AVIFAUNAL IMPACT ASSESSMENT

Bon Espirage to Komsberg 132kV Overhead Power Line Grid Connection for the Karreebosch Wind Energy Facility located in the Northern Cape and Western Cape Provinces

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EXECUTIVE SUMMARY

Red Rocket South Africa (Pty) Ltd is proposing the construction and operation of a 132kV overhead power line (OHL) to connect the Karreebosch Wind Energy Facility (WEF) Energy Facility to the national grid via the existing Eskom Komsberg MTS (Main Transmission Substation). Part of this will entail the construction of a section of OHL between the Bons Espirange substation and the Komsberg MTS. This section of line will be approximately 6km in length. The project is situated north of the town of Matjiesfontein in the Karoo Hoogland Local Municipality and the Laingsburg Local Municipality in the Northern Cape Province and Western Cape Province.

The proposed grid connection is comprised of the following:

- A 132kV overhead power line constructed using a single or double circuit steel monopole structure, between 15m and 20m in height

The proposed 132kV grid connection power line are the subjects of this impact assessment report.

PROJECT ALTERNATIVES

Only one alignment option has been provided for assessment, which runs next to an existing powerline. This alternative was found to be acceptable from an avifaunal perspective.

AVIFAUNA

The SABAP2 data indicates that a total of 151 bird species could potentially occur within the broader – Appendix 1 provides a comprehensive list of all the species. Of these, 46 species are classified as priority species (see definition of priority species in section 4) and ten of these are South African Red List species. Of the priority species, 18 are likely to occur regularly at the study area and immediate surrounding area, and another 28 could occur sporadically.

POTENTIAL IMPACTS

The following impacts have been identified in the Avifauna Specialist Assessment.

Construction Phase

- Displacement due to disturbance associated with the construction of the grid connection power line.
- Displacement due to habitat transformation associated with the construction of the grid connection power line.

Operational Phase

- Displacement due to habitat transformation associated with the operation of the grid connection power line.
- Collisions with the grid connection power line.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the grid connection power line.

Cumulative Impacts

- Displacement due to disturbance associated with the construction and decommissioning of the grid connection power line.
- Displacement due to habitat transformation associated with the grid connection power line.
- Collisions with the overhead power line.

ENVIRONMENTAL SENSITIVITIES

The entire study area is regarded as highly sensitive due to the regular occurrence of Red List powerline priority species. Areas that are particularly risky from a potential bird collision perspective are the following:

- Natural flight paths: Topographical features e.g. ridges and areas where the line crosses a valley, or drainage lines.
- Waterbodies: Several priority species are attracted open water. If a line skirts a waterbody, or run between two waterbodies, it can pose a collision risk to birds which are attracted to the water.

MITIGATION MEASURES

The following mitigation measures are proposed for the grid connection:

Construction phase

- A pre-construction inspection to identify Red List species that may be breeding within the project footprint must be conducted by an avifaunal specialist to ensure that the impacts to breeding species (if any) are adequately managed.
- Construction activity should be restricted to the immediate footprint of the infrastructure as much as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

Operational phase

- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the biodiversity specialist must be strictly enforced.
- Eskom approved Bird flight diverters should be installed for the full span length on the earthwire (according to Eskom guidelines - five metres apart) of the entire line. Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively.

De-commissioning phase

- An inspection to identify Red List species that may be breeding within the project footprint must be conducted by an avifaunal specialist to ensure that the impacts to breeding species (if any) are adequately managed.
- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

STATEMENT AND REASONED OPINION

No-Go alternative

The no-go alternative will result in the current status quo being maintained at the proposed development site as far as the avifauna is concerned. The study area itself consists mostly of renosterveld, ephemeral drainage lines and ridge lines. The no-go option would maintain the natural habitat which would be beneficial to the avifauna currently occurring there.

Concluding statement

The expected impacts of the 132kV overhead power line were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of the identified impacts should be reduced to Low negative, except in the case of powerline collisions, where the significance will be reduced, but will remain at a Moderate level (see Appendix 4). No fatal flaws were discovered in the course of the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the EMPr (Appendix 3) are strictly implemented.

CONTENTS

DETAILS OF THE SPECIALIST AND EXPERTISE TO COMPILE A SPECIALIST REPORT

Chris van Rooyen (Avifaunal Specialist)

Chris has 24 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (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 worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and wind generation projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in Southern Africa, which is currently (2016) accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Albert Froneman (Avifaunal and GIS Specialist)

Albert has an M. Sc. in Conservation Biology from the University of Cape Town and started his career in the natural sciences as a Geographic Information Systems (GIS) specialist at Council for Scientific and Industrial Research (CSIR). In 1998, he joined the Endangered Wildlife Trust where he headed up the Airports Company South Africa – EWT Strategic Partnership, a position he held until he resigned in 2008 to work as a private ornithological consultant. Albert's specialist field is the management of wildlife, especially bird related hazards at airports. His expertise is recognized internationally; in 2005 he was elected as Vice Chairman of the International Bird Strike Committee. Since 2010, Albert has worked closely with Chris van Rooyen in developing a protocol for pre-construction monitoring at wind energy facilities, and he is currently jointly coordinating pre-construction monitoring programmes at several wind farm facilities. Albert also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

National Environmental Management Act, 1998 (Act No. 107 of 1998) and Environmental Impact Regulations 2014 (as amended) Requirements for Specialist Reports (Appendix 6)

Section in EIA Regulations 2014 (as amended)		**Clause**	**Section in Report**
Appendix 6	(1)	A specialist report prepared in terms of these Regulations must contain —	
	(a)	details of –	
		(i) the specialist who prepared the report; and	Pg.6
		(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae.	Pg.6
	(b)	A declaration that the person is independent in a form as may be specified by the competent authority;	Pg.6
	(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 3
	(cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8
	(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 7
	(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process; inclusive of equipment and modelling used;	Section 3
	(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;	Sections 6 - 9
	(g)	An indication of any areas to be avoided, including buffers;	Not applicable
	(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;	Not applicable
	(i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
	(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;	Sections 9 and 10
	(k)	Any mitigation measures for inclusion in the EMPr;	Section 10
	(l)	Any conditions for inclusion in the environmental authorization;	Section 10 & Appendix 3
	(m)	Any monitoring requirements for inclusion in the EMPr or environmental authorization;	Not applicable
	(n)	A reasoned opinion –	
		(i) as to whether the proposed activity, activities or portions thereof should be authorized;	Sections 11

		(iA) regarding the acceptability of the proposed activity or activities; and	Sections 11
		(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11
	(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3
	(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	No comments received
	(q)	Any other information requested by the authority.	Not applicable
	(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

1 INTRODUCTION

Red Rocket South Africa (Pty) Ltd is proposing the construction and operation of a 132kV overhead power line (OHL) to connect the Karreebosch Wind Energy Facility (WEF) Energy Facility to the national grid via the existing Eskom Komsberg MTS (Main Transmission Substation). Part of this will entail the construction of a section of OHL between the Bons Espirange substation and the Komsberg MTS. This section of line will be approximately 6km in length. The project is situated north of the town of Matjiesfontein in the Karoo Hoogland Local Municipality and the Laingsburg Local Municipality in the Northern Cape Province and Western Cape Province.

The OHL will be a 132kV steel single or double structure with kingbird conductor (between 15 and 20m in height – above ground level). Standard overhead line construction methodology will be employed – drill holes (typically 2 – 3m in depth), plant poles, string conductor. It is not envisaged that any large excavations and stabilized backfill will be required however this will only be verified on site once the Geotech has been undertaken at each pole position (part of construction works). The proposed 132kV grid connection power line is the subject of this impact assessment report.

1.1 Project alternatives

Only one alignment option has been provided for assessment, which runs next to an existing powerline.

2 PROJECT SCOPE

The terms of reference for this assessment report are as follows:

- Describe the affected environment from an avifaunal perspective;
- Discuss gaps in baseline data and other limitations;
- List and describe the expected impacts associated with the proposed 132kV power line grid connection;
- Conduct an assessment of the potential impacts; and
- Recommend mitigation measures to reduce the significance of the expected impacts.

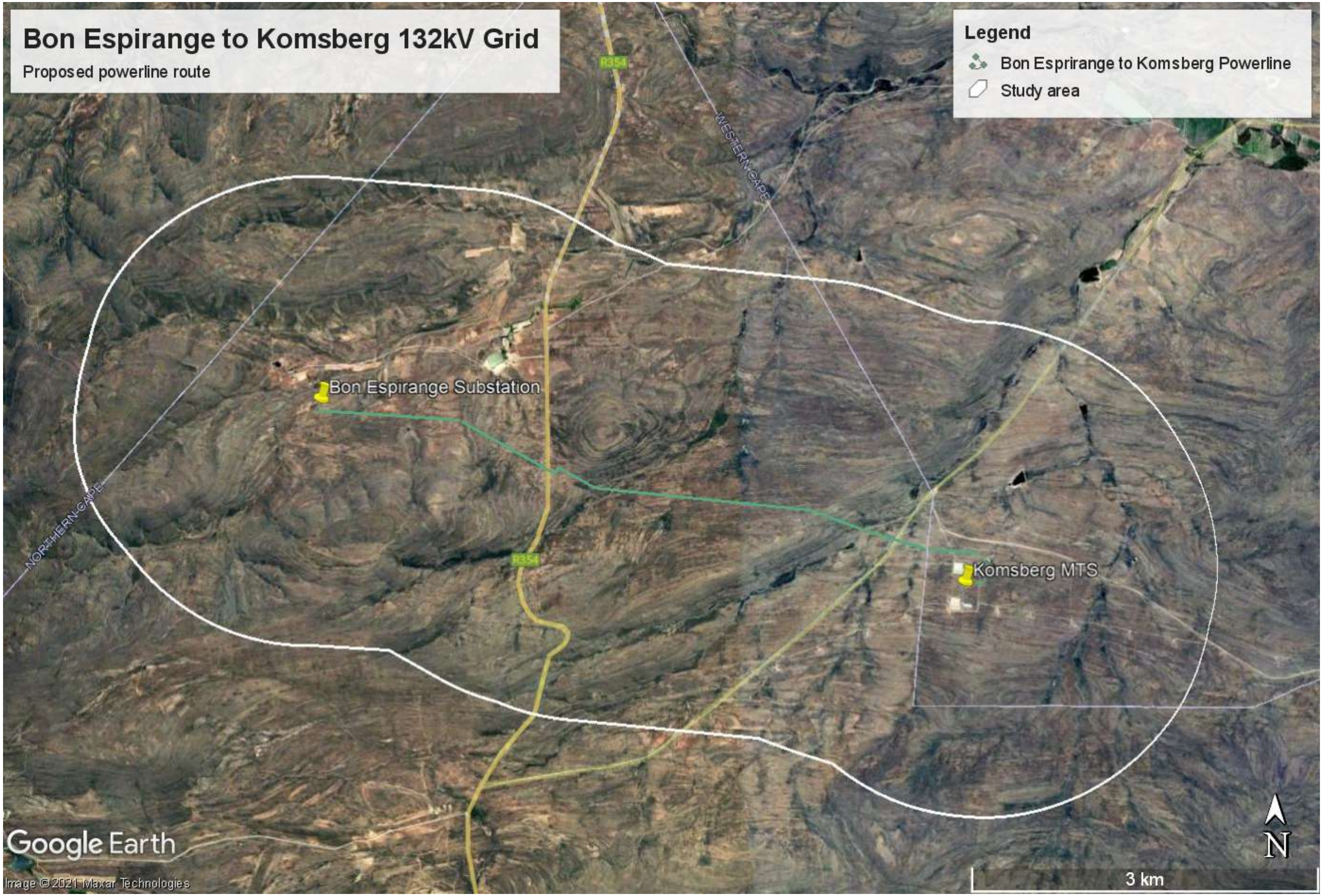


Figure 1: Locality map of the study area indicating the location of the Karreebosch on-site substation and 132kV overhead power line route alignment.

3 OUTLINE OF METHODOLOGY AND INFORMATION REVIEWED

The following information sources were consulted 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 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. To get a more representative impression of the birdlife, a consolidated data set was obtained for a total of 20 pentads some of which intersect and others that are near the study area (**the broader area**). The decision to include multiple pentads around the study area was influenced by the fact that the pentads within which the proposed development is located have few completed full protocol surveys. The additional pentads and their data augment the bird distribution data. The 20 pentad grid cells are the following: 3240_2025, 3240_2030, 3240_2035, 3240_2040, 3245_2025, 3245_2030; 3245_2035; 3245_2040; 3250_2025; 3250_2030; 3250_2035; 3250_2040; 3255_2025; 3255_2030; 3255_2035; 3255_2040; 3300_2025; 3300_2030; 3300_2035 and 3300_2040 (see Figure 22). A total of 131 full protocol lists (i.e. bird listing surveys lasting a minimum of two hours each) and 52 ad hoc protocol lists (surveys lasting less than two hours but still yielding valuable data) have been completed to date for the 20 pentads where the study area is located. The SABAP2 data is regarded as a reliable reflection of the avifauna which occurs in the area, but the data was also supplemented by data collected during site surveys and general knowledge of the area.
- A classification of the vegetation types in the study area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- 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 (2021.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015; http://www.birdlife.org.za/conservation/important-bird-areas) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- Satellite imagery (Google Earth © 2021) was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.
- The Department of Forestry, Fisheries and the Environment (DFFE) National Screening Tool was used to determine the assigned avian sensitivity of the study area (September 2021).
- A site visit to the study area was conducted on 17 August 2021 to record the avifaunal habitat first-hand, using a 4 x 4 vehicle, a Zeiss 10 x 32 pair of binoculars and a Nikon 20 x 60 spotting scope.
- Additional Information on bird diversity and abundance at the proposed Karreebosch development site was obtained by consulting studies previously conducted namely additional monitoring conducted by Birds & Bats Unlimited (Simmons & Martins 2014, 2020 and 2021) and an 18-month monitoring programme which was implemented in 2013 – 2014 (Williams 2014).

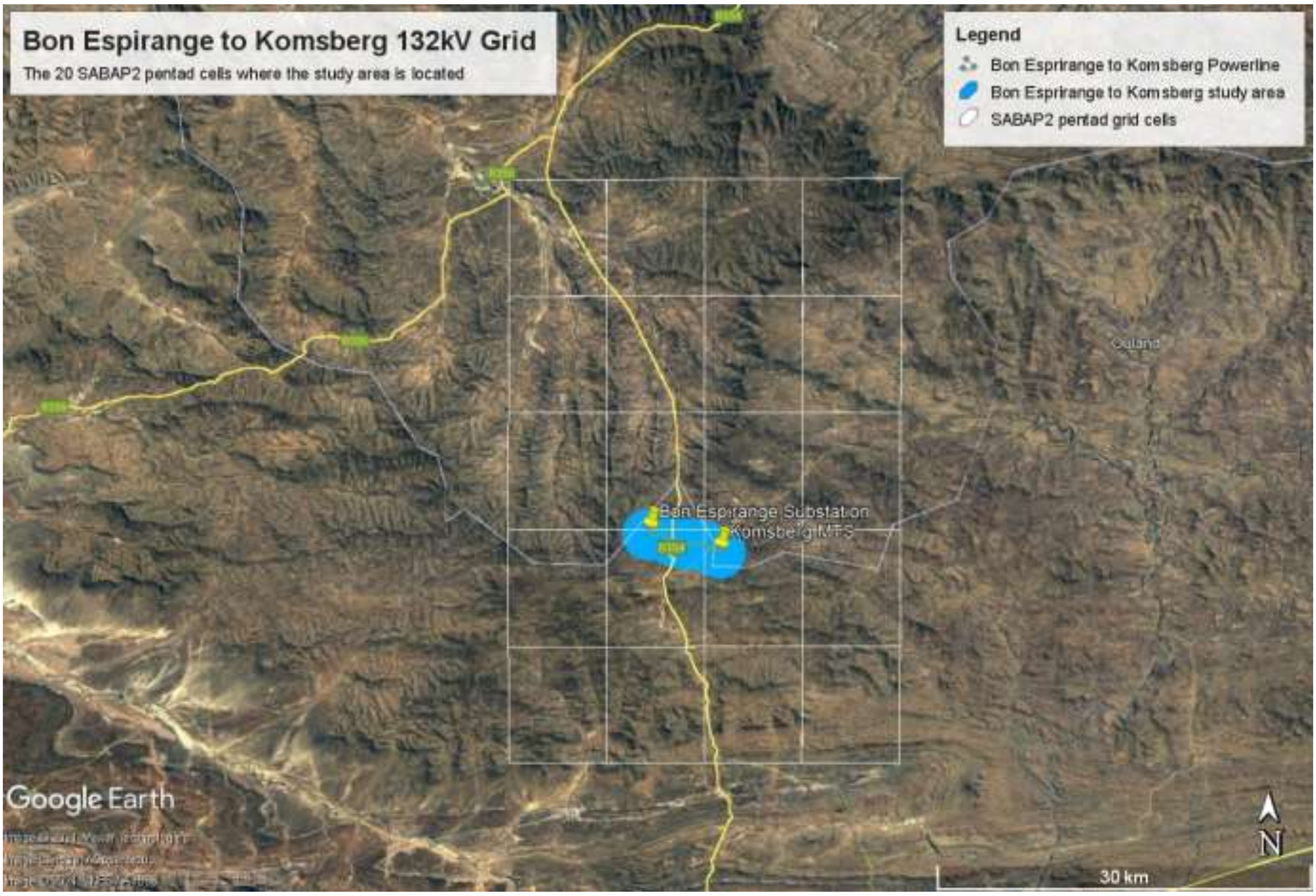


Figure 2: Location of the twenty South African Bird Atlas Project 2 (SABAP2) pentad grid cells (broader area) that were considered for the proposed 132kV overhead power line project.

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:

- The focus of the study was primarily on the potential impacts of the proposed 132kV overhead power line 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.
- The assessment of impacts is based on the baseline environment as it currently exists in the study area.
- Cumulative impacts include all wind energy projects with grid connections within a 10km radius that currently have open applications or have been approved by the Competent Authority as per the 2021 Q1 database from the DFFE.
- Despite thorough and extremely onerous and time-consuming internet searches, details of all the proposed grid connections of all the registered wind energy projects within a 10km radius could not be located. The accuracy of the ones that were located can also not be guaranteed as amendments are taking place on an ongoing basis.
- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances.
- The study area was defined as a 2km zone around the proposed 132kV overhead power line.

- Although the habitat in the broader area is fairly marginal for Verreaux's Eagle from a breeding perspective, as the exposed ridge lines are very small, an active nest was recorded during the 2013 – 2014 pre-construction monitoring (Williams 2014) at 32°51'59.27"S 20°30'12.02"E (Beacon Hill) (see Figure 7). Subsequent nest inspections were performed by Dr. Rob Simmons in October 2014, September 2020 and May 2021. No activity was reported at the nest in 2021, and no activity was recorded by this author during the current survey either. However, a pair was in attendance in September 2020. The possibility therefore always remains that the territory could still be active or become active again.

5 LEGISLATIVE CONTEXT

5.1 Agreements and conventions

Table 1 below lists agreements and conventions which South Africa is party to, and which is relevant to the conservation of avifauna[1].

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

[1] (BirdLife International (2021) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2021-09-29).

5.2 National legislation

5.2.1 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.

5.2.2 The National Environmental Management Act 107 of 1998 (NEMA)

The National Environmental Management Act 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 a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated. NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

NEMA makes provision for the prescription of procedures for the assessment and minimum criteria for reporting on identified environmental themes (Sections 24(5)(a) and (h) and 44) when applying for environmental authorisation. The Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Animal Species was published on 30 October 2020. This protocol applies also for the assessment of impacts caused by power lines on avifauna.

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

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

5.3 Provincial Legislation

5.3.1 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 wild animals, including avifauna.

5.3.2 Northern Cape Nature Conservation Act No 9 of 2009

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

6 BASELINE ASSESSMENT

6.1 Important Bird Areas

There are no Important Bird Areas (IBA) within the confines of the study area. The closest IBA (Anysberg Nature Reserve) is located a 40km south of the proposed Karreebosch grid connection (Figure 4). It is therefore highly unlikely that the proposed on-site substation and 132kV overhead power line will have a negative impact on the IBAs within the broader area.

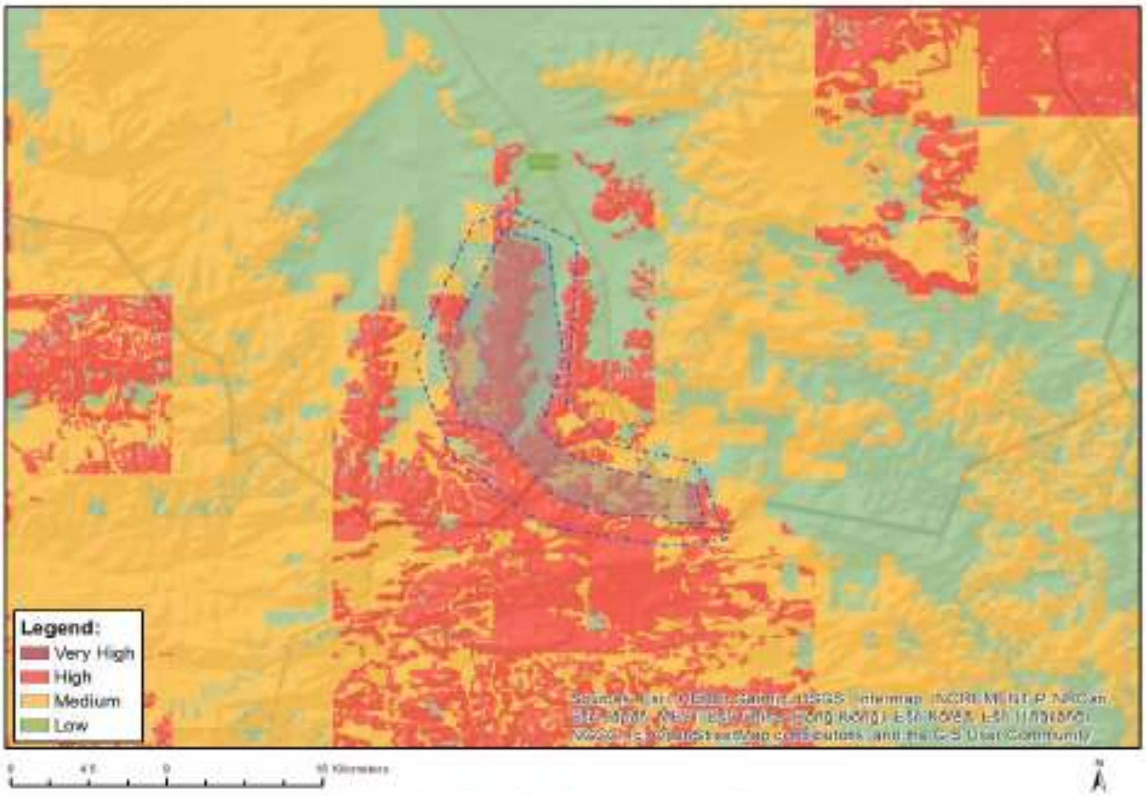
6.2 Critical Biodiversity Areas (CBAs)

The majority of the study area is classified as a Critical Biodiversity Area Category 1 and 2. The remainder is classified mostly as Ecological Support Area and Other Natural Areas.

6.3 DFFE National Screening Tool

The DFFE National Screening Tool classifies parts of the study area as highly sensitive from an animal species theme perspective, due to the potential presence of Ludwig's Bustard *Neotis ludwigii* and Verreaux's Eagle *Aquila verreauxii*. A site sensitivity verification was conducted through the use of both a desktop analysis and a site visit in August 2021. The desktop analysis and site visit confirmed and concur with the HIGH sensitivity rating assigned to the study area, based on the habitat available to Verreaux's Eagle within the project study area (see Figure 3 below).

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



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

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Aquila verreauxii
High	Aves-Neotis ludwigii
Low	Low sensitivity
Medium	Aves-Sagittarius serpentarius
Medium	Aves-Aquila verreauxii
Medium	Mammalia-Bunolagus monticularis

Figure 3: The DFFE screening tool rating for the study area. The high sensitivity rating is related to the potential presence of Ludwig's Bustard (Neotis ludwigii) and Verreaux's Eagle (Aquila verreauxii). The medium rating is related to the presence of Verreaux's Eagle and Secretarybird (Sagittarius serpentarius).

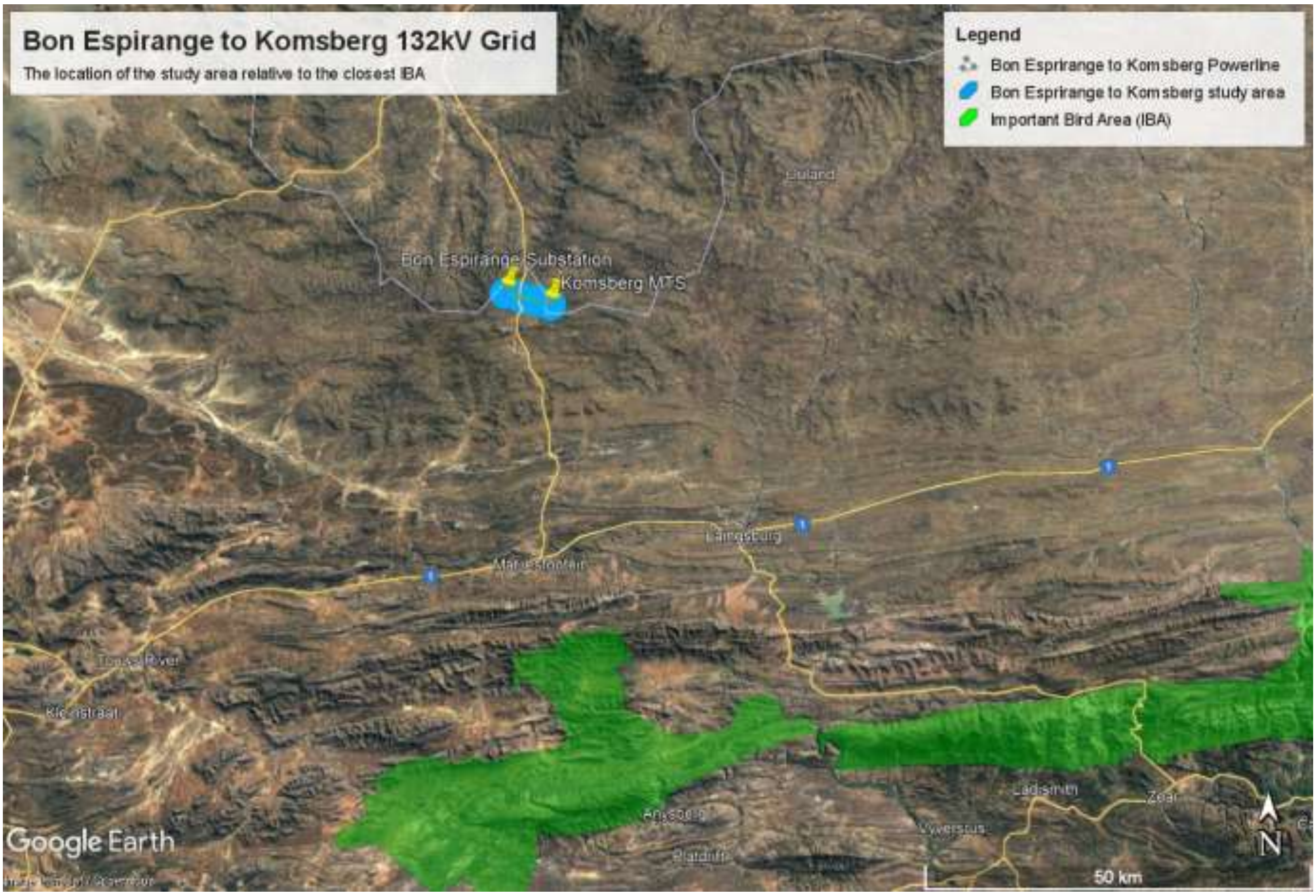


Figure 4: Regional map detailing the location of the proposed 132kV grid overhead power line project in relation to Important Bird Areas (IBAs)

6.4 Biomes and vegetation types

The study area is situated approximately 30km north of the town of Matjiesfontein in the Western Cape Province. The habitat in the study area is rugged, consisting of rolling hills and ridges with boulder-strewn slopes and exposed ridge lines, and is bisected by a few ephemeral drainage lines. The study area contains a number of man-made dams used for the irrigation of a few crops (mostly pastures), which is grown as supplementary fodder for small stock farming. Sheep farming is the main economic activity. Eskom's Droërivier-Kappa 2 400kV, Bacchus-Droërivier 1400kV and Gamma Kappa 1 765 kV transmission lines and Komsberg Substation are located in the east of the study area.

The natural vegetation at the site is dominated by Central Mountain Shale Renosterveld which exists in a transitional zone between the Fynbos and Succulent Karoo Biomes (Mucina & Rutherford 2006). The vegetation type is found on slopes and broad ridges of low mountains and escarpments. It consists of tall shrubland dominated by renosterbos and large suites of mainly non-succulent karoo shrubs with a rich geophytic flora in the undergrowth or in more open, wetter or rocky habitats (Mucina & Rutherford 2006). In the east, the Central Mountain Shale Renosterveld is replaced by Koedoesberge – Moordenaars Karoo which is found on slightly undulating to hilly landscapes consisting of low succulent scrub and dotted by scattered tall shrubs and patches of “white” grass (Mucina & Rutherford 2006).

The climate is arid to semi-arid with a mean average precipitation of 219mm, most of which takes place between March and September. Mean daily maximum and minimum temperatures in Laingsburg range between 29°C and 2°C for February and July (http://www.worldweatheronline.com/laingsburg-weather-averages/northern-cape/za.aspx).

Whilst the distribution and abundance of the bird species in the study area and immediate surrounding environment are typical of the broad vegetation type, it is also necessary to examine bird habitats in more detail as it may influence the distribution and behaviour of priority species. These are discussed in more detail below. The priority species most likely associated with the various bird habitats are listed in Table 2.

6.5 Bird habitats

6.5.1 Renosterveld/Karoo

The Fynbos biome is dominated by low shrubs and has two major vegetation divisions: fynbos proper, characterised by restioid, erioid and proteoid components; and renosterveld, dominated by *Asteraceae*, specifically Renosterbos *Elytropappus rhinocerotis*, with geophytes and some grasses. Renosterveld, unlike fynbos, extend into the karoo shales, where rainfall patterns allow a high grass cover and abundance of non-succulent shrubs. Shale renosterveld shows strong affinities with neighbouring succulent Karoo vegetation (Mucina & Rutherford 2006). This biome is characterised by a high level of diversity and endemism in its botanical composition, which is not paralleled in its terrestrial avifauna, which is depauperate relative to other southern African biomes (Harrison *et al*. 1997). Priority species that may occur in renosterveld in the study area are Ludwig's Bustard, Common Buzzard *Buteo buteo*, Jackal Buzzard *Buteo rufofuscus*, Cape Crow *Corvus capensis*, Pied Crow *Corvus albus*, Black-chested Snake-Eagle *Circaetus pectoralis*, Booted Eagle *Hieraaetus pennatus*, Black Harrier *Circus maurus*, Martial Eagle *Polemaetus bellicosus*, Verreaux's Eagle, Helmeted Guineafowl *Numida meleagris*, Lesser Kestrel *Falco naumanni*, Rock Kestrel *Falco rupicolus*, Black-winged Kite *Elanus caeruleus*, Karoo Korhaan *Eupodotis vigorsii*, Southern Black Korhaan *Afrotis afra* and Secretarybird *Sagittarius serpentarius* may occur, especially in ecotonal areas between renosterveld and succulent Karoo.

6.5.2 Surface water

Man-made impoundments, although artificial in nature, can be very important for a variety of birds, particularly water birds. Apart from the water quality, the structure of the dam, and specifically the margins and the associated shoreline and vegetation, plays a big role in determining the species that will be attracted to the dam. The study area contains a few dams and the larger impoundments probably support good numbers of waterbirds in wet years. Priority species recorded in the broader area by SABAP2 that could be attracted to these dams include Red-knobbed Coot *Fulica cristata*, Reed Cormorant *Microcarbo africanus*, White-breasted Cormorant *Phalacrocorax lucidus*, Maccoa Duck *Oxyura maccoa*, Yellow-billed Duck *Anas undulata*, African Black Duck *Anas sparsa*, Greater Flamingo *Phoenicopterus roseus*, Egyptian Goose *Alopochen aegyptiaca*, Spur-winged Goose *Plectropterus gambensis*, Black-necked Grebe *Podiceps nigricollis*, Greater Crested Grebe *Podiceps cristatus*, Little Grebe *Tachybaptus ruficollis*, Black-headed Heron *Ardea melanocephala*, Grey Heron *Ardea cinerea*, African Sacred Ibis *Threskiornis aethiopicus*, Hadeda Ibis *Bostrychia hagedash*, Common Moorhen *Gallinula chloropus*, Southern Pochard *Netta erythrophthalma*, South African Shelduck *Tadorna cana*, Cape Shoveler *Spatula smithii,* African Spoonbill *Platalea alba*, Black Stork *Ciconia nigra*, Cape Teal *Anas capensis*, Red-billed Teal *Anas erythrorhyncha* and Hamerkop *Scopus umbretta*.

6.5.3 Ridges, Cliffs and Rocky Outcrops

Steep terrain is another identified habitat within the project area. Ridges are potentially important roosting, breeding and foraging habitat for a variety of priority species, e.g., Jackal Buzzard, Booted Eagle, Verreaux's Eagle, Rock Kestrel, White-necked Raven *Corvus albicollis* and Black Stork. Although the habitat is fairly marginal for Verreaux's Eagle from a breeding perspective, as the exposed ridge lines are very small, an active nest outside the study area was recorded during the 2013 – 2014 pre-construction monitoring (Williams 2014) at 32°51'59.27"S 20°30'12.02"E (Beacon Hill) (see Figure 7). Subsequent nest inspections were performed by Dr. Rob Simmons in October 2014, September 2020 and May 2021. No activity was reported at the nest in 2021, and no activity was recorded by this author during the current survey either. However, a pair was in attendance in September 2020. The possibility therefore always remains that the territory could still be active or become active again.

6.5.4 Cultivated Lands

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten by birds, or attract insects which are in turn eaten by birds. Relevant to this study, pastures grown as supplementary fodder for small stock farming occur within the study area and are likely draw cards for several priority species e.g. Ludwig's Bustard, Common Buzzard, Egyptian Goose, Spur-winged Goose, Helmeted Guineafowl, Black-headed Heron, Hadeda Ibis, Lesser Kestrel and Black-winged Kite.

6.5.5 Exotic Trees

Although stands of *Eucalyptus* are strictly-speaking invader species, they have become important refuges for certain species of raptors, particularly Amur Falcon, a Palearctic migrant, which will commonly roost in small stands of *Eucalyptus* in suburbs of small towns. Black Sparrowhawk *Accipiter melanoleucus* and Ovambo Sparrowhawk *Accipiter ovampensis* are another two species that use these trees for roosting and breeding purposes. Relevant to this project Common Buzzard, Jackal Buzzard, Cape Crow, Pied Crow, Black-chested Snake-eagle, Booted Eagle, Martial Eagle, Verreaux's Eagle, Spotted Eagle-Owl *Bubo africanus*, Egyptian Goose, Pale Chanting Goshawk *Melierax canorus*, Helmeted Guineafowl, Black-headed Heron, Grey Heron, African Sacred Ibis, Hadeda Ibis, Lesser Kestrel, Rock Kestrel, Black-winged Kite, White-necked Raven, Rufous-breasted Sparrowhawk *Accipiter rufiventris*, African Spoonbill and Secretarybird may utilise this habitat type occasionally. There are very few large trees in the study area, and they are associated with homesteads.

6.5.6 Power Lines

Eskom power line pylons/towers are regularly used as roosting, hunting and/or nesting habitat by certain species. The Droërivier-Kappa 2 400kV, Bacchus-Droërivier 1400kV and Gamma Kappa 1 765 kV transmission lines that run through the southern part of the study area utilised by Martial Eagle further to the west beyond the impact zone of the proposed power line. Relevant to this project Common Buzzard, Jackal Buzzard, Cape Crow, Pied Crow, Black-chested Snake-eagle, Booted Eagle, Martial Eagle, Verreaux's Eagle, Spotted Eagle-Owl, Pale Chanting Goshawk, Helmeted Guineafowl, Black-headed Heron, Hadeda Ibis, Lesser Kestrel, Rock Kestrel and Black-winged Kite may utilise power line infrastructure for perching, roosting, and (in some instances) breeding.

See Appendix 2 for photographic record of the habitat in the study area.

7 AVIFAUNA IN THE STUDY AREA

7.1 South African Bird Atlas Project 2

The SABAP2 data indicates that a total of 151 bird species could potentially occur within the broader area Appendix 1 provides a comprehensive list of all the species. Of these, 46 species are classified as priority species (see definition of priority species in section 4) and ten of these are South African Red List species. Of the priority species, 18 are likely to occur regularly at the study area and immediate surrounding area, and another 28 could occur sporadically.

Table 2 below lists all the priority species and the possible impact on the respective species by the proposed 132kV overhead power line. The following abbreviations and acronyms are used:

Table 2: Priority species potentially occurring at the site and immediate surroundings.

Group	Species	Taxonomic name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during surveys: Karreebosch	Powerline priority	Likelihood of regular occurrence: Karreebosch	Renosterveld/Succulent Karoo	Alien trees	High voltage lines	Ridges/cliffs	Surface water	Agriculture	Collision	Displacement: Disturbance	Displacement: Habitat transformation
Bustard	Ludwig's Bustard	*Neotis ludwigii*	4,62	3,85	EN	EN		x	L	x					x	x	x	x
Buzzard	Common Buzzard	*Buteo buteo*	4,62	5,77			x	x	H	x	x	x			x			
Buzzard	Jackal Buzzard	*Buteo rufofuscus*	35,38	13,46			x	x	H	x	x	x	x					
Coot	Red-knobbed Coot	*Fulica cristata*	15,38	7,69			x	x	L					x		x		
Cormorant	Reed Cormorant	*Microcarbo africanus*	7,69	3,85			x	x	L					x		x		
Cormorant	White-breasted Cormorant	*Phalacrocorax lucidus*	3,08	1,92			x	x	L					x		x		
Crow	Cape Crow	*Corvus capensis*	0,00	1,92				x	H	x	x	x						
Crow	Pied Crow	*Corvus albus*	53,85	30,77			x	x	L	x	x	x						
Duck	African Black Duck	*Anas sparsa*	3,08	0,00			x	x	L					x		x		
Duck	Maccoa Duck	*Oxyura maccoa*	0,00	1,92	VU	NT	x	x	L					x		x		
Duck	Yellow-billed Duck	*Anas undulata*	8,46	3,85			x	x	L					x		x		
Eagle	Black-chested Snake Eagle	*Circaetus pectoralis*	0,77	0,00				x	H	x	x	x		x				
Eagle	Booted Eagle	*Hieraaetus pennatus*	9,23	1,92			x	x	H	x	x	x	x	x				
Eagle	Martial Eagle	*Polemaetus bellicosus*	11,54	3,85	VU	EN	x	x	H	x	x	x		x				
Eagle	Verreaux's Eagle	*Aquila verreauxii*	31,54	7,69	LC	VU	x	x	L	x	x	x	x	x		x		
Eagle-Owl	Spotted Eagle-Owl	*Bubo africanus*	7,69	1,92				x	H	x	x	x						
Flamingo	Greater Flamingo	*Phoenicopterus roseus*	0,00	1,92	LC	NT	x	x	L					x		x		
Goose	Egyptian Goose	*Alopochen aegyptiaca*	55,38	19,23			x	x	M		x			x	x	x		
Goose	Spur-winged Goose	*Plectropterus gambensis*	14,62	1,92			x	x	M					x	x	x		
Goshawk	Pale Chanting Goshawk	*Melierax canorus*	40,00	21,15			x	x	H		x	x		x				
Grebe	Black-necked Grebe	*Podiceps nigricollis*	2,31	0,00			x	x	L					x		x		
Grebe	Great Crested Grebe	*Podiceps cristatus*	0,77	0,00			x	x	L					x		x		
Grebe	Little Grebe	*Tachybaptus ruficollis*	6,15	3,85			x	x	L					x		x		
Guineafowl	Helmeted Guineafowl	*Numida meleagris*	7,69	3,85				x	M	x	x	x		x	x	x	x	x

Group	Species	Taxonomic name	Full protocol	Ad hoc protocol	Global status	SA status	Recorded during surveys: Karreebosch	Powerline priority	Likelihood of regular occurrence: Karreebosch	Renosterveld/Succulent Karoo	Alien trees	High voltage lines	Ridges/cliffs	Surface water	Agriculture	Collision	Displacement: Disturbance	Displacement: Habitat transformation
Harrier	Black Harrier	*Circus maurus*	11,54	7,69	EN	EN	x	x	M	x				x				
Heron	Black-headed Heron	*Ardea melanocephala*	11,54	1,92			x	x	L		x	x		x	x	x		
Heron	Grey Heron	*Ardea cinerea*	10,00	3,85			x	x	L		x			x		x		
Ibis	African Sacred Ibis	*Threskiornis aethiopicus*	13,85	1,92			x	x	L		x			x		x		
Ibis	Hadada Ibis	*Bostrychia hagedash*	33,85	7,69			x	x	M		x	x		x	x	x		
Kestrel	Lesser Kestrel	*Falco naumanni*	0,77	3,85				x	H	x	x	x			x			
Kestrel	Rock Kestrel	*Falco rupicolus*	49,23	26,92			x	x	L	x	x	x	x					
Kite	Black-winged Kite	*Elanus caeruleus*	3,08	0,00			x	x	L	x	x	x			x			
Korhaan	Karoo Korhaan	*Eupodotis vigorsii*	16,92	3,85	LC	NT		x	H	x						x	x	x
Korhaan	Southern Black Korhaan	*Afrotis afra*	5,38	0,00	VU	VU		x	M	x						x	x	x
Moorhen	Common Moorhen	*Gallinula chloropus*	0,77	1,92			x	x	L					x		x		
Pochard	Southern Pochard	*Netta erythrophthalma*	0,77	1,92				x	L					x		x		
Raven	White-necked Raven	*Corvus albicollis*	56,92	19,23			x	x	H		x		x					
Shelduck	South African Shelduck	*Tadorna cana*	49,23	26,92			x	x	M					x		x		
Shoveler	Cape Shoveler	*Spatula smithii*	3,85	0,00			x	x	L					x		x		
Sparrowhawk	Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	2,31	0,00				x	L		x							
Spoonbill	African Spoonbill	*Platalea alba*	4,62	1,92			x	x	L		x			x		x		
Stork	Black Stork	*Ciconia nigra*	1,54	0,00	LC	VU	x	x	L				x	x		x		
Teal	Cape Teal	*Anas capensis*	6,92	3,85			x	x	L					x		x		
Teal	Red-billed Teal	*Anas erythrorhyncha*	1,54	0,00			x	x	L					x		x		
	Hamerkop	*Scopus umbretta*	3,08	0,00			x	x	L					x				
	Secretarybird	*Sagittarius serpentarius*	0,77	0,00	VU	VU	x	x	L	x	x					x		
EN = Endangered VU = Vulnerable NT = Near threatened LC = Least concern																		

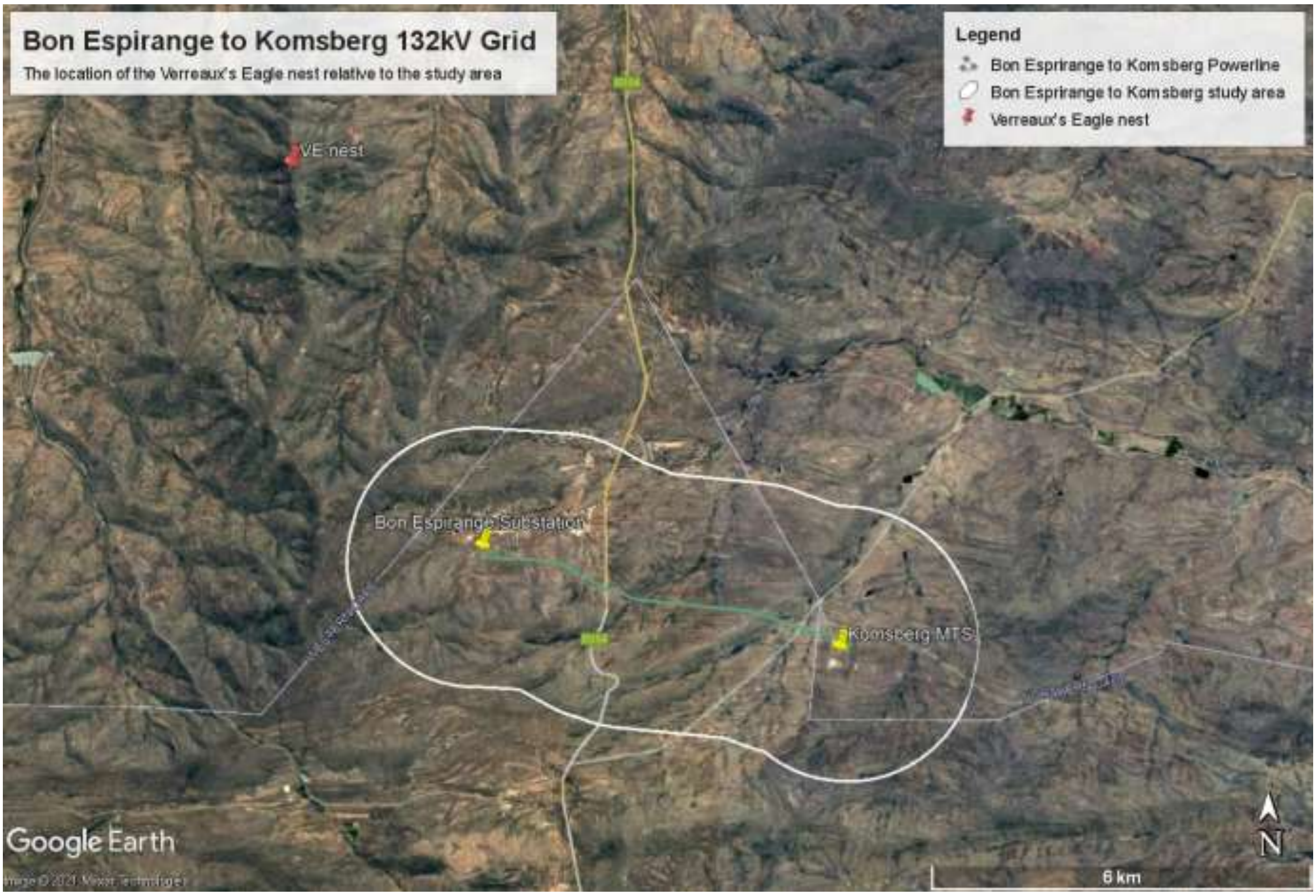


Figure 5: Verreaux's Eagle nest location in relation to the proposed 132kV overhead power line alignment.

8 IMPACT ASSESSMENT

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 overhead power line, the electrocution risk is envisaged to be low because the proposed design of the 132kV line, namely the steel monopole and the clearance distances between the live and earthed components. The grid connection power line should not pose an electrocution threat to the priority species which are likely to occur in the study area and immediate surrounding environment.

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 (Figure 6).

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).

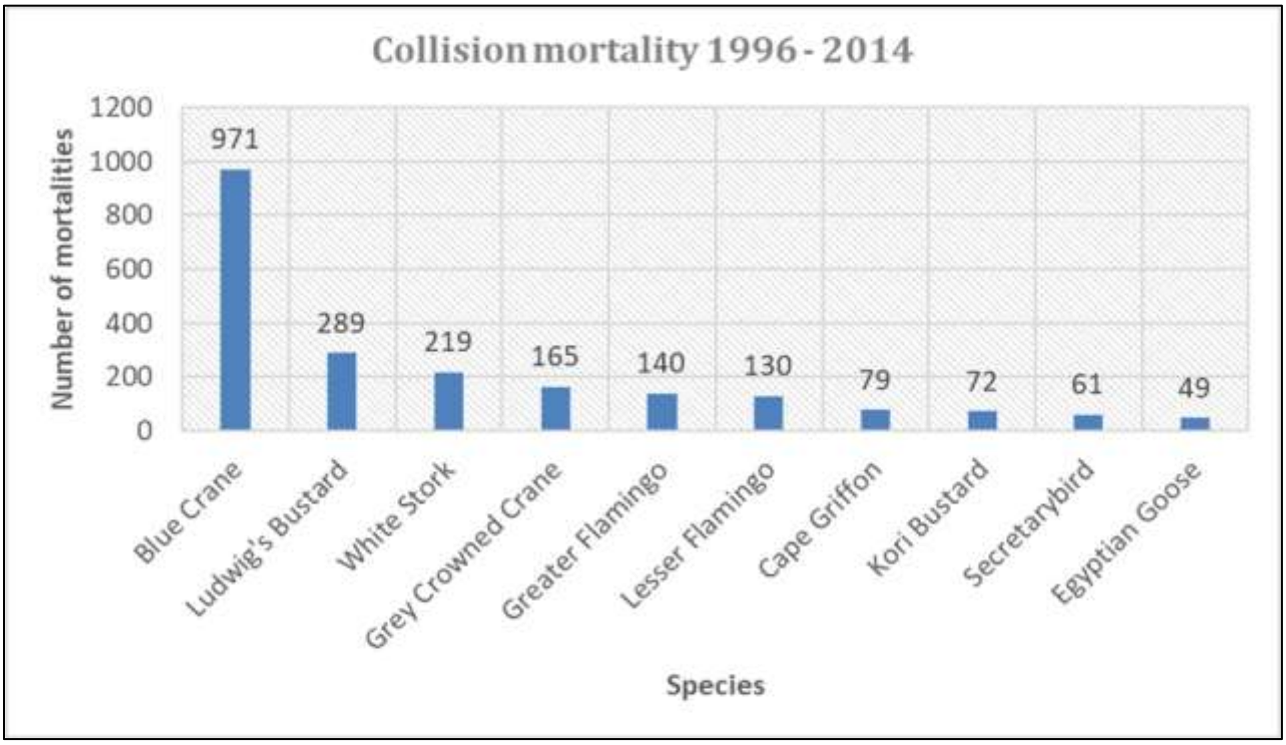


Figure 6: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/Endangered Wildlife Trust Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data)

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 and White Storks. 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 priority species which are potentially vulnerable to this impact are listed in Table 2, and below:

- Ludwig's Bustard
- Red-knobbed Coot
- Reed Cormorant
- White-breasted Cormorant
- African Black Duck
- Maccoa Duck
- Yellow-billed Duck
- Verreaux's Eagle
- Greater Flamingo
- Egyptian Goose
- Spur-winged Goose
- Black-necked Grebe
- Great Crested Grebe
- Little Grebe
- Helmeted Guineafowl
- Black-headed Heron
- Grey Heron
- African Sacred Ibis
- Hadeda Ibis
- Karoo Korhaan
- Southern Black Korhaan
- Common Moorhen
- Southern Pochard
- South African Shelduck
- Cape Shoveler
- African Spoonbill
- Black Stork
- Cape Teal
- Red-billed Teal

- Secretarybird

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;
- Transportation of personnel, construction material and equipment to the site, and personnel away from the site;
- Removal of vegetation for the overhead power line, 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 powerline through **transformation of habitat**, which could result in temporary or permanent displacement. Fortunately, due to the structure of the vegetation, very little vegetation clearance will be necessary, basically only around the footprint of the poles themselves. The habitat in the study area is relatively uniform from a bird impact perspective, with large expanses of karoo/renosterveld. The loss of habitat for priority species due to direct habitat transformation associated with the construction of the proposed 132kV overhead power line is likely to be minimal.

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. Terrestrial species and raptors are most likely to be affected by displacement due to disturbance in the study area.

The study area contains one Verreaux's Eagle territory, with the nest situated at 32°51'59.27"S 20°30'12.02"E (Beacon Hill). While indications are that the territory is not currently active, it cannot be conclusively assumed, and the territory might become active again anytime in the future. However, the distance from the nest to the proposed powerline is more than 6km, and the nest is out of sight from the study area. No disturbance impact is therefore foreseen on the birds.

The priority species which are potentially vulnerable to this impact are listed in Table 2, and below:

- Ludwig's Bustard
- Helmeted Guineafowl
- Karoo Korhaan
- Southern Black Korhaan

9 IMPACT RATING AND MANAGEMENT ACTIONS

9.1 Potential impacts

The following potential impacts have been identified:

Construction Phase

- Displacement due to disturbance associated with the construction of the grid connection power line.
- Displacement due to habitat transformation associated with the construction of the grid connection power line.

Operational Phase

- Displacement due to habitat transformation associated with the operation of the grid connection power line.
- Collisions with the grid connection power line.

Decommissioning Phase

- Displacement due to disturbance associated with the decommissioning of the grid connection power line.

Cumulative Impacts

- Displacement due to disturbance associated with the construction and decommissioning of the grid connection power line.
- Displacement due to habitat transformation associated with the grid connection power line.
- Collisions with the overhead power line.

9.2 Determination of Significance of Impacts

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects are reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[2], indirect[3], secondary[4] as well as cumulative[5] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[6] presented in **Table 3**.

Table 3: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes

[2] Impacts that arise directly from activities that form an integral part of the Project.

[3] Impacts that arise indirectly from activities not explicitly forming part of the Project.

[4] Secondary or induced impacts caused by a change in the Project environment.

[5] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

[6] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

9.3 Impact Assessments

9.3.1 Impact assessment tables

The impacts are summarised in table form in Appendix 4.

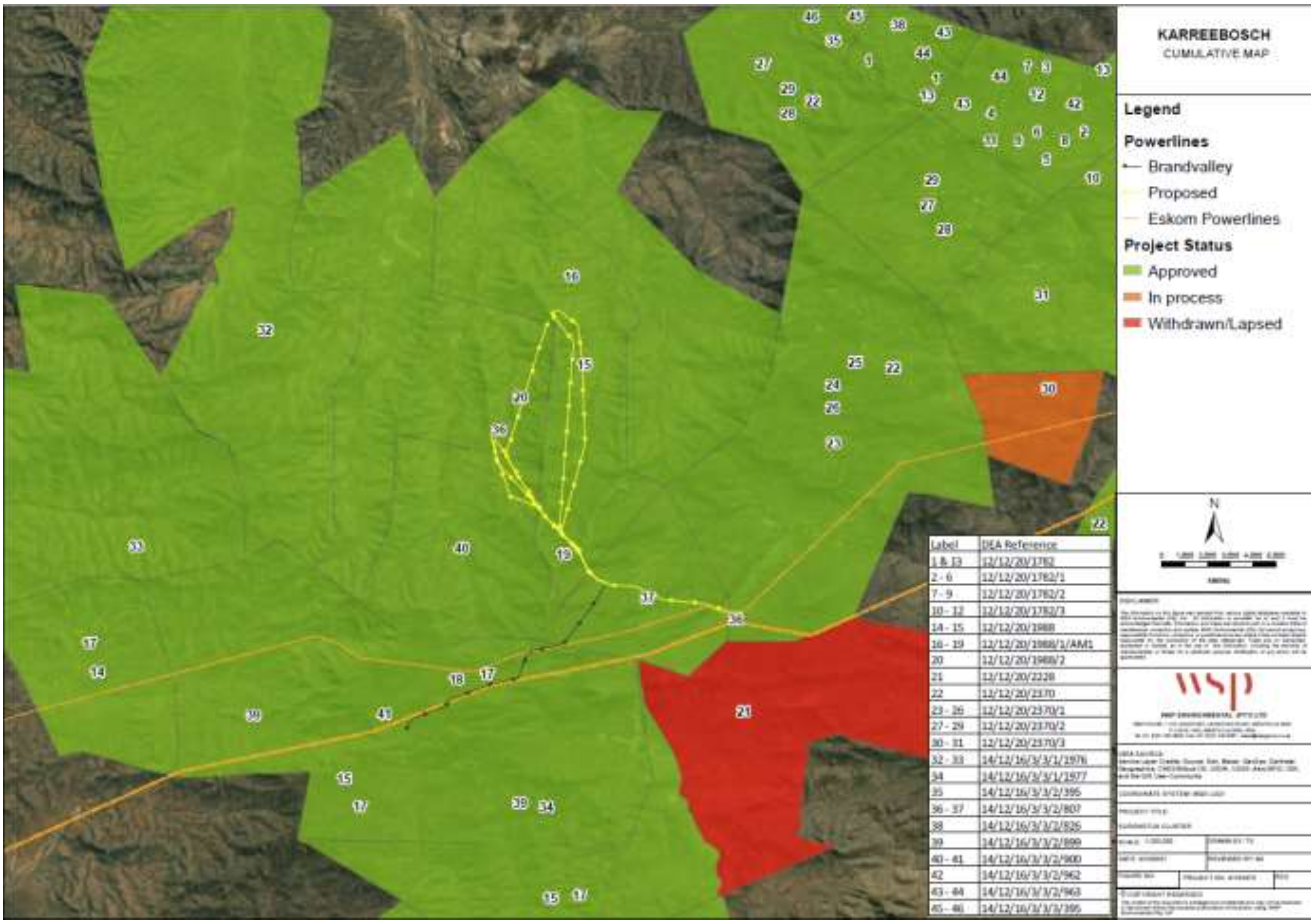
9.3.2 Cumulative impacts

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

The role of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). This section addresses whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment
- Unacceptable increase in impact

According to the official database of DFFE, there are currently 46 registered applications involving at least seven planned renewable wind energy projects within a 11km radius around the proposed development (see Figure 7)



Label	DEA_REF	PROJ_TITLE	MEGAWATT	PRJ_STATUS
1 & 13	12/12/20/1782	Proposed development of renewable Energy facility at the Sutherland site, Western and Northern Cape province	811	Approved
2 - 6	12/12/20/1782/1	140 Megawatts (MW) Rietrug Wind Energy Facility near Sutherland, Northern Cape Province	0	Approved
7 - 9	12/12/20/1782/2	140 Megawatts (MW) Sutherland Wind Energy Facility near Sutherland, Northern Cape Province and Western Cape Provinces	0	Approved
10 - 12	12/12/20/1782/3	140 Megawatts (MW) Sutherland 2 Wind Energy Facility near Sutherland Wind Energy, Northern Cape Province and Western Cape Provinces	0	Approved
14 - 15	12/12/20/1988	Proposed Construction Of The 750 Mw Roggeveld Wind Farm Within The Karoo Hoogland Local Municipality Of The Northern Cape Province And Within The Laingsburg Local Municipality Of The Western Cape Province	750	Approved
16 - 19	12/12/20/1988/1/AM1	Proposed Construction Of The 750 Mw Roggeveld Wind Farm Within The Karoo Hoogland Local Municipality Of The Northern Cape Province And Within The Laingsburg Local Municipality Of The Western Cape Province	0	Approved
20	12/12/20/1988/2	Proposed Construction Of The 140Mw Roggeveld Wind Farm Within The Karoo Hoogland Local Municipality Of The Northern Cape Province And Within The Laingsburg Local Municipality Of The Western Cape Province	0	Approved
21	12/12/20/2228	Proposed wind energy facility near Komsberg, Western Cape	0	Withdrawn/Lapsed
22	12/12/20/2370	Proposed Hidden Valley Wind Energy Facility (Karusa & Soetwater), Northern Cape	650	Approved
23 - 26	12/12/20/2370/1	Proposed Hidden Valley Wind Energy Facility (Karusa & Soetwater), Northern Cape	150	Approved
27 - 29	12/12/20/2370/2	Proposed Hidden Valley Wind Energy Facility (Karusa & Soetwater), Northern Cape	150	In process
30 - 31	12/12/20/2370/3	Proposed Hidden Valley Wind Energy Facility (Karusa & Soetwater), Northern Cape	150	In process
32 - 33	14/12/16/3/3/1/1976	Proposed development of the 325MW Kudusberg Wind Energy facility and associated infrastructure in Western and Northern Cape Provinces	325	Approved
34	14/12/16/3/3/1/1977	Proposed development of the 14MW Rietkloof Wind Energy Facility and associated infrastructure near Matjiesfontein in the Western Cape	147	Approved
35	14/12/16/3/3/2/395	Proposed 280 MW Gunstfontein Wind Energy Facility, Northern Cape Province	280	Approved

36 - 37	14/12/16/3/3/2/807	The Proposed Karreebosch Wind Farm (Roggeveld Phase 2) and its Associated Infrastructure within the Karoo Hoogland Local Municipality and the Laingsburg Local Municipality in the Northern and Western Cape Provinces	140	Approved
38	14/12/16/3/3/2/826	Environmental Authorisation for the 200 MW Gunstfontein Wind Energy Facility on the Remainder of the Farm Gunstfontein 131 South of the Town of Sutherland Within the Karoo Hoogland Local Municipality In The Northern Cape Province	200	Approved
39	14/12/16/3/3/2/899	140 MW Rietkloof WE, near Sutherland, NC_WC	140	Approved
40 - 41	14/12/16/3/3/2/900	147MW Brandvalley Wind Energy Facility North of the town of Matjiesfontein within Karoo Hoogland	147	Approved
42	14/12/16/3/3/2/962	140MW Maralla East Wind Energy Facility in Laingsburg, Northern and Western Cape provinces	140	Approved
43 - 44	14/12/16/3/3/2/963	140MW Maralla West Wind Energy Facility in Laingsburg, Northern and Western Cape provinces	140	Approved
45 - 46	14/12/16/3/3/3/395	Proposed Gunstfontein Wind Energy Facility, Northern Cape Province	0	Approved

Figure 7: Renewable energy applications and existing high voltage power lines within 10km of the proposed Karreebosch grid connection project.

The proposed grid connection equates to a maximum of approximately 6km. There are approximately 53km of existing high voltage lines within the 10km radius around the project (counting parallel lines as one). In addition, at least around 250+km of new grid connections are planned to connect to the Komsberg MTS. The grid connection grid project will thus increase the total number of existing high voltage lines by approximately 2-3%. The contribution of the proposed grid connection to the cumulative impact of all the high voltage lines is thus low. However, the combined cumulative impact of the existing and proposed high voltage power lines on avifauna within a 10km radius is considered to be High.

The cumulative impact of displacement due to disturbance and habitat transformation by the proposed powerline is low, due to the small size of the footprint, and the availability of similar habitat within the 10km radius area.

The table in Appendix 4 summarises the cumulative impacts associated with the proposed development.

9.4 Mitigation measures

The impact significance without mitigation measures is assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 8 below.

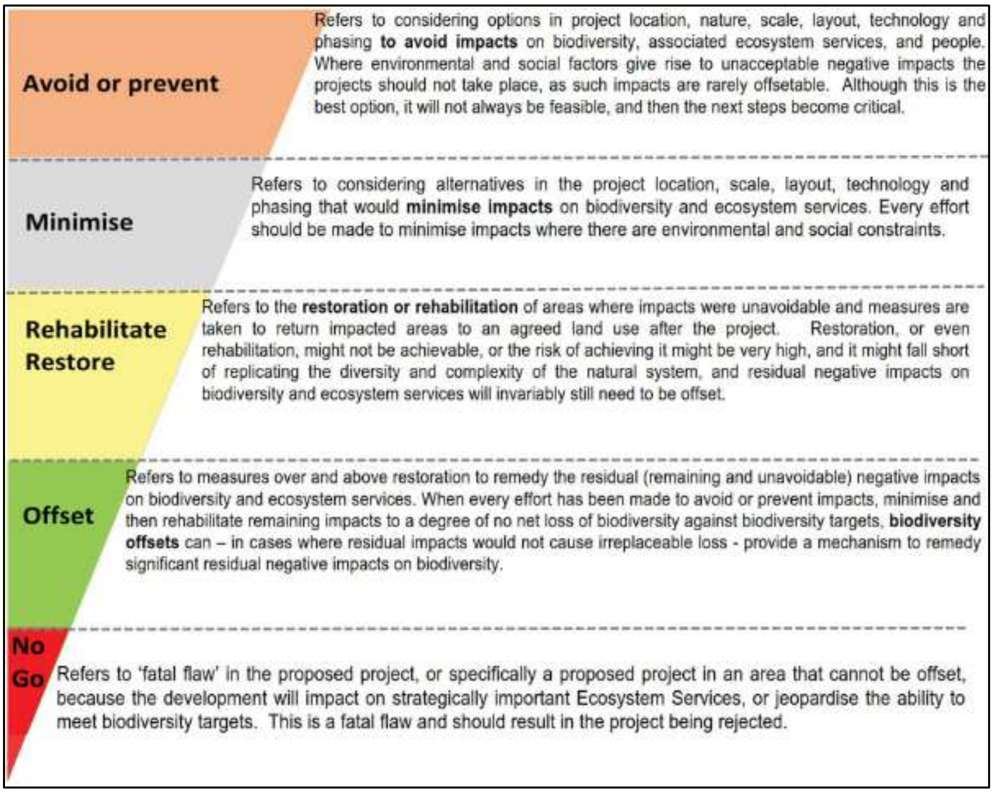


Figure 8: **Mitigation Sequence/Hierarchy**

The following mitigation measures are proposed for the grid connection:

Construction phase

- A pre-construction inspection to identify Red List species that may be breeding within the project footprint must be conducted by an avifaunal specialist to ensure that the impacts to breeding species (if any) are adequately managed.
- Construction activity should be restricted to the immediate footprint of the infrastructure as much as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

Operational phase

- Vegetation clearance should be limited to what is absolutely necessary.
- The mitigation measures proposed by the biodiversity specialist must be strictly enforced.
- Eskom approved Bird flight diverters should be installed for the full span length on the earthwire (according to Eskom guidelines - five metres apart) of the entire line. Light and dark colour devices must be alternated to provide contrast against both dark and light backgrounds respectively.

De-commissioning phase

- An inspection to identify Red List species that may be breeding within the project footprint must be conducted by an avifaunal specialist to ensure that the impacts to breeding species (if any) are adequately managed.
- Decommissioning activity should be restricted to the immediate footprint of the infrastructure as far as possible.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.

- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

9.5 Identifying a preferred alternative

There is only one proposed alignment. The proposed alignment is acceptable from an avifaunal perspective.

9.6 No-Go Alternative

The no-go alternative will result in the current status quo being maintained at the proposed development site as far as the avifauna is concerned. The study area itself consists mostly of renosterveld, ephemeral drainage lines and ridge lines. The no-go option would maintain the natural habitat which would be beneficial to the avifauna currently occurring there.

9.7 Environmental sensitivities

The entire study area is regarded as highly sensitive due to the regular occurrence of Red List powerline priority species. Areas that are particularly risky from a potential bird collision perspective are the following:

- Natural flight paths: Topographical features e.g. ridges and areas where the line crosses a valley, or drainage lines.
- Waterbodies: Several priority species are attracted open water. If a line skirts a waterbody, or run between two waterbodies, it can pose a collision risk to birds which are attracted to the water.

10. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

Refer to Appendix 3 for a description of the key mitigation and monitoring recommendations for each applicable mitigation measure identified for all phases of the project.

11. FINAL SPECIALIST STATEMENT AND AUTHORISATION RECOMMENDATION

11.1 Statement and Reasoned Opinion

The expected impacts of the 132kV overhead power line were rated to be of Moderate significance and negative status pre-mitigation. However, with appropriate mitigation, the post-mitigation significance of the identified impacts should be reduced to Low negative (see Appendix 4). No fatal flaws were discovered in the course of the investigation. It is therefore recommended that the activity is authorised, on condition that the proposed mitigation measures as detailed in the EMPr (Appendix 3) are strictly implemented.

11.2 EA Condition Recommendations

The proposed mitigation measures are detailed in the EMPr (Appendix 3).

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13 APPENDICES

Appendix 1: Species List
Appendix 2: Habitat in the study area
Appendix 3: Environmental Management Plan
Appendix 4: Impact Tables

APPENDIX 1: SABAP 2 SPECIES LIST FOR THE BROADER AREA

Group	Species	Taxonomic name	Full protocol reporting rate	Ad hoc protocol reporting rate	Global status (IUCN)	SA status (Taylor et.al. 20215)	Powerline priority species
Avocet	Pied Avocet	*Recurvirostra avosetta*	2,31	0,00			
Barbet	Acacia Pied Barbet	*Tricholaema leucomelas*	13,85	3,85			
Batis	Pririt Batis	*Batis pririt*	7,69	0,00			
Bee-eater	European Bee-eater	*Merops apiaster*	7,69	1,92			
Bishop	Southern Red Bishop	*Euplectes orix*	7,69	1,92			
Bulbul	Cape Bulbul	*Pycnonotus capensis*	20,00	0,00			
Bunting	Cape Bunting	*Emberiza capensis*	80,77	34,62			
Bunting	Lark-like Bunting	*Emberiza impetuani*	28,46	3,85			
Bustard	Ludwig's Bustard	*Neotis ludwigii*	4,62	3,85	EN	EN	x
Buzzard	Common Buzzard	*Buteo buteo*	4,62	5,77			x
Buzzard	Jackal Buzzard	*Buteo rufofuscus*	35,38	13,46			x
Canary	Black-headed Canary	*Serinus alario*	46,92	17,31			
Canary	Cape Canary	*Serinus canicollis*	6,92	0,00			
Canary	White-throated Canary	*Crithagra albogularis*	42,31	7,69			
Canary	Yellow Canary	*Crithagra flaviventris*	76,15	23,08			
Chat	Ant-eating Chat	*Myrmecocichla formicivora*	18,46	3,85			
Chat	Familiar Chat	*Oenanthe familiaris*	37,69	13,46			
Chat	Karoo Chat	*Emarginata schlegelii*	64,62	21,15			
Chat	Sickle-winged Chat	*Emarginata sinuata*	63,85	9,62			
Chat	Tractrac Chat	*Emarginata tractrac*	0,77	1,92			
Cisticola	Grey-backed Cisticola	*Cisticola subruficapilla*	76,15	26,92			
Cisticola	Levaillant's Cisticola	*Cisticola tinniens*	4,62	1,92			
Coot	Red-knobbed Coot	*Fulica cristata*	15,38	7,69			x
Cormorant	Reed Cormorant	*Microcarbo africanus*	7,69	3,85			x
Cormorant	White-breasted Cormorant	*Phalacrocorax lucidus*	3,08	1,92			x
Crombec	Long-billed Crombec	*Sylvietta rufescens*	10,77	0,00			
Crow	Cape Crow	*Corvus capensis*	0,00	1,92			x
Crow	Pied Crow	*Corvus albus*	53,85	30,77			x
Dove	Cape Turtle Dove	*Streptopelia capicola*	46,92	13,46			
Dove	Laughing Dove	*Spilopelia senegalensis*	18,46	9,62			
Dove	Namaqua Dove	*Oena capensis*	10,77	3,85			
Dove	Red-eyed Dove	*Streptopelia semitorquata*	10,77	0,00			
Duck	African Black Duck	*Anas sparsa*	3,08	0,00			x
Duck	Maccoa Duck	*Oxyura maccoa*	0,00	1,92	VU	NT	x
Duck	Yellow-billed Duck	*Anas undulata*	8,46	3,85			x
Eagle	Black-chested Snake Eagle	*Circaetus pectoralis*	0,77	0,00			x
Eagle	Booted Eagle	*Hieraaetus pennatus*	9,23	1,92			x
Eagle	Martial Eagle	*Polemaetus bellicosus*	11,54	3,85	VU	EN	x
Eagle	Verreaux's Eagle	*Aquila verreauxii*	31,54	7,69	LC	VU	x
Eagle-Owl	Spotted Eagle-Owl	*Bubo africanus*	7,69	1,92			x
Egret	Western Cattle Egret	*Bubulcus ibis*	1,54	1,92			x
Eremomela	Karoo Eremomela	*Eremomela gregalis*	14,62	0,00			
Eremomela	Yellow-bellied Eremomela	*Eremomela icteropygialis*	16,15	0,00			
Fiscal	Southern Fiscal	*Lanius collaris*	51,54	28,85			
Flamingo	Greater Flamingo	*Phoenicopterus roseus*	0,00	1,92	LC	NT	x
Flycatcher	Fairy Flycatcher	*Stenostira scita*	20,77	3,85			
Flycatcher	Fiscal Flycatcher	*Melaenornis silens*	3,08	3,85			
Francolin	Grey-winged Francolin	*Scleroptila afra*	26,15	7,69			
Goose	Egyptian Goose	*Alopochen aegyptiaca*	55,38	19,23			x
Goose	Spur-winged Goose	*Plectropterus gambensis*	14,62	1,92			x
Goshawk	Pale Chanting Goshawk	*Melierax canorus*	40,00	21,15			x

Group	Species	Taxonomic name	Full protocol reporting rate	Ad hoc protocol reporting rate	Global status (IUCN)	SA status (Taylor et.al. 20215)	Powerline priority species
Grebe	Black-necked Grebe	*Podiceps nigricollis*	2,31	0,00			x
Grebe	Great Crested Grebe	*Podiceps cristatus*	0,77	0,00			x
Grebe	Little Grebe	*Tachybaptus ruficollis*	6,15	3,85			x
Greenshank	Common Greenshank	*Tringa nebularia*	0,77	0,00			
Guineafowl	Helmeted Guineafowl	*Numida meleagris*	7,69	3,85			x
Harrier	Black Harrier	*Circus maurus*	11,54	7,69	EN	EN	x
Heron	Black-headed Heron	*Ardea melanocephala*	11,54	1,92			x
Heron	Grey Heron	*Ardea cinerea*	10,00	3,85			x
Honeyguide	Lesser Honeyguide	*Indicator minor*	0,77	0,00			
Hoopoe	African Hoopoe	*Upupa africana*	0,77	0,00			
Ibis	African Sacred Ibis	*Threskiornis aethiopicus*	13,85	1,92			x
Ibis	Hadada Ibis	*Bostrychia hagedash*	33,85	7,69			x
Kestrel	Lesser Kestrel	*Falco naumanni*	0,77	3,85			x
Kestrel	Rock Kestrel	*Falco rupicolus*	49,23	26,92			x
Kite	Black-winged Kite	*Elanus caeruleus*	3,08	0,00			x
Korhaan	Karoo Korhaan	*Eupodotis vigorsii*	16,92	3,85	LC	NT	x
Korhaan	Southern Black Korhaan	*Afrotis afra*	5,38	0,00	VU	VU	x
Lapwing	Blacksmith Lapwing	*Vanellus armatus*	28,46	11,54			
Lapwing	Crowned Lapwing	*Vanellus coronatus*	14,62	5,77			
Lark	Cape Clapper Lark	*Mirafra apiata*	29,23	7,69			
Lark	Karoo Lark	*Calendulauda albescens*	36,92	9,62			
Lark	Karoo Long-billed Lark	*Certhilauda subcoronata*	59,23	17,31			
Lark	Large-billed Lark	*Galerida magnirostris*	59,23	28,85			
Lark	Red-capped Lark	*Calandrella cinerea*	29,23	0,00			
Lark	Spike-heeled Lark	*Chersomanes albofasciata*	16,15	1,92			
Martin	Brown-throated Martin	*Riparia paludicola*	6,15	1,92			
Martin	Rock Martin	*Ptyonoprogne fuligula*	56,15	5,77			
Moorhen	Common Moorhen	*Gallinula chloropus*	0,77	1,92			x
Mousebird	Red-faced Mousebird	*Urocolius indicus*	10,77	1,92			
Mousebird	Speckled Mousebird	*Colius striatus*	1,54	0,00			
Mousebird	White-backed Mousebird	*Colius colius*	35,38	1,92			
Nightjar	Rufous-cheeked Nightjar	*Caprimulgus rufigena*	0,77	1,92			
Pigeon	Speckled Pigeon	*Columba guinea*	38,46	9,62			
Pipit	African Pipit	*Anthus cinnamomeus*	20,00	5,77			
Pipit	African Rock Pipit	*Anthus crenatus*	0,00	1,92	NT	NT	
Pipit	Nicholson's Pipit	*Anthus nicholsoni*	3,08	0,00			
Plover	Kittlitz's Plover	*Charadrius pecuarius*	7,69	0,00			
Plover	Three-banded Plover	*Charadrius tricollaris*	36,15	11,54			
Pochard	Southern Pochard	*Netta erythrophthalma*	0,77	1,92			x
Prinia	Karoo Prinia	*Prinia maculosa*	72,31	17,31			
Quail	Common Quail	*Coturnix coturnix*	2,31	0,00			
Raven	White-necked Raven	*Corvus albicollis*	56,92	19,23			x
Robin-Chat	Cape Robin-Chat	*Cossypha caffra*	31,54	3,85			
Sandgrouse	Namaqua Sandgrouse	*Pterocles namaqua*	30,77	3,85			
Scrub Robin	Karoo Scrub Robin	*Cercotrichas coryphoeus*	71,54	25,00			
Shelduck	South African Shelduck	*Tadorna cana*	49,23	26,92			x
Shoveler	Cape Shoveler	*Spatula smithii*	3,85	0,00			x
Sparrow	Cape Sparrow	*Passer melanurus*	61,54	15,38			
Sparrow	House Sparrow	*Passer domesticus*	23,08	3,85			
Sparrow	Southern Grey-headed Sparrow	*Passer diffusus*	3,08	0,00			
Sparrowhawk	Rufous-breasted Sparrowhawk	*Accipiter rufiventris*	2,31	0,00			x
Sparrow-Lark	Grey-backed Sparrow-Lark	*Eremopterix verticalis*	1,54	0,00			

Group	Species	Taxonomic name	Full protocol reporting rate	Ad hoc protocol reporting rate	Global status (IUCN)	SA status (Taylor et.al. 20215)	Powerline priority species
Spoonbill	African Spoonbill	*Platalea alba*	4,62	1,92			x
Spurfowl	Cape Spurfowl	*Pternistis capensis*	41,54	17,31			
Starling	Common Starling	*Sturnus vulgaris*	13,85	3,85			
Starling	Pale-winged Starling	*Onychognathus nabouroup*	13,85	1,92			
Starling	Pied Starling	*Lamprotornis bicolor*	53,08	25,00			
Starling	Red-winged Starling	*Onychognathus morio*	1,54	0,00			
Starling	Wattled Starling	*Creatophora cinerea*	4,62	0,00			
Stilt	Black-winged Stilt	*Himantopus himantopus*	4,62	1,92			
Stint	Little Stint	*Calidris minuta*	0,77	0,00			
Stonechat	African Stonechat	*Saxicola torquatus*	0,77	0,00			
Stork	Black Stork	*Ciconia nigra*	1,54	0,00	LC	VU	x
Sunbird	Dusky Sunbird	*Cinnyris fuscus*	4,62	0,00			
Sunbird	Malachite Sunbird	*Nectarinia famosa*	39,23	13,46			
Sunbird	Southern Double-collared Sunbird	*Cinnyris chalybeus*	26,15	1,92			
Swallow	Barn Swallow	*Hirundo rustica*	15,38	5,77			
Swallow	Greater Striped Swallow	*Cecropis cucullata*	29,23	7,69			
Swallow	Pearl-breasted Swallow	*Hirundo dimidiata*	1,54	0,00			
Swallow	South African Cliff Swallow	*Petrochelidon spilodera*	0,00	3,85			
Swallow	White-throated Swallow	*Hirundo albigularis*	3,08	0,00			
Swift	African Black Swift	*Apus barbatus*	0,77	0,00			
Swift	Alpine Swift	*Tachymarptis melba*	6,15	0,00			
Swift	Common Swift	*Apus apus*	0,77	0,00			
Swift	Little Swift	*Apus affinis*	15,38	3,85			
Swift	White-rumped Swift	*Apus caffer*	13,85	3,85			
Teal	Cape Teal	*Anas capensis*	6,92	3,85			x
Teal	Red-billed Teal	*Anas erythrorhyncha*	1,54	0,00			x
Thick-knee	Spotted Thick-knee	*Burhinus capensis*	2,31	1,92			
Thrush	Karoo Thrush	*Turdus smithi*	6,15	3,85			
Thrush	Olive Thrush	*Turdus olivaceus*	1,54	0,00			
Tit	Cape Penduline Tit	*Anthoscopus minutus*	20,77	0,00			
Tit	Grey Tit	*Melaniparus afer*	23,08	3,85			
Wagtail	Cape Wagtail	*Motacilla capensis*	55,38	9,62			
Warbler	Chestnut-vented Warbler	*Curruca subcoerulea*	8,46	3,85			
Warbler	Layard's Warbler	*Curruca layardi*	28,46	3,85			
Warbler	Lesser Swamp Warbler	*Acrocephalus gracilirostris*	1,54	0,00			
Warbler	Namaqua Warbler	*Phragmacia substriata*	16,15	5,77			
Warbler	Rufous-eared Warbler	*Malcorus pectoralis*	26,15	5,77			
Waxbill	Common Waxbill	*Estrilda astrild*	17,69	1,92			
Weaver	Cape Weaver	*Ploceus capensis*	40,77	15,38			
Weaver	Southern Masked Weaver	*Ploceus velatus*	30,77	3,85			
Wheatear	Capped Wheatear	*Oenanthe pileata*	3,85	0,00			
Wheatear	Mountain Wheatear	*Myrmecocichla monticola*	51,54	13,46			
White-eye	Cape White-eye	*Zosterops virens*	3,08	0,00			
Woodpecker	Ground Woodpecker	*Geocolaptes olivaceus*	6,92	0,00			
	Bokmakierie	*Telophorus zeylonus*	83,85	21,15			
	Hamerkop	*Scopus umbretta*	3,08	0,00			
	Neddicky	*Cisticola fulvicapilla*	1,54	0,00			
	Secretarybird	*Sagittarius serpentarius*	0,77	0,00	VU	VU	

APPENDIX 2: HABITAT AT THE STUDY AREA

Figure 1: Shale renosterveld shows strong affinities with neighbouring succulent Karoo vegetation.

Figure 2: Ground dams are an important source of surface water in the study area and immediate surroundings.

Figure 3: Ridges are present in the study area.

Figure 4: Verreaux's Eagle nest at Beacon Hill (Photograph: Dr Rob Simmons – Birds & Bats Unlimited)

Management Plan for the Planning and Design Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna					
None					

Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the construction activities at the development footprint will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent displacement of avifauna by ensuring that contractors are aware of the requirements of the Construction Environmental Management Programme (CEMPr.)	Conduct a pre-construction inspection to identify Red List species that may be breeding within the project footprint to ensure that the impacts to breeding species (if any) are adequately managed. A site-specific CEMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads, where possible; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Walk-through by avifaunal specialist 2. Implementation of the CEMPr. Oversee activities to ensure that the CEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 3. Ensure that construction personnel are made aware of the impacts relating to off-road driving. 4. Construction access roads must be demarcated clearly. Undertake site inspections to verify. 5. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 6. Ensure that the construction area is demarcated clearly and that construction personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. Once-off 2. On a daily basis 3. Weekly 4. Weekly 5. Weekly	1. Contractor 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO 6. Contractor and ECO
Avifauna: Mortality due to collision with the overhead power line					
Mortality of avifauna due to collisions with the overhead power line.	Reduction of avian collision mortality	Mark power line with Eskom approved Bird Flight Diverters (BFDs).	1. Fit Eskom approved Bird Flight Diverters on the earthwire on all spans.	1. Once-off	1. Contractor 2. Contractor and ECO

Management Plan for the Operational Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
Avifauna: Displacement due to habitat transformation in the substations					
Total or partial displacement of avifauna due to habitat transformation associated with the vegetation clearance in the onsite substations.	Prevent unnecessary displacement of avifauna by ensuring that the rehabilitation of transformed areas is implemented where possible by an appropriately qualified rehabilitation specialist, according to the recommendations of the botanical specialist study.	1. Develop a Habitat Restoration Plan (HRP) and ensure that it is approved. 2. Monitor rehabilitation via site audits and site inspections to ensure compliance. Record and report any non-compliance.	1. Appointment of rehabilitation specialist to develop HRP. 2. Site inspections to monitor progress of HRP. 3. Adaptive management to ensure HRP goals are met.	1. Once-off 2. Once a year 3. As and when required	1. Facility operator
Avifauna: Mortality of avifauna due to collision with the overhead power line					
Mortality of avifauna due to collisions with the overhead power line.	Reduction of avian collision mortality	1. Monitor the collision mortality on the overhead power line.	1. Avifaunal specialist to conduct quarterly inspections of the overhead power line for a period of two years.	1. Quarterly	1. Facility operator

Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives and Outcomes	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Avifauna: Displacement due to disturbance					
The noise and movement associated with the decommissioning activities will be a source of disturbance which would lead to the displacement of avifauna from the area	Prevent unnecessary displacement of avifauna by ensuring that contractors are aware of the requirements of the Decommissioning EMPr.	A site-specific Decommissioning EMPr (DEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the DEMPr and should apply good environmental practice during decommissioning. The DEMPr must specifically include the following: 1. No off-road driving; 2. Maximum use of existing roads during the decommissioning phase and the construction of new roads should be kept to a minimum as far as practical; 3. Measures to control noise and dust according to latest best practice; 4. Restricted access to the rest of the property; 5. Strict application of all recommendations in the botanical specialist report pertaining to the limitation of the footprint.	1. Implementation of the DEMPr. Oversee activities to ensure that the DEMPr is implemented and enforced via site audits and inspections. Report and record any non-compliance. 2. Ensure that decommissioning personnel are made aware of the impacts relating to off-road driving. 3. Access roads must be demarcated clearly. Undertake site inspections to verify. 4. Monitor the implementation of noise control mechanisms via site inspections and record and report non-compliance. 5. Ensure that the decommissioning area is demarcated clearly and that personnel are made aware of these demarcations. Monitor via site inspections and report non-compliance.	1. On a daily basis 2. Weekly 3. Weekly 4. Weekly 5. Weekly	1. Contractor and ECO 2. Contractor and ECO 3. Contractor and ECO 4. Contractor and ECO 5. Contractor and ECO

APPENDIX 4 IMPACT ASSESSMENT TABLES

Project Name: Bon Espirange to Komsberg Grid Connection

Impact Assessment

CONSTRUCTION

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with construction of the 132kV overhead power line	Construction	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	3	**30**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
Impact 2:	Displacement	Displacement of priority species due to habitat transformation associated with construction of the 132kV overhead power line	Construction	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	3	**30**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

OPERATIONAL

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to habitat transformation associated with the operation of the 132kV overhead power line	Operational	Negative	Moderate	3	2	3	4	2	**24**	**N2**	2	2	3	4	2	**22**	**N2**
					Significance	**N2 - Low**							**N2 - Low**						

Impact 2:	Mortality: Collision	Mortality of priority species due to collisions with the 132kV overhead power line	Operational	Negative	Moderate	5	3	3	4	4	**60**	**N3**	3	3	3	4	3	**39**	**N3**
					Significance	**N3 - Moderate**							**N3 - Moderate**						

DECOMISSIONING

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P =	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Displacement	Displacement of priority species due to disturbance associated with decommissioning of the 132kV overhead power line	Decommissioning	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						

CUMULATIVE

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P =	S		(M+	E+	R+	D)x	P=	S	
Impact 1:	Mortality: Collision	Powerline collision mortality of priority avifauna due to the construction of the overhead power line.	Cumulative	Negative	Moderate	5	3	4	4	4	64	N4	5	3	3	4	3	45	N3
					Significance	**N4 - High**							**N3 - Moderate**						
Impact 2:	Displacement	Displacement of priority avifauna due to disturbance and habitat transformation	Cumulative	Negative	Moderate	4	2	3	2	4	**44**	**N3**	3	2	3	2	2	**20**	**N2**
					Significance	**N3 - Moderate**							**N2 - Low**						
					Significance	**N2 - Low**							**N2 - Low**						