Oya Energy (Pty) Ltd

132kV Oya Overhead Power Line near Matjiesfontein, Western and Northern Cape Provinces

Avifaunal Impact Assessment

DEFF Reference: To be Allocated
Report Prepared by: Chris van Rooyen Consulting
Issue Date: 3 November 2020
Version No.: 1

OYA ENERGY (PTY) LTD

132kV Oya Overhead Power Line (OHL) near Matjiesfontein, Western and Northern Cape Provinces

Avifaunal Impact Assessment

EXECUTIVE SUMMARY

The proposed Oya 132kV OHL will have several **direct** impacts on priority avifauna. No **indirect** impacts are envisaged.

The direct impacts can be summarised as follows:

- Displacement of priority species due to habitat destruction in the substation footprint, and due to disturbance associated with the construction activities.
- Mortality of priority species due to electrocutions in the substation yard.
- Mortality of priority species due to collisions with the 132kV OHL.

1. CONSTRUCTION PHASE

1.1 Displacement of priority species due to habitat destruction in the substation footprint and disturbance associated with the construction activities

Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed transmission substation through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the substation yard is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing power lines, very little if any vegetation clearing will be required in the power line servitudes. The habitat in the study area is very uniform from a bird impact perspective; therefore, the loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed substation is likely to be fairly minimal. The species most likely to be directly affected by this impact would be small, non-Red Data species.

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Large terrestrial species namely Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan are most likely to be affected by displacement due to disturbance. Cliff-nesting Jackal Buzzards, Booted Eagles, Verreaux's Eagles and Black Storks could also potentially be vulnerable to this impact.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Verreaux's Eagle**
- **White-necked Raven**
- **Lanner Falcon**
- **Booted Eagle**
- Cape Crow
- **Jackal Buzzard**
- **Martial Eagle**
- **Karoo Korhaan**
- **Ludwig's Bustard**
- Secretarybird
- **Greater Kestrel**
- **Pied Crow**
- Southern Black Korhaan
- **Rock Kestrel**
- Black Stork

This impact is assessed to be medium to low and can be reduced to low through mitigation.

2. OPERATIONAL PHASE

2.1 Electrocutions in the substation yard

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed power lines, no electrocution risk is envisaged because the proposed design of the 132kV line, namely the steel monopole and self-supporting lattice structures, should not pose an electrocution threat to any of the priority species which are likely to occur in the study area. Electrocutions within the proposed substation yard are possible but should not affect the more sensitive Red Data bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls and certain species of waterbirds.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- Cape Crow
- **Greater Kestrel**
- **Hadeda Ibis**
- **Pied Crow**
- **Rock Kestrel**
- **Spotted Eagle-owl**
- **White-necked Raven**
- Black-headed Heron
- **Egyptian Goose**

This impact is assessed to be low and can be further reduced through mitigation.

2.2 Collisions with the 132kV OHL

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). The most likely Red Data candidates for collision mortality on the proposed OHL are large terrestrial species e.g. bustards, korhaans and Secretarybird, certain raptors and storks, particularly Verreaux's Eagles, Jackal Buzzards and Black Storks where the line drops down the escarpment, and waterbirds at drainage lines and waterbodies.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Hadeda Ibis**
- Black-headed Heron
- **Egyptian Goose**
- Black Harrier
- **Booted Eagle**
- **Jackal Buzzard**
- **Martial Eagle**
- **Verreaux's Eagle**
- African Black Duck
- African Sacred Ibis
- Cape Teal
- Hamerkop
- **Karoo Korhaan**
- **Ludwig's Bustard**
- **Namaqua Sandgrouse**
- Pied Avocet
- Red-knobbed Coot
- Secretarybird
- **South African Shelduck**
- Southern Black Korhaan
- Yellow-billed Duck
- Black Stork
-

This impact is assessed to be medium and can be reduced through mitigation, but it will remain at medium level after mitigation.

2.3 Preferred corridor option for avifauna

Corridor Option 3 is the preferred option from an avifaunal perspective for the section of the proposed overhead power line which connects the Oya substation to the Kappa substation, because it is the shortest option, and the of all the options, this option has the longest section running next to existing high voltage (HV) lines. By routing a line next to an existing HV line, the avian collision risk is reduced for both lines. However, none of the other route alternatives were deemed to be fatally flawed.

2.4 Environmental sensitivities

The following environmental sensitivities were identified from an avifaunal perspective for the proposed power line grid connections:

- High sensitivity (Mitigation required): Surface water

Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this semi-arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon, Verreaux's Eagle and Black Stork and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Power lines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. These areas will require mitigation with Bird Flight Diverters (BFDs).

- High sensitivity (Mitigation required): Cliffs

The proposed OHL runs down two escarpment areas, where it will pose a risk to cliff nesting species such as Verreaux's Eagle, Booted Eagle, Lanner Falcon, Jackal Buzzard and Black Stork. These species all use the declivity wind currents along the cliff faces and slopes for lift and they will be at risk of collisions with the OHL where it traverses these cliffs and slopes. These areas will require mitigation with Bird Flight Diverters (BFDs).

- Medium sensitivity (Mitigation preferred): Succulent Karoo

  The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan. It would therefore be advisable to mitigate the whole OHL with Bird Flight Diverters (BFDs) if possible.

2.5 Overall significance rating

The table below provides a summary of the respective significance ratings, and an average overall rating before and after mitigation.

Overall impact significance rating

Impact	Rating pre-mitigation	Rating post-mitigation
Displacement due to habitat transformation	Low (12)	Low (12)
Displacement due to disturbance	Medium (30)	Low (14)
Electrocution in substation	Medium (26)	Low (12)
Collisions with 132kV OH	Medium (26)	Medium (24)
Cumulative impacts	Medium (26)	Medium (24)
Average:	**Medium (24)**	**Low (17)**

2.6 Conclusion

The proposed Oya 132kV OHL is expected to have a medium impact on priority species. This impact could be reduced to low through the application of appropriate mitigation measures. No fatal flaws were discovered in the course of the investigations.

2.7 Impact Statement

Based on the outcome of the investigations into the impact of the proposed 132kV OHL on avifauna, the authorization of the OHL is supported, provided the mitigation measures contained in this specialist report are strictly implemented. The proposed layout is acceptable from an avifauna perspective and should be approved as part of the EA.

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

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page 8-9
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 7
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7
g) an identification of any areas to be avoided, including buffers;	Section 7
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 7
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 7

k) any mitigation measures for inclusion in the EMPr;	Section 7
l) any conditions for inclusion in the environmental authorisation;	Section 7
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 7
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

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

Proposed Development of the 132kV Oya Power Line near Matjiesfontein, Western and Northern Cape Provinces

Kindly note the following:

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

Departmental Details

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

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

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

1. SPECIALIST INFORMATION

Specialist Company Name:	Afrimage Photography (Pty) Ltd t/a Chris van Rooyen Consulting			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 4	Percentage Procurement recognition	
Specialist name:	Chris van Rooyen			
Specialist Qualifications:	BA LLB			
Professional affiliation/registration:	I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.			
Physical address:	6 Pladda Drive Plettenberg Bay			
Postal address:	P.O Box 2676, Fourways			
Postal code:	2055			
Telephone:	0824549570			
E-mail:	Vanrooyen.chris@gmail.com			

2. DECLARATION BY THE SPECIALIST

I, Chris van Rooyen, declare that –

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

Signature of the Specialist

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company:

1 November 2020

Date

Details of Specialist, Declaration and Undertaking Under Oath

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

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

Signature of the Specialist

Afrimage Photography t/a Chris van Rooyen Consulting

Name of Company

1 November 2020

Date

Signature of the Commissioner of Oaths

2020-11-01

Date

SOUTH AFRICAN POLICE SERVICE
PLETTENBERG BAY
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SOUTH AFRICAN POLICE SERVICE

OYA ENERGY (PTY) LTD

132kV Oya Overhead Power Line (OHL) near Matjiesfontein, Western and Northern Cape Provinces

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Appendix 1 (or A): Species List

Glossary of Terms

- Broader area: The area encompassed by the 9 pentads where the project is located.
- Cumulative impact: Impacts from different projects that combine to result in significant change, which could be larger than the sum of all the individual impacts.
- Pentad: A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km.
- Priority species: Species which could potentially be impacted by powerline collisions or electrocutions, based on specific morphological and/or behavioural characteristics.
- Study area: The area covered by a 2km buffer around the proposed alignments options.

List of Abbreviations

- BFD: Bird Flight Diverter
- DEFF: Department of Environment, Forestry and Fisheries
- EA: Environmental Authorisation
- EMPr: Environmental Management Programme
- GN: Government Notice
- HV: High voltage
- IBA: Important Bird Area
- IUCN: International Union for the Conservation of Nature
- kV: Kilovolt
- MW: Megawatt
- NPEAS: National Protected Areas Expansion Strategy
- OHL: Overhead Powerline
- SABAP: South African Bird Atlas Project
- SANBI: South African National Biodiversity Institute
- WEF: Wind Energy Facility

3. INTRODUCTION

Chris van Rooyen Consulting has been appointed by SiVEST (Pty) Ltd, on behalf of Oya Energy (Pty) Ltd to undertake the assessment of the proposed 132 kilovolt (kV) overhead power line and associated infrastructure (referred to as "the proposed development"). The proposed development is located within one (1) of the Strategic Transmission Corridors as defined and in terms of the procedures laid out in Government Notice (GN) No. 113[1], namely the Central Corridor, near Matjiesfontein in the Western and Northern Cape Provinces of South Africa.

The proposed overhead power line (OHL) project will therefore be subject to a Basic Assessment (BA) process in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) (as amended) and Appendix 1 of the Environmental Impact Assessment (EIA) Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority for this BA is the national Department of Environment, Forestry and Fisheries (DEFF). An avifaunal specialist study has been commissioned to assess and verify the OHL under the new Gazetted specialist protocols[2].

3.1 Scope and Objectives

To assess the impacts associated with the proposed 132 kilovolt (kV) overhead power line and substations on avifauna.

3.2 Terms of Reference

- Describe the affected environment from an avifaunal perspective.
- Describe bird habitats based on on-site monitoring, desk-top review, collation of available information, studies in the local area and previous experience.
- Map the sensitivity of the site in terms of avifaunal features such as habitat use, roosting, feeding and nesting / breeding.
- Discuss gaps in baseline data and other limitations.
- Provide a thorough overview of all applicable legislation and guidelines (if relevant).
- Provide an overview of assessment methodology used.
- Provide a comparative assessment of alternatives and indicate a preferred alternative (if any).
- Confirm the impact status of the site in comparison to the DEFF screening tool and associated protocols.
- Identify and assess the potential impacts of the proposed development on avifauna, including cumulative impacts.
- Provide sufficient mitigation measures to include in the environmental management plan.
- Conclude with an impact statement whether the development is fatally flawed or may be authorised.

[1] Formally gazetted on 16 February 2018 (GN No. 113)
[2] Formally gazetted on 20 March 2020 (GN No. 320)

3.3 Specialist Credentials

Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	22 years

Chris van Rooyen has twenty-two years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience, and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry. Chris works under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

Albert Froneman

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	MSc (Conservation Biology)
Nationality	:	South African
Years of experience	:	18 years

Albert Froneman (Pr.Sci.Nat) has more than 18 years' experience in the management of avifaunal interactions with industrial infrastructure. He holds a M.Sc. degree in Conservation Biology from the University of Cape Town. He managed the Airports Company South Africa (ACSA) – Endangered Wildlife Trust Strategic Partnership from 1999 to 2008 which has been internationally recognized for its achievements in addressing airport wildlife hazards in an environmentally sensitive manner at ACSA's airports across South Africa. Albert is recognized worldwide as an expert in the field of bird hazard management on airports and has worked in South Africa, Swaziland, Botswana, Namibia, Kenya, Israel, and the USA. He has served as the vice chairman of the International Bird Strike Committee and has presented various papers at international conferences and workshops. At present he is consulting to ACSA with wildlife hazard management on all their airports. He also an accomplished specialist ornithological consultant outside the aviation industry and has completed a wide range of bird impact assessment studies. He has co-authored many avifaunal specialist studies and pre-construction monitoring reports for proposed renewable energy developments across South Africa. He also has vast experience in using Geographic Information Systems to analyse and interpret avifaunal data spatially and derive meaningful conclusions. Since 2009 Albert has been a registered Professional Natural Scientist (reg. nr 400177/09) with The South African Council for Natural Scientific Professions, specialising in Zoological Science.

3.4 Assessment Methodology

3.4.1 Sources of information

The following information sources were consulted in order to conduct this study:

- Bird distribution data from the Southern African Bird Atlas Project 2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed development area is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 14 pentads some of which intersect and others that are in the vicinity of the development, henceforth called **the broader area**. The SABAP2 data covers the period 2007 to 2020. The relevant pentads are 3250_2010, 3250_2015, 3255_2005, 3255_2010, 3255_2015, 3255_2020, 3300_2000, 3300_2005, 3300_2010, 3300_2015, 3305_2000, 3305_2005, 3055_2010, 3305_2015.
- A classification of the vegetation types in the development area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map (2018) accessed via the South African National Biodiversity BGIS map viewer (SANBI 2020).
- The national threatened status of all priority species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al*. 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all priority species was determined by consulting the latest (2020.2) IUCN Red List of Threatened Species.
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- The South African National Biodiversity BGIS map viewer was used to determine the locality of the study area relative to National Protected Areas.
- The DEFF National Screening Tool was consulted to determine the assigned avian sensitivity of the study area.
- Satellite imagery was used to view the broader area on a landscape level and to help identify bird habitat on the ground.
- Information previously collected during various bird and power line surveys in the Kappa area in 2019 and 2020, including the pre-construction monitoring that was conducted at the proposed Oya Energy Facility was used to supplement the data collected during the site visit for the current 132kV OHL.
- A three-day on-site survey was conducted from 19 - 21 October 2020 to record the habitat in the study area, and to search for priority species nests. The **study area** was defined as a 2km buffer zone around the proposed OHL corridors. The surveys were conducted with a 4 x 4 vehicle and where necessary, on foot. The cliffs were inspected from several vantage points with a 60x spotting scope to search for nests.

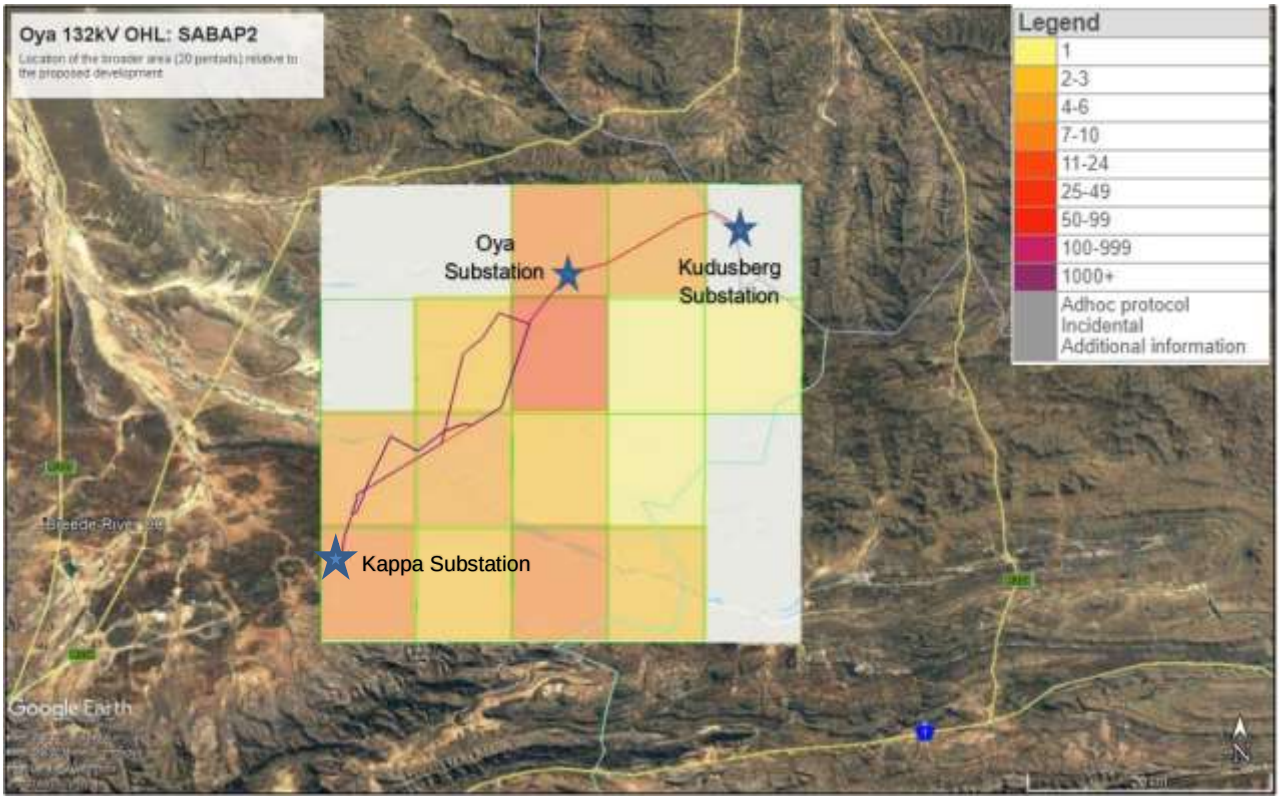

Figure 1: Area covered by the 14 SABAP 2 pentads (broader area) and the proposed alternative alignments. The legend shows the number of completed full protocol cards.

3.4.2 DEFF National Online Screening Tool

No specific protocol for avifauna were promulgated in GN 320 on 20 March 2020 as far as specialist studies for power lines are concerned. In such an instance, the specialist is required to undertake a site sensitivity verification process, to determine if the site sensitivity allocated by the screening tool is accurate from an avifaunal perspective. See Figure 2 below for the outcome of the screening process (Animal Species Theme).

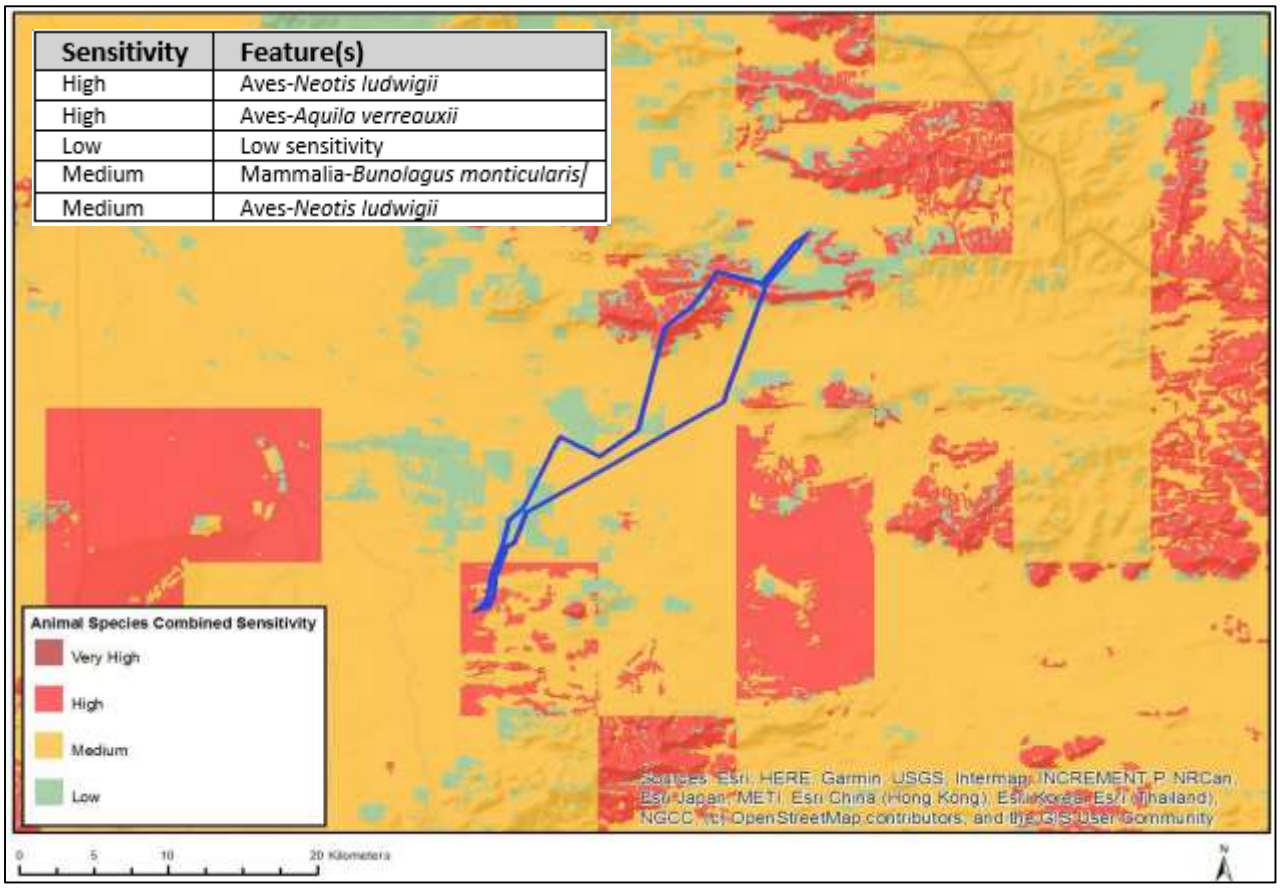

Figure 2: The outcome of the screening process for the proposed development: Animal Species Theme Sensitivity

The screening tool classifies the study area largely as Medium sensitivity due to the potential presence of Ludwig's Bustard, with some sections classified as Very High sensitivity, due to the presence of Ludwig's Bustard, and Verreaux's Eagle. There are also a few low sensitivity areas. The sensitivity ratings of the screening tool were confirmed during the site visit from 19 – 21 October 2020. The study area contains suitable habitat for both Ludwig's Bustard and Verreaux's Eagle, with the latter probably breeding, based on the presence of a nest discovered in the course of the investigation. More details on the avifauna and bird habitats is provided in Section 6 below.

4. ASSUMPTIONS AND LIMITATIONS

This study assumed that the sources of information used in this report are reliable. In this respect, the following must be noted:

- A total of 58 SABAP2 full protocol lists had been completed for the broader area where the proposed project is located (i.e. bird listing surveys lasting a minimum of two hours each). In addition, 95 ad hoc protocol lists (i.e. bird listing surveys lasting less than two hours but still giving useful data) were also recorded. The SABAP2 data was therefore regarded as an adequate indicator of the avifauna which could occur at the proposed development area, and it was further supplemented by data collected during the on-site surveys and previous surveys.

- The focus of the study was primarily on the potential impacts of the proposed OHL on priority species. Priority species were defined as species which could potentially be impacted by power line collisions or electrocutions, based on specific morphological and/or behavioural characteristics[3]. Priority species were further subdivided into raptors, waterbirds, terrestrial birds and corvids.
- The assessment of impacts is based on the baseline environment as it existed at the time of the field investigations.
- Cumulative impacts include all proposed and existing renewable energy projects within a 35km radius around the proposed development areas.
- Conclusions drawn in this study are based on experience of the specialist on the species found on site and similar species in different parts of South Africa. However, bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The **broader area** was defined as the area encompassed by the 9 pentads where the project is located (see Figure 2 above). The **study area** was defined as the area covered by a 2km buffer around the proposed alignments options.

5. TECHNICAL DESCRIPTION

5.1 Project Location

Oya Energy (Pty) Ltd (hereafter referred to as "Oya Energy") is proposing to construct a 132kV overhead power line and 33/132kV substations near Matjiesfontein in the Western and Northern Cape Provinces (hereafter referred to as the "proposed development"). The overall objective of the proposed development is to feed the electricity generated by the proposed Oya Energy Facility (part of separate on-going EIA process with DEFF Ref No.: 14/12/16/3/3/2/2009) as well as potentially the nearby developments into the national grid. The grid connection and substations (this application) require a separate EA, in order to allow the EA to be handed over to Eskom.

[3] Other species were also considered in the case of potential displacement due to disturbance associated with the construction of the OHL.

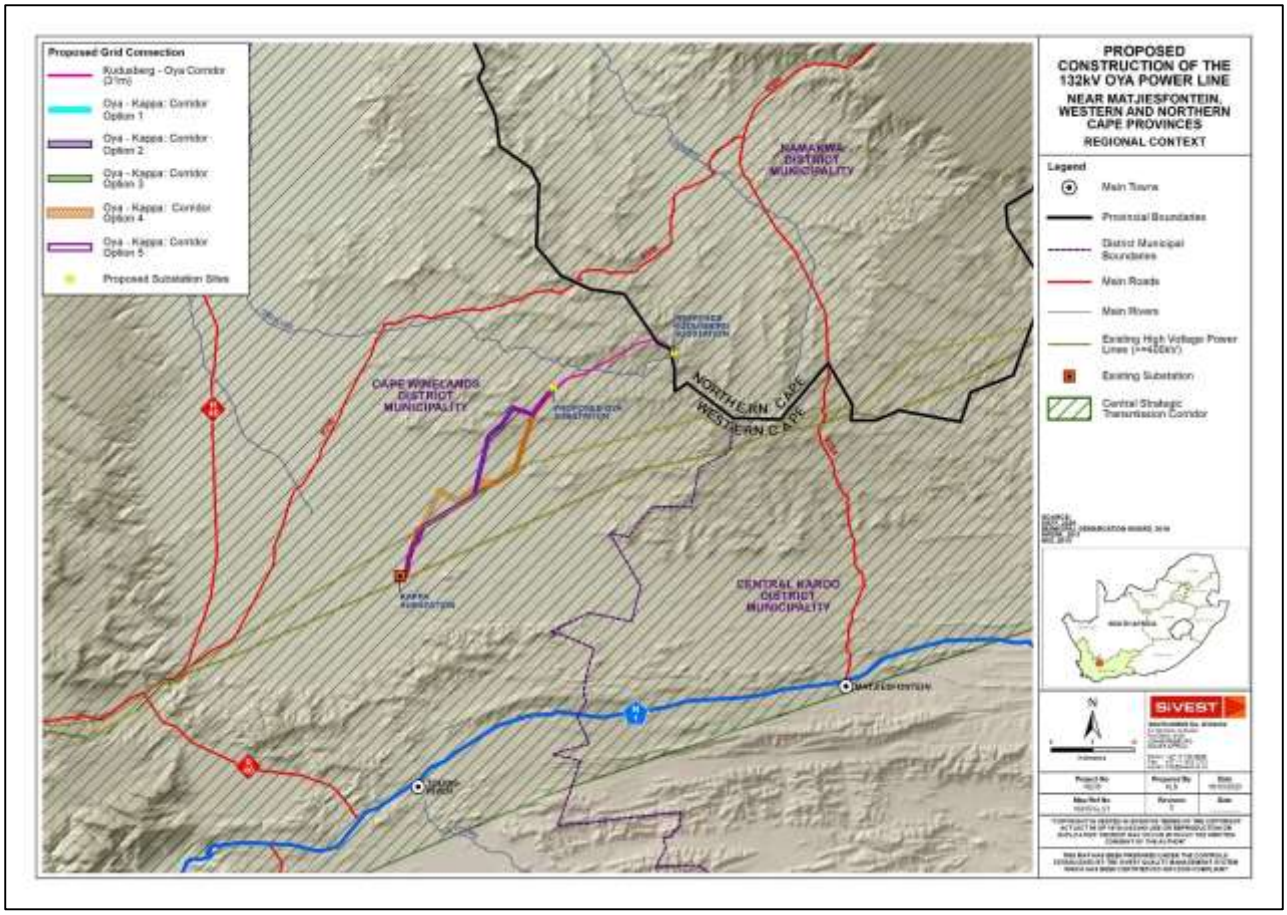

Figure 3: Oya 132kV overhead power line and substations regional context map.

The proposed overhead power line and 33/132kV substations will affect the following properties[4]:

- Portion 2 of the Farm Bakovens Kloof No 152 (2/152): C01900000000015200002
- Remainder of the Farm Bakovens Kloof No 152 (RE/152): C01900000000015200000
- Portion 3 of the Farm Baakens Rivier No 155 (3/155): C01900000000015500003
- Remainder of the Farm Baakens Rivier No 155 (RE/155): C01900000000015500000
- Portion 1 of the Farm Gats Rivier No 156 (1/156): C01900000000015600001
- Remainder of the Farm Gats Rivier No 156 (RE/156): C01900000000015600000
- Portion 1 of the Farm Amandelboom No 158 (1/158): C01900000000015800001
- Remainder of the Farm Oliviers Berg No 159 (RE/159): C01900000000015900000
- Portion 2 of the Farm Bantamsfontein No 168 (2/168): C01900000000016800002
- Portion 4 of the Farm Bantamsfontein No 168 (4/168): C01900000000016800004
- Portion 5 of the Farm Bantamsfontein No 168 (5/168): C01900000000016800005
- Portion 7 of the Farm Bantamsfontein No 168 (7/168): C01900000000016800007
- Portion 13 of the Farm Bantamsfontein No 168 (13/168): C01900000000016800013
- Remainder of the Farm Bantamsfontein No 168 (RE/168): C01900000000016800000
- Remainder of the Farm Lower Roodewal No 169 (RE/169): C01900000000016900000
- Remainder of the Farm Matjes Fontein No 194 (RE/194): C07200000000019400000
- The Farm Platfontein No 240 (240): C01900000000024000000
- The Farm Die Brak No 241 (241): C01900000000024100000
- Portion 1 of the Farm Rietpoort No 243 (1/243): C01900000000024300001
- Remainder of the Farm Rietpoort No 243 (RE/243): C01900000000024300000

[4] 21-digit surveyor general (SG) codes also provided

- Remainder of the Farm Toover berg No 244 (RE/244): C01900000000024400000

The proposed development is located in the Witzenberg and Karoo Hoogland Local Municipalities respectively, which fall within the Cape Winelands and Namakwa District Municipalities.

The entire extent of the proposed overhead power line is located within one (1) of the Strategic Transmission Corridors as defined and in terms of the procedures laid out in GN No. 113, namely the Central Corridor. The proposed project irrespective of this would be subject to a BA process in terms of the NEMA (as amended) and Appendix 1 of the EIA Regulations, 2014 promulgated in Government Gazette 40772 and GN R326, R327, R325 and R324 on 7 April 2017. The competent authority for this BA is the DEFF.

At this stage, it is anticipated that the proposed development will include a 132kV power line and 33/132kV substations to feed electricity generated by the renewable energy facilities owned by the applicant into the national gird at the Kappa substation.

The type of power line towers being considered at this stage include both lattice and monopole towers and it is assumed that these towers will be located approximately 200m to 250m apart. The towers will be up to 45m in height, depending on the terrain, but will ensure minimum overhead line clearances from buildings and surrounding infrastructure.

300m wide power line corridors (i.e. 150m on either side) are being assessed to allow flexibility when determining the final route alignment. The proposed power line however only requires a 31m wide servitude and as such, this servitude would be positioned within the assessed corridor.

The size of the proposed substation and O&M building sites will be approximately 2 hectares (ha) each.

5.1.1 Alternatives

It should be noted that only one (1) route is possible for the section of the proposed power line which connects the Kudusberg substation to the Oya substation (i.e. Kudusberg to Oya). No alternatives can therefore be provided for this section of the power line. The Kudusberg to Oya power line corridor route is approximately 16.6km in length and runs from the Kudusberg on-site substation along the RE/194, 1/158, RE/159, RE/156, 1/156 and RE/155 properties to the Oya on-site substation.

Five (5) power line corridor route alternatives have however been provided for the section of the proposed overhead power line which connects the Oya on-site substation to the Kappa substation (i.e. Oya to Kappa). The above-mentioned alternatives are described below:

- **Power Line Corridor Alternative 1 (Oya to Kappa):** Approximately 34.14km in length and runs along the RE/155, RE/152, 2/152, RE/169, RE/243, 241, 240 and RE/244 properties to the Kappa substation
- **Power Line Corridor Alternative 2 (Oya to Kappa)**: Approximately 32.43km in length and runs along the RE/155, 3/155, RE/152, 2/152, RE/169, 13/168, 5/168, 1/243, RE/243, 241 and 240 properties to the Kappa substation
- **Power Line Corridor Alternative 3 (Oya to Kappa):** Approximately 30.56km in length and runs along the RE/155, 4/168, 13/168, 5/168, 1/243, 240 and RE/244 properties to the Kappa substation
- **Power Line Corridor Alternative 4 (Oya to Kappa):** Approximately 32.94km in length and runs along the RE/155, 4/168, 13/168, RE/169, RE/243, 241 and 240 properties to the Kappa substation
- **Power Line Corridor Alternative 5 (Oya to Kappa):** Approximately 32.26km in length and runs along the RE/155, RE/152, 2/152, RE/169, 5/168, 1/243 and 240 properties to the Kappa substation

The power line corridor routes mentioned above provide different route alignments contained within an assessment corridor of up to approximately 300m wide. This is to allow for flexibility to route the power line within the authorised corridors.

5.1.2 'No-go' alternative

The 'no-go' alternative is the option of not fulfilling the proposed project as well as prevent the connection of the energy development in the area to feed electricity into the national grid. This alternative would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. Implementing the 'no-go' option would entail no development. The affected properties are currently not used for agricultural activities, although they are suitable for very low-level grazing.

The 'no-go' option is a feasible option; however, this would prevent the proposed development from contributing to the environmental, social and economic benefits associated with the development of the renewables sector.

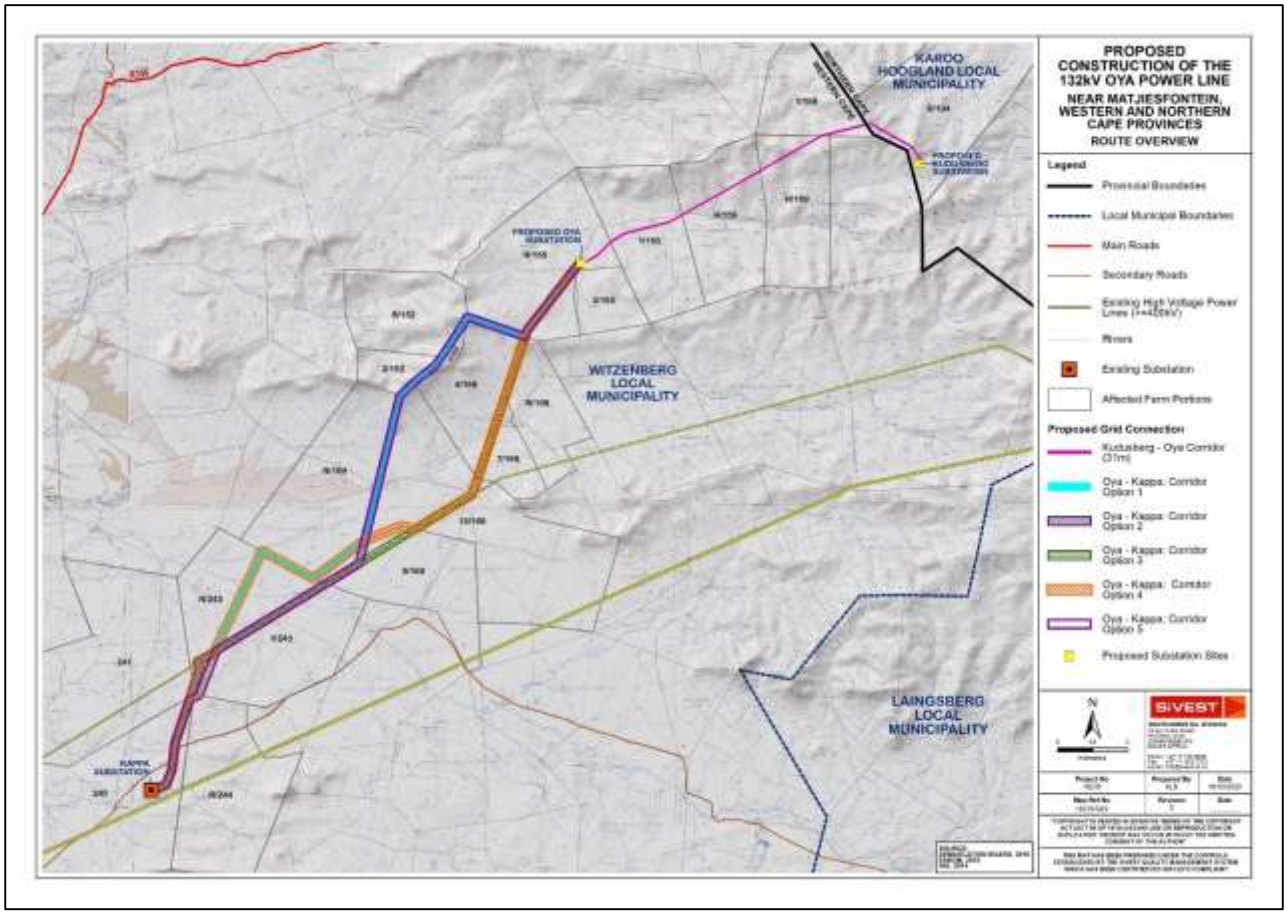

Figure 4: Oya 132kV overhead power line alternatives located near Matjiesfontein in the Western and Northern Cape Provinces

6. LEGAL REQUIREMENT AND GUIDELINES

6.1 National Legislation

6.1.1 Constitution of the Republic of South Africa, 1996

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

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

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

  (i) prevent pollution and ecological degradation;

  (ii) promote conservation; and

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

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

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

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

6.1.3 The National Environmental Management: Biodiversity Act 10 of 2004 (NEM:BA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)

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

6.2 Provincial Legislation

6.2.1 Western Cape Nature Conservation Laws Amendment Act, 2000

This statute provides for the amendment of various laws on nature conservation in order to transfer the administration of the provisions of those laws to the Western Cape Nature Conservation Board, which includes various regulations pertaining to wind animals, including avifauna.

6.2.2 Northern Cape Nature Conservation Act No. 9 Of 2009

The statute provides for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.

6.3 Agreements and Conventions

Table 1 below lists agreements and conventions which South Africa is party to and which is directly relevant to the conservation of avifauna (BirdLife International 2020).

Table 1: Agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

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

7. DESCRIPTION OF THE RECEIVING ENVIRONMENT

7.1 Important Bird Areas (IBAs)

The Cedarberg - Koue Bokkeveld Complex Important Bird Area (IBA) SA101 is the closest IBA and is located approximately 30km west of the study area at its closest point. The development is not expected to have any impact on the avifauna in this IBA.

7.2 Protected Areas

The study area does not form part of a formally protected area. The closest protected area is the Inverdoorn Private Nature Reserve which is located approximately 13km away from the Kappa Substation at its closest point. The OHL is not expected to impact on avifauna in the reserve.

7.3 Description of Study Area

The Kudusberg on-site substation, where the OHL will start, is located on a plateau. From there, the proposed alignment drops sharply westwards down an escarpment and continues through undulating terrain until it reaches a second escarpment about 15-20km further west. Thereafter it drops again down the escarpment in a south-westerly direction, and then runs for about 20km on a flat plain until it reaches the Kappa Substation.

The climate in the greater Matjiesfontein area is semi-arid with a mean annual rainfall of about 353mm (www.worldweatheronline.com). Figure 5 below shows the mean monthly rainfall and temperatures in the Matjiesfontein area, which is approximately 44km from the Kudusberg WEF on-site substation.

The land use is mostly extensive grazing of live-stock and game.

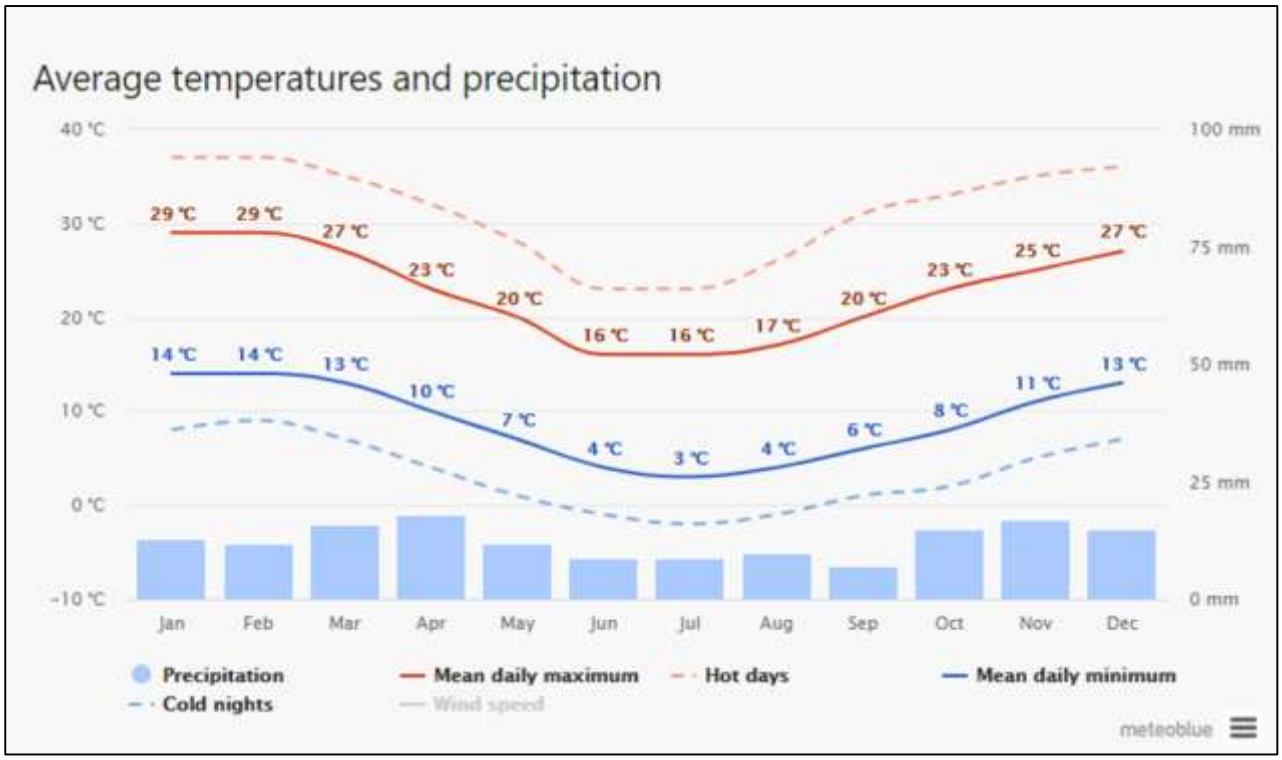

Figure 5: The "mean daily maximum" (solid red line) shows the maximum temperature of an average day for every month for Matjiesfontein. Likewise, "mean daily minimum" (solid blue line) shows the average minimum temperature. Hot days and cold nights (dashed red and blue lines) show the average of the hottest day and coldest night of each month of the last 30 years.

The most important anthropogenic avifaunal-relevant habitat modifications currently present in the study area which could potentially attract birds that were recorded in or close to the study area, are sources of surface water (earth dams and boreholes) and high voltage lines.

The habitat in the study area is discussed in more detail below. The priority species associated with each habitat class are listed in Table 2.

7.3.1 Succulent Karoo

The whole of the study area is predominantly covered with natural vegetation. Vegetation structure, rather than the actual plant species, is more significant for bird species distribution and abundance (Harrison *et al.* 1997). The study area is located mostly in the Succulent Karoo Biome, in the Rainshadow Valley Karoo Bioregion, with a small section around the Kudusberg Substation falling in the Fynbos Biome in the Karoo Renosterveld Bioregion (Mucina & Rutherford 2006). The dominant vegetation types in the study area are Tankwa Karoo and Koedoesberge – Moordenaars Karoo. Tankwa Karoo occurs on the plains in the western half of the study area. The plains are very sparsely vegetated with low succulent shrubland, and in extreme precipitation-poor years could appear almost barren (Mucina & Rutherford 2006). Koedoesberge – Moordenaars occurs in undulating area in the eastern half of the study area. It consists mainly of low succulent scrub and dotted by scattered tall shrubs and patches of 'white' grass, the most conspicuous dominants being dwarf shrubs (Mucina & Rutherford 2006). The dominant impression of the natural vegetation in the study area is that of medium to high density Karoo shrubland. Images of the typical vegetation structure in the study area is shown below in Figure 6.

Figure 6: An example of the dominant Succulent Karoo habitat in the study area, consisting mostly of dwarf shrubs with open ground in between.

The priority species which could potentially utilise the Succulent Karoo habitat in the study area listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- Black Harrier
- **Booted Eagle**
- Cape Crow
- Common Buzzard
- **Greater Kestrel**

- **Jackal Buzzard**
- **Karoo Korhaan**
- **Lanner Falcon**
- **Ludwig's Bustard**
- **Martial Eagle**
- **Namaqua Sandgrouse**
- **Pale Chanting Goshawk**
- **Pied Crow**
- **Rock Kestrel**
- Secretarybird
- Southern Black Korhaan
- **Spotted Eagle-owl**

7.3.2 Surface water

Surface water is of specific importance to avifauna in this semi-arid environment. There are many small earth dams in the study area, which are mostly located in drainage lines. The dams and larger drainage lines, e.g. the Groot River which transects the study area, hold water after good rains, when it could be attractive to various bird species, including large raptors, to drink and bath. It could also serve as an attraction to waterbirds when it contains water, although it must be noted that the study site is generally dry for most of the year. There are several drainage lines in the study area, which are mostly tributaries of the ephemeral Groot River. Some of the channels contain boulders and sheets of rock. Pools of standing water form in the larger drainage lines after good rains, especially where there are sheets of rock in the channel. Some of the drainage lines have steep sides, lined with exposed rock (see Figures 7 – 8).

Figure 7: An earth dam in the study area.

Figure 8: A drainage line in the study area

Figure 9: A map of the rivers and waterbodies (dams and boreholes) in the study area relative to the proposed corridor options.

The priority species which could potentially be attracted to the surface water in the study area listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- Black Harrier

- **Booted Eagle**
- Cape Teal
- **Lanner Falcon**
- **Martial Eagle**
- **Pale Chanting Goshawk**
- Secretarybird
- Common Buzzard
- **Jackal Buzzard**
- **Verreaux's Eagle**
- African Black Duck
- African Sacred Ibis
- Black-headed Heron
- **Egyptian Goose**
- **Hadeda Ibis**
- Hamerkop
- **Namaqua Sandgrouse**
- Red-knobbed Coot
- **South African Shelduck**
- Yellow-billed Duck

7.3.3 High voltage lines

Transmission lines are an important breeding substrate for raptors in the Karoo, due to the lack of large trees (Jenkins *et al.* 2006, 2013). The Droërivier – Kappa 2 400kV transmission line runs through a large section of the study area. There is a nest originally built by Martial Eagles located on pylon 667 of this transmission line (see Figures 10 and 11). The pair of eagles have not bred there in the 2019 and 2020 breeding season. A pair of Lanner Falcons was recorded breeding on the nest in November 2019. Many other priority species, apart from Martial Eagles, also use the high voltage lines for roosting and/or breeding

Figure 10: Martial Eagle nest on tower 667 of the Droërivier – Kappa 2 400kV transmission line.

Figure 11: A map of the high voltage lines in the study area. ME = Martial Eagle LF = Lanner Falcon JB = Jackal Buzzard

The priority species which could potentially be attracted to the high voltage lines in the study area listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Booted Eagle**
- Common Buzzard
- **Lanner Falcon**
- **Martial Eagle**
- **Pale Chanting Goshawk**
- **Egyptian Goose**
- **Hadeda Ibis**
- **Verreaux's Eagle**
- **Greater Kestrel**
- **Pied Crow**
- **Rock Kestrel**
- **Spotted Eagle-owl**
- **Jackal Buzzard**

7.3.4 Trees

Many of the drainage lines in the study area are lined with tall shrubs, and stunted *Vachellia* trees, which can form fairly dense thickets in places. Although the trees are generally too small to be used for nesting by most of the priority species, some of the priority do use them on occasion for nesting and roosting.

Figure 12: An example of Vachellia shrub in a drainage line.

The priority species which could potentially be attracted to the trees in the study area listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Booted Eagle**
- **Lanner Falcon**
- **Martial Eagle**
- **Pale Chanting Goshawk**
- **Egyptian Goose**
- **Hadeda Ibis**
- **Greater Kestrel**
- **Rock Kestrel**
- **Spotted Eagle-owl**
- Secretarybird
- African Sacred Ibis
- Black-headed Heron
- Hamerkop
- Cape Crow
- **White-necked Raven**

7.3.5 Cliffs

The eastern half of the study area contains very rugged terrain, and there are several cliffs which offer suitable habitat for cliff-nesting species. A Verreaux's Eagle nest was located on a cliff face approximately 2km from the closest corridor options (1, 2 and 5) and an active Jackal Buzzard nest was also located approximately 700m from the closest corridor options (1, 2 and 5) (see Figures 13 - 14).

The priority species which could potentially be attracted to the cliffs in the study area listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Verreaux's Eagle**
- **White-necked Raven**

- **Lanner Falcon**
- **Booted Eagle**
- **Rock Kestrel**
- Hamerkop
- Black Stork
- **Jackal Buzzard**

Figure 13: Cliffs with a Verreaux's Eagle nest in the study area

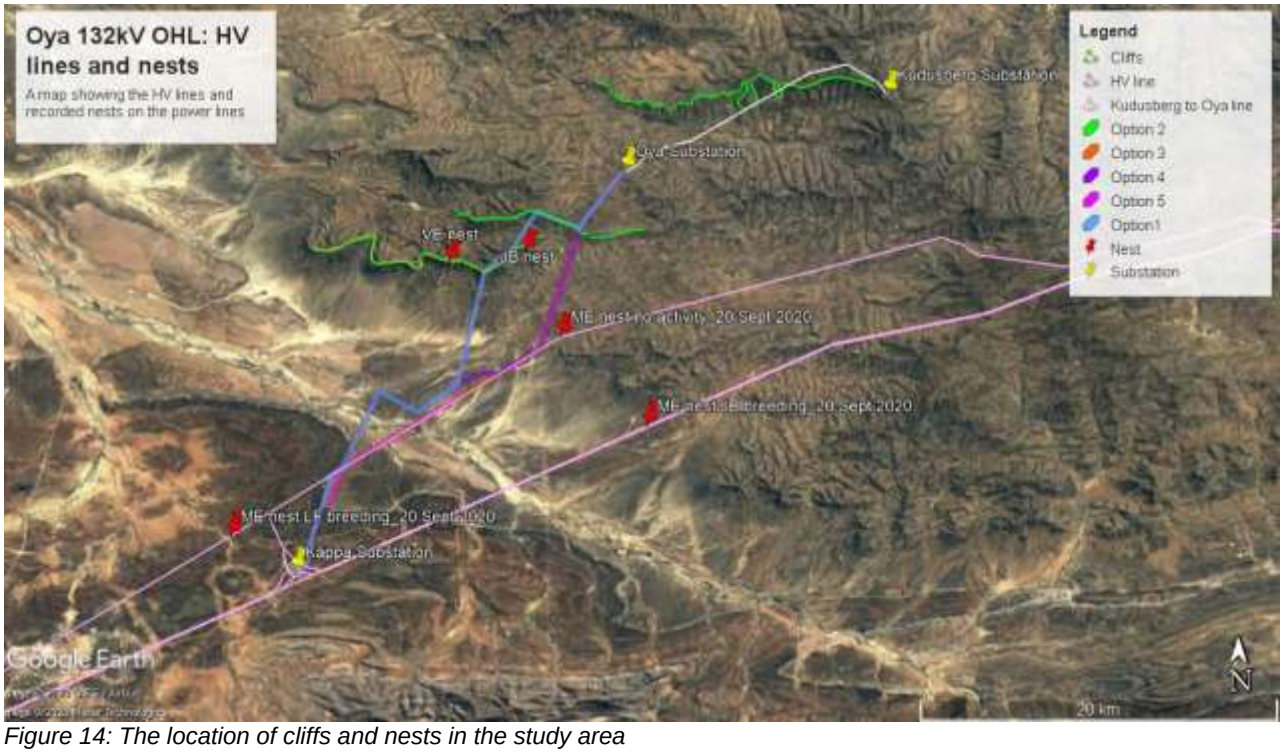

Figure 14: The location of cliffs and nests in the study area

7.4 AVIFAUNA

7.4.1 Southern African Bird Atlas 2

It is estimated that a total of 117 bird species could potentially occur in the broader area. Please refer to Appendix 1 which provides a comprehensive list of all the species, including those recorded during the site investigation. Of these, 29 species are classified as priority species. The probability of a priority species occurring regularly in the study area is indicated in Table 2.

Table 2 below lists all the priority species and the possible impact on the respective species by the proposed OHL.

Key

- EN = Endangered
- VU = Vulnerable
- NT = Near threatened
- H = High
- M = Medium
- L = Low

Table 2: Priority species occurring within the broader area

		SABAP 2			Status		Class						Habitat class					Impact		
Common name	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Raptor	Waterbird	Terrestrial	Corvid	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Surface water	Trees	HV pylons	Cliffs	Displacement: Disturbance and habitat transformation	Electrocution	Collisions
African Black Duck	*Anas sparsa*	1.72	0.00	x				x			L			x						x
African Sacred Ibis	*Threskiornis aethiopicus*	1.72	0.00	x				x			L			x	x					x
Black Harrier	*Circus maurus*	8.62	7.37	x	EN	EN	x				M		x	x					x	x
Black-headed Heron	*Ardea melanocephala*	0.00	1.05	x				x			M			x	x					x
Black Stork	*Ciconia nigra*	0.00	0.00	x	LC	VU		x			M			x			x	x		x
Booted Eagle	*Aquila pennatus*	10.34	7.37	x			x				M		x	x	x	x	x		x	x
Cape Crow	*Corvus capensis*	0.00	1.05	x						x	L		x		x		x		x	
Cape Teal	*Anas capensis*	1.72	0.00	x			x				L			x						x
Common Buzzard	*Buteo buteo*	0.00	1.05	x			x				L		x	x		x			x	
Egyptian Goose	*Alopochen aegyptiacus*	24.14	5.26	x				x			H			x	x	x				x
Greater Kestrel	*Falco rupicoloides*	1.72	5.26	x			x				H		x		x	x		x	x	
Hadeda Ibis	*Bostrychia hagedash*	15.52	7.37	x				x			H			x	x	x			x	x
Hamerkop	*Scopus umbretta*	5.17	0.00	x				x			M			x	x		x			x
Jackal Buzzard	*Buteo rufofuscus*	10.34	8.42	x			x				H	x	x	x		x		x	x	x
Karoo Korhaan	*Eupodotis vigorsii*	15.52	1.05	x	NT	LC			x		H		x					x		x
Lanner Falcon	*Falco biarmicus*	6.90	1.05	x	VU	LC	x				H		x	x	x	x	x	x	x	
Ludwig's Bustard	*Neotis ludwigii*	15.52	6.32	x	EN	EN			x		M		x					x		x
Martial Eagle	*Polemaetus bellicosus*	5.17	2.11	x	VU	EN	x				H		x	x	x	x		x	x	x
Namaqua Sandgrouse	*Pterocles namaqua*	10.34	5.26	x					x		M	x	x	x						x

		SABAP 2			Status		Class						Habitat class					Impact		
Common name	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Priority species	Red Data status: International	Red Data status: Regional	Raptor	Waterbird	Terrestrial	Corvid	Possibility of regular occurrence	Recorded during surveys	Succulent Karoo	Surface water	Trees	HV pylons	Cliffs	Displacement: Disturbance and habitat transformation	Electrocution	Collisions
Pale Chanting Goshawk	*Melierax canorus*	67.24	36.84	x			x				H	x	x	x	x	x			x	
Pied Avocet	*Recurvirostra avosetta*	1.72	0.00	x				x			L									x
Pied Crow	*Corvus albus*	39.66	20.00	x						x	H	x	x			x		x	x	
Red-knobbed Coot	*Fulica cristata*	1.72	1.05	x				x			L			x						x
Rock Kestrel	*Falco rupicolus*	29.31	10.53	x			x				H	x	x		x	x	x		x	
Secretarybird	*Sagittarius serpentarius*	6.90	0.00	x	VU	VU	x		x		M		x	x	x			x		x
South African Shelduck	*Tadorna cana*	31.03	4.21	x				x			H			x						x
Southern Black Korhaan	*Afrotis afra*	0.00	1.05	x	VU	VU			x		L		x							x
Spotted Eagle-owl	*Bubo africanus*	10.34	1.05	x			x				H		x		x	x			x	
Verreaux's Eagle	*Aquila verreauxii*	10.34	7.37	x	VU	LC	x				H			x		x	x	x	x	x
White-necked Raven	*Corvus albicollis*	29.31	8.42	x						x	H	x			x		x	x	x	
Yellow-billed Duck	*Anas undulata*	1.72	1.05	x				x			L			x						x

8. SPECIALIST FINDINGS / IDENTIFICATION AND ASSESSMENT OF IMPACTS

8.1 General

Negative impacts on avifauna by electricity infrastructure generally take two main forms namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins *et al*. 2010). Displacement due to habitat destruction and disturbance associated with the construction of the electricity infrastructure is another impact that could potentially impact on avifauna.

8.2 Electrocutions

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed power lines, no electrocution risk is envisaged because the proposed design of the 132kV line, namely the steel monopole and self-supporting lattice structures, should not pose an electrocution threat to any of the priority species which are likely to occur in the study area. Electrocutions within the proposed transmission substation yard are possible but should not affect the more sensitive Red Data bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls and certain species of waterbirds. The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- Cape Crow
- **Greater Kestrel**
- **Hadeda Ibis**
- **Pied Crow**
- **Rock Kestrel**
- **Spotted Eagle-owl**
- **White-necked Raven**
- Black-headed Heron
- **Egyptian Goose**

8.3 Collisions

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). In a PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are

both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude, or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Alonso et al. 1994a, Bevanger 1994)."

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (see Figure 15 below).

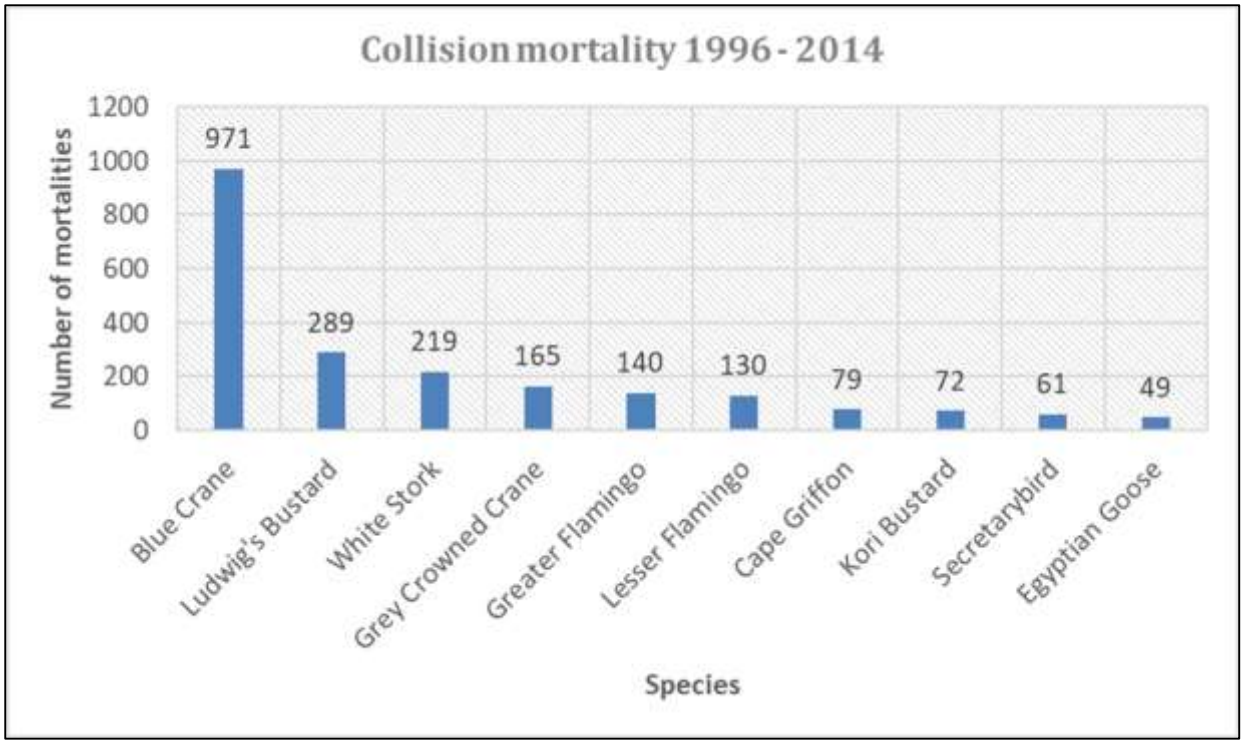

Figure 15: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

Power line collisions are generally accepted as a key threat to bustards (Raab *et al*. 2009; Raab *et al*. 2010; Jenkins & Smallie 2009; Barrientos *et al*. 2012, Shaw 2013). In a recent study, carcass surveys were performed under high voltage transmission lines in the Karoo for two years, and low voltage distribution lines for one year (Shaw 2013). Ludwig's Bustard was the most common collision victim (69% of carcasses), with bustards generally comprising 87% of mortalities recovered. Total annual mortality was estimated at 41% of the Ludwig's Bustard population, with Kori Bustards also dying in large numbers (at least 14% of the South African population killed in the Karoo alone). Karoo Korhaan was also recorded, but to a much lesser extent than Ludwig's Bustard. The reasons for the relatively low collision risk of this species probably include their smaller size (and hence greater agility in flight) as well as their more sedentary lifestyles, as local birds are familiar with their territory and are less likely to collide with power lines (Shaw 2013).

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards *Ardeotis kori*, Blue Cranes *Anthropoides paradiseus* and White Storks *Ciconia ciconia*. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously

recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (A*ccipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to power line collisions.

Despite doubts about the efficacy of line marking to reduce the collision risk for bustards (Jenkins *et al*. 2010; Martin *et al.* 2010), there are numerous studies which prove that marking a line with PVC spiral type Bird Flight Diverters (BFDs) generally reduce mortality rates (e.g. Bernardino *et al.* 2018; Sporer *et al.* 2013, Barrientos *et al*. 2011; Jenkins *et al*. 2010; Alonso & Alonso 1999; Koops & De Jong 1982), including to some extent for bustards (Barrientos *et al*. 2012; Hoogstad 2015 pers.comm). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. Barrientos *et al.* (2011) reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease of 55–94% in bird mortalities. Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5m, whereas using the same devices at 10m intervals only reduces the mortality by 57%. Barrientos *et al*. (2012) found that larger BFDs were more effective in reducing Great Bustard collisions than smaller ones. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al*. 2010).

Using a controlled experiment spanning a period of nearly eight years (2008 to 2016), the Endangered Wildlife Trust (EWT) and Eskom tested the effectiveness of two types of line markers in reducing power line collision mortalities of large birds on three 400kV transmission lines near Hydra substation in the Karoo. Marking was highly effective for Blue Cranes, with a 92% reduction in mortality, and large birds in general with a 56% reduction in mortality, but not for bustards, including the endangered Ludwig's Bustard. The two different marking devices were approximately equally effective, namely spirals and bird flappers, they found no evidence supporting the preferential use of one type of marker over the other (Shaw *et al*. 2017).

The most likely Red Data candidates for collision mortality on the proposed powerline are large terrestrial species e.g. bustards, korhaans and Secretarybird, certain raptors and storks, particularly Verreaux's Eagles, Jackal Buzzards and Black Storks where the line drops down the escarpment, and waterbirds at drainage lines and waterbodies. The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Hadeda Ibis**
- Black-headed Heron
- **Egyptian Goose**
- Black Harrier
- **Booted Eagle**
- **Jackal Buzzard**
- **Martial Eagle**
- **Verreaux's Eagle**
- African Black Duck
- African Sacred Ibis
- Cape Teal
- Hamerkop
- **Karoo Korhaan**
- **Ludwig's Bustard**
- **Namaqua Sandgrouse**
- Pied Avocet

- Red-knobbed Coot
- Secretarybird
- **South African Shelduck**
- Southern Black Korhaan
- Yellow-billed Duck
- Black Stork

8.4 Displacement due to habitat destruction and disturbance

During the construction of power lines, service roads (jeep tracks) and substations, habitat destruction/transformation inevitably takes place. The construction activities will constitute the following:

- Site clearance and preparation;
- Construction of the infrastructure (i.e. the on-site substation, OHL and service road);
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site;
- Removal of vegetation for the proposed substation and stockpiling of topsoil and cleared vegetation;
- Excavations for infrastructure;

These activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed transmission substation through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the substation yard is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing power lines, very little if any vegetation clearing will be required in the power line servitudes. The habitat in the study area is very uniform from a bird impact perspective; therefore, the loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed substation is likely to be fairly minimal. The species most likely to be directly affected by this impact would be small, non-Red Data species.

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Large terrestrial species namely Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan are most likely to be affected by displacement due to disturbance. Cliff-nesting Jackal Buzzards, Booted Eagles, Verreaux's Eagles and Black Storks could also potentially be vulnerable to this impact.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Verreaux's Eagle**
- **White-necked Raven**
- **Lanner Falcon**
- **Booted Eagle**
- Cape Crow
- **Jackal Buzzard**
- **Martial Eagle**
- **Karoo Korhaan**
- **Ludwig's Bustard**

- Secretarybird
- **Greater Kestrel**
- **Pied Crow**
- Southern Black Korhaan
- **Rock Kestrel**
- Black Stork

8.5 Identification of environmental sensitivities

The following environmental sensitivities were identified from an avifaunal perspective for the proposed power line grid connections:

- High sensitivity (Mitigation required): Surface water

Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this semi-arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon, Verreaux's Eagle and Black Stork and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Power lines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds. These areas will require mitigation with Bird Flight Diverters (BFDs).

- High sensitivity (Mitigation required): Cliffs

The proposed OHL runs down two escarpment areas, where it will pose a risk to cliff nesting species such as Verreaux's Eagle, Booted Eagle, Lanner Falcon, Jackal Buzzard and Black Stork. These species all use the declivity wind currents along the cliff faces and slopes for lift and they will be at risk of collisions with the OHL where it traverses these cliffs and slopes. These areas will require mitigation with Bird Flight Diverters (BFDs).

- Medium sensitivity (Mitigation preferred): Succulent Karoo

The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan. It would therefore be advisable to mitigate the whole OHL with Bird Flight Diverters (BFDs) if possible.

See Figure 16 for a map of high sensitivity areas.

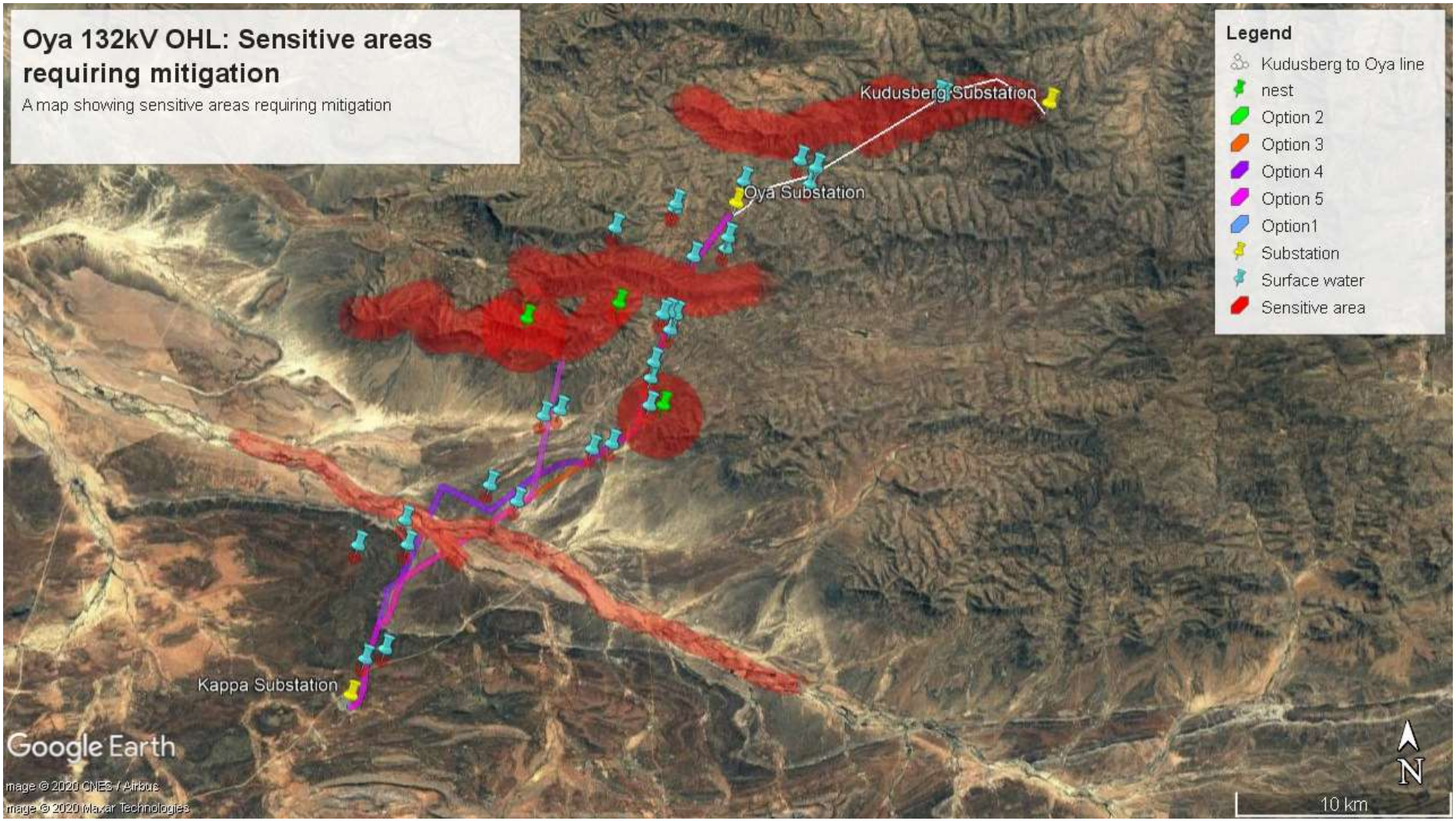

Figure 16: High sensitivity areas in the study area: cliffs, dams and boreholes, and the Groot River.

8.6 Overall Impact Rating

8.6.1 Planning / Preconstruction

Direct Impacts include the following:

None

Indirect Impacts include the following:

None

8.6.2 Construction

Direct Impacts include the following:

- Displacement of priority species due to habitat destruction in the substation footprint
- Displacement of priority species due to disturbance associated with the construction activities

Indirect Impacts include the following:

None

Please refer to Table 3 below for a rating of impacts for the construction phase.

Table 3: Rating of impacts: Construction Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction																				
Direct Impacts																				
Avifauna	Displacement of priority species due to habitat destruction in the substation footprint	1	1	3	4	3	1	12	_	Low	A site-specific Construction Environmental Management Programme (EMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction and degradation of habitat. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr should specifically include the following: ▪ The minimum footprint areas for	1	1	3	4	3	1	12	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction																				
											infrastructure should be used; ▪ Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks) must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist and implemented accordingly.									
Avifauna	Displacement of priority species due to disturbance associated with the construction activities	1	3	2	3	1	3	30	_	Medium	▪ No off-road driving; ▪ Maximum use of existing roads; ▪ Measures to control noise; ▪ Restricted access to the rest of the property; ▪ Should Corridor Option 3 or 4 be utilised, the avifaunal specialist should conduct an inspection to see if	1	2	2	1	1	2	14	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction																				
											the Martial Eagle nest on Tower 667 of the Droërivier – Kappa 2 400kV transmission line is active. If the nest is not active, the construction activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the construction period. This could include measures such as delaying some of the construction activities until after the breeding season.									

8.6.3 Operation

Direct Impacts include the following:

- Mortality of priority species due to electrocutions in the substation yard
- Mortality of priority species due to collisions with the 132kV OHL

Indirect Impacts include the following:

None

Table 4: Rating of impacts: Operational Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operation																				
Direct Impacts																				
Avifauna	Mortality of priority species due to electrocutions in the substation yard	1	3	2	4	3	2	26	_	Medium	▪ The hardware within the proposed transmission substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once	1	2	2	4	3	1	12	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operation																				
											operational, site specific mitigation be applied reactively. This is an acceptable approach because priority avifauna, especially Red Data species, is unlikely to frequent the substation and be electrocuted.									
Avifauna	Mortality of priority species due to collisions with the 132kV OHL	1	3	2	4	3	2	26	_	Medium	▪ It is recommended that the entire grid connection is marked with BFDs if possible. ▪ The operational monitoring programme must include regular monitoring (i.e. quarterly) of the power lines for collision mortalities for at least two years.	1	2	2	4	3	2	24	_	Medium

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operation																				
											▪ If additional collision hot-spots are identified during quarterly monitoring, these sections must be marked with BFDs to reduce the collision risk.									

8.6.4 Decommissioning

Direct Impacts include the following:

- Displacement of priority species due to disturbance associated with the decommissioning activities

Indirect Impacts include the following:

None

Table 5: Rating of impacts: Decommissioning Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Decommissioning																				
Direct Impacts																				
Avifauna	Displacement of priority species due to disturbance associated with the decommissioning activities	1	1	3	4	3	1	12	_	Low	• No off-road driving; • Maximum use of existing roads; • Measures to control noise; • Restricted access to the rest of the property; • The avifaunal specialist should conduct an inspection to see if the Martial Eagle nest on Tower 667 of the Droërivier – Kappa 2 400kV transmission line is active. If the nest is not active, the decommissioning activities can proceed without delay. If the nest is occupied, the avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to the breeding pair of eagles during the decommissioning	1	1	3	4	3	1	12	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Decommissioning																				
											period. This could include measures such as delaying some of the decommissioning activities until after the breeding season.									

8.6.5 "No-go" Impact

Direct Impacts include the following:

None

Indirect Impacts include the following:

None

8.7 Cumulative Impacts

Although it is important to assess the potential avifaunal impacts of the proposed power line and substations specifically, it is equally important to assess the potential avifaunal visual impact that could materialise if other renewable energy facilities (both wind and solar facilities) with associated power line infrastructure projects are developed in the broader area. Cumulative impacts occur where existing or planned developments, in conjunction with the proposed development, result in significant incremental changes in the broader study area. In this instance, such developments would include renewable energy facilities with associated power line infrastructure development.

Fifteen (15) renewable energy projects were identified within a 35 km radius of the proposed development as shown in Figure 17 and Table 6 below. These projects were identified using the DEFF's Renewable Energy EIA Application Database for SA in conjunction with information provided by Independent Power Producers (IPPs) operating in the broader region. It is assumed that all of these renewable energy developments include grid connection infrastructure, although few details of this infrastructure were available at the time of writing this report. It should be noted that this list is based on information available at the time of writing this report and as such there may be other renewable energy projects proposed within the study area.

Table 6: Renewable energy developments proposed within a 35km radius of the proposed 132kV Oya power line and substations

Applicant	Project	Technology	Capacity	Status of Application / Development
Oya Energy (Pty) Ltd	Oya Energy Facility	Hybrid	305MW	EIA Process underway
Brandvalley Wind Farm (Pty) Ltd	Brandvalley WEF	Wind	140MW	Approved
Biotherm Energy (Pty) Ltd	Esizayo WEF	Wind	140MW	Approved
African Clean Energy Developments Renewables	Hidden Valley (Karusa & Soetwater) WEF	Wind	140MW	Under Construction
Karreebosch Wind Farm (Pty) Ltd	Kareebosch WEF	Wind	140W	Approved
Rondekop Wind Farm (Pty) Ltd	Rondekop WEF	Wind	325MW	Approved
Kudusberg Wind Farm (Pty) Ltd	Kudusberg WEF	Wind	325W	Approved
South Africa Mainstream Renewable Power Perdekraal West (Pty) Ltd	Perdekraal West WEF & Associated Grid Connection Infrastructure	Wind	150M	Approved
South Africa Mainstream Renewable Power	Perdekraal East WEF & Associated Grid Connection Infrastructure	Wind	110MW	Operational

Perdekraal East (Pty) Ltd				
Rietkloof Wind Farm (Pty) Ltd	Rietkloof WEF	Wind	186MW	Approved
Roggeveld Wind Power (Pty) Ltd	Roggeveld WEF	Wind	140MW	Under Construction
ENERTRAG SA (Pty) Ltd	Tooverberg WEF & Associated Grid Connection Infrastructure	Wind	140MW	Approved
Pele Green Energy (Pty) Ltd	Touws River SEF	Solar	36MW	Operational
Montague Road Energy (Pty) Ltd	Montagu Road Solar PV SEF	Solar	75MW	Approved
Witberg Wind Power (Pty) Ltd	Witberg WEF & Associated Grid Connection Infrastructure	Wind	120MW	Approved

It is important to note however that the study area is located within the REDZ 2, known as Komsberg REDZ, and also within a Strategic Transmission Corridor and thus the relevant authorities support the concentration of renewable energy developments and associated power line infrastructure in this area.

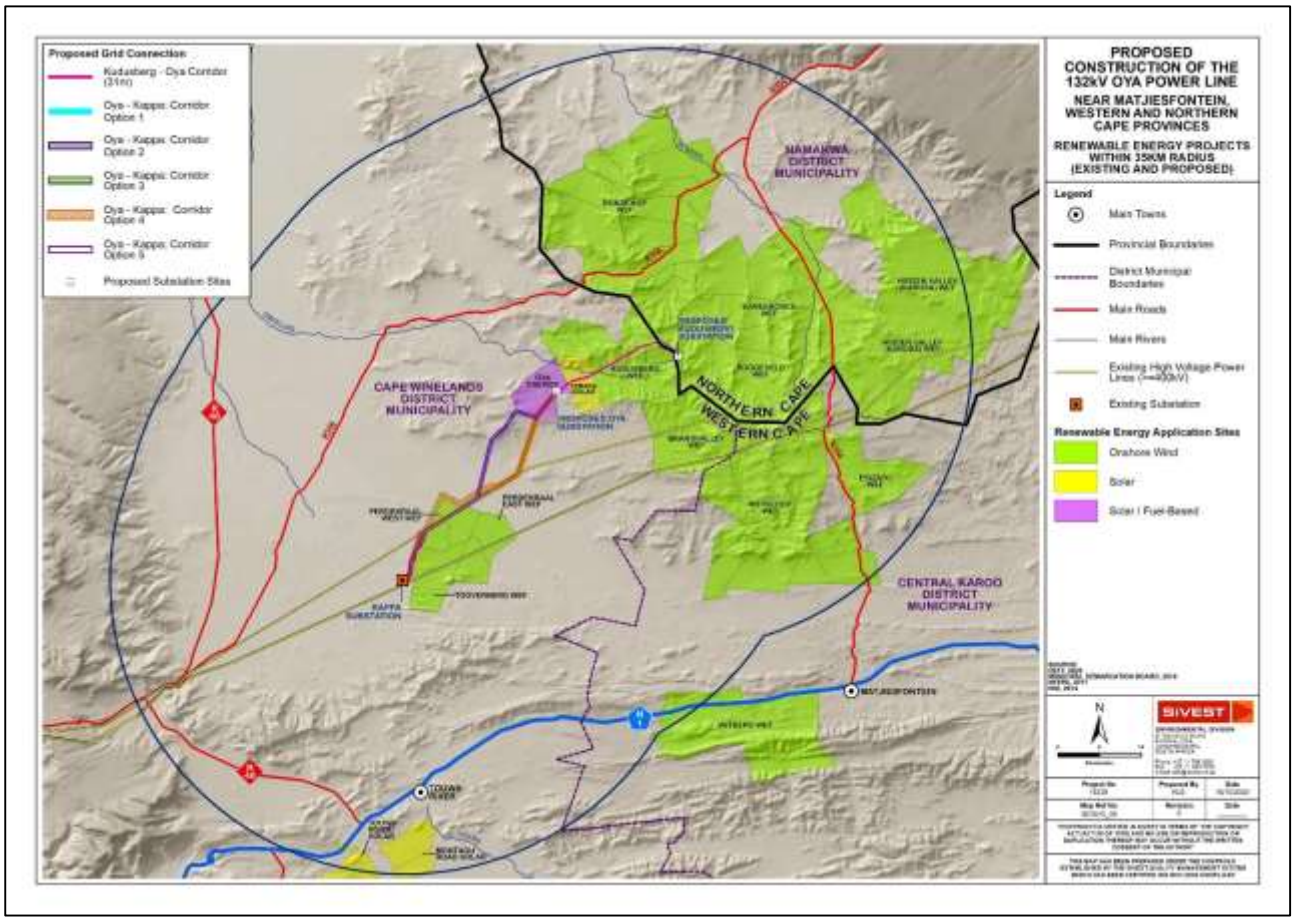

Figure 17: Renewable energy developments identified within a 35km radius of the proposed development

The most significant impact of the proposed OHL and all the other grid connections associated with the renewable energy facilities within the 35km radius around the current project, is the potential for priority species mortality through collisions. The impacts of electrocution and displacement associated with the

proposed substations are relatively minor compared to the envisaged collision impacts. This is especially relevant for large terrestrial species, particularly Ludwig's Bustard, which is highly susceptible to power line collisions. The proposed Kudusberg – Oya – Kappa OHL will add approximately 47- 50kmkm of HV line to the existing HV network in the area, depending on which alignment is ultimately used. Several hundred kilometres of HV line already exists within this area, and several more are planned, should the renewable energy projects all be built. The overall cumulative impact of the proposed development, when viewed with the impacts of existing HV lines on avifauna, and the potential impacts of the grid connections and substations of the planned renewable energy facilities, is assessed to be of medium significance. It could be reduced to some extent with mitigation but will remain at a medium level, specifically as far a power line collisions are concerned.

8.7.1 Cumulative Impact Rating

Direct Impacts include the following:

- Displacement of priority species due to habitat destruction in the substation footprint
- Displacement of priority species due to disturbance associated with the construction activities
- Mortality of priority species due to electrocutions in the substation yard
- Mortality of priority species due to collisions with the 132kV OHL
- Displacement of priority species due to disturbance associated with the decommissioning activities

Indirect Impacts include the following:

None

Table 7: Rating of cumulative impacts

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
Direct Impacts																				

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
Avifauna	Displacement of priority species due to habitat destruction in the substation footprint	1	1	3	4	3	1	12	_	Low	▪ A site-specific Construction Environmental Management Programme (CEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction and degradation of habitat. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr should specifically include the	1	1	3	4	3	1	12	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
											following: The minimum footprint areas for infrastructure should be used; Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks) must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist and implemented accordingly.									

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
Avifauna	Displacement of priority species due to disturbance associated with the construction activities	1	3	2	3	1	3	30	_	Medium	▪ No off-road driving; Maximum use of existing roads; Measures to control noise; Restricted access to the rest of the property; The avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to breeding eagles on existing HV lines during the construction period. This could include measures such as delaying some of the construction activities until after the breeding season.	1	2	2	1	1	2	14	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
Avifauna	Mortality of priority species due to electrocutions in the substation yard	1	3	2	4	3	2	26	_	Medium	▪ The hardware within the proposed transmission substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation be applied reactively. This is an acceptable approach because priority avifauna, especially Red Data species, is unlikely to frequent the substation and be electrocuted.	1	2	2	4	3	1	12	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
Avifauna	Mortality of priority species due to collisions with the 132kV OHL	1	3	2	4	3	2	26	_	Medium	▪ The entire OHL should be marked with BFDs. ▪ The operational monitoring programme must include regular monitoring (i.e. quarterly) of the powerlines for collision mortalities.	1	2	2	4	3	2	24	_	Medium
Avifauna	Displacement of priority species due to disturbance associated with the decommissioning activities	1	1	3	4	3	1	12	_	Low	▪ No off-road driving; Maximum use of existing roads; Measures to control noise; Restricted access to the rest of the property; The avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to breeding eagles	1	1	3	4	3	1	12	_	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
											on existing HV lines during the de-commissioning period. This could include measures such as delaying some of the activities until after the breeding season.									

8.8 Recommendations to be included in EA

The following main recommendations should be considered for inclusion in the EA (should such authorisation be granted by the DEFF):

Pre-Construction / Design Phase:

- Corridor Option 3 must be implemented if possible.

Construction Phase:

- The minimum footprint areas for infrastructure should be used;
- Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks) must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist and implemented accordingly;
- No off-road driving must be allowed;
- Existing roads must be used as far as possible;
- Measures to control noise and dust must be implemented;
- Access to the rest of the property outside the construction footprint must be strictly controlled; and
- The avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to breeding eagles on existing HV lines during the construction period. This could include measures such as delaying some of the construction activities until after the breeding season.

Operational Phase:

- The entire OHL should be marked with BFDs

Decommissioning Phase:

- No off-road driving must be allowed;
- Existing roads must be used as far as possible;
- Measures to control noise and dust must be implemented;
- Access to the rest of the property outside the footprint must be strictly controlled; and
- The avifaunal specialist must consult with the contractor to find ways of minimising the potential disturbance to breeding eagles on existing HV lines during the de-commissioning period. This could include measures such as delaying some of the activities until after the breeding season.

Operational Phase Monitoring:

- The operational monitoring programme must include quarterly monitoring of the power lines for collision mortalities for two years.
- If additional collision hot-spots are identified during quarterly monitoring, these sections must be marked with BFDs to reduce the collision risk.

9. COMPARATIVE ASSESSMENT OF ALTERNATIVES

Key

PREFERRED	The alternative will result in a low impact / reduce the impact / result in a positive impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons (incl. potential issues)
POWER LINE CORRIDOR ROUTE ALTERNATIVES		
Power Line Corridor Alternative 1 (Oya to Kappa)	Least preferred	▪ This is the longest option ▪ Except for a very small section, it does not run next to any existing

Alternative	Preference	Reasons (incl. potential issues)
		HV lines, and therefore creates new collision risks where it did not exist before.
Power Line Corridor Alternative 2 (Oya to Kappa)	Favourable	▪ It is only approximately 3km longer than Option 3, which is the preferred option. ▪ It does have a section running next to existing HV lines, although not as long as Option 3, the preferred option.
Power Line Corridor Alternative 3 (Oya to Kappa)	Preferred	▪ It is the shortest option ▪ Of all the options, this option has the longest section running next to existing HV lines. By routing a line next to an existing HV line, the avian collision risk is reduced for both lines.
Power Line Corridor Alternative 4 (Oya to Kappa)	Least preferred	▪ This is the second longest option ▪ Only two small sections run next to existing HV lines, and therefore it mostly creates new collision risks where it did not exist before.
Power Line Corridor Alternative 5 (Oya to Kappa)	Favourable	▪ It is only approximately 3km longer than Option 3, which is the preferred option. ▪ It does have a section running next to existing HV lines, although not as long as Option 3, the preferred option.

10. CONCLUSION AND SUMMARY

10.1 Summary of Findings

The proposed Oya 132kV OHL and substations will have several impacts on priority avifauna. These can be summarised as follows:

- Displacement of priority species due to habitat destruction in the substation footprint, and due to disturbance associated with the construction activities.
- Mortality of priority species due to electrocutions in the substation yard.
- Mortality of priority species due to collisions with the 132kV OHL.

10.1.1 Construction Phase: Displacement of priority species due to habitat destruction in the substation footprint and disturbance associated with the construction activities

Construction activities could impact on birds breeding, foraging and roosting in or in close proximity of the proposed transmission substation through **transformation of habitat**, which could result in temporary or permanent displacement. Unfortunately, very little mitigation can be applied to reduce the significance of this impact as the total permanent transformation of the natural habitat within the construction footprint of the substation yard is unavoidable. Fortunately, due to the nature of the vegetation, and judged by the existing power lines, very little if any vegetation clearing will be required in the power line servitudes. The habitat in

the study area is very uniform from a bird impact perspective; therefore, the loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed substation is likely to be fairly minimal. The species most likely to be directly affected by this impact would be small, non-Red Data species.

Apart from direct habitat destruction, the above-mentioned activities also impact on birds through **disturbance**; this could lead to breeding failure if the disturbance happens during a critical part of the breeding cycle. Construction activities in close proximity to breeding locations could be a source of disturbance and could lead to temporary breeding failure or even permanent abandonment of nests. A potential mitigation measure is the timeous identification of nests and the timing of the construction activities to avoid disturbance during a critical phase of the breeding cycle, although in practice that can admittedly be very challenging to implement. Large terrestrial species namely Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan are most likely to be affected by displacement due to disturbance. Cliff-nesting Jackal Buzzards, Booted Eagles, Verreaux's Eagles and Black Storks could also potentially be vulnerable to this impact.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Verreaux's Eagle**
- **White-necked Raven**
- **Lanner Falcon**
- **Booted Eagle**
- Cape Crow
- **Jackal Buzzard**
- **Martial Eagle**
- **Karoo Korhaan**
- **Ludwig's Bustard**
- Secretarybird
- **Greater Kestrel**
- **Pied Crow**
- Southern Black Korhaan
- **Rock Kestrel**
- Black Stork

This impact is assessed to be medium to low and can be reduced to low through mitigation.

10.1.2 Operational Phase: Electrocutions in the substation yard

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (Van Rooyen 2004). The electrocution risk is largely determined by the pole/tower design. In the case of the proposed power lines, no electrocution risk is envisaged because the proposed design of the 132kV line, namely the steel monopole and self-supporting lattice structures, should not pose an electrocution threat to any of the priority species which are likely to occur in the study area. Electrocutions within the proposed substation yard are possible but should not affect the more sensitive Red Data bird species, as these species are unlikely to use the infrastructure within the substation yard for perching or roosting. Species that are more vulnerable to this impact are corvids, owls and certain species of waterbirds.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- Cape Crow

- **Greater Kestrel**
- **Hadeda Ibis**
- **Pied Crow**
- **Rock Kestrel**
- **Spotted Eagle-owl**
- **White-necked Raven**
- Black-headed Heron
- **Egyptian Goose**

This impact is assessed to be low and can be further reduced through mitigation.

10.1.3 Operational Phase: Collisions with the 132kV OHL

Collisions are the biggest threat posed by transmission lines to birds in southern Africa (Van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds, and to a lesser extent, vultures. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines (Van Rooyen 2004, Anderson 2001). The most likely Red Data candidates for collision mortality on the proposed OHL are large terrestrial species e.g. bustards, korhaans and Secretarybird, certain raptors and storks, particularly Verreaux's Eagles, Jackal Buzzards and Black Storks where the line drops down the escarpment, and waterbirds at drainage lines and waterbodies.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below. Species with a high likelihood of regular occurrence in the study area are in bold:

- **Hadeda Ibis**
- Black-headed Heron
- **Egyptian Goose**
- Black Harrier
- **Booted Eagle**
- **Jackal Buzzard**
- **Martial Eagle**
- **Verreaux's Eagle**
- African Black Duck
- African Sacred Ibis
- Cape Teal
- Hamerkop
- **Karoo Korhaan**
- **Ludwig's Bustard**
- **Namaqua Sandgrouse**
- Pied Avocet
- Red-knobbed Coot
- Secretarybird
- **South African Shelduck**
- Southern Black Korhaan
- Yellow-billed Duck
- Black Stork

This impact is assessed to be medium and can be reduced through mitigation, but it will remain at medium level after mitigation.

10.1.4 Preferred corridor option

Corridor Option 3 is the preferred option for the section of the proposed overhead power line which connects the Oya substation to the Kappa substation (i.e. Oya to Kappa route), because it is the shortest option, and the of all the options, this option has the longest section running next to existing HV lines. By routing a line next to an existing HV line, the avian collision risk is reduced for both lines. However, none of the alternatives are deemed to be fatally flawed.

10.1.5 Environmental sensitivities

The following environmental sensitivities were identified from an avifaunal perspective for the proposed power line grid connections:

- High sensitivity (Mitigation required): Surface water

Included are areas within 300m of water troughs and earth dams, and all major drainage lines. Surface water in this semi-arid habitat is crucially important for priority avifauna, including several Red Data species such as Martial Eagle, Lanner Falcon, Verreaux's Eagle and Black Stork and many non-priority species. Drainage lines when flowing also attract waterbirds on occasion, as do the large pools that remain in the channel after the flow has stopped. Power lines that are routed near these sources of surface water pose a collision risk to birds using the water for drinking and bathing, and drainage lines, when flowing, are natural flight paths for birds.

- High sensitivity (Mitigation required): Cliffs

The proposed OHL runs down two escarpment areas, where it will pose a risk to cliff nesting species such as Verreaux's Eagle, Booted Eagle, Lanner Falcon, Jackal Buzzard and Black Stork. These species all use the declivity wind currents along the cliff faces and slopes for lift and they will be at risk of collisions with the OHL where it traverses these cliffs and slopes.

- Medium sensitivity (Mitigation preferred): Succulent Karoo

The entire study area is rated as medium sensitivity due to the regular presence of collision-prone species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan.

10.1.6 Overall significance rating

The table below provides a summary of the respective significance ratings, and an average overall rating before and after mitigation.

Table 8: Overall impact significance rating

Impact	Rating pre-mitigation	Rating post-mitigation
Displacement due to habitat transformation	Low (12)	Low (12)
Displacement due to disturbance	Medium (30)	Low (14)
Electrocution in substation	Medium (26)	Low (12)
Collisions with 132kV OH	Medium (26)	Medium (24)
Cumulative impacts	Medium (26)	Medium (24)
Average:	**Medium (24)**	**Low (17)**

10.2 Conclusion

The proposed Oya 132kV OHL is expected to have a medium impact on priority species. This impact could be reduced to low through the application of appropriate mitigation measures. No fatal flaws were discovered in the course of the investigations.

10.3 Impact Statement

Based on the outcome of the investigations into the impact of the proposed 132kV OHL on avifauna, the authorization of the OHL is supported, provided the mitigation measures contained in this specialist report are strictly implemented. The proposed layout is acceptable from an avifauna perspective and should be approved as part of the EA.

11. REFERENCES

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APPENDIX 1: SPECIES LIST

Common name	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Recorded during surveys
Acacia Pied Barbet	*Tricholaema leucomelas*	25.86	0.00	x
African Black Duck	*Anas sparsa*	1.72	0.00	
African Hoopoe	*Upupa africana*	10.34	1.05	
African Pipit	*Anthus cinnamomeus*	3.45	0.00	
African Reed-warbler	*Acrocephalus baeticatus*	5.17	1.05	
African Sacred Ibis	*Threskiornis aethiopicus*	1.72	0.00	
Alpine Swift	*Tachymarptis melba*	1.72	1.05	
Anteating Chat	*Myrmecocichla formicivora*	0.00	4.21	
Barn Swallow	*Hirundo rustica*	17.24	6.32	
Black Harrier	*Circus maurus*	8.62	7.37	
Black Stork	*Ciconia nigra*	0.00	0.00	
Black-headed Canary	*Serinus alario*	27.59	12.63	x
Black-headed Heron	*Ardea melanocephala*	0.00	1.05	
Blacksmith Lapwing	*Vanellus armatus*	1.72	0.00	
Bokmakierie	*Telophorus zeylonus*	70.69	34.74	x
Booted Eagle	*Aquila pennatus*	10.34	7.37	
Brown-throated Martin	*Riparia paludicola*	3.45	1.05	
Cape Bulbul	*Pycnonotus capensis*	39.66	2.11	x
Cape Bunting	*Emberiza capensis*	68.97	38.95	x
Cape Canary	*Serinus canicollis*	3.45	0.00	
Cape Clapper Lark	*Mirafra apiata*	0.00	1.05	
Cape Crow	*Corvus capensis*	0.00	1.05	
Cape Penduline-tit	*Anthoscopus minutus*	1.72	1.05	
Cape Robin-chat	*Cossypha caffra*	22.41	0.00	
Cape Sparrow	*Passer melanurus*	62.07	23.16	x
Cape Spurfowl	*Pternistis capensis*	10.34	2.11	
Cape Teal	*Anas capensis*	1.72	0.00	
Cape Turtle-dove	*Streptopelia capicola*	50.00	9.47	
Cape Wagtail	*Motacilla capensis*	48.28	9.47	
Cape Weaver	*Ploceus capensis*	12.07	4.21	x
Cape White-eye	*Zosterops virens*	3.45	2.11	
Cardinal Woodpecker	*Dendropicos fuscescens*	5.17	0.00	
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*	24.14	3.16	
Cinnamon-breasted Warbler	*Euryptila subcinnamomea*	3.45	0.00	
Common (Southern) Fiscal	*Lanius collaris*	53.45	16.84	
Common Buzzard	*Buteo buteo*	0.00	1.05	
Common Ostrich	*Struthio camelus*	0.00	2.11	
Common Quail	*Coturnix coturnix*	5.17	0.00	
Common Starling	*Sturnus vulgaris*	1.72	0.00	
Common Waxbill	*Estrilda astrild*	8.62	1.05	
Double-banded Courser	*Rhinoptilus africanus*	3.45	0.00	
Dusky Sunbird	*Cinnyris fuscus*	5.17	3.16	
Egyptian Goose	*Alopochen aegyptiacus*	24.14	5.26	
European Bee-eater	*Merops apiaster*	8.62	6.32	
Fairy Flycatcher	*Stenostira scita*	29.31	2.11	x
Familiar Chat	*Cercomela familiaris*	46.55	17.89	x
Fiscal Flycatcher	*Sigelus silens*	8.62	0.00	
Greater Kestrel	*Falco rupicoloides*	1.72	5.26	
Greater Striped Swallow	*Hirundo cucullata*	3.45	4.21	
Grey Heron	*Ardea cinerea*	1.72	0.00	

Common name	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Recorded during surveys
Grey Tit	*Parus afer*	46.55	12.63	
Grey-backed Cisticola	*Cisticola subruficapilla*	63.79	31.58	x
Grey-backed Sparrowlark	*Eremopterix verticalis*	1.72	1.05	
Grey-winged Francolin	*Scleroptila africanus*	3.45	1.05	
Ground Woodpecker	*Geocolaptes olivaceus*	0.00	1.05	
Hadeda Ibis	*Bostrychia hagedash*	15.52	7.37	
Hamerkop	*Scopus umbretta*	5.17	0.00	
House Sparrow	*Passer domesticus*	1.72	0.00	
Jackal Buzzard	*Buteo rufofuscus*	10.34	8.42	x
Karoo Chat	*Cercomela schlegelii*	86.21	56.84	x
Karoo Eremomela	*Eremomela gregalis*	36.21	12.63	
Karoo Korhaan	*Eupodotis vigorsii*	15.52	1.05	
Karoo Lark	*Calendulauda albescens*	1.72	2.11	x
Karoo Long-billed Lark	*Certhilauda subcoronata*	75.86	41.05	x
Karoo Prinia	*Prinia maculosa*	65.52	30.53	x
Karoo Scrub-robin	*Cercotrichas coryphoeus*	62.07	24.21	
Karoo Thrush	*Turdus smithi*	15.52	1.05	
Lanner Falcon	*Falco biarmicus*	6.90	1.05	
Large-billed Lark	*Galerida magnirostris*	46.55	24.21	x
Lark-like Bunting	*Emberiza impetuani*	12.07	2.11	
Laughing Dove	*Streptopelia senegalensis*	12.07	5.26	
Layard's Tit-babbler	*Parisoma layardi*	25.86	5.26	
Little Swift	*Apus affinis*	1.72	0.00	
Long-billed Crombec	*Sylvietta rufescens*	15.52	1.05	
Ludwig's Bustard	*Neotis ludwigii*	15.52	6.32	
Malachite Sunbird	*Nectarinia famosa*	44.83	20.00	x
Martial Eagle	*Polemaetus bellicosus*	5.17	2.11	
Mountain Wheatear	*Oenanthe monticola*	1.72	0.00	x
Namaqua Dove	*Oena capensis*	5.17	3.16	x
Namaqua Sandgrouse	*Pterocles namaqua*	10.34	5.26	x
Namaqua Warbler	*Phragmacia substriata*	25.86	1.05	
Pale Chanting Goshawk	*Melierax canorus*	67.24	36.84	x
Pale-winged Starling	*Onychognathus nabouroup*	8.62	0.00	
Pearl-breasted Swallow	*Hirundo dimidiata*	1.72	0.00	
Pied Avocet	*Recurvirostra avosetta*	1.72	0.00	
Pied Crow	*Corvus albus*	39.66	20.00	x
Pied Starling	*Spreo bicolor*	20.69	4.21	
Pririt Batis	*Batis pririt*	24.14	3.16	
Red-capped Lark	*Calandrella cinerea*	68.97	40.00	
Red-faced Mousebird	*Urocolius indicus*	8.62	1.05	
Red-knobbed Coot	*Fulica cristata*	1.72	1.05	
Rock Kestrel	*Falco rupicolus*	29.31	10.53	x
Rock Martin	*Hirundo fuligula*	65.52	15.79	x
Rufous-cheeked Nightjar	*Caprimulgus rufigena*	1.72	0.00	
Rufous-eared Warbler	*Malcorus pectoralis*	68.97	31.58	
Secretarybird	*Sagittarius serpentarius*	6.90	0.00	
Sickle-winged Chat	*Cercomela sinuata*	15.52	1.05	
South African Shelduck	*Tadorna cana*	31.03	4.21	
Southern Black Korhaan	*Afrotis afra*	0.00	1.05	
Southern Double-collared Sunbird	*Cinnyris chalybeus*	48.28	16.84	x
Southern Grey-headed Sparrow	*Eremopterix verticalis*	15.52	1.05	
Southern Masked-weaver	*Ploceus velatus*	29.31	2.11	

Common name	Taxonomic name	Full protocol reporting rate	Ad hoc reporting rate	Recorded during surveys
Southern Red	*Euplectes orix*	5.17	0.00	
Speckled Pigeon	*Columba guinea*	31.03	10.53	
Spike-heeled Lark	*Chersomanes albofasciata*	32.76	14.74	x
Spotted Eagle-owl	*Bubo africanus*	10.34	1.05	
Three-banded Plover	*Charadrius tricollaris*	22.41	2.11	
Tractrac Chat	*Cercomela tractrac*	1.72	1.05	
Verreaux's Eagle	*Aquila verreauxii*	10.34	7.37	
White-backed Mousebird	*Colius colius*	27.59	3.16	
White-necked Raven	*Corvus albicollis*	29.31	8.42	x
White-rumped Swift	*Apus caffer*	1.72	0.00	
White-throated Canary	*Crithagra albogularis*	53.45	12.63	
White-throated Swallow	*Hirundo albigularis*	1.72	0.00	
Yellow Canary	*Crithagra flaviventris*	74.14	40.00	x
Yellow-bellied Eremomela	*Eremomela icteropygialis*	15.52	2.11	
Yellow-billed Duck	*Anas undulata*	1.72	1.05	