Mulilo Struisbult PV2 Grid Connection

Basic Assessment

Avifaunal Impact Assessment

February 2022

Prepared by:
WildSkies Ecological Services (Pty) Ltd
Jon Smallie
jon@wildskies.co.za

Submitted to:
EIMS
GP Kriel
gp@eims.co.za

Executive summary

Mulilo Renewable Project Developments (Pty) Ltd (Mulilo) is in the process of preparing Struisbult PV2 solar facility for a private off-taker. One of the Eskom conditions received for connecting the project to the grid is to build an additional 8.8 km 132 kV line between Kronos and Cuprum substations. The Applicant proposes construction of the required 132 kV line alongside an existing power line servitude with associated grid connection infrastructure as follows:

- An access road to the Struisbult PV2 On-Site Substation;
    - The On-site Substation consists of a 132 kV Switching Station (assessed here) back-to-back with the IPP substation
- An approximately 1 km 132kV Loop-In Loop-Out line (LILO);
- 132 kV Feeder Bay at both Cuprum and Kronos Substations; and
- An approximately 8.8 km 132 KV Transmission Line along the existing Kronos-Cuprum Transmission Line.

The second Southern African Bird Atlas Project (www.sabap2.adu.org.za) recorded a combined total of approximately 130 bird species in the four pentads (a pentad is approximately 9 x 9km) within which the proposed project is located. These are the species which could occur on the proposed site if conditions are right, but they have not all necessarily been confirmed on the site. Included amongst these 130 species are a number of regionally and globally Red Listed bird species and a number of endemics. These species are the priority bird species for this assessment and are presented in this report. These include: Ludwig's Bustard and Martial Eagle (both regionally Endangered); Verreaux's Eagle, Lanner Falcon, Burchell's Courser, and Secretarybird (all regionally Vulnerable); and Karoo Korhaan, Abdim's Stork, Sclater's Lark and Kori Bustard (all regionally Near-threatened).

Based on the formal methodology supplied by EIMS, we have rated the potential impacts on avifauna as follows:

- Disturbance of birds during the construction phase will be of Low negative significance post mitigation.
- Destruction of bird habitat during the construction phase will be of Medium negative significance post mitigation.
- Collision of birds with overhead cables on the power lines will be of Low negative significance post mitigation.
- Electrocution of birds on the pylons of the power lines will be of Low negative significance.

The mitigation measures to be implemented are as follows:

- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.
- The overhead cables (specifically the earth wires) on both power lines should be fitted with an approved anti bird collision line marking device to make the cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw et al, 2021). The line marking device should be a dynamic (moving – bird flapper type) device.
- The new power line should be patrolled during operation by Eskom annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices.
- Where multiple devices on a span have failed (broken off or become stuck and non-dynamic due to wind) they should be replaced immediately.
- It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware.
- It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structure and design mitigation. Any recorded bird fatality data should be submitted to the Eskom –EWT Strategic Partnership where it will be curated and publicly accessible.

If these mitigation measures are implemented correctly, we believe that the impacts of the proposed project will be at an acceptable level and we recommend the proposed project be authorised to proceed.

Table of Contents

List of Figures

List of Tables

1. Introduction

Mulilo Renewable Project Developments (Pty) Ltd (Mulilo) is in the process of preparing Struisbult PV2 solar facility for a private off-taker. One of the Eskom conditions received for connecting the project to the grid is to build an additional 8.8 km 132 kV line between Kronos and Cuprum substations. The Applicant proposes construction of the required 132 kV line alongside an existing power line servitude with associated grid connection infrastructure as follows:

- An access road to the Struisbult PV2 On-Site Substation;
    - The On-site Substation consists of a 132 kV Switching Station (assessed here) back-to-back with the IPP substation
- An approximately 1 km 132kV Loop-In Loop-Out line (LILO);
- 132 kV Feeder Bay at both Cuprum and Kronos Substations; and
- An approximately 8.8 km 132 KV Transmission Line along the existing Kronos-Cuprum Transmission Line.

In terms of the EIA Regulations, 2014 (as amended), various aspects of the proposed development may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. One (1) application for EA for the proposed development will be submitted to the DFFE, in the form of a BA process, in terms of the EIA Regulations, 2014 (as amended).

Mulilo has appointed EIMS to conduct the necessary Basic Assessment (BA) Process. The project has the potential to impact on avifauna and so WildSkies Ecological Services Pty Ltd (“WildSkies”) was appointed by EIMS to conduct an avifaunal impact assessment.

Figure 1 shows the layout of the proposed activities.

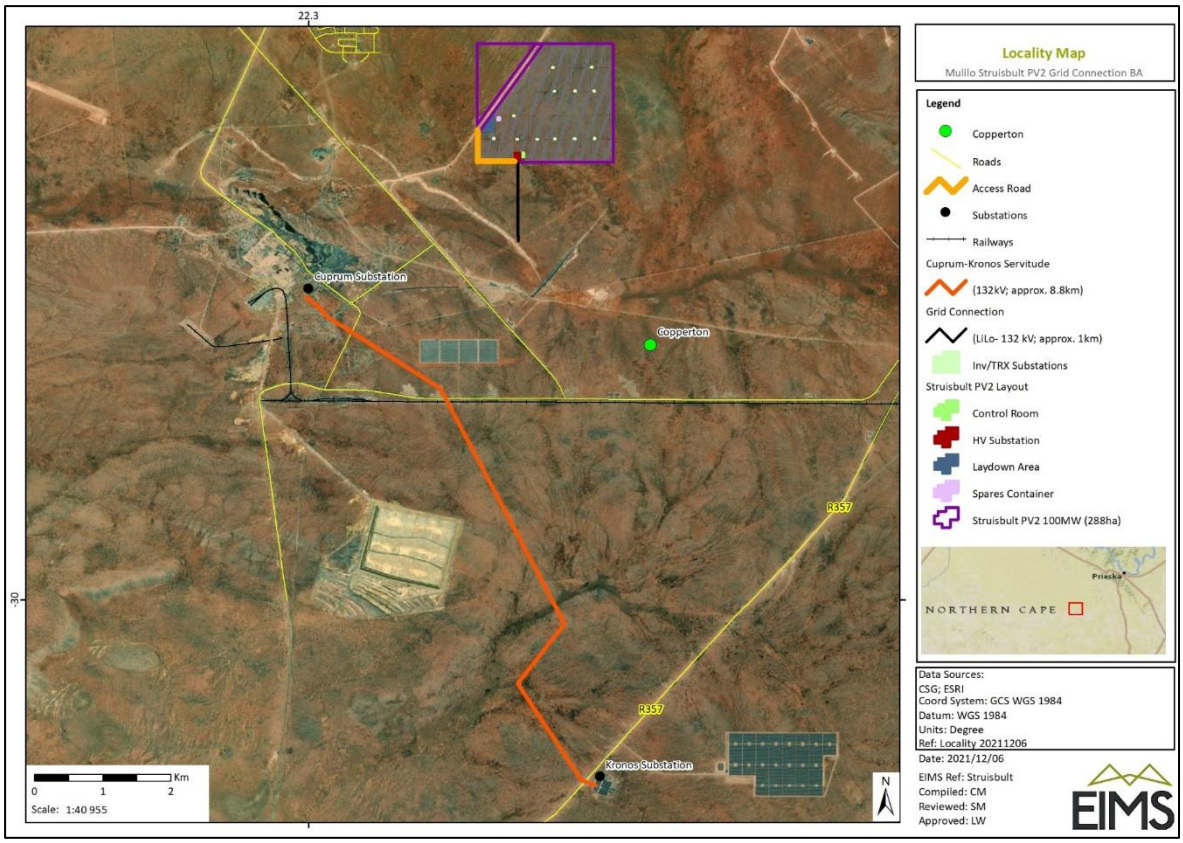


Figure 1. The locality map (supplied by EIMS).

2. Document Structure

This report has been compiled in accordance with the EIA Regulations, 2014 (Government Notice (GN) R982). A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 1 below.

Table 1. Summary of report structure in compliance with above legislation.

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 3, Appendix 2
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 1
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 4
(cA) an indication of the quality and age of base data used for the specialist report;	Section 7 & 8

(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 7
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 7
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7
g) an identification of any areas to be avoided, including buffers;	Section 9
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 9
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 13
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Section 12
k) any mitigation measures for inclusion in the EMPr;	Section 11
l) any conditions for inclusion in the environmental authorisation;	Section 11
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 11
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 12
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 7
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	7
q) any other information requested by the competent authority.	n/a
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n/a

3. Specialist details

The avifaunal specialist, Jon Smallie completed a BSC WILDLIFE SCIENCE (Hons) at the University of KwaZulu-Natal-Pietermaritzburg in 1998, and an MSC ENVIRONMENTAL SCIENCE at University of Witwatersrand in 2011. He has 20 years of experience working on bird conservation and impact assessment, in particular the interaction between birds and power lines. This includes 4 years managing the Eskom-Endangered Wildlife Trust Strategic Partnership. He is SACNASP registered (# 400020/06).

A full *curriculum vitae* can be seen in Appendix 2.

4. Terms of reference

The appointed specialist is required to conduct an Avifauna (bird) Impact Assessment on the proposed project, as set out below:

- Avifaunal Impact Assessment (including marking and recording of affected protected and other avifaunal features);
- Input into the Site Sensitivity Verification Process;
- Impact rating (as per EIMS methodology);
- Recommended Mitigation measures and rehabilitation measures where required for inclusion in the Environmental Management Programme;
- Provision of GIS information for the features identified, clearly indicating feature sensitivity.

5. Project description

The proposed project consists of the following:

- An access road to the Struisbult PV2 On-Site Substation;
    - The On-site Substation consists of a 132 kV Switching Station (assessed here) back-to-back with the IPP substation
- An approximately 1 km 132kV Loop-In Loop-Out line (LILO);
- 132 kV Feeder Bay at both Cuprum and Kronos Substations; and

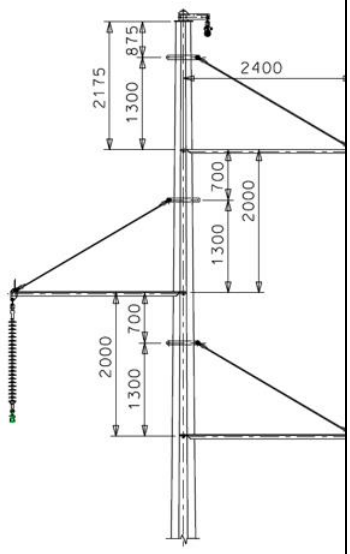
- An approximately 8.8 kilometre 132 KV Transmission Line along the existing Kronos-Cuprum Transmission Line.

The proposed project site is within the following properties: Farm Vogelstruisbult 104, Farm Klipgats Pan 117 and Farm Hoekplaas 146 near Copperton, Siyathemba Local Municipality, Northern Cape.

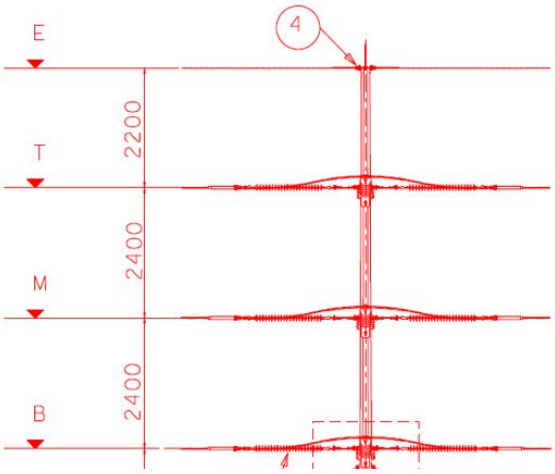
- The access road to the Struisbult PV2 Substation has the following coordinates:
  - Start: 29°56'16.91"S and 22°19'20.32"E;
  - Middle: 29°56'31.73"S and 22°19'20.36"E; and
  - End: 29°56'31.76"S and 22°19'37.80"E.
- The LILO Line has the following coordinates:
  - Start: 29°56'31.94"S and 22°19'38.99"E;
  - Middle: 29°56'49.14"S and 22°19'39.43"E; and
  - End: 29°57'9.54"S and 22°19'39.64"E.
- The new 132 KV Transmission Line has the following coordinates:
  - Start: 30°01'25.43"S and 22°20'17.36"E;
  - Middle: 29°59'24.65"S and 22°19'39.06"E; and
  - End: 29°57'33.45"S and 22°18'02.27"E.
- Both lines will be a 'single circuit twin Tern'
- The pylon structures will be: D-DT-7649 (Rev C) for intermediate structures (which will make up the majority of pylons; D-DT-7645 (Freestanding) for the in line strainers; and D-DT-7645 (Freestanding) for the large bends.

Minimum phase-phase and phase-earth clearances for the above structures will be 2.4 metres.

Figure 2 shows these structures.



24m Masts, 37 kN



16m, 6000 kNM
16m; 3000 kNM

Figure 2. Pylon structures.

6. Legislative & Policy Framework

The legislation and guidelines relevant to this specialist field and development include the following:

The Convention on Biological Diversity (CBD): dedicated to promoting sustainable development. The Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. It is an international convention signed by 150 leaders at the Rio 1992 Earth Summit. South Africa is a signatory to this convention and should therefore abide by its' principles.

An important principle encompassed by the CBD is the precautionary principle which essentially states that where serious threats to the environment exist, lack of full scientific certainty should not be used a reason for delaying management of these risks. The burden of proof that the impact will not occur lies with the proponent of the activity posing the threat.

The Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention): aims to conserve terrestrial, aquatic and avian migratory species throughout their range. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. Since the Convention's entry into force, its membership has grown steadily to include 117 (as of 1 June 2012) Parties from Africa, Central and South America, Asia, Europe and Oceania. South Africa is a signatory to this convention.

The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA): is the largest of its kind developed so far under the CMS. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle, including many species of divers, grebes, pelicans, cormorants, herons, storks, rails, ibises, spoonbills, flamingos, ducks, swans, geese, cranes, waders, gulls, terns, tropic birds, auks, frigate birds and even the South African penguin. The agreement covers 119 countries and the European Union (EU) from Europe, parts of Asia and Canada, the Middle East and Africa.

The National Environmental Management – Biodiversity Act - Threatened or Protected Species list (TOPS).

The National Environmental Management Act, No. 107 of 1998 (NEMA as amended): An Environmental Authorisation is required for Listed Activities in Regulations pursuant to NEMA The

avifaunal assessment feeds into the Scoping and EIA process to inform whether the project can proceed or not.

7. Methodology

7.1. General approach

In predicting the interactions between the proposed development and birds, a combination of science, field experience and common sense is required. More specifically the methodology used to predict impacts in the current study was as follows:

- The various avifaunal data sets listed below and the micro habitats within the study area were examined to determine the likelihood of these relevant species occurring on or near the site, and the importance of the study area for these species.
- The grid connection site was surveyed by driving and walking as much as possible of the route. During this field work the following was conducted:
    - Identification of micro habitats/land use on site
        - Representative photographs were taken of available micro habitats (e.g. dams, wetlands, crops, etc.);
        - Identification of any sensitive receptors e.g. wetlands, roosts, raptor nests etc.; and
        - Identification of any constraints to power line routing. For example wetlands and dams that could be avoided with slight route amendment.
- Field survey work was done in January 2022. This qualifies as peak summer, which is a good time to sample this type of avifaunal community. Extensive rain had also fallen in the area prior to field work, meaning that food availability and avifaunal abundance was at a peak. The timing of the field survey is therefore acceptable.
- A list of priority bird species was determined for this assessment.
- The potential impacts of the proposed project on these above species and habitats were described and evaluated.
- Recommendations were made for the management and mitigation of impacts.

In simple terms, this study assesses which bird species could occur on site, how important they are, how important the site is for them, how the project will affect them, and how to mitigate these effects.

7.2. Information sources

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP1 – Harrison, Allan, Underhill, Herremans, Tree, Parker & Brown, 1997 & SABAP2 - http://sabap2.adu.org.za) was consulted in order to ascertain which species occur in the study area.
- The regional conservation status of all bird species occurring in the aforementioned degree squares was then determined with the use of The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al,* 2015). The global conservation status was obtained from the IUCN Red List (2022).
- The Important Bird and Biodiversity Areas of South Africa data (Marnewick *et al*. 2015) was consulted. The nearest IBA is too far (140km – Platberg Karoo Conservancy IBA) to be relevant to this project and is not discussed further.
- The Co-ordinated Avifaunal Roadcount (CAR) data from South Africa (www.car.birdmap.africa) was consulted to determine its relevance. There are no routes close enough to the proposed site to be useful.
- The Co-ordinated Waterbird Count (CWAC) data was consulted (www.cwac.birdmap.africa) to determine whether any data is available for the site. . There are no CWAC sites close enough to the proposed project to be useful.
- Information on the micro-habitat level was obtained through visiting the area and obtaining a first-hand perspective.
- Satellite Imagery of the area was studied using Google Earth ©2022.
- Previous studies on the solar photovoltaic site by Avisense and JAH Environmental Consultancy (2013).

7.3. Potential interaction between birds & proposed project

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & 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). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Habitat destruction during construction

During the construction phase of almost any development, some habitat destruction and alteration inevitably takes place. This happens with the construction of the development itself, access roads, and associated infrastructure. This is true of power lines and roads such as those proposed. Birds rely on habitat to meet their needs for foraging, drinking, resting, commuting and breeding. Of these it is probably breeding habitat which is most important to protect, although this varies between bird species. The significance of habitat destruction is influenced by a number of factors, including: size of area to be affected; sensitivity of receiving habitat; uniqueness of the habitat; degree of habitat specialisation of the bird species utilising the habitat; and the conservation status and sensitivity of the species using the habitat.

Disturbance of birds during construction of the proposed development

The construction and operational activities can impact on birds through disturbance, particularly during bird breeding activities. Particular project activities of concern include blasting, drilling, heavy earth moving general vehicular movement and any other activities which result in noise or increased human activity in an area. Disturbance of non-breeding birds may simply require them to move further away or adjust their activities during the disturbance. This may be either temporary or permanent. Disturbance of breeding birds may result in lower breeding productivity, failed breeding in the relevant season, and temporary or permanent abandonment of a breeding site. All of these reduce the recruitment of young birds to the population and can have significant implications for Red Listed species in particular, many of which are slow to reach breeding age and breed in small numbers.

Electrocution of birds whilst perched on pylons

This is caused when a bird bridges the gap between either: a live and an earthed component (phase-earth electrocution); or two live phases (phase-phase electrocutions). This type of impact is a function of line design and the dimensions of the birds' extremities. Larger bird species have a greater chance of bridging the critical clearances, causing a short circuit and being electrocuted. This risk is fairly easily managed by designing the pylons in a bird friendly manner from the outset.

Collision of birds with overhead cables

Collisions are the biggest single threat posed by the larger overhead lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. 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 power lines (van Rooyen 2004, Anderson 2001).

The Red List bird species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding,

resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the result that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

8. Receiving environment

8.1. Vegetation type & micro habitat

The site is comprised entirely of two vegetation type – "Bushmanland Arid Grassland' and "Bushmanland Basin Shrubland"as shown in Figure 3 (Mucina & Rutherford, 2018). These are both classified as 'Least threatened' and 'Hardly protected' or 'not protected' respectively.

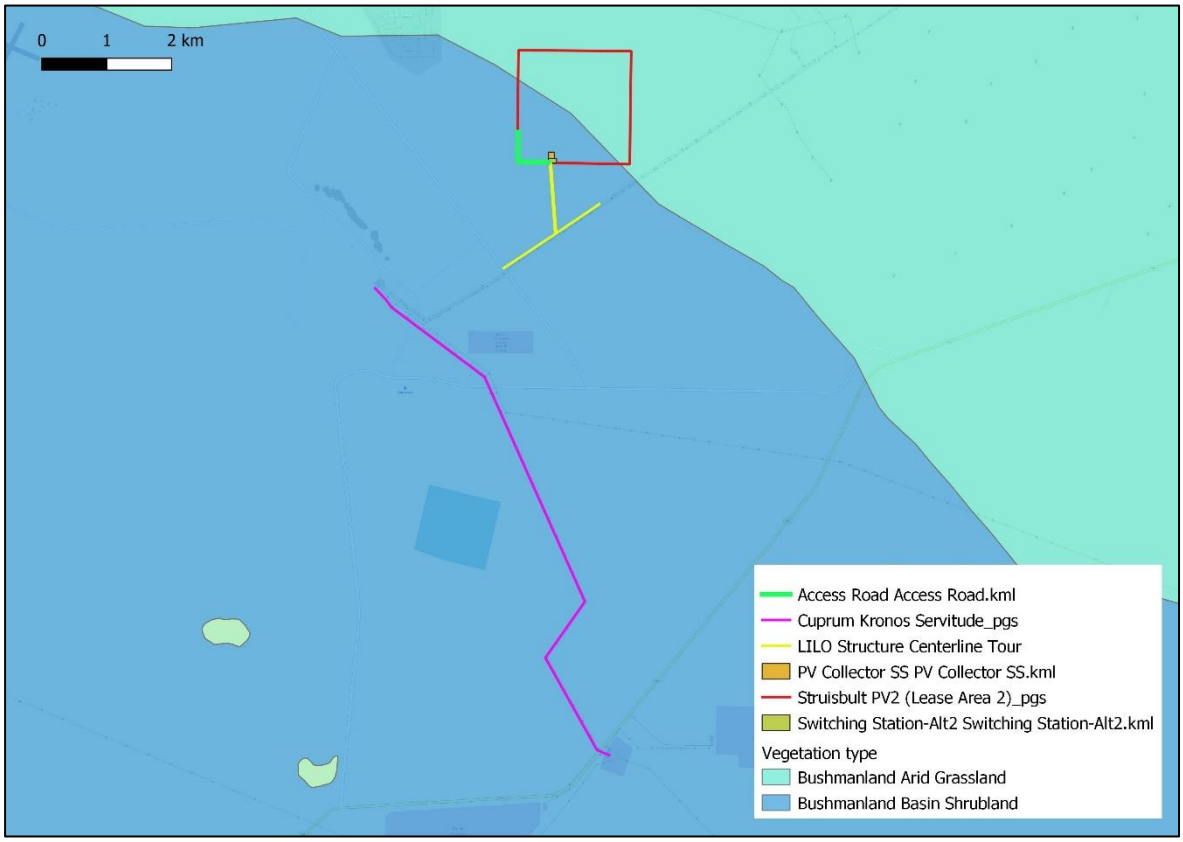


Figure 3. Vegetation types on site (Mucina & Rutherford, 2018).

For avifaunal purposes, the site is predominantly a short shrubland Karoo type vegetation interspersed with some isolated woody elements, mostly in minor drainage lines or close to

livestock water points (wind mills and reservoirs). The micro habitats available to birds on the site are: shrubland; thorn trees; and drainage lines. Examples of these are shown Appendix 4.

8.2. Avifaunal community

The second Southern African Bird Atlas Project (www.sabap2.adu.org.za) recorded a combined total of approximately 130 bird species in the four pentads (a pentad is approximately 9 x 9km) within which the proposed project is located. These are the species which could occur on the proposed site if conditions are right, but they have not all necessarily been confirmed on the site. Included amongst these 130 species are a number of regionally and globally Red Listed bird species and a number of endemics. These species are the priority bird species for this assessment and are presented in Table 2. Our own brief field survey recorded 50 bird species (Appendix 3), including most importantly:

- A large congregation (up to approximately 300) of Abdim's Storks *Ciconia abdimii* roosting in trees in Copperton village, and smaller groups of birds flying within the site itself. These birds are likely congregating in the broader area in response to a temporary high food availability and roost in the village as these are the only suitable available trees for some distance. They are likely to forage on the proposed site when conditions are right for them. This species could be susceptible to collision with the overhead power lines.

- A pair of Verreaux's Eagle *Aquila verreauxi* recorded repeatedly perched on a concrete tower associated with the old copper mine. It is highly likely that these birds have a nest out of sight within this tower structure, although we could not gain sight of a nest due to the height. This probable nest location is approximately 750m from the Cuprum end (closest point) of the proposed Cuprum Kronos power line, approximately 2800m from the closest point of the access road, and approximately 3000m from the closest point of the proposed LILO line. Due to other activities in the area we do not believe that this pair of eagles is at risk of disturbance by the proposed project. The probable nest site is shielded from the proposed Cuprum Kronos power line by the entire Cuprum Substation and various

mining infrastructure, and from the access road and LILO by mining infrastructure and the main tar road to Copperton. Overall we do not believe this nest or pair of eagles is placed at risk by the proposed project.

- Lanner Falcon *Falco biarmicus* pairs and small family groups (adults plus two juveniles) recorded several times. This suggestive of breeding somewhere in the broader area. We surveyed for nests on the existing power lines and other tower structures but could not find a nest. This species will be at risk of collision with the proposed power lines

- Several records of Ludwig's Bustard *Neotis ludwigii* singly and in small groups on site. This is a nomadic species which moves around the Karoo in response to rainfall and other environmental conditions. It will be susceptible to collision with the proposed power lines.

- Multiple records of Karoo Korhaan *Eupodotis vigorsii* in pairs on site. It appears that several pairs reside in the broader area. These birds will be susceptible to collision with the power lines

- Multiple records of Burchell's Courser *Cursorius rufus* in pairs on site. This species moves around in response to feeding conditions. The proposed project is unlikely to place them at much risk.

- A large eagle nest (probably either Martial Eagle *Polemaetus bellicosus* or Tawny Eagle *Aquila rapax*) on an Eskom pylon (Hydra-Kronos 519) close to Kronos Substation (on the eastern side of the substation, on the opposite side to the proposed Cuprum Kronos line, and approximately 650m from the proposed power line at the closest point). [we note that Avisense 2013 note a Martial Eagle nest on tower 512, approximately 3km further east]. The nest is approximately This nest is not currently in use by eagles, and appears to be in

use by Pied Crows *Corvus albus*. A pair of Lanner Falcon is also in the area and may be using a second smaller nest on the tower. This feature does not require any particular management for the proposed project.

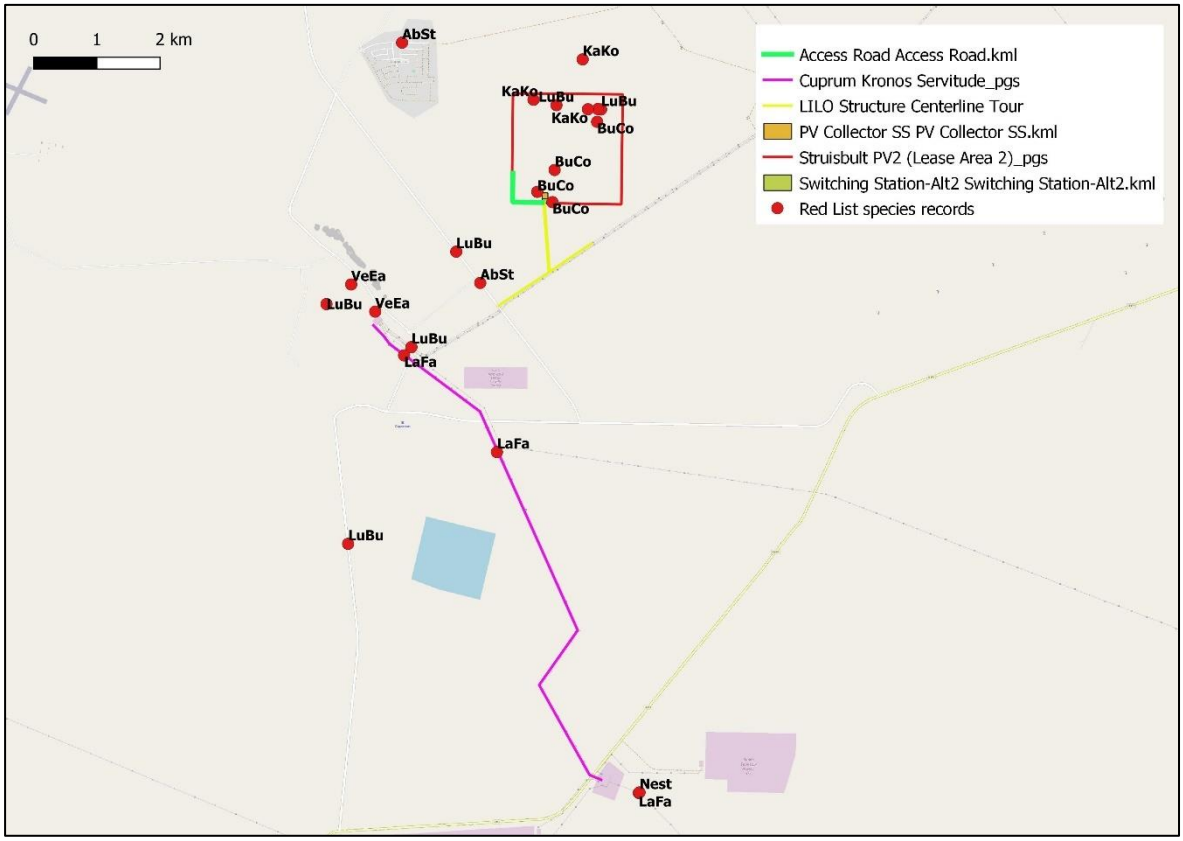


Figure 4. Red Listed species records.

Species abbreviations: AbSt=Abdim's Stork; BuCo=Burchell's Courser; KaKo=Karoo Korhaan; LaFa=Lanner Falcon; LuBu=Ludwig's Bustard; VeEa=Verreaux's Eagle.

Appendix 3 presents the bird atlas data for the site and includes the species we recorded on the site. Table 2 summarises the priority bird species for the site and their likelihood of occurrence on site and possible impacts.

Three main ecological groups of bird species are relevant to this assessment:

1. Raptors – including Martial and Verreaux's Eagles, and Lanner Falcon. These species will occur throughout the site and will be at some risk of collision with the power line and electrocution on the power line. A probable nest site of Verreaux's Eagle was found close to site, and two juvenile Lanner Falcons were recorded indicating a breeding site somewhere in the area, but which was not located.

2. Large terrestrial species – including Ludwig's Bustard, Kori Bustard *Ardeotis kori* and Karoo Korhaan. These species will occur mostly in the more open areas and will be at high risk of collision with overhead cables.

3. Small terrestrial species – such as Burchell's Courser and other pipits, larks, plovers, and many others. These species will occur on the site and be at risk of habitat destruction and disturbance.

Table 2. Priority bird species for the site.

Full Name	*Scientific Name*	RD (Regional, Global)	Endemic	SAB AP2	Specialist survey	Likelihood of occurring on site	Relative importance of site for species	Potential impacts of project
Ludwig's Bustard	*Neotis ludwigii*	EN, EN		√	√	Confirmed	Medium	Collision with power line
Martial Eagle	*Polemaetus bellicosus*	EN, VU		√		Probable	Medium	Collision with power line, electrocution on pylons
Karoo Korhaan	*Eupodotis vigorsii*	NT, LC		√	√	Confirmed	Medium	Collision with power line
Abdim's Stork	*Ciconia abdimii*	NT, LC			√	Confirmed	Low	Collision with power line
Sclater's Lark	*Spizocorys sclateri*	NT, NT	NE	√		Possible	Low	Habitat destruction, disturbance
Kori Bustard	*Ardeotis kori*	NT, NT		√		Possible	Low	Collision with power line
Verreaux's Eagle	*Aquila verreauxii*	VU, LC		√	√	Confirmed	High – breeding	Electrocution on pylons
Lanner Falcon	*Falco biarmicus*	VU, LC		√	√	Confirmed	High – breeding	Collision with power line
Burchell's Courser	*Cursorius rufus*	VU, LC			√	Confirmed	Medium	Habitat destruction, disturbance
Secretarybird	*Sagittarius serpentarius*	VU, VU		√		Possible	Low	Collision with power line

Regional: Red Data regional (Taylor et al, 2015). CR- Critically Endangered; EN-Endangered; VU-Vulnerable; NT-Near-threatened; LC-Least concern

Global: IUCN, 2022

Endemic: E-Endemic; NE-Near-endemic; SLS-Endemic to South Africa, Lesotho, Swaziland; BSLS=Endemic to Botswana, SA, Lesotho, Swaziland

SABAP 2 = Southern African Bird Atlas Project 2. '1' denotes presence, not abundance

9. Spatial sensitivity mapping

9.1. Site sensitivity verification report

In accordance with GN 320 and GN 1150 (20 March 2020) of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool).

We examined the Screening Tool output and found the following:

- Animal Theme is classed as High sensitivity (Figure 5), with Ludwig's Bustard highlighted. Terrestrial Biodiversity Theme is rated as Very High due to Ecological Support Areas and FEPA sub-catchments (Figure 6). Avian theme is not rated.

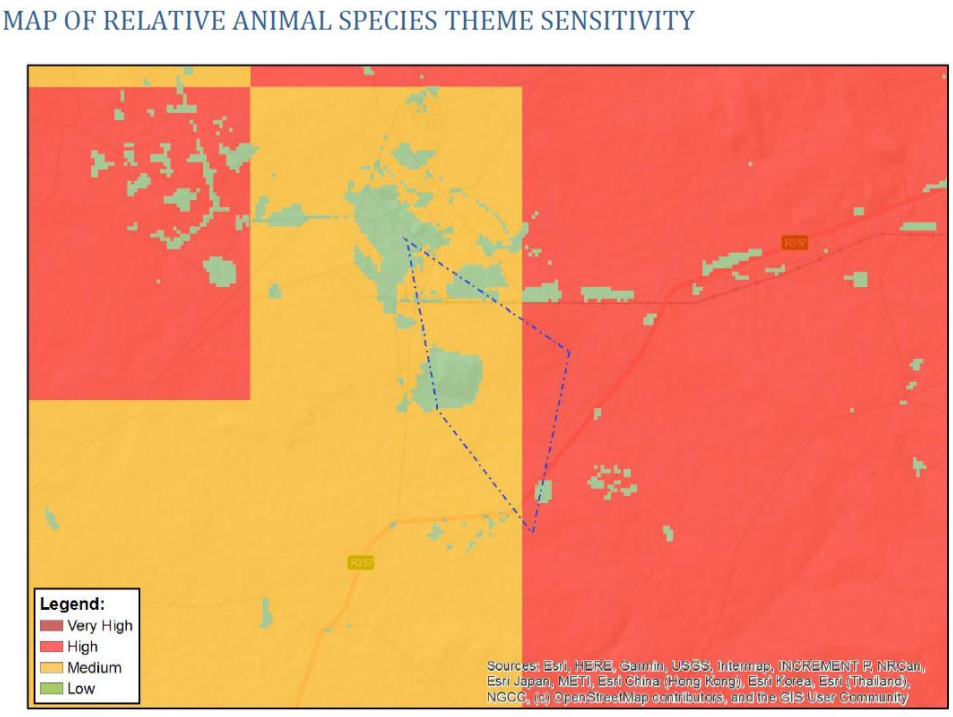


Figure 5. DFFE Screening Tool output for Animal Theme.

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY

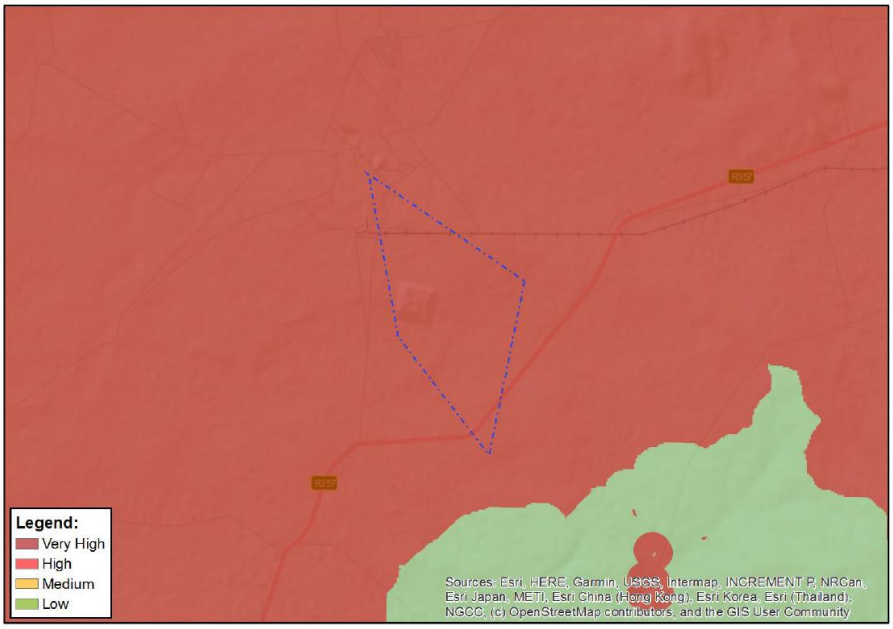


Figure 6. DFFE Screening Tool output for Terrestrial Biodiversity Theme.

The environmental sensitivity of the proposed development area for the "Avian Theme" (although not rated by the tool) was established by our own work as follows:

- desk top analysis, using all available data sources (specified in Section 7); and
- field survey on site as described in Section 7

Based on our work we confirm that the site is of Medium sensitivity for avifauna.

9.2. Site sensitivity mapping

The site has been classified in terms of avifaunal sensitivity, and the results presented in Figure 7. The two power line sections of the site are classed as Medium sensitivity for avifauna – for collision of birds, electrocution of birds, and to a lesser extent habitat destruction. The access road area has been classified as Low sensitivity (for habitat destruction only – collision and electrocution obviously being irrelevant) since it is relatively short (approximately 950m long) and is not in particularly unique or sensitive habitat.

Figure 7. Sensitivity mapping for the site.

10. Impact assessment

10.1. Impact Assessment methodology

The impact significance rating methodology, as presented herein and utilised for all EIMS Impact Assessment Projects, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. The ER is determined for both the pre- and post-mitigation scenario. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives.

a. Determination of Environmental Risk

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular

impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\boldsymbol{C} = \frac{(\boldsymbol{E} + \boldsymbol{D} + \boldsymbol{M} + \boldsymbol{R}) * \boldsymbol{N}}{\boldsymbol{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 3 below.

Table 3. Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary)
	3	Local (i.e. the area within 5 km of the site)
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction)
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected)
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected)
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way, moderate improvement for +ve impacts)
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease, high improvement for +ve impacts)
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts)
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.

	5	Irreversible Impact.

Once the C has been determined, the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 4.

Table 4. Probability Scoring

Probabiliy	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$\boldsymbol{ER = C\ x\ P}$$

Table 5. Determination of Environmental Risk

Consequenc	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 6.

Table 6. Environmental Risk Scores

ER Score	Description
<9	Low (i.e. where this impact is unlikely to be a significant environmental risk/ reward).
≥9 ≤17	Medium (i.e. where the impact could have a significant environmental risk/ reward),

>17	High (i.e. where the impact will have a significant environmental risk/ reward).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

b. Impact Prioritisation

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 7. Criteria for Determining Prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 7. The impact priority is therefore determined as follows:

$$Priority = CI + LR$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 2 (Refer to Table 8).

Table 8. Determination of Prioritisation Factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 9. Final Environmental Significance Rating

Significance Rating	Description
<-17	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
≥-17, ≤-9	Medium negative (i.e. where the impact could influence the decision to develop in the area).
>-9, < 0	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
>0, <9	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥9, ≤17	Medium positive (i.e. where the impact could influence the decision to develop in the area).
>17	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

Table 10 summarises the impact assessment findings.

10.2. Planning Phase Impacts

No avifaunal impacts are expected in the planning phase.

10.3. Construction Phase Impacts

10.3.1. Destruction of bird habitat during construction of power lines & access road

The impact of habitat destruction will be of Medium negative significance (score of -9.84). The amount of habitat to be transformed for the power lines and access road is relatively small in this landscape and the habitat is not particularly unique or limited in availability. However destruction of habitat cannot be reversed and there is a cumulative impact. We recommend several mitigation measures which will slightly reduce the impact significance, but these will not entirely reduce the significance since a certain amount of habitat destruction is inevitable.

Mitigation measures

- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.

Cumulative Impacts

The DFFE Online screening tool identified 14 approved solar PV projects within 30km of the proposed project (see Figure 8). The cumulative impact assessed will therefore be the collective impact of the proposed Struisbult power lines and access road, and the other approved projects. We assume that the other Solar PV projects also probably have overhead grid connection power lines to connect to the grid. This means that the cumulative impact of renewable energy and overhead power lines on birds is quite substantial. However the habitat in this area is not particularly unique and nor is it limited in availability. We conclude that the significance of this impact is Medium negative.

Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No	EIA Reference No	Classification	Status of application	Distance from proposed area (km)
1	12/12/20/2503	Solar PV	Approved	0
2	12/12/20/2320/4	Solar PV	Approved	8.9
3	14/12/16/3/3/2/579	Solar PV	Approved	12.6
4	14/12/16/3/3/2/767	Solar PV	Approved	0
5	12/12/20/2501	Solar PV	Approved	0
6	12/12/20/2502	Solar PV	Approved	0
7	14/12/16/3/3/2/766	Solar PV	Approved	0
8	14/12/16/3/3/2/765	Solar PV	Approved	0
9	14/12/16/3/3/1/454	Solar PV	Approved	0
10	14/12/16/3/3/2/579/1	Solar PV	Approved	12.6
11	12/12/20/2320/5	Solar PV	Approved	8.9
12	12/12/20/2320/2	Solar PV	Approved	5.8
13	12/12/20/1722	Solar PV	Approved	0
14	12/12/20/2320	Solar PV	Approved	5.8

Figure 8. Approved wind and solar developments within 30km of the proposed project (DFFE).

Irreplaceable loss of Resources

Natural habitat is destroyed or altered and cannot be rehabilitated to its former state.

Impact on Alternatives considered

No alternatives considered – the proposed alignments are acceptable from an avifaunal perspective.

10.3.2. Disturbance of birds during construction of the power line & substation

We judge the significance of this impact to be Low negative significance (score of -1.75). Disturbance of birds typically reaches significant levels when the receptor is a breeding site for a sensitive species, or some other important feature, such as a roost. We have identified several such features off site but in reasonable proximity. However these features are already accustomed to disturbance levels far higher than that which will be produced by the proposed project (due to the recent construction of two wind farms).

Mitigation measures

- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.

Cumulative Impacts

As described in Section 10.3.1 the cumulative impact of renewable energy and overhead power lines on birds in this area is of Medium negative significance.

Irreplaceable loss of Resources

None

Impact on Alternatives considered

No alternatives considered – the proposed alignments are acceptable from an avifaunal perspective.

10.4. Operations Phase Impacts

10.4.1. Collision of birds with overhead cables during operations of the power line

Using the formal methodology supplied by EIMS we judge the significance of this impact to be Low negative significance (score of -8.9), although it is very close to being Medium (which is scores of 9 and above), and we would be more comfortable with a score of Medium. Several regionally Red Listed bird species which are known to be susceptible to collision with overhead power lines occur in the study area, including Ludwig's Bustard, Kori Bustard, Abdim's Stork, and Karoo Korhaan. The significance of this risk is slightly diminished by the placement of the Kronos Cuprum proposed power line within a corridor of existing power lines.

Mitigation measures

- The overhead cables (specifically the earth wires) on both power lines should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw et al, 2021). The line marking device should be a dynamic (moving – bird flapper type) device.
- The new power line should be patrolled during operation by Eskom annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices.
- Where multiple devices on a span have failed (broken off or become stuck and non dynamic due to wind) they should be replaced immediately.
- Any recorded bird fatality data should be submitted to the Eskom –EWT Strategic Partnership where it will be curated and publicly accessible.

Cumulative Impacts

The cumulative impacts of overhead power lines on birds in this area through collision is of medium concern, since all renewable projects require overhead grid connection power lines. Mitigation is possible through line marking devices as described above, but does not eliminate bird collisions entirely.

Irreplaceable loss of Resources

Birds are killed.

Impact on Alternatives considered

No alternatives considered – the proposed alignments are acceptable from an avifaunal perspective.

10.4.2. Electrocution of birds on pylons during operations of the power line

The significance of bird electrocution on the proposed power lines will be of Low negative significance (score of -3) since the proposed pylon structures have phase-phase and phase-earth clearances greater than 1800mm (minimum will be 2400mm). This means that large eagles and even vultures (this site is marginally within range for White-backed Vultures *Gyps africanus*) can perch safely without bridging these critical clearances. It is recommended as a further precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware. It is also essential that if any of the pylon structures are changed, we are given opportunity to assess the electrocution risk of the new structure and design mitigation.

Mitigation measures

- It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware.
- It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structure and design mitigation.

Cumulative Impacts

The cumulative impacts of overhead power lines on birds in this area through electrocution is of slight concern, since all renewable projects require overhead grid connection power lines, and there is an almost complete absence of any natural perches in the landscape for raptors, so it is inevitable that they will perch frequently on pylons. However it is possible to design pylons in a completely safe manner.

Irreplaceable loss of Resources

Birds are killed.

Impact on Alternatives considered

No alternatives considered – the proposed alignments are acceptable from an avifaunal perspective.

Table 10. Summary of impact assessment.

IMPACT DESCRIPTION			Pre-Mitigation							Post Mitigation							Priority Factor Criteria			
Impact	Alternative	Phase	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Pre-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
Destruction of bird habitat	Alternative 1	Construction	-1	1	2	1	3	5	-8.75	-1	1	2	1	3	5	-8.75	High	1	2	1.13	-9.84375
Disturbance of birds	Alternative 1	Construction	-1	3	2	1	1	2	-3.5	-1	3	2	1	1	1	-1.75	High	1	1	1.00	-1.75
Collision of birds with overhead cables	Alternative 1	Operation	-1	2	4	3	5	4	-14	-1	2	4	2	5	2	-6.5	High	2	3	1.38	-8.9375
Electrocution of birds on pylons	Alternative 1	Operation	-1	2	4	1	5	1	-3	-1	2	4	1	5	1	-3	High	1	1	1.00	-3

10.5. Decommissioning Phase Impacts

The only impact that could possibly occur during this phase is disturbance of birds, which would be similar to that assessed for the construction phase.

10.6. Rehabilitation & Closure Phase Impacts

Once again, the only impact that could possibly occur during this phase is disturbance of birds, which would be similar to that assessed for the construction phase.

10.7. Overall Preferred Alternative

No alternative alignments for the power lines or access roads were presented for assessment. This is acceptable since the proposed routing is logical and takes a 'least impact' approach, making use of grouping the new project components with existing infrastructure in the landscape.

11. Specialist management plan

To summarise, the following mitigation measures are necessary:

Table 11. Summary of mitigation measures.

No.	Mitigation Measures	Phase	Timeframe	Responsible Party for Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)
1. Destruction of birds during construction							
A	All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment. All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.	Construction	Through construction	Applicant ECO	ECO	No unnecessary impact on habitat	ECO inspection
2. Disturbance of birds during construction							
A	All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment. All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.	Construction	Through construction	Applicant ECO	ECO	No unnecessary impact on habitat	ECO inspection
3. Collision of birds with overhead cables							
A	The overhead cables (specifically the earth wires) on both power lines should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw et al, 2021). The line marking device should be a dynamic (moving – bird flapper type) device. The new power line should be patrolled during operation by ESKOM annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices. Where multiple devices on a span have failed (broken off or become stuck and non dynamic due to wind) they should be replaced immediately.	Operations	Should be installed once conductors and earth wires are strung and prior to commissioning of lines	Applicant Contractor	Safety Department (weekly) ECO (Monthly)	No bird collisions once operational	Annual line patrols by Eskom

	Any recorded bird fatality data should be submitted to the Eskom –EWT Strategic Partnership where it will be curated and publicly accessible.						
4. Electrocution of birds on pylons							
A	It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware. It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structure and design mitigation.	Operations	Should be installed once prior to commissioning of lines	Applicant Contractor	Safety Department (weekly) ECO (Monthly)	No bird collisions once operational	Annual line patrols by Eskom

12. Conclusions

Up to approximately 130 bird species occur in the broader area within which the proposed project is located. Included amongst these 130 species are a number of regionally and globally Red Listed bird species and a number of endemics. These include: Ludwig's Bustard and Martial Eagle (both regionally Endangered); Verreaux's Eagle, Lanner Falcon, Burchell's Courser, and Secretarybird (all regionally Vulnerable); and Karoo Korhaan, Abdim's Stork, Sclater's Lark and Kori Bustard (all regionally Near-threatened).

Based on the formal criteria supplied by EIMS, we have rated the potential impacts on avifauna as follows:

- Disturbance of birds during the construction phase will be of Low negative significance post mitigation.
- Destruction of bird habitat during the construction phase will be of Medium negative significance post mitigation.
- Collision of birds with overhead cables on the power lines will be of Low negative significance post mitigation.
- Electrocution of birds on the pylons of the power lines will be of Low negative significance post mitigation.

The following mitigation measures are to be implemented:

- All construction activities should be strictly managed according to generally accepted environmental best practice standards, so as to avoid any unnecessary impact on the receiving environment.
- All temporary disturbed areas should be rehabilitated according to the site's rehabilitation plan, following construction.
- The overhead cables (specifically the earth wires) on both power lines should be fitted with an approved anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. This should be done according to the Eskom Distribution and Transmission standards in terms of device spacing and other factors. Literature around the world points towards a 50-60% reduction in bird collision risk if the line is marked (Jenkins, Smallie & Diamond, 2010; Shaw et al, 2021). The line marking device should be a dynamic (moving – bird flapper type) device.
- The new power line should be patrolled during operation by Eskom annually to measure any impacts on birds (through detecting collision fatalities) and to monitor the durability of the line marking devices.

- Where multiple devices on a span have failed (broken off or become stuck and non dynamic due to wind) they should be replaced immediately.
- It is recommended as a precautionary measure that the standard Eskom Bird Perch be fitted to all pole tops to further provide safe perching substrate well above dangerous hardware.
- It is also essential that if any of the pylon structures are changed we are given opportunity to assess the electrocution risk of the new structure and design mitigation. Any recorded bird fatality data should be submitted to the Eskom –EWT Strategic Partnership where it will be curated and publicly accessible.

If these mitigation measures are implemented correctly, we believe that the impacts of the proposed project will be at an acceptable level and we recommend the proposed project be authorised to proceed.

13. Assumptions, uncertainties & gaps in knowledge

This study made the assumption that the sources of information described throughout the report are reliable. The following factors may potentially detract from the accuracy of the predicted results:

This report is the result of a short term study, no long term studies were conducted on site. This study therefore depends heavily upon secondary or existing data sources such as those listed above. This study assumes a reasonable degree of accuracy of these data.

Predictions in this study are based on experience of these and similar species in different parts of southern Africa, through the authors' experience working in the field of wildlife – energy interaction since 2000. However bird behaviour can't be reduced to formulas that will hold true under all circumstances.

14. References

Avian Power Line Interaction Committee (APLIC). 2012. Reducing Avian Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute and APLIC. Washington, D.C.

Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

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. (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, pp 23-27.

Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (Eds) 2005. Roberts – Birds of Southern Africa, VIIth ed. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

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 (2010) 20:263–278. ª BirdLife International, 2010 doi:10.1017/S0959270910000122

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. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.)

Kruger, R. 1999. Towards solving raptor electrocutions on Eskom Distribution Structures in South Africa. M. Phil. Mini-thesis. University of the Orange Free State. Bloemfontein. South Africa.

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, pp15-24.

Ledger, J.A. 1984. “Engineering Solutions to the problem of Vulture Electrocutions on Electricity Towers.” The Certificated Engineer, 57, pp 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, 13-15 September 1992. Electric Power Research Institute.)

Mucina, L, Rutherford, C. 2018. The Vegetation of South Africa, Lesotho and Swaziland, South African National Biodiversity Institute, Pretoria.

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

Van Rooyen, C.S. 1998. Raptor mortality on power lines in South Africa. (5th World Conference on Birds of Prey and Owls: 4 - 8 August 1998. Midrand, South Africa.)

Van Rooyen, C.S. 1999**.** An overview of the Eskom - WILDSKIES ECOLOGICAL SERVICES Strategic Partnership in South Africa. (EPRI Workshop on Avian Interactions with Utility Structures 2-3 December 1999, Charleston, South Carolina.)

Van Rooyen, C.S. 2000. “An overview of Vulture Electrocutions in South Africa.” Vulture News, 43, pp 5-22. Vulture Study Group: Johannesburg, South Africa.

Van Rooyen, C.S. 2004a. The Management of Wildlife Interactions with overhead lines. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.

Van Rooyen, C.S. 2004b. Investigations into vulture electrocutions on the Edwardsdam-Mareetsane 88kV feeder, Unpublished report, Endangered Wildlife Trust, Johannesburg.

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)

Verdoorn, G.H. 1996. Mortality of Cape Griffons Gyps coprotheres and African White-backed Vultures *Gyps africanus* on 88kV and 132kV power lines in Western Transvaal, South Africa, and mitigation measures to prevent future problems. (2nd International Conference on Raptors: 2-5 October 1996. Urbino, Italy.)

Websites:

www.sabap2.adu.org.za Southern African Bird Atlas Project 2
www.iucnredlist.org. Accessed January 2022

Appendix 1. Specialist declaration form

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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

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

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

PROJECT TITLE

PROPOSED CONSTRUCTION AND OPERATION OF THE STRUISBULT PV2 GRID CONNECTION NEAR COPPERTON IN THE NORTHERN CAPE PROVINCE

Kindly note the following:

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

Departmental Details

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

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

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

SPECIALIST INFORMATION

Specialist Company Name:	WILDSKIES ECOLOGICAL SERVICES PTY LTD			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	J. SMALLIE			
Specialist Qualifications:	BSC MSC			
Professional affiliation/registration:	SACNASP 400020/06			
Physical address:	36 UTRECHT AVENUE, EAST LONDON, 5241			
Postal address:				
Postal code:	5241	Cell:	0824448919	
Telephone:		Fax:		
E-mail:	JON@WILDSKIES.CO.ZA			

DECLARATION BY THE SPECIALIST

I, _____J. SMALLIE_____, declare that –

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

Signature of the Specialist
WILDSKIES ECOLOGICAL SERVICES PTY LTD

Name of Company:
14 January 2022

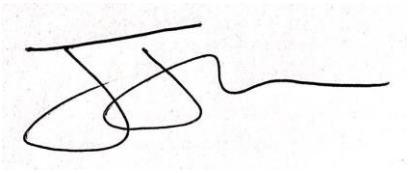
Date:

Appendix 2. Specialist CV

JONATHAN JAMES SMALLIE
WildSkies Ecological Services (2011/131435/07)
Curriculum Vitae

Background
Date of birth: 20 October 1975
Qualifications: BSC – Agriculture (Hons) (completed 1998)
University of Natal – Pietermaritzburg
MSC – Environmental Science (completed 2011)
University of Witwaterstrand
Occupation: Specialist avifaunal consultant
Profession registration: South African Council for Natural Scientific Professions

Contact details
Cell number: 082 444 8919
Fax: 086 615 5654
Email: jon@wildskies.co.za
Postal: 36 Utrecht Avenue, Bonnie Doon, East London, 5210
ID #: 7510205119085



Professional experience
World Bank Group – International Finance Corporation:
Short term consultant role as avifaunal specialist advisor

Renewable energy:
Post construction bird monitoring for wind energy facilities:
Dassieklip (Caledon) –initiated in April 2014 (2yrs); Dorper Wind Farm (Molteno) – initiated in July 2014 (5yrs); Jeffreys Bay Wind Farm – initiated in August 2014 (4yrs); Kouga Wind Farm – started Feb 2015 (2yrs); Cookhouse Wind Farm – started March 2015 (1yr); Grassridge Wind Farm – initiated in April 2015 (2yrs); Chaba Wind Farm – initiated December 2015 (1yr); Amakhala Emoyeni 01 Wind Farm initiated August 2016 (5yrs) – IFC funded project; Gibson Bay Wind Farm – initiated March 2017 (4yrs); Nojoli Wind Farm initiated March 2017 (4yrs); Sere Wind Farm (2yrs); Golden Valley Wind Farm (started Sep 2021 – 1 yr).

Pre-construction bird monitoring & EIA for wind energy facilities:
Golden Valley 1; Middleton; Dorper; Qumbu; Ncora; Nqamakhwe; Ndakana; Thomas River; Peddie; Mossel Bay; Hluhluwe; Richards Bay; Garob; Outeniqua; Castle; Wolf; Inyanda-Roodeplaat; Dassiesridge; Great Kei; Bayview; Grahamstown; Bakenskop; Umsobomvu; Stormberg; Zingesele; Oasis; Gunstfontein; Naumanii; Golden Valley Phase 2; Ngxwabangu; Hlobo; Woodstock; Scarlet Ibis; Albany; Golden Valley 1 2nd monitoring; Umtathi Emoyeni; Serenje Zambia; Unika 1 Zambia; Impofu East, West, and North; Nuweveld East, West and North; Elands Wind Farm; Ingwe Wind Farm; Hoogland Wind Farm; Cradock Wind Farm Cluster; Canyon Springs Wind Farm; Loxton Wind Farm; Taaibos Wind Farm; Aberdeen Wind Farm.

Screening studies for wind energy facilities:
Tarkastad Wind Farm; Quanti Wind Farm; Ruitjies Wind Farm; Beaufort West Wind Farm; Success Wind Farm; Cradock Wind Farm; Britstown Wind Farm; Clanwilliam Wind Farm; Ebenhezer Wind Farm.

Avifaunal walk through for wind energy facilities:
Garob Wind Farm; Golden Valley 1 wind farm; Nxuba Wind Farm.

Pre-construction bird monitoring and EIA for Solar energy facilities:
Bonnievale Solar Energy Facility; Dealesville Solar Energy Facility; Rooipunt Solar Energy Facility; De Aar Solar Energy Facility; Noupoort Solar Energy Facility, Aggeneys Solar Energy Facility; Eskom Concentrated Solar Power Plant; Bronkhorstspruit Solar Photovoltaic Plant; De Aar Solar Energy Facility; Paulputs Solar Energy Facility; Kenhardt Solar Energy Facility; Wheatlands Solar Energy Facility; Nampower CSP project; Dwaalboom PV; Slurry PV; De Hoek PV; Suikerbekkie PV; Springhaas PV.

Other Electricity Generation:
Port of Nqura Power Barge EIA; Tugela Hydro-Electric Scheme; Mmamabula West Coal Power Station (Botswana).

Electricity transmission & distribution:
Overhead transmission power lines (>132 000 kilovolts):
Oranjemund Gromis 220kv; Perseus Gamma 765kv; Aries Kronos 765kv; Aries Helios 765kv; Perseus Kronos 765kv; Helios Juno 765kv; Borutho Nzelele 400kv; Foskor Merensky 275kv; Kimberley Strengthening; Mercury Perseus 400kV; Eros Neptune Grassridge 400kV; Kudu Juno 400kV; Garona Aries 400kV; Perseus Hydra 765Kv; Tabor Witkop 275kV; Tabor Spencer 400kV; Moropule Orapa 220kV (Botswana); Coega Electrification; Majuba Venus 765kV; Gamma Grassridge 765kV; Gourikwa Proteus 400KV; Koeberg Strengthening 400kV; Ariadne Eros 400kV; Hydra Gamma 765kV; Zizabona transmission – Botswana; Maphutha Witkop 400kv; Makala B 400kv; Aggeneis Paulputs 400kv; Northern Alignment 765kv; Kappa Omega 765kv; Isundu 400kv and Substation; Senakangwedi B Integration; Oranjemund Gromis;

Overhead distribution power lines (<132 000 kilovolts):
Kanoneiland 22KV; Hydra Gamma 765kV; Komani Manzana 132kV; Rockdale Middelburg 132kV; Irenedale 132 kV; Zandfontein 132kV; Venulu Makonde 132 kV; Spencer Makonde 132 kV; Dalkeith Jackal Creek 132Kv; Glen Austin 88kV; Bulgerivier 132kV; Ottawa Tongaat 132kV; Disselfontein 132kV; Voorspoed Mine 132kV; Wonderfontein 132kV; Kabokweni Hlau Hlau 132kV; Hazyview Kiepersol 132kV; Mayfern Delta 132kV; VAAL Vresap 88kV; Arthursview Modderkuil 88kV; Orapa, AK6, Lethakane substations and 66kV lines (Botswana); Dagbreek Hermon 66kV; Uitkoms Majuba 88kV; Pilanesberg Spitskop 132kV; Qumbu PG Bison 132kV; Louis Trichardt Venetia 132kV; Rockdale Middelburg Ferrochrome 132kV; New Continental Cement 132KV; Hillside 88kV; Marathon Delta 132kV; Malelane Boulder 132kV; Nondela Strengthening 132kV; Spitskop Northern Plats 132kV; West Acres Mataffin 132kV; Westgate Tarlton Kromdraai 132kV; Sappi Elliot Ugie 132kV; Melkhout Thyspunt 132kV; St Francis Bay 66kv; Etna Ennerdale 88kv; Kroonstad 66kv; Firham Platrand; Paradise Fondwe 132kv; Kraal Mafube 132kv; Loeriesfontein 132kv; Albany Mimosa 66kv; Zimanga 132kv; Grootpan Brakfontein; Mandini Mangethe; Valkfontein Substation; Sishen Saldanha; Corinth Mzongwana 132kv; Franklin Vlei 22kv; Simmerpan Strengthening; Ilanga Lethemba 132kv; Cuprum Burchell Mooidraai 132; Oliphantskop Grassridge 132;

Risk Assessments on existing power lines:
Hydra-Droerivier 1,2 & 3 400kV; Hydra-Poseidon 1,2 400kV; Butterworth Ncora 66kV; Nieu-Bethesda 22kV; Maclear 22kV (Joelshoek Valley Project); Wodehouse 22kV (Dordrecht district); Burgersdorp

Aliwal North Jamestown 22kV; Cradock 22kV; Colesberg area 22kV; Loxton self build 11kV; Kanoneiland 22kV; Stutterheim Municipality 22kV; Majuba-Venus 400kV; Chivelston-Mersey 400kV; Marathon-Prairie 275kV; Delphi-Neptune 400kV; Ingagane – Bloukrans 275kV; Ingagane – Danskraal 275kV; Danskraal – Bloukrans 275kV

Avifaunal "walk through" (EMP's):
Kappa Omega 765kv; Rockdale Marble Hall 400kv; Beta Delphi 400kV; Mercury Perseus 765kV; Perseus 765kV Substation; Beta Turn 765kV in lines; Spencer Tabor 400kV line; Kabokweni Hlau Hlau 132kV; Mayfern Delta 132Kv; Eros Mtata 400kV; Cennergi Grid connect 132kV; Melkhout Thyspunt 132kv; Imvubu Theta 400kv; Outeniqua Oudshoorn 132kv; Clocolan Ficksburg 88kv.

Strategic Environmental Assessments for Master Electrification Plans:
Northern Johannesburg area; Southern KZN and Northern Eastern Cape; Northern Pretoria; Western Cape Peninsula

Other electrical infrastructure work
Investigation into rotating Bird Flapper saga – Aberdeen 22Kv; Special investigation into faulting on Ariadne-Eros 132kV; Special investigation into Bald Ibis faulting on Tutuka Pegasus 275kV; Special investigation into bird related faulting on 22kV Geluk Hendrina line; Special investigation into bird related faulting on Camden Chivelston 400kV line

Water sector:
Umkhomazi Dam and associated tunnel and pipelines; Rosedale Waste Water Treatment Works; Lanseria Outfall Sewer; Lanseria Wastewater Treatment Works;

Wildlife airport hazards:
Kigali International Airport – Rwanda; Port Elizabeth Airport – specialist study as part of the EIA for the proposed Madiba Bay Leisure Park; Manzini International Airport (Swaziland); Polokwane International Airport; Mafekeng International Airport; Lanseria Airport. Namibia Airports Company – wildlife hazard management plans for three airports.

Conservation planning:
East Cape Biodiversity Strategy & Action Plan – avifaunal input; City of Ekurhuleni Biodiversity Plan – avifaunal input.

Other sectors:
Submarine telecommunications cables project; Lizzard Point Golf Estate – Vaaldam; Lever Creek Estates housing development; East Cape Biodiversity Strategy and Action Plan 2017; Cathedral Peak Road diversion; Dube Tradeport; East London Transnet Ports Authority Biodiversity Management Plan; Leazonia Feedlot; Carisbrooke Quarry; Senekal Sugar Development; Frankfort Paper Mill;

Employment positions held to date:

- August 1999 to May 2004: Eastern Cape field officer for the South African Crane Working Group of the Endangered Wildlife Trust
- May 2004 to November 2007: National Field officer for Eskom-EWT Strategic Partnership and Airports Company SA – EWT Strategic Partnership (both programmes of Endangered Wildlife Trust)
- November 2007 to August 2011: Programme Manager – Wildlife & Energy Programme – Endangered Wildlife Trust
- August 2011 to present: Independent avifaunal specialist – Director at WildSkies Ecological Sevices (Pty) Ltd

Relevant achievements:

- Recipient of BirdLife South Africa's Giant Eagle Owl in 2011 for outstanding contribution to bird conservation in SA
- Founded and chaired for first two years – the Birds and Wind Energy Specialist Group (BAWESG) of the Endangered Wildlife Trust & BirdLife South Africa.

Conferences attended & presented at:

- 2021. African Conference on Linear Infrastructure and Environment
- 2018. Raptor Research Foundation conference, Kruger National Park.
- 2019. Conference on Wind Energy and Wildlife, Stirling, Scotland.
- 2017. Conference on Wind Energy and Wildlife, Estoril, Portugal.
- 2012-2020. Windaba Conference. Various attendance.
- May 2011. Conference of Wind Energy and Wildlife, Trondheim, Norway.
- March 2011. Chair and facilitator at Endangered Wildlife Trust – Wildlife & Energy Programme – "2011 Wildlife & Energy Symposium", Howick, SA
- September 2010 – Raptor Research Foundation conference, Fort Collins, Colorado. Presented on the use of camera traps to investigate Cape Vulture roosting behaviour on transmission lines
- May 2010 - Wind Power Africa 2010. Presented on wind energy and birds
- October 2008. Session chair at Pan-African Ornithological Conference, Cape Town, South Africa
- March 27 – 30 2006: International Conference on Overhead Lines, Design, Construction, Inspection & Maintenance, Fort Collins Colorado USA. Presented a paper entitled "Assessing the power line network in the Kwa-Zulu Natal Province of South Africa from a vulture interaction perspective".
- June 2005: IASTED Conference at Benalmadena, Spain – presented a paper entitled "Impact of bird streamers on quality of supply on transmission lines: a case study"
- May 2005: International Bird Strike Committee 27th meeting – Athens, Greece. Presented a paper entitled Bird Strike Data analysis at SA airports 1999 to 2004.
- 2003: Presented a talk on "Birds & Power lines" at the 2003 AGM of the Amalgamated Municipal Electrical Unions – in Stutterheim - Eastern Cape
- September 2000: 5th World Conference on Birds of Prey in Seville, Spain.

Papers & publications:

- Jenkins, A.R., Van Rooyen, C.S., Smallie, J., Harrison, J.A., Diamond, M., Smit-Robbinson, H.A. & Ralston, S. 2015. "Best practice guidelines for assessing and monitoring the impact of wind energy facilities on birds in southern Africa" Unpublished guidelines
- Ralston-Paton, S., Smallie, J., Pearson, A., & Ramalho, R. 2017. Wind energy's impacts on birds in South Africa: a preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme Wind Farms in South Africa. BirdLife South Africa Occasional Report Series No. 2. BirdLife South Africa, Johannesburg, South Africa.
- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Guidelines on how to avoid or mitigate impacts of electricity power grids on migratory birds in the African-Eurasian Region. CMS Technical Series Number XX. Bonn, Germany.
- Prinsen, H.A.M., J.J. Smallie, G.C. Boere, & N. Pires. (compilers), 2011. Review of the conflict between migratory birds and electricity power grids in the African-Eurasian region. CMS Technical Series Number XX, Bonn, Germany.

- Jenkins, A.R., van Rooyen, C.S, Smallie, J.J, Harrison, J.A., Diamond, M.D., Smit-Robinson, H.A & Ralston, S. 2014. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa
- Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International.
- Jordan, M., & Smallie, J. 2010. A briefing document on best practice for pre-construction assessment of the impacts of onshore wind farms on birds. Endangered Wildlife Trust , Unpublished report
- Smallie, J., & Virani, M.Z. 2010. A preliminary assessment of the potential risks from electrical infrastructure to large birds in Kenya. Scopus 30: p32-39
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. Ostrich 2010. 81 (2) p109-113
- 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 2010. 20: 263-278.
- Shaw, J.M., Jenkins, A.R., Ryan, P.G., & Smallie, J.J. 2010. Modelling power line collision risk for the Blue Crane *Anthropoides paradiseus* in South Africa. Ibis 2010 (152) p590-599.
- Jenkins, A.R., Allan, D.G., & Smallie, J.J. 2009. Does electrification of the Lesotho Highlands pose a threat to that countries unique montane raptor fauna? Dubious evidence from surveys of three existing power lines. Gabar 20 (2).
- Smallie, J.J., Diamond, M., & Jenkins, A.R. 2008. Lighting up the African continent – what does this mean for our birds? Pp 38-43. In Harebottle, D.M., Craig, A.J.F.K., Anderson, M.D., Rakotomanana, H., & Muchai. (eds). Proceedings of the 12th Pan-african Ornithological Congress. 2008. Cape Town. Animal Demography Unit. ISBN (978-0-7992-2361-3)
- Van Rooyen, C., & Smallie, J.J. 2006. The Eskom –EWT Strategic Partnership in South Africa: a brief summary. Nature & Faunae Vol 21: Issue 2, p25
- Smallie, J. & Froneman, A. 2005. Bird Strike data analysis at South African Airports 1999 to 2004. Proceedings of the 27th Conference of the International Bird Strike Committee, Athens Greece.
- Smallie, J. & Van Rooyen, C. 2005. Impact of bird streamers on quality of supply on transmission lines: a case study. Proceedings of the Fifth IASTED International Conference on Power and Energy Systems, Benalmadena, Spain.
- Smallie, J. & Van Rooyen, C. 2003. Risk assessment of bird interaction on the Hydra-Droërivier 1 and 2 400kV. Unpublished report to Eskom Transmission Group. Endangered Wildlife Trust. Johannesburg. South Africa
- Van Rooyen, C. Jenkins, A. De Goede, J. & Smallie J. 2003. Environmentally acceptable ways to minimise the incidence of power outages associated with large raptor nests on Eskom pylons in the Karoo: Lessons learnt to date. Project number 9RE-00005 / R1127 Technology Services International. Johannesburg. South Africa
- Smallie, J. J. & O'Connor, T. G. (2000) Elephant utilization of *Colophospermum mopane*: possible benefits of hedging. African Journal of Ecology 38 (4), 352-359.

Courses & training:

- Successfully completed a 5 day course in High Voltage Regulations (modules 1 to 10) conducted by Eskom – Southern Region
- Successfully completed training on, and obtained authorization for, live line installation of Bird Flappers

Appendix 3. Bird data for the site

Regional: Red Data regional (Taylor et al, 2015). CR- Critically Endangered; EN-Endangered; VU-Vulnerable; NT-Near-threatened; LC-Least concern

Global: IUCN, 2021

Endemic: E-Endemic; NE-Near-endemic; SLS-Endemic to South Africa, Lesotho, Swaziland; BSLS=Endemic to Botswana, SA, Lesotho, Swaziland

SABAP 2 = Southern African Bird Atlas Project 2. '1' denotes presence, not abundance

Specialist site visit = recorded on the specialists site visit in January 2022

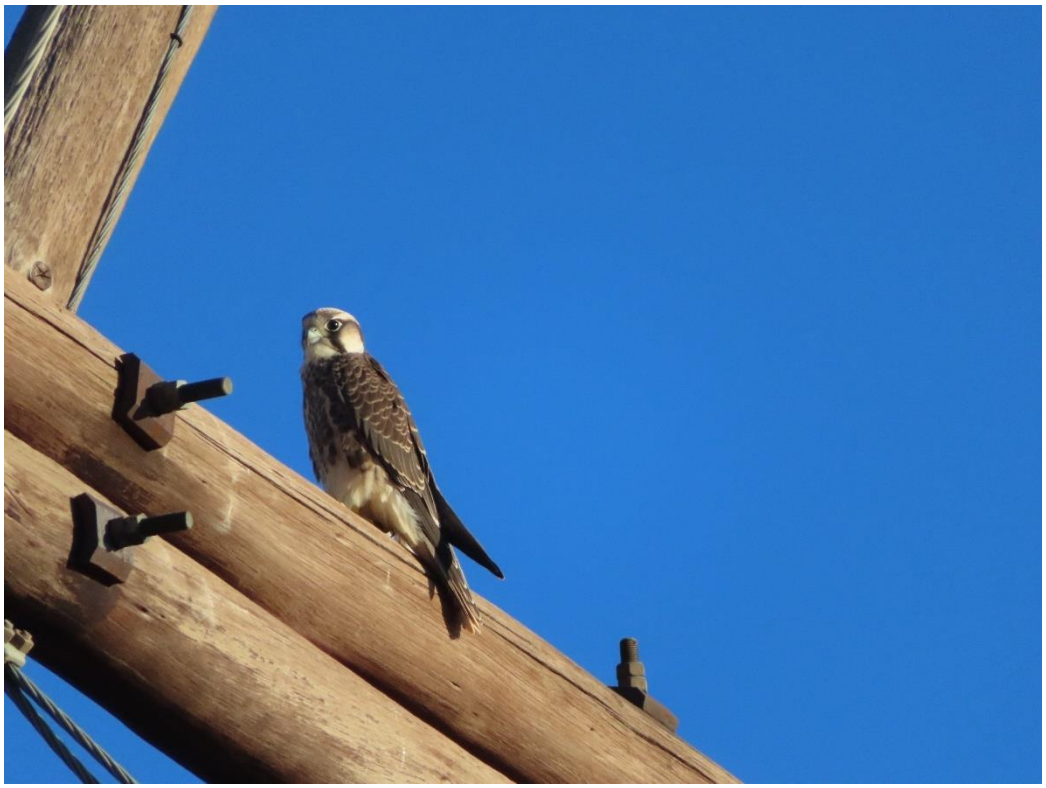
Full Name	Scientific Name	RD (Regional, Global)	Endemic	SABAP2	Specialist survey
Ludwig's Bustard	*Neotis ludwigii*	EN, EN		1	1
Martial Eagle	*Polemaetus bellicosus*	EN, VU		1	
Karoo Korhaan	*Eupodotis vigorsii*	NT, LC		1	1
Abdim's Stork	*Ciconia abdimii*	NT, LC			1
Sclater's Lark	*Spizocorys sclateri*	NT, NT	NE	1	
Kori Bustard	*Ardeotis kori*	NT, NT		1	
Verreaux's Eagle	*Aquila verreauxii*	VU, LC		1	1
Lanner Falcon	*Falco biarmicus*	VU, LC		1	1
Burchell's Courser	*Cursorius rufus*	VU, LC			1
Secretarybird	*Sagittarius serpentarius*	VU, VU		1	
Jackal Buzzard	*Buteo rufofuscus*		NE	1	1
Fiscal Flycatcher	*Melaenornis silens*		NE	1	1
Black-headed Canary	*Serinus alario*		NE	1	
Sickle-winged Chat	*Emarginata sinuata*		NE	1	
Fairy Flycatcher	*Stenostira scita*		NE	1	
Black-eared Sparrow-Lark	*Eremopterix australis*		NE	1	
Large-billed Lark	*Galerida magnirostris*		NE	1	
Karoo Prinia	*Prinia maculosa*		NE	1	
Karoo Thrush	*Turdus smithi*		NE	1	
Cape Weaver	*Ploceus capensis*		NE	1	
Cape White-eye	*Zosterops virens*		NE	1	
Bokmakierie	*Telophorus zeylonus*			1	1
Common (Steppe) Buzzard	*Buteo buteo*			1	1
Ant-eating Chat	*Myrmecocichla formicivora*			1	1
Karoo Chat	*Emarginata schlegelii*			1	1
Grey-backed Cisticola	*Cisticola subruficapilla*			1	1
Long-billed crombec	*Sylvietta rufescens*			1	1
Pied Crow	*Corvus albus*			1	1
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*			1	1
Laughing Dove	*Spilopelia senegalensis*			1	1
Namaqua Dove	*Oena capensis*			1	1
Red-eyed Dove	*Streptopelia semitorquata*			1	1

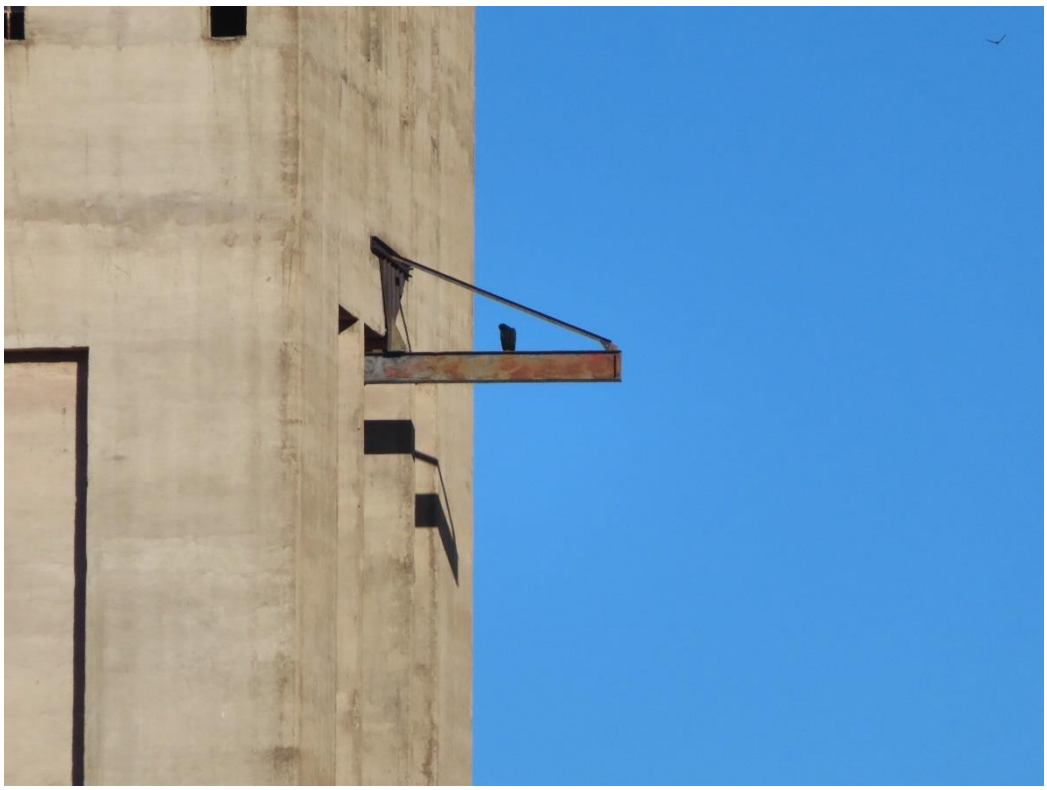
Black-chested Snake Eagle	*Circaetus pectoralis*			1	1
Southern (Common) Fiscal	*Lanius collaris*			1	1
Chat Flycatcher	*Melaenornis infuscatus*			1	1
Egyptian Goose	*Alopochen aegyptiaca*			1	1
Pale Chanting Goshawk	*Melierax canorus*			1	1
Greater Kestrel	*Falco rupicoloides*			1	1
Lesser Kestrel	*Falco naumanni*			1	1
Northern Black Korhaan	*Afrotis afraoides*			1	1
Eastern Clapper Lark	*Mirafra fasciolata*			1	1
Grey-backed Sparrow-lark	*Eremopterix verticalis*			1	1
Karoo Long-billed Lark	*Certhilauda subcoronata*			1	1
Sabota Lark	*Calendulauda sabota*			1	1
Spike-heeled Lark	*Chersomanes albofasciata*			1	1
Speckled Pigeon	*Columba guinea*			1	1
Red-billed Quelea	*Quelea quelea*			1	1
Karoo Scrub Robin	*Cercotrichas coryphoeus*			1	1
Lesser Grey Shrike	*Lanius minor*			1	1
White-browed Sparrow-Weaver	*Plocepasser mahali*			1	1
Cape Sparrow	*Passer melanurus*			1	1
Barn Swallow	*Hirundo rustica*			1	1
White-throated Swallow	*Hirundo albigularis*			1	1
African Black Swift	*Apus barbatus*			1	1
Sociable Weaver	*Philetairus socius*			1	1
Capped Wheatear	*Oenanthe pileata*			1	1
Acacia Pied Barbet	*Tricholaema leucomelas*			1	
Crested Barbet	*Trachyphonus vaillantii*			1	
Pririt Batis	*Batis pririt*			1	
African Red-eyed Bulbul	*Pycnonotus nigricans*			1	
Cape Bunting	*Emberiza capensis*			1	
Lark-like Bunting	*Emberiza impetuani*			1	
Black-throated Canary	*Crithagra atrogularis*			1	
White-throated Canary	*Crithagra albogularis*			1	
Yellow Canary	*Crithagra flaviventris*			1	
Familiar Chat	*Oenathe familiaris*			1	
Tractrac Chat	*Emarginata tractrac*			1	
Desert Cisticola	*Cisticola aridulus*			1	
Double-banded Courser	*Rhinoptilus africanus*			1	
Diederik Cuckoo	*Chrysococcyx caprius*			1	
Rock Dove	*Columba livia*			1	
Booted Eagle	*Hieraaetus pennatus*			1	
Yellow-bellied Eremomela	*Eremomela icteropygialis*			1	
Pygmy Falcon	*Polihierax semitorquatus*			1	
Red-headed Finch	*Amadina erythrocephala*			1	
Scaly-feathered Finch (Weaver)	*Sporopipes squamifrons*			1	
Spotted flycatcher	*Muscicapa striata*			1	
Spur-winged Goose	*Plectropterus gambensis*			1	

Little Grebe	*Tachybaptus ruficollis*			1	
Common Greenshank	*Tringa nebularia*			1	
Helmeted Guineafowl	*Numida meleagris*			1	
African Hoopoe	*Upupa africana*			1	
African Sacred Ibis	*Threskiornis aethiopicus*			1	
Hadeda (Hadada) Ibis	*Bostrychia hagedash*			1	
Rock Kestrel	*Falco rupicolus*			1	
Black-winged Kite	*Elanus caeruleus*			1	
Blacksmith Lapwing	*Vanellus armatus*			1	
Crowned Lapwing	*Vanellus coronatus*			1	
Fawn-coloured Lark	*Calendulauda africanoides*			1	
Red-capped Lark	*Calandrella cinerea*			1	
Stark's Lark	*Spizocorys starki*			1	
Rock Martin	*Ptyonoprogne fuligula*			1	
Red-faced Mousebird	*Urocolius indicus*			1	
White-backed Mousebird	*Colius colius*			1	
Rufous-cheeked Nightjar	*Caprimulgus rufigena*			1	
Common Ostrich	*Struthio camelus*			1	
Spotted Eagle-Owl	*Bubo africanus*			1	
Western Barn Owl	*Tyto alba*			1	
Cape Penduline-tit	*Anthoscopus minutus*			1	
African Pipit	*Anthus cinnamomeus*			1	
Buffy Pipit	*Anthus vaalensis*			1	
Nicholson's Pipit	*Anthus similis*			1	
Three-banded Plover	*Charadrius tricollaris*			1	
Black-chested Prinia	*Prinia flavicans*			1	
Cape Robin-chat	*Cossypha caffra*			1	
Kalahari Scrub Robin	*Cercotrichas paena*			1	
Namaqua Sandgrouse	*Pterocles namaqua*			1	
Common Sandpiper	*Actitis hypoleucos*			1	
South African Shelduck	*Tadorna cana*			1	
Cape Shoveler	*Spatula smithii*			1	
House Sparrow	*Passer domesticus*			1	
Southern Grey-headed Sparrow	*Passer diffusus*			1	
Pale-winged Starling	*Onychognathus nabouroup*			1	
Black-winged Stilt	*Himantopus himantopus*			1	
Dusky Sunbird	*Cinnyris fuscus*			1	
White-bellied Sunbird	*Cinnyris talatala*			1	
Greater Striped Swallow	*Cecropis cucullata*			1	
African Palm Swift	*Cypsiurus parvus*			1	
Bradfield's Swift	*Apus bradfieldi*			1	
Common Swift	*Apus apus*			1	
Little Swift	*Apus affinis*			1	
White-rumped Swift	*Apus caffer*			1	
Cape Teal	*Anas capensis*			1	
Spotted Thick-knee	*Burhinus capensis*			1	

Short-toed Rock Thrush	*Monticola brevipes*			1	
Ashy Tit	*Melaniparus cinerascens*			1	
Cape Wagtail	*Motacilla capensis*			1	
Rufous-eared Warbler	*Malcorus pectoralis*			1	
Black-faced Waxbill	*Estrilda erythronotos*			1	
Southern Masked Weaver	*Ploceus velatus*			1	
Mountain Wheatear	*Myrmecocichla monticola*			1	
Orange River White-eye	*Zosterops pallidus*			1	
Zitting Cisticola	*Cisticola juncidis*				1
Temminck's Courser	*Cursorius temminckii*				1
Amur Falcon	*Falco amurensis*				1
Gabar Goshawk	*Micronisus gabar*				1
Yellow-billed Kite	*Milvus aegyptius*				1
Wattled Starling	*Creatophora cinerea*				1
Chestnut-vented Tit-Babbler (Warbler)	*Sylvia subcoerulea*				1

Appendix 4. Photographs of the site.





Appendix 5. GPS tracks from field survey of the site.