Holland & Associates
Environmental Consultants

Impact Assessments - Environmental Management Programs - Compliance Monitoring - Process Review

AVIFAUNAL SPECIALIST IMPACT ASSESSMENT REPORT FOR THE PROPOSED SOUTRIVIER CENTRAL WIND ENERGY FACILITY, NEAR VICTORIA WEST, NORTHERN CAPE PROVINCE

JANUARY 2023

Postnet Suite #108, Private Bag X12, Tokai, 7966, South Africa
Mobile 072 601 0803 ~ e-mail: info@hollandandassociates.net
Web: www.hollandandassociates.net

Compiled for:
Jasper Dick
WKN Windcurrent South Africa (Pty) Ltd
jasper@wkn-windcurrent.com

Compiled by:
Anja Albertyn, Pr.Sci.Nat.(Ecological Science)
Holland & Associates Environmental Consultants
PostNet Suite #108, Private Bag X12
Tokai, 7966

M 076 265 8933
E anja@hollandandassociates.net

Avifaunal Specialist **Anja Albertyn** holds a Master of Science in Zoology specialising in Ornithology from the Percy FitzPatrick Institute for African Ornithology at the University of Cape Town, a Bachelor of Science (Honours) in Zoology, and a Bachelor of Science in Botany and Zoology. She has 13 years of experience as an environmental consultant and has worked on a variety of projects including wind and solar energy facilities, transmission lines and other electrical infrastructure, housing developments, water use license applications, effluent treatment technology testing, and aquaculture management. She has compiled basic, scoping & environmental impact assessment reports, environmental management plans and environmental authorisation amendment applications, as well as a large number of avifaunal specialist reports. Anja has a keen interest in birds and the ecology of estuarine birds in particular, and has published eight scientific papers on this topic to date. She has been involved in bird monitoring activities since 2004 and has acted as lead specialist for avifaunal impact assessments, avifaunal feasibility studies and bird specialist reports on a large number of projects. Anja is a registered Professional Natural Scientist (Ecological Science: 400037/16) with the South African Council for Natural Scientific Professions, and is an active member of the South African affiliate of the International Association for Impact Assessment (IAIAsa). She is a select member of the *Birds and Renewable Energy Specialist Group (BARESG)*.

Contents

List of Figures

List of Tables

List of Abbreviations

AEWA:	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
APLIC:	Avian Power Line Interaction Committee
BESS:	Battery Energy Storage System
BI:	Biodiversity Importance
CBA:	Critical Biodiversity Area
CBD:	Convention on Biological Diversity
CEO:	Contractor’s Environmental Officer
CI:	Conservation Importance
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS:	Conservation of Migratory Species of Wild Animals
CR:	Critically Endangered
DD:	Data Deficient
DEO:	Developer’s Environmental Officer
DENC:	Northern Cape Department of Environmental Affairs and Nature Conservation
DFFE:	Department of Forestry, Fisheries and the Environment
DPM:	Developer’s Project Manager
DSS:	Developer’s Site Supervisor
EAP:	Environmental Assessment Practitioner
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment
EN:	Endangered
EOO:	Extent of Occurrence
FI:	Functional Integrity
GN:	Government Notice
IKA:	Index of Kilometric Abundance

IUCN:	International Union for Conservation of Nature
MTS:	Main Transmission Station
MW:	Megawatt
NEMBA:	National Environmental Management: Biodiversity Act 10 of 2004
NFEPA:	National Freshwater Ecosystem Priority Areas
NEMA:	National Environmental Management Act 107 of 1988
NT:	Near-threatened
OHPL:	Overhead Power Line
PAOI:	Project Area of Influence
PV:	Photo-voltaic
RR:	Receptor Resilience
SA:	South Africa
SABAP2:	South African Bird Atlas Project 2
SANBI:	South African National Biodiversity Institute
SCC:	Species of Conservation Concern
SDM:	Species Distribution Model
SEI:	Site Ecological Importance
UNEP:	United Nations Environment Programme
VU:	Vulnerable
WEF:	Wind Energy Facility

Glossary

Avifauna: taken to mean birds (class: Aves) of a specific area (region, habitat etc.) or time period.

Class: a principal taxonomic grouping that ranks above order and below phylum, such as Aves.

Critical Biodiversity Area (CBA): an area that must be maintained in a good ecological condition (natural or semi-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types, as well as for species and ecological processes that depend on natural or semi-natural habitat that have not already been met in the protected area network. CBAs are identified through a systematic biodiversity planning process in a configuration that is complementary, efficient and avoids conflict with other land uses where possible.

Cumulative impact: in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

Endemic or near-endemic: species where >70% of the population occurs in South Africa, or South Africa, Lesotho and Swaziland, as per Birdlife South Africa Checklist 2019.

Environmental Impact Assessment (EIA): a systematic process of identifying, assessing and reporting environmental impacts associated with an activity and includes basic assessments and scoping and environmental impact reporting (S&EIR) (see below for definition).

Extent of Occurrence (EOO): the area contained within the shortest continuous imaginary boundary that can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy; and in short is the species' contemporary distribution range.

IUCN Red List Categories and Criteria: the threatened species categories used in Red Data Books and Red Lists have been in place for almost 30 years. The IUCN Red List Categories and Criteria provide an easily and widely understood system for classifying species at high risks of global extinction, so as to focus attention on conservation measures designed to protect them.

IUCN Red List status: the conservation status of species, based on the IUCN Red List categories and criteria.

Migratory species: these are defined as per NEMBA to mean the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant portion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. Furthermore, this includes all species that are native to South Africa and are listed under the Convention on the Conservation of Migratory Species of Wild Animals (CMS) or the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), with the exception of those species in respect of which South Africa has entered reservations.

Mitigation: means to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.

NEMA EIA Regulations: Environmental Impact Assessment Regulations, 2014 (as amended), in terms of Chapter 5 of NEMA.

Priority Species: Species identified as the most sensitive to impacts from wind energy facilities in South Africa for the Avian Wind Farm Sensitivity Map for South Africa (Retief et al. 2014).

Project Area of Influence (PAOI): The geographic area that the proposed development has potential impacts on avifauna.

Screening Tool Report: A report generated by the National web-based Screening Tool for the Project Area of Influence.

Receptor: in the context of impact assessments on biodiversity, receptors are environmental components (e.g. flora/fauna species/communities or habitat type) that may be affected, adversely or beneficially, by the proposed project activities within the project areas of influence (PAOI).

Red Data species: species listed as Near-threatened, Vulnerable, Endangered or Critically Endangered in the *Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*; or on *iucnredlist.org.*

Species: a kind of animal, plant or other organism that does not normally interbreed with individuals of another kind, and includes as subsets, any subspecies, cultivar, variety, geographic race, strain, hybrid or geographically separate population.

Species distribution model (SDM): a probability surface representing relative habitat suitability for a species based on known occurrence records for this species and a suit of environmental predictor variables reflecting the ecological requirements of the species. SDMs can therefore be considered to represent the potential geographic distribution of a species based on habitat suitability. The term 'ecological niche model' is often also used interchangeably with SDM.

Species of Conservation Concern (SCC): includes all species that are assessed according to the IUCN Red List Criteria as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Data Deficient (DD) or Near-threatened (NT), as well as range-restricted species which are not declining and are nationally listed as Rare or Extremely Rare (also referred to in some Red Lists as Critically Rare).

1 Introduction

WKN-Windcurrent South Africa (Pty) Ltd (WKN-WC) is interested in developing a cluster of wind and solar photo-voltaic (PV) energy facilities south-west of Victoria West, within the Ubuntu Local Municipality in the Pixley ka Seme District Municipality in the Northern Cape Province. Holland & Associates Environmental Consultants (H&A) conducted an initial desktop ecological feasibility study for a larger Area of Interest (AOI) with a 25 km radius in 2020. Following the recommendations from the feasibility study, WKN-WC appointed H&A to conduct a raptor nest survey and site visit in an updated AOI which had a relatively low ecological sensitivity, in order to determine exclusion areas and nest buffers to inform the way forward. The Verreaux's Eagle Risk Assessment (VERA) model was then run using the Verreaux's Eagle nests identified during the nest survey. WKN-WC used the results of the VERA model to determine a new AOI which avoids all areas of medium and high collision risk for Verreaux's Eagle, and all other likely required buffers identified by H&A during the feasibility study and nest survey. H&A was then further appointed in 2021 to conduct avifaunal pre-application monitoring and assessment in line with all applicable Best Practice Guidelines and legislation for the proposed 'Soutrivier Wind Energy Facilities (WEFs), consisting of three separate WEFs, the Soutrivier North WEF, the Soutrivier Central WEF and the Soutrivier South WEF, and three associated overhead power line (OHPL) projects to connect the WEFs to the National grid. Pre-application monitoring was conducted from March 2021 to January 2022 for the combined area of the WEFs (the updated AOI).

This report presents the specialist avifaunal impact assessment for the proposed Soutrivier Central Wind Energy Facility to be located on Remainder of Farm 197 (6869 ha), Portion 3 of Farm 158 (1965 ha), and Portion 6 (4188 ha) of Farm 158, near Victoria West in the Northern Cape Province.

2 The Soutrivier Central WEF

The up to 270 MW Soutrivier Central WEF is proposed to consist of up to 32 turbines (Table 1). with a total estimated development footprint of 124.68 ha during construction, and 76.68 ha during operation (Table 2). The development site affected farm portions cover an area of 20 222 ha, with the Area of Interest for turbine development within the affected portions covering 5 193 ha. The infrastructure includes laydown areas, internal access roads, a Battery Energy Storage System, a concrete tower manufacturing facility and construction compound and an on-site substation. The grid connection to connect the Soutrivier Central WEF to the National Grid will be part of a separate environmental authorisation process and is not included in this assessment.

Table 1: Soutrivier Central WEF Design Specifications

WEF DESIGN SPECIFICATIONS	
Number of turbines	Up to 32
Power output per turbine	Unspecified
Facility output	Up to 270 MW
Turbine hub height	Up to 200 m
Turbine rotor diameter	Up to 240 m
Turbine blade length	Up to 120 m
Turbine tip height	Up to 320 m
Turbine road width	14 m to be rehabilitated to 8 m

WEF DESIGN SPECIFICATIONS	
BESS Technology	Solid State (Li-Ion) or REDOX-Flow – 10 ha / 2700 MWh

Table 2: Footprints of the Proposed Development

FACILITY COMPONENT	CONSTRUCTION FOOTPRINT	FINAL FOOTPRINT AFTER REHABILITATION
Permanent Laydown Area	TOTAL 3000 m^2 x 32 turbines = 96 000 m^2 which equates to **9.6 ha**	TOTAL 3000 m^2 x 32 turbines = 96 000 m^2 which equates to **9.6 ha**
Temporary Laydown Area	TOTAL 3000 m^2 x 32 turbines = 96 000 m^2 which equates to **9.6 ha**	TOTAL 0 m^2 x turbines = 0m^2 which equates to 0 **ha**
Turbine Foundation	TOTAL Up to 900 m^2 x 32 turbines = 28 800 m^2 which equates to **2.88 ha**	TOTAL Up to 900 m^2 x 32 turbines = 28 800 m^2 which equates to **2.88 ha**
WEF Substation	33/132 kV Substation – 1.5 ha Offices and parking – 0.5 ha Permanent Laydown – 1 ha	33/132kV Substation – 1.5 ha Offices and parking – 0.5 ha Permanent Laydown – 1 ha
BESS	TOTAL 10 ha / 2700 MWh	TOTAL 10 ha / 2700 MWh
Temporary Laydown Area, Concrete Tower Manufacturing Facility and Construction Compound	10 ha clearance includes Temporary laydown Construction compound Concrete batching plant Crusher plant All to become area cleared for BESS (above) afterwards.	10 ha clearance includes Temporary laydown Construction compound Concrete batching plant Crusher plant All to become area cleared for BESS (above) afterwards.
New Internal Access Roads (14 m construction, rehabilitated to 8 m during operation)	TOTAL 32 000 m x 14 m = 448 000 m^2 which equates to **44.8 ha**	TOTAL 32 000 m x 8 m = 256 000 m^2 which equates to **25.6 ha**
Upgraded Existing Internal Access Roads	TOTAL 32 000 m x 14 m = 448 000 m^2 which equates to 44.8 ha	TOTAL 31 000 m x 8 m = 256 000 m^2 which equates to 25.6 ha
TOTAL FOOTPRINT:	**124.68 ha of clearing needed for the construction phase**	**76.68 ha of clearing remaining during the operational phase (after rehabilitation)**

3 Applicable Legislation

South African environmental legislation contains a plethora of environmentally related statutes, guidelines and protocols, many of which place onerous responsibilities on landowners, developers, environmental assessment practitioners (EAP's) and independent specialist consultants. The legislation considered most pertinent in the context of undertaking a legally compliant avifaunal assessment, is outlined below.

3.1 The Convention on Biological Diversity (CBD), 1993

The Convention on Biological Diversity is the international legal instrument for the conservation of biological biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the utilisation of genetic resources that has been ratified by 196 nations[1]. The overall objective of the CBD is to encourage actions which will lead to a sustainable future. States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. Each contracting party shall, in accordance with its particular conditions and capabilities develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity, and integrate the conservation and sustainable use of biological diversity.

3.2 The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention), 1983

The Convention on Migratory Species (CMS), also known as the Bonn Convention, is an environmental treaty of the United Nations that provides a global platform for the conservation and sustainable use of terrestrial, aquatic and avian migratory animals and their habitats.[2]

Parties that are range states of a migratory species listed as endangered shall endeavour to conserve, and where feasible and appropriate restore the habitats of the species which are of importance in removing the species from danger of extinction, and to prevent, remove, compensate or minimise as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species, and to prevent, reduce or control factors that are endangering or are likely to further endanger the species.

3.3 The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 1999

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[3].

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

[1] www.cbd.int
[2] www.cms.int
[3] Unep-aewa.org

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

AEWA covers migratory waterbirds that are ecologically dependent on wetlands for at least a part of their annual life cycle. These include divers, grebes, pelicans, gannets, cormorants, herons and egrets, storks, ibises and spoonbills, flamingos, ducks, geese and swans, cranes and rails, waders, gulls, terns, skimmers, tropic and frigate birds, auks and the African Penguin.

All AEWA species cross international boundaries during their migrations and require good quality habitat for breeding as well as a network of suitable sites to support their annual journeys. International cooperation across their entire migratory range, as provided by AEWA, is therefore essential for the conservation and management of migratory waterbird populations and the habitats on which they depend.

3.4 Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia

The Signatories agree 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.

3.5 Ramsar Convention on Wetlands of International Importance, Ramsar, 1971

The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

3.6 The Convention on the International trade in Endangered Species of Wild Flora and Fauna, Washington DC, 1973

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

3.7 The Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right – (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that – (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

3.8 National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Act (NEMA) No. 107 of 1998, as amended is the legislative framework that gives effect to the environmental rights in the Constitution and sets out guiding principles that apply to organs of state that may affect the environment. One of the key principles of the NEMA is sustainable development and the precautionary approach. Regulations promulgated in terms of the NEMA that are relevant to this study are detailed below.

3.8.1 Environmental Impact Assessment Regulations, 2014, as amended

The Environmental Impact Assessment (EIA) Regulations 2014, as amended, set out requirements for the appointment of specialists, the general requirements of specialists, and the disqualification of specialists. Appendix 6 of the EIA Regulations, 2014, as amended sets out the Contents of Specialist Reports.

3.8.2 Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of Section 24(5) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation.

On 20 March 2020, in Government Gazette No. 43110 (GN 320) the Minister of Environment, Forestry and Fisheries prescribed general requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum report requirements of environmental impacts for environmental themes for activities requiring environmental authorisations. When the requirements of a protocol apply, they replace the requirements of Appendix 6 of the EIA Regulations, 2014, as amended. The *'Protocol for the Specialists Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifaunal Species by onshore wind generation facilities where the electricity output is 20W or more*.' published in the same gazette therefore applies to the proposed development (hereafter referred to as 'the Avifaunal Protocol').

In addition, on 30 October 2020 the "Protocol for the Specialists Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species" (GN 1150 of 30 October 2020), was published which replaces the requirements of Appendix 6 of the EIA Regulations (hereafter referred to as 'the Animal Species Protocol').

4 Methodology

The methodology for this avifaunal specialist assessment is based on the Avifaunal Protocol (GN 320 of 20 March 2020), and the Animal Species Protocol (GN 1150 of 30 October 2020), and the associated *'South African Best Practice Guidelines for Pre-construction Monitoring at Proposed Wind Energy Facilities'* (Jenkins et al. 2015) *the 'Verreaux's Eagle and Wind Farms Guidelines'* (Ralston-Paton 2017 & Ralston-Paton & Murgatroyd 2021) and the '*Species Environmental Assessment Guidelines' (*SANBI 2022).

4.1 Desktop study

Initially, in March 2020, a desktop feasibility study was undertaken by Holland & Associates for the Applicant for a larger area with a circular radius of 25 km (196 349 ha) surrounding the coordinate point 31°33'24.12"S; 22°54'57.85"E, south-west of Victoria West, in the Northern Cape Province.

The following data sources were used to inform the desktop study and this assessment:

- Vegetation Map of South Africa, Lesotho and Swaziland (South African National Biodiversity Institute (SANBI) 2018);
- Critical Biodiversity Areas of the Northern Cape (Northern Cape Department of Environmental Affairs and Nature Conservation (DENC) 2016);
- National Freshwater Ecosystem Priority Areas (NFEPA);
- Terrestrial Ecosystem Threat Status and Protection Level (SANBI 2018);

- The Department of Forestry, Fisheries and the Environment (DFFE) National Web-based Screening Tool;
- The SA Renewable Energy EIA Applications Database (DFFE 2020 Q1);
- South African Bird Atlas Project 2 (SABAP2) (Brooks and Ryan 2020);
- Important Bird and Biodiversity Areas (Birdlife South Africa);
- The 2015 Eskom Red Data Book of Birds (Taylor et al. 2015);
- The International Union for Red List of Threatened Species (www.iucnredlist.org);
- South Africa Protected Areas Database (DFFE 2020 Q1);
- South African Conservation Areas (DFFE 2020 Q1);
- Publicly available satellite imagery, elevation, and topographical data; and
- Specialist's knowledge and experience in the area.

4.1.1 The Avifaunal Protocol Requirements

An Avifaunal Specialist Assessment is to be undertaken for all sensitivity ratings provided by the Screening Tool for the avian theme for on-shore wind generation facilities.

The requirements of the avifaunal protocol and the reference where this is complied with, is presented in Table 3.

Table 3: Requirements of the Avifaunal Protocol (GN 320 of 20 March 2020)

Avifaunal Specialist Assessment	Details / Reference
The process for undertaking the Avifaunal Impact Assessment comprises of three phases: (a) a reconnaissance study; (b) the preparation of a pre-application avifaunal monitoring plan; and (c) the undertaking of an avifaunal impact assessment and the preparation of a report.	(a) Section 4.2 (b) Section 4.3; Annexure B (c) This report
All tasks of the Avifaunal Specialist Assessment must be undertaken by an avifauna specialist registered with the South African Council for Natural Scientific Professionals (SACNASP).	ANNEXURE A: Specialist Declaration, CV & SACNASP Certificate
All tasks are to be undertaken on the site being submitted as the preferred site and on a control site located in accordance with the latest version of the Bird and Wind- Energy Best -Practice Guideline[4], and must identify: (a) the extent of the impact of the proposed development on priority bird species; and (b) whether the proposed development will have an unacceptable impact on priority or threatened bird species.	Pre-application monitoring was undertaken on the preferred site and a control site (ANNEXURE B: Pre-application and Post-authorisation Avifaunal Monitoring Plan). Section **Error! Reference source not found.**; Annexure B Section 7
The Avifaunal Specialist Assessment must be undertaken based on the results of a site-specific Pre-Application Avifaunal Monitoring Plan that is informed	This assessment was undertaken based on the results of Pre-application Monitoring conducted over four seasons on the preferred site and a

[4] The Best Practice Guidelines for assessing and monitoring the impact of wind energy facilities on birds in Southern Africa is available from: https://www.birdlife.org.za/documents.

by a Reconnaissance Study, as well as data collected over four seasons (i.e. summer, autumn, winter and spring) on the preferred site and the control site.	control site as per the Pre-application Monitoring Plan (ANNEXURE B: Pre-application and Post-authorisation Avifaunal Monitoring Plan), that was informed by a reconnaissance survey and nest survey (Section 4.2).
3. Reconnaissance Study	**Details / Reference**
The Reconnaissance Study is to be based on a desktop study of relevant information as well as a 2 to 4-day on-site inspection of both sites.	Section 4.1 Section 4.2
The occurrence of target species is to be identified, including seasonality of occurrence and migratory patterns of the species.	**Table 12**
The study must define the study area (avifaunal impact zone).	Section **Error! Reference source not found.** Section 4.3
The study is to produce a site-specific Pre-Application Avifaunal Monitoring Plan.	Annexure B: The Pre-application Monitoring Plan
4. Pre-application Avifaunal Monitoring Plan	**Report Section**
4.1. The plan, as a minimum, must include:	
4.1.1. the study area and its characteristics which must be mapped including the extent, habitat, special features including topographical and water features, quarries, drainage lines, known breeding sites, existing uses of land, existing infrastructure such as power lines and roads, and existing operational wind energy facilities within 30km of the site;	ANNEXURE B: Pre-application and Post-authorisation Avifaunal Monitoring Plan Figure 1
4.1.2. target avifaunal species that are likely to occur on the preferred site and for which monitoring is required;	**Table 12** ANNEXURE C: List of Species recorded during Pre-application Avifaunal Monitoring
4.1.3 pre-application monitoring requirements for both the site as well as the control site, that must include the following:	
4.1.3.1. the monitoring intervals including the number and duration of monitoring events which must be based on the latest version of the *BirdLife South Africa Bird and Wind-Energy Best-Practice Guideline* or a motivation provided for the deviation;	ANNEXURE B: Pre-application and Post-authorisation Avifaunal Monitoring Plan
4.1.3.2. the location of monitoring points;	Annexure B: The Pre-application Monitoring Plan Table A
4.1.3.3. aspects to be monitored (for example, bird abundance and flight activity, presence of target species, proportion of flying time each target species spends at turbine rotor height, preferred flight paths, risk of identified target species to collision, areas for specific monitoring if any, etc.);	Annexure B: The Pre-application Monitoring Plan
4.1.3.4. equipment to be used;	Annexure B: The Pre-application Monitoring Plan
4.1.3.5. monitoring methodology for the abundance or activity monitoring and for direct observation or vantage point surveys, the latest version of the *BirdLife*	Annexure B: The Pre-application Monitoring Plan

South Africa Bird and Wind-Energy Best-Practice Guideline must be followed or a motivation provided for the deviation;	
4.1.3.6. numbers of observers to be used; and	Annexure B: The Pre-application Monitoring Plan
4.1.3.7. data to be captured including a pro-forma data capturing template consistent with that envisaged by the national bird monitoring database, once operational.	Annexure B: The Pre-application Monitoring Plan
5. Implementation of the site-specific Pre-Application Avifaunal Monitoring Plan	**Report Section**
5.1. Monitoring according to the plan is to be carded out for a period of not less than four seasons.	Monitoring was conducted in four seasons. Annexure B: The Pre-application Monitoring Plan Table C
5.2. Data on pre -application monitoring must be captured on the national bird monitoring database accessed at https://www.environment.gov.za/birddatabase, once operational.	Not operational
6. Avifaunal Specialist Assessment	**Report Section**
6.1. Based on the outcome of the reconnaissance study and the findings of the preapplication avifaunal monitoring, an Avifaunal Specialist Assessment must be undertaken. The assessment, as a minimum, must include the following aspects:	
6.1.1. discussion on bird abundance and movement within the site;	Section **Error! Reference source not found.**
6.1.2. discussion on presence of target or threatened species and their occurrence on the site at heights which could pose risks to collision;	Table 12
6.1.3. assessment of risk of identified target species to collision including the expected fatality rates of the target species based on a suitable model commonly used for risk determination, per species and for the site;	Annexure D: Verreaux's Eagle Risk Assessment Model Section 4.4.1 Section 7
6.1.4. identification and mapping where relevant, of any migratory or preferential bird routes or corridors;	Figure 2
6.1.5. where relevant, discussion on the risk of displacement;	Section 6.1.1 Section 6.1.2
6.1.6. where relevant, areas identified within the site as having a very high sensitivity for bird collision or displacement and in which the development of turbines should be avoided. These areas are to be mapped;	Figure 3
6.1.7. in areas where existing operational wind energy generation facilities have been identified within a 30 km radius, a cumulative impact assessment must be undertaken which includes:	
6.1.7.1. the fatality rates for target species at the wind energy generation facilities within a 10 km radius;	n/a
6.1.7.2. the possible additional fatalities from the proposed wind energy generation facility for target species as well as general avifaunal species; and	Section 5.3

6.1.7.3. a discussion on the possible cumulative impact of the proposed facility on regional populations of target species;	Section 6.1.6
6.1.8. where no existing operating wind energy generation facilities occur within the 10km radius, the specialist must include a discussion on possible cumulative impacts on target species from the proposed facility; and	Section 6.1.6
6.1.9. a plan for post construction monitoring (on both the preferred site as well as the control site) and reporting, which must include:	Annexure B
6.1.9.1. timeframes and intervals for monitoring;	Annexure B
6.1.9.2. number of turbines to be monitored, including any specific area for monitoring;	Annexure B
6.1.9.3. methodology for searcher efficiency and scavenger removal;	Annexure B
6.1.9.4. method for monitoring, i.e. transects or radial as well as extent of monitoring area;	Annexure B
6.1.9.5. results of monitoring compared against expected fatality rates per target species as well as general species;	Annexure B
6.1.9.6. reporting requirements, including organisations for submission of reports;	Annexure B
6.1.9.7. years and intervals for monitoring to occur; and	Annexure B
6.1.9.8. all methods used to estimate bird numbers and movements during reconnaissance and pre-application monitoring, which should be applied in exactly the same order to ensure the comparability of these two data sets.	Annexure B
6.2. The findings of the Avifaunal Specialist Assessment must be written up in an Avifaunal Specialist Assessment Report that contains as a minimum the following information:	
6.2.1. the SACNASP registration number of the avifauna) specialist preparing the assessment and their curriculum vitae;	Annexure A
6.2.2. a signed statement of independence by the specialist;	Annexure A
6.2.3. a description of the study area including a map of all the aspects identified in the duration, dates and seasons of the site investigation and the relevance of the season to the outcome of the assessment;	Annexure B
6.2.4. the outcome of the reconnaissance study and the resultant site specific pre-application avifaunal monitoring;	Section 4.3 Annexure B
6.2.5. a description of the methodology used to undertake the site specific pre-application avifaunal monitoring program inclusive of the equipment used;	Annexure B
6.2.6. a map showing the Global Positioning System (GPS) coordinates for each of the monitoring points for both the preferred site as well as the control site;	Figure 1

6.2.7. the monitoring intervals for both sites;	Annexure B
6.2.8. where relevant, a map showing the areas to be avoided;	Figure 3
6.2.9. fatality prediction for target species and general species on the preferred site;	Section 4.4.1 Section 7 Annexure D: Verreaux's Eagle Risk Assessment Model
6.2.10. a map showing the existing renewable energy facilities within a 10km radius of the proposed development;	No existing renewable energy facilities within 30 km.
6.2.11. where relevant, the outcomes of the cumulative impact assessment;	Section 6.1.6
6.2.12. a discussion based on the pre-application monitoring of the expected impact of the proposed development on avifauna! species;	Section 7
6.2.13. a substantiated statement from the avifauna specialist, indicating the acceptability or not of the proposed development and a recommendation on the approval, or not, of the proposed development;	Section 7
6.2.14. any conditions to which this statement is subjected;	Section 7
6.2.15. a detailed post construction monitoring programme;	Annexure B
6.2.16. the outcomes of the post -construction monitoring, including data and specialists reports, must be uploaded onto the national bird monitoring database, to be accessed at https://www.environment.gov.za/birddatabase, once operational;	Not operational
6.2.17. where required, proposed mitigation measures or any monitoring requirements for inclusion in the Environmental Management Programme (EMPr); and	Section 7
6.2.18. a description of the assumptions made and any uncertainties or gaps in knowledge or data.	Section 4.7
6.3. The findings of the Avifaunal Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr.	EAP to complete
6.4. A signed copy of the Avifaunal Specialist Assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	Annexure A EAP to append

4.1.2 The Animal Species Protocol Requirements

The Screening Tool Report identified the area as of high sensitivity for the avian species of conservation concern (SCC) Ludwig's Bustard (*Neotis ludwigii*), and Verreaux's Eagle (*Aquila verreauxii*), in terms of the terrestrial animal species theme.

Therefore, according to the Screening Tool Report an avian impact assessment and animal species assessment (for the avian species Ludwig's Bustard and Verreauxs' Eagle) is required.

According to the animal species protocol a Terrestrial Animal Species Specialist Assessment must be conducted by a specialist registered with SACNASP with a field of practice relevant to the taxonomic group (in this case Aves – Birds), for which the assessment is being undertaken. The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline (SANBI 2022). The requirements of the Animal Species Protocol and the reference where this is complied with in this report is presented in Table 4.

Table 4: Terrestrial Species Protocol Assessment Report Content Requirements (as per GN 1150 of 30 October 2020)

Clause	Requirement	Report
3.1.1	Contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae	Annexure A
3.1.2	A signed statement of independence by the specialist	Annexure A
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment	Annexure B
3.1.4	A description of the methodology used to undertake the site sensitivity verification, impact assessment and site inspection, including equipment and modelling used where relevant	Annexure F
3.1.5	A description of the mean density of observations/number of sample sites per unit area and the site inspection observations	Annexure B
3.1.6	A description of the assumptions made and any uncertainties or gaps in knowledge or data	Section 4.7
3.1.7	Details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported	Section 5.5 Annexure C
3.1.8	The online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area	Birdlasser /SABAP2
3.1.9	The location of areas not suitable for development and to be avoided during construction where relevant	Figure 3
3.1.10	A discussion of the cumulative impacts	Section 6.1.6
3.1.11	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr)	Table 20
3.1.12	A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant	Section 7
3.1.13	A motivation must be provided if there were any development footprints identified as per paragraph 3.2.12 above that were identified as having	N/A

	"low" or "medium" terrestrial animal species sensitivity and were not considered appropriate	

4.2 Reconnaissance Study, Site inspection and Raptor Nest Survey

Following the recommendations of the desktop study, the Applicant appointed Holland & Associates Environmental Consultants (H&A) to conduct a specialist raptor nest survey and site visit for a revised, smaller Area of Interest (AOI) with an extent of 27 471 ha, which excluded most areas of high sensitivity identified at a desktop level in the larger area. Based on the results at a desk-top level this survey area was expected to be of lower ecological sensitivity within the region, and the raptor nest survey and site visit would determine exclusion areas and nest buffers to inform the determination of an AOI potentially suitable for wind energy facility development, and the way forward.

The raptor nest survey area was determined as the AOI with a 7 km buffer, as per the Verreaux's Eagle and Wind Energy Guidelines current at the time (Ralston-Paton 2017) and was visited by the avifaunal specialist and a senior avifaunal observer from 29 July to 3 August 2020, during the large raptor breeding season. The results of the desktop study were used to identify areas of potential raptor breeding activity in advance within the raptor nest survey area. This included cliffs, rocky ridges, transmission lines and stands of large trees. All areas identified at a desktop level were visited during the raptor nest survey. In addition, areas found potentially suitable whilst traversing the site were also searched.

15 Verreauxs' Eagle nest locations were used to run the Verreauxs' Eagle Risk Assessment (VERA) model which identifies areas of high, medium and low risk of collisions for Verreaux's Eagles with wind turbines (Annexure D). The AOI was then revised using the results of this model, and the results of the reconnaissance and desktop surveys. The resulting proposed initial AOI for pre-application monitoring for the Soutrivier WEFs avoided all areas of high and medium collision risk as identified by the VERA model and had an extent 23 282 ha (Figure 1).

4.3 Summary of the Pre-application Avifaunal Monitoring Plan

The Pre-application Avifaunal Monitoring Plan (Annexure B) for the proposed Soutrivier WEFs was compiled by the avifaunal specialist following the reconnaissance study, site inspection and raptor nest survey and was conducted in line with the South African Best Practice Guidelines for pre-construction bird monitoring at proposed wind energy facilities applicable at the time of the survey ((Jenkins et al. 2015[5]) and the Verreaux's Eagle Guidelines (Ralston-Paton 2017)[6]).

The Pre-application Avifaunal Monitoring Plan was updated throughout the survey period in response to changes in scope. Four seasonal surveys were conducted by a team of four avifaunal observers, and consisting of vantage point (VP) surveys, walked transects, driven transects, incidental observations and checklist surveys. Details of the conducted surveys, including coordinates of sampling locations, sampling dates and sampling times, are presented in the Pre-application Avifaunal Monitoring Plan attached as ANNEXURE B: Pre-application and Post-authorisation Avifaunal Monitoring Plan

[5] Jenkins AR, van Rooyen CS, Smallie, JJ, Harrison JA, Diamond M, Smit-Robinson HA & Paton S. *Birds and Wind-Energy Best-Practice Guidelines*. Third Edition, 2015. Birdlife South Africa / Endangered Wildlife Trust
[6] BirdLife SA, 2017. *Verreauxs' Eagle and Wind Farms-Guidelines for impact assessment, monitoring and mitigation*.

During the first and second seasonal survey fourteen vantage points (VPs) were surveyed in the AOI and two VPs were established on a Control Site (Figure 1). Each AOI area VP was surveyed for a total of 18 hours per season, in 3-hour sessions on different days, at different times of day, where practically possible, in order to get as wide a spread of environmental conditions as possible. Control VPs were sampled for a total of 12 hours per season each.

Three large raptor nests were located during the pre-application monitoring winter survey (the second of four surveys), that had not been located previously. As these nests require buffers which exclude a large area of the initially surveyed AOI from turbine placement, the AOI was reduced and monitoring for the following two seasons was conducted on only 10 of the initial 14 VPs in the AOI area, reducing the AOI for the Soutrivier WEFs further to 15 551 ha (Figure 1).

4.3.1 Fatality rates and collision risk

According to the applicable protocol the avifaunal specialist assessment must include an '*assessment of risk of identified target species to collision <u>including the expected fatality rates</u> of the target species based on a suitable model commonly used for risk determination, per species and for the site'.*

In order to estimate fatality rates with an acceptable level of confidence a collision risk model (CRM) such as the Band model (Band et al. 2007), among others (refer to Masden & Cook 2016 for a summary) are commonly used in countries in North America, Europe and the United Kingdom. CRMs require much data, including data on flight paths, flight heights, the duration spent at each specific height, details on the specific species flight behaviour, avoidance behaviour, the average body length of the species, and it's expected flight speed, in addition to details of the proposed turbine spinning speed, rotor swept area and time of expected operation (as a minimum). In order to obtain reliable data, satellite tracking or radar tracking data have been collected in countries where CRM is commonly used (such as Desholm 2006, Harvey et al. 2018), with the aim of increasing the confidence in the predicted fatality rates. These studies have also shown that other factors such as seasonal and daily variations, wind speed and direction, age and status of the bird play a role in fatality rate estimates (Masden & Cook 2016, May et al. 2011)

Collision risk models such as the most commonly used Band model are very sensitive to the avoidance behaviour of the investigated species, which is a value for which no data exists for South African species. Small variations in avoidance rates result in relatively large changes in predicted collisions, so that errors in avoidance rate estimation can have large impacts on estimated fatality rates (Chamberlain et al. 2006). A pre-cautionary approach implemented in the United Kingdom (Scottish Natural Heritage 2018) is to use a conservative avoidance rate of 98% for species for which no avoidance rate has been measured. However, several studies comparing the Band model predictions using a 98% avoidance rate with mortalities observed at operational wind farms have shown actual avoidance rates of 99.2% for Red Kite (Urquhart & Whitfield 2016) and 99.3% for Golden Eagle (Whitfield 2009), resulting in a two-fold overestimation of fatality rates by the Band model (2007) using a 98% avoidance rate. Contrarily, the Scottish Natural Heritage recommendation for White-tailed Eagle and Kestrel is an avoidance rate of 95% based on evidence from flight behaviour and collision monitoring studies. Therefore, using an avoidance rate of 98% would result in a significant underestimation of fatality rates for these species. The confidence in CRM models for species for which no avoidance rate has been measured is therefore low. In addition, no data on flying speeds are available for priority species in South

Africa, and a number of assumptions have to be made that can influence the outcome of the model to a significant degree.

Another method that has been used to estimate fatality rates is the crude extrapolation of observed passage rates, to the turbine area, and daylight hours, making a number of further assumptions, in addition to the estimation of avoidance rates, resulting in a fatality rate with a very low confidence.

While the use of CRM and crude estimation of fatality rates can be useful for comparative purposes, and may indicate a potential 'worst-case scenario', research has shown that mortality by collisions is influenced by other factors than flight activity levels which forms the basis of CRM, and these factors are easily ignored in an impact assessment if a fatality rate has been calculated based on activity levels alone (Smallwood & Thelander 2004, Marques et al. 2014).

For comparisons to be drawn between sites without species-specific and state-specific data (ie different bird activities and behaviours under a range of conditions, for example breeding birds, recently fledged or moulting birds), this would be dependent on evidence that potential sites being compared can be assumed to have equal avoidance rates (Chamberlain et al. 2006).

The latest Verreaux's Eagle and Wind Energy guidelines (Ralston-Paton & Murgatroyd 2021) state in this regard: *'Collision risk models make a number of assumptions, including predictions of species-specific bird behaviour (Madders & Whitfield, 2006). They assume that the risk of collisions increases with flight activity and bird abundance, although evidence to support this assumption is equivocal (Gove et al., 2013). While these models may be useful for comparing the relative risk of alternative sites and layouts, literature verifying fatality rate predictions for eagles is limited. Collision risk modelling is only likely to yield meaningful results if adequate data has been collected (e.g. data collection has been extended to two years), and if assumptions are clearly outlined and tested.'*

Since only one year of monitoring was conducted in line with the Verreaux's Eagle and Wind Energy Guidelines (2017 and 2021) for the Soutrivier WEFs and only one site and layout alternative are assessed in this report, any calculation of fatality rates is not deemed appropriate for this project in line with the current Best Practice Guidelines. No avoidance rate data exists and there is no CRM that has been tested against actual post-construction mortality data in South Africa to date. The calculation of fatality rates for priority species would produce potentially misleading numbers, with a low to very low confidence, rendering the fatality rate meaningless to the specialist in terms of the impact assessment methodology used in this impact assessment process that is the subject of this report.

The best available science in South Africa with regards to predicting the collision risk of a specific species is currently the tested and peer-reviewed Verreaux's Eagle Risk Assessment (VERA) model which predicts the collision risk of resident adult Verreaux's Eagles using the location and distribution of Verreaux's Eagle nests, topographic slope, elevation and distance to slope. While similar models are currently being developed for other species it is currently only available and tested for Verreaux's Eagle. Verreaux's Eagle was determined as one of the species at most risk from proposed wind energy developments in this area. Therefore, the VERA model was run for the study area using 15 Verreaux's Eagle nest locations following a dedicated specialist raptor nest survey prior to site selection. All areas identified by the VERA as of medium and high risk of collision were excluded from the development footprint as avoidance mitigation. The full methodology and results of the VERA model are presented in Annexure D.

The residual collision risk to Verreaux's Eagle and all other priority species, was then assessed qualitatively, informed by the results of the specialist nest survey, one year of pre-application monitoring survey data, topography and other site characteristics, as per the impact assessment methodology described below in Section 4.6 and Annexure E.

4.4 Determining Site Ecological Importance (SEI)

As per the Species Assessment guidelines (SANBI 2022), the Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the Impact Receptor (i.e., SCC or habitat of the SCC) and its resilience to impacts (Receptor Resilience, RR):

SEI = BI + RR (Table 2)

Table 5: Calculation of Site Ecological Importance (SANBI 2021)

Site Ecological Importance		**Biodiversity importance**				
		Very high	High	Medium	Low	Very low
Receptor resilience	Very low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very high	Medium	Low	Very low	Very low	Very low

Biodiversity importance in turn is a function of conservation importance (CI) and functional integrity (FI):

BI = CI + FI (Table 3)

Table 6: Calculation of Biodiversity Importance (SANBI 2021)

Biodiversity Importance		**Conservation importance**				
		Very high	High	Medium	Low	Very low
Functional Integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

4.4.1 Conservation Importance

Conservation importance is defined here as: *'The importance of a site for supporting biodiversity features of conservation concern present, e.g. populations of IUCN threatened and Near-threatened species (CR, EN, VU and NT), Rare species, range-restricted species, globally* *significant populations of congregatory species, and areas of threatened ecosystem types, through predominantly natural processes.'* (Table 7).

Table 7: Conservation Importance Criteria as per Species Assessment Guidelines (SANBI 2021)

Conservation Importance	Fulfilling Criteria
Very high	Confirmed or highly likely occurrence of CR, EN, VU, or Extremely Rare or Critically Rare species that have a global EOO (Extent of Occurrence) of <10 $km^{2.}$ Any area of natural habitat of a CR ecosystem type or large area (>0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type. Globally significant populations of congregatory species (>10% of global population).
High	Confirmed of highly likely occurrence of CR, EN, VU species that have a global EOO of >10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any Criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or <10 000 mature individuals remaining. Small area (>0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (>0.1%) of natural habitat of VU ecosystem type. Presence of Rare species. Globally significant populations of congregatory species (>1% but <10% of global population).
Medium	Confirmed or highly likely occurrence of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals. Any area of natural habitat of threatened ecosystems type with status of VU. Presence of range-restricted species. >50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed of highly likely populations of SCC. No confirmed or highly likely populations of range-restricted species. <50% of receptor contains natural habitat with limited potential to support SCC.
Very low	No confirmed and highly unlikely populations of SCC. No confirmed and highly unlikely populations of range-restricted species. No natural habitat remaining.

4.4.2 Functional Integrity

Functional integrity (FI) of the receptor is defined here as the receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions. Simply stated, FI is: *'A measure of the ecological condition of the impact receptor as determined by its remaining intact and functional area, its connectivity to other natural areas and the degree of current persistent ecological impacts.'* (Table 8).

Table 8: Functional Integrity Criteria as per Species Assessment Guidelines (SANBI 2021)

Functional integrity	Fulfilling Criteria
Very high	Very large (>100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types. High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.

Functional integrity	Fulfilling Criteria
	No or minimal current negative ecological impacts with no signs of major past disturbances (e.g. ploughing)
High	Large (>20 ha but < 100 ha) intact area for any conservation status of ecosystem type or >10 ha for EN ecosystem types.
Medium	Medium (> 4 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types. Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches. Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (>1 ha but < 5 ha) area. Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy road network surrounds the area. Low rehabilitation potential.
Very low	Very small (<1 ha) area. No habitat connectivity except for flying species or flora with wind-dispersed seeds. Several major current negative ecological impacts

4.4.3 Receptor Resilience

Receptor resilience (RR) is defined here as*: "The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention'.* (Table 9)

Table 9: Receptor Resilience Criteria as per Species Assessment Guidelines (SANBI 2021)

Resilience	Fulfilling Criteria
Very high	Habitat that can recover rapidly (~ less than 5 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.

Resilience	Fulfilling Criteria
Very low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

4.4.4 Interpretation of Site Ecological Importance

Site Ecological Importance should be described in the above manner for each impact receptor within the PAOI and clearly mapped in relation to development activities and infrastructure, and interpreted in the context of the proposed development activities (Table 10).

Table 10: SANBI (2022) Guidelines for the Interpretation of Site Ecological Importance

SEI	Interpretation in relation to proposed development activities
	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

4.5 Avifaunal Sensitivity Mapping

Following the final pre-application monitoring seasonal survey, a sensitivity map was produced, informed by the results of pre-application monitoring, in order to inform turbine placement (Figure 3). The following features were considered in the sensitivity map:

- Priority Species nests and roosts;
- NFEPA rivers and wetlands by 200 m;
- Ridges and steep slopes;
- VERA results; and
- Areas of high priority species flight activity.

4.6 Impact Assessment Methodology

Potential impacts on avifauna were first identified through a literature review and desktop study, and further informed by site surveys conducted between July 2020 and October 2022. Impacts were then assessed using an impact assessment methodology supplied by the EAP (refer to Annexure E). For each impact, the nature (positive/negative), type of impact, extent (spatial scale), duration (time scale), probability and severity or benefits is ranked and described. These criteria are used to ascertain the significance of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place (Annexure E).

Mitigation measures applied and recommended followed the mitigation hierarchy by first applying avoidance mechanisms, then minimizing residual impacts, and determining if the residual impact is acceptable and the project should be authorised. Rectification, reduction and offsets should only be considered if the residual impact is found to be unacceptable post-authorisation despite, and not as part of the application for authorisation.

Cumulative impacts were assessed for past, existing and proposed projects within a 30 km radius of the project. According to the South African Database for Renewable Energy EIA Applications (2022 Q2) no projects are located within 30 km of the proposed WEF. It is however known that besides the three Soutrivier WEFs and three associated other overhead power lines (OHPL) the Developer has also applied for Environmental Authorisation (EA) for the Taaibos North WEF and Taaibos South WEF, and their two associated OHPLs which are undergoing a separate EA process. In addition, the developer is also planning to apply for EA for four solar photovoltaic facilities (Soutrivier Solar PV) within the original Soutrivier AOI, for which avifaunal pre-application monitoring has been conducted by this specialist. The cumulative assessment therefore is for the combined impacts of the proposed Soutrivier North WEF, Soutrivier Central WEF, Soutrivier South WEF, Soutrivier Solar PV Facilities, Taaibos North WEF, Taaibos South WEF and their associated OHPL grid connections.

4.7 Assumptions & Limitations

It is assumed that all information provided by the Applicant and EAP is correct and true.

This report is based on baseline data collected during a nest survey in July 2020 and four seasons of avifaunal pre-application monitoring for wind energy facilities in line with Best Practice and Verreaux's Eagle guidelines from March 2021 – January 2022. The timings of the surveys are deemed as ideal, however inter-annual variations are not accounted for. The survey was conducted at the end of a drought period. The area experienced uncharacteristic rains in the third and particularly the fourth survey, with increased rain throughout 2022, and the avifauna is likely to change in response to this. A precautionary approach was therefore used in the assessment of impacts.

A precautionary approach was taken in the analysis and interpretation of data. All flights recorded at heights between 20 and 300 m were considered to be potentially at risk height in order to take observer error into account, as well as future changes in turbine design. If height was not recorded, the flight was assumed to be at risk height in the analysis of data.

All unidentified species recorded on Vantage Points were assumed to be Priority Species and included in the calculations of overall passage rates of priority species.

Avifaunal monitoring is prone to observer bias, in particular when estimating heights and distances. The recorded flight maps and resulting maps are therefore considered to be estimates of the location and not accurate recordings. Observer skills also vary particularly in the identification of small passerine species. Therefore, in the interpretation of the data more emphasis was placed on overall abundance recorded on walked transects, than on the species and number of species recorded.

As birds are mobile, with some species occupying large territories, migrating, or ranging widely, the assessment assumes that any bird recorded during pre-application monitoring in the wider study area could potentially occur at any of the three proposed WEFs from time to time. If the bird was not recorded in the area of a particular WEF, then a low probability of occurrence was assumed for that WEF (and not zero).

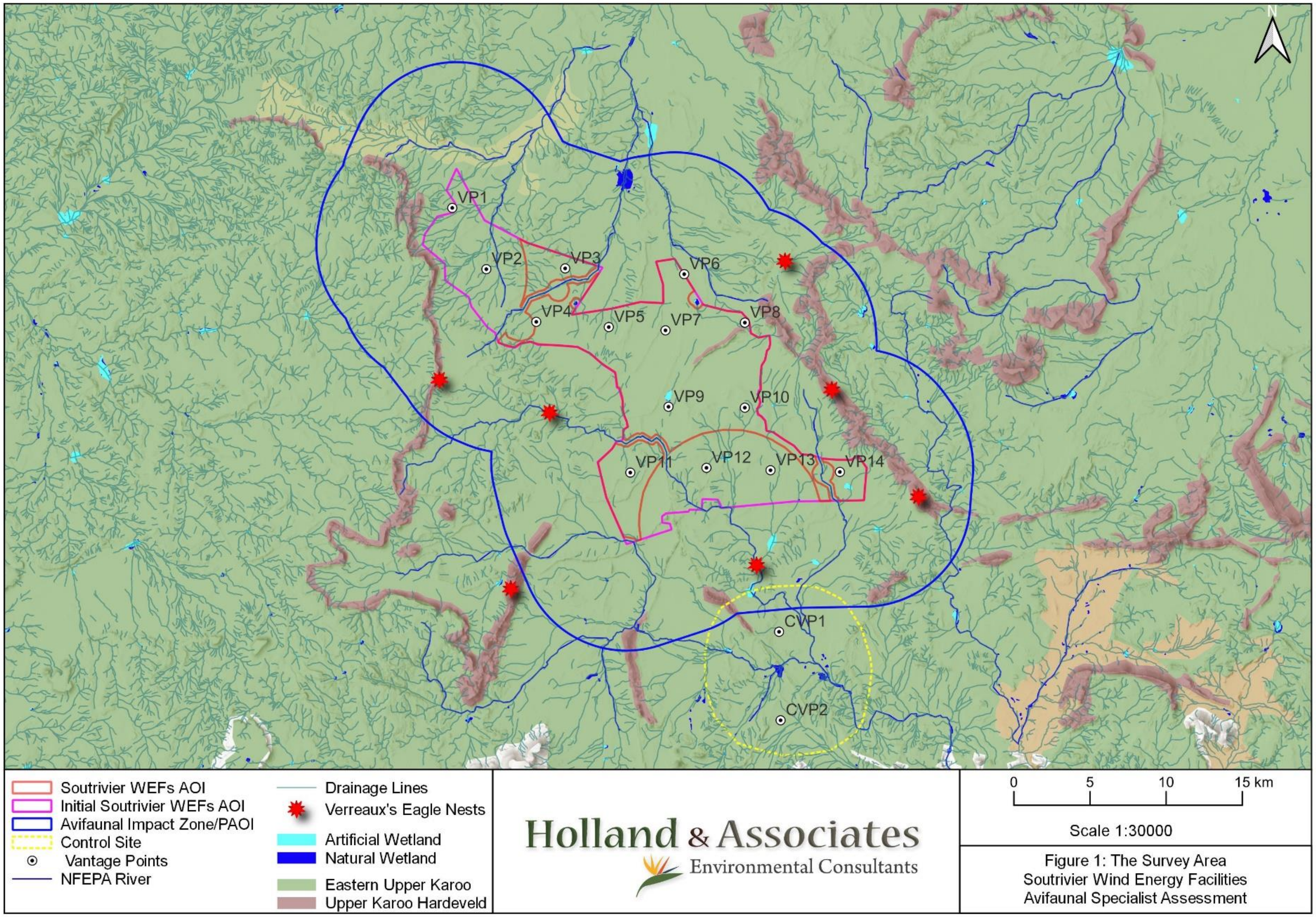


Figure 1: The Survey Area Soutrivier WEFs

5 The Baseline Avifaunal Environment

5.1 The Regional Context

The proposed Soutrivier Central WEF is located approximately 40 km south-west of the town of Victoria West and 35 km south-east of the town of Loxton, in the Ubuntu Local Municipality within the Pixley ka Seme District, in the Northern Cape Province. The site falls within the Nama-Karoo Biome and Upper Karoo Bioregion. The closest Important Bird Area and Protected Area to the project is the Karoo National Park located approximately 70 km south-west of the site (Figure 1).

The region went through a decade long drought period which broke during the course of the pre-application monitoring, with high rainfall events in October, November and particularly December 2021 taking place.

5.2 The Project Area of Influence / The Local Context

The project area of influence (PAOI) / avifaunal impact zone is considered to be an area of 7 km surrounding the proposed turbine areas for the combined Soutrivier North, Central and South WEFs (the study area). The climate of the PAOI is semi-arid with rainfall of an average of 200 – 400 mm per annum occurring mainly in late summer to autumn. Temperatures range from approximately -8°C to +37°C. The topography of the region can be described as lowlands with mountains, i.e., the terrain is generally flat, interrupted with prominent mountains. The majority of the proposed WEF site lies within lowlands and avoids the mountainous areas which are suitable for cliff-nesting raptors. The study area is utilised for low-intensity livestock grazing (mainly sheep farming). There is a minimal amount of development in the study area, with buildings consisting only of scattered and isolated farmsteads.

The study area does not contain any formal protected areas (SAPAD Q4, 2019), conservation areas (SACAD Q4, 2019) or Important Bird Areas (Marnewick *et al.* 2015). The closest Important Bird Area to the site is the Karoo National Park which is located approximately 50 km to the south-west of the site. This is also the closest national protected area to the site.

The PAOI site falls within the Nama Karoo Biome and the mapped vegetation types (SANBI, 2018) are the Eastern Upper Karoo vegetation type, and a small section of Upper Karoo Hardeveld (Figure 1). The threat status of the two mapped vegetation types is that of *Least Concern* (SANBI, 2018).

There are four NFEPA rivers running through the study area, and a number of drainage lines in the northern and southern sections of the site, with a marked absence of aquatic features in the central area of the site (Figure 1). A few small natural and artificial wetlands are mapped within the site (NFEPA wetlands database).

5.3 Avifaunal Habitats

Five avifaunal habitat types were identified in the PAOI: Karoo scrub, drainage lines and watercourses, farm dams, rocky ridges and cliffs, and alien trees and buildings.

5.3.1 Karoo scrub

This is a relatively uniform habitat in terms of plant species composition and abundance, and dominated by a small number of grass and fern species. This type of habitat supports several Species of Conservation Concern (SCC), including the SCC recorded in the study area Blue Crane (*Near-threatened*), Karoo Korhaan (*Near-threatened*), Lanner Falcon (*Vulnerable*), Ludwig's Bustard (*Endangered*), Martial Eagle (Endangered), Secretarybird (*Endangered*) and Verreaux's Eagle (*Vulnerable*). Several endemic and near-endemic passerine species also occur here, such as Large-billed Lark, Karoo Eremomela, Karoo Lark, Karoo Prinia, Namaqua Warbler, Sickle-winged Chat and Pied Starling. The majority of the AOI consists of this habitat

5.3.2 Drainage lines and watercourses

Drainage lines and watercourses are characterised by taller riparian vegetation with small trees, than the surrounding karoo scrub areas, and generally support a higher avifaunal abundance and diversity than the surrounding areas. The SCC listed above for karoo scrub habitat may also occur here occasionally, but this habitat is more likely to be frequented by smaller passerine species. Endemic and near-endemic species recorded in the PAOI that prefer this habitat include Cape Weaver, Cape White-eye, Fiscal Flycatcher, Grey Tit and Southern Double-collared Sunbird.

5.3.3 Farm dams and drainage lines

The PAOI includes several artificial NFEPA wetlands (farm dams), which when full can attract a variety of waterfowl and water-associated birds including the SCC Blue Crane (*Vulnerable*) that prefers to breed and roost near waterbodies. Most dams were found to be dry during the nest survey and all pre-application monitoring survey.

5.3.4 Rocky ridges and cliffs

The PAOI contains rocky ridges and cliffs which are potentially a foraging habitat for raptors including the SCC Verreaux's Eagle (*Vulnerable*), and a variety of smaller raptors. Steeper cliffs are an important breeding habitat for many species of raptors, including Martial Eagle, Verreaux's Eagle, Booted Eagle, Jackal Buzzard, Peregrine Falcon, and Rock Kestrel.

5.3.5 Alien trees and buildings

The PAOI contains several stands of alien trees such as conifer, eucalyptus, poplar and willow trees that provide a suitable roosting and nesting substrate for a variety of avian species, including large raptors such as Martial Eagle (*Endangered*) and Verreaux's Eagle (*Vulnerable*), otherwise unavailable in the area.

5.4 Site Ecological Importance

The calculation of the Site Ecological Importance is presented in Table 11. Four avifaunal habitat types were identified on the proposed development footprint: Karoo scrub, drainage lines and watercourses, rocky areas, dams and wetlands, and cultivated areas.

The Conservation Importance (CI) for karoo scrub, rocky ridges, and drainage lines was determined as medium due to more than 50% of the receptor containing natural habitat with potential to support SCC (Table 7). Dams were rated as low CI for the assessment corridor as no confirmed or highly likely populations of SCC occur, and <50% of the receptor contains natural habitat that can support SCC.

The Functional Integrity of the karoo scrub, drainage lines, and rocky ridges has been rated as high as the vegetation is semi-intact and has been utilised for sheep grazing for decades, but there is high habitat connectivity, limited road networks, and no signs of major past disturbance such as ploughing apparent. Dams were rated as low due to their small size or low rehabilitation potential (Table 8).

The Receptor Resilience of the karoo scrub, drainage line and rocky ridges habitat has been rated as medium as a recovery to restore >75% of functionality is assumed to be slow, but possible with rehabilitation, over more than 10 years. It was rated as very high for dams as these are artificial habitats that can be restored readily (Table 9).

The resulting Site Ecological Importance (SEI) rating was determined as medium for karoo scrub, drainage lines and rocky ridges (Table 11), which means with minimisation and restoration mitigation development activities with medium impact are acceptable if followed by appropriate restoration activities (Table 10). The SEI for dams was determined as very low.

Table 11: Calculation of Site Ecological Importance

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor resilience	Site Ecological Importance
Karoo scrub	Medium	High	Medium	Medium	Medium
Drainage lines	Medium	High	Medium	Medium	Medium
Rocky ridges	Medium	High	Medium	Medium	Medium
Dams	Low	Low	Low	Very high	Very low
Alien trees	Low	Low	Low	Medium	Low

The combined SEI is the highest rating, i.e., medium for the proposed development as a whole.

5.5 Summary of Pre-application Monitoring Results

SAPAP2 has recorded a total of 185 species in the study area, of which 13 are regional Red List species (Taylor et al. 2015), 24 are endemic or near-endemic, and 25 are priority species for wind energy developments (Retief et al. 2014). The potentially occurring Red List species are Ludwig's Bustard (*Endangered*), Black Harrier (*Endangered*), Martial Eagle (*Endangered*), African Rock Pipit (*Near-threatened*), Double-banded Courser (*Near-threatened*), Marabou Stork (*Near-threatened*), Karoo Korhaan (*Near-Threatened*), Greater Flamingo (*Near-threatened*), Lesser Flamingo *(Near-threatened*), Maccoa Duck (*Near-Threatened*), Blue Crane (*Near-Threatened*), Verreauxs' Eagle (*Vulnerable*) and Secretarybird (*Vulnerable).*

During pre-application monitoring a total of 121 species of birds were recorded within the study area (Annexure C). Of these, ten are Species of Conservation Concern (SCC), 21 are considered Wind Energy Facility Priority Species (Retief et al. 2014), and 17 are endemic or near-endemic (Table 12).

Table 12: Species of Conservation Concern, Priority Species and near-endemic species recorded in the study area

Full Name	*Scientific Name*	Red Data Status (Regional[7], Global[8])	Endemic[9]	WEF Priority Score	Migratory status[10]	Risk of turbine collision	Risk of displace-ment	Risk of powerline collisions
Black Stork	*Ciconia nigra*	VU, LC		330	Resident & nomadic	x	x	x
Ludwig's Bustard	*Neotis ludwigii*	EN, EN		320	Resident, nomadic & partial migrant	x	x	x
Tawny Eagle	*Aquila rapax*	EN, VU		290	Resident with local movements	x	x	x
Martial Eagle	*Polemaetus bellicosus*	EN, VU		350	Mostly resident, but adults and & immatures disperse widely	x	x	x
Karoo Korhaan	*Eupodotis vigorsii*	NT, LC		240	Sedentary resident		x	x
Blue Crane	*Grus paradisea*	NT, VU		320	Resident & locally nomadic	x	x	x
Burchell's Courser	*Cursorius rufus*	VU, LC		210	Nomadic & local migrant		x	
Lanner Falcon	*Falco biarmicus*	VU, LC		300	Resident, partial and facultative migrant	x	x	x
Verreaux's Eagle	*Aquila verreauxii*	VU, LC		360	Resident adults, wandering juveniles & immatures	x	x	x
Secretarybird	*Sagittarius serpentarius*	VU, EN		320	Non-sedentary resident, nomadic	x	x	x
Spotted Eagle-Owl	*Bubo africanus*			170	Resident	x	x	x
Greater Kestrel	*Falco rupicoloides*			174	Sedentary resident with local movements	x	x	x
Lesser Kestrel	*Falco naumanni*			214	Palaearctic-breeding migrant (summer visitor)	x	x	x
Northern Black Korhaan	*Afrotis afraoides*			180	Sedentary resident	x	x	x
Grey-winged Francolin	*Scleroptila afra*		SLS	190	Resident	x	x	x

[7] Taylor et al (2015)
[8] iucnredlist.org
[9] E = Endemic; NE = Near-endemic; SLS = South Africa, Lesotho, Swaziland
[10] Hockey et al. 2005.

Full Name	***Scientific Name***	**Red Data Status (Regional[7], Global[8])**	**Endemic[9]**	**WEF Priority Score**	**Migratory status[10]**	**Risk of turbine collision**	**Risk of displace-ment**	**Risk of powerline collisions**
African Harrier-Hawk	*Polyboroides typus*			190	Sedentary resident & nomadic	x	x	x
Pale Chanting Goshawk	*Melierax canorus*			200	Sedentary resident	x	x	x
Double-banded Courser	*Rhinoptilus africanus*			204	Resident		x	
Common (Steppe) Buzzard	*Buteo buteo*			210	Palaearctic breeding migrant (summer visitor)	x	x	x
Booted Eagle	*Hieraaetus pennatus*			230	Intra-African migrant (few overwintering) population and Palaearctic non-breeding migratory population	x	x	x
Jackal Buzzard	*Buteo rufofuscus*		NE	250	Largely sedentary resident	x	x	x
African Fish Eagle	*Haliaeetus vocifer*			290	Largely sedentary resident	x	x	x
Black-eared Sparrow-Lark	*Eremopterix australis*		NE		Nomadic in response to rainfall		x	
Cape Weaver	*Ploceus capensis*		NE		Sedentary resident with some local movements		x	
Cape White-eye	*Zosterops virens*		NE		Mostly sedentary resident.		x	
Fairy Flycatcher	*Stenostira scita*		NE		Sedentary resident or altitudinal migrant.		x	
Fiscal Flycatcher	*Melaeornis silens*		NE		Sedentary resident or altitudinal migrant.		x	
Grey Tit	*Melaniparus afer*		NE		Resident, locally nomadic		x	
Karoo Eremomela	*Eremomela gregalis*		NE		Resident		x	
Karoo Lark	*Calendulauda albescens*		NE		Mostly sedentary, may be locally nomadic		x	
Karoo Prinia	*Prinia maculosa*		NE		Resident, some local movements		x	

Full Name	***Scientific Name***	**Red Data Status (Regional[7], Global[8])**	**Endemic[9]**	**WEF Priority Score**	**Migratory status[10]**	**Risk of turbine collision**	**Risk of displace-ment**	**Risk of powerline collisions**
Karoo Thrush	*Turdus smithi*		NE		Mostly resident, some local movements		x	
Large-billed Lark	*Galerida magnirostris*		NE		Localised sedentary resident		x	
Layard's Warbler	*Sylvia layardi*		NE		Sedentary resident some altitudinal movements.		x	
Namaqua Warbler	*Phragmacia substriata*		NE		Resident with some local movements		x	
Sickle-winged Chat	*Emarginata sinuata*		NE		Resident with some local altitudinal movements		x	
Pied Starling	*Lamprotornis bicolor*		SLS		Mostly sedentary resident, occasionally nomadic		x	

5.5.1 *Walked Transect Results*

A total of 70 species of birds were recorded during 65 walked transects of approximately 500 m each, on the PAOI, with a total of 1851 birds recorded (Table 13). The average Index of Kilometric Abundance (IKA) ranged from 9.2 birds per km (WT12) to 100.6 birds per km (WT14). Walked transects WT1 and WT12 were not sampled during the last two surveys, as they fell within a Martial Eagle nest buffer that was removed from the project description, and not part of the revised Area of Interest. WT14 was only added in the last survey. The average IKA for the PAOI was 56.9 birds per km, which is within the expected range for the arid karoo region.

Table 13: Summary of Walked Transect results from four seasonal surveys at the Soutrivier WEFs

Reference	Total distance surveyed	No. of species recorded	Total no. individuals recorded	Index of Kilometric Abundance	Priority Species and near-endemic species recorded
WT1	3000m	24	161	53.7	Grey-winged Francolin, Rock Kestrel, Pied Starling, Large-billed Lark
WT3	5500m	30	239	43.5	Jackal Buzzard, Karoo Korhaan, Blue Crane, Black-eared Sparrow-lark, Large-billed Lark, Grey Tit, Karoo Lark
WT5	6000m	27	129	23.5	Blue Crane, Karoo Korhaan, Large-billed Lark, Karoo Lark
WT9	6500m	33	96	14.8	Blue Crane, Double-banded Courser, Karoo Korhaan, Large-billed Lark, Karoo Lark, Grey Tit
WT11	6500m	54	908	139.7	Blue Crane, Karoo Korhaan, Double-banded Courser, Black-eared Sparrow-lark, Karoo Prinia, Large-billed Lark, Karoo Lark, Black-headed Canary, Sickle-winged Chat, Cape Weaver
WT12	3500m	11	60	9.2	Blue Crane, Karoo Korhaan Large-billed Lark
WT14	1500m	21	151	100.6	Blue Crane, Karoo Korhaan Lesser Kestrel, Ludwig's Bustard, Sickle-winged Chat, Large-billed Lark, Karoo Lark
Total PAOI	**32.5 km**	**70 species**	**1851 individuals**	**56.9 birds /km**	**9 Priority Species** **12 near-endemic species**
CWT1	3000m	35	211	70.3	Northern Black Korhaan, Karoo Korhaan Grey Tit, Large-billed Lark, Karoo Lark, Karoo Prinia
CWT2	1500m	23	230	153.3	Blue Crane, Karoo Korhaan, Pale Chanting Goshawk, Karoo Prinia, Cape White-

					eye, Layard's Warbler, Pied Starling
Total Control	**4.5 km**	**45 species**	**441 individuals**	**98 birds/km**	**4 Priority Species** **7 near-endemic species**

5.5.2 Driven Transect Survey Results

A total of 11 target species were recorded during 14 driven transects on the AOI, of which four were Species of Conservation Concern (Table 14). The most frequently recorded species was Blue Crane, followed by Karoo Korhaan. Driven Transect one was only sampled a total of six times due to access problems. The abundance of target species was relatively low, with an average of 0.3 individuals recorded per km.

Table 14: Summary of Driven Transect Results

Reference	Number of samples	Number of species	Index of Kilometric Abundance	SCC recorded
DT1	6	2	0.272	Blue Crane, Karoo Korhaan,
DT2	8	4	0.323	Blue Crane, Karoo Korhaan, Ludwig's Bustard, Verreaux's Eagle
CDT	7	6	0.111	Secretarybird, Karoo Korhaan, Blue Crane

5.5.3 Vantage Point Survey Results

A total of 864 hours of observations were made from 14 VPs within the study area. Passage rates of priority species ranged from 0.25 flights per hour (0.05 flights at risk height) to 1.99 flights per hour (0.96 flights at risk height). The greatest number of flightpaths were recorded from VP9, which was mainly due to flocks of Blue Crane being recorded more frequently. The least number of flights within the AOI were recorded from VP3 (Table 15).

Table 15: Vantage Point Survey Results per Vantage Point in the study area

VP	No. of priority species recorded	No. of flights recorded	No. of flights at risk height (RH)	Passage Rate (flights/ hour)	Passage rate of Priority Species at RH
1	4	9	6	0.25	0.05
2	8	16	9	0.5	0.25
3	5	18	5	0.26	0.07
4	8	38	21	0.62	0.29
5	7	34	7	0.47	0.09
6	7	47	12	0.59	0.15
7	9	84	17	1.09	0.22
8	6	51	36	0.68	0.48
9	**10**	**143**	**69**	**1.99**	**0.96**
10	**10**	**97**	**69**	**1.26**	**0.90**
11	**8**	**81**	**59**	**1.09**	**0.79**
12	8	27	21	0.75	0.58
13	3	15	2	0.42	0.06

14	7	24	14	0.66	0.39
CVP1	4	21	19	0.88	0.79
CVP2	4	7	6	0.29	0.25

Blue Crane (*Near-threatened*) was the species with the highest number of individual flights (254) recorded at risk height, and the most time recorded at risk height and the highest passage rate with 0.294 flights recorded at risk height per hour of observations in the study area (Table 16). This was due to several observations of flocks of up to 38 individuals of Blue Crane recorded at VP 9, 10 and 11. As flight heights and times for individual birds in flocks were difficult to estimate, the length of the entire flock flight was used and if any of the birds flew through risk height, all individual flights in the flock were deemed to be at risk height. Regardless of this likely resulting in an overestimation of flights, Blue Crane is deemed to be the SCC flying the most time at risk height in the study area. All larger flocks (10-38) individuals were recorded in the first seasonal survey (April), indicating the risk may depend on seasonality. Based on results at operational wind energy facilities to date Blue Crane appear to not be particularly prone to collisions with turbines or displacement by WEFs in South Africa (Perold et al. 2020, Ralston-Paton et al. 2017)

Fifty-seven individual flights of Jackal Buzzard were recorded at risk height a passage rate of 0.066, flying for 3h56m during 864h of VP surveys, making it the most at-risk species in the study area after Blue Crane (Table 16). While Jackal Buzzard is not a Red Data species, it is endemic to southern Africa and the species has been shown to be very susceptible to turbine collisions in South Africa (Perold et al 2020, Ralston-Paton et al. 2017). Due to its abundance and widespread occurrence a cumulative impact on this species is becoming an increasing concern.

Forty-five individual flights of Verreaux's Eagle were recorded with a total of 3h36m spent flying at risk height, making it the third most at risk species in the study area (Table 16). A number of these flightpaths were by the same individual roosting in a stand of trees near VP4, with activity recorded on a ridge to the south of the roost.

Table 16: Vantage Point Survey Results per Priority Species within the study area

Species	WEF Priority Score & Red Data Status	Flightpaths at RH[11]	Individual flights at RH[12]	Passage rate at RH (flights/h)	Total time of flightpaths at RH	Total individual time at RH
Verreaux's Eagle	**360, VU**	**37**	**45**	**0.052**	**02:46:20**	**03:36:24**
Martial Eagle	350, EN	11	12	0.014	01:19:18	01:21:21
Ludwig's Bustard	320, EN	16	21	0.024	00:33:46	00:43:14
Blue Crane	**320, NT**	**37**	**254**	**0.294**	**02:54:18**	**48:57:37**
Secretarybird	320, EN	3	6	0.007	00:07:00	00:14:00
Lanner Falcon	300, VU	2	2	0.002	00:05:33	00:05:33
Tawny Eagle	290, EN	1	1	0.001	00:02:29	00:02:29
Jackal Buzzard	**250**	**48**	**57**	**0.066**	**01:36:46**	**03:56:17**
Karoo Korhaan	240, NT	8	12	0.014	00:08:39	00:17:14
Booted Eagle	230	4	4	0.005	00:18:50	00:18:50

[11] RH: Risk Height: Flights estimated between 20 and 300 m height which due to observer error could be at turbine blade heights
[12] One flightpath was recorded if multiple individuals were flying together

Lesser Kestrel	214	4	4	0.005	00:03:27	00:03:27
Common Buzzard	210	2	2	0.002	00:01:45	00:01:45
Pale Chanting Goshawk	200	3	5	0.006	00:50:48	01:09:13
African Harrier-Hawk	190	1	1	0.001	00:03:37	00:03:37
Northern Black Korhaan	180	4	4	0.005	00:04:50	00:04:50
Greater Kestrel	174	2	2	0.002	00:06:49	00:08:29

Three SCC were recorded within the Soutrivier Central WEF site boundary: Blue Crane, Ludwig's Bustard and Verreaux's Eagle (Figure 2). The highest flightpath duration and length within the Soutrivier Central WEF site boundary were flightpaths of Verreaux's Eagle recorded on a ridge in the mid-east of the site, where higher Jackal Buzzard flight activity was also recorded. Therefore, a no-turbine buffer was applied to the ridge area based on VP survey results (Figure 3). Blue Crane was recorded flying to and from the area of the wetlands, and a wetland no turbine buffer was applied surrounding the wetlands.

Flight activity of priority species at risk height was relatively low with no other clear patterns of flight activity by priority species discernible within the turbine areas (Figure 2). It should be noted that not all flights in Figure 2 were recorded at risk height.

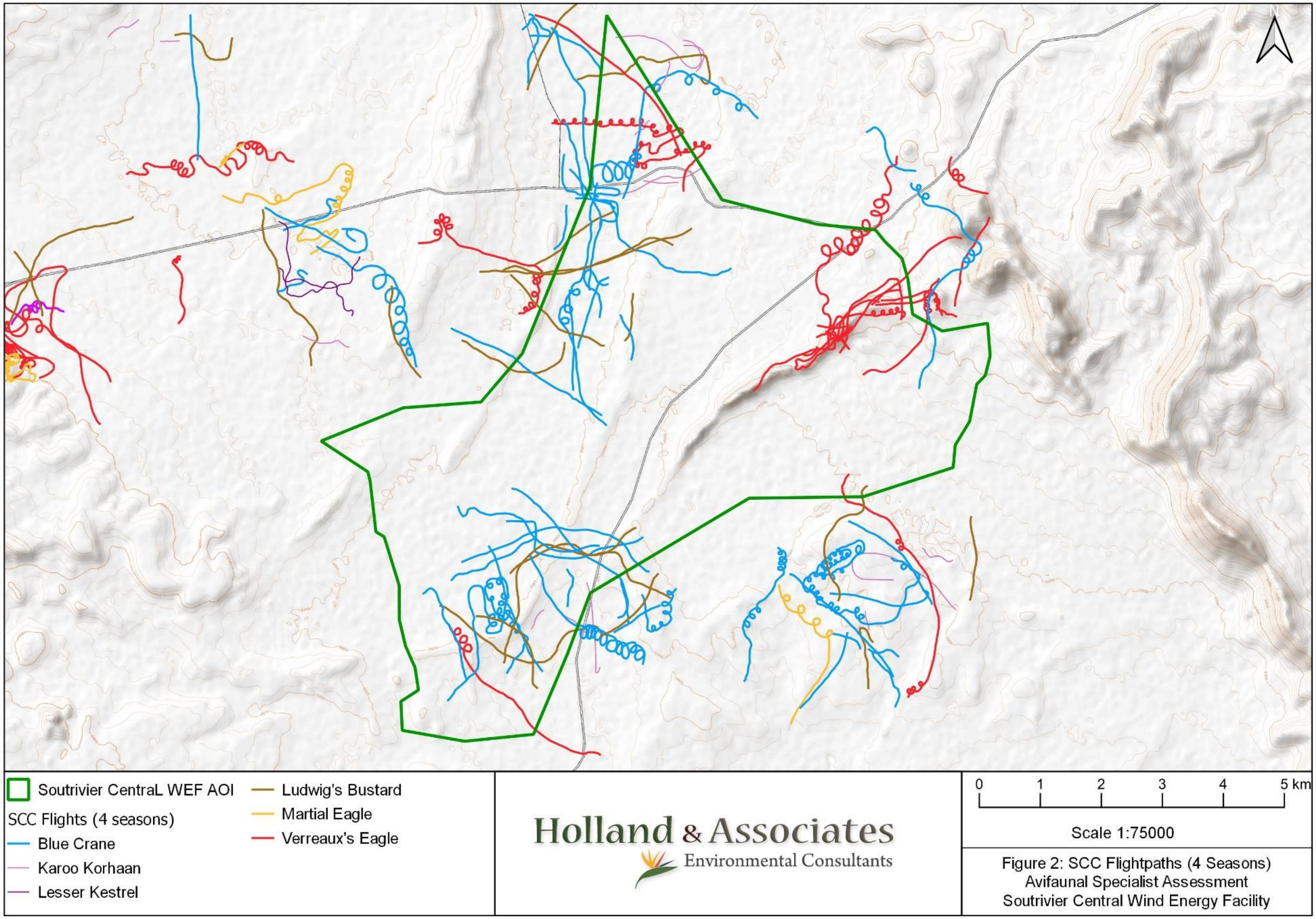


Figure 2: Soutrivier Central WEF SCC Flightpaths

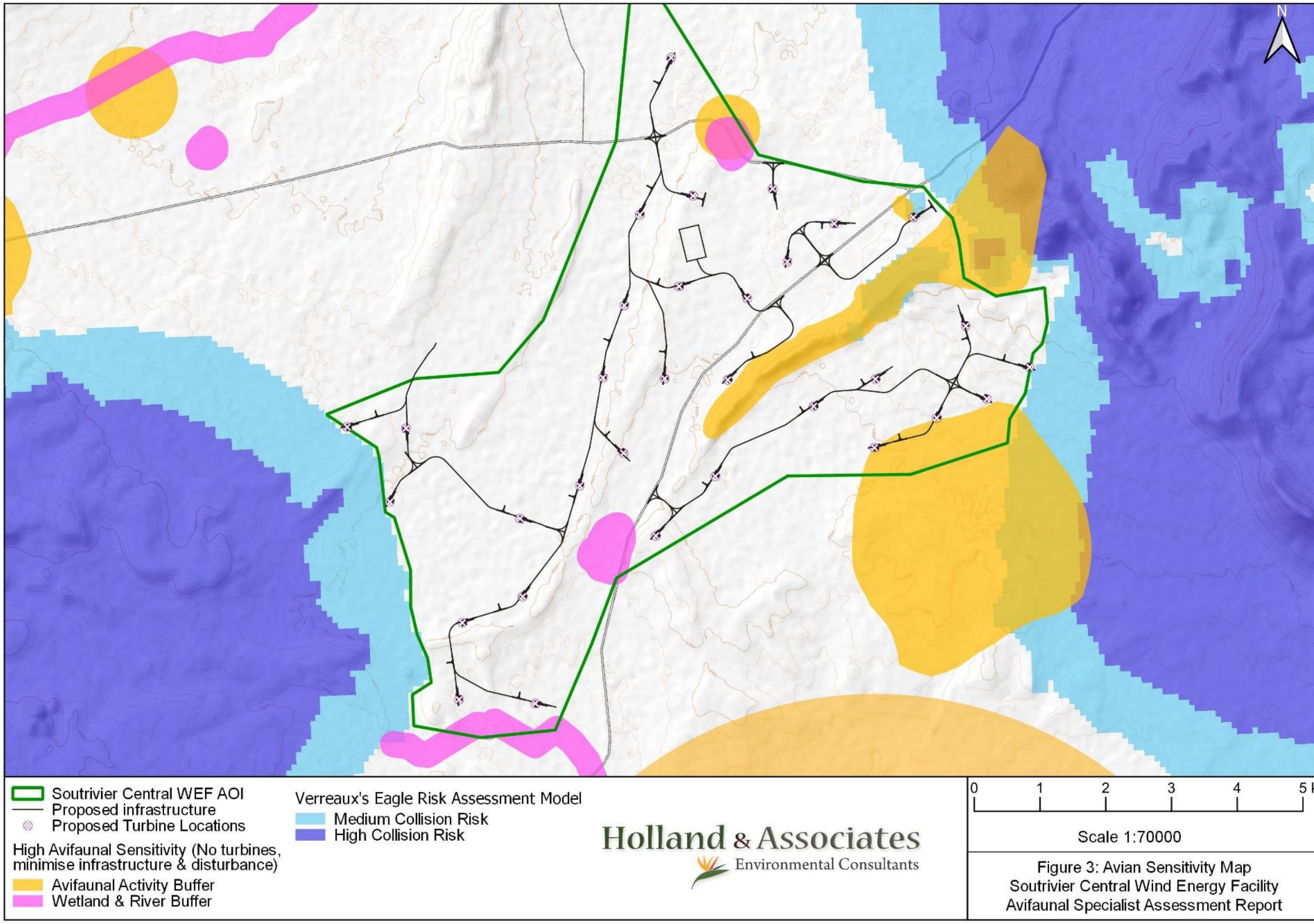


Figure 3: Avifaunal Sensitivity Map of the Soutrivier Central WEF

5.5.4 Incidental Records

A total of 28 Priority Species were recorded incidentally during four seasons of monitoring (Table 17) in the studv area. Blue Crane was the species recorded most frequently and with the highest number of birds. It should be noted that incidental records are frequently made of the same individuals that are recorded on different occasions and are not an indication of population size. This is particularly true for sedentary, resident species such as Grey-winged Francolin, Karoo Korhaan, Northern Black Korhaan, but also for species such as Amur Falcon, Blue Crane and Ludwig's Bustard which congregate in certain areas at certain times of year, and for locally breeding and/or territorial birds such as Booted Eagle, Jackal Buzzard, Martial Eagle, Pale Chanting Goshawk and Verreaux's Eagle. Therefore, the recorded numbers are of less significance than the location of incidental records which is presented in Figure 4. It should be noted that the map shows the location from which the recording was made and is therefore heavily biased towards the roads in the area. However, the recordings indicate that Karoo Korhaan, which is a sedentary and territorial species is likely to be to be fairly regularly distributed throughout the region. Pale Chanting Goshwak and Jackal Buzzard were also recorded widely. Blue Crane were recorded in areas closer to wetlands. Ludwig's Bustard, Martial Eagle, Verreaux's Eagle and Spotted Eagle Owl were only recorded along the eastern site boundary, closer to the ridge areas to the east of the site, and the Ludwig's Bustard breeding area to the south-east of the site.. (Figure 4).

Table 17: Incidental Record Results from four seasons of Pre-application Monitoring in the Study Area

Priority Species name	Number of birds (number of records)				Grand Total
	Season 1	Season 2	Season 3	Season 4	
African Black Duck	1 (1)				1 (1)
African Fish Eagle		1 (1)		1 (1)	2 (2)
African Harrier-Hawk	1 (1)	2 (1)		1 (1)	4 (3)
African Rock Pipit				2 (1)	2 (1)
Amur Falcon				2 (1)	2 (1)
Black Stork				2 (1)	2 (1)
Blue Crane	95 (13)	15 (5)	29 (7)	61 (13)	200 (38)
Booted Eagle		1 (1)			1 (1)
Burchell's Courser	6 (2)				6 (2)
Cape Eagle-Owl				1 (1)	1 (1)
Common Buzzard	1 (1)				1 (1)
Double-banded Courser	5 (2)	14 (11)	1 (1)	2 (1)	22 (15)
Gabar Goshawk		1 (1)			1 (1)
Greater Kestrel	1 (1)			2 (2)	3 (3)
Grey-winged Francolin		2 (1)	3 (1)		5 (2)
Jackal Buzzard	6 (6)	14 (10)	7 (6)	2 (2)	29 (24)
Karoo Korhaan	66 (23)	82 (33)	23 (12)	26 (11)	197 (79)
Ludwig's Bustard	30 (11)	1 (1)	3 (3)	22 (8)	56 (23)
Martial Eagle		2 (1)	1 (1)	2 (2)	5 (4)

Priority Species name	Number of birds (number of records)				Grand Total
	Season 1	Season 2	Season 3	Season 4	
Northern Black Korhaan	5 (5)	3 (1)		9 (6)	17 (12)
Pale Chanting Goshawk	24 (21)	20 (13)	4 (3)	14 (11)	62 (48)
Peregrine Falcon				1 (1)	1 (1)
Secretarybird	7 (4)	2 (1)		4 (3)	13 (8)
Spotted Eagle-Owl		1 (1)	2 (1)	1 (1)	4 (3)
Unidentified raptor	4 (4)	5 (5)		11 (11)	20 (20)
Verreaux's Eagle	3 (3)	5 (4)			8 (7)
Yellow-billed Kite				1 (1)	1 (1)
Grand Total	**256 (98)**	**170 (91)**	**74 (35)**	**167 (80)**	**668 (306)**

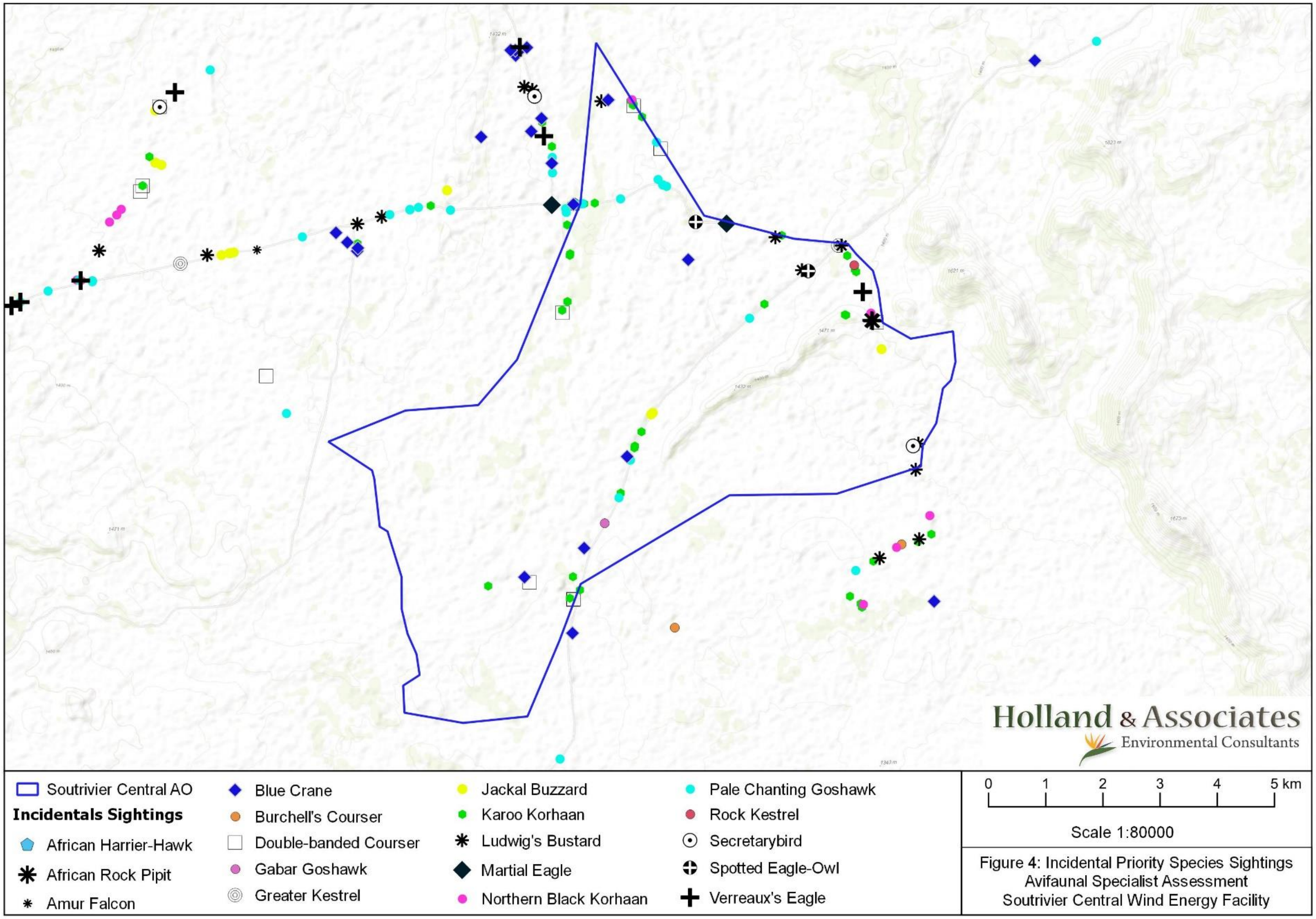


Figure 4: Incidental Priority Species Records from Pre-application Monitoring at Soutrivier Central WEF

5.5.5 Focal Sites

A summary of focal site observations is provided in Table 18.

Table 18: Focal Site Survey Results

Reference	Type	Species Recorded	Notes
FS Reservoir	Reservoir	16	Black-eared Sparrow-lark, Chat Flycatcher, Red-headed Finch
FS12	Dam	22	**Blue Crane,** African Black Duck, Red-billed Teal, Kittlitz's Plover
SECR1	Secretarybird Nest	0	Inactive nest
SECR2	Secretarybird Nest	0	Active nest
SECR3	Secretarybird Roost	1	Roost
LUBU1	Ludwig's Bustard Nest	0	Chick present April 2021
MAEA1	Martial Eagle Nest	1	Active in August 2021
MAEA2	Martial Eagle Nest	2	Active in August 2021
JB01	Jackal Buzzard Nest	2	Verreaux's Eagle roosting in same stand of trees

The majority of birds recorded at the focal site FS RESERVOIR were passerines, with a number of seedeaters recorded, which is an expected result a reservoir in an otherwise arid environment. The majority of individuals recorded were Cape Sparrow, Red-headed Finch, Black-eared Sparrow-Lark and White-throated Canary.

At focal site FS12, which was a relatively full dam, in addition to passerines attracted by water, a variety of waterfowl and water-associated birds were recorded including African Black Duck, South African Shelduck, Three-banded Plover, Kittlitz's Plover, Blacksmith Lapwing and Red-billed Teal. In addition, Blue Crane were recorded foraging near the dam. Blue Crane roost at waterbodies at night and nest close to water.

Focal site SECR1 was identified as an old Secretarybird nest in the top of a medium-sized thorn tree, and no Secretarybird activity was recorded at the site during the four surveys.

Focal site SECR2 was an active Secretarybird nest found in April 2021 with signs of recent activity recorded, even though breeding was not confirmed. As the nest is located relatively close to the active Martial Eagle nest MAEA1, which was buffered by 6 km, no additional buffer for this nest is required.

No nest structure was found at focal site SECR3 but Secretarybird was observed roosting in a thorn tree with much splatter and evidence that the tree was frequently used to roost in potentially by Secretarybird.

A Ludwig's Bustard chick (Plate 1) was found on the ground at focal site LUBU1 in April 2021. No Ludwig's Bustard were observed at the focal site in following visits. Ludwig's Bustard (*Endangered*) is a polygynous species and a solitary nester, with males displaying at regularly used sites (leks), with some leks recorded as being used for more than 25 years. These leks may have 1-3 males displaying, with adjacent males displaying ca 300 m apart. Nests are typically located within 2 km of the display sites. The area within 2 km of the nest was searched during each season in efforts to locate the lek. Adult Ludwig's Bustard were regularly seen in the area, and therefore a no-go buffer area was placed around the location of the chick, the shape of which was informed by the location of Ludwig's Bustard sightings during pre-application monitoring.

Focal site MAEA1 is a large Martial Eagle nest hidden by a tree on a cliff located in August 2021. A Martial Eagle was observed sitting on the nest and a second Martial Eagle was observed flying in and out presumably with food. A 6 km no-turbine buffer was applied to this nest.

Focal site MAEA2 is a stand of poplar trees which contain two large stick nest structures (Plate 2). Fresh splatter, Martial Eagle sized pellets and Martial Eagle feathers were found underneath the nests, one of which is presumed to be active. A 6 km no -turbine buffer was applied to this nest.

Focal site JB01 is a stick nest in a stand of trees, in which a Verreaux's Eagle was perched and observed flying on numerous occasions in August 2021). It was therefore suspected that the nest may be used by a Verreaux's Eagle. A separate visit to the site with a drone was therefore undertaken in September 2021 in order to confirm if the nest, which was high up and difficult to view from the ground, was active and used by Verreaux's Eagle. The drone survey video showed that the nest was relatively small made of small twigs, and lined with sheep wool and red string, which is typical for cows or could potentially be used by smaller raptors. It was therefore concluded that the Verreaux's Eagle was using the stand of trees as a roost only. The following surveys recorded only one flight path by a Verreaux's Eagle in the immediate area of the trees.

Plate 1: Ludwig's Bustard Chick at LUBU1

Plate 2: Martial Eagle nests in poplar stand

6 Identification and Assessment of Potential Impacts on Avifauna

6.1.1 Displacement through disturbance

Disturbance during the construction, operational and decommissioning phases can negatively affect all avifauna on an individual or population level by increasing stress, decreasing food and habitat availability, causing displacement into potentially less suitable neighbouring environments, and ultimately potentially decreasing reproductive success (Bennun et al. 2021, Jenkins et al. 2017, Madders & Whitfield 2006, Marques et al. 2021). An avoidance of the WEF at a macro scale (barrier effect), can lead to displacement, but can also lead to no response (if the bird avoiding the WEF area does not alter its habitat use otherwise) (Laranjeiro et al. 2018, May 2015).

In a review of 71 peer-reviewed studies on displacement in Europe and North America (Marques et al. 2021) about half of these studies found no effects of displacement, 40.6% found displacement effects and 7.7% found attraction effects, i.e., an increased abundance at the site during operation against pre-application results. A study on long-established wind farms in India indicates that certain bird species avoided wind-turbine dominated sites, affecting their distribution pattern (Kumara et al. 2022). Displacements effects have been reported for large raptors in other countries, but the studies are often inconclusive due to lack of baseline and collision data.

Five of eight wind farms in a study in South Africa in 2017 (Ralston-Paton et al. 2017) reported an increase in the total number of species on site after construction, even though this difference was not statistically significant.

Different species vary in their susceptibility to disturbance. The risk of displacement from disturbance is higher for shy, secretive species not habituated to human activities. For this project, disturbance is of particular concern due to the confirmed occurrence of SCC in the area which are locally breeding resident species, such as Secretarybird (*Endangered*), Martial Eagle (*Endangered*), Verreaux's Eagle (*Vulnerable*), Karoo Korhaan (*Near-threatened*) and Blue Crane (*Near-threatened*). One case study suggests Martial Eagle are not sensitive to displacement by operational facilities and have been recorded breeding within an operational WEF site in South Africa. Blue Crane and Jackal Buzzard also do not appear to be highly sensitive to displacement by disturbance as successful breeding was recorded at an operational WEF, but these are anecdotal data and the effect on long-term reproductive success was not measured. There is no consistent evidence that Verreaux's Eagle avoid operational wind farms with some sites recording increased flight activity after construction, while other sights recorded decreased flight activity (Ralston-Paton & Murgatroyd 2021). Tracking data of Verreaux's Eagle showed no change in frequency of use before and during operation, but the number of recorded Verreaux's Eagle fatalities demonstrates that if there is displacement, it is not complete.

To date too little evidence has been gathered and published to determine the impact of disturbance for the Priority Species that occur at this site, and a precautionary approach must be taken.

The impact of disturbance on avifauna is rated as potentially negative and would affect the avifauna of the PAOI for the duration of all phases. Some displacement is certain to occur, while some attraction may also occur, but the impact will cease with the completion of the phases and is reversible. The impact severity is potentially moderately severe if breeding areas of SCC are affected. This results in the significance of the impact rated as potentially moderate negative before mitigation for the construction and decommissioning phases and as low negative for the operational phase.

Disturbance can be managed and mitigated most effectively at the design stage by avoiding important nesting, roosting and foraging areas of sensitive species during site selection and layout design, which has been achieved for the proposed development (embedded mitigation).

In order to ensure no SCCs are breeding within the proposed disturbance footprint prior to the commencement of construction or decommissioning activities, a walkthrough of the site conducted within the month prior to commencement of construction can identify areas that require additional mitigation during construction and limit negative impacts on sensitive species.

The impact significance ratings for all phases are rated as low negative if all mitigation measures are implemented.

Impact Significance: Disturbance		
	Before mitigation	**After mitigation**
Construction Phase	MODERATE NEGATIVE	LOW NEGATIVE
Operational Phase	LOW NEGATIVE	LOW NEGATIVE
Decommissioning Phase	MODERATE NEGATIVE	LOW NEGATIVE

6.1.2 Displacement through habitat loss

The construction of the proposed development will require the transformation of indigenous vegetation. Any transformation of vegetation leads to habitat loss for avian species utilising that vegetation, causing displacement into areas which are potentially less suitable or already occupied by competing individuals or species (Frid & Dill 2002, Percival 2005, Dwyer et al. 2018). Once constructed, the development infrastructure, and any available perches within the facility may be used as nesting and roosting substrate by some less-sensitive species and create some new habitat, which would be lost during decommissioning.

While according to the project description the proposed permanent development footprint is relatively small within the development site, some habitat loss will definitely occur. Many bird species will persist within the operational WEF site, due to the relatively small footprint, however some avian species may be displaced from the area. Some habitat could occur due to the road and cable network and this would impact mainly on terrestrial species such as Ludwig's Bustard, Karoo Korhaan, Northern Black Korhaan

The impact of habitat loss on avifauna is negative and would affect the site directly and surrounding areas indirectly through displacement. Therefore, the spatial extent of the impact is rated as the study area. Habitat loss is definite to occur and may impact some SCC. Reversibility is considered to be possible with rehabilitation to some degree for the construction phase. The impact will persist for the lifetime of the facility and is therefore rated as long-term. There would be much equivalent habitat remaining in surrounding areas, but the resource will be partly lost. The severity of habitat loss for SCC is potentially moderately severe if habitat loss occurs within breeding areas. The resulting impact significance rating is potentially moderate negative during the construction phase and low negative during the decommissioning phase.

Mitigation of habitat loss from construction of the facility is mainly achieved through site selection and the avoidance of sensitive areas, as was achieved for this project (embedded mitigation).

Following site selection mitigation is only marginally possible by retaining as much of the indigenous vegetation as possible, minimising the footprint of all associated infrastructure, including buildings, electrical infrastructure and the width and length of roads, and rehabilitating as many disturbed areas as possible following construction. Before construction and decommissioning an avifaunal walkthrough can identify any active nesting and breeding sites, which must be protected until the breeding has concluded.

If all mitigation measures are implemented the impact significance rating is expected to be low negative for the construction and decommissioning phase.

Impact Significance: Habitat loss		
	Before mitigation	**After mitigation**
Construction Phase	MODERATE NEGATIVE	LOW NEGATIVE
Decommissioning Phase	LOW NEGATIVE	LOW NEGATIVE

6.1.3 Mortality from collisions with turbines

Bird collisions with wind turbine blades has been well documented worldwide, and can be devastating to avian populations in certain locations (Drewitt & Langston 2006, Dwyer et al. 2018, Laranjeiro et al. 2018). Birds can collide with wind turbines and the monopoles if they do not avoid them (Kunz et al. 2007), and their ability to avoid turbines can be site-, species- and weather- and turbine-specific (Cook et al. 2014, Drewitt & Langston 2006, Marques et al. 2014). Mortalities from collisions with turbines can vary greatly between sites (Sovacool 2009) and the effect of mortalities on the species population can vary greatly depending on the species resilience, with large-bodies, long-living species with a low reproductive rate and slow maturation rates being disproportionately affected. In addition to being more prone to collisions due to body size, even low fatality rates can have population-level effects, particularly for already heavily impacted upon SCC (Carrete et al. 2009, Drewitt & Langston 2006, Marques et al 2014).

A high number of species is affected in South Africa with 130 species from 46 families having been recorded as turbine collision mortalities (Perold et al. 2020). The same study suggests that some 42% of species recorded during pre-application monitoring will be affected during the lifetime of the facility. Diurnal raptors were most affected making up 36% of carcasses with 23 species recorded, followed by passerines (30%, 49 species), waterbirds (11%,24 species), swifts (9%, six species), large terrestrial birds 5%, 10 species), pigeons and other near passerines (5%, 13 species) (Perold et al. 2020).

Monitoring at operational wind farms in South Africa has recorded fatalities of priority species that occur at the proposed WEF, including African Fish Eagle, African Harrier-hawk, Blue Crane (*Near-threatened*), Booted Eagle, Common Buzzard, Jackal Buzzard, Lanner Falcon (*Vulnerable*), Ludwig's Bustard, Martial Eagle (*Endangered*), Pale Chanting Goshawk, Rock Kestrel, Secretarybird (*Endangered*), Spotted Eagle-Owl, Tawny Eagle (*Endangered*), Verreaux's Eagle (*Vulnerable*) and Yellow-billed Kite (Ralston-Paton et al. 2017, Ralston-Paton & Murgatroyd 2021, Simmons et al. 2020). It must however be assumed that all priority species potentially occurring and confirmed in the area are potentially affected.

The impact is rated as long-term for the lifetime of the facility with potential effects on the regional populations. It is deemed probable that collisions of priority species with turbines will occur without mitigation and the severity of the impact occurring could be severe, resulting in a high negative impact significance without mitigation.

The main mitigation measure for the avoidance of collisions is the placement of turbines outside of areas likely to be frequented by collision-prone bird species. Therefore, pre-construction monitoring in line with Best Practice Guidelines, a specialist raptor nest survey and collision risk modelling were completed prior to the selection of the facility site and the selection of the turbine layout, as has been done for this project. The proposed turbine layout avoids all areas of high and medium collision risk for Verreaux's Eagle identified by the VERA model, in addition to avoiding high flight activity buffers of priority species, nest buffers that were identified for Martial Eagle, Secretarybird, Jackal Buzzard and Pale Chanting Goshawk, as well as applied buffers of ridgelines, wetlands and rivers.

Proactive minimizing mitigation measures that are recommended (refer to Table 19) include habitat management measures, such as removing artificial rock piles used by eagle prey, minimising perching and nesting opportunities within the facility, blade painting and implementing post-construction monitoring. The painting of one turbine blade in a different colour has shown to lower collisions by raptors successfully (May et al 2020), and this is currently being implemented retrospectively (in-situ) at one WEF in South Africa. As this mitigation is potentially highly effective, proactively painting the blades of as many turbines as legally possible prior to construction, at a fraction of the cost of a reactive approach is highly recommended.

Post-construction monitoring according to Best Practice Guidelines applicable at the time of commencement of construction is required in order to determine what mortalities are occurring, and if any additional adaptive (reactive) management mitigation measures are required, such as curtailment of certain turbines (shutting down during certain times/seasons/conditions) or shutdown on demand when flight activity by SCC is observed by observers or automated devices.

While Blue Crane has the highest recorded passage rates for the WEF Site, Blue Crane appear to not be particularly prone to collisions with turbines, with eight fatalities reported at four out of 20 WEFs over four years, despite being a wide-spread and relatively common species in its range (Perold et al. 2020). The high passage rate recorded is due to several flocks being observed in certain areas of the site only. Blue Crane is therefore not deemed to be of unacceptable risk to turbine collisions for the preferred layout.

Jackal Buzzard was the second-most recorded species flying at risk height and is deemed the most at-risk species for collisions at the proposed WEF site, as it appears to be particularly prone to collisions (Perold et al. 2020). This may be a function of their relatively high abundance in South Africa in relation to other larger raptors and their flight behaviour. While not a threatened species (yet), Jackal Buzzard are endemic to southern Africa and some mortalities at the proposed WEF are expected to occur, despite the implementation of a 1 km nest buffer surrounding a Jackal Buzzard nest, and ridge and flight activity buffers. The mortalities at the proposed WEF are unlikely to have an unacceptable impact at a population or regional level to this widespread species with a population of tens of thousands, but cumulative national and regional impacts (which are beyond the scope of this assessment) to this species are a growing concern. This highlights the importance of submitting all post-construction reporting to Birdlife South Africa or the Department of Forestry, Fisheries and the Environment (DFFE). In order to reduce the risk of Jackal Buzzard mortalities blade painting should be implemented proactively.

Verreaux's Eagle recorded the third highest passage rate during pre-application monitoring. In response to this flight activity buffers were applied to the site, and the turbine layout was revised to avoid areas of high Verreaux's Eagle flight activity. The preferred layout therefore avoids all areas of high and medium collision risk identified by the VERA model, as well as areas and ridges with increased flight activity, which has minimised the probability of Verreaux's Eagle collisions to an acceptable degree. However, the VERA model does not account for dispersing and non-breeding birds, and only one year of monitoring was conducted (in line with Verreaux's Eagle Guidelines but annual variation is not accounted for). Therefore, a pro-active approach of blade painting of all turbines on the WEF is highly recommended.

By implementing the preferred layout and the recommended mitigation strategy the probability of the impact is lowered, resulting in a medium negative impact significance.

Impact Significance: Collisions with turbines		
	Before mitigation	**After mitigation**
Operational Phase	HIGH NEGATIVE	MEDIUM NEGATIVE

6.1.4 Mortality from collisions with powerlines

Collisions with powerlines is a well-known and increasing threat for many bird species worldwide (Bernardino et al. 2018, Jenkins et al. 2015, Loss et al. 2014). In South Africa, a number of endemic and threatened species are known to be significantly affected by collisions (Taylor et al. 2015), including SCC's that were recorded in the area such as Ludwig's Bustard, Blue Crane, Secretarybird and Black Stork (Shaw et al. 2021). Ludwig's Bustard is particularly prone to collisions and made up 69% of carcasses found under powerlines in a two-year study in the Karoo (Shaw 2013). Karoo Korhaan is also affected, but does not collide as frequently as Ludwig's Bustard, possibly due to their sedentary nature making them familiar with their area and their smaller size increasing their maneuverability (Shaw 2013).

For raptors, collisions appear to be a less frequent source of mortality compared to electrocutions (Loss et al. 2014, Slater et al. 2020). This is likely due to a combination of their good eyesight, high aspect-ratio wings, and often high flight altitude while engaged in thermal soaring (Bevanger 1998, Martin & Shaw 2010, Janss 2000, Slater et al. 2020). However, power line collisions increase when lines intersect with home ranges or if lines span regularly used flight paths between nesting and foraging grounds (Rollan et al. 2010, Slater et al. 2020). For some raptor species collisions with powerlines are a major conservation concern, such as the Bonelli's Eagle in Spain (Rollan et al. 2010).

The impact is long-term, potentially regional and rated as severe. As it is probable that collisions with power lines will occur the impact rating without mitigation is high negative.

The impact can be completely avoided by burying all internal overhead powerlines along the internal road network. Where this is technically not possible, in order to minimise collisions, line markers such as bird flappers and static bird flight diverters are being widely used with some success. One recent study (Shaw et al. 2021) demonstrated a 51% reduction in mortality for all large birds, while reducing collision rates effectively for some species (92% for Blue Crane) and having no effect on others (Ludwig's Bustard). As bird flight diverters are not effective for Ludwig's Bustard, all internal overhead power lines must be buried, which will remove the impact. Where this is not possible, every meter of overhead power line potentially significantly increases the probability of collisions resulting in a high negative, and unacceptable impact significance rating.

The below assessment assumed all internal power lines will be buried, therefore any deviation in the final as built layout must be signed off by an avifaunal specialist as acceptable.

Impact Significance: Collisions with internal 33 kV powerlines		
	Before mitigation	**After mitigation**
Operational Phase	HIGH NEGATIVE	NO IMPACT

6.1.5 Mortality from electrocutions on electrical infrastructure

Normally, energised components on overhead powerlines are not insulated but are elevated to place them safely out of people's reach, which elevates energised wires into places that are also attractive perches for birds (Dwyer et al. 2017). Large birds can be electrocuted or incur electric shock injuries when simultaneously contacting two uninsulated energised components of differing electric potential (phase-to-phase electrocution), or when contacting an uninsulated energised component and a path to ground (phase-to-ground- electrocution) (Dwyer 2006, APLIC 2006). Because electrocutions result from birds bridging air-gaps, larger birds with larger wingspans, such as Martial Eagle, are disproportionately affected (Slater et al. 2020). Most bird electrocutions occur at relatively low and medium voltage distribution systems, rather than with transmission systems where the separations created by longer insulators and wider air- gaps around wires are larger (APLIC 2006, Bennun et al. 2020, Slater et al. 2020).

The impact is long-term, potentially regional and rated as severe due to the presence of the susceptible species Martial Eagle (*Endangered*) in the area. As it is probable that electrocutions with power lines will occur the impact rating without mitigation is high negative.

Bird electrocutions can be easily avoided by burying overhead powerlines, and by creating separation between conductors of differing electrical potential at substations and electrical infrastructure, and by placing insulation over conductors, or by redirecting birds to perch or nest away from conductors (APLIC 2006, Dwyer et al. 2017).

If all overhead powerlines are buried any exposed electrical infrastructure within the substation is of a bird-friendly insulated design, the impact can be completely removed. The below assessment assumed all internal power lines will be buried, therefore any deviation in the final as built layout must be signed off by an avifaunal specialist as acceptable.

Impact Significance: Electrocutions on internal powerlines and electrical infrastructure		
	Before mitigation	**After mitigation**
Operational Phase	HIGH NEGATIVE	NO IMPACT

6.1.6 Cumulative Impacts

Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Cumulative impacts assessed include the combination of all the impacts discussed above for this project, which may be higher than the sum of impacts, as well as the associated two Soutrivier WEFs, the Soutrivier Solar PV Facilities and their associated OHPLs, and all known past, present and proposed projects in an area of 30 km surrounding the proposed development. In addition to the Soutrivier projects two WEFs are proposed within this radius: the Taaibos North WEF and associated OHPL, and the Taaibos South WEF and associated OHPL. All of these facilities are to ultimately connect to the Gamma MTS with one shared powerline from the Soutrivier Collector Substation to the Gamma Substation, which lowers the cumulative impact.

The impacts of the cumulative projects will be negative by making a larger area of avifaunal karoo scrub habitat unavailable and of higher risk for SCC flying between Victoria West and Loxton.

There is also a potential for an increased barrier effect being created by the combination of these projects, which would be a negative, regional, long-term impact. As these projects are not located on any major flyways, the probability of this occurring is however unlikely.

The contribution of the Soutrivier central WEF to the cumulative impact in a 30 km radius is considered to be moderate, i.e., the cumulative impact will be lower but the cumulative significance rating will remain unchanged regardless of the Soutrivier Central WEF being constructed or not.

The only real mitigation possible in order to minimise cumulative impacts, beyond minimising impacts for each project separately during the EIA process, is for the Competent Authority to ensure only projects are authorised that are practically mitigatable to an acceptable level, and that do not lead to unacceptable negative impacts, including cumulative impacts, and to ensure the correct implementation of authorised Environmental Management Programmes through compliance audits and enforcement.

The impact management actions and outcomes as per Table 20 must be included in the EMPr for the proposed development.

Impact Significance: Cumulative impacts		
	Before mitigation	**After mitigation**
All phases	HIGH NEGATIVE	MODERATE NEGATIVE

7 Conclusion & Impact Statement

This avifaunal specialist assessment is based on a desktop-level feasibility study, a specialist raptor nest survey, VERA collision risk modelling and one year of pre-application monitoring in line with Verreaux's Eagle (Ralston-Paton & Murgatroyd 2021) guidelines, with an increased effort over the Best Practice Guidelines (Jenkins et al. 2015).

It complies with the requirements of the Avifaunal Protocol (GN 320 of 20 March 2020), and the Animal Species Protocol (GN 1150 of 30 October 2020), the associated 'South African Best Practice Guidelines for Pre-construction Monitoring at Proposed Wind Energy Facilities' (Jenkins et al. 2015) the 'Verreaux's Eagle and Wind Farms Guidelines' (Ralston-Paton 2017 & Ralston-Paton & Murgatroyd 2021) and the 'Species Environmental Assessment Guidelines' (SANBI 2022).

Potential impacts and mitigation measures for the proposed development were identified and rated according to the provided Impact Assessment methodology before and after mitigation (Table 19).

Table 19: Impact Assessment Summary

Impact Significance: Habitat loss		
	Before mitigation	**After mitigation**
Construction Phase	MODERATE NEGATIVE	LOW NEGATIVE
Decommissioning Phase	LOW NEGATIVE	LOW NEGATIVE
Impact Significance: Disturbance		
Construction Phase	MODERATE NEGATIVE	LOW NEGATIVE
Operational Phase	LOW NEGATIVE	LOW NEGATIVE
Decommissioning Phase	MODERATE NEGATIVE	LOW NEGATIVE
Impact Significance: Collisions with turbines		
Operational Phase	HIGH NEGATIVE	MODERATE NEGATIVE
Impact Significance: Collisions with power lines		
Operational Phase	HIGH NEGATIVE	NO IMPACT
Impact Significance: Electrocutions on powerlines and electrical infrastructure		
Operational Phase	HIGH NEGATIVE	NO IMPACT
Impact Significance: Cumulative impacts		
All phases	HIGH NEGATIVE	MODERATE NEGATIVE

The main mitigation measure for all identified impacts of the proposed wind energy facility development on avian species is the avoidance of high-risk areas. This has been satisfactorily applied by the developer from an early stage prior to site selection, with involvement of the avifaunal specialist. The proposed development therefore considered the results of feasibility studies, nest surveys, collision risk modelling, and pre-application monitoring in a larger area, resulting in a site and turbine layout that avoids sensitive areas and poses the lowest risk to avifauna (and other environmental sensitivities) for a development of this type, in the wider area.

In order to minimise residual impacts, and achieve the significance ratings after mitigation given above, and following the mitigation hierarchy, impact management outcomes and impact management measures must be included in the Environmental Management Programme (EMPr) for the proposed development as detailed in Table 20.

With regards to the highest risk impacts, the risk to the SCC Verreaux's Eagle (*Vulnerable*), Martial Eagle (*Endangered*) and Secretarybird (*Endangered*) has been reduced from a high risk of turbine collisions and electrocutions prior to avoidance and mitigation to a medium and low risk. The risk to the SCC Blue Crane (*Near-threatened*), Ludwig's Bustard (*Endangered*) and Karoo Korhaan can be reduced from a high risk from collisions with powerlines to a low risk if all powerlines are buried.

Overall species diversity and abundance is relatively low in the proposed development site, and the site is not of particular significance in the larger area in terms of avifauna. The site represents the preferred area with the lowest avifaunal sensitivity determined through an iterative site selection process which evaluated the ecological sensitivity of the larger area.

It is this therefore this specialist's opinion that the proposed development layout as presented in Figure 3 can be authorised if Table 20 is included in the EMPr for the project, as the mitigation measures achieve a lowering of the risk to avifauna and in particular to Species of Conservation Concern to a level of acceptable (medium and low negative) impact significance.

Table 20: Impact management actions and outcomes to be included in the EMPr

Impact Management Action	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
Development layout excludes all areas of high avifaunal sensitivity and minimises impacts on avifauna.	Developer's Project Manager (DPM) / Developer Site Supervisor (DSS) / Developer Environmental Officer (dEO) / Contractor /	The final authorised development layout must adhere to all identified no go and no turbine areas as indicated in the final avifaunal assessment report.	Design / Pre-construction phase	DPM / DSS Environ-mental Control officer (ECO)	Before commencement	Final layout overlaid with avifaunal sensitivities is included in EMPr.
Demarcate disturbance footprint during construction, to the minimum practically possible to minimise disturbance and habitat loss. All areas outside of disturbance footprint are No Go areas.	Developer's Project Manager (DPM) / Developer Site Supervisor (DSS) / Developer Environmental Officer (dEO) / Contractor Contractor's Environmental Officer (cEO)	Demarcate disturbance footprint with construction tape or other appropriate effective means	Pre-construction phase	Environ-mental Control officer (ECO) cEO	Before commencement and monthly throughout construction phase	Disturbance footprint is clearly demarcated and areas outside of disturbance footprint are undisturbed.
Keep vegetation clearing within the development footprint to the minimum practically possible to minimise habitat loss. Indigenous vegetation which does not interfere with the development	DSS dEO Contractor cEO	Demarcate clearance footprint with construction tape or other appropriate effective means	Construction phase	ECO cEO	Before commencement and monthly throughout construction phase	Areas of indigenous vegetation are demarcated and undisturbed.

Impact Management Action	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
must be left undisturbed.						
Breeding sites of any avian species as identified within the disturbance footprint must be kept intact and disturbance to breeding birds must be avoided.	dEO/cEO Avifaunal specialist	Avifaunal specialist to undertake an avifaunal walkthrough of the development footprint to identify any breeding sites. Identified breeding sites must be clearly indicated on a map of the site and all staff must be made aware of these areas. Any additional mitigation measures recommended by the avifaunal specialist are implemented.	Once-off within 6 weeks prior to commencement of Construction phase Once-off within 6 weeks prior to commencement of Decommissioning phase	ECO cEO	Monthly during construction phase	Avifaunal walkthrough report is kept on file. Map of breeding sites is displayed on site. Documentary/photographic evidence of complying with any additional mitigation measures recommended by the specialist in the walk-through report are provided.
Avifaunal specialist to train ECO, cEO/dEO in the identification of SCC potentially occurring on site.	ECO cEO/dEO Avifaunal contractor	Avifaunal specialist to undertake 1 hour training session with ECO and cEO/dEO on site prior to construction and prior to decommissioning activities	Once-off prior to commencement of construction/ decommissioning phases	ECO cEO	Monthly during construction phase	Register of training sessions kept on file.
Breeding sites of SCC must be left intact and undisturbed.	cEO/dEO ECO Avifaunal specialist	Should SCC be found breeding within the disturbance footprint prior to or during construction or decommissioning all works within 1 km of the breeding site must be halted and an avifaunal specialist must be contacted for further instruction. Any resulting recommendation by the avifaunal specialist to protect the breeding SCC must be implemented. Breeding sites of SCC are to be clearly demarcated with	Pre-construction, construction and decommissioning phase	dEO / cEO ECO	Ongoing Monthly	Avifaunal walkthrough report is kept on file with proof of submission to Birdlife SA and the DFFE. All breeding sites of SCC are clearly demarcated as per the instruction of the avifaunal specialist with photographic evidence provided. An avifaunal specialist's recommendation is on

Impact Management Action	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
		construction tape as per the instruction of the avifaunal specialist.				file for each breeding site. Documentary / photographic evidence of complying with any additional mitigation measures recommended by the avifaunal specialist is provided.
Minimise risk of impacts of fences on birds	dEO Contractor cEO	Adhere to Birdlife SA Guideline: 'Fences & Birds': • Remove all non-essential fences; • Replace at least the top two barbed wire strands with smooth wire • Routinely re-tension loose wires • Increase spacing between strands (min. 30 cm) • Make fences more visible • Reduce the barrier effect Refer to https://www.birdlife.org.za/wp-content/uploads/2019/07/Fences_Birds.pdf for details. • Report (with photographs) all mortalities on or near fences to avifaunal specialist and submit records to Birdlife SA via website link:	Design / pre-construction, construction, operation and decommissioning phases	dEO / cEO ECO	Ongoing Monthly	Documentary / photographic evidence of compliance with guidelines. Record of submission of mortalities to avifaunal specialist responsible for operational monitoring, and to Birdlife SA website.

Impact Management Action	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
		https://www.birdlife.org.za/what-we-do/important-bird-and-biodiversity-areas/what-we-do-ibas/fence-mitigation-project/				
Eliminate / minimise risk of avian collisions with overhead powerlines	cEO/dEO ECO Avifaunal specialist	All internal overhead powerlines must be buried. Should this not be possible for any length of power line, an avifaunal specialist has to be consulted and approve the location and length of the overhead powerline, which must be fitted and maintained with Bird Flight Diverters in line with current Eskom Technical Standards.	Design / pre-construction, construction, operation and decommissioning phases	dEO / cEO ECO	Once-off Ongoing Monthly	The final development layout indicating any overhead powerline is included in the authorised EMPr with a letter of acceptance by a SACNASP registered avifaunal specialist. Documentary / photographic evidence of bird flight diverters and any additional mitigation measures recommended by the avifaunal specialist is provided.
Minimise risk of avian mortalities from electrical infrastructure	DPM	Minimise perching opportunities on pylons by installing and maintaining anti-perching devices, or other deterrents wherever possible. All electrical infrastructure is to be of bird-friendly, insulated design in line with the latest Eskom Technical Standards.	Design / pre-construction phase Operational phase	ECO	Monthly	Documentary / photographic evidence of compliance is on file.
Monitor and mitigate collisions of avifauna with turbine blades	DPM cEO/dEO ECO Avifaunal specialist	1) Implement blade painting as per a Birdlife SA recommendation prior to construction on all turbines, if practically possible, and authorised by the Civil Aviation	1) Design phase 2) Construction phase 3) Operational phase	dEO / cEO ECO	1) Once-off 2) Ongoing for first 2 years of operation as a minimum, and every 5 years, or	1) Proof of correspondence with Birdlife SA / CAA regarding blade painting prior to construction /

Impact Management Action	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe for implementation	Responsible person	Frequency	Evidence of compliance
	Avifaunal monitors	Authority, at the time of construction. This may greatly reduce risk of additional, more expensive measures being required following construction. 2) Finalisation of Post-authorisation Monitoring Programme (refer to Annexure B of the Avifaunal Assessment Report) 3) Implementation of the Post-authorisation monitoring programme 4) Implementation of any adaptive mitigation measures as recommended by avifaunal specialist, if required, including shut down on demand, curtailment, blade painting (if not possible during construction), habitat management and environmental offsets.	4) Operational Phase		as indicated in the finalised Post-authorisation monitoring programme	Photographic evidence of painted blades. 2) Finalised Post-authorisation monitoring programme is attached as an Appendix to the authorised EMPr. 3) Quarterly post-construction monitoring and annual nest monitoring reports are on record and have been submitted to Birdlife SA and DFFE for the duration of on-going monitoring. 4) Any adaptive mitigation measures as recommended in post-construction monitoring and nest survey reports by an avifaunal specialist are implemented and included in any amendments to the EMPr for the project.

8 References

Avian Power Line Interaction Committee (APLIC). 2006. Suggested practices for avian protection on power lines: The State of the Art in 2006. Project report prepared for Edinson Electric Institute, APLIC and RE California Energy Commission, Washington DC, and Sacramento, CA, USA.

Band W, Madders M & Whitfield DP. 2007. Developing field and analytical methods to assess avian collision risk at wind farms. In: de Lucas M, Janss GFE & ferrer M (eds) Birds and Wind farms: Risk Assessment and Mitigation pp 259-275. Quercus, Madrid

Bennun L, van Bochove J, Ng C, Fletcher C, Wilson D, Phair N & Carbone G. 2021. *Mitigating biodiversity impacts associated with solar and wind energy development. Guidelines for project developers.* Gland, Switzerland: IUCN and Cambridge, UK: The Biodiversity Consultancy

Bernadino J, Bevanger K Barrientos R, Dwyer JF, Marques AT, Martins RC, Shaw JM, Silva JP & Moreira F. 2018. Bird collisions with powerlines: state of the art and priority areas for research. *Biological Conservation* 222: 1-13

Bevanger, K. 1998. Biological and conservation aspects of bird mortality caused by electricity power lines: a review. Biological Conservation 86:67-76

Birdlife SA. 2015. Important Bird and Biodiversity Areas.

Brooks M & Ryan P. 2022. Southern African Bird Atlas Project 2. Version 1.51. FitzPatrick Institute of African Ornithology. Occurrence dataset https://doi.org/10.15468/8x5b7h accessed via GBIF.org on 2023-01-06.

Carrete, M., Sánchez-Zapata, J.A., Benítez, J.R., Lobón, M., Donázar, J.A., 2009. Large scale risk-assessment of wind-farms on population viability of a globally endangered long-lived raptor. *Biological Conservation* 142, 2954–2961.

Chamberlain DE, Rehfisch MR, Fox AD, Desholm M & Antony SJ. 2006. The effect of avoidance rates on bird mortality predictions made by wind turbine collision models. *Ibis* 148: 198-202

Cook ASCP, Humphreys EM, Masden EA, Burton NHK. 2014. The avoidance rates of collision between birds and offshore turbines. *Scottish Marine Freshwater Science* 5(16):247 pp. Edinburgh: Scottish government. https://doi.org/10.7489/1553-1

Desholm M. 2006. Wind farm related mortality among avian migrants – a remote sensing study and model analysis. PhD thesis. National Environmental Research Institute. Denmark.

Drewitt, A.L. & Langston, R.H.W. 2006. Assessing the impacts of wind farms on birds. *Ibis*. 148:29–42.

Dwyer JF. 2006. Electric shock injuries in a Harris's hawk population. *Journal of Raptor Research* 40: 193-199.

Dwyer JF, Harness RE & Eccleston D. 2017. Avian electrocutions on incorrectly retrofitted power poles. *Journal of raptor Research* 51: 293-304.

Dwyer, J.F., Landon, M.A. and Mojica, E.K. 2018. Impact of Renewable Energy Sources on Birds of Prey. In: Sarasola, J.H., Grande, J.M. and Negro, J.J. (eds). *Birds of Prey Biology and conservation in the XXI century*. p 303-321

Frid, A. & Dill, L.M. 2002. Human-caused disturbance stimuli as a form of predation risk. Conservation Ecology 6(1): 11.

Gove, B., Langston, R., McCluskie, A., Pullan, J. & Scrase, I. 2013. Wind farms and birds: An updated analysis of the effects of wind farms on birds, and best practice guidance on integrated planning and impact assessment. Strasbourg.

Harvey and Associates. 2018. Marbled Murrelet Collision Risk Assessment Assciated with the Humboldt Wind Project proposed for Humboldt County, California. *Biological Resources.* Report for Humboldt Wind LLC.

Hockey PAR, Dean WRJ & Ryan PG. 2005. *Roberts Birds of Southern Africa*. 7th Edition. The Trustees of the John Voelcker Bird Book Fund, Cape Town, South Africa

Janss GFE. 2000. Avian mortality from power lines: a morphologic approach of a species-specific mortality. *Biological Conservation* 95: 353-359

Jenkins AR, van Rooyen CS, Smallie, JJ, Harrison JA, Diamond M, Smit-Robinson HA & Paton S. *Birds and Wind-Energy Best-Practice Guidelines*. Third Edition, 2015. Birdlife South Africa / Endangered Wildlife Trust

Kumara HN, Babu S, Babu Rao G, Mahato S, Bhattacharya M, Ranga Rao NV, Tamiliniyan D, Parengal H, Deepak D, Balakrishnan A & Bilaskar M. 2022. Responses of birds and mammals to long-established wind farms in India. *Nature: Scientific Reports* 12:1339. https://doi.org/10.1038/s41598-022-05159-1

Kunz TH, Arnett EB, Cooper BM, Erickson WP, Larkin RP, Mabee T, Morrison ML, Strickland MD, Szewczak JM, 2007. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. *Journal of Wildlife Management* 71. 2449–2486.

Laranjeiro T, May R & Verones F. 2018. Impacts of onshore wind energy production on birds and bats: recommendations for future life cycle impact assessment developments. *The international Journal of Life Cycle Assessments.* https://doi.org/10.1007/s11367-017-1434-4

Loss SR, Will T & Marra PP. 2014. Refining estimates of bird collision and electrocution mortality at power lines in the United States. *PLoS One* 9e:101565.

Madders, M. & Whitfield, D.P. 2006. Upland raptors and the assessment of wind farm impacts. Ibis. 148:43–56.

Marques A T, Batalha H, Rodrigues S, Costa H, Pereira MJR, Fonseca C, Mascarenhas M & Bernardino J. 2014. Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. *Biological Conservation* 179: 40-52

Marques AT, Batalha H, Bernardino J. 2021 Bird Displacement by Wind Turbines: Assessing Current Knowledge and Recommendations for Future Studies. *Birds* 2021, 2, 460–475. https://doi.org/10.3390/birds2040034

Masden EA & Cook ASCP. 2016. Avian collision risk models for wind energy impact assessments. *Environmental Impact Assessment Review* 56: 43-49.

Martin GR & Shaw JM. 2010. Bird collisions with power lines: failing to see the way ahead? *Biological Conservation* 143: 2695-270

May R. 2015. A unifying framework for the underlying mechanisms of avian avoidance of wind turbines. *Biological Conservation* 190: 179-187. doi.org/10.1016/j.biocon.2015.06.004

May R., Nygård T, Dahl EL, Reitan O & Bevanger K. 2011. Collision risk in white-tailed eagles. Modelling kernel-based collision risk using satellite telemetry data in Smøla wind-power plant. – NINA Report 692. 22 pp.

May R, Nygård T, Falkdalen U, Åstr¨om J, Hamre Ø, Stokke BG. 2020. Paint it black: Efficacy of increased wind-turbine rotor blade visibility to reduce avian fatalities. Ecological Evolution 10, 8927–8935

Percival S. 2005. Birds and windfarms: what are the real issues? British Birds 98: 194-204.

Perold V, Ralston-Paton S & Ryan P. 2020: On a collision course? The large diversity of birds killed by wind turbines in South Africa, Ostrich, DOI:10.2989/00306525.2020.1770889

Ralston-Paton S. 2017. Verreaux's Eagle and Wind Farms - Guidelines for impact assessment, monitoring and mitigation. Birdlife South Africa. First Edition

Ralston-Paton S & Murgatroyd M. 2021. Verreaux's Eagle and Wind Farms – Guidelines for impact assessment, monitoring and mitigation. Birdlife South Africa. Second Edition.

Ralston Paton S., Smallie J., Pearson A., and Ramalho R. 2017. Wind energy's impacts on birds in South Africa: A preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme in South Africa. BirdLife South Africa Occasional Report Series No. 2. BirdLife South Africa, Johannesburg, South Africa

Retief EF., Diamond M, Anderson MD, Smit HA, Jenkins A, Brooks M & Simmons R. 2014. Avian Wind Farm Sensitivity Map for South Africa. Birdlife South Africa

Rollan LEX, Real J, Bosch R & Tinto A. 2010. Modelling the risk of collision with power lines in Bonelli's Eagle *Hieraaetus fasciatus* and its conservation implications. *Bird Conservation International* 20:279-294

Scottish Natural Heritage. 2018. Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model. SNH Guidance Note. September 2018 v2.

Shaw J, Reid TA, Shuttgens M, Jenkins AR & Ryan PG. 2018. High power line collision mortality of threatened bustards at a regional scale in the Karoo, South Africa. Ibis 160: 431-446. doi: 10.1111/ibi.12553

Shaw JM, Reid TA, Gibbons BK, Pretorius M, Jenkins AR, Visagie R, Michael MD & Ryan PG. 2021. A large-scale experiment demonstrates that line marking reduces power line collision mortality for large terrestrial birds but not bustards, in the Karoo, South Africa. *Ornithological Applications* 123: 1-10 DOI: 10.1093/ornithapp/duaa067

Simmons RE, Ralston-Paton S, Colyn R and Garcia-Heras M-S. 2020. Black Harriers and wind energy: guidelines for impact assessment, monitoring and mitigation. BirdLife South Africa, Johannesburg, South Africa

Slater SJ, Dwyer JF & Murgatroyd M. 2020. Conservation letter: raptors and Overhead Electrical Systems. *Journal of Raptor Research* 54: 198-203

Smallwood, K.S. & Thelander, C.G. 2004. Developing methods to reduce bird mortality in the Altamont Pass Wind Resource Area. Final Report by BioResource Consultants to the California Energy Commission, Public Interest Energy Research-Environmental Area, Contract No. 500-01-019.

South African National Biodiversity Institute (SANBI) 2022. *Species Environmental Assessment Guideline. Guidelines for the implementation of the terrestrial Fauna and Flora Species protocol for environmental impact assessments in South Africa.* South African National Biodiversity Institute, Pretoria. Version 3.2022

Sovacool BK. 2009. Contextualizing avian mortality: A preliminary appraisal of bird and bat fatalities from wind, fossil-fuel, and nuclear electricity. *Energy Policy* 37: 2241-2248. doi:10.1016/j.enpol.2009.02.011

Strickland MD, Arnett EB, Erickson WP, Johnson DH, Johnson GD, Morrison ML, Shaffer JA, and Warren-Hicks W. 2011. Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA

Taylor, M.R., Peacock, F., and Wanless, R.M. 2015. Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.

Urquhart, B. & Whitfield, D.P. 2016. Derivation of an avoidance rate for red kite Milvus milvus suitable for onshore wind farm collision risk modelling. Natural Research Information Note 7. Natural Research Ltd, Banchory, UK.

Whitfield DF. 2009. Collision Avoidance of Golden Eagles at Wind Farms under the 'Band' Collision Risk Model. Report to Scottish Natural Heritage. National Research Ltd, Banchory, UK.

ANNEXURE A: Specialist Declaration, CV & SACNASP Certificate

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

Avifaunal Specialist Impact Assessment Report for the Proposed Soutrivier Central Wind Energy Facility near Victoria West, Northern Cape Province

Kindly note the following:

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

Departmental Details

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

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

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

CB

AH

1. SPECIALIST INFORMATION

Specialist Company Name:	**Holland Group (Pty) Ltd t/a Holland & Associates Environmental Consultants**			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	**Anja Isabel Albertyn**			
Specialist Qualifications:	**MSc Zoology (Ornithology), BSc (Hon) Zoology, BSc Zoology & Botany**			
Professional affiliation/registration:	**SACNASP (400037/16)**			
Physical address:	**4 Central Building Apartments, 6 Central Square, Pinelands**			
Postal address:	**As above**			
Postal code:	**7405**		Cell:	**0762658933**
Telephone:	**0762658933**		Fax:	**n/a**
E-mail:	**anja@hollandandassociates.net**			

2. DECLARATION BY THE SPECIALIST

I, ___Anja Albertyn_______________, declare that –

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

Anja Albertyn

Signature of the Specialist

Holland Group (Pty) Ltd t/a Holland & Associates Environmental Consultants

Name of Company:

6 January 2023

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

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

Anja Albertyn

Signature of the Specialist

Holland Group (Pty) Ltd

Name of Company

6 January 2023

Date

CABYett

Ref no 9/1/8/2
C.A. Byett
Commissioner of Oaths

Signature of the Commissioner of Oaths

06/01/2023

Date

SOUTH AFRICAN POLICE SERVICE
STATION COMMANDER
PINELANDS
06 JAN 2023
PINELANDS
STASIEBEVELVOERDER
SOUTH AFRICAN POLICE SERVICE

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Anja Isabel Albertyn

Registration Number: 400037/16

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)

Effective **27 January 2016** Expires **31 March 2023**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

ANJA ISABEL ALBERTYN

neé Terörde, in Germany 1977
RSA permanent resident

CURRICULUM VITAE

Ornithologist (MSc Ornithology) and Environmental Consultant (IAIASA) with thirteen years of experience in the environmental consulting field, including seven years conducting EIAs & Basic Assessments, eleven years of avifaunal specialist studies, and eighteen years of avifaunal monitoring. SACNASP Registered Professional Natural Scientist (Ecological Science) (400037/16) with eight scientific publications on avian ecology to date. Selected member of the Birds and Renewable Energy Specialist Group (BARESG).

Professional Experience

2019 – present (2022)	**Avifaunal Specialist and Environmental Consultant** *Holland & Associates Environmental Consultants, Tokai / Port Alfred*
2017-2019	**Avifauna Specialist & Environmental Consultant** *Arcus Consultancy Services South Africa, Cape Town*
2013 - 2017	**Ecology Consultant (Avifauna)** *Arcus Consultancy Services South Africa, Cape Town*
2011 - 2013	**Avifaunal Monitoring Services** *Self-employed, Cape Town*
2011 - 2013	**Project Manager and UX Designer (part-time)** *the binary family, Cape Town / Berlin*
2009 - 2011	**Researcher** *Anchor Environmental Consultants, Tokai*
2005 - 2008	**Director & Co-founder** *Fishriver Horse Safaris, Port Alfred*
2002 - 2003	**Assistant Camp Manager** *Mashatu Game Reserve, Tuli Block, Botswana*
1999 - 2002	**Wildlife Research Assistant** *Centre for Wildlife Management, Pretoria / Mashatu Game Reserve, Botswana*

Academic Qualifications

- *Department of Environmental Science, Rhodes University, 2015:* Introduction to Environmental Impact Assessment Procedure **Short Course** *(Highly competent)*
- *Percy FitzPatrick Institute, University of Cape Town, 2006-2009:* Zoology (Ornithology), **Master of Science**
- *Rhodes University, 2005-2006:* Zoology, Bachelor of Science (**Honours**)
- *University of South Africa, 2002 – 2004:* Zoology & Botany, **Bachelor of Science** (*cum laude*)
- *Heinrich-Heine Universität, Düsseldorf, Germany, 1999 – 2002,* Biology, Vordiplom

PROJECT EXPERIENCE

Avifaunal Pre-application Monitoring & Impact Assessments for Wind Energy Facilities (WEFs):

- Proposed Soutrivier WEFs, Victoria West
- Proposed Brandberg WEF, Laingsburg
- Proposed Kabbo WEF, Victoria West
- Authorised Kap Vley WEF Kleinzee
- Authorised Paulputs WEF, Pofadder
- Authorised Highlands North, Central & South WEFs, Somerset East
- Proposed Kleinberg WEF Mossel Bay
- Proposed WEF Pofadder
- Proposed WEF Aggeneys
- Proposed WEF Loxton, NC
- Proposed WEF Riebeek East, EC
- Proposed WEF Gqeberha, Eastern Cape
- Kolkies WEF Touw's River
- Karee WEF Touws River
- Komsberg WEFs, Sutherland
- Grassridge II WEF Addo
- Proposed WEF Elliot
- Proposed WEF Indwe
- Koingnaas WEF
- Richtersveld WE Alexander Bay
- Namakwaland WEF, West Coast
- Authorised Springbok WEF

Avifaunal Post-construction Monitoring for Wind Energy Facilities:

- West Coast 1 WEF, Western Cape
- Hopefield WEF, Western Cape
- Gouda WEF, Western Cape

Avian Species Specialist Impact Assessments, Compliance Statements & specialist Studies:

- Mulilo Paarde Valley PV2
- Billy Kloppers Agricultural Developments
- Lingenfelder Agricultural Developments
- ACED Bloemfontein Solar PV Facilities
- LIV Village Development, Makhanda, EC
- ACED Dealesville Solar PV Facilities
- Umsinde WEF EMPr
- Khangela WEF EMPr
- Indigo Fruit Farm Agricultural Expansions, Ashton, WC
- Padloper Solar PV Facilities, WC&NC
- Padloper Electrical Grid Infrastructure
- Soutrivier Solar PV, Victoria West
- Mossel Bay Zipline EMPr Avian Study
- Arlington Mixed-Use Development, Gqeberha, EC
- Kweek Kraal Agricultural Expansion, Citrusdal, WC
- Doornkloof Dam and Agricultural Expansion, Swellendam
- De Wilgen Agricultural Expansion, Ashton
- Welgegund Agricultural Expansion, Robertson
- Hive Energy Solar PV, Gqeberha, EC
- Jan Rabie Dam Enlargement Robertson
- Auriga Thermal Power Plant Saldanha Bay

- Vortum Gas Cycle Turbine in Saldanha Bay
- SPV Renfields Solar PV Facility Hopefield
- Parsons PV Power Park, Gqberha, EC
- Hive Energy Solar Project, Gqberha, EC
- Bokpoort Solar Farm, Groblershoop, NC
- Metsimatala CSP Facility, NC
- Avifaunal Impact Assessment 132 kV Mbumbu-Tsakani Powerline
- Avifaunal Walkthrough, Robben Island PV, Western Cape

Avian Feasibility Studies and Specialist Nest Surveys

- Avifaunal Feasibility Assessment, 2 Confidential WEFs, Western Cape
- Avifaunal Feasibility Assessment, 6 Confidential WEFs, Eastern Cape
- Avifaunal Feasibility Assessment, 6 Confidential WEFs, Northern Cape
- Canal Walk Wetlands Avifauna Study, Cape Town
- Review and mitigation strategy design for birds at the Kinangob Wind Park, Kenya

Lead Environmental Consultant

- De Zwartland Werf Stormwater Detention Pond Basic Assessment Process, Malmesbury
- Paarde Valley PV2 Grid Connection Basic Assessment Process, De Aar, NC
- Paarde Valley PV2 Amendment Application Process, De Aar, NC
- Bernheim Agricultural Expansion, Robertson, Basic Assessment Process
- Kransvlei Agricultural Expansions, Scoping & EIA Process, WC
- Melkboomfontein Agricultural Expansions, Citrusdal S24G Process
- Wasplaas Dam, Paarl, S24G Application
- Brandwagt Agricultural Expansion, Robertson, Basic Assessment Process
- Bruwers Agricultural Expansions, Basic Assessment Process
- Ouplaas Dam Enlargement, Greyton, S24G Application
- Boekenhoutskloof Agricultural Expansion, Hermanus, Basic Assessment Process
- Malmesbury Mall & Hospital, WC, Basic Assessment Process
- Malmesbury Mall & Hospital, WC, Part 1 Amendment
- Namaquasfontein Skool Dam, WC, Section 24G Application
- De Molen Dam, WC, Section 24G Application, De Molen Dam, WC
- Oude Schuur Agricultural Developments, Worcester, Scoping & EIA Process
- Highlands WEFs, Eastern Cape, Scoping & EIA Process
- Phezukomoya WEF, Noupoort, Scoping & EIA Process
- San Kraal WEF, Noupoort, Scoping & EIA Process

Scientific Publications & Conferences

Cowley, PD, Terörde, AI & Whitfield, AK. **2018.** Birds as major predators of fishes in a small estuary: does this influence the nursery area concept for estuary-associated fish species? African Zoology 52: 147-154

Maree, BA, Cowley, PD, Naesje, TF Childs, A-R, Terörde, AI & Thorstad, EB. **2016**. Influence of prey abundance and abiotic factors on the long-term home-range and movement dynamics of spotted grunter Pomadasys commersonnii in an intermittently open estuary. African Journal of Marine Science 2016: 1-10

Terörde, AI & Turpie, JK. **2013**. Influence of habitat structure and mouth dynamics on avifauna of intermittently-open estuaries: A study of four small South African estuaries. Estuarine, Coastal and Shelf Science 125: 10-19

Terörde, AI & Turpie, JK. **2012**. Use of a small, intermittently-open estuary by waterbirds: a case study of the East Kleinemonde Estuary, Eastern Cape, South Africa. African Journal of Aquatic Science 37: 183-190

Terörde, AI, Clark, B. Hutchings, K. Orr, K. **2011**. Ballast water management technology testing. South African Marine Science Symposium 2011.

Turpie, JK. Clark, B.M., Bornman, T, Cowley, PD & Terörde, AI. **2009**. Integrated Ecological-Economic Modeling as an Estuarine Management Tool: A Case Study of the East Kleinemonde Estuary. Volume II: Model Construction, Evaluation and User Manual. WRC Report No. 1679/2/08

Terörde, AI & Turpie, JK. **2008**. Appendix K. Specialist Report: Birds. In: van Niekerk, L., Bate, G.C. & Whitfield, A.K. (eds). East Kleinemonde Estuary Reserve determination study: Technical report. Department of Water Affairs & Forestry, Pretoria.

Whitfield, AK, Adams, JB, Bate, GC, Bezuidenhout, K, Bornman, TG, Cowley, PD, Froneman, PW, Gama, PT, James, NC, Mackenzie, B, Riddin, T, Snow, GC, Strydom, NA, Taljaard, S, Terörde, AI, Theron, AK, Turpie, JK, van Niekerk, L, Vorwerk, PD & Wooldridge, T.H. **2008**. A multidisciplinary study of a small, intermittently open South African estuary, with particular emphasis on the influence of mouth state on the ecology of the system. African Journal of Marine Science 30: 453-474

Terörde, AI & Turpie, JK. **2008**. Use of a small, intermittently-open estuary by waterbirds: a case study of the East Kleinemonde estuary, Eastern Cape, South Africa. South African Marine Science Symposium 2008. (Awarded best student oral presentation)

Terörde, AI & Turpie, JK. **2007**. Birds. In: Whitfield AK, Bate GC (eds). A Review of Information on Temporarily Open/closed Estuaries in the Warm and Cool Temperate Biogeographic Regions of South Africa, with Particular Emphasis on the Influence of River Flow on these Systems. WRC Report No. 1581/1/07.

ANNEXURE B: Pre-application and Post-authorisation Avifaunal Monitoring Plans

The Pre-application and Post-authorisation Avifaunal Monitoring Plan was compiled by the avifaunal specialist in line with current South African Best Practice Guidelines for pre-construction bird monitoring at proposed wind energy facilities applicable ((Jenkins et al. 2015) and the Verreauxs' Eagle Guidelines (Ralston-Paton 2017).

Annexure B1: The Pre-application Avifaunal Monitoring Plan

The Pre-application Avifaunal Monitoring Plan was compiled following a desktop study, a 7 day raptor nest survey / reconnaissance study / site inspection, in March 2021, for the Soutrivier WEFs Area of Interest (AOI) and was updated in response to changes in the project description throughout the course of monitoring .

The Study Area

The climate of the area is semi-arid with rainfall of an average of 200 – 400 mm per annum occurring mainly in late summer to autumn. Temperatures range from approximately -8°C to +37°C. The topography of the region can be described as lowlands with mountains, i.e. the terrain is generally flat and interrupted with prominent mountains. The majority of the AOI lies within lowlands and avoids the mountainous areas which are suitable for cliff-nesting raptors. The AOI is utilised for low-intensity livestock grazing (mainly sheep farming). There is a minimal amount of development in the area, with only scattered and isolated farmsteads.

The AOI does not contain any formal protected areas (SAPAD Q4 2019), conservation areas (SACAD Q4 2019) or Important Bird Areas (Marnewick *et al.* 2015). The closest Important Bird Area to the site is the Karoo National Park which is located approximately 50 km to the south-west of the site. This is also the closest national protected area to the site.

The study area falls within the Nama Karoo Biome and the mapped vegetation types are the Eastern Upper Karoo vegetation type, and a small section of Upper Karoo Hardeveld (Figure B). The threat status of the two mapped vegetation types is that of *Least Concern* (SANBI 2018).

There are four NFEPA rivers running through the AOI, and a number of drainage lines in the northern and southern sections of the site, with a marked absence of aquatic features in the central area (Figure 1). Few small natural and artificial wetlands are mapped for the site (NFEPA wetlands database).

The South African Bird Atlas Project 2 has recorded a total of 186 species in the study area in 24 pentads (~ approximately 9x9 km per pentad), covering and surrounding the AOI, with a total of 78 cards submitted. Of these, 16 are Species of Conservation Concern (SCC) with a regional (Taylor et al. 2015) or global (iucnredlist.org) threat status of Near-threatened (NT), Vulnerable (VU), Endangered (EN) or Critically Endangered (CR). 23 of the 186 recorded species are endemic or near-endemic, and 27 are priority species for wind energy developments (Retief et al. 2014). The potentially occurring SCC are African Rock Pipit (NT), Bar-tailed Godwit (NT), Black Harrier (EN), Blue Crane (NT), Curlew Sandpiper (NT), Double-banded Courser (NT), Greater Flamingo (NT), Ground Woodpecker (NT), Karoo Korhaan (NT), Lesser Flamingo (NT), Ludwig's Bustard (EN), Maccoa Duck (NT), Marabou Stork (NT), Martial Eagle (EN), Secretarybird (VU), and Verreaux's Eagle (VU).

Methodology

Four seasonal surveys were conducted by four observers over twelve days (Table A), consisting of vantage point (VP) surveys, walked transect surveys, driven transect surveys, focal site surveys, incidental records and checklist surveys, according to the methodologies outlined in the Best Practice Guidelines (Jenkins et al. 2015).

A Control Site was selected approximately 5 km from the AOI, which matched the study area as closely as possible (Figure A).

Table A: Survey dates

Season	Survey Dates
Autumn	01 April – 12 April 2021
Winter	31 July – 11 August 2021
Spring	18 October – 29 October 2021
Summer	11 December – 22 December 2021

Vantage Points

Fourteen VPs were established on the AOI (refer to the below table) and monitored for 18 hours per survey, four times per year (seasonally), with a total of 72 hours of VP surveys per VP per annum. Martial Eagle nests were located during the 2nd seasonal survey, and a 6 km no-turbine buffer was recommended surrounding the nests. Therefore, VPs within these buffers were dropped (VP1, VP2, VP12 and VP13) following the second seasonal survey (highlighted in grey in the table below), as the buffers were excluded from the AOI.

Two VPs were established on the Control Site and monitored for 12 hours per survey, four surveys per year.

Each VP was surveyed in 3 to 4 hour sessions on different days, using binoculars, and continuously searching the skies, at different times of day, where practically possible, in order to get as wide a spread of environmental conditions as possible.

All Priority Species (Retief et al. 2014) flights were mapped on topographical field maps, and the flight duration, height, including changes in height were recorded together with details on the observed individuals, and environmental conditions. Heights were recorded in meter estimates.

Table B: Vantage Point Survey Locations

Reference	Coordinates	Hours surveyed per season / annum
VP1	-31.480878°/ 22.632780°	18 / 36
VP2	-31.517906°/ 22.654614°	18 / 36
VP3	-31.519308°/ 22.709117°	18 / 72
VP4	-31.550240°/ 22.687678°	18 / 72
VP5	-31.555024°/ 22.737660°	18 / 72
VP6	-31.525441°/ 22.791179°	18 / 72
VP7	-31.558270°/ 22.776747°	18 / 72
VP8	-31.555513°/ 22.831798°	18 / 72
VP9	-31.603564°/ 22.776790°	18 / 72
VP10	-31.605832°/ 22.829531°	18 / 72

Reference	Coordinates	Hours surveyed per season / annum
VP11	-31.641641°/ 22.748603°	18 / 72
VP12	-31.640560°/ 22.801416°	18 / 36
VP13	-31.643428°/ 22.845663°	18 / 36
VP14	-31.646011°/ 22.893623°	18 / 72
CVP1	-31.739236°/ 22.847315°	12 / 48
CVP2	-31.791639°/ 22.846044°	12 / 48

Walked Transects

The purpose of walked transects is to sample the abundance of smaller and passerine species. Six walked transects were established in the AOI and one on the Control site and were sampled three times per seasonal survey. WT1 and WT 12 were dropped following the second seasonal survey as they fell outside of the revised AOI. WT14 was added in the final survey. Walked transects were surveyed by observers walking along the transect, and recording all individual birds encountered within 250 m of each side of the transect line, using Birdlasser software. At the beginning of each transect environmental variables are recorded (cloud cover, temperature, rain, visibility, wind strength, wind direction. For each record the following is recorded (where possible): the species, number of individuals, age, sex, behaviour (flushed, commuting, foraging, perched, displaying), seen or heard, and GPS coordinates from where the bird was seen.

Table C: Walked Transect Survey Locations

Reference	Start coordinates	End coordinates	Approximate length	Times sampled per seasonal survey / annum
WT1	-31.510029/ 22.664269	-31.524209/ 22.661659	500 m	3 / 6
WT3	-31.519646/ 22.708904	-31.524209/22.703955	500 m	3 / 12
WT5	-31.555375/ 22.737681	-31.550595/22.738311	500 m	3 / 12
WT9	-31.60349/ 22.776426	-31.606872/ 22.774962	500 m	3 / 12
WT11	-31.641846/ 22.74838	-31.643045/ 22.74333	500 m	3 / 12
WT12	-31.638878/ 22.802221	-31.634879/ 22.804972	500 m	3 / 6
WT 14	-31.645808/ 22.893398	-31.64185/ 22.896064	500 m	3 / 3
CWT	-31.794228/ 22.851024	-31.796778/ 22.856685	500 m	3 /12

Driven Transects

Two driven transects were established across the AOI site, and one traversing the control site. Driven transects were sampled twice per seasonal survey, by driving slowly with windows open along a pre-determined route and recording all large terrestrial species and priority species. The purpose of driven transects is to sample abundances and occurrence of terrestrial species which are otherwise not recorded or detected with other sample methods. Environmental variables were recorded at the start and the end of each transect (temperature, visibility, cloud cover, wind strength and direction, rain), and each record was logged using Birdlasser software including the species, number, age, sex, behaviour, GPS location of the observer, and distance and direction of the bird from the recorded GPS location.

Table D: Driven Transect Survey Details.

Reference	Start Coordinates	End Coordinates	Times Surveyed during seasonal survey
DT1	-31.539798/ 22.798456	-31.550494/ 22.69051	2
DT2	-31.522361/ 22.860256	-31.600065/ 22.778866	2
CDT	-31.791598/ 22.845921	-31.751329/ 22.761607	2

Focal Sites

Focal sites are potential nesting areas of priority species, such as cliffs, known nests, large stands of trees, wetlands, waterpoints and powerlines. Six focal sites were identified during the surveys and each of these focal sites was surveyed at least once per seasonal survey.

Table E: Focal Site Survey Details

Reference	Start Coordinates	Type
FS Reservoir	-31.548042/ 22.716708	Reservoir
FS12	-31.636988/ 22.81518	Dam
SECR1	-31.532086/ 22.703707	Secretarybird Nest
SECR2	-31.481207/ 22.629104	Secretarybird Nest
SECR3	-31.646282/ 22.881992	Secretarybird Roost
LUBU1	-31.598952/ 22.833454	Ludwig’s Bustard Nest
ME01	-31.51349/ 22.616071	Martial Eagle nest
ME02	-31.51931/ 22.619285	Martial Eagle nest
ME03	-31.67245/ 22.816565	Martial Eagle nest
JB01	-31.55242/ 22.675715	Jackal Buzzard nest

Incidental Records

All priority species encountered throughout the survey, outside of the survey methods outlined above while traversing the site, as well as up to 5 km from the site boundary were recorded as incidental sightings with GPS coordinates, and details of the individuals and behaviour and environmental conditions, as per the transect methodology, using Birdlasser software.

Checklist Survey

Each observer kept a bird list for the survey for the WEF Site and the Control Site using Birdlasser software. The lists of all observers are compiled into one bird list for the AOI and one bird list for the control site, and any new birds are added to the list following subsequent surveys.

Verreaux’s Eagle nests in PAOI

The following nests were identified within 7 km of the AOI during the initial raptor nest survey and should be monitored for activity during the breeding period (June – August). It is notable that three Verreaux’s Eagle nests were found in large trees, of which two were confirmed as active.

Nest ref	Latitude	Longitude	Notes (2020)
VE1	-31,702343	22,662741	Active on cliff
VE1a	-31,702343	22,662741	Alternate (inactive) on cliff

Nest ref	Latitude	Longitude	Notes (2020)
VE1b	-31,700974	22,66522	Alternate (inactive) on cliff
VE2	-31,582299	22,619117	Active on cliff
VE3	-31,662372	22,947375	Active on cliff
VE4	-31,520033	22,861203	Active in large conifer tree
VE5	-31,597141	22,890223	Active on cliff
VE5a	-31,597045	22,890181	Inactive on cliff
VE6a	-31,699267	22,833478	Signs of recent activity. Breeding unconfirmed. Large nest on top of Hamerkop nest in poplar tree grove. VE pair flushed from grove.
VE6b	-31,699267	22,833729	Signs of recent activity. Breeding unconfirmed. Large stick nest in poplar tree grove. VE pair flushed from grove.
VE6c	-31,699169	22,833343	Signs of recent activity. Breeding unconfirmed. Large stick nest in poplar tree grove. VE pair flushed from grove.
VE6d	-31,699532	22,833762	Signs of recent activity. Breeding unconfirmed. Large stick nest in poplar tree grove. VE pair flushed from grove.
VE7	-31,604039	22,693715	Active in large conifer tree

Annexure B2: Post-authorisation Avifaunal Monitoring

Should the project receive environmental authorisation, an avifaunal walkthrough by an avifaunal specialist must be completed as close as possible prior to construction commencing (within 6 weeks prior to the start of construction), in order to confirm that no SCC are breeding within the construction disturbance footprint, and to monitor all located SCC nests within the Avifaunal Impact Zone. The walkthrough will determine if during construction monitoring of any nests will be required.

The Verreaux's Eagle nests and SCC nests listed in the Pre-application Monitoring Plan within the PAOI, and any additional nests that are located during avifaunal monitoring surveys within 7 km of the authorised turbines must be monitored annually from authorisation pre-construction (as a baseline) and during the operational lifetime of the facility by a suitably qualified avifaunal observer (as instructed by an avifaunal specialist) during the species breeding season. Reports of breeding status and activity at the nests must be submitted annually to Birdlife SA and the Department of Forestry, Fisheries and the Environment (DFFE).

Operational monitoring must be conducted in line with Best Practice Guidelines applicable at the time that the facility comes into operation. Therefore, detailed post-construction monitoring methodologies are not provided in this plan, but must be implemented as per the Best Practice Guidelines current at the time of commencement of the operational phase.

The purpose of operational monitoring is to determine the actual impacts of the wind energy facility, if additional mitigation is required, and to improve future assessments (Jenkins et al. 2015). Operational monitoring should start on the date of commercial operation or as soon as practically possible thereafter (within the first month of operation) and consist of a replication of pre-application monitoring (as per Annexure B1) on the AOI and the Control Site, and the quantification of avian mortalities due to the operational wind energy facility.

The replication of pre-application monitoring may require minor adaptations around new infrastructure and roads, but the scope, survey locations, survey hours and surveys seasons must resemble pre-application monitoring methodology as closely as practically possible (as per the Pre-application Avifaunal Monitoring Plan).

Avian mortality quantification must consist of regular carcass searching underneath the turbines, the frequency and scope of which must be informed by searcher efficiency trials, and scavenger removal trials, as per the applicable Best Practice Guidelines at the time.

The Post-authorisation Monitoring Plan must be reviewed as a minimum following year 1, 2, 5, and every 5 years thereafter, or as indicated in an operational monitoring report by an avifaunal specialist, and be updated with any available updated Best Practice Guidelines or information obtained during post-construction monitoring at the site and elsewhere. The duration and scope of operational monitoring must be in line with current Best Practice Guidelines, as a minimum, and may be required to be extended, based on the results of operational monitoring.

Operational monitoring reports are to be produced quarterly for the WEF operator by the appointed avifaunal specialist conducting the monitoring while operational monitoring is underway. The operator must submit all monitoring reports to Birdlife South Africa (energy@birdlife.org.za) and the Department of Forestry, Fisheries and the Environment (DFFE): Compliance annually throughout on-going monitoring.

ANNEXURE C: List of Species recorded during Pre-application Avifaunal Monitoring

Full Name	*Scientific Name*	Red List (Regional, Global)	Endemism	WEF Priority Score	Autumn 2021	Winter 2021	Spring 2021	Summer 2021/2022
African Black Duck	*Anas sparsa*				x			
African Black Swift	*Apus barbatus*							x
African Fish Eagle	*Haliaeetus vocifer*			290		x		
African Harrier-Hawk	*Polyboroides typus*			190	x	x		x
African Hoopoe	*Upupa africana*				x			
African Pipit	*Anthus cinnamomeus*							x
African Red-eyed Bulbul	*Pycnonotus nigricans*				x	x		x
Ant-eating Chat	*Myrmecocichla formicivora*				x	x		x
Barn Swallow	*Hirundo rustica*				x		x	x
Bar-throated Apalis	*Apalis thoracica*				x			
Black Stork	*Ciconia nigra*	VU, LC		330				x
Black-eared Sparrow-Lark	*Eremopterix australis*		NE			x	x	
Black-headed Canary	*Serinus alario*		NE					x
Blacksmith Lapwing	*Vanellus armatus*				x			x
Blue Crane	*Grus paradisea*	NT, VU		320	x	x	x	x
Bokmakierie	*Telophorus zeylonus*				x	x	x	
Booted Eagle	*Hieraaetus pennatus*			230	x	x		
Brown-throated Martin	*Riparia paludicola*					x	x	
Burchell's Courser	*Cursorius rufus*	VU, LC		210	x			
Cape Bunting	*Emberiza capensis*				x	x	x	
Cape Canary	*Serinus canicollis*				x	x		x
Cape Crow	*Corvus capensis*					x	x	
Cape Penduline-tit	*Anthoscopus minutus*				x	x		
Cape Robin-chat	*Cossypha caffra*					x	x	x
Cape Shoveler	*Anas smithii*				x			

Full Name	*Scientific Name*	Red List (Regional, Global)	Endemism	WEF Priority Score	Autumn 2021	Winter 2021	Spring 2021	Summer 2021/2022
Cape Sparrow	*Passer melanurus*				x	x	x	x
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*				x	x	x	
Cape Wagtail	*Motacilla capensis*				x	x		
Cape Weaver	*Ploceus capensis*		NE		x	x		
Cape White-eye	*Zosterops virens*		NE		x	x	x	x
Capped Wheatear	*Oenanthe pileata*				x			x
Chat Flycatcher	*Melaeornis infuscatus*				x	x	x	
Chestnut-vented Tit-Babbler (Warbler)	*Sylvia subcoerulea*					x		
Common (Steppe) Buzzard	*Buteo buteo*			210	x			
Common Quail	*Coturnix coturnix*							x
Common Swift	*Apus apus*							x
Common Waxbill	*Estrilda astrild*				x			
Denham’s Bustard	*Neotis denhami*	VU, NT		300				x
Desert Cisticola	*Cisticola aridulus*					x		x
Double-banded Courser	*Rhinoptilus africanus*			204	x	x	x	
Eastern Clapper Lark	*Mirafra fasciolata*							x
Egyptian Goose	*Alopochen aegyptiaca*				x	x	x	x
European Roller	*Coracias garrulus*	NT, LC						x
Fairy Flycatcher	*Stenostira scita*		NE		x	x	x	
Familiar Chat	*Oenathe familiaris*				x	x	x	x
Fiscal Flycatcher	*Melaeornis silens*		NE			x	x	
Gabar Goshawk	*Melierax gabar*					x		
Greater Kestrel	*Falco rupicoloides*			174	x			x
Greater Striped Swallow	*Cecropis cucullata*				x		x	
Grey Tit	*Melaniparus afer*		NE		x	x	x	
Grey-backed Cisticola	*Cisticola subruficapilla*				x	x	x	

Full Name	***Scientific Name***	**Red List (Regional, Global)**	**Endemism**	**WEF Priority Score**	**Autumn 2021**	**Winter 2021**	**Spring 2021**	**Summer 2021/2022**
Grey-backed Sparrow-lark	*Eremopterix verticalis*				x	x	x	x
Grey-winged Francolin	*Scleroptila afra*		SLS	190	x	x	x	
Hadeda (Hadada) Ibis	*Bostrychia hagedash*				x	x		
Hamerkop	*Scopus umbretta*				x	x		
Helmeted Guineafowl	*Numida meleagris*				x	x		
House Sparrow	*Passer domesticus*					x		
Jackal Buzzard	*Buteo rufofuscus*		NE	250	x	x	x	x
Karoo Chat	*Emarginata schlegelii*				x	x	x	x
Karoo Eremomela	*Eremomela gregalis*		NE		x		x	
Karoo Korhaan	*Eupodotis vigorsii*	NT, LC		240	x	x	x	x
Karoo Lark	*Calendulauda albescens*		NE		x	x	x	x
Karoo Long-billed Lark	*Certhilauda subcoronata*				x	x	x	x
Karoo Prinia	*Prinia maculosa*		NE		x	x		x
Karoo Scrub Robin	*Cercotrichas coryphoeus*				x	x		
Karoo Thrush	*Turdus smithi*		NE		x	x		
Kittlitz's Plover	*Charadrius pecuarius*				x			
Lanner Falcon	*Falco biarmicus*	VU, LC		300		x		
Large-billed Lark	*Galerida magnirostris*		NE		x	x	x	x
Lark-like Bunting	*Emberiza impetuani*				x	x	x	x
Laughing Dove	*Spilopelia senegalensis*				x	x	x	
Layard's Tit-Babbler (Warbler)	*Sylvia layardi*		NE		x	x		
Lesser Kestrel	*Falco naumanni*			214				x
Little Grebe	*Tachybaptus ruficollis*				x			
Little Swift	*Apus affinis*				x		x	
Long-billed crombec	*Sylvietta rufescens*					x	x	
Ludwig's Bustard	*Neotis ludwigii*	EN, EN		320	x	x	x	x
Martial Eagle	*Polemaetus bellicosus*	EN, VU		350	x	x	x	

Full Name	*Scientific Name*	Red List (Regional, Global)	Endemism	WEF Priority Score	Autumn 2021	Winter 2021	Spring 2021	Summer 2021/2022
Mountain Wheatear	*Oenanthe monticola*				x	x	x	
Namaqua Dove	*Oena capensis*				x	x	x	x
Namaqua Sandgrouse	*Pterocles namaqua*				x	x	x	x
Namaqua Warbler	*Phragmacia substriata*		NE			x		
Neddicky	*Cisticola fulvicapilla*					x		x
Northern Black Korhaan	*Afrotis afraoides*			180	x	x		x
Pale Chanting Goshawk	*Melierax canorus*			200	x	x	x	x
Pied Avocet	*Recurvirostra avosetta*				x			x
Pied Crow	*Corvus albus*				x	x	x	x
Pied Starling	*Lamprotornis bicolor*		SLS		x	x	x	
Pririt Batis	*Batis pririt*				x	x		
Red-billed Firefinch	*Lagonosticta senegala*				x			
Red-billed Quelea	*Quelea quelea*					x		
Red-billed Teal	*Anas erythrorhyncha*				x			
Red-capped Lark	*Calandrella cinerea*				x	x	x	x
Red-eyed Dove	*Streptopelia semitorquata*					x		
Red-faced Mousebird	*Urocolius indicus*				x			
Red-headed Finch	*Amadina erythrocephala*				x		x	
Red-winged Starling	*Onychognathus morio*				x	x		
Rock Dove	*Columba livia*					x		
Rock Kestrel	*Falco rupicolus*				x	x	x	
Rock Martin	*Ptyonoprogne fuligula*				x	x	x	
Rufous-eared Warbler	*Malcorus pectoralis*				x	x	x	x
Sabota Lark	*Calendulauda sabota*					x	x	x
Scaly-feathered Finch (Weaver)	*Sporopipes squamifrons*					x		
Secretarybird	*Sagittarius serpentarius*	VU, VU		320	x	x		x
Sickle-winged Chat	*Emarginata sinuata*		NE		x	x	x	x

Full Name	*Scientific Name*	Red List (Regional, Global)	Endemism	WEF Priority Score	Autumn 2021	Winter 2021	Spring 2021	Summer 2021/2022
South African Shelduck	*Tadorna cana*				x	x	x	
Southern (Common) Fiscal	*Lanius collaris*				x	x	x	x
Southern Grey-headed Sparrow	*Passer diffusus*					x		
Southern Masked Weaver	*Ploceus velatus*						x	x
Southern Red Bishop	*Euplectes orix*				x	x	x	
Speckled Pigeon	*Columba guinea*				x	x	x	x
Spike-heeled Lark	*Chersomanes albofasciata*				x	x	x	x
Spotted Eagle-Owl	*Bubo africanus*			170		x	x	
Spur-winged Goose	*Plectropterus gambensis*							x
Streaky-headed Seedeater	*Crithagra gularis*						x	
Tawny Eagle	*Aquila rapax*	EN, VU		290		x		
Three-banded Plover	*Charadrius tricollaris*				x		x	
Tractrac Chat	*Emarginata tractrac*				x		x	
Verreaux's Eagle	*Aquila verreauxii*	VU, LC		360	x	x	x	
Wattled Starling	*Creatophora cinerea*				x			x
White-backed Mousebird	*Colius colius*				x	x		
White-necked Raven	*Corvus albicollis*				x	x	x	
White-rumped Swift	*Apus caffer*				x		x	
White-throated Bee-eater	*Merops albicollis*					x		
White-throated Canary	*Crithagra albogularis*					x	x	
White-throated Swallow	*Hirundo albigularis*				x			
Yellow Canary	*Crithagra flaviventris*				x	x	x	x
Yellow-bellied Eremomela	*Eremomela icteropygialis*				x	x		
Yellow-billed Duck	*Anas undulata*				x	x		
Yellow-billed Kite	*Milvus aegyptius*							x

ANNEXURE D: Verreaux's Eagle Risk Assessment Model Report

Verreaux's Eagle Risk Assessment
Site: Victoria West Energy Facility, WKN Windcurrent SA
Processed on: 2020 Sept 18

Project background: 15 Verreaux's eagle nests, likely belonging to 8 eagle pairs, have been located during pre-application site screening in and around the proposed Loxton wind energy facility. All nests, or an alternate nest of the same pair, were found to be active on initial surveys. This document outlines the Verreaux's Eagle Risk Assessment (VERA) modelling which has been used to predict collision risk for Verreaux's eagle at the development, using these nest locations.

Model background: The VERA model is built from 57,285 at-risk GPS fix locations from 15 Verreaux's eagles each tracked between 18–895 days each, equivalent to a total of 13.6 bird-years of tracking data. For each nest, the VERA model calculates the collision risk potential on a 90x90m resolution in a 12km buffer around the nest location, nests within 1.5km of each other are treated as alternative nests of the same pair. The model takes into account the distance from the nest, distance to all other conspecific nests within 12km of a given nest, topographic slope, elevation and distance to slope. The model gives collision risk potential as a probability (a continuous value between zero and one). Collision risk potential is then re-classified as high, medium or low using model derived (Youden) thresholds calculated by cross-validating the results on territories of tracked eagles.

Model thresholds: The impacts of using different model thresholds can be checked using predictions from tracked eagles (Fig. 1) and from operational developments where collisions have occurred (Fig. 2).

High collision risk potential area: The high risk area is the area predicted to be most intensively used by eagles; for tracked eagles it incorporates 73% of the area used (Fig.1 – dashed line). 50% (7 of 14) of the known collisions have occurred in this area (Fig. 2 – dashed line). Development of wind turbines should not occur in these areas.

Medium collision risk potential: The medium risk area is also likely to be used by eagles; for tracked eagles it represents an additional 12% of the area used, thus protection of the high and medium risk areas can be expected to offer protection to 85% of an eagle's home range (Fig. 1 – dotted line). 79% (11 of 14) of the known collisions have occurred in the medium and high risk areas combined (Fig. 2 – dotted line). Development in this area should be avoided where possible and only proceed with additional specialist input.

Low collision risk potential: The low risk area (with ordinal risk predictions less 0.13) is the area predicted to be least used by eagles and development here poses the lowest risk to eagles within the 12km buffer. However this area is not without risk, and three collisions have occurred at operational wind energy sites, within areas that would be predicted to be low risk.

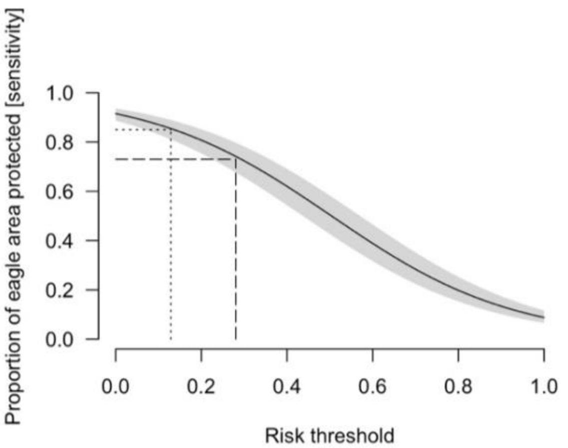


Figure 1. Proportion of the area used by tracked Verreaux's eagles which is protected along a gradient of thresholds used to classify collision risk, this is calculated on a 90x90 m cell basis and is equivalent to the model 'sensitivity'. Lines represent two risk thresholds; i.e. if a risk threshold of 0.13 is applied (dotted line) then 0.85 of the area used by eagles is protected (covered by medium and high risk areas), if a higher threshold of 0.28 (dashed line) is applied then 0.73 of the area used by eagles is protected (covered by high risk only).

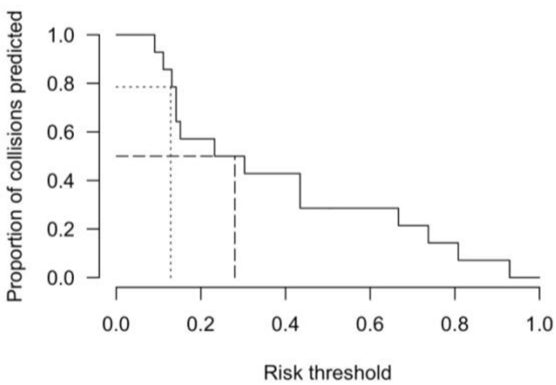


Figure 2. Proportion of known Verreaux's eagles collisions (n=14) correctly predicted by the model along a gradient of risk thresholds. 0.79 collisions were above the medium risk threshold (dotted line), while 0.5 were in the area considered to be high risk (dashed line).

Model results: The collision risk estimates are dependent on accurate information on nest locations and will only be reliable if all nest locations have been found and provided for this analysis. Recommendations are intended to minimise collision risk to resident adult eagles but will not be relevant to non-breeding eagles using the area. The modelling methods used here are currently being compiled for scientific publication and may be subject to further refinements. The final published VERA model may differ from the one used here, but it is unlikely to significantly change the overall patterns of risk outlined in this report.

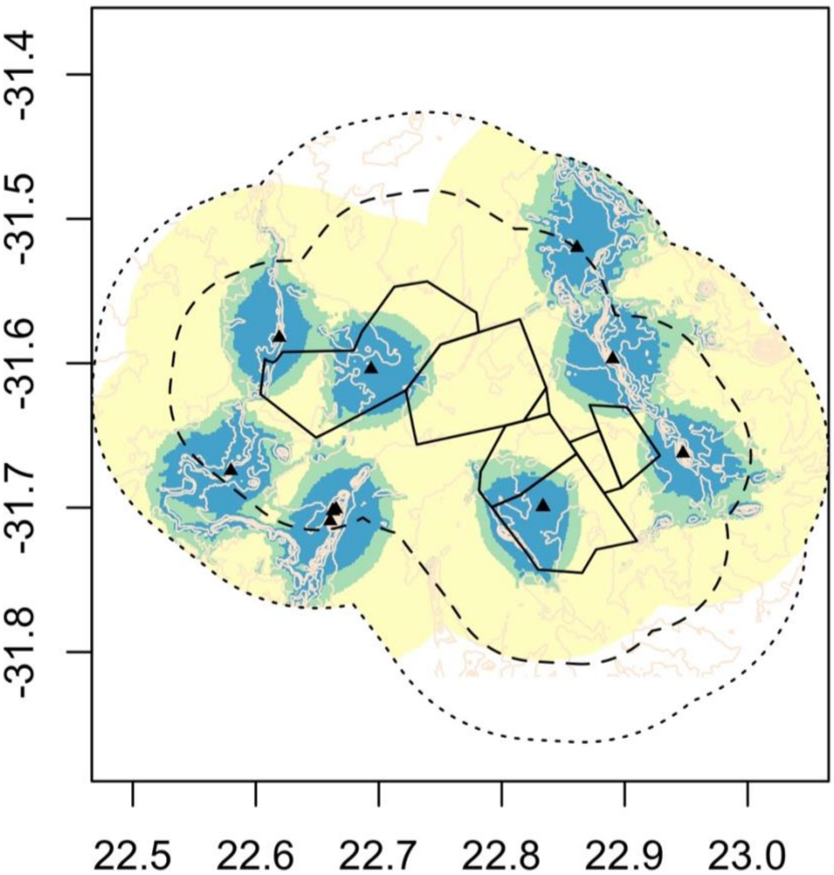


Figure 3. Verreaux's eagle collision risk potential for Victoria West wind energy facility. Solid line [development boundary/farms], dashed line [6km surveyed area], dotted line [12km from development boundary, model projected area]. Verreaux's eagle nest locations are shown by triangles. Collision risk potential is represented in high risk [blue]; medium risk [green] and low risk [yellow]. White is more than 12km from a known nest.

ANNEXURE E: Impact Assessment Methodology and Impact Assessment Tables

1) Explanation of the six impact rating criteria

Criterion 1: Nature
Negative or positive impact on the environment.

Criterion 2: Type
Direct, indirect and/or cumulative effect of impact on the environment.

Criteria 3, 4, & 5: Temporal, Spatial, and Likelihood Scales
These four factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to temporal scales - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.
- Relationship of the impact to spatial scales - the spatial scale defines the physical extent of the impact.
- The likelihood of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts could occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance. In this case likelihood equates to some extent with risk. If the impact is definite, then there is a high risk that it will occur. However, likelihood and risk are not to be confused, and for certain impacts (e.g. risk of a vehicle accident) a risk assessment will be required (see Section 4).

The table below provides definitions for Criteria 3,4 & 5.

Duration (Temporal Scale)		***Score***
Short term	*Less than 5 years*	*1*
Medium term	*Between 5-20 years*	*2*
Long term	*Between 20 and 40 years (a generation) and from a human perspective also permanent*	*3*
Permanent	*Over 40 years and resulting in a permanent and lasting change that will always be there*	*4*
Extent (Spatial Scale)		
Localised	*At localised scale and a few hectares in extent*	*1*
Study Area	*The proposed site and its immediate environs*	*2*
Regional	*District and Provincial level*	*3*
National	*Country*	*3*
International	*Internationally*	*4*
Probability (Likelihood)		
Unlikely	*The likelihood of these impacts occurring is slight*	*1*
May Occur	*The likelihood of these impacts occurring is possible*	*2*
Probable	*The likelihood of these impacts occurring is probable*	*3*
Definite	*The likelihood is that this impact will definitely occur*	*4*

Criteria 6: Severity Scales

- The severity of the impact - the severity/beneficial scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party. The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it, and how effective the mitigation might be. The word 'mitigation' means not just 'compensation', but includes concepts of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

Impact Severity *(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)*		***Score***
Very severe	**Very beneficial**	**4**
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.	
Severe	**Beneficial**	**3**
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.	
Moderately severe	**Moderately beneficial**	**2**
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.	
Slight	**Slightly beneficial**	**1**
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the	

Impact Severity *(The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)*		***Score***
For example a temporary fluctuation in the water table due to water abstraction.	beneficial effects are easier, cheaper and quicker, or some combination of these.	
No effect	**Don't know/Can't know**	
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

2) Applying the criteria to ASSESS environmental significance before mitigation

The scores for the three criteria in the first table are added to obtain a composite score. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is then obtained by reading off the matrix presented in the table below. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

		COMPOSITE DURATION, EXTENT & PROBABILITY SCORE									
		3	4	5	6	7	8	9	10	11	12
SEVERITY	Slight	3	4	5	6	7	8	9	10	11	12
	Mod severe	3	4	5	6	7	8	9	10	11	12
	Severe	3	4	5	6	7	8	9	10		
	Very severe	3	4	5	6	7	8				

The **environmental significance** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

It is clear that an impact that has a *slight severity* could be of MODERATE significance because it is permanent (4), has a regional affect (3) and is definite. This elevates it from a LOW to a MODERATE rating. Conversely, a *moderately severe* impact could be rated as LOW since it is short term (1), localised (1) and only probable (3). An impact rated as *severe* could be of VERY HIGH significance because it is permanent (4), of national importance (3) and is definite (4). For example, the impact on a frog species of conservation concern (SCC) might only be rated as *severe* as a result of the project actions, but because the loss is permanent and of national importance (it's a SCC) and is definite, we rate the significance as VERY HIGH and not HIGH. If the impact was long term and not permanent then it would be rated as HIGH.

The Significance Rating Scale is defined in the table below.

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
VERY HIGH NEGATIVE	**VERY BENEFICIAL**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. *Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.* *Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.*	
HIGH NEGATIVE	**BENEFICIAL**
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. *Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.* *Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.*	
MODERATE NEGATIVE	**SOME BENEFITS**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. *Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.*	
LOW NEGATIVE	**FEW BENEFITS**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. *Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.* *Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.*	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. *Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.*	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. *Example: The effect of a particular development on people's psychological perspective of the environment.*	

3) Significance Post Mitigation

Once mitigation measures are proposed, the following criteria are then used to determine the overall post mitigation significance of the impact:

- Reversibility: The degree to which an environment can be returned to its original/partially original state.
- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in the table below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*
Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

These criteria are applied using the logic represented in the flow chart below.

4) Degree of Confidence

If you wish, you may also mention the confidence you have in your impact ratings, but this is not a legislative requirement. It does, however, assist in determining the level of certainty of our impact predictions.

Degree of Confidence *(The confidence with which one has predicted the significance of an impact)*	
Certain	I am more than 90% sure of the facts that underpin my assessment, my data is current and the information I have is comprehensive enough for me to be *certain* of my impact rating.
Confident	I am more than 70% sure of the facts that underpin my assessment, my data is current and the information I have, although not comprehensive, is enough for me to be *confident* in my impact rating.
Undecided	I am between 40% and 70% sure of the facts that underpin my assessment, but my data is scant and the information I have is outdated, not very site specific and/or has other limitations so I am *undecided* if my impact rating is correct. I have therefore adopted a precautionary approach when rating this impact.

Unconvinced	I am less than 40% sure of the facts that underpin my assessment, my data is scant and the information I have is very outdated. I lack site specific information and details on the nature of the impact, as its effect is not well researched. I am therefore *unconvinced* that my impact rating is correct. I have therefore adopted a precautionary approach when rating this impact.

FULL IMPACT ASSESSMENT TABLE: SOUTRIVIER CENTRAL WEF

	Nature	Duration	Extent	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Disturbance of avifauna										
Construction Phase	Negative	Short term (1)	Study Area (2)	Moderately severe (2)	Definite (4)	MODERATE NEGATIVE	Reversible	Resource will not be lost	Achievable	LOW NEGATIVE
Operational Phase	Negative	Long-term (3)	Study Area (2)	Slight (1)	Probable (3)	LOW NEGATIVE	Reversible	Resource will not be lost	Achievable	LOW NEGATIVE
Decommissioning Phase	Negative	Short term (1)	Study Area (2)	Moderately severe (2)	Definite (4)	LOW NEGATIVE	Reversible	Resource will not be lost	Achievable	LOW NEGATIVE
Impact 2: Habitat loss										
Construction Phase	Negative	Long-term (3)	Study Area (2)	Moderately severe (2)	Definite (4)	MODERATE NEGATIVE	Reversible	Resource will be partly lost	Achievable	LOW NEGATIVE
Decommissioning Phase	Negative	Long-term (3)	Study Area (2)	Slight (1)	May occur (2)	LOW NEGATIVE	Reversible	Resource will be partly lost	Difficult	LOW NEGATIVE
Impact 3: Collisions with turbines										
Operational Phase	Negative	Long-term (3)	Regional (2)	Severe (3)	Probable (3)	HIGH NEGATIVE	Irreversible	Resource will be partly lost	Achievable	MODERATE NEGATIVE
Impact 4: Collisions with overhead power lines										
Operational Phase	Negative	Long-term (3)	Regional (2)	Severe (3)	Probable (3)	HIGH NEGATIVE	Irreversible	Resource will be partly lost	Achievable	NO IMPACT
Impact 5: Electrocutions										
Operational Phase	Negative	Long-term (3)	Regional (2)	Severe (3)	May occur (2)	HIGH NEGATIVE	Irreversible	Resource will be partly lost	Easily achievable	LOW NEGATIVE
Impact 6: Cumulative impacts										
Cumulative	Negative	Long-term (3)	Regional (2)	Severe (3)	Definite (4)	HIGH NEGATIVE	Irreversible	Resource will be lost	Difficult	MODERATE NEGATIVE

ANNEXURE F: Site Sensitivity Verification Report

On 20 March 2020, in Government Gazette No. 43110 (GN 320) the Minister of Environment, Forestry and Fisheries prescribed general requirements for undertaking site sensitivity verification and for protocols for the assessment and minimum report content requirements of environmental impacts for environmental themes for activities requiring environmental authorisations. When the requirements of a protocol apply, they replace the requirements of Appendix 6 of the EIA Regulations, 2014, as amended. The *'Protocol for the Specialists Assessment and Minimum Report Content Requirements for Environmental Impacts on Avifaunal Species by onshore wind generation facilities where the electricity output is 20W or more.'* published in the same gazette therefore applies to the proposed development (hereafter referred to as 'the Avifaunal Protocol').

The Screening Tool identified the development as of low sensitivity under the avian theme. It must be noted, that avian data under the avian theme is only available for Renewable Energy Development Zones (REDZ, and that according to the Avifauna Protocol an Avifaunal Specialist Assessment is to be undertaken for all sensitivity ratings provided by the Screening Tool for the avian theme for on-shore wind generation facilities.

On 30 October 2020 the "Protocol for the Specialists Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species" (GN No. 1150 of 30 October 2020), was published which replaces the requirements of Appendix 6 of the EIA Regulations.

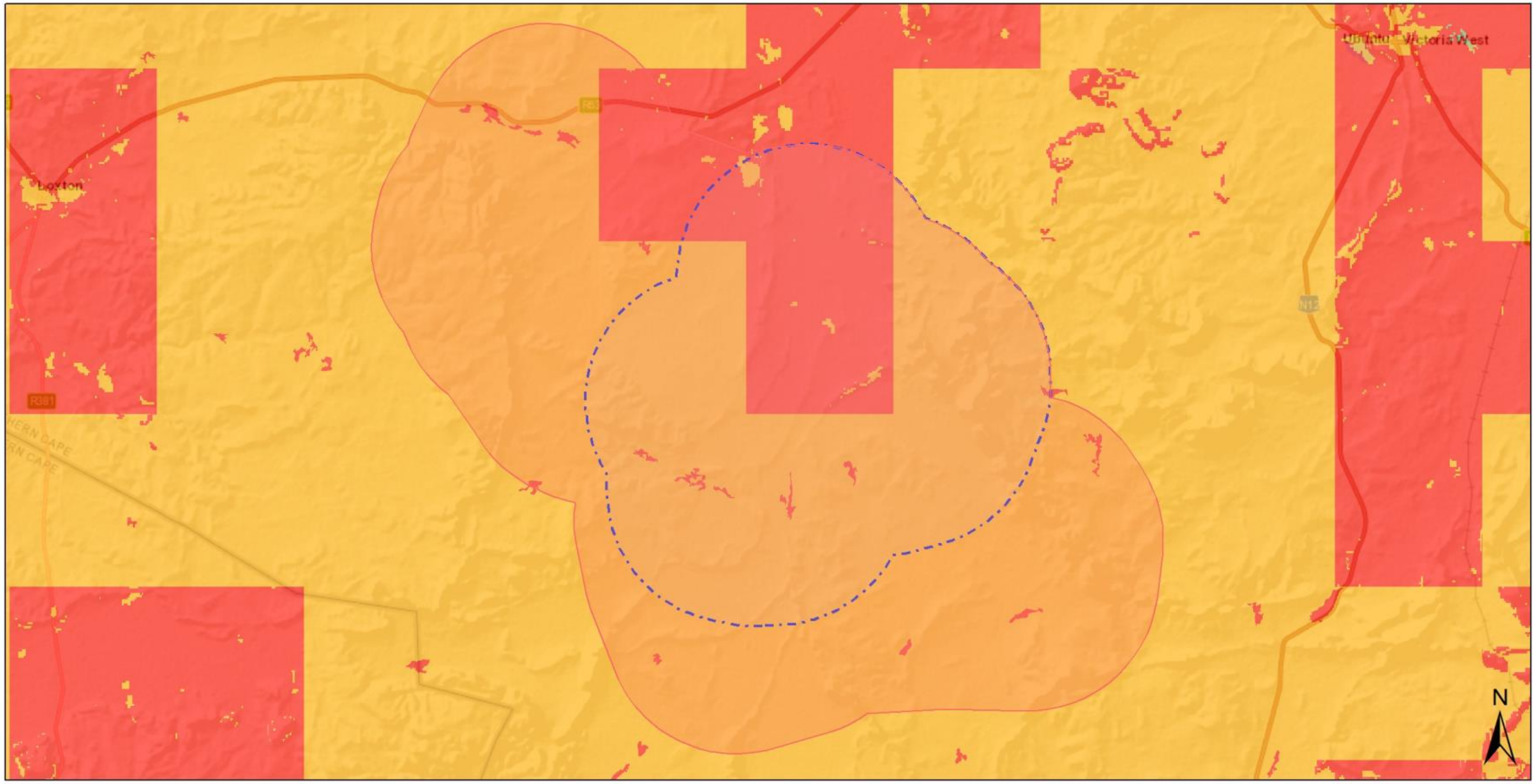
The National web-based Screening Tool was investigated for the Project Area of Influence (PAOI), which was determined as a 7 km buffer around the proposed Soutrivier Central WEF Area of Interest. The Screening Tool identified the PAOI as of high sensitivity for the avian species of conservation concern (SCC) Ludwig's Bustard (*Neotis ludwigii*) and of medium sensitivity for the avian SCC Verreaux's Eagle (*Aquila verreauxii*), Ludwig's Bustard (*Neotis ludwigii*) and Caspian tern (*Hydropogne caspia*) in terms of the terrestrial animal species theme (which includes avian species) (refer to Figure below).

Pre-application avifaunal monitoring was conducted in a larger study area (the initial PAOI in the below figure) over four seasons from April 2021 to December 2022. The presence of ten SCC was confirmed in the study area which includes the PAOI. Due to the mobile nature of avian species, it must be assumed by applying the precautionary principle, that all species identified in the study area are likely to also occur or pass through the PAOI corridor.

Therefore, the sensitivity of the site has been confirmed as of high sensitivity, and an avian species specialist impact assessment is required.

forestry, fisheries & the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Screening Report Map



10 January 2023

Legend

- B009 Initial PAOI
- Site Area
- EIA Application Site
- National Jurisdiction Area

Animal Species Combined Sensitivity

- Very High
- High
- Medium
- Low

0 10 20 km

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community