BIOTHERM ESIZAYO WIND PROJECT

BIRD IMPACT ASSESSMENT STUDY: AVIFAUNA

132KV GRID CONNECTION

Compiled by

AFRIMAGE Photography (Pty) Ltd t/a:
Chris van Rooyen Consulting
VAT#: 4580238113
email: vanrooyen.chris@gmail.com
Tel: +27 (0)82 4549570 cell

for

WSP | PARSONS BRINCKERHOFF

DECEMBER 2016

EXECUTIVE SUMMARY

BioTherm Energy (BioTherm) is proposing to develop three wind energy facilities (WEFs) in the vicinity of Sutherland, in the Western Cape and Northern Cape. The planned sites are called Esizayo East and West (2 x sites) and Esizayo (1 x site). The localities are located in the proposed Komsberg Renewable Energy Development Zone (REDZ).

This report deals with the potential impacts on avifauna of the 132kV grid connection between the proposed sites and the Komsberg Substation.

The proposed Esizayo grid connection will have several potential impacts on avifauna ranging from a site to a regional level. These impacts are summarised in the table below:

	Substation 1				Substation 2			
	Powerline Option 1		Powerline Option 2		Powerline Option 1		Powerline Option 2	
Impact	**Rating prior to mitigation**	**Rating post mitigation**	**Rating prior to mitigation**	**Rating post mitigation**	**Rating prior to mitigation**	**Rating post mitigation**	**Rating prior to mitigation**	**Rating post mitigation**
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	-27 Low	-14 Low	-33 Medium	-14 Low	-27 Low	-14 Low	-44 Medium	-21 Low
Collisions of Red Data avifauna with the earthwire of the proposed 132kV powerlines	-68 High	-51 Medium	-34 Medium	-17 Low	-68 High	-51 Medium	-51 Medium	-31 Medium
Electrocution of Red Data avifauna	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low
Displacement of Red Data fauna due to habitat destruction and disturbance associated with the de-commissioning of the powerlines	-27 Low	-14 Low	-27 Low	-14 Low	-27 Low	-14 Low	-27 Low	-14 Low
	Substation 1				**Substation 2**			
Impact	**Rating prior to mitigation**		**Rating post mitigation**		**Rating prior to mitigation**		**Rating post mitigation**	
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with	-18 Low		-12 Low		-18 Low		-12 Low	

the construction of the substation				
Electrocution of Red Data avifauna in the substation yard	-7 Low	-7 Low	-7 Low	-7 Low
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the decommissioning of the substation	-18 Low	-12 Low	-18 Low	-12 Low

The greatest potential concern in the 70km radius around Komsberg Substation is for the large raptor species, particularly Verreaux's Eagle and Martial Eagle, due to their low numbers and vulnerability to turbine collisions. However, the Esizayo grid connection should not materially threaten these species. The concern from a powerline interaction perspective is more for large terrestrial species, particularly Ludwig's Bustard, which is highly susceptible to powerline collisions. The Esizayo grid connection will add an additional 6 – 12km of HV line to the existing HV network in the area, depending on which alternative is built. Several hundred kilometres of HV line already exists within this area, and several more are planned should the renewable energy projects all be built. The overall cumulative impact of the Esizayo grid connection, when viewed with the existing impacts on avifauna, is assessed to be LOW, due to its short length, and it can be further reduced through mitigation.

Both substation alternatives are located in transitional zones between the Renosterveld and Succulent Karoo habitat with a similar footprint size. However, Substation 1 coupled with powerline option 2 is the most preferred combination due to it running along the R354 and existing transmission lines for most of the way. The road and powerlines already constitute utility corridors and by placing it along these linear anthropogenic features should reduce the risk of collisions. Red Data species would normally avoid the immediate vicinity of a road due to the noise and movement of the traffic, and putting a new powerline next to an existing one could help to make both lines more visible.

From an avifaunal impact perspective, the proposed development could go ahead, provided the proposed mitigation measures are strictly implemented.

TABLE OF CONTENTS

1. INTRODUCTION

1.1. SCOPE OF WORK

The terms of reference for this impact 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 for the Esizayo 132kV grid connection on avifauna;
- Assess and evaluate the potential impacts; and
- Recommend mitigation measures to reduce the impact of the expected impacts on avifauna.

1.2. OBJECTIVES OF THE REPORT

The objectives of the report are to investigate the potential impact of the proposed Esizayo 132kV grid connection on avifauna in order to assess whether the project is fatally flawed from an avifaunal impact perspective and, if not, what mitigation measures should be implemented to reduce the potential impacts.

1.3. LEGISLATIVE FRAMEWORK

There is no legislation pertaining specifically to the impact of wind facilities and associated infrastructure on avifauna. There are best practice guidelines available which were compiled under the auspices of Birdlife South Africa (BLSA) and the Endangered Wildlife Trust (EWT) i.e. *Jenkins A R; Van Rooyen C S; Smallie J J; Anderson M D & Smit H A. 2011. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Endangered Wildlife Trust and Birdlife South Africa.* These guidelines have been updated on several occasions, with the latest version released in 2015, which require the regular inspection of associated powerlines for collision mortality.

1.3.1 AGREEMENTS AND CONVENTIONS

Table 1 below lists international 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:	Global

[1] (BirdLife International (2016) Country profile: South Africa. Available from: http://www.birdlife.org/datazone/country/south_africa. Checked: 2016-04-02).

	• 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.	
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

1.3.2 NATIONAL LEGISLATION

1.3.2.1 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.

1.3.2.2 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.

1.3.2.3 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.

1.4. STUDY APPROACH AND METHODOLOGY

The following approach was followed in compiling the report:

- Bird distribution data of the Southern African Bird Atlas Project2 (SABAP 2) was obtained (http://sabap2.adu.org.za/), in order to ascertain which species occur in the pentads where the proposed wind facility is located. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. In order to get a more representative impression of the birdlife, a consolidated data set was obtained for the 9 pentads which overlap substantially with the proposed Esizayo development site and associated grid connection (see **Figure 1**). A total of 63 full protocol lists have been completed to date for the 9 pentads where the study area is located (i.e. lists surveys lasting a minimum of two hours each). The SABAP2 data was therefore regarded as a reliable snapshot of the avifauna, especially when supplemented by actual data collected during surveys and through general knowledge of the area.

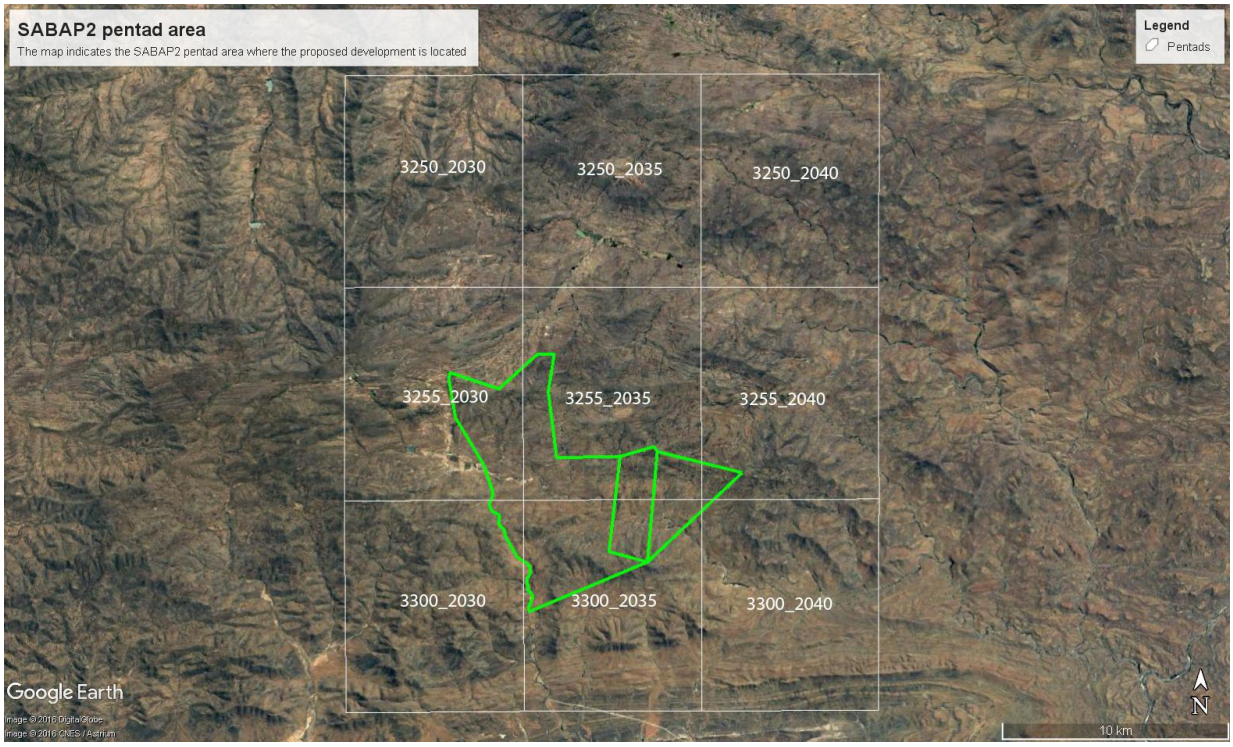

Figure 1: The 9 pentads where the Esizayo development area and grid connection is located.

- 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 (2016.2) IUCN Red List of Threatened Species (http://www.iucnredlist.org/).

- The BirdLife South Africa (BLSA) was consulted on Important Bird Areas of Southern Africa for information on relevant Important Bird Areas (IBAs) (http://www.birdlife.org.za/conservation/important-bird-areas) (Marnewick *et al*. 2015).

- Satellite imagery from Google Earth was used in order to view the broader area on a landscape level and to help identify bird habitat on the ground.

- Information on bird diversity and abundance at the Esizayo development site was obtained through a 12-months monitoring programme. Data was collected through transect counts, incidental sightings, inspection of potential focal points and the recording of flight behaviour from vantage points. This data was used as a supplementary source of information on the variety and abundance of avifauna in the study area.

- Information on existing raptor nests were obtained from avifaunal specialists Dr. Andrew Jenkins (Avisense Consulting) and Andrew Pearson (Arcus), as well as from the staff of the Komsberg Nature Reserve. Various landowners were also interviewed to obtain information on nests and roosting sites.

1.5. ASSUMPTIONS AND LIMITATIONS

- A total of 63 full protocol lists have been completed to date for the 9 pentads for the Esizayo grid connection study area (i.e. lists surveys lasting a minimum of two hours or more each). This is a fairly comprehensive dataset which provides an accurate snapshot of the avifauna which could occur

in the study area. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, SABAP1 records (Harrison *et al.* 1997), and data from the pre-construction bird monitoring.

- 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. However, power line and substation impacts can be predicted with a fair amount of certainty, based on a robust body of research stretching back over thirty years (see References Section 9).

- To date no peer-reviewed, scientific papers are available on the impacts of wind farms on birds in South Africa. The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle (http://www.unep.org). The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: “in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation.”

- All Red Data species were classified as priority species for purposes of the investigation (Retief *et al.* 2012).

- The study area was defined as a 2km buffer zone around the proposed powerline alignments (see Figure 2).

1.6. DECLARATION OF INDEPENDENCE

Chris van Rooyen
Chris has 20 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 several renewable energy 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
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.

Nico Laubscher
Nico holds a D.Sc. from the University of Potchefstroom and was head of the Statistics Division, National Research Institute for Mathematical Sciences of the CSIR from 1959 – 1975. He retired in 1989 as head of the Centre for Statistical Consultation at the University of Stellenbosch. Nico held several offices, including President of the South African Statistical Association, and editor of the South African Statistical Journal. Nico has five decades' experience in statistical analysis and data science applications, including specialisation in model building with massive data sets, designing of experiments for process improvement and analysis of data so obtained, and statistical process control. He also has published peer reviewed papers in several leading statistical journals, including Annals of Mathematical Statistics, American Statistical Journal, Technometrics and The American Statistician. He currently operates as a private statistical consultant to industry and academia.

SPECIALIST DECLARATION

I, Chris van Rooyen as duly authorised representative of Chris van Rooyen Consulting, and working under the supervision of and in association with Albert Froneman (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003, hereby confirm my independence (as well as that of Chris van Rooyen Consulting) as a specialist and declare that neither I nor Chris van Rooyen Consulting have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which WSP was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Environmental Impact Assessment for the proposed Esizayo grid connections.

Signed: Chris van Rooyen
Tel: 0824549570
Email: vanrooyen.chris@gmail.com

See **APPENDIX 1** for Chris van Rooyen's CV.

2. DESCRIPTION OF THE PROJECT

The proposed infrastructure will consist of the following:

- An onsite Eskom Substation of up to 132kV which will occupy an area of 250mx 250m;
- A double circuit power line using steel monopole structures of up to 132kV that will run from the onsite Eskom substation to the existing Eskom Komsberg Substation;

See Figure 2 for a map of the proposed grid connection, showing the various alignment options.

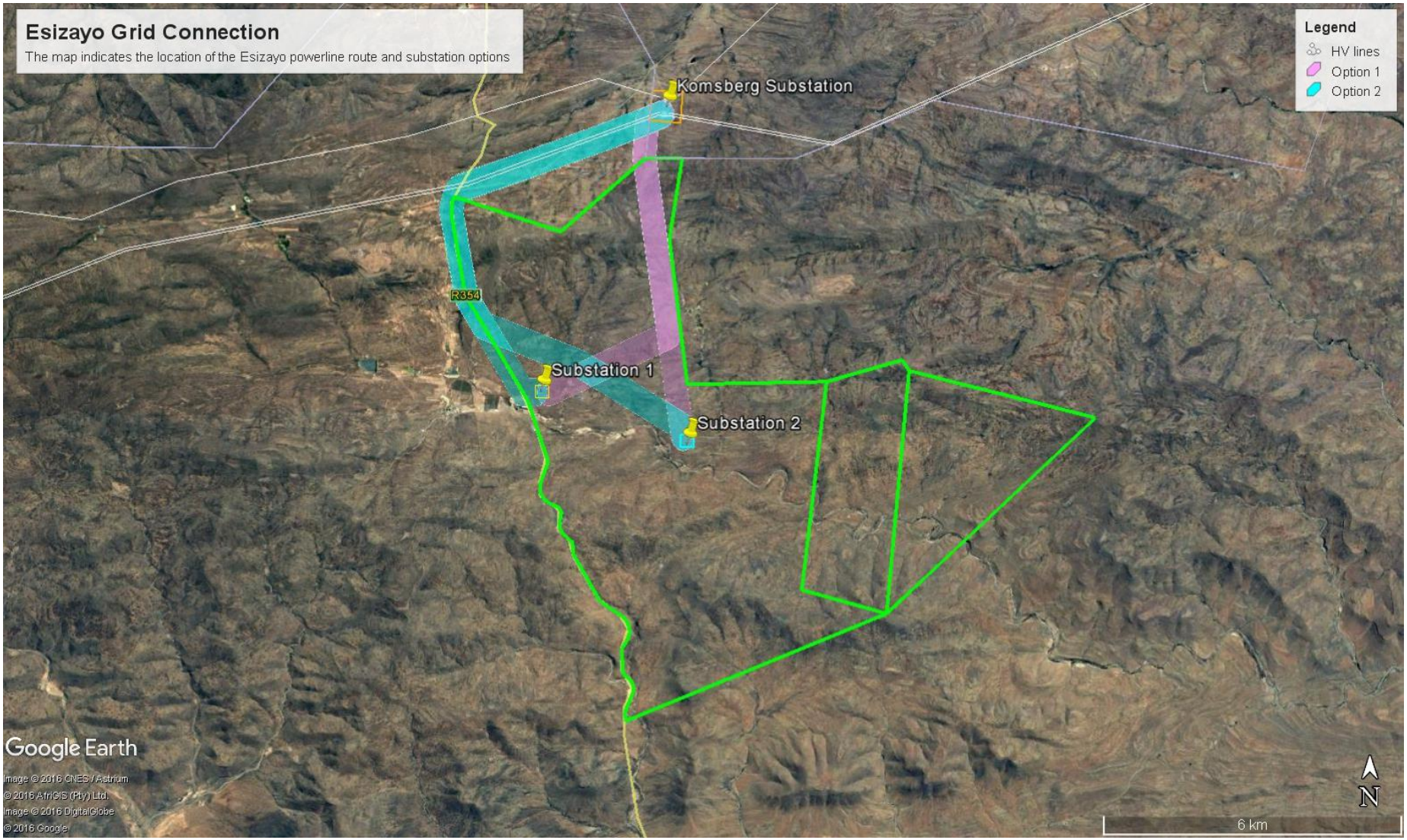

Figure 2: The proposed Esizayo grid connections.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. STUDY AREA IN GENERAL

3.1.1. BIRD HABITATS

The proposed Esizayo site is situated approximately 65km south of the town of Sutherland, and 33km north-west of the town of Laingsburg in the Laingsburg Local Municipality of the Western Cape Province. The habitat in the study area is rugged, consisting of rolling hills with boulder-strewn slopes and exposed ridge lines, and is bisected by a few ephemeral drainage lines. The highest points in the study area are Spitskop (1430m a.s.l) and Skaapberg (1386m a.s.l.). 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-Muldersvlei, Bachus-Droërivier 400 kV transmission lines and Komsberg Substation are located just north of the site.

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 extreme south-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).

The habitat in the study area from an avian perspective is relatively uniform, dominated by open, rocky, undulating or montane renosterbos, with moderate, rocky slopes and ridges, with denser, woody vegetation along the bigger drainage lines (and stands of alien trees), and a few lands. The larger artificial impoundments in the area probably support good numbers of waterbirds in wet years, and the Eskom power pylons are used as roosting, hunting and/or nesting habitat by certain species, e.g. the Droërivier-Muldersvlei and Bachus-Droërivier 132kV transmission lines which run north of the site are used by Martial Eagle for breeding, with the closest known nest to the development approximately 3km away from Komsberg Substation.

The site is not located within 35 km of any of the currently registered national Important Bird Areas (Marnewick *et al.* 2015).

See **APPENDIX 2** for representative samples of the habitat in the study area.

3.1.2 AVIFAUNA

A total of 143 species could potentially occur in the study area. Of these, 9 are classified as Red Data species. **Table 2** below lists the priority species that could potentially occur in the study area, as well as the potential impact on the species in the study area.

See **APPENDIX 3** for a list of all species that could potentially occur in the study area.

Table 2: Red Data species that could potentially occur in the study area. **EN = Endangered VU = Vulnerable NT = Near threatened LC = Least concern**

		Status				Abundance			Habitat						Impact		
Species	Taxonomic name	Global status Red Data	Regional status Red Data	Endemic status SA	Endemic status region	SABAP2 reporting rate % (9 pentad)	SABAP1 reporting rate %	Recorded during pre-construction monitoring	Renosterveld/Karoo	Dams	Agriculture	Alien trees	Drainage lines	HV lines	Collisions with earthwire of 132kV powerline	Electrocutions on 132kV powerline	Displacement through disturbancea and habitat destruction
Eagle, Martial	*Polemaetus bellicosus*	VU	EN			4.76	✓ 5.88	x	x	x		x		x			x
Harrier, Black	*Circus maurus*	VU	EN	Near endemic	Endemic	4.76	✓ 11.76	x	x		x						x
Korhaan, Southern Black	*Afrotis afra*	VU	VU	Endemic	Endemic	0	✓ 9.76		x						x		x
Eagle, Verreaux's	*Aquila verreauxii*	LC	VU			20.63	✓ 9.76	x	x	x				x			x
Falcon, Lanner	*Falco biarmicus*	LC	VU			0	0	x	x	x	x			x			x
Korhaan, Karoo	*Eupodotis vigorsii*	LC	NT		Endemic	36.51	✓ 16.67	x	x						x		x
Stork, Black	*Ciconia nigra*	LC	VU			1.59	✓ 5.88	x		x			x		x		
Bustard, Ludwig's	*Neotis ludwigii*	EN	EN		Near-endemic	9.52	✓ 7.32	x	x		x				x		x

4. IMPACTS OF POWERLINES AND SUBSTATIONS ON AVIFAUNA

4.1. GENERAL

Negative impacts on birds by electricity infrastructure generally take two 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). Birds also impact on the infrastructure through nesting and streamers, which can cause interruptions in the electricity supply (Van Rooyen *et al.* 2002).

4.2. 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 Esizayo grid connections, no electrocution risk is envisaged because the proposed design of the 132kV lines will not pose an electrocution threat to any of the priority species which are likely to occur at the site. Electrocutions within the proposed on-site substation yard are possible, but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yards for perching or roosting.

4.3. COLLISIONS

Collisions are probably the bigger 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. 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 recent PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with transmission lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the lower-resolution, and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).
Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 2012).

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

From incidental record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are generally susceptible to power line collisions in South Africa (see **Figure 3** below - Jenkins *et al.* 2010).

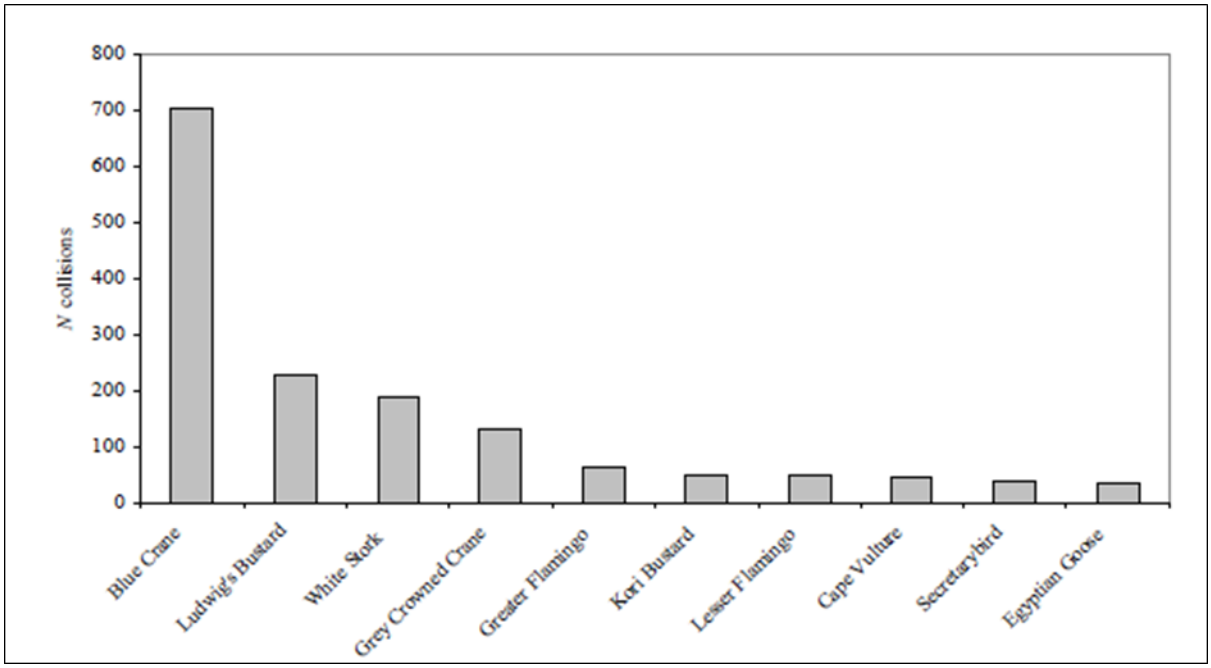

Figure 3: The top 10 collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2008 (Jenkins *et al.* 2010)

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

Several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is key to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative

of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes *Anthropoides paradiseus* and White Storks *Ciconia ciconia*. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35°, respectively, are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) 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. 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).

4.4 DISPLACEMENT DUE TO HABITAT DESTRUCTION AND DISTURBANCE

During the construction phase and maintenance of power lines and substations, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the substation and power line servitudes through transformation of habitat, which could result in temporary or permanent displacement.

Apart from direct habitat destruction, the above-mentioned construction and maintenance 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.

5 DETAILED DESCRIPTION OF IMPACTS PER PHASE

5.1. CONSTRUCTION PHASE

5.1.1. DISPLACEMENT DUE TO HABITAT DESTRUCTION AND DISTURBANCE ASSOCIATED WITH THE CONSTRUCTION OF THE POWERLINES

The construction of the powerlines and associated substations will result in a significant amount of movement and noise, which will lead to the temporary displacement of Red Data avifauna from the vicinity of the construction activities. It is highly likely that most priority species listed in **Table 2** will vacate the immediate vicinity of the construction area for the duration of these activities. Larger, sensitive species such as Martial Eagle, Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan are most likely to be affected by this temporary impact. Due to the nature of the vegetation, very little if any vegetation clearing will be required. Loss of habitat is therefore likely to be minimal and should not materially affect any Red Data species.

Substation 1

The combination of Substation 1 and powerline option 2 is strongly preferred due to it running along the R354 and existing transmission lines for most of the way. The road and powerlines already constitute utility corridors and by placing it along these linear anthropogenic features it should reduce the impact of fragmentation on the habitat. There is a potential for temporary disturbing large eagles breeding on the existing Bacchus – Droërivier 400kV and Gamma – Omega 765kV transmission lines, but no nests were recorded on this section of line during the pre-construction monitoring. A further advantage of placing the line next to the R354 and existing transmission servitudes is that it will reduce the need for new roads to be constructed.

Substation 2

None of these options are preferred due to the potential for habitat fragmentation. Option 1 follows existing utility corridors for some of the way, but it has a section of 4.3km that runs through pristine habitat. Option 2 runs through pristine habitat all the way for 6.68km.

5.2. OPERATIONAL PHASE

5.2.1. COLLISIONS WITH THE EARTHWIRE OF THE PROPOSED 132KV POWERLINES

The most likely Red Data candidates for collision mortality on the proposed powerlines are Ludwig's Bustards, Karoo Korhaan and Southern Black Korhaan in natural habitat and agricultural areas, and Black Stork at dams and drainage lines. Non-Red Data waterbirds could also be at risk at dams and where the line crosses drainage lines (see **Table 2** for a list of species that could be at risk). Martial and Verreaux's Eagle might also be at risk, but not to the same degree as the large terrestrial species.

Substation 1

The combination of Substation 1 and powerline option 2 is strongly preferred due to it running along the R354 and existing transmission lines for most of the way. The road and powerlines already constitute utility corridors and by placing it along these linear anthropogenic features should reduce the risk of collisions. Red Data species would normally avoid the immediate vicinity of a road due to the noise and movement of the traffic, and putting a new powerline next to an existing one could help to make both lines more visible.

Substation 2

None of the two options is preferred. Option 1 follows existing utility corridors for some of the way, but it has a section of 4.3km that runs through pristine habitat. Option 2 runs through pristine habitat all the way for 6.68km. The risk of collisions is the highest in pristine habitat.

5.2.2. ELECTROCUTION

No electrocution risk is envisaged because the proposed double circuit steel monopole design of the 132kV lines will not pose an electrocution threat to any of the priority species which are likely to occur

in the study area. Electrocutions within the proposed on-site substation yard are possible, but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yards for perching or roosting.

5.3 DE-COMMISSIONING PHASE

5.3.1 DISPLACEMENT DUE TO HABITAT DESTRUCTION AND DISTURBANCE ASSOCIATED WITH THE DE-COMMISSIONING OF THE POWERLINES

The de-commissioning of the powerlines and associated substations will result in a significant amount of movement and noise, which will lead to the temporary displacement of priority avifauna from the vicinity of the construction activities. It is highly likely that most priority species listed in **Table 2** will vacate the immediate vicinity of the decommissioning operations for the duration of these activities. Larger, sensitive Red Data species such as Ludwig's Bustard, Karoo Korhaan and Southern Black Korhaan are most likely to be affected by this temporary impact. However, once the activities have ceased, the study area should be re-colonised in due course.

Substation 1

The combination of Substation 1 and powerline option 2 is strongly preferred due to it running along the R354 and existing transmission lines for a considerable length, which eliminates the need for new roads during the decommissioning activities. There is a potential for temporary disturbing large eagles breeding on the existing Bacchus – Droërivier 400kV and Gamma – Omega 765kV transmission lines, but no nests were recorded on this section of line during the pre-construction monitoring.

Substation 2

None of the two options is preferred. Option 1 follows existing utility corridors for some of the way, but it has a section of 4.3km that runs through pristine habitat. Option 2 runs through pristine habitat all the way for 6.68km. The creation of new roads in pristine habitat is not ideal.

5.4 PREFERRED ALTERNATIVE: SUBSTATION 1 OR SUBSTATION 2

Both substation alternatives are located in transitional zones between the Renosterveld and Succulent Karoo habitat with a similar footprint size. However, Substation 1 coupled with powerline option 2 is the most preferred combination for reasons set out above.

5.5 CUMULATIVE IMPACTS

The renewable energy project applications currently registered with DEA between Touws River and Sutherland within a 70km radius around Komsberg Substation are listed in **APPENDIX 4.** Possible impacts by renewable energy projects on birds within this area are temporary displacement due to disturbance associated with the construction of the facility and associated infrastructure, collisions with solar panels and wind turbines, permanent displacement due to habitat transformation, entrapment in perimeter fences and collisions with the associated power lines.

Apart from renewable energy developments, several other threats are currently facing avifauna in the natural Karoo habitat (Marnewick *et al.* 2015):

- Overgrazing

This results in a depletion of palatable plant species, erosion, and encroachment by Karoo shrubs. The result is loss of suitable habitat and a decrease in the availability of food for large terrestrial birds. Centre-pivot irrigated croplands using underground water are increasing and agriculture is intensifying, which may benefit some Red Data species, but not all.

- Poisoning

Strychnine poison was used extensively in the past to control damage-causing predators, such as Black-backed Jackal *Canis mesomelas* and Caracal *Caracal caracal*, and reduced scavenging raptor populations. The use of poison may be continuing, and the potential impacts on threatened raptor species has not been confirmed or quantified.

- Road-kills

Many birds are commonly killed on roads, especially nocturnal species such as Spotted Eagle-Owl.

- Powerlines

Numerous existing and new power lines are significant threats to some priority species. Power lines kill substantial numbers of all large terrestrial bird species in the Karoo, including threatened species (Jenkins *et al*. 2010; Shaw, J. 2013) There is currently no completely effective mitigation method to prevent collisions.

- Climate change

Climate change scenarios for the region predict slightly higher summer rainfall by 2050, and increased rainfall variability. Droughts are expected to become more severe. The climate change is predicted to have both positive and negative consequences for priority species. Increased summer rainfall could improve survival, and conversely drought years can lower long-term average survival. Large, mainly resident species dependent on rainfall are also more vulnerable to climate change. This would include the slow-breeding Verreaux's Eagle, Tawny Eagle and Martial Eagle, which also exhibit extended parental care. Severe hailstorms kill many priority species and could become more frequent.

- Shale gas fracking

There is a potential threat of shale gas fracking throughout the Karoo. Populations of bird species may be locally reduced through disturbance caused by lights, vibration, vehicles and dust, and may be affected by pollutants in ponds containing contaminated water produced by returned fracking fluids.

- Persecution

Although it is difficult to prove, the direct persecution of raptors such as Verreaux's Eagle and Martial Eagle for stock predation is still taking place (R. Visagie pers. comm).

The greatest potential concern in the 70km radius around Komsberg Substation is for the large raptor species, particularly Verreaux's Eagle and Martial Eagle, due to their low numbers and vulnerability to turbine collisions. However, the Esizayo grid connection should not materially threaten these species. The concern from a powerline interaction perspective is more for large terrestrial species, particularly Ludwig's Bustard, which is highly susceptible to powerline collisions. The Esizayo grid connection will add an additional 6 – 12km of HV line to the existing HV network in the area, depending on which alternative is built. Several hundred kilometres of HV line already exists within this area, and several more are planned should the renewable energy projects all be built. The overall cumulative impact of the Esizayo grid connection, when viewed with the existing impacts on avifauna, is assessed to be LOW, due to its short length, and it can be further reduced through mitigation.

6. ASSESSMENT OF IMPACTS

The EIA uses a methodological framework developed by WSP | Parsons Brinckerhoff to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014 (GN No. 982) (the "EIA Regulations").

As required by the EIA Regulations (2014), the determination and assessment of impacts were based on the following criteria:

→ Nature of the Impact
→ Significance of the Impact

- Consequence of the Impact
- Extent of the impact
- Duration of the Impact
- Probability if the impact
- Degree to which the impact:
  - can be reversed;
  - may cause irreplaceable loss of resources; and
  - can be avoided, managed or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- Magnitude: to what extent environmental resources are going to be affected;
- Sensitivity of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
- Severity of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that 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.

6.1 METHODOLOGY

Impacts were assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected and how it will be affected

Nature or Type of Impact	Definition
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).

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

- The physical **extent**, wherein it is indicated whether:

Score	Description
1	the impact will be limited to the site;
2	the impact will be limited to the local area;
3	the impact will be limited to the region;
4	the impact will be national; or
5	the impact will be international;

- The **duration**, wherein it is indicated whether the lifetime of the impact will be:

Score	Description
1	of a very short duration (0 to 1 years)
2	of a short duration (2 to 5 years)
3	medium term (5–15 years)
4	long term (> 15 years)
5	permanent

- The **magnitude of impact on ecological processes**, quantified on a scale from 0-10, where a score is assigned:

Score	Description
0	small and will have no effect on the environment.
2	minor and will not result in an impact on processes.

4	low and will cause a slight impact on processes.
6	moderate and will result in processes continuing but in a modified way.
8	high (processes are altered to the extent that they temporarily cease).
10	very high and results in complete destruction of patterns and permanent cessation of processes.

→ The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:

Score	Description
1	very improbable (probably will not happen.
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

→ the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
→ the **status**, which is described as either positive, negative or neutral;
→ the degree to which the impact can be reversed;
→ the degree to which the impact may cause irreplaceable loss of resources; and
→ the *degree* to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

$$S = (E+D+M)*P$$

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

Overall Score	Significance Rating	Description

< 30 points	**Low**	where this impact would not have a direct influence on the decision to develop in the area
31-60 points	**Medium**	where the impact could influence the decision to develop in the area unless it is effectively mitigated
> 60 points	**High**	where the impact must have an influence on the decision process to develop in the area

6.1 IMPACT ASSESSMENT TABLES

The impact assessment tables are attached as **APPENDIX 5**.

7. MITIGATION AND MANAGEMENT MEASURES

The proposed mitigation measures are set out below in **Table 5.**

Table 5: Mitigation and management

ACTIVITY	MITIGATION AND MANAGEMENT MEASURE	RESPONSIBLE PERSON	APPLICABLE DEVELOPMENT PHASE	INCLUDE AS CONDITION OF AUTHORISATION	MONITORING REQUIREMENTS
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	• 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 as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned. • Prior to construction commencing, an inspection should be performed by the avifaunal specialist to record any large raptor nests on the existing Droërivier-Muldersvlei 1 400kV line that could be impacted by the construction of the proposed powerline • Should any nests be recorded, it would require management of the potential impacts on the breeding birds once construction commences, which would necessitate the involvement of the avifaunal specialist, and the Environmental Control Officer. An effective communication strategy should be implemented whereby the avifaunal specialist is provided with a construction schedule which will enable him/her to	Construction manager Environmental Control Officer	Construction	Yes	None

ACTIVITY	MITIGATION AND MANAGEMENT MEASURE	RESPONSIBLE PERSON	APPLICABLE DEVELOPMENT PHASE	INCLUDE AS CONDITION OF AUTHORISATION	MONITORING REQUIREMENTS
	ascertain when and where breeding priority raptors could be impacted by the construction activities. This could then be addressed through the timing of construction activities during critical periods of the breeding cycle, once it has been established that a particular nest is active				
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the substation	• Construction activity should be restricted to the immediate footprint of the infrastructure. • 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 as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.	Construction manager Environmental Control Officer	Construction	Yes	None
Collisions of Red Data avifauna with the earthwire of the proposed 132kV powerlines	• A walk-through must be conducted by the avifaunal specialist after final pole positions have been determined, to demarcate	Construction manager	Operation	Yes	• The powerlines should be inspected at least once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality. Thereafter the

ACTIVITY	MITIGATION AND MANAGEMENT MEASURE	RESPONSIBLE PERSON	APPLICABLE DEVELOPMENT PHASE	INCLUDE AS CONDITION OF AUTHORISATION	MONITORING REQUIREMENTS
	sections of line that will need to be mitigated with Bird Flight Diverters (BFDs).	Environmental Control Officer Site management Avifaunal specialist			frequency of inspections will be informed by the results of the first two years. • The detailed protocol to be followed for the inspections will be compiled by the avifaunal specialist prior to the first inspection.
Electrocution of priority species on the powerlines	None are required				
Electrocution of priority species within the substation yard	The hardware within the substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation be applied reactively. This is an acceptable approach because Red List bird species are unlikely to frequent the substation and be electrocuted.	Site management Avifaunal specialist	Operation	Yes	None
Displacement due to habitat destruction and disturbance associated with the de-commissioning of the powerlines	• Activity should be restricted to the immediate footprint of the infrastructure. • 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 as far as practical.	Site management	De-commissioning	No	None

ACTIVITY	MITIGATION AND MANAGEMENT MEASURE	RESPONSIBLE PERSON	APPLICABLE DEVELOPMENT PHASE	INCLUDE AS CONDITION OF AUTHORISATION	MONITORING REQUIREMENTS
	• The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the footprint and rehabilitation of disturbed areas is concerned.				
Displacement due to habitat destruction and disturbance associated with the de-commissioning of the substation	• Activity should be restricted to the immediate footprint of the infrastructure. • 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 as far as practical. • The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the footprint and rehabilitation of disturbed areas is concerned.	Construction manager Environmental Control Officer	De-commissioning	No	None

8. STAKEHOLDER CONSULTATION

8.1. STAKEHOLDER CONSULTATION PROCESS

Public participation is a requirement of the S&EIR process; it consists of a series of inclusive and culturally appropriate interactions aimed at providing stakeholders with opportunities to express their views, so that these can be considered and incorporated into the S&EIR decision-making process. Effective public participation requires the prior disclosure of relevant and adequate project information to enable stakeholders to understand the risks, impacts, and opportunities of the Proposed Project.

A comprehensive stakeholder consultation process was undertaken during the scoping phase. Stakeholders were identified through existing databases, site notices, newspaper adverts and meetings. All stakeholders identified to date have been registered on the project database. All concerns, comments, viewpoints and questions (collectively referred to as 'issues') received to date have been documented and responded to in a Comment and Response Report.

There will be ongoing communication between WSP | Parsons Brinckerhoff and stakeholders throughout the S&EIR process.

8.2. STAKEHOLDER COMMENTS AND RESPONSE

Stakeholder Details	Comment	Specialist Response
Cape Nature	5.3. The one aspect that is not dealt with is the accumulative impact. Both sites are surrounded by other windfarm developments either proposed or at the bidding stage. Considering the size of the area that will eventually be under windfarms, this aspect needs to be addressed. Currently the accumulative impact is a difficult subject to address as there are a number of stakeholders involved because of the different applications, but DEA needs to be made aware of this and be reminded on a regular basis as they will have to come up with a plan to address this issue. The other aspect is the accumulative impact of collisions that also need to be addressed.	The issue of cumulative impacts is addressed under Section 5.4 of this report.

9. CONCLUSIONS

The proposed Esizayo grid connection will have several potential impacts on avifauna ranging from a site to a regional level. These impacts are summarised in the table below:

		Substation 1				Substation 2			
		Powerline Option 1		Powerline Option 2		Powerline Option 1		Powerline Option 2	
Environmental parameter	**Impact**	**Rating prior to mitigation**	**Rating post mitigation**	**Rating prior to mitigation**	**Rating post mitigation**	**Rating prior to mitigation**	**Rating post mitigation**	**Rating prior to mitigation**	**Rating post mitigation**
Avifauna	Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	-27 Low	-14 Low	-33 Medium	-14 Low	-27 Low	-14 Low	-44 Medium	-21 Low
	Collisions of Red Data avifauna with the earthwire of the proposed 132kV powerlines	-68 High	-51 Medium	-34 Medium	-17 Low	-68 High	-51 Medium	-51 Medium	-31 Medium
	Electrocution of Red Data avifauna	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low	-7 Low
	Displacement of Red Data fauna due to habitat destruction and disturbance associated with the de-commissioning of the powerlines	-27 Low	-14 Low	-27 Low	-14 Low	-27 Low	-14 Low	-27 Low	-14 Low
	Impact	**Substation 1**				**Substation 2**			
		Rating prior to mitigation		**Rating post mitigation**		**Rating prior to mitigation**		**Rating post mitigation**	
	Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the substation	-18 Low		-12 Low		-18 Low		-12 Low	

	Electrocution of Red Data avifauna in the substation yard	-7 Low	-7 Low	-7 Low	-7 Low
	Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the decommissioning of the substation	-18 Low	-12 Low	-18 Low	-12 Low

The greatest potential concern in the 70km radius around Komsberg Substation is for the large raptor species, particularly Verreaux's Eagle and Martial Eagle, due to their low numbers and vulnerability to turbine collisions. However, the Esizayo grid connection should not materially threaten these species. The concern from a powerline interaction perspective is more for large terrestrial species, particularly Ludwig's Bustard, which is highly susceptible to powerline collisions. The Esizayo grid connection will add an additional 6 – 12km of HV line to the existing HV network in the area, depending on which alternative is built. Several hundred kilometres of HV line already exists within this area, and several more are planned should the renewable energy projects all be built. The overall cumulative impact of the Esizayo grid connection, when viewed with the existing impacts on avifauna, is assessed to be LOW, due to its short length, and it can be further reduced through mitigation.

Both substation alternatives are located in transitional zones between the Renosterveld and Succulent Karoo habitat with a similar footprint size. However, Substation 1 coupled with powerline option 2 is the most preferred combination due to it running along the R354 and existing transmission lines for most of the way. The road and powerlines already constitute utility corridors and by placing it along these linear anthropogenic features should reduce the risk of collisions. Red Data species would normally avoid the immediate vicinity of a road due to the noise and movement of the traffic, and putting a new powerline next to an existing one could help to make both lines more visible.

From an avifaunal impact perspective, the proposed development could go ahead, provided the proposed mitigation measures are strictly implemented.

10 REFERENCES

- ALLAN, D.G. 1994. The abundance and movements of Ludwig's Bustard *Neotis ludwigii*. *Ostrich* 65: 95-105
- ANIMAL DEMOGRAPHY UNIT. The southern African Bird Atlas Project 2. University of Cape Town. http://sabap2.adu.org.za.
- AVIAN POWER LINE INTERACTION COMMITTEE (APLIC). 2012. *Mitigating Bird Collisions with Power Lines: The State of the Art in 2012*. Edison Electric Institute. Washington D.C.
- BARNES, K.N. (ed.) 1998. The Important Bird Areas of southern Africa. BirdLife South Africa: Johannesburg.
- BARRIENTOS R, PONCE C, PALACIN C, MARTÍN CA, MARTÍN B, ET AL. 2012. Wire marking results in a small but significant reduction in avian mortality at power lines: A BACI Designed Study. PLoS ONE 7(3): e32569. doi:10.1371/journal.pone.0032569.
- BARRIENTOS, R., ALONSO, J.C., PONCE, C., PALACÍN, C. 2011. Meta-Analysis of the effectiveness of marked wire in reducing avian collisions with power lines. Conservation Biology 25: 893-903.
- BEAULAURIER, D.L. 1981. Mitigation of bird collisions with transmission lines. Bonneville Power Administration. U.S. Dept. of Energy.
- HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V & BROWN, C.J. (eds). 1997. The atlas of southern African birds. Vol 1 & 2. BirdLife South Africa, Johannesburg.
- HOBBS, J.C.A. & LEDGER J.A. 1986a. The Environmental Impact of Linear Developments; Power lines and Avifauna. *Proceedings of the Third International Conference on Environmental Quality and Ecosystem Stability*. Israel, June 1986.
- HOBBS, J.C.A. & LEDGER J.A. 1986b. Power lines, Birdlife and the Golden Mean. *Fauna and Flora,* 44:23-27.
- HOOGSTAD, C. Email communication from the manager of the Eskom-EWT Strategic Partnership to the author on 25 June 2015.
- HOCKEY P.A.R., DEAN W.R.J., AND RYAN P.G. 2005. Robert's Birds of Southern Africa, seventh edition. Trustees of the John Voelcker Bird Book Fund, Cape Town.
- JENKINS, A., DE GOEDE, J.H. & VAN ROOYEN, C.S. 2006. Improving the products of the Eskom Electric Eagle Project. Unpublished report to Eskom. Endangered Wildife Trust.

- JENKINS, A. & SMALLIE, J. 2009. Terminal velocity: the end of the line for Ludwig's Bustard? Africa Birds and Birding. Vol 14, No 2.
- JENKINS, A.R., SMALLIE, J.J. & DIAMOND, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. *Bird Conservation International* 20: 263-278.
- KOOPS, F.B.J. & DE JONG, J. 1982. Vermindering van draadslachtoffers door markering van hoogspanningsleidingen in de omgeving van Heerenveen. Electrotechniek 60 (12): 641 – 646.
- KRUGER, R. & VAN ROOYEN, C.S. 1998. Evaluating the risk that existing power lines pose to large raptors by using risk assessment methodology: The Molopo Case Study. *Proceedings of the 5th World Conference on Birds of Prey and Owls*. August 4-8,1998. Midrand, South Africa.
- KRUGER, R. 1999. *Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa*. Bloemfontein (South Africa): University of the Orange Free State. (M. Phil. Mini-thesis)
- LEDGER, J. 1983. *Guidelines for Dealing with Bird Problems of Transmission Lines and Towers.* Eskom Test and Research Division. (Technical Note TRR/N83/005).
- LEDGER, J.A. & ANNEGARN H.J. 1981. Electrocution Hazards to the Cape Vulture (*Gyps coprotheres*) in South Africa. *Biological Conservation* 20:15-24.
- LEDGER, J.A. 1984. Engineering Solutions to the Problem of Vulture Electrocutions on Electricity Towers. *The Certificated Engineer*, 57:92-95.
- LEDGER, J.A., J.C.A. HOBBS & SMITH T.V. 1992. Avian Interactions with Utility Structures: Southern African Experiences. *Proceedings of the International Workshop on Avian Interactions with Utility Structures*. Miami (Florida), Sept. 13-15, 1992. Electric Power Research Institute.
- MARNEWICK, M.D., RETIEF E.F., THERON N.T., WRIGHT D.R., ANDERSON T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.
- MARTIN, G., SHAW, J., SMALLIE J. & DIAMOND, M. 2010. Bird's eye view – How birds see is key to avoiding power line collisions. Eskom Research Report. Report Nr: RES/RR/09/31613.
- MUCINA. L. & RUTHERFORD, M.C. (Eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- SHAW, J.M. 2013. Power line collisions in the Karoo: Conserving Ludwig's Bustard. Unpublished PhD thesis. Percy FitzPatrick Institute of African Ornithology, Department of Biological Sciences, Faculty of Science University of Cape Town May 2013.
- VAN ROOYEN, C.S. & LEDGER, J.A. 1999. *Birds and utility structures: Developments in southern Africa*. Pp 205-230, in Ferrer, M. & G.F.M. Janns. (eds.). *Birds and Power lines*. Quercus, Madrid (Spain). Pp 238.
- VAN ROOYEN, C.S. & TAYLOR, P.V. 1999. Bird Streamers as probable cause of electrocutions in South Africa. EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999. Charleston, South Carolina.
- VAN ROOYEN, C.S. 1998. Raptor mortality on power lines in South Africa. *Proceedings of the 5th World Conference on Birds of Prey and Owls*. Midrand (South Africa), Aug.4 – 8, 1998. .
- VAN ROOYEN, C.S. 1999. An overview of the Eskom-EWT Strategic Partnership in South Africa. *EPRI Workshop on Avian Interactions with Utility Structures* Charleston (South Carolina), Dec. 2-3 1999.
- VAN ROOYEN, C.S. 2000. An overview of Vulture Electrocutions in South Africa. *Vulture News,* 43: 5-22. (Vulture Study Group, Johannesburg, South Africa).
- VAN ROOYEN, C.S. 2007. Eskom-EWT Strategic Partnership: Progress Report April-September 2007. Endangered Wildlife Trust, Johannesburg.
- VAN ROOYEN, C.S. VOSLOO, H.F. & R.E. HARNESS. 2002. Eliminating bird streamers as a cause of faulting on transmission lines in South Africa. *Proceedings of the IEEE 46th Rural Electric Power Conference.* Colorado Springs (Colorado), May. 2002.
- VERDOORN, G.H. 1996. Mortality of Cape Griffons *Gyps coprotheres* and African Whitebacked Vultures *Pseudogyps africanus* on 88kV and 132kV power lines in Western Transvaal, South

Africa, and mitigation measures to prevent future problems. *Proceedings of the 2nd International Conference on Raptors*: Urbino (Italy), Oct. 2-5, 1996.

APPENDIX 1: CHRIS VAN ROOYEN CV

Curriculum vitae: Chris van Rooyen

Name	:	Chris van Rooyen
Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	LLB
Nationality	:	South African
Years of experience	:	20 years

Key Qualifications

Chris van Rooyen has twenty years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed more than 100 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments (see key project experience below).

Key Project Experience

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

1. Eskom Klipheuwel Experimental Wind Power Facility, Western Cape
2. Mainstream Wind Facility Jeffreys Bay, Eastern Cape (EIA and monitoring)
3. Biotherm, Swellendam, (Excelsior), Western Cape (EIA and monitoring)
4. Biotherm, Napier, (Matjieskloof), Western Cape (pre-feasibility)
5. Windcurrent SA, Jeffreys Bay, Eastern Cape (2 sites) (EIA and monitoring)
6. Caledon Wind, Caledon, Western Cape (EIA)
7. Innowind (4 sites), Western Cape (EIA)
8. Renewable Energy Systems (RES) Oyster Bay, Eastern Cape (EIA and monitoring)
9. Oelsner Group (Kerriefontein), Western Cape (EIA)
10. Oelsner Group (Langefontein), Western Cape (EIA)
11. InCa Energy, Vredendal Wind Energy Facility Western Cape (EIA)
12. Mainstream Loeriesfontein Wind Energy Facility (EIA and monitoring)
13. Mainstream Noupoort Wind Energy Facility (EIA and monitoring)
14. Biotherm Port Nolloth Wind Energy Facility (Monitoring)
15. Biotherm Laingsburg Wind Energy Facility (EIA and monitoring)
16. Langhoogte Wind Energy Facility (EIA)
17. Vleesbaai Wind Energy Facility (EIA and monitoring)
18. St. Helena Bay Wind Energy Facility (EIA and monitoring)
19. Electrawind, St Helena Bay Wind Energy Facility (EIA and monitoring)
20. Electrawind, Vredendal Wind Energy Facility (EIA)
21. SAGIT, Langhoogte and Wolseley Wind Energy facilities
22. Renosterberg Wind Energy Project – 12 month preconstruction avifaunal monitoring project (2014)
23. De Aar – North (Mulilo) Wind Energy Project – 12 month preconstruction avifaunal monitoring project (2014)

24. De Aar – South (Mulilo) Wind Energy Project – 12 month bird monitoring (2014)
25. Namies – Aggenys Wind Energy Project – 12 month bird monitoring (2014)
26. Pofadder - Wind Energy Project – 12 month bird monitoring (2014)
27. Dwarsrug Loeriesfontein - Wind Energy Project – 12 month bird monitoring (2014)
28. Waaihoek – Utrecht Wind Energy Project – 12 month bird monitoring (2014)
29. Amathole – Butterworth Utrecht Wind Energy Project – 12-month bird monitoring & EIA specialist
30. Phezukomoya and San Kraal Wind Energy Projects 12-month bird monitoring & EIA specialist study (Innowind)
31. Beaufort West Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
32. Leeuwdraai Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mainstream)
33. Sutherland Wind Energy Facility 12-month bird monitoring (Mainstream)
34. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
35. Esizayo Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
36. Humansdorp Wind Energy Facility 12-month bird monitoring & EIA specialist study (Cennergi)
37. Aletta Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
38. Eureka Wind Energy Facility 12-month bird monitoring & EIA specialist study (Biotherm)
39. Makambako Wind Energy Faclity (Tanzania) 12-month bird monitoring & EIA specialist study (Windlab)
40. R355 Wind Energy Facility 12-month bird monitoring (Mainstream)
41. Groenekloof Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)
42. Tsitsikamma Wind Energy Facility 24-months post-construction monitoring (Cennergi)
43. Noupoort Wind Energy Facility 24-months post-construction monitoring (Mainstream)
44. Kokerboom Wind Energy Facility 12-month bird monitoring & EIA specialist study (Business Venture Investments)
45. Kuruman Wind Energy Facility 12-month bird monitoring & EIA specialist study (Mulilo)

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape
4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Veld Solar One Project, Aggeneys, Northern Cape.

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV

14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV
71. Witkop-Silica 132kV

72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV
94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
117. Matla-Glockner 400kV
118. Delmas North 44kV
119. Houwhoek 11kV Refurbishment
120. Clau-Clau 132kV
121. Ngwedi-Silwerkrans 134kV
122. Nieuwehoop 400kV walk-through
123. Booysendal 132kV Switching Station
124. Tarlton 132kV
125. Medupi - Witkop 400kV walk-through
126. Germiston Industries Substation
127. Sekgame 132kV
128. Botswana – South Africa 400kV Transfrontier Interconnector
129. Syferkuil – Rampheri 132kV

130. Queens Substation and associated 132kV powerlines
131. Oranjemond 400kV Transmission line

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

1. Lizard Point Golf Estate
2. Lever Creek Estates
3. Leloko Lifestyle Estates
4. Vaaloewers Residential Development
5. Clearwater Estates Grass Owl Impact Study
6. Sommerset Ext. Grass Owl Study
7. Proposed Three Diamonds Trading Mining Project (Portion 9 and 15 of the Farm Blesbokfontein)
8. N17 Section: Springs To Leandra –"Borrow Pit 12 And Access Road On (Section 9, 6 And 28 Of The Farm Winterhoek 314 Ir)
9. South African Police Services Gauteng Radio Communication System: Portion 136 Of The Farm 528 Jq, Lindley.
10. Report for the proposed upgrade and extension of the Zeekoegat Wastewater Treatment Works, Gauteng.
11. Bird Impact Assessment for Portion 265 (a portion of Portion 163) of the farm Rietfontein 189-JR, Gauteng.
12. Bird Impact Assessment Study for Portions 54 and 55 of the Farm Zwartkop 525 JQ, Gauteng.
13. Bird Impact Assessment Study Portions 8 and 36 of the Farm Nooitgedacht 534 JQ, Gauteng.
14. Shumba's Rest Bird Impact Assessment Study
15. Randfontein Golf Estate Bird Impact Assessment Study
16. Zilkaatsnek Wildlife Estate
17. Regenstein Communications Tower (Namibia)
18. Avifaunal Input into Richards Bay Comparative Risk Assessment Study
19. Maquasa West Open Cast Coal Mine
20. Glen Erasmia Residential Development, Kempton Park, Gauteng
21. Bird Impact Assessment Study, Weltevreden Mine, Mpumalanga
22. Bird Impact Assessment Study, Olifantsvlei Cemetery, Johannesburg
23. Camden Ash Disposal Facility, Mpumalanga
24. Lindley Estate, Lanseria, Gauteng

Professional affiliations

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

APPENDIX 2: BIRD HABITAT

Figure 1: The Esizayo development areas is located in a transitional zone between the Fynbos and Succulent Karoo Biomes.

Figure 2: An artificial impoundment in the study area.

Figure 3: An agricultural field in the study area.

Figure 4: Existing HV lines in the study area.

Figure 5: Exotic trees and a dirt road in the study area.

APPENDIX 3: SPECIES LIST

		Status				Abundance	
Species	Taxonomic name	Global status Red Data	Regional status Red Data	Endemic status SA	Endemic status region	SABAP2 reporting rate % (9 pentad)	SABAP1 reporting rate %
Eagle, Martial	*Polemaetus bellicosus*	VU	EN			4.76	✓ 5.88
Harrier, Black	*Circus maurus*	VU	EN	Near endemic	Endemic	4.76	✓ 11.76
Korhaan, Southern Black	*Afrotis afra*	VU	VU	Endemic	Endemic	0	✓ 9.76
Eagle, Verreaux's	*Aquila verreauxii*	LC	VU			20.63	✓ 9.76
Falcon, Lanner	*Falco biarmicus*	LC	VU			0	0
Korhaan, Karoo	*Eupodotis vigorsii*	LC	NT		Endemic	36.51	✓ 16.67
Stork, Black	*Ciconia nigra*	LC	VU			1.59	✓ 5.88
Bustard, Ludwig's	*Neotis ludwigii*	EN	EN		Near-endemic	9.52	✓ 7.32
Buzzard, Jackal	*Buteo rufofuscus*			Near endemic	Endemic	28.57	✓ 5.88
Buzzard, Steppe	*Buteo vulpinus*					4.76	✓ 17.65
Eagle, Booted	*Aquila pennatus*					3.17	✓ 9.76
Eagle-owl, Spotted	*Bubo africanus*					14.29	✓ 5.88
Francolin, Grey-winged	*Scleroptila africanus*			Endemic (SA, Lesotho, Swaziland)	Endemic	25.4	✓ 4.88
Goshawk, Southern Pale Chanting	*Melierax canorus*				Near-endemic	31.75	✓ 48.78
Kestrel, Lesser	*Falco naumanni*					0	✗ 0.00
Kite, Black-shouldered	*Elanus caeruleus*					4.76	✓ 14.63
Owl, Barn	*Tyto alba*					0	✓ 4.17
Sparrowhawk, Rufous-chested	*Accipiter rufiventris*					3.17	✗ 0.00
Avocet, Pied	*Recurvirostra avosetta*						✓ 4.88
Barbet, Acacia Pied	*Tricholaema leucomelas*				Near-endemic	9.3	✓ 26.83
Batis, Pririt	*Batis pririt*				Near-endemic		✓ 7.32
Bee-eater, European	*Merops apiaster*					16.28	✓ 7.32
Bishop, Southern Red	*Euplectes orix*					2.33	✗ 0.00
Bulbul, Cape	*Pycnonotus capensis*			Endemic	Endemic	16.28	✓ 62.50
Bunting, Cape	*Emberiza capensis*				Near-endemic	79.07	✓ 70.73
Bunting, Lark-like	*Emberiza impetuani*				Near-endemic	16.28	✓ 8.33
Canary, Black-headed	*Serinus alario*			Near endemic	Endemic	32.56	✓ 21.95
Canary, Cape	*Serinus canicollis*				Endemic	11.63	✓ 29.17
Canary, White-throated	*Crithagra albogularis*				Near-endemic	30.23	✓ 43.90
Canary, Yellow	*Crithagra flaviventris*				Near-endemic	72.09	✓ 58.54

		Status				Abundance	
Species	Taxonomic name	Global status Red Data	Regional status Red Data	Endemic status SA	Endemic status region	SABAP2 reporting rate % (9 pentad)	SABAP1 reporting rate %
Chat, Anteating	*Myrmecocichla formicivora*				Endemic	16.28	✓ 17.65
Chat, Familiar	*Cercomela familiaris*					48.84	✓ 31.71
Chat, Karoo	*Cercomela schlegelii*				Near-endemic	48.84	✓ 65.85
Chat, Sickle-winged	*Cercomela sinuata*			Near endemic	Endemic	65.12	✓ 12.20
Cisticola, Grey-backed	*Cisticola subruficapilla*				Near-endemic	58.14	✓ 36.59
Cliff-swallow, South African	*Hirundo spilodera*			Endemic (SA, Lesotho, Swaziland) Breeding	Breeding-endemic		✗ 0.00
Coot, Red-knobbed	*Fulica cristata*					11.63	✓ 5.88
Cormorant, Reed	*Phalacrocorax africanus*					2.33	✓ 4.17
Cormorant, White-breasted	*Phalacrocorax carbo*					2.33	✗ 0.00
Crombec, Long-billed	*Sylvietta rufescens*					9.3	✓ 17.07
Crow, Cape	*Corvus capensis*						✓ 17.65
Crow, Pied	*Corvus albus*					62.79	✓ 29.27
Dove, Laughing	*Streptopelia senegalensis*					20.93	✓ 51.22
Dove, Namaqua	*Oena capensis*					16.28	✓ 4.17
Dove, Red-eyed	*Streptopelia semitorquata*					11.63	✓ 20.83
Dove, Rock	*Columba livia*						✓ 4.17
Duck, African Black	*Anas sparsa*					6.98	✓ 11.76
Duck, Yellow-billed	*Anas undulata*					4.65	✓ 23.53
Egret, Cattle	*Bubulcus ibis*						✓ 4.88
Eremomela, Karoo	*Eremomela gregalis*			Near endemic	Endemic	4.65	✓ 16.67
Eremomela, Yellow-bellied	*Eremomela icteropygialis*					11.63	✓ 7.32
Flycatcher, Fairy	*Stenostira scita*			Near endemic	Endemic	6.98	✓ 12.50
Flycatcher, Fiscal	*Sigelus silens*			Near endemic	Endemic	2.33	✓ 19.51
Flycatcher, Spotted	*Muscicapa striata*						✓ 4.17
Francolin, Grey-winged	*Scleroptila africanus*			Endemic (SA, Lesotho, Swaziland)	Endemic	13.95	✓ 4.88
Goose, Egyptian	*Alopochen aegyptiacus*					55.81	✓ 21.95

		Status				Abundance	
Species	Taxonomic name	Global status Red Data	Regional status Red Data	Endemic status SA	Endemic status region	SABAP2 reporting rate % (9 pentad)	SABAP1 reporting rate %
Goose, Spur-winged	*Plectropterus gambensis*					11.63	✗ 0.00
Grebe, Little	*Tachybaptus ruficollis*					2.33	✗ 0.00
Greenshank, Common	*Tringa nebularia*						✓ 5.88
Guineafowl, Helmeted	*Numida meleagris*					20.93	✓ 5.88
Heron, Black-headed	*Ardea melanocephala*					2.33	✓ 7.32
Heron, Grey	*Ardea cinerea*					6.98	✓ 11.76
Honeyguide, Lesser	*Indicator minor*					2.33	✗ 0.00
Hoopoe, African	*Upupa africana*						✓ 4.88
Ibis, African Sacred	*Threskiornis aethiopicus*					11.63	✓ 11.76
Ibis, Hadeda	*Bostrychia hagedash*					39.53	✓ 17.65
Kestrel, Rock	*Falco rupicolus*					46.51	✓ 51.22
Kite, Yellow-billed	*Milvus aegyptius*						✓ 4.17
Lapwing, Blacksmith	*Vanellus armatus*					23.26	✓ 24.39
Lapwing, Crowned	*Vanellus coronatus*					13.95	✓ 7.32
Lark, Cape Clapper	*Mirafra apiata*			Near endemic	Endemic	18.6	✓ 11.76
Lark, Karoo	*Calendulauda albescens*			Near endemic	Endemic	13.95	✓ 7.32
Lark, Karoo Long-billed	*Certhilauda subcoronata*				Endemic	53.49	✓ 12.20
Lark, Large-billed	*Galerida magnirostris*			Near endemic	Endemic	48.84	✓ 26.83
Lark, Red-capped	*Calandrella cinerea*					34.88	✓ 9.76
Lark, Spike-heeled	*Chersomanes albofasciata*				Near-endemic	6.98	✓ 23.53
Martin, Brown-throated	*Riparia paludicola*					2.33	✓ 14.63
Martin, Rock	*Hirundo fuligula*					53.49	✓ 58.54
Masked-weaver, Southern	*Ploceus velatus*					32.56	✓ 46.34
Mousebird, Red-faced	*Urocolius indicus*					4.65	✓ 8.33
Mousebird, Speckled	*Colius striatus*						✓ 4.17
Mousebird, White-backed	*Colius colius*				Endemic	25.58	✓ 51.22
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*						✗ 0.00
Penduline-tit, Cape	*Anthoscopus minutus*				Near-endemic	16.28	✓ 16.67
Pigeon, Speckled	*Columba guinea*					51.16	✓ 43.90

		Status				Abundance	
Species	Taxonomic name	Global status Red Data	Regional status Red Data	Endemic status SA	Endemic status region	SABAP2 reporting rate % (9 pentad)	SABAP1 reporting rate %
Pipit, African	*Anthus cinnamomeus*					18.6	✓ 9.76
Pipit, Long-billed	*Anthus similis*					9.3	✓ 5.88
Plover, Kittlitz's	*Charadrius pecuarius*					2.33	✗ 0.00
Plover, Three-banded	*Charadrius tricollaris*					20.93	✓ 19.51
Prinia, Karoo	*Prinia maculosa*			Near endemic	Endemic	58.14	✓ 58.54
Raven, White-necked	*Corvus albicollis*					55.81	✓ 24.39
Robin-chat, Cape	*Cossypha caffra*					27.91	✓ 34.15
Sandgrouse, Namaqua	*Pterocles namaqua*				Near-endemic	34.88	✓ 9.76
Sandpiper, Wood	*Tringa glareola*						✓ 5.88
Scrub-robin, Karoo	*Cercotrichas coryphoeus*				Endemic	62.79	✓ 53.66
Seedeater, Streaky-headed	*Crithagra gularis*						✓ 4.17
Shelduck, South African	*Tadorna cana*				Endemic	46.51	✓ 29.27
Sparrow, Cape	*Passer melanurus*				Near-endemic	60.47	✓ 80.49
Sparrow, House	*Passer domesticus*					27.91	✓ 51.22
Sparrow, Southern Grey-headed	*Passer diffusus*					4.65	✗ 0.00
Sparrowhawk, Rufous-chested	*Accipiter rufiventris*					4.65	✗ 0.00
Sparrowlark, Grey-backed	*Eremopterix verticalis*				Near-endemic	2.33	✗ 0.00
Spoonbill, African	*Platalea alba*					2.33	✓ 17.65
Spurfowl, Cape	*Pternistis capensis*			Near endemic	Endemic	27.91	✓ 17.07
Starling, Common	*Sturnus vulgaris*					25.58	✓ 45.83
Starling, Pale-winged	*Onychognathus nabouroup*				Near-endemic	4.65	✓ 17.07
Starling, Pied	*Spreo bicolor*			Endemic (SA, Lesotho, Swaziland)	Endemic	72.09	✓ 68.29
Starling, Red-winged	*Onychognathus morio*					2.33	✓ 37.50
Starling, Wattled	*Creatophora cinerea*					2.33	✓ 5.88
Stilt, Black-winged	*Himantopus himantopus*					2.33	✗ 0.00
Sunbird, Malachite	*Nectarinia famosa*					13.95	✓ 31.71
Sunbird, Southern Double-collared	*Cinnyris chalybeus*			Near endemic	Endemic	23.26	✓ 26.83
Swallow, Barn	*Hirundo rustica*					27.91	✓ 12.20

		Status				Abundance	
Species	Taxonomic name	Global status Red Data	Regional status Red Data	Endemic status SA	Endemic status region	SABAP2 reporting rate % (9 pentad)	SABAP1 reporting rate %
Swallow, Greater Striped	*Hirundo cucullata*					37.21	✓ 12.20
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*					2.33	✗ 0.00
Swift, African Black	*Apus barbatus*						✓ 4.88
Swift, Alpine	*Tachymarptis melba*					11.63	✓ 9.76
Swift, Common	*Apus apus*						✓ 5.88
Swift, Little	*Apus affinis*					20.93	✓ 29.17
Swift, White-rumped	*Apus caffer*					27.91	✓ 5.88
Teal, Cape	*Anas capensis*						✓ 5.88
Thick-knee, Spotted	*Burhinus capensis*					2.33	✓ 4.17
Thrush, Karoo	*Turdus smithi*			Near endemic	Endemic	9.3	✓ 50.00
Thrush, Olive	*Turdus olivaceus*					4.65	✓ 50.00
Tit, Grey	*Parus afer*			Near endemic	Endemic	20.93	✓ 24.39
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*				Near-endemic	2.33	✓ 14.63
Tit-babbler, Layard's	*Parisoma layardi*			Near endemic	Endemic	18.6	✓ 9.76
Turtle-dove, Cape	*Streptopelia capicola*					46.51	✓ 48.78
Wagtail, Cape	*Motacilla capensis*					55.81	✓ 70.73
Warbler, Namaqua	*Phragmacia substriata*			Near endemic	Endemic	6.98	✓ 14.63
Warbler, Rufous-eared	*Malcorus pectoralis*				Endemic	20.93	✓ 24.39
Waxbill, Common	*Estrilda astrild*					13.95	✓ 21.95
Weaver, Cape	*Ploceus capensis*			Near endemic	Endemic	39.53	✓ 19.51
Wheatear, Capped	*Oenanthe pileata*					2.33	✓ 11.76
Wheatear, Mountain	*Oenanthe monticola*				Near-endemic	51.16	✓ 29.27
White-eye, Cape	*Zosterops virens*			Near endemic	Endemic	2.33	✓ 37.50
White-eye, Orange River	*Zosterops pallidus*				Endemic		✓ 37.50
Woodpecker, Ground	*Geocolaptes olivaceus*			Endemic (SA, Lesotho, Swaziland)	Endemic	2.33	✓ 5.88
Snake-Eagle, Black-chested	*Circaetus pectoralis*					0	0
Bokmakierie	*Telophorus zeylonus*					88.37	✓ 56.10
Fiscal, Common (Southern)	*Lanius collaris*					51.16	✓ 73.17
Hamerkop	*Scopus umbretta*					6.98	✗ 0.00

APPENDIX 4: RENEWABLE ENERGY APPLICATIONS WITHIN A 70KM RADIUS

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
Proposed 280 MW Gunstfontein Wind Energy Project	14/12/16/3/3/2/395	S&EIR	Networx Eolos Renewables (Pty) Ltd	12 000	280 MW				L	L		L		L	L				Pre-construction monitoring Delineation of suitable buffer zones Post-construction monitoring
Proposed development of renewable energy facility at 3 x Sutherland wind farm sites, Western and Northern Cape.	12/12/20/1782/AM1	S&EIR	Mainstream Power Sutherland	28 600	811 MW					M		M		M					Delineation of no-go zones and pre-construction monitoring. On-site demarcation of 'no-go'

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			areas identified during pre-construction monitoring must be undertaken to minimise disturbance impacts associated with the construction of the facility. Schedule maintenance activities to avoid disturbances in sensitive areas (identified through

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			operational monitoring). Carefully monitoring the local avifauna pre- and post-construction monitoring must be undertaken. Excluding development from within 500 m of the edge of the escarpment along its entire length through the development area to reduce

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			collision risk, primarily for slope soaring raptors.
Proposed Hidden Valley Wind Energy Facility, Northern Cape	12/12/20/2370/2	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	9 530	150 MW				M	M		M			L				Implement exclusion zones In high sensitivity zones Implement post-construction monitoring Curtailment of turbines if need be Nest searches

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			Control of staff and equipment to prevent disturbance
Proposed Hidden Valley wind energy facility , Northern Cape	12/12/20/2370/3	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	9 180	150 MW				M	M		M			L				Implement exclusion zones In high sensitivity zones Implement post-construction monitoring Curtailment of turbines if need be Nest searches Control of staff and

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			equipment to prevent disturbance
Proposed Hidden Valley wind energy facility , Northern Cape	12/12/20/2370/1	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd	16 620	150MW				M	M		M			L				Implement exclusion zones In high sensitivity zones Implement post-construction monitoring Curtailment of turbines if need be Nest searches Control of staff and equipment

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			to prevent disturbance
Proposed Hidden Valley wind energy facility, Northern Cape	12/12/20/2370	S&EIR	Hidden Valley Wind- African Clean Energy Developments (Pty) Ltd		650 MW				M	M		M			L				Implement exclusion zones In high sensitivity zones Implement post-construction monitoring Curtailment of turbines if need be Nest searches Control of staff and equipment

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			to prevent disturbance
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	12/12/20/1988/1/AM1	Amendment	G7 Renerable Energies (Pty) Ltd	26 529	140 MW				L	L		L	L	L	M				Maintain 1.3km buffer zones around Verreaux's Eagle nests Perform a pre-construction walk-through on the 132kV grid connection.

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
Proposed Photovoltaic (PV) Solar Energy Facility On A Site South Of Sutherland, Within The Karoo Hoogland Municipality Of The Namakwa District Municipality, Northern Cape Province	12/12/20/2235	BAR	Inca Komsberg Wind (Pty) Ltd	2 859	10 MW							M			L				Install visibility “flappers” on all new power lines that are associated with the solar energy facility in order to reduce bird collisions with the power lines. Implement existing Eskom standards for this mitigation. Install “safe” perch or nesting sites at or around the live

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
																			electric sites on power line pylons so that large perching birds like eagles will not be electrocuted when perching or nesting on these parts of the pylons.
Proposed establishment of the Suurplaat wind energy facility and associated infrastructure on a site near Sutherland,	12/12/20/1583	S&EIR	Moyeng Energy (Pty) Ltd	28 600	120 MW														Could not be sourced

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
Western Cape and Northern Cape.																			
Proposed establishment of the Witberg Bay wind energy facility, Laingsburg Local Municipality, Central Karoo District, Western cape	12/12/20/1966/A2	Amendment	Witberg Wind Power (Pty) Ltd	23 777	Unknown														Could not be sourced
Proposed Wind Energy facility at Konstabel	12/12/20/1787	S&EIR	South Africa Mainstream Renewable Power Development	5 129	170 MW														Could not be sourced
Proposed development of a renewable Energy	12/12/20/1783/2/AM1	Amendment	South Africa Mainstream Renewable	6 347	Unknown														Could not be sourced

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
facility at Perdekraal, Western Cape - Split 1			Power Development																
Proposed Touwsrivier Solar energy facility	12/12/20/1956	S&EIR	Unknown	215	36 MW			L	M	L		L					M		The security fence should be adequately marked and the entire length of the 132 kV transmission line should be marked with bird “flappers” or diverters to make it visible.
Proposed development of renewable energy facility at Komsberg East and	?	S&EIR	Komsberg Wind Farms (Pty) Ltd	25 600	550 MW				L	L		M	L	L	L				Implement exclusion zones in high sensitivity areas

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
West near Sutherland																			Implement operational phase monitoring Use bird-friendly powerline designs Mark powerlines with BFDs Implement construction phase monitoring of raptor nests
				Total Ha	**Total MW**														
				193 986	3 217 MW														

Proposed Development Name	DEA Reference	Current EA Status	Proponent	Extent	Proposed Capacity	Farms	Impacts												Proposed Mitigation Measures
							Construction				Operation					Decommissioning			
							Overall	Collision	Displacement	Habitat loss	Overall	Collision	Displacement	Habitat loss	Electrocution	Overall	Displacement		
Significance Totals per impact	Significance Rating							**Total Hectares per impact**											
	High Significance																		
	Medium Significance								35 545	63 930		63 932		28 600	26 529		215		
	Low Significance							215	38 529	38 744		38 744	26 529	38 529	47 332				
	Positive Impacts																		

APPENDIX 5: IMPACT TABLES

Attached as a separate spreadsheet

BioTherm Energy - Esizayo Powerline

Avifauna

Significance Rating Table

Construction Phase

Komsberg Connection - Substation 1 Powerline Alternative 1

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	6	3	27	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Construction activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	2	14	Low		Medium

Komsberg Connection - Substation 1 Powerline Alternative 2

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	8	3	33	Medium	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Construction activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	2	14	Low		Medium

Komsberg Connection - Substation 2 Powerline Alternative 1

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	6	3	27	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Construction activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	2	14	Low		Medium

Komsberg Connection - Substation 2 Powerline Alternative 2

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	8	4	44	Medium	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Construction activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	3	21	Low		Medium

Powerline - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
The no-go option will result in no additional impacts on avifauna and will maintain the current ecological integrity	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
Substation Alternative 1									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the substation	Nature of impact:	Negative							
	Without Mitigation	1	1	4	3	18	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Construction activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	1	1	2	3	12	Low		Medium
Substation Alternative 2									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the construction of the substation	Nature of impact:	Negative							
	Without Mitigation	1	1	4	3	18	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Construction activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	1	1	2	3	12	Low		Medium
Substation - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
The no-go option will result in no additional impacts on avifauna and will maintain the current ecological integrity	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Esizayo Powerline

Avifauna

Significance Rating Table

Operational Phase

Komsberg Connection - Substation 1 Powerline Alternative 1

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Collisions of Red Data avifauna with the earthwire of the proposed 132kV powerlines	Nature of impact:	Negative							
	Without Mitigation	3	4	10	4	68	High	-	Medium
	degree to which impact can be reversed:	Low							Medium
	degree of impact on irreplaceable resources:	High							Medium
	Mitigation Measures	• A walk-through must be conducted by the avifaunal specialist after final pole positions have been determined, to demarcate sections of line that will need to be mitigated with Bird Flight Diverters (BFDs).							Medium
	With Mitigation	3	4	10	3	51	Medium		Medium
Electrocution of Red Data avifauna	Nature of impact:	Negative							
	Without Mitigation	3	4	0	1	7	Low		High
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	No mitigation is required due to the low risk of electrocution posed by the steel monopole double circuit structures							High
	With Mitigation	3	4	0	1	7	Low		High

Komsberg Connection - Substation 1 Powerline Alternative 2

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Collisions with the earthwire of the proposed 132kV powerlines	Nature of impact:	Negative							
	Without Mitigation	3	4	10	2	34	Medium	-	Medium
	degree to which impact can be reversed:	Low							Medium
	degree of impact on irreplaceable resources:	High							Medium
	Mitigation Measures	• A walk-through must be conducted by the avifaunal specialist after final pole positions have been determined, to demarcate sections of line that will need to be mitigated with Bird Flight Diverters (BFDs).							Medium
	With Mitigation	3	4	10	1	17	Low		Medium
Electrocution of Red Data avifauna	Nature of impact:	Negative							
	Without Mitigation	3	4	0	1	7	Low		High
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	No mitigation is required due to the low risk of electrocution posed by the steel monopole double circuit structures							High
	With Mitigation	3	4	0	1	7	Low		High

Komsberg Connection - Substation 2 Powerline Alternative 1

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Collisions with the earthwire of the proposed 132kV powerlines	Nature of impact:	Negative							
	Without Mitigation	3	4	10	4	68	High	-	Medium
	degree to which impact can be reversed:	Low							Medium
	degree of impact on irreplaceable resources:	High							Medium
	Mitigation Measures	• A walk-through must be conducted by the avifaunal specialist after final pole positions have been determined, to demarcate sections of line that will need to be mitigated with Bird Flight Diverters (BFDs).							Medium
	With Mitigation	3	4	10	3	51	Medium		Medium

Electrocution of Red Data avifauna	Nature of impact:	Negative							
	Without Mitigation	3	4	0	1	7	Low		High
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	No mitigation is required due to the low risk of electrocution posed by the steel monopole double circuit structures							High
	With Mitigation	3	4	0	1	7	Low		High
Komsberg Connection - Substation 2 Powerline Alternative 2									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Collisions with the earthwire of the proposed 132kV powerlines	Nature of impact:	Negative							
	Without Mitigation	3	4	10	3	51	Medium	-	Medium
	degree to which impact can be reversed:	Low							Medium
	degree of impact on irreplaceable resources:	High							Medium
	Mitigation Measures	• A walk-through must be conducted by the avifaunal specialist after final pole positions have been determined, to demarcate sections of line that will need to be mitigated with Bird Flight Diverters (BFDs).							Medium
	With Mitigation	3	4	10	2	34	Medium		Medium
Electrocution of Red Data avifauna	Nature of impact:	Negative							
	Without Mitigation	3	4	0	1	7	Low		High
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	No mitigation is required due to the low risk of electrocution posed by the steel monopole double circuit structures							High
	With Mitigation	3	4	0	1	7	Low		High
Powerline - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
The no-go option will result in no additional impacts on avifauna and will maintain the current ecological integrity	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
Substation Alternative 1									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Electrocution of Red Data avifauna in the substation yard	Nature of impact:	Negative							
	Without Mitigation	3	4	0	1	7	Low		High
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	The hardware within the substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation be applied							High
	With Mitigation	3	4	0	1	7	Low		High
Substation Alternative 2									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Electrocution of Red Data avifauna in the substation yard	Nature of impact:	Negative							
	Without Mitigation	3	4	0	1	7	Low		High
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	The hardware within the substation yard is too complex to warrant any mitigation for electrocution at this stage. It is recommended that if on-going impacts are recorded once operational, site specific mitigation be applied							High
	With Mitigation	3	4	0	1	7	Low		High
Substation - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
	Nature of impact:								

The no-go option will result in no additional impacts on avifauna and will maintain the current ecological integrity	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Esizayo Powerline

Avifauna

Significance Rating Table

Decommissioning Phase

Komsberg Connection - Substation 1 Powerline Alternative 1

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement due to habitat destruction and disturbance associated with the de-commissioning of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	6	3	27	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	2	14	Low		Medium

Komsberg Connection - Substation 1 Powerline Alternative 2

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement due to habitat destruction and disturbance associated with the de-commissioning of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	6	3	27	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	2	14	Low		Medium

Komsberg Connection - Substation 2 Powerline Alternative 1

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement due to habitat destruction and disturbance associated with the de-commissioning of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	6	3	27	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	2	14	Low		Medium

Komsberg Connection - Substation 2 Powerline Alternative 2

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement due to habitat destruction and disturbance associated with the de-commissioning of the powerlines	Nature of impact:	Negative							
	Without Mitigation	2	1	6	3	27	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	2	1	4	2	14	Low		Medium

Powerline - No-Go

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
The no-go option will result in no additional impacts on avifauna and will maintain the current ecological integrity	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

Substation Alternative 1

Potential Impact		Extent	Duration	Magnitude	Probability	Significance		Status	Confidence

Potential Impact		(E)	(D)	(M)	(P)	(S=(E+D+M)*P)		(+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the decomissioning of the substation	Nature of impact:	Negative							
	Without Mitigation	1	1	4	3	18	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Decomissioning activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	1	1	2	3	12	Low		Medium
Substation Alternative 2									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the decomissioning of the substation	Nature of impact:	Negative							
	Without Mitigation	1	1	4	3	18	Low	-	Medium
	degree to which impact can be reversed:	High							High
	degree of impact on irreplaceable resources:	Low							High
	Mitigation Measures	• Decomissioning activity should be restricted to the immediate footprint of the infrastructure.							
	With Mitigation	1	1	2	3	12	Low		Medium
Substation - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Displacement of Red Data avifauna due to habitat destruction and disturbance associated with the decomissioning of the substation	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								

BioTherm Energy - Esizayo Powerline

Avifauna

Significance Rating Table

Cumulative Impacts									
Komsberg Connection - Substation 1 Powerline Alternative 1									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Habitat destruction and disturbance, collisions, electrocutions	Nature of impact:	Negative							
	Without Mitigation	3	4	4	2	22	Low	-	Medium
	degree to which impact can be reversed:	Medium							
	degree of impact on irreplaceable resources:	Medium							
	Mitigation Measures	Strict implementation of site-specific mitigation. Strict monitoring of total number of authorised renewable applications to ensure that populations of Red Data avifauna can absorb the impacts.							
	With Mitigation	3	4	4	1	11	Low		Medium
Komsberg Connection - Substation 1 Powerline Alternative 2									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Habitat destruction and disturbance, collisions, electrocutions	Nature of impact:	Negative							
	Without Mitigation	3	4	4	2	22	Low	-	Medium
	degree to which impact can be reversed:	Medium							
	degree of impact on irreplaceable resources:	Medium							
	Mitigation Measures	Strict implementation of site-specific mitigation. Strict monitoring of total number of authorised renewable applications to ensure that populations of Red Data avifauna can absorb the impacts.							
	With Mitigation	3	4	4	1	11	Low		Medium
Komsberg Connection - Substation 2 Powerline Alternative 1									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Habitat destruction and disturbance, collisions, electrocutions	Nature of impact:	Negative							
	Without Mitigation	3	4	4	2	22	Low	-	Medium
	degree to which impact can be reversed:	Medium							
	degree of impact on irreplaceable resources:	Medium							
	Mitigation Measures	Strict implementation of site-specific mitigation. Strict monitoring of total number of authorised renewable applications to ensure that populations of Red Data avifauna can absorb the impacts.							
	With Mitigation	3	4	4	1	11	Low		Medium
Komsberg Connection - Substation 2 Powerline Alternative 2									
Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Habitat destruction and disturbance, collisions, electrocutions	Nature of impact:	Negative							
	Without Mitigation	3	4	4	2	22	Low	-	Medium
	degree to which impact can be reversed:	Medium							
	degree of impact on irreplaceable resources:	Medium							
	Mitigation Measures	Strict implementation of site-specific mitigation. Strict monitoring of total number of authorised renewable applications to ensure that populations of Red Data avifauna can absorb the impacts.							
	With Mitigation	3	4	4	1	11	Low		Medium
Powerline - No-Go									
Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
The no-go option will result in no additional impacts on avifauna and will maintain the current ecological integrity	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								
Substation Alternative 1									
Potential Impact		Extent	Duration	Magnitude	Probability	Significance		Status	Confidence

Potential Impact		(E)	(D)	(M)	(P)	(S=(E+D+M)*P)		(+ve or -ve)	Confidence
Habitat destruction and disturbance, electrocutions	Nature of impact:								
	Without Mitigation	3	4	4	1	11	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Strict implementation of site-specific mitigation. Strict monitoring of total number of authorised renewable applications to ensure that populations of Red Data avifauna can absorb the impacts.							
	With Mitigation	3	4	2	1	9	Low	-	Medium

Substation Alternative 2

Potential Impact		Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
Habitat destruction and disturbance, electrocutions	Nature of impact:								
	Without Mitigation	3	4	4	1	11	Low	-	Medium
	degree to which impact can be reversed:	High							
	degree of impact on irreplaceable resources:	Low							
	Mitigation Measures	Strict implementation of site-specific mitigation. Strict monitoring of total number of authorised renewable applications to ensure that populations of Red Data avifauna can absorb the impacts.							
	With Mitigation	3	4	2	1	9	Low	-	Medium

Substation - No-Go

Potential Impact	Mitigation	Extent (E)	Duration (D)	Magnitude (M)	Probability (P)	Significance (S=(E+D+M)*P)		Status (+ve or -ve)	Confidence
The no-go option will result in no additional impacts on avifauna and will maintain the current ecological integrity	Nature of impact:								
	Without Mitigation								
	degree to which impact can be reversed:								
	degree of impact on irreplaceable resources:								
	Mitigation Measures								
	With Mitigation								