations outlined in the VE Guidelines, Windfarm Guidelines and Black Harrier Guidelines (see Section 4.3).

6.2.5 <u>High sensitivity zones: 100m buffers around surface water (artificial dams and waterpoints),and 25m buffers around ephemeral drainage lines and wetlands</u>

An exclusion zone precluding wind turbine development should be implemented within a 100m buffer around permanent surface water sites (artificial dams, boreholes, and reservoirs), as well as within a 25m buffer around drainage lines and wetlands (as per aquatic specialist recommendations). The blade swept area of the turbine rotors should be placed beyond these buffer zones. Surface water in this arid habitat is crucially important for priority avifauna, including several Red List species such as Black Harrier, Black Stork, Blue Crane, Lanner Falcon, Martial Eagle, Secretarybird, and Verreaux's Eagle. Wind turbines that are placed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing. A turbine exclusion buffer zone as indicated by the aquatic specialist around non-perennial drainage lines and wetlands should be demarcated as high sensitivity risk zones from where turbines should be excluded. When flowing, drainage lines are conduits for heightened bird flight paths, attraction points for bathing and drinking. Wind turbines that are placed near drainage lines and wetlands therefore pose a collision risk to priority bird species.

6.2.6 <u>Medium sensitivity limited infrastructure/proactive mitigation zones: Verreaux's Eagle nest secondary buffer (3.7-5.2km).</u>

The latest VE guidelines recommend that, if 3.7km-radius circular buffers are selected over VERA, an addition buffer between 3.7-5.2km of the nest sites should be demarcated as medium sensitivity risk zones from where turbines should be relocated if possible. Should relocation not be feasible, these turbines should be subject to pro-active mitigation in the form of a proven mitigation method such as Shutdown on Demand (SDoD), using either biomonitors or an automated system such as IdentiFlight (Ralston-Paton and Murgatroyd, 2021).

6.2.7 <u>Areas outside designated buffer zones</u>

Based on the recorded flight activity of several SCC at the project site, including Verreaux's Eagle, Black Harrier and Martial Eagle, during the of pre-construction monitoring, all the areas within the project site that fall outside the designated buffer zones should be classified as medium risk. SDoD is therefore recommended for all areas outside designated buffer zones.

See Error! Reference source not found. for a map indicating the avifaunal sensitivities within the PAOI.

7. COMPARATIVE ASSESSMENT OF ALTERNATIVES

7.1 Wind Energy Facility

The final layout has yet to be determined. The Ezelsjacht WEF project site is approximately approximately 5 544 hectares in extent. Design and layout alternatives will be considered and assessed as part of the EIA. These will include alternatives for the substation locations and for the construction / laydown area.

7.2 No-Go Alternatives

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 Ezelsjacht WEF 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.

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 Blue Crane, Double-banded Courser, Grey-winged Francolin Southern Black Korhaan, and Spotted Eagle-Owl. Extensive searches for breeding Black Harriers (another ground-nesting species) were conducted, but none were found. Avifaunal specialists working on a neighbouring property to the west of the proposed Ezelsjacht site were also consulted on potential Black Harrier nests, but they confirmed the absence of any nests.

Some raptors might also be affected, such as Black-winged Kite and Pale Chanting Goshawk which could potentially breed in the small trees along the ephemeral drainage lines. Some species might be able to recolonise the area after the completion of the construction phase, although it cannot be assumed that population densities will recover to pre-construction levels, due to the disturbance factor of the operational turbines. The pre-mitigation impact is rated as **medium** but can 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 influence the density of several species, particularly terrestrial species such as Blue Crane, Double-banded Courser, Grey-winged Francolin, Southern Black Korhaan. Additionally, raptors are also vulnerable to habitat transformation/fragmentation, due in part to loss of breeding/roosting habitats, as well as reduced ecological carrying capacity of preferred prey items. 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 by habitat transformation within the PAOI. The building infrastructure and substation location are likely to be all situated in essentially the same habitat, namely Renosterveld low fynbos shrubland, and should have a small footprint size. The habitat classified as Least Concern and 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. The pre-mitigation impact is rated as **low**, and can be further reduced to **very low** levels.

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

The proposed Ezelsjacht WEF will pose a significant collision risk to several priority species which could occur regularly at the site. Priority species exposed to this risk are large terrestrial species which are likely to regularly occur within the POAI, namely Black Stork, Blue Crane, Southern Black Korhaan, and to a lesser extent Grey-winged Francolin. Several soaring species are also likely to regularly occur within the PAOI, namely Black Harrier, Black-chested Snake Eagle, Black-winged Kite, Booted Eagle, Jackal Buzzard, Lanner Falcon, Martial Eagle, Pale Chanting Goshawk, Rufous-breasted Sparrowhawk, Secretarybird, and Verreaux's Eagle. Other soaring species such as Black Sparrowhawk, Common Buzzard , and Greater Kestrel are less common. The mountainous topography affords numerous slope-soaring and slope-kiting opportunities which will increase the vulnerability of these species to wind turbines. The pre-mitigation impact is rated as **high**, and can be reduced to **medium** levels.

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 **high** pre-mitigation and **very 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

Southern Black Korhaan, and various waterbirds when the dams are full, and the drainage lines contain water, such as Black Stork and 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 14 summarises the expected impacts of the proposed WEF and proposed mitigation measures per impact.

Table 14: 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. (3) Construction-related activity should be limited as far as possible within the buffer zones surrounding the observed nests for Martial Eagle, Verreaux's Eagle, and Booted Eagle/Jackal Buzzard. No construction activity should take place within 1km of Verreaux's Eagles nests and 2.5km of Martial Eagle nests.	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.	Very low -

Nature of impact and phase	Overall impact significance (pre - mitigation)	Proposed mitigation	Overall impact significance (post - mitigation)
		(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.	
Operational: Collisions with the turbines	High -	(1) No turbines should be located in the turbine exclusion zone buffers around confirmed nests for Martial Eagle, Verreaux's Eagle, and Booted Eagle/Jackal Buzzard within the PAOI. No turbines should likewise be constructed in turbine exclusion zones where high Black Harrier flight activity was recorded. (2) No turbines should be in the turbine exclusion zones associated with surface water and water points. Turbine construction should also be excluded within the buffers associated with ephemeral/non-perennial streams and wetlands as indicated by the aquatic specialist. (3) Construction of turbines should be limited as far as possible within 3.7-5.2km medium risk sensitivity zone buffers around confirmed Verreaux's Eagle nests within the PAOI. If turbines are to be constructed in these medium risk sensitivity areas, proactive mitigation following approved procedures are required (e.g., shutdown on command – SDoD). (4) Based on the recorded flight activity of several SCC at the project site, including Verreaux's Eagle, Black Harrier and Martial Eagle,	Medium -

Nature of impact and phase	Overall impact significance (pre - mitigation)	Proposed mitigation	Overall impact significance (post - mitigation)
		during the of pre-construction monitoring, all the areas within the project site that fall outside the designated buffer zones should be classified as medium risk. SDoD is therefore recommended for all areas outside designated buffer zones. (5) Live-bird monitoring and carcass searches should be implemented in the operational phase, as per the most recent edition of the Windfarm Guidelines at the time to assess collision rates.	
Operational: Electrocutions on the 33kV MV network	High -	(1) Underground cabling should be used as much as is practically possible. (2) If the use of overhead lines is unavoidable due to technical reasons, the Avifaunal Specialist must be consulted timeously to ensure that a raptor friendly pole design is used, and that appropriate mitigation is implemented pro-actively for complicated pole structures e.g., insulation of live components to prevent electrocutions on terminal structures and pole transformers. (3) Regular inspections of the overhead sections of the internal reticulation network must be conducted during the operational phase to look for carcasses, as per the most recent edition of the Windfarm Guidelines.	Very low -
Operational: Collisions with the 33kV MV network	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.	Low -

Nature of impact and phase	Overall impact significance (pre - mitigation)	Proposed mitigation	Overall impact significance (post - mitigation)
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 Ezelsjacht WEF will have a **low to high** impact on priority avifauna which could be reduced to a **very low to medium** impact through appropriate mitigation. No fatal flaws are expected to be discovered during the onsite investigations. The development is therefore supported, provided the mitigation measures listed in this report are strictly implemented.

9. FINAL LAYOUT

The final layout is yet to be determined. The Ezelsjacht WEF project site is approximately 3 594 hectares in extent. Design and layout alternatives will be considered and assessed as part of the EIA. These will include alternatives for the substation locations and for the construction/laydown area. Error! Reference source not found.**9** shows the layout out high and medium avifaunal sensitivities within the PAOI.

Figure 8: Proposed avifaunal buffer zones

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APPENDIX 1: TERMS OF REFERENCE

Site Sensitivity Verification and Reporting

The Specialists are required to compile four (4) separate Specialist Impact Assessment Reports / Compliance Statements (including Site Sensitivity Verification Reports - SSVRs), as required (depending on sensitivities identified and level of assessment required considering the findings of DFFE’s online screening tool report1). Appendix 1 Table 1 shows a summary of the number of specialist reports required for the proposed project, as well as the requisite processes (Scoping & EIA or BA) being undertaken for the proposed project.

Appendix 1 Table 1: NEMA processes for proposed Ezelsjacht Renewable Energy Facilities

Specialist Report	Project	Process
140 MW Wind Energy Facility (WEF)	Ezelsjacht Renewable Energy Facilities	Scoping and EIA Process
100 MW Solar PV Energy Facility (SEF)		Scoping and EIA Process
EGI for WEF		BA Process
EGI for SEF		BA Process

Site Sensitivity Verification Report (SSVR)

SSVRs are mandatory for all specialists, according to GN. 320 of March 2020. This will be appended to the specialist’s Impact Assessment Report or factored into the Compliance Statement (depending on level of assessment required).

In summary, the key content is as follows:

1. If relevant, a table cross referencing how the requirements for specialist reports have been adhered to according to Appendix 6 of the EIA Regs, 2014 (as amended).
2. Executive summary
3. Project description
4. Relevant legislation and guidelines including the requirement for any permits
5. Methodology including details of field work, consultations, gaps and uncertainties
6. Baseline environment
7. Sensitivity mapping (overlain with the layout/s)
8. Impact assessment, including the no-go assessment
9. Mitigation and EMPr requirements
10. Cumulative impact assessment
11. Conclusion / impact statement on the acceptability of the project/s

<u>Executive Summary</u>

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

<u>Project Description</u>

The project descriptions for each of the projects are set out in the Assessment Report template which has been compiled so as to explicitly depict the differences between the respective projects. This same project description can then be used for the SSV Reports and Compliance Reports although not repeated in these templates.

Relevant legislation and guidelines including the requirement for any permits

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

Methodology including details of field work, consultations, gaps and uncertainties

The impacts of the proposed project (during the Construction, Operation and Decommissioning phases) are to be assessed and rated according to the methodology described below, which was developed by SLR to align with the requirements of the EIA Regulations, 2014 (as amended). Specialists will be required to make use of the impact rating matrix provided by SLR (in Excel format) for this purpose.

Baseline environment

The specialist report must include a description of the baseline environment, including baseline environmental sensitivity.

Sensitivity mapping

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.

Impact assessment, including the no-go assessments

The impacts (both direct and indirect) of the proposed WEF, SEF, 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 SLR. 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 SLR.

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

Consideration must be given to the 'no-go' option in the respective Scoping & EIA and BA processes. The 'no-go' option assumes that the respective project sites remain in their current state, i.e., there is no construction of the WEF, solar PV energy facility (including associated infrastructure) and supporting grid infrastructure in the proposed project area and the status quo would proceed.
The findings of the respective specialist studies will be used to further inform the location of the wind turbines and solar PV array. All identified sensitive and/or no-go areas (including their respective buffers) will be avoided accordingly, as required. The site areas / location alternatives for the associated infrastructure such as the O&M Buildings, IPP Substations and BESS, as well as the respective powerline corridor alternatives, will also need to be assessed against the 'no go' alternative. The 'no-go' alternative is the option of not constructing the respective projects, where the status quo of the current status and/or activities on the site would prevail.

Mitigation and EMPr requirements

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.

Cumulative Impact Assessment

A cumulative impact assessment must be undertaken for each respective proposed project (namely the WEF, solar PV energy facility and supporting grid infrastructure projects), to determine the cumulative impact that will materialise should the other Renewable Energy Facilities (REFs) mentioned above, with their associated powerlines and substations (i.e., grid infrastructure), and large-scale industrial developments be constructed within a 30 km radius of the proposed Ezelsjacht Renewable Energy Facilities project site.

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.

Conclusion / impact statement on the acceptability of the project/s

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).

Compliance Statements

Where a compliance statement is required, it needs to be undertaken/compiled according to GN. 320 of March 2020, where applicable; and an impact assessment is mandatory and needs to be undertaken in accordance with GN. 320 of March 2020 and Appendix 6 of GN. R982 (as amended) of NEMA. As mentioned above, SSVRs are mandatory for all specialists and thus this needs to be included in the impact assessment.

As specified in the respective protocols, in summary the compliance statement must:

1. be applicable to the preferred site and proposed development footprint
2. confirm the sensitivity of the site for your discipline; and
3. indicate whether the proposed development will have any impact/unacceptable impact on the
4. resource.
5. The compliance statement must contain, as a minimum, the following information:
    - the contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.
    - a signed statement of independence by the specialist
    - baseline profile or sensitivity mapping as required by the applicable protocol.
    - methodology including details of site inspection, any modelling or calculations required by the protocol, or any associated design recommendations that have applied to reduce impacts.
    - a substantiated statement from the specialist on the acceptability, or not, of the proposed development and a recommendation on the approval, or not, of the proposed development.
    - any conditions to which this statement is subjected.
    - in the case of a linear activity, confirmation from the specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase.
    - where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr.
    - a description of the assumptions made and any uncertainties or gaps in knowledge or data.

APPENDIX 2: SPECIALIST EXPERTISE

Curriculum vitae: Chris van Rooyen

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

Key Experience

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

Key Project Experience

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

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12-month preconstruction avifaunal monitoring project
23. De Aar – North (Mulilo) Wind Energy Project – 12-month preconstruction avifaunal monitoring project
24. De Aar – South (Mulilo) Wind Energy Project – 12-month bird monitoring

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

Bird Impact Assessment Studies for Solar Energy Plants:

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

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV
14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV

34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV

93. Tabor Louis Trichardt 132kV
94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
118. Matla-Glockner 400kV
119. Delmas North 44kV
120. Houwhoek 11kV Refurbishment
121. Clau-Clau 132kV
122. Ngwedi-Silwerkrans 134kV
123. Nieuwehoop 400kV walk-through
124. Booysendal 132kV Switching Station
125. Tarlton 132kV
126. Medupi - Witkop 400kV walk-through
127. Germiston Industries Substation
128. Sekgame 132kV
129. Botswana – South Africa 400kV Transfrontier Interconnector
130. Syferkuil – Rampheri 132kV
131. Queens Substation and associated 132kV powerlines
132. Oranjemond 400kV Transmission line
133. Aries – Helios – Juno walk-down
134. Kuruman Phase 1 and 2 Wind Energy facilities 132kV Grid connection
135. Transnet Thaba 132kV

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

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Somerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra –“Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.

10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works, Gauteng.
11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng
25. Proposed open cast iron ore mine on the farm Lylyveld 545, Northern Cape
26. Avifaunal monitoring for the Sishen Mine in the Northern Cape as part of the EMPr requirements
27. Steelpoort CNC Bird Impact Assessment Study

Professional affiliations

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

Curriculum vitae: Jake Mulvaney

Profession/Specialisation	:	Postdoctoral researcher/Avifaunal Specialist
Highest Qualification	:	PhD (Zoology)
Nationality	:	South African
Years of experience	:	0.5 years

Key Qualifications

Jake Mulvaney is a postdoctoral researcher in ornithology at Stellenbosch University. He is author and/or co-author of four academic papers involving bird population assessments and GIS modelling and is a licensed South African bird ringer. From 2021, he assists Chris van Rooyen Consulting with environmental impact assessments of wind and solar energy facility developments.

Key project experience

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

1. Highlands Wind Energy Facility, Dordrecht, Eastern Cape
2. Duiker Wind Energy Facility, Vredendal, Western Cape
3. Taaibosch Wind Energy Complex, Postmasburg, Northern Cape
4. Lunsklip Wind Energy Facility, Still Bay, Western Cape
5. Mukondeleli Wind Energy Facility, Secunda, Mpumalanga

Bird impact assessment studies for solar energy plants:

1. Taaibosch Solar Energy Complex, Postmasburg, Northern Cape
2. Vhuvhili Solar Energy Facility, Secunda, Mpumalanga

Bird Impact Assessment Studies for the following overhead line projects:

1. Hendrina North Grid Infrastructure, Hendrina, Mpumpalanga

Professional affiliations

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

Curriculum vitae: Albert Froneman

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

Key Qualifications

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

Key Project Experience

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

1. Jeffrey's Bay Wind Farm – 12-months preconstruction avifaunal monitoring project
2. Oysterbay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
3. Ubuntu Wind Energy Project near Jeffrey's Bay – 12-months preconstruction avifaunal monitoring project
4. Bana-ba-Pifu Wind Energy Project near Humansdorp – 12-months preconstruction avifaunal monitoring project
5. Excelsior Wind Energy Project near Caledon – 12-months preconstruction avifaunal monitoring project
6. Laingsburg Spitskopvlakte Wind Energy Project – 12-months preconstruction avifaunal monitoring project
7. Loeriesfontein Wind Energy Project Phase 1, 2 & 3 – 12-months preconstruction avifaunal monitoring project
8. Noupoort Wind Energy Project – 12-months preconstruction avifaunal monitoring project
9. Vleesbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
10. Port Nolloth Wind Energy Project – 12-months preconstruction avifaunal monitoring project
11. Langhoogte Caledon Wind Energy Project – 12-months preconstruction avifaunal monitoring project
12. Lunsklip – Stilbaai Wind Energy Project – 12-months preconstruction avifaunal monitoring project
13. Indwe Wind Energy Project – 12-months preconstruction avifaunal monitoring project
14. Zeeland St Helena bay Wind Energy Project – 12-months preconstruction avifaunal monitoring project
15. Wolseley Wind Energy Project – 12-months preconstruction avifaunal monitoring project
16. Renosterberg Wind Energy Project – 12-months preconstruction avifaunal monitoring project
17. De Aar – North (Mulilo) Wind Energy Project – 12-months preconstruction avifaunal monitoring project (2014)
18. De Aar – South (Mulilo) Wind Energy Project – 12-months bird monitoring

19. Namies – Aggenys Wind Energy Project – 12-months bird monitoring
20. Pofadder - Wind Energy Project – 12-months bird monitoring
21. Dwarsrug Loeriesfontein - Wind Energy Project – 12-months bird monitoring
22. Waaihoek – Utrecht Wind Energy Project – 12-months bird monitoring
23. Amathole – Butterworth Wind Energy Project – 12-months bird monitoring & EIA specialist study
24. De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
25. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
26. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
27. Aletta Wind Energy Facility 12-month bird monitoring (Biotherm)
28. Maralla Wind Energy Facility 12-month bird monitoring (Biotherm)
29. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
30. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
31. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
32. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
33. Kuruman Wind 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

APPENDIX 3: SPECIALIST STATEMENT OF INDEPENDENCE

To be inserted

APPENDIX 4: PRE-CONSTRUCTION MONITORING PROTOCOL

1 Objectives

The objective of the pre-construction monitoring at the proposed Ezelsjacht Wind Energy Facility (WEF) is to gather baseline data over a period of one year on the following aspects pertaining to avifauna:

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

2 Methods

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. The first five of six planned surveys of the pre-construction monitoring programme were conducted during the following periods:

- 01 July – 06 July 2021
- 29 September – 10 October 2021
- 04 January – 09 January 2022
- 04 March – 11 March 2022
- 01 May – 06 May 2022

Monitoring was conducted in the following manner:

- One (1) drive transect as identified totalling 12.7km on the development site and one drive transect in the control site, with a total length of 12.6km.
- One monitor travelling slowly (± 10km/h) in a vehicle records all birds on both sides of the transect. The observer stops at regular intervals (every 500m) to scan the environment with binoculars. Drive transects are counted three times per sampling session.
- In addition, five (5) walk transects of 1km each were identified. The transects are counted four (4) times per survey. All birds are recorded during walk transects. Two walk transects were also identified at the control site.
- The following variables were recorded:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Estimated distance from transect
    - Wind direction
    - Wind strength (estimated Beaufort scale)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Behaviour (flushed; flying-display; perched; perched-calling; perched-hunting; flying-foraging; flying-commute; foraging on the ground) and
    - Co-ordinates (priority species only)

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

- Six (6) vantage points (VPs) were identified from which the majority of the wind 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 are recorded for each flight:
    - Species
    - Number of birds
    - Date
    - Start time and end time
    - Wind direction
    - Wind strength (estimated Beaufort scale 1-7)
    - Weather (sunny; cloudy; partly cloudy; rain; mist)
    - Temperature (cold; mild; warm; hot)
    - Flight altitude (high i.e. >300m; medium i.e. 30m – 300m; low i.e. <30m)
    - Flight mode (soar; flap; glide; kite; hover) and
    - Flight time (in 15 second intervals).

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

A total of six (6) potential focal points (FPs) of bird activity were identified so far and are being monitored. The focal points are as follows:

- FP 1: Dam
- FP 2: Dam
- FP 3: Verreaux's Eagle (Skulpiesberg) nest on a cliff
- FP 4: Martial Eagle (Ratelbosch) nest on a powerline
- FP 5: Jackal Buzzard or Booted Eagle (Tafelberg) nest
- FP 6: Dam (Blue Crane roost)
- FP7: New Martial Eagle (Leeuwenboschfontein) nest

Appendix 4 Figure 1 below indicates the proposed turbine and control areas where monitoring is being implemented.

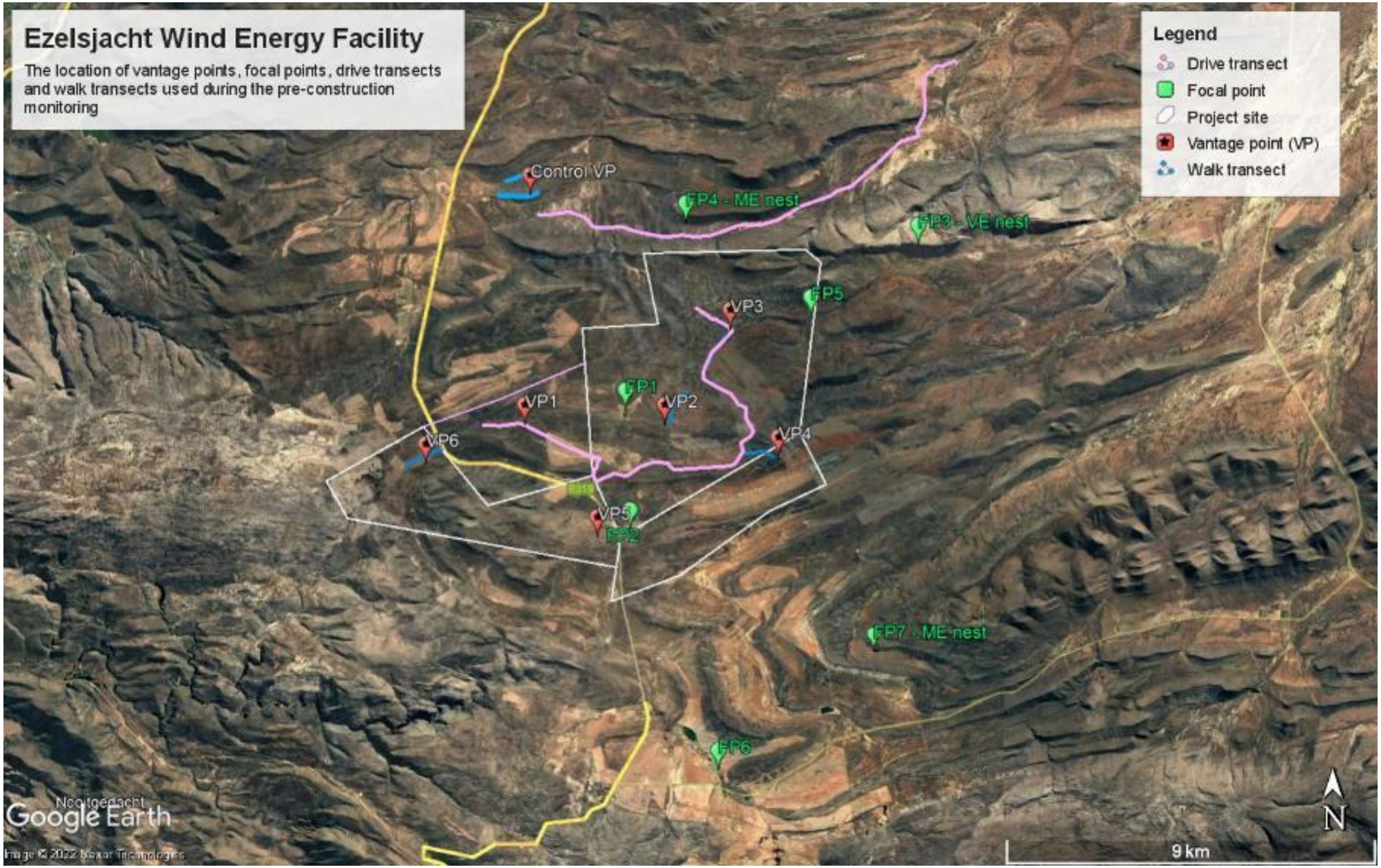


Figure 1: The transects, vantage points and focal points used for the pre-construction monitoring

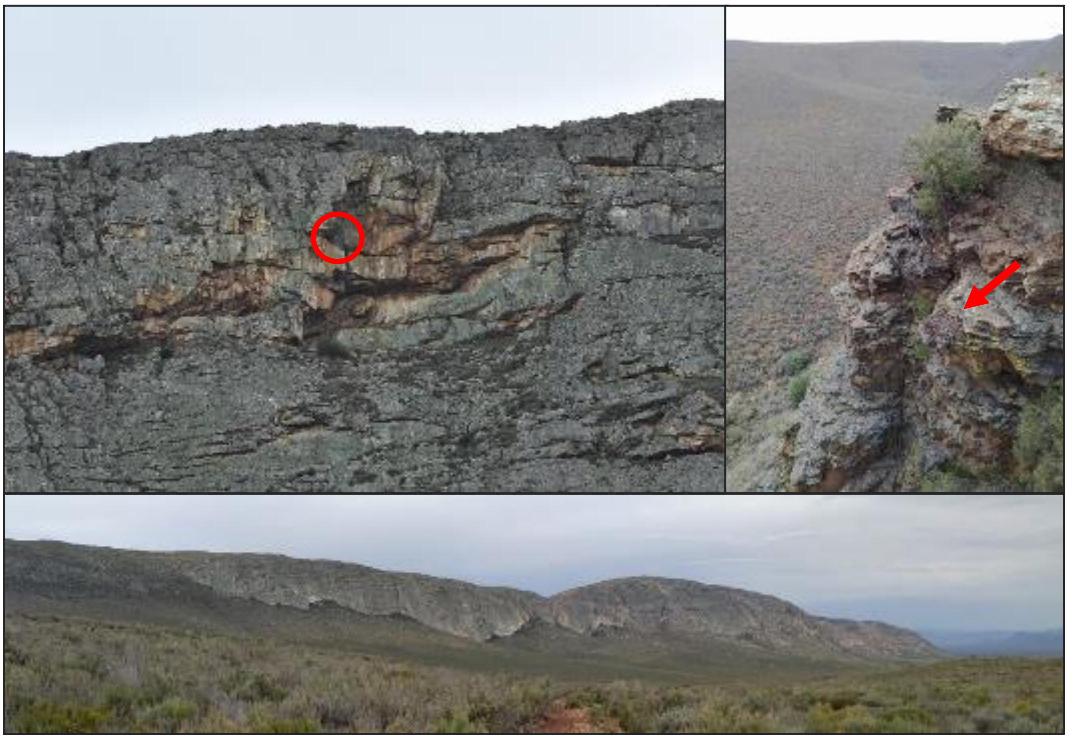
APPENDIX 5: BIRD HABITAT

Appendix 5 Figure 1: Renosterveld shrubland at FP7 (above) and CVP (below).

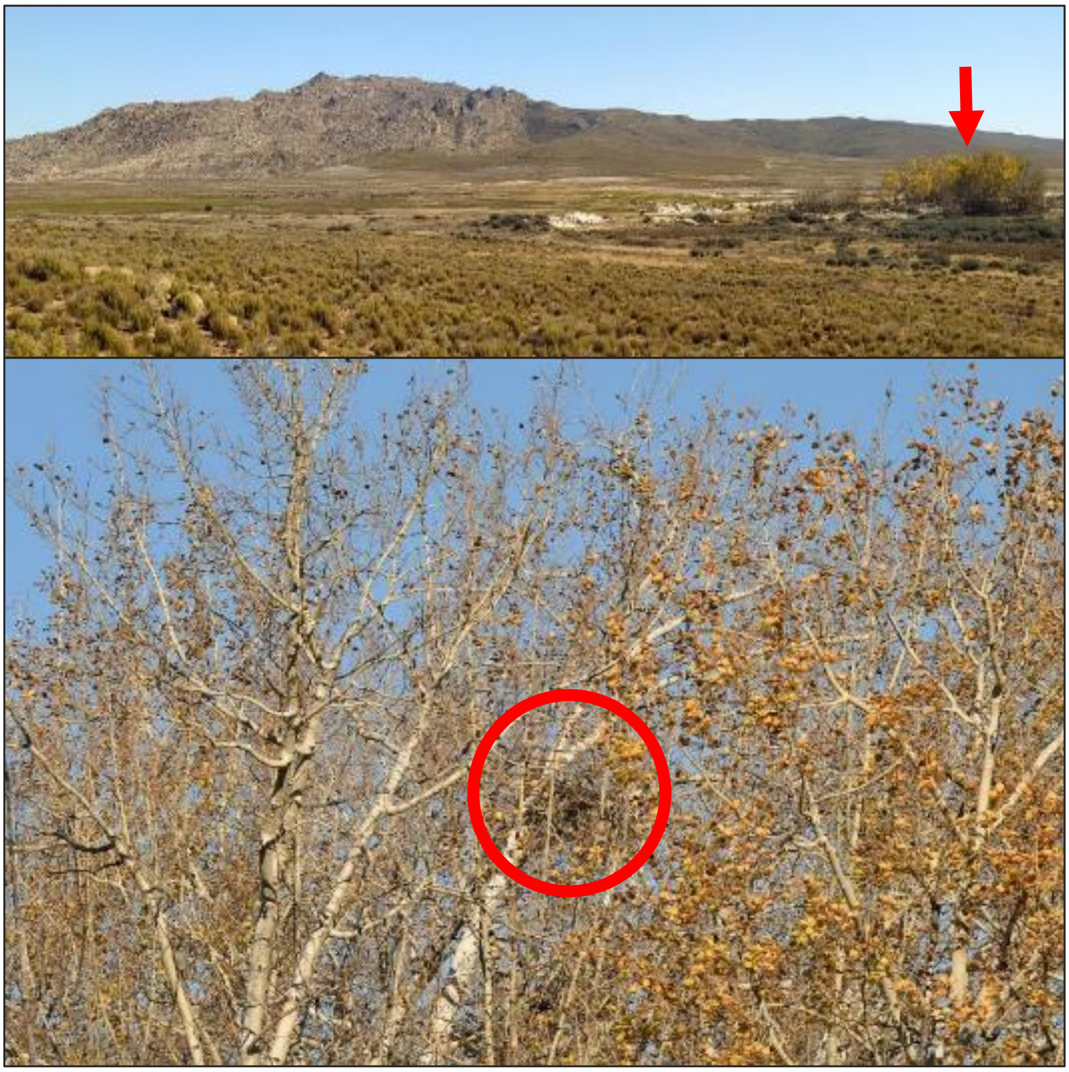
Appendix 5 Figure 2: Cereal agriculture and fallow field tracts (indicated by the red arrow) at VP5.

Appendix 5 Figure 3: Artificial dam at FP2.

Appendix 5 Figure 4: Herbaceous wetland (indicated by the red arrow) along the inlet drainage line to the artificial dam at FP1.



Appendix 5 Figure 5: Mountain ridges within the PAOI. Top left shows a Verreaux's Eagle nest (encircled in red) on a cliff at FP3. Top right shows the Booted Eagle or Jackal Buzzard nest on a cliff at FP5. The bottom image shows a mountain ridgeline within the PAOI.



Appendix 5 Figure 6: A view of the alien popular tree stand from FP7 (top image, red arrow), which supports the Martial Eagle nest (bottom image, encircled in red).

Appendix 5 Figure 7: Overhead high voltage powerlines intersecting the north-western portions of the PAOI (left image), with a Martial Eagle nest on a pylon at FP4 (encircled in red).

APPENDIX 6: SABAP2 AND PRE-CONSTRUCTION SPECIES LIST FOR THE BROADER AREA

NT = Near threatened, VU = Vulnerable, EN = Endangered, LC = Least Concern

Species name	Scientific name	Full protocol	Ad hoc protocol	Global Red List status	Regional Red List status
Bokmakierie	*Telophorus zeylonus*	84.15	28.33	LC	LC
Hamerkop	*Scopus umbretta*	6.10	3.33	LC	LC
Mallard	*Anas platyrhynchos*	3.66	0.00	LC	LC
Neddicky	*Cisticola fulvicapilla*	6.10	1.67	LC	LC
Secretarybird	*Sagittarius serpentarius*	1.22	0.00	EN	VU
Bar-throated Apalis	*Apalis thoracica*	4.88	0.00	LC	LC
Pied Avocet	*Recurvirostra avosetta*	3.66	1.67	LC	LC
Acacia Pied Barbet	*Tricholaema leucomelas*	12.20	0.00	LC	LC
Cape Batis	*Batis capensis*	2.44	0.00	LC	LC
European Bee-eater	*Merops apiaster*	3.66	1.67	LC	LC
Southern Red Bishop	*Euplectes orix*	36.59	13.33	LC	LC
Yellow Bishop	*Euplectes capensis*	3.66	0.00	LC	LC
Southern Boubou	*Laniarius ferrugineus*	4.88	0.00	LC	LC
Cape Bulbul	*Pycnonotus capensis*	31.71	6.67	LC	LC
Cape Bunting	*Emberiza capensis*	93.90	28.33	LC	LC
Lark-like Bunting	*Emberiza impetuani*	7.32	1.67	LC	LC
Common Buzzard	*Buteo buteo*	3.66	1.67	LC	LC
Jackal Buzzard	*Buteo rufofuscus*	40.24	16.67	LC	LC
Black-headed Canary	*Serinus alario*	28.05	3.33	LC	LC
Brimstone Canary	*Crithagra sulphurata*	4.88	0.00	LC	LC
Cape Canary	*Serinus canicollis*	21.95	11.67	LC	LC
Forest Canary	*Crithagra scotops*	1.22	0.00	LC	LC
Protea Canary	*Crithagra leucoptera*	3.66	0.00	NT	NT
White-throated Canary	*Crithagra albogularis*	34.15	11.67	LC	LC
Yellow Canary	*Crithagra flaviventris*	78.05	33.33	LC	LC
Ant-eating Chat	*Myrmecocichla formicivora*	1.22	1.67	LC	LC
Familiar Chat	*Oenanthe familiaris*	64.63	21.67	LC	LC
Karoo Chat	*Emarginata schlegelii*	26.83	13.33	LC	LC
Sickle-winged Chat	*Emarginata sinuata*	43.90	8.33	LC	LC
Grey-backed Cisticola	*Cisticola subruficapilla*	81.71	35.00	LC	LC
Levaillant's Cisticola	*Cisticola tinniens*	12.20	3.33	LC	LC
Zitting Cisticola	*Cisticola juncidis*	1.22	0.00	LC	LC
Red-knobbed Coot	*Fulica cristata*	29.27	6.67	LC	LC
Reed Cormorant	*Microcarbo africanus*	14.63	3.33	LC	LC
White-breasted Cormorant	*Phalacrocorax lucidus*	3.66	1.67	LC	LC

Species name	Scientific name	Full protocol	Ad hoc protocol	Global Red List status	Regional Red List status
Blue Crane	*Grus paradisea*	43.90	21.67	VU	NT
Long-billed Crombec	*Sylvietta rufescens*	14.63	0.00	LC	LC
Cape Crow	*Corvus capensis*	37.80	11.67	LC	LC
Pied Crow	*Corvus albus*	65.85	26.67	LC	LC
Diederik Cuckoo	*Chrysococcyx caprius*	1.22	0.00	LC	LC
Klaas's Cuckoo	*Chrysococcyx klaas*	2.44	0.00	LC	LC
African Darter	*Anhinga rufa*	2.44	0.00	LC	LC
Cape Turtle Dove	*Streptopelia capicola*	53.66	20.00	LC	LC
Laughing Dove	*Spilopelia senegalensis*	17.07	3.33	LC	LC
Namaqua Dove	*Oena capensis*	8.54	0.00	LC	LC
Red-eyed Dove	*Streptopelia semitorquata*	13.41	0.00	LC	LC
Rock Dove	*Columba livia*	10.98	5.00	LC	LC
Fork-tailed Drongo	*Dicrurus adsimilis*	1.22	0.00	LC	LC
African Black Duck	*Anas sparsa*	3.66	0.00	LC	LC
Maccoa Duck	*Oxyura maccoa*	1.22	0.00	EN	NT
Yellow-billed Duck	*Anas undulata*	42.68	10.00	LC	LC
African Fish Eagle	*Haliaeetus vocifer*	2.44	0.00	LC	LC
Booted Eagle	*Hieraaetus pennatus*	23.17	23.33	LC	LC
Martial Eagle	*Polemaetus bellicosus*	7.32	0.00	EN	EN
Verreaux's Eagle	*Aquila verreauxii*	30.49	6.67	LC	VU
Spotted Eagle-Owl	*Bubo africanus*	8.54	0.00	LC	LC
Western Cattle Egret	*Bubulcus ibis*	2.44	1.67	LC	LC
Karoo Eremomela	*Eremomela gregalis*	0.00	1.67	LC	LC
Yellow-bellied Eremomela	*Eremomela icteropygialis*	2.44	0.00	LC	LC
Lanner Falcon	*Falco biarmicus*	4.88	0.00	LC	VU
Southern Fiscal	*Lanius collaris*	68.29	16.67	LC	LC
Greater Flamingo	*Phoenicopterus roseus*	1.22	0.00	LC	NT
African Paradise Flycatcher	*Terpsiphone viridis*	0.00	1.67	LC	LC
Fairy Flycatcher	*Stenostira scita*	6.10	0.00	LC	LC
Fiscal Flycatcher	*Melaenornis silens*	15.85	5.00	LC	LC
Grey-winged Francolin	*Scleroptila afra*	15.85	1.67	LC	LC
Egyptian Goose	*Alopochen aegyptiaca*	75.61	35.00	LC	LC
Spur-winged Goose	*Plectropterus gambensis*	10.98	1.67	LC	LC
Pale Chanting Goshawk	*Melierax canorus*	50.00	16.67	LC	LC
Cape Grassbird	*Sphenoeacus afer*	4.88	0.00	LC	LC
Black-necked Grebe	*Podiceps nigricollis*	1.22	0.00	LC	LC
Great Crested Grebe	*Podiceps cristatus*	3.66	1.67	LC	LC
Little Grebe	*Tachybaptus ruficollis*	15.85	3.33	LC	LC
Sombre Greenbul	*Andropadus importunus*	4.88	0.00	LC	LC

Species name	Scientific name	Full protocol	Ad hoc protocol	Global Red List status	Regional Red List status
Common Greenshank	*Tringa nebularia*	6.10	0.00	LC	LC
Helmeted Guineafowl	*Numida meleagris*	15.85	0.00	LC	LC
Black Harrier	*Circus maurus*	18.29	1.67	EN	EN
African Harrier-Hawk	*Polyboroides typus*	4.88	3.33	LC	LC
Black-headed Heron	*Ardea melanocephala*	31.71	10.00	LC	LC
Grey Heron	*Ardea cinerea*	21.95	8.33	LC	LC
Greater Honeyguide	*Indicator indicator*	1.22	0.00	LC	LC
Lesser Honeyguide	*Indicator minor*	2.44	0.00	LC	LC
African Hoopoe	*Upupa africana*	4.88	0.00	LC	LC
African Sacred Ibis	*Threskiornis aethiopicus*	13.41	3.33	LC	LC
Hadada Ibis	*Bostrychia hagedash*	50.00	28.33	LC	LC
Greater Kestrel	*Falco rupicoloides*	1.22	0.00	LC	LC
Rock Kestrel	*Falco rupicolus*	64.63	23.33	LC	LC
Pied Kingfisher	*Ceryle rudis*	1.22	0.00	LC	LC
Black-winged Kite	*Elanus caeruleus*	13.41	0.00	LC	LC
Yellow-billed Kite	*Milvus aegyptius*	1.22	1.67	LC	LC
Southern Black Korhaan	*Afrotis afra*	35.37	20.00	VU	VU
Blacksmith Lapwing	*Vanellus armatus*	51.22	8.33	LC	LC
Crowned Lapwing	*Vanellus coronatus*	3.66	1.67	LC	LC
Agulhas Long-billed Lark	*Certhilauda brevirostris*	1.22	0.00	LC	NT
Cape Clapper Lark	*Mirafra apiata*	20.73	3.33	LC	LC
Karoo Lark	*Calendulauda albescens*	21.95	10.00	LC	LC
Karoo Long-billed Lark	*Certhilauda subcoronata*	13.41	1.67	LC	LC
Large-billed Lark	*Galerida magnirostris*	70.73	26.67	LC	LC
Red-capped Lark	*Calandrella cinerea*	39.02	10.00	LC	LC
Spike-heeled Lark	*Chersomanes albofasciata*	2.44	1.67	LC	LC
Cape Longclaw	*Macronyx capensis*	1.22	0.00	LC	LC
Brown-throated Martin	*Riparia paludicola*	3.66	1.67	LC	LC
Rock Martin	*Ptyonoprogne fuligula*	52.44	8.33	LC	LC
Common Moorhen	*Gallinula chloropus*	7.32	0.00	LC	LC
Red-faced Mousebird	*Urocolius indicus*	13.41	3.33	LC	LC
Speckled Mousebird	*Colius striatus*	8.54	0.00	LC	LC
White-backed Mousebird	*Colius colius*	37.80	15.00	LC	LC
Common Ostrich	*Struthio camelus*	14.63	8.33	LC	LC
Western Barn Owl	*Tyto alba*	0.00	1.67	LC	LC
Speckled Pigeon	*Columba guinea*	65.85	16.67	LC	LC
African Pipit	*Anthus cinnamomeus*	15.85	3.33	LC	LC
Nicholson's Pipit	*Anthus nicholsoni*	8.54	0.00	LC	LC
Plain-backed Pipit	*Anthus leucophrys*	1.22	0.00	LC	LC
Common Ringed Plover	*Charadrius hiaticula*	2.44	0.00	LC	LC
Kittlitz's Plover	*Charadrius pecuarius*	14.63	0.00	LC	LC

Species name	Scientific name	Full protocol	Ad hoc protocol	Global Red List status	Regional Red List status
Three-banded Plover	*Charadrius tricollaris*	37.80	6.67	LC	LC
Southern Pochard	*Netta erythrophthalma*	2.44	0.00	LC	LC
Karoo Prinia	*Prinia maculosa*	90.24	35.00	LC	LC
Common Quail	*Coturnix coturnix*	3.66	1.67	LC	LC
Red-billed Quelea	*Quelea quelea*	2.44	0.00	LC	LC
White-necked Raven	*Corvus albicollis*	65.85	20.00	LC	LC
Cape Robin-Chat	*Cossypha caffra*	24.39	8.33	LC	LC
Cape Rockjumper	*Chaetops frenatus*	4.88	0.00	NT	NT
Namaqua Sandgrouse	*Pterocles namaqua*	14.63	3.33	LC	LC
Common Sandpiper	*Actitis hypoleucos*	1.22	0.00	LC	LC
Wood Sandpiper	*Tringa glareola*	2.44	0.00	LC	LC
Karoo Scrub Robin	*Cercotrichas coryphoeus*	84.15	35.00	LC	LC
Streaky-headed Seedeater	*Crithagra gularis*	8.54	1.67	LC	LC
South African Shelduck	*Tadorna cana*	59.76	26.67	LC	LC
Cape Shoveler	*Spatula smithii*	8.54	0.00	LC	LC
Cape Siskin	*Crithagra totta*	10.98	0.00	LC	LC
Cape Sparrow	*Passer melanurus*	82.93	33.33	LC	LC
House Sparrow	*Passer domesticus*	39.02	5.00	LC	LC
Southern Grey-headed Sparrow	*Passer diffusus*	1.22	0.00	LC	LC
Grey-backed Sparrow-Lark	*Eremopterix verticalis*	14.63	3.33	LC	LC
Black Sparrowhawk	*Accipiter melanoleucus*	1.22	0.00	LC	LC
Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	3.66	3.33	LC	LC
African Spoonbill	*Platalea alba*	6.10	0.00	LC	LC
Cape Spurfowl	*Pternistis capensis*	45.12	8.33	LC	LC
Common Starling	*Sturnus vulgaris*	29.27	6.67	LC	LC
Pale-winged Starling	*Onychognathus nabouroup*	4.88	0.00	LC	LC
Pied Starling	*Lamprotornis bicolor*	74.39	23.33	LC	LC
Red-winged Starling	*Onychognathus morio*	15.85	1.67	LC	LC
Black-winged Stilt	*Himantopus himantopus*	13.41	6.67	LC	LC
Little Stint	*Calidris minuta*	12.20	0.00	LC	LC
African Stonechat	*Saxicola torquatus*	54.88	18.33	LC	LC
Cape Sugarbird	*Promerops cafer*	18.29	1.67	LC	LC
Malachite Sunbird	*Nectarinia famosa*	60.98	13.33	LC	LC
Orange-breasted Sunbird	*Anthobaphes violacea*	15.85	1.67	LC	LC
Southern Double-collared Sunbird	*Cinnyris chalybeus*	36.59	8.33	LC	LC
Barn Swallow	*Hirundo rustica*	25.61	8.33	LC	LC
Greater Striped Swallow	*Cecropis cucullata*	43.90	10.00	LC	LC

Species name	Scientific name	Full protocol	Ad hoc protocol	Global Red List status	Regional Red List status
Pearl-breasted Swallow	*Hirundo dimidiata*	3.66	0.00	LC	LC
White-throated Swallow	*Hirundo albigularis*	6.10	6.67	LC	LC
African Black Swift	*Apus barbatus*	4.88	0.00	LC	LC
Alpine Swift	*Tachymarptis melba*	18.29	6.67	LC	LC
Little Swift	*Apus affinis*	3.66	1.67	LC	LC
White-rumped Swift	*Apus caffer*	10.98	3.33	LC	LC
Southern Tchagra	*Tchagra tchagra*	6.10	0.00	LC	LC
Cape Teal	*Anas capensis*	9.76	1.67	LC	LC
Red-billed Teal	*Anas erythrorhyncha*	18.29	1.67	LC	LC
Spotted Thick-knee	*Burhinus capensis*	13.41	0.00	LC	LC
Cape Rock Thrush	*Monticola rupestris*	8.54	0.00	LC	LC
Karoo Thrush	*Turdus smithi*	6.10	0.00	LC	LC
Olive Thrush	*Turdus olivaceus*	3.66	0.00	LC	LC
Sentinel Rock Thrush	*Monticola explorator*	8.54	0.00	NT	LC
Cape Penduline Tit	*Anthoscopus minutus*	30.49	3.33	LC	LC
Grey Tit	*Melaniparus afer*	1.22	1.67	LC	LC
Cape Wagtail	*Motacilla capensis*	69.51	21.67	LC	LC
African Reed Warbler	*Acrocephalus baeticatus*	2.44	0.00	LC	LC
Chestnut-vented Warbler	*Curruca subcoerulea*	10.98	1.67	LC	LC
Layard's Warbler	*Curruca layardi*	12.20	0.00	LC	LC
Lesser Swamp Warbler	*Acrocephalus gracilirostris*	3.66	0.00	LC	LC
Little Rush Warbler	*Bradypterus baboecala*	0.00	1.67	LC	LC
Namaqua Warbler	*Phragmacia substriata*	3.66	0.00	LC	LC
Rufous-eared Warbler	*Malcorus pectoralis*	26.83	10.00	LC	LC
Common Waxbill	*Estrilda astrild*	45.12	11.67	LC	LC
Cape Weaver	*Ploceus capensis*	51.22	18.33	LC	LC
Southern Masked Weaver	*Ploceus velatus*	32.93	5.00	LC	LC
Capped Wheatear	*Oenanthe pileata*	37.80	13.33	LC	LC
Mountain Wheatear	*Myrmecocichla monticola*	28.05	6.67	LC	LC
Cape White-eye	*Zosterops virens*	14.63	3.33	LC	LC
Pin-tailed Whydah	*Vidua macroura*	1.22	0.00	LC	LC
Cardinal Woodpecker	*Dendropicos fuscescens*	4.88	0.00	LC	LC
Ground Woodpecker	*Geocolaptes olivaceus*	10.98	1.67	NT	LC
Black Stork	*Ciconia nigra*	0.00	0.00	LC	VU
Black-chested Snake Eagle	*Circaetus pectoralis*	0.00	0.00	LC	LC
Black-eared Sparrow-Lark	*Eremopterix australis*	0.00	0.00	LC	LC
Common Swift	*Apus apus*	0.00	0.00	LC	LC
Double-banded Courser	*Rhinoptilus africanus*	0.00	0.00	LC	LC

APPENDIX 7: 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
- 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 impacts of the proposed project (during the Construction, Operation and Decommissioning phases) are to be assessed and rated according to the methodology described below, which was developed by SLR to align with the requirements of the EIA Regulations, 2014 (as amended). Specialists will be required to make use of the impact rating matrix provided by SLR (in Excel format) for this purpose.
The criteria used to assess both the impacts and the method of determining the significance of the impacts is outlined in Appendix 7 Tables 1-4). This method complies with the method provided in the EIA guideline document (GN. 654 of 2010). Part A provides the definitions of the criteria and the approach for determining impact consequence (combining intensity, extent, and duration). In Part B, a matrix is applied to determine this impact consequence. In Part C, the consequence rating is considered together with the probability of occurrence to determine the overall significance of each impact. Lastly, the interpretation of the impact significance is provided in Part D.

Appendix 7 Table 1: Definitions of assessment criteria

<table>
<tr><th colspan="3">PART A: DEFINITIONS AND CRITERIA</th></tr>
<tr><td colspan="2">Determination of CONSEQUENCE</td><td>Consequence is a function of intensity, spatial extent, and duration</td></tr>
<tr><td colspan="2">Determination of SIGNIFICANCE</td><td>Significance is a function of consequence and probability</td></tr>
<tr><td rowspan="5">Criteria for ranking of the INTENSITY of environmental impacts</td><td>Very High</td><td>Severe change, disturbance or degradation caused to receptors. Associated with severe consequences. May result in severe illness, injury, or death. Targets, limits, and thresholds of concern continually exceeded. Substantial intervention will be required.</td></tr>
<tr><td>High</td><td>Prominent change, or large degree of modification, disturbance or degradation caused to receptors, or which may affect a large proportion of receptors, possibly entire species, or community.</td></tr>
<tr><td>Medium</td><td>Moderate change, disturbance or discomfort caused to receptors and/or which may affect a moderate proportion of receptors.</td></tr>
<tr><td>Low</td><td>Minor (slight) change, disturbance or nuisance caused to receptors which is easily tolerated without intervention, or which may affect a small proportion of receptors.</td></tr>
<tr><td>Very Low</td><td>Negligible change, disturbance or nuisance caused to receptors which is barely noticeable or may have minimal effect on receptors or affect a limited proportion of the receptors.</td></tr>
<tr><td rowspan="5">Criteria for ranking the DURATION of impacts</td><td>Very Short-term</td><td>The duration of the impact will be < 1 year or may be intermittent.</td></tr>
<tr><td>Short-term</td><td>The duration of the impact will be between 1 - 5 years</td></tr>
<tr><td>Medium-term</td><td>The duration of the impact will be Medium-term between, 5 to 10 years.</td></tr>
<tr><td>Long-term</td><td>Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)</td></tr>
<tr><td>Permanent</td><td>The duration of the impact will be permanent</td></tr>
<tr><td rowspan="2">Criteria for ranking the EXTENT of impacts</td><td>Site</td><td>Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.</td></tr>
<tr><td>Local</td><td>Impact is confined to within the project site / area and its nearby surroundings.</td></tr>
</table>

	Regional	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.
	National	Impact may extend beyond district or regional boundaries with national implications.
	International	Impact extends beyond the national scale or may be transboundary.

Appendix 7 Table 2: Determination of impact consequence

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

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

Appendix 7 Table 3: Determining the impact significance

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

Appendix 7 Table 4: Interpretation of significance key

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

APPENDIX 8: 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)

1 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 site sensitivity verification visit has been undertaken to the project site 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).

2 Site sensitivity verification

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

- The project site concerns the land properties upon which the development will occur, occupying an extent of approximately 3594 hectares.
- The project area of impact (PAOI) of the proposed WEF was defined as a 5km buffer zone around surrounding the land parcels making up the project site, with an extent of approximately 25950 hectares.
- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the University of Cape Town, to ascertain which species occurs within the broader area of four pentad grid cells each within which the proposed projects are situated. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. To get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 9 pentads which intersect with the development area, hereafter referred to as '**the broader area'**. From 2007-present, a total of 82 full protocol lists (i.e., surveys of at least two hours each) have been completed for this area. In addition, 60 *ad hoc* protocol lists (i.e., surveys lasting less than two hours but still yielding valuable data) have been completed. The SABAP2 data was therefore regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during the site surveys and general knowledge of the area and bird and habitat associations.
- Priority species for wind development were identified from the updated list of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map (Ralston-Paton et al., 2017; Retief et al., 2012).
- The national threatened status of all wind 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 (2022.1) International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org/).
- A classification of the vegetation habitat ecotypes within the PAOI was obtained from the National Vegetation Map (2018) from the South African National Biodiversity Institute (SANBI) BGIS map viewer (http://bgisviewer.sanbi.org/) (Mucina & Rutherford, 2006; SANBI, 2018). The PAOI is the area where the primary impacts on avifauna are expected and includes the land parcels where the project will be located.
- Avifaunal habitat usage within the PAOI by birds was informed by the Atlas of Southern African Birds 1 (SABAP 1) (Harrison et al., 1997a, 1997b).

- Land-cover and land-use within the PAOI was determined using the 2018 South African national land-cover surveys jointly conducted by the Department of Environmental Affairs, and the Department of Rural Development and Land Reform (DEA & DALRRD, 2019).
- The Important Bird Areas of Southern Africa (Marnewick et al., 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth ©2022) was used to view the PAOI and broader area on a landscape level and to help identify sensitive bird habitat.
- The 2022 South Africa Protected Areas Database compiled by the Department of Environment, Forestry and Fisheries (DFFE) was used to identify Nationally Protected Areas, National Protected Areas Expansion Strategy (NPAES) near the PAOI (DFFE, 2022).
- The Department of Forestry, Fisheries and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the PAOI.
- Data collected during previous site visits to the broader area was also considered as far as habitat classes and the occurrence of priority species are concerned.
- The following sources were used to determine the investigation protocol that is required for the site:
    - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on avifaunal species by onshore wind energy generation facilities where the electricity output is 20MW or more (Government Gazette No. 43110 – 20 March 2020).
    - BirdLife South Africa's (BLSA) 'Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa' (Jenkins et al., 2015) – hereafter referred to as the 'Windfarm Guidelines' – were consulted to determine the level of survey effort that is required.
    - The latest best practice guidelines for monitoring Verreaux's Eagle (Ralston-Paton, 2017; Ralston-Paton and Murgatroyd, 2021) - hereafter referred to as 'VE Guidelines' - and for monitoring Black Harrier (Simmons et al., 2019) – hereafter referred to as 'BH Guidelines'. We consulted the latter two guidelines as the expected regular occurrence of Verreaux's Eagle, Marital Eagle, and Black Harrier at the site would necessitate that protocols for these species be considered.
- The primary source of information on avifaunal diversity, abundance, and flight patterns at the site were the results of a pre-construction programme currently being conducted over four seasons at the proposed Ezelsjacht WEF application sites. The primary methods of data capturing are walk transect counts, drive transect counts, focal point monitoring, vantage point counts and incidental sightings (see Appendix 4 for a detailed explanation of the monitoring methods).

3 Outcome of site reconnaissance

3.1 Natural environment

The Ezelsjacht WEF PAOI is situated within mountainous terrain, with rugged slopes, ridges and ravines present throughout the PAOI. The Project Site itself positioned with comparably gentler slopes within a broad valley between mountains flanking the PAOI. There are numerous minor drainage lines intersecting the PAOI, which largely originate from the local mountains. Most of these drainage lines, however, are non-perennial streams. Only one perennial river is present within the PAOI – the west-flowing Keurboskloof River which ostensibly originates from the north-westernmost portions of the PAOI (note: this river does not intersect the Project Site itself).

The PAOI has drier Mediterranean climate seasonality, experiencing warm, dry summers and mildly cold, wet winters (https://www.meteoblue.com/, accessed October 2022). The mean temperatures range 33°C (January) to 5°C (July). The mean annual precipitation is 267 mm. Rainfall seasonality is relatively low within the PAOI, ranging from 14mm during the drier summer months to 35mm during the late autumn/winter months.

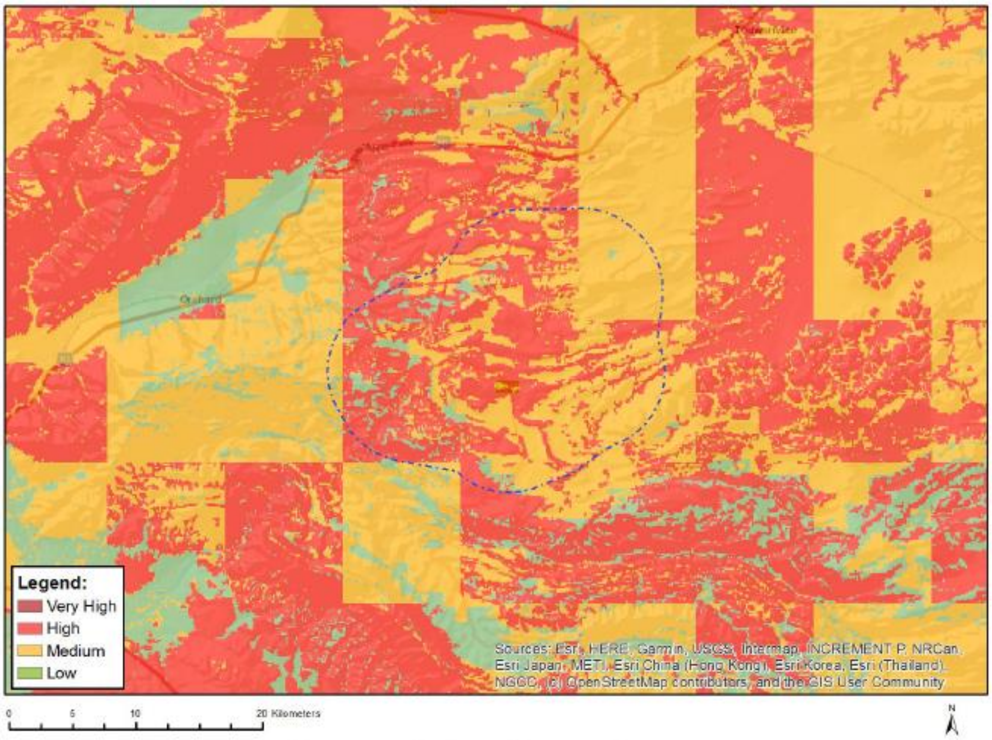
The PAOI is situated in at a transition zone between two bioregions within the Fynbos Biome (SANBI, 2018). The Southern Fynbos Bioregion – comprising North- and South Langeberg Sandstone Fynbos – is present over the western portions of the PAOI, while Western Fynbos-Renosterverld Bioregion – largely comprising Matjiesfontein Shale Renosterveld with Matjiesfontein Quartzite along ridgeline slopes (Rebelo et al., 2006; SANBI, 2018). Renosterveld vegetation is the dominant natural habitat over much of the PAOI (Rebelo et al., 2006; SANBI, 2018), and this is characterized as "open to medium dense leptophyllous shrubland with a medium dense matrix of short divaricate shrubs, dominated by renosterbos" (Rebelo et al., 2006). The North- and South Langeberg Sandstone Fynbos which occupy the western portions of the PAOI are characterised by "proteoid and resitoid fynbos, with ericacesous fynbos at higher altitudes and asteraceous fynbos on lower slopes" (Rebelo et al., 2006). Both bioregions within the PAOI form part of the Cape Floristic Region, a recognised Centre of Endemism within South Africa (Van Wyk & Smith, 2001).

3.2 DFFE Screening Tool

According to the DFFE national screening tool, the habitat within the PAOI is classified as **High Sensitivity** according to the Terrestrial Animal Species theme (Figure 1)[5]. The classification of **High Sensitivity** in the Terrestrial Animal Species theme is linked to the potential presence of species of conservation concern (SCC), namely Black Harrier (Globally Endangered, Regionally Endangered), Martial Eagle (Globally Endangered, Regionally Endangered), Southern Black Korhaan (Globally Vulnerable, Regionally Vulnerable), and Verreaux's Eagle (Globally Least Concern, Regionally Vulnerable). Additionally, **Medium sensitivity** is linked to these same species, except for Martial Eagle.

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

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Circus maurus
High	Aves-Polemaetus bellicosus
High	Aves-Afrotis afra
High	Aves-Aquila verreauxii
Low	Subject to confirmation
Medium	Aves-Circus maurus
Medium	Aves-Afrotis afra
Medium	Aves-Aquila verreauxii
Medium	Insecta-Aloeides caledoni
Medium	Mammalia-Bunolagus monticularis

Figure 1: The classification of the PAOI according to the avian theme for terrestrial animal species theme in the DFFE National Screening Tool. Medium and High sensitivity is linked to Black Harrier (*Circus maurus*), Martial Eage (*Polemaetus bellicosus*), Southern Black Korhaan (*Afrotis afra*), and Verreaux's Eagle *(Aquila verreauxii*).

4 Conclusion

The PAOI contains confirmed habitat for the 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 the above four SCC recorded during pre-construction monitoring. Other Red List species were also during preconstruction monitoring include Black Stork (Globally Least Concern, Regionally Vulnerable), Blue Crane (Globally Vulnerable, Regionally Near Threatened), Lanner Falcon (Globally Least Concern, Regionally Vulnerable), Secretarybird (Globally Endangered, Regionally Vulnerable). A classification of High sensitivity is therefore proposed for the whole PAOI.