

# MAPHUTHA WITKOP 400KV POWER LINE

## AVIFAUNAL SPECIALIST STUDY

November 2017



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## EXECUTIVE SUMMARY

Eskom have identified a need to strengthen the network between the existing Witkop Substation near Polokwane, and the new proposed Maphutha Substation near Steelpoort. Due to developments in platinum and ferrochrome mines, the forecasted high growth rate between 2013 and 2030 is expected to exceed the maximum transfer capability of the transmission network supplying the area. Consequently, Eskom proposes the development of Maphutha-Witkop 400kV powerline in order to mitigate the short term network reliability constraints and also to create additional capacity for the forecasted load in the Tubatse area. The fundamental aim of the proposed development is to increase the transfer capacity of the network beyond the forecasted 2030 load under all N-1 contingencies in Limpopo province and the country as a whole. The proposed development will directly and indirectly improve the standard of living for Limpopo communities as it will create employment opportunities, generate income and contribute to the local economy and to a larger extent the country as a whole.

The proposed project consists of approximately 160km of new 400kV overhead power line between the above two localities. Eskom appointed Nsovo Environmental Consulting to conduct the necessary Environmental Impact Assessment. Since a project of this type has the potential to impact significantly on birds, WildSkies Ecological Services (Jon Smallie) was appointed to conduct an avifaunal specialist study for the project.

A project of this nature has the potential to impact on avifauna through: habitat destruction and disturbance of birds (both during construction predominantly); and collision of birds with the overhead cables during the operational phase. Birds are also able to cause electrical faults on the power line, through mechanisms explained in this report.

The study area is home to an exceptionally broad diversity of bird species, up to 532 bird species having been recorded by the first and second Southern African Bird Atlas Projects (Harrison *et al*, 1997; [www.sabap2.adu.org.za](http://www.sabap2.adu.org.za)) in the broader area within which the site is located. A fair number of these (45 species) are regionally Red Listed species (Taylor *et al*, 2015), and several of these will in fact be at risk of interaction with the proposed power line. The likelihood and implication of these interactions has been assessed by this study.

The impact of collision of certain bird species with the overhead cables (in particular the earth wires) has been judged to be of medium significance. This can be reduced to low significance with mitigation in the form of: selecting the correct route for the power line; and installing effective line marking devices to

make the cables more visible to birds. In order to implement effective mitigation measures it will be necessary to conduct an avifaunal walk through as part of the site specific EMP. It is also essential that sufficient time be budgeted for in order to do a thorough job with the walk through. This exercise will identify those exact spans of the power line that require mitigation. Generically speaking the key areas are likely to be river crossings, drainage lines and dams.

Destruction and alteration of habitat will be of medium significance. Since this is difficult to mitigate for (a certain amount of vegetation has to be removed or altered) it is not possible to reduce this to low significance with mitigation.

Disturbance of birds is judged to be of low significance. However, if threatened raptors are found to breed close to the alignment this would change. New nests could be built between the writing of this report and construction of the power line and so it is essential that a detailed site specific avifaunal walk through be conducted as close as possible to construction to identify any nests.

The risk of electrical faulting caused by birds is judged to be of medium significance – reduced to low significance with the installation of Bird Guards on high risk towers to ensure that large birds cannot perch directly above the relevant live hardware. This is however an impact on the business, not the birds, and is best mitigated reactively if a problem is identified once the line is operational. Those towers that will obviously require Bird Guards installed will be identified during the avifaunal walk through.

Certain bird species may choose to nest on the new power line towers once constructed. This is rated as a low significance.

We conclude that Corridor 1 (southern) is the most preferred overall for avifauna. The middle route or Corridor 2 is the second most preferred. Corridor 3 (Northern) should ideally not be used although it is not fatally flawed.

If the recommendations of this report are adhered to, this project can proceed.

## SPECIALIST DETAILS

### Professional registration

The Natural Scientific Professions Act of 2003 aims to “Provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP) and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith.”

“Only a registered person may practice in a consulting capacity” – Natural Scientific Professions Act of 2003 (20(1)-pg 14)

Investigator:	Jon Smallie ( <i>Pri.Sci.Nat</i> )
Qualification:	BSc (Hons) Wildlife Science – University of Natal MSc Environmental Science – University of Witwatersrand
Affiliation:	South African Council for Natural Scientific Professions
Registration number:	400020/06
Fields of Expertise:	Ecological Science
Registration:	Professional Member

### Professional experience

Jon Smallie has been involved in bird interactions with energy infrastructure for 18 years. During this time he has completed impact assessments for many projects, many of which have been transmission power lines. A *Curriculum Vitae* can be supplied on request.

### Declaration of Independence

The specialist investigator declares that:

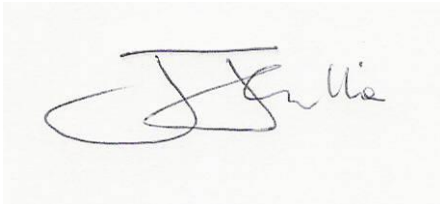
- I act as an independent specialist for this project.
- I consider myself bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- I do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2006.
- I will not be affected by the outcome of the environmental process, of which this report forms part of.
- I do not have any influence over the decisions made by the governing authorities.
- I do not object to or endorse the proposed developments, but aim to present facts and our best scientific and professional opinion with regard to the impacts of the development.

- I undertake to disclose to the relevant authorities any information that has or may have the potential to influence its decision or the objectivity of any report, plan, or document required in terms of the Environmental Impact Assessment Regulations, 2006.

### Terms and Liabilities

- This report is based on a short term investigation using the available information and data related to the site to be affected. No long term investigation or monitoring was conducted.
- The Precautionary Principle has been applied throughout this investigation.
- Additional information may become known or available during a later stage of the process for which no allowance could have been made at the time of this report.
- The specialist investigator reserves the right to amend this report, recommendations and conclusions at any stage should additional information become available.
- Information, recommendations and conclusions in this report cannot be applied to any other area without proper investigation.
- This report, in its entirety or any portion thereof, may not be altered in any manner or form or for any purpose without the specific and written consent of the specialist investigator as specified above.
- Acceptance of this report, in any physical or digital form, serves to confirm acknowledgment of these terms and liabilities.

Signed in November 2017 by Jon Smallie in his capacity as specialist investigator.

A handwritten signature in black ink, appearing to read 'Jon Smallie', is written on a light-colored rectangular background.

## 1. INTRODUCTION & BACKGROUND

Eskom have identified a need to strengthen the network between the existing Witkop Substation near Polokwane, and the new proposed Maphutha Substation near Steelpoort. Due to developments in platinum and ferrochrome mines, the forecasted high growth rate between 2013 and 2030 is expected to exceed the maximum transfer capability of the transmission network supplying the area. Consequently, Eskom proposes the development of Maphutha-Witkop 400kV powerline in order to mitigate the short term network reliability constraints and also to create additional capacity for the forecasted load in the Tubatse area. The fundamental aim of the proposed development is to increase the transfer capacity of the network beyond the forecasted 2030 load under all N-1 contingencies in Limpopo province and the country as a whole. The proposed development will directly and indirectly improve the standard of living for Limpopo communities as it will create employment opportunities, generate income and contribute to the local economy and to a larger extent the country as a whole.

The proposed project consists of approximately 160km of new 400kV overhead power line between the above two localities. Eskom appointed Nsovo Environmental Consulting to conduct the necessary Environmental Impact Assessment. Since a project of this type has potential to impact significantly on birds, WildSkies Ecological Services (Jon Smallie) was appointed to conduct an avifaunal specialist study for the project.

A project of this nature has the potential to impact on avifauna through: habitat destruction and disturbance of birds (both during construction); and collision of birds with the overhead cables during the operational phase. Birds are also able to cause electrical faults on the power line, through mechanisms explained elsewhere in this report.

The broader area within which the study area is located is home to an exceptionally broad diversity of bird species, up to 532 species having been recorded by the first and second Southern African Bird Atlas Projects (Harrison *et al*, 1997; [www.sabap2.adu.org.za](http://www.sabap2.adu.org.za)). A fair number of these (45 species) are Red Listed species (Taylor *et al*, 2015), and many of these will in fact be at risk of interaction with the proposed power line. The likelihood and implication of these interactions has been assessed by this study.

### 1.1. Terms of reference

The following terms of reference were utilized for this study:

- Present the *status quo* of avifauna in the area.
- Identify and discuss avifaunal impacts and rate them according to a specified methodology.
- Identify and provide mitigation measures for each impact.
- Conclude with a recommendation on whether the project should proceed or not and if so to what extent avifauna will be impacted upon.

## 1.2 Description of proposed project

The proposed power line is approximately 160km in length (depending on which route is selected) and will be 400kV. There are three main proposed alternative routes for the power line, as shown in Figure 1. In all cases a 3km corridor (1.5km either side of the centre line) is considered for assessment. Three alternative tower designs are considered: the cross rope suspension tower; self-supporting tower; and guyed V tower. Since a line of this size (voltage) cannot electrocute birds, the only implications that the tower structure has for birds is in determining the risk of electrical faulting caused by birds. If the tower structure provides suitable perching space directly above the live conductors there is a strong likelihood that birds will cause faults on the line, as explained elsewhere in this report.

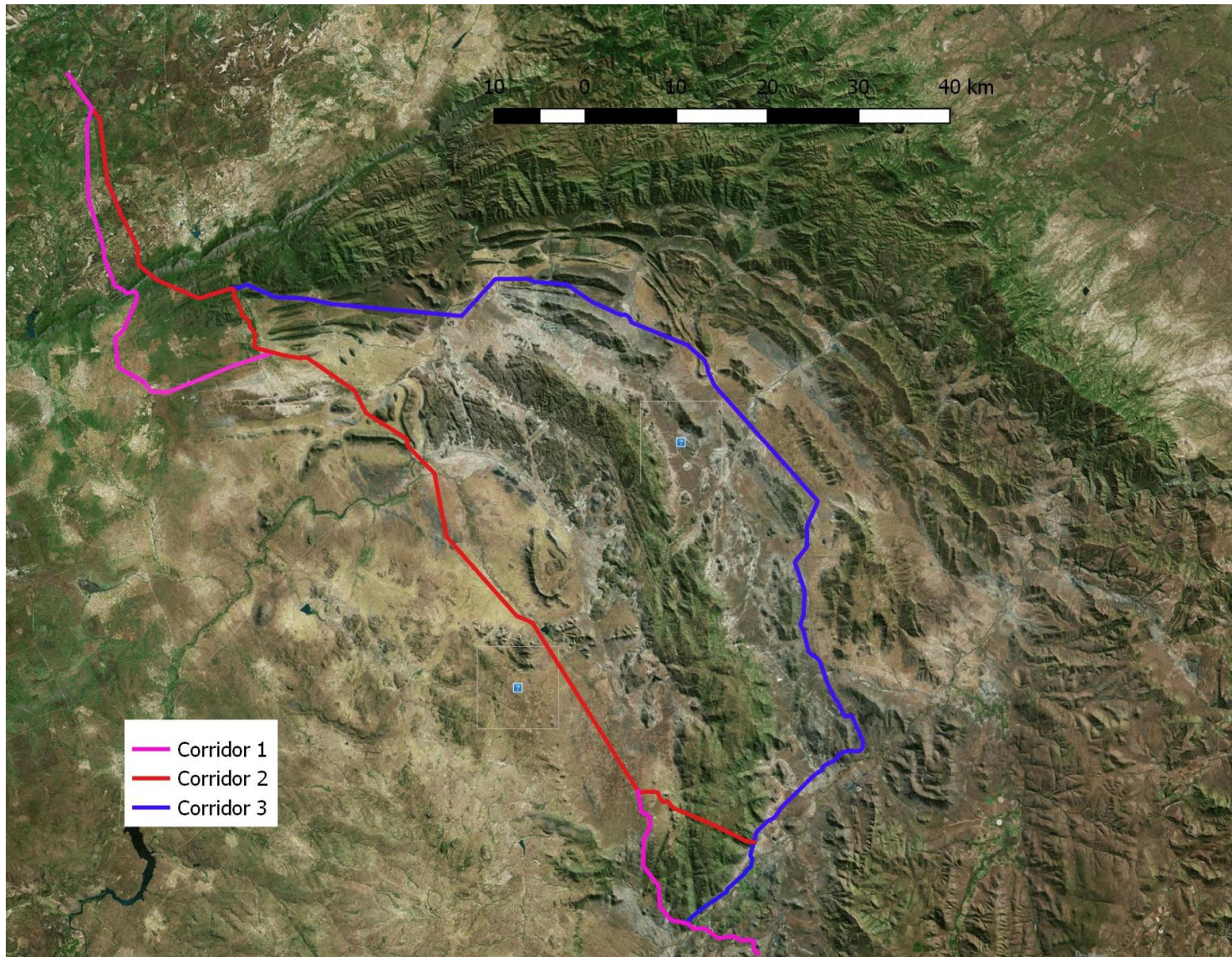


Figure 1. The general study area and proposed routes for the Maphutha Witkop 400kV power line. For reasons of scale the centre line of the corridor is shown in each case.

## 2. BACKGROUND TO POTENTIAL IMPACTS OF PROPOSED POWER LINE ON BIRDS

### 2.1. Bird collision with conductors and earth wires

Collision with power lines is a well-known conservation problem for many birds and for some species it can be a significant source of mortality (Bevanger 1998, Erickson *et al.* 2005, Drewitt & Langston 2008, Shaw *et al.* 2010, Jenkins *et al.* 2011). The reasons for collisions are complex, with each case involving a variety of biological, topographical, meteorological and technical factors (Bevanger 1994). Although all birds have the potential to be affected by collisions, those most heavily impacted are generally large, flocking species which fly often, with waterfowl, gamebirds, cranes, bustards and storks usually among the most frequently reported casualties (Bevanger 1998, Janss 2000, Jenkins *et al.* 2010). The large body size of such species mean that they have limited maneuverability in the air and are less able to take necessary evasive action to avoid colliding with power lines (Bevanger 1998).

In South Africa, incidentally discovered mortality incidents reported by Eskom staff, conservationists and the general public are collated in the Central Incident Register, which is maintained by the Eskom-Endangered Wildlife Trust Strategic Partnership (Eskom-EWT). These data, together with those from more systematic power line surveys near De Aar (Anderson 2002), in the Overberg (Shaw *et al.* 2010) and across the Karoo (Jenkins *et al.* 2011, Shaw 2013) highlight the high levels of large terrestrial bird mortality caused by existing power lines in this country. Particularly affected are Red-listed birds including cranes, bustards, storks, Secretarybirds, flamingos and vultures, which are generally long-lived and slow to reproduce (Shaw 2013). These species have not evolved to cope with high adult mortality, with the result that consistent mortality in this age group over an extended period could seriously affect a population's ability to sustain itself in the long or even medium term. The cumulative effects of collisions together with other anthropogenic threats to these species (e.g. habitat destruction, disturbance) are unknown over the long term.

Mitigating bird collisions with power lines typically involves the installation of line marking devices on the cables in order to make them more visible to approaching birds. Worldwide, a variety of marking devices are used, but very few have been adequately field-tested (Jenkins *et al.* 2010). Great uncertainty remains about which are best, as they vary enormously in effectiveness between species and in different conditions (van Rooyen & Ledger 1999, Anderson 2002). Generally though, marking seems to be fairly effective, with a recent meta-analysis showing a 78% decrease in mortality rates on marked lines (Barrientos *et al.* 2011).

The reason for this apparently low efficacy is likely to be a result of the visual capacity of bustards. A recent South African study on Kori Bustards *Ardeotis kori*, Blue Cranes *Anthropoides paradiseus* and White Storks *Ciconia ciconia* demonstrated that these birds have a narrow field of frontal vision, so when in flight, head

movements in the vertical plane (pitching the head to look downwards, perhaps to look for other birds or foraging patches) will render the bird blind in the direction of travel and they will not see the power line at all (Martin & Shaw 2010). Similar visual constraints were subsequently found in *Gyps* vultures, including White-backed Vultures (Martin *et al.* 2012). Development of additional mitigation to draw the bird's attention to the marked line (which must still be marked, because the bird will see the markers if it is looking at the line) is a priority for future research for these groups of birds.

While collisions generally occur in hot-spots (i.e. many collisions, sometimes of multiple species in small areas) and are not spread evenly across the landscape, the factors describing these locations are still very difficult to understand. Landscape level GIS studies on Blue Cranes and Ludwig's Bustard in South Africa have failed to find useful contributory factors (Shaw *et al.* 2010, Shaw 2013). Some locations are clearly high risk for resident birds with predictable movement patterns, such as lines in close proximity to roosting dams for cranes.

## **2.2. Habitat destruction**

During the construction phase of power lines, a certain amount of habitat destruction and alteration takes place on the site. This happens with the construction of access roads, the clearing of the site itself and any associated infrastructure. The servitude also has to be maintained free of any natural vegetation, amongst other reasons to minimize the risk of fire. The destruction or alteration of natural habitat has an impact on birds breeding, foraging and roosting in close proximity to the site.

## **2.3. Disturbance**

Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. The potential exists for the impact of disturbance to influence a greater area than the site itself. This site is relatively un-disturbed by other infrastructure in parts, particularly in the protected areas. There is a strong likelihood of sensitive species such as large eagles and storks nesting in the vicinity of the proposed power line alignments. This means that the impact of disturbance could be significant for this project.

## **2.4. Electrocution of birds on tower structures**

Electrocution refers to the scenario whereby a bird bridges the gap between two phases or a phase and an earthed component thereby causing an electrical short circuit. The larger bird species such as vultures and eagles are particularly vulnerable to this impact, as obviously the larger the wingspan and other dimensions of a bird, the greater the likelihood of it being able to bridge the gap between hardware. On transmission lines such

the proposed power line the impact of electrocutions is not possible due to the large clearances between phases and/or phases and earthed structures. This impact is not discussed further.

## 2.5. Nesting on power line

Raptors, large eagles, crows, Hadedda Ibises *Bostrychia hagedash* and Egyptian Geese *Alopochen aegyptiaca* have learnt to nest on transmission towers, and this has allowed them to breed in areas of the country where breeding would not previously have been possible due to limited nesting substrates (van Rooyen & Ledger 1999, de Goede & Jenkins 2001). This has probably resulted in a range expansion for some of these species, and large eagles such as Tawny, Martial and Verreaux's are now quite common inhabitants of transmission towers in the Karoo (e.g. de Goede & Jenkins 2001). Cape Vultures *Gyps africanus* and White-backed Vultures have also taken to roosting on power lines in certain areas in large numbers, while Lappet-faced Vultures are also known to use power lines as roosts, especially in areas where large trees are scarce (J. Smallie pers. obs.). At face value this appears a positive contribution that power lines can make to these species. However the situation is more complex in that nesting on the tower places the adults and young at much greater risk of collision with the overhead cables than would otherwise be the case. Due to the electrical faulting that these birds can cause on transmission towers, Eskom also sometimes wishes to remove nests in order to manage the risk of faulting, with negative effects for the birds if not correctly handled.

This report makes a strong argument for building the proposed power line as close as possible to existing transmission lines. However, a consequence of this is that if eagles are nesting on the existing line, disturbance of these birds will be a real risk during construction of the new line. This EIA study cannot possibly check every existing tower for nests (and new nests could be built between the EIA and construction), so it is recommended that an avifaunal walk-through be conducted to do this, as detailed elsewhere in this report.

If nests are found, case specific recommendations will be developed. Likely recommendations will be to avoid construction of the new line within a buffer area around nests during breeding season, but in spite of such efforts there is a real chance that breeding birds may be disturbed and breeding success negatively affected (see de Goede 2011). However, our opinion is that the benefits of placing the new line adjacent to the existing one for a lifespan of 50 – 60 years outweigh the risks to one season's breeding during construction. The actual nesting of birds on the proposed new power line only becomes an issue if Eskom need to intervene with nesting and breeding activities. It is essential that all activities related to raptor nests be subject to Eskom Transmissions nest management guidelines, and to the relevant provincial and national legislation.

## 2.6. Electrical faulting due to birds

Birds are able to cause electrical faults on transmission power lines through their faeces and/or nest material. Large birds sitting above live conductors can cause flashovers when they produce long continuous 'streamers' of excrement which bridges the critical air gap, or through buildup of faeces on insulators to the point where the insulation is compromised and a fault occurs. Material used to build nests on towers can also intrude into the air gap and cause short circuits. With the likely abundance of large eagles and vultures in this study area, this interaction is a strong likelihood for the proposed power line. Of the alternative proposed tower designs, the cross rope suspension is believed to be best from a bird induced electrical faulting perspective as it does not provide much safe perching substrate for birds directly above the live conductors. This impact has been described in more detail in Section 5.

### 3. METHODOLOGY

#### 3.1. Information sources used

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

- Bird distribution data of the first and second Southern African Bird Atlas Project (Harrison *et al*, 1997; [www.sabap2.adu.org.za](http://www.sabap2.adu.org.za)) was obtained for the broader area within which the study area is located, as a means to ascertain which species occur within the study area.
- The regional conservation status of all bird species occurring in the aforementioned quarter degree squares was 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 of species was determined from the IUCN Red List (2017).
- Google Earth was used to examine the study area on a desktop level.
- The location of the project in relation to the Important Bird Areas (IBA's) (Barnes 1998, Marnewick *et al*, 2015) was examined.
- The location of Co-ordinated Water bird Counts (CWAC) (Taylor *et al*, 1999) and Coordinated Avifaunal Roadcount (CAR) routes relative to the study area were examined.
- A site visit was conducted in November 2017 to examine the micro-habitats available in the area and get an overall idea of what the site looks like. In addition to an overall assessment of the study area, specific surveys were conducted for any sensitive avifaunal features, including nest sites of sensitive species. The most likely of these are large eagles and other cliff nesting species, so all suitable cliffs (and existing overhead power lines) were surveyed with binoculars and spotting scope to detect any nests.

## 4. DESCRIPTION OF RECEIVING ENVIRONMENT

### 4.1. Vegetation & micro-habitats

This site is comprised of a complex set of vegetation types, particularly in the north where the proposed power line will cross the Wolkberg. According to Mucina & Rutherford (2006) nine separate vegetation types occur on or near the site (Figure 2). The majority of the proposed alignments pass through “Sekhukhune Plains Bushveld” and “Sekhukhune Mountain Bushveld”. In the north towards Witkop the vegetation is “Polokwane Plateau Bushveld”. The vegetation types are generally more complex in the areas of higher topographic relief and simpler in the flatter areas.

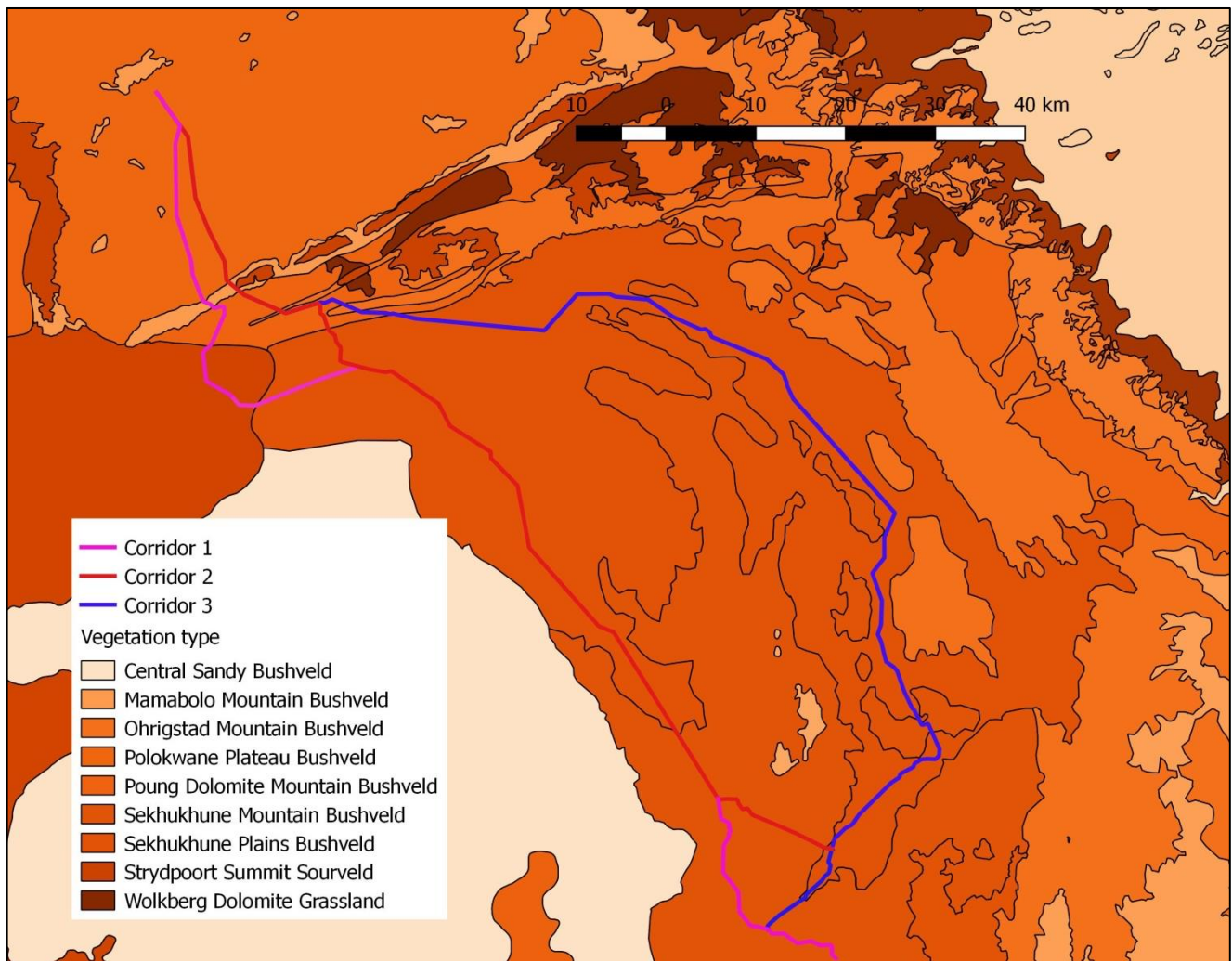


Figure 2. Vegetation classification for the Maphutha Witkop 400kV power line study area. For reasons of scale the centre line of the corridor is shown in each case.

Micro habitats are sometimes more useful in understanding bird distribution and abundance than vegetation types. Micro habitats are formed by a number of factors, one of which is vegetation. Others include land use, topography, and other anthropogenic influences.

The most distinct micro habitats present in the study area are: bushveld; flats/plains; rocky ridges; cliffs; dams; rivers and drainage lines. In general, the areas closest to Witkop in the north and Maphutha in the south are the most mountainous and provide the best remaining vegetation. The middle section is primarily flatter ground with denser human settlement, and has been heavily impacted by livestock grazing and firewood harvesting. Several drainage lines or streams bisect the study area, the most important of which are the Olifants, Tudumo and Steepoort rivers. These rivers form flight paths for birds commuting up and down their courses, hold different vegetation often attractive to various bird species, and attract bird for foraging, drinking and bathing. One large dam (the Lepellane Dam – approximately 140m from the centre line of Corridor 1 and 2) is present in the study area and is a significant attractant for avifauna in the broader area. Several Yellow-billed Storks *Mycteria ibis* were recorded there during our site visit (amongst other species).

#### **4.2. Relevant bird populations**

The data source for bird distribution and abundance used for this study is the Southern African Bird Atlas Project (SABAP1 – first -Harrison *et al*, 1997; & second – [www.sabap2.adu.org.za](http://www.sabap2.adu.org.za)). These data provide a good indication of which species occur in the broader area. Up to approximately 532 bird species have been recorded across the broader area within which the proposed project falls by the Southern African Bird Atlas Project 1 and 2 (Harrison *et al*, 1997; [www.sabap2.adu.org.za](http://www.sabap2.adu.org.za)) (Appendix 2). It is important to note that these species could have been recorded anywhere in the broader area and not necessarily in the exact study area. It does however mean that these species could occur in the proposed study area if conditions are right on site

Table 1 below shows only the Red Listed species amongst those recorded. A total of 45 Red Listed species have been recorded, of which 12 are “Endangered”, 17 are “Vulnerable” and 16 are “Near-threatened”. In addition, a number of species are endemic or near-endemic to southern Africa.

Table 1 also shows how likely the above mentioned species are to occur on the site itself and how important this proposed site is for the Red Listed species. This will ultimately determine the significance of any likely impacts of the proposed power line on these species. Fifteen of the 45 Red Listed species have been judged as probably occurring on site and for which the site is of medium or higher importance. These are the species that will form the main focus of this study.

Field work conducted in November 2017 recorded 59 species in total on site (see Appendix 4). This included

three Red Listed species: Lanner Falcon *Falco biarmicus*; Yellow-billed Stork; and Tawny Eagle *Aquila rapax*.

Table 1. Red Listed bird species: preferred micro habitats, likelihood of occurring on site and importance of the site.

Common name	Scientific name	SAB AP1	SAB AP2	Taylor et al 2015	TOPS list	IUCN 2017	Endemic /near	Likelihood of occurring on site	Importance of site for species
Parrot, Cape	<i>Poicephalus robustus</i>	1	1	EN	CE	LC	1	Unlikely	Low
Vulture, White-backed	<i>Gyps africanus</i>	1	1	EN	E	EN		Possible	Medium
Vulture, Cape	<i>Gyps coprotheres</i>	1	1	EN	E	EN		Probable	Medium
Stork, Saddle-billed	<i>Ephippiorhynchus senegalensis</i>	1	1	EN	E	LC		Possible	Low
Marsh-harrier, African	<i>Circus ranivorus</i>	1	1	EN	P	LC		Unlikely	Low
Ground-hornbill, Southern	<i>Bucorvus leadbeateri</i>	1	1	EN	P	VU		Possible	Low
Eagle, Tawny	<i>Aquila rapax</i>	1	1	EN	VU	LC		Confirmed	Medium
Bateleur	<i>Terathopius ecaudatus</i>	1		EN	VU	NT		Unlikely	Low
Eagle, Martial	<i>Polemaetus bellicosus</i>	1	1	EN	VU	VU		Possible	Medium
Hawk, Bat	<i>Macheiramphus alcinus</i>	1	1	EN		LC		Possible	Medium
Stork, Yellow-billed	<i>Mycteria ibis</i>	1	1	EN		LC		Confirmed	Medium
Vulture, Hooded	<i>Necrosyrtes monachus</i>		1	EN		EN		Unlikely	Low
Pelican, Pink-backed	<i>Pelecanus rufescens</i>	1		VU	E	LC	1	Possible	Low
Stork, Black	<i>Ciconia nigra</i>	1	1	VU	VU	LC		Probable	Medium
Grass-owl, African	<i>Tyto capensis</i>	1	1	VU	VU	LC		Unlikely	Low
Ibis, Southern Bald	<i>Geronticus calvus</i>	1	1	VU	VU	VU	1	Possible	Low
Vulture, Lappet-faced	<i>Torgos tracheliotus</i>	1	1	VU		EN		Possible	Low
Eagle, Verreaux's	<i>Aquila verreauxii</i>	1	1	VU		LC		Probable	Medium
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	1	1	VU		LC		Unlikely	Low
Falcon, Lanner	<i>Falco biarmicus</i>	1	1	VU		LC		Confirmed	Medium
Night-Heron, White-backed	<i>Gorsachius leuconotus</i>	1		VU		LC		Possible	Medium
Pygmy-Goose, African	<i>Nettapus auritus</i>	1		VU		LC		Possible	Low
Painted-snipe, Greater	<i>Rostratula benghalensis</i>	1	1	VU		LC		Probable	Low
Flufftail, Striped	<i>Sarothrura affinis</i>		1	VU		LC		Possible	Low

Blackcap, Bush	<i>Lioptilus nigricapillus</i>	1		VU		NT		Possible	Medium
Eagle, African Crowned	<i>Stephanoaetus coronatus</i>	1	1	VU		NT		Possible	Medium
Secretarybird	<i>Sagittarius serpentarius</i>	1	1	VU		VU		Probable	Medium
Finfoot, African	<i>Podica senegalensis</i>	1	1	VU		LC		Possible	Low
Denham's Bustard	<i>Neotis denhamii</i>	1		VU		NT		Unlikely	Low
Crane, Blue	<i>Anthropoides paradiseus</i>	1		NT	E	VU	1	Unlikely	Low
Bustard, Kori	<i>Ardeotis kori</i>	1		NT	VU	NT		Possible	Medium
Kingfisher, Half-collared	<i>Alcedo semitorquata</i>	1	1	NT		LC		Possible	Medium
Lark, Short-clawed	<i>Certhilauda chuana</i>	1	1	NT		LC		Possible	Low
Stork, Abdim's	<i>Ciconia abdimii</i>	1	1	NT		LC		Possible	Low
Roller, European	<i>Coracias garrulus</i>	1	1	NT		LC		Probable	Low
Stork, Marabou	<i>Leptoptilos crumeniferus</i>	1	1	NT		LC		Probable	Low
Bustard, Black-bellied	<i>Lissotis melanogaster</i>	1	1	NT		LC		Possible	Low
Flamingo, Greater	<i>Phoenicopterus ruber</i>	1	1	NT		LC		Possible	Low
Courser, Double-banded	<i>Rhinoptilus africanus</i>	1	1	NT		LC		Possible	Low
Ground-thrush, Orange	<i>Zoothera gurneyi</i>	1	1	NT		LC		Unlikely	Low
Harrier, Pallid	<i>Circus macrourus</i>	1	1	NT		NT		Possible	Low
Falcon, Red-footed	<i>Falco vespertinus</i>	1		NT		NT		Possible	Low
Pratincole, Black-winged	<i>Glareola nordmanni</i>		1	NT		NT		Possible	Low
Duck, Maccoa	<i>Oxyura maccoa</i>	1	1	NT		NT		Possible	Low
Flamingo, Lesser	<i>Phoenicopterus minor</i>	1		NT		NT		Possible	Low

This group of priority bird species includes: woodland species, such as vultures and large eagles; riverine species such as White-backed Night Heron *Gorsachius leuconotus*, Half-collared Kingfisher *Alcedo semitorquata* and Yellow-billed Stork; and open woodland large terrestrials such as Secretarybird *Sagittarius serpentarius*. The vultures and eagles are anticipated to interact with the power line predominantly through perching, nesting and roosting on the infrastructure. This may also place them at risk of collision with the earth wires. The storks and large terrestrials will be at risk of collision with the power line. Most of the species mentioned above are physically large species. These are the species most at risk of direct interaction with the proposed power line. However all species, including the small passerines, could be affected by the power line, particularly through disturbance and habitat destruction. This impact assessment also focuses by necessity on the Red Listed species. This does not mean that the impacts on non-Red Listed species are totally ignored. It is believed that the mitigation proposed for Red Listed species will also provide protection for non-Red Listed species in many cases.

Several key avifaunal features exist in the proposed study area. These features affect the significance of possible impacts of the proposed power line and influence the selection of the route on which to build the line. These features are described in more detail below:

#### **4.2.1. Wolkberg Forest Belt – Important Bird & Biodiversity Area (IBBA) – SA005**

This IBBA consists of hills and forests in the vicinity of Tzaneen and spreading westwards. Spectacular mountains with steep slopes and gorges prevail in this area, and this is evident even in Figures 3 and 4. Large expanses of Afromontane forest still exist in this area and several significant rivers begin in these mountains. The IBBA is home to species such as Bat Hawk *Macheiramphus alcinus*, Martial Eagle, African Crowned Eagle *Stephanoaetus coronatus*, Peregrine Falcon *Falco peregrinus* and Cape Parrot *Poicephalus robustus*. Other physically smaller special species include: Black-fronted Bush-Shrike *Chlorophoneus nigrifrons*; Orange Ground Thrush *Zoothera gurneyi*; Bush Blackcap *Lioptilus nigricapillus*; Forest Buzzard *Buteo trizonatus*; Knysna Turaco *Tauraco corythaix*; Chorister Robin-Chat *Cossypha dichroa*; Brown Scrub Robin *Erythropygia signata*; Grey Cuckooshrike *Coracina caesia*; Olive Bush-Shrike *Chlorophoneus olivaceus*; Green Twinspot *Mandingoa nitidula* and Forest Canary *Crithagra scotops*. Riverine species such as African Finfoot *Podica senegalensis*, Half-collared Kingfisher *Alcedo semitorquata* and White-backed Night Heron *Gorsachius leuconotus* frequent some of the better rivers and the grasslands hold Broad-tailed Warbler *Schoenicola brevirostris*, Striped Flufftail *Sarothrura affinis* and Blue Swallow *Hirundo atrocaerulea* (which probably regularly uses these grasslands on migration).

The IBBA descriptions lists “spread of alien trees from plantations” as the main threat to birds in the IBBA but also states “it is unclear whether infrastructure such as power lines and roads have a negative impact on the IBBA’s trigger species”.

It is far from ideal for a power line of this nature to be built through this IBBA. Important Bird & Biodiversity

Areas are recognized internationally for their importance for the conservation of birds. Since there are already several existing power lines within this IBBA, it would however be difficult to argue that no power lines can be built in IBBA's. There are also some other significant human impacts on the area such as the surface mining pictured in Figure 4. However it is recommended that the length of new power line through the IBBA should be kept to an absolute minimum, and the exact position of the power line in the IBBA should be carefully planned.

All 3 proposed corridors for the Maphutha Witkop line pass through this IBBA. Corridor 1 is mostly positioned adjacent to an existing 132kV line through the IBBA, which is sensible. Corridors 2 and 3 are the same for most of the way through the IBBA and are adjacent to an existing 400kV line. The Wolkberg mountain range becomes smaller with less significant cliff face the further west it goes, meaning that in general building the power line more west is an advantage. Most vertical cliff (better substrate for cliff nesting bird species) appears to be on the north facing side of the mountain, or in smaller gorges running north-south, whilst the rock face on the south facing slope appears more sloped.

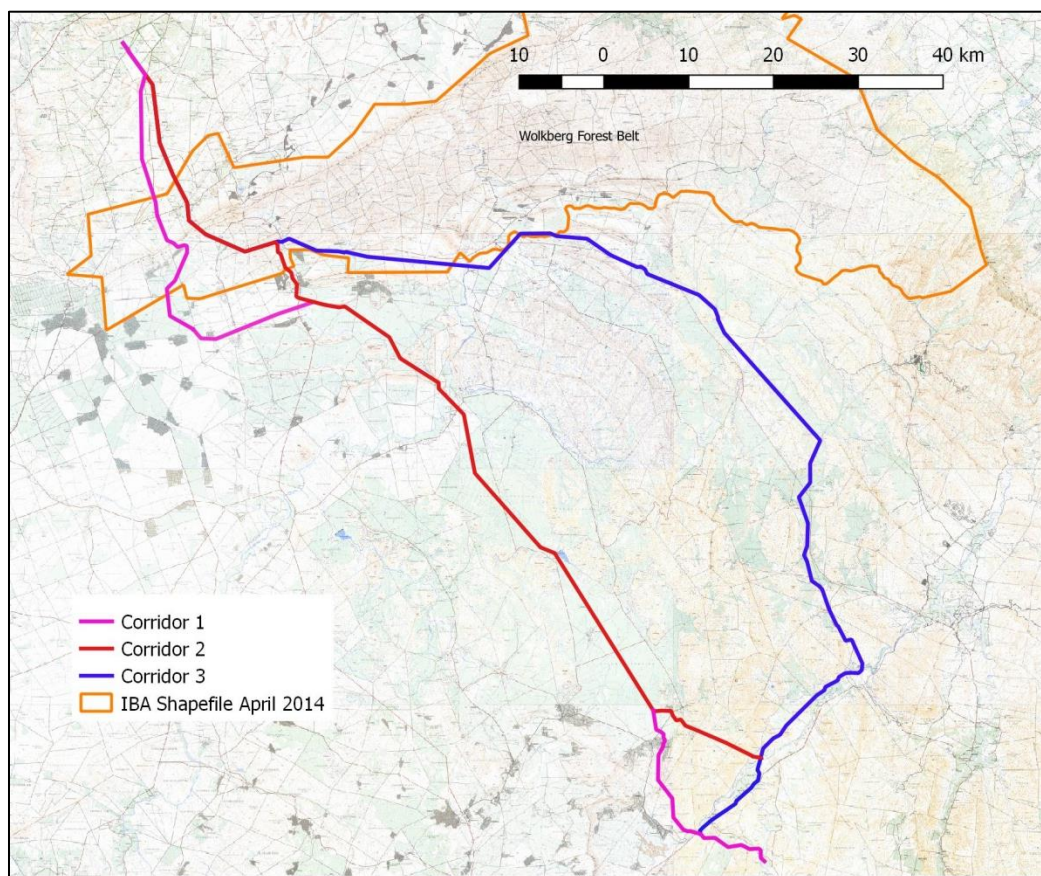


Figure 3. Important Bird & Biodiversity Areas in the Maphutha Witkop 400kV power line study area. For reasons of scale the centre line of the corridor is shown in each case.



Figure 4. Views of the Wolkberg mountain range.

#### **4.2.2. *Olifants River***

This is a significant river which bisects the study area (Figure 5). Building a power line across or adjacent to such a river poses a risk to avifauna through collision and to avifaunal habitat through destruction or alteration at construction. Many common bird species will frequent these rivers and be susceptible to collision with overhead cables across the river. In addition several Red Listed species such as storks, in particular Yellow-billed Stork will use these areas.

The same importance can be attributed to the Tudumo and Steelpoort Rivers to a lesser extent.

It is recommended that the new power line should cross these rivers as few times as possible and should also not run adjacent and close to the rivers for any length if avoidable.



Figure 5. The Olifants River.

#### **4.2.3. Lepellane Dam**

This is probably the only large dam close to any of the proposed power line routes. It appears to be a strong dam in the sense of holding water permanently (based on vegetation growth, water levels during this dry year, and presence of small subsistence fishing operations). This dam provides vital habitat for birds to roost, forage, drink and bathe. Large birds such as storks, herons, pelicans, and flamingos are likely to visit the dam occasionally (Yellow-billed Stork recorded during our site visit) and African Fish-Eagle *Haliaeetus vocifer* is likely to be resident. Building a new power line close to this dam will pose a significant collision risk to birds, some of which are Red Listed.

At present the proposed Corridors 1 and 2 pass approximately 140m from the dam edge. We recommend placing the power line as far west within the 3km corridor as possible (to achieve a 1.5km separation between dam and line) for a distance of at least 1km either side of this dam.



Figure 6. The Lepellane Dam.

#### **4.2.4. Cape Vulture roost sites**

From previous field work in the broader area we are aware of 2 Cape Vulture *Gyps coprotheres* roost sites approximately 10km north of Corridor 3. The location of these sites is shown in Figure 7. Building power lines close to roost sites is not advised as it would increase collision risk for the birds and may even disturb them during construction. Although this distance of 10km is probably sufficient to provide adequate protection from risk for birds roosting at these sites, if it is possible to build the new power line further from these roosts (by using Corridors 1 or 2) we recommend this be done. Corridors 1 and 2 are approximately 40 – 50km from these roost sites.

In addition, during field work for this project we found a new possible roost site at the position shown in Figure 7. This site had significant whitewash (bird faeces) on ledges on the cliff, strongly resembling a vulture roost. However no vultures were recorded here. It is possible that the site is used by another bird species and not vultures, however we believe it more likely that this is a seasonal or temporary (thereby explaining the birds absence) vulture roost site. The site would be slightly less sensitive if another species other than vultures is using it (and responsible for the whitewash) but it would still be ill advised to build a new power line close to this site. The proposed Corridor 3 is currently sited approximately 1.5km from the roost cliff (if centre line of corridor is

used). Corridors 1 and 2 are approximately 7km from the roost site.

## 5. EVALUATION OF IMPACTS & CHOICE OF ALTERNATIVE

### 5.1. Evaluation of impacts

The impacts of the proposed power line have been assessed and rated using the tables below and the criteria found in Appendix 1 (standard criteria for a study of this nature):

Table 2. Impact ratings of each route alternative – Bird collisions

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Avifauna</b>							
Collision of birds with earth wires							
Route alternative 1	No	Negative	Local	Permanent	Medium	Medium	<b>Medium</b>
	Yes	Negative	Local	Permanent	Medium	Low	<b>Low</b>
Route alternative 2	No	Negative	Local	Permanent	Medium	Medium	<b>Medium</b>
	Yes	Negative	Local	Permanent	Medium	Low	<b>Low</b>
Route alternative 3	No	Negative	Local	Permanent	Medium	Medium	<b>Medium</b>
	Yes	Negative	Local	Permanent	Medium	Low	<b>Low</b>
<b>Mitigation Measures</b>							
Choose optimum route for power line. Do not use Corridor 3 Conduct avifaunal walk through to ground truth final alignment and identify high risk sections of power line Install line marking devices on high risk sections to make cables more visible to birds and reduce risk of collisions Monitor line annually to measure how many birds are killed through collision							

Table 3. Impact ratings of each route alternative – Habitat destruction

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Avifauna</b>							
Destruction of bird habitat during construction							

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Route alternative 1	No	Negative	Local	Permanent	Medium	High	<b>Medium</b>
	Yes	Negative	Local	Permanent	Medium	High	<b>Medium</b>
Route alternative 2	No	Negative	Local	Permanent	Medium	High	<b>Medium</b>
	Yes	Negative	Local	Permanent	Medium	High	<b>Medium</b>
Route alternative 3	No	Negative	Local	Permanent	Medium	High	<b>Medium</b>
	Yes	Negative	Local	Permanent	Medium	High	<b>Medium</b>
<b>Mitigation Measures</b>							
Choose optimum route for power line. Don't use Corridor 3 Conduct avifaunal walk through to ground truth final alignment and identify sensitive habitats Minimise any vegetation clearing required							

Table 4. Impact ratings of each route alternative – Disturbance of birds

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Avifauna</b>							
Disturbance of birds – particularly whilst breeding							
Route alternative 1	No	Negative	Local	Short term	Low	Low	<b>Low</b>
	Yes	Negative	Local	Short term	Low	Low	<b>Low</b>
Route alternative 2	No	Negative	Local	Short term	Low	Low	<b>Low</b>
	Yes	Negative	Local	Short term	Low	Low	<b>Low</b>
Route alternative 3	No	Negative	Local	Short term	Low	Low	<b>Low</b>
	Yes	Negative	Local	Short term	Low	Low	<b>Low</b>
<b>Mitigation Measures</b>							

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Choose optimum route for power line. Don't use Corridor 3 Conduct avifaunal walk through to ground truth final alignment and identify any breeding sites for sensitive species. If any found provide case specific management measures							

Table 5. Impact ratings of each route alternative – Nesting of birds on power lines.

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Avifauna</b>							
Nesting of birds on power line towers/pylons							
Route alternative 1	No	Negative	Local	Permanent	Low	Low	<b>Low</b>
	Yes	Negative	Local	Permanent	Low	Low	<b>Low</b>
Route alternative 2	No	Negative	Local	Permanent	Low	Low	<b>Low</b>
	Yes	Negative	Local	Permanent	Low	Low	<b>Low</b>
Route alternative 3	No	Negative	Local	Permanent	Low	Low	<b>Low</b>
	Yes	Negative	Local	Permanent	Low	Low	<b>Low</b>
<b>Mitigation Measures</b>							
Choose optimum route for power line. Don't use Corridor 3 Once line is operational, any management of bird nests on power line must be strictly according to Eskom Transmission guidelines for nest management, and relevant legislation.							

Table 6. Impact ratings of each route alternative – Electrical faulting caused by birds.

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Avifauna</b>							
Electrical faulting caused by birds – <u>impact on business not birds</u>							
Route alternative 1	No	Negative	Local	Permanent	Low	Medium	<b>Medium</b>

Route Alternatives	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
	Yes	Negative	Local	Permanent	Low	Low	<b>Low</b>
Route alternative 2	No	Negative	Local	Permanent	Low	Medium	<b>Medium</b>
	Yes	Negative	Local	Permanent	Low	Low	<b>Low</b>
Route alternative 3	No	Negative	Local	Permanent	Low	Medium	<b>Medium</b>
	Yes	Negative	Local	Permanent	Low	Low	<b>Low</b>
<b>Mitigation Measures</b>							
Choose optimum route for power line. Don't use Corridor 3. Conduct avifaunal walk through to ground truth final alignment and identify towers requiring Bird Guards Install Bird Guards on relevant towers as per Eskom Transmission Guidelines							

## 5.2. Evaluation of alternatives

Table 7 below summarises key factors pertaining to each alternative route. For each route, a final ranking was assigned which indicates the preference for the route.

Table 7. Summary of route alternatives by specialist

Description of the route alternatives		
Corridor 1	Corridor 2	Corridor 3
<p><b>Ranking: 1 – most preferred</b></p> <p>Factors considered:</p> <ul style="list-style-type: none"> <li>• 160km long – less line = less impacts</li> <li>• 30km adjacent to 132kV existing line – placing new line adjacent to existing partially mitigates for collision since it makes them more visible</li> <li>• 16km through Important Bird &amp; Biodiversity Area – this is a sensitive area and new power line through it should be minimised</li> <li>• Crosses Olifantsrivier once. Crossing the river is not advised for avifauna as it is a sensitive area</li> <li>• Further from Cape Vulture roosts (40-50km from 2, 7km from one)</li> <li>• Lepellane Dam – 140m from edge - disadvantage</li> </ul>	<p><b>Ranking: 2 – second most preferred</b></p> <p>Factors considered:</p> <ul style="list-style-type: none"> <li>• 160km long</li> <li>• 38km adjacent to 400kV line, 16km adjacent to 132kv</li> <li>• 22km through IBBA</li> <li>• Crosses Olifantsrivier once</li> <li>• Further from Cape Vulture roosts (40-50km from 2, 7km from one)</li> <li>• Lepellane Dam – 140m from edge - disadvantage</li> </ul>	<p><b>Ranking: 3 – least preferred – try not to use</b></p> <p>Factors considered:</p> <ul style="list-style-type: none"> <li>• 195km long – significantly longer than routes 1 and 2</li> <li>• 66km adjacent to 400kV line, 32km adjacent to 132kV line</li> <li>• 46km through IBBA</li> <li>• Crosses Olifantsrivier 3 times and is adjacent to river for some distance</li> <li>• Closer to Cape Vulture roosts (10km from 2 roosts &amp; 1.5km from one). This is a disadvantage.</li> <li>• Lepellane Dam – approximately 30km from dam - advantage</li> </ul>

In addition to corridor alternatives, 3 alternatives are proposed for the tower design: self-support; cross rope; and guyed V. The preference from an avifaunal perspective is to use the cross rope suspension tower as it provides no perching or nesting substrate for large birds directly above live hardware. This would therefore pose less risk of electrical faulting and problems arising from nests on towers.

## 6. CONCLUSION & IMPACT STATEMENT

This proposed power line route passes through an area that is rich in avifauna, due to its varied geology and vegetation. A large number of regionally Red Listed bird species could occur on site. The most relevant of these are eagles, vultures, storks, bustards and Secretarybird.

The impact of collision of certain bird species with the overhead cables (in particular the earth wires) has been judged to be of medium significance. This can be reduced to low significance with mitigation in the form of: selecting the correct route for the power line; and installing effective line marking devices to make the cables more visible to birds. In order to implement effective mitigation measures it will be necessary to conduct an avifaunal walk through as part of the site specific EMP. It is also essential that sufficient time be budgeted for in order to do a thorough job with the walk through. This exercise will identify those exact spans of the power line that require mitigation. Generically speaking the key areas are likely to be river crossings, drainage lines and dams.

Destruction and alteration of habitat will be of medium significance. Since this is difficult to mitigate for (a certain amount of vegetation has to be removed or altered) it is not possible to reduce this to low significance with mitigation.

Disturbance of birds is judged to be of low significance. However, if threatened raptors are found to breed close to the alignment this would change. New nests could be built between the writing of this report and construction of the power line and so it is essential that a detailed site specific avifaunal walk through be conducted as close as possible to construction to identify any nests.

The risk of electrical faulting caused by birds is judged to be of medium significance – reduced to low significance with the installation of Bird Guards on high risk towers to ensure that large birds cannot perch directly above the relevant live hardware. This is however an impact on the business, not the birds, and is best mitigated reactively if a problem is identified once the line is operational. Those towers that will obviously require Bird Guards installed will be identified during the avifaunal walk through.

Certain bird species may choose to nest on the new power line towers once constructed. This is rated as a low significance.

We conclude that Corridor 1 (southern) is the most preferred overall for avifauna. Corridor 2 is the second most preferred. Corridor 3 (Northern) should ideally not be used although it is not fatally flawed.

If the recommendations of this report are adhered to, this project can proceed.

## 7. REFERENCES

Barnes, K.N. (ED.) 1998. The Important Bird Areas of Southern Africa. Birdlife South Africa, Johannesburg.

Barnes, K.N. (ED.) 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa: Johannesburg.

Benson, P (Phd). 2012. Research Officer, School of Animal, Plant & Environmental Sciences, University of the Witwatersrand. Personal communication.

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.

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.

IUCN 2017. IUCN Red List of Threatened Species. Version 2012.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>.

Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.

Mucina, L; Rutherford, C. 2006. The Vegetation of South Africa, Lesotho and Swaziland, South African National Biodiversity Institute, Pretoria.

Shaw, J.M. 2009. The End of the Line for South Africa's National Bird? Modelling Power Line Collision Risk for the Blue Crane. Master of Science in Conservation Biology. Percy FitzPatrick Institute of African Ornithology

Shaw J, Jenkins AR and Ryan PG 2010a. Modelling power line collision risk in the Blue Crane *Anthropoides paradiseus* in South Africa. *Ibis* 152: 590-599.

Shaw J, Jenkins AR, Ryan PG and Smallie J. 2010b. A preliminary survey of avian mortality on power lines in the Overberg, South Africa. *Ostrich* 81: 109-113.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A., & Kieswetter, S.L. 1999. TOTAL CWAC Report: Coordinated Water bird Counts in South Africa, 1992 – 1997. Avian Demography Unit, Cape Town.

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

## APPENDIX 1 - CRITERIA FOR ASSESSMENT OF THE IMPACTS

The following criteria were used to evaluate the significance of the anticipated impacts:

Extent of the impact:

The extent of the impact was assessed accordingly:

- (1) Limited to the site and its immediate surroundings
- (2) Local/Municipal extending only as far as the local community or urban area
- (3) Provincial/Regional
- (4) National i.e. South Africa
- (5) Across International borders

Duration of the impact:

The lifespan of the impact was assessed to be:

- (1) Immediate (less than 1 year)
- (2) Short term (1-5 years)
- (3) Medium term (6-15 years)
- (4) Long term (the impact will cease after the operational life span of the project)
- (5) Permanent (no mitigation measures of natural process will reduce the impact after construction)

Magnitude of the impact:

The magnitude or severity of the impacts is indicated as either:

- (0) None (where the aspect will have no impact on the environment)
- (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),
- (4) High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
- (5) Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).

Probability of occurrence:

The likelihood of the impact actually occurring was indicated as either:

(0) None (impact will not occur)

(1) Improbable (the possibility of the impact materializing is very low as a result of design, historic experience or implementation of adequate mitigation measures)

(2) Low probability (there is a possibility that the impact will occur)

(3) Medium probability (the impact may occur)

(4) High probability (it is most likely that the impact will occur)

(5) Definite / do not know (the impact will occur regardless of the implementation of any prevention or corrective actions or if the specialist does not know what the probability will be based on too little published information)

Status of the Impact:

The impacts are assessed as either having a:

Negative effect (i.e. at a cost to the environment)

Positive effect (i.e. at a benefit to the environment)

Neutral effect on the environment.

Accumulative Impact:

The impact of the development is considered together with additional developments of the same or similar nature and magnitude. The combined impacts may be:

Negligible (i.e. the net effect is the same as a single development)

Marginal (i.e. the impact of the two developments of a similar nature is less than twice the impact of a single development. This implies it is better to place the two developments in the same environment rather than in separate environments.

Compounding (i.e. the impact of the two developments is more than twice the impact of two single developments. This implies that it is better to split the two developments into separate environments.

Significance of the Impact:

Based on a synthesis of the information contained in the points above, the potential impacts were assigned a significance weighting (S). The weighting is formulated by adding the sum of the numbers assigned to extent (E), duration (D) and magnitude (M) and multiplying this sum by the probability (P) of the impact hence  $S=(E+D+M)P$ .

Low (less than 30 points): the impact does not have a direct influence on the decision to develop the area

Medium (30-60 points): the impact could influence the decision to develop in the area unless it is effectively mitigated

High (above 60 points): where the impact must have an influence on the decision to proceed to develop in the area

## APPENDIX 2. BIRD SPECIES RECORDED IN THE BROADER STUDY AREA BY THE SABAP1 & SABAP2.

'1' denotes presence not abundance

*SABAP 1* – species recorded in the broader area by First Southern African Bird Atlas Project. These are species that could be expected to occur on the Maphutha Witkop site. These are not necessarily recorded on site by our own work.

*SABAP2* - species recorded in the broader area by Second Southern African Bird Atlas Project. These are species that could be expected to occur on the Maphutha Witkop site. These are not necessarily recorded on site by our own work.

*Taylor et al 2015* – most recent regional conservation status for species.

*TOPS* – on the national ‘Threatened or Protected Species’ list.

*IUCN 2017*. Global 2017 IUCN red data classification

*Endemic/near endemic* – whether the species is endemic or near endemic to South Africa.

Common name	Scientific name	SAB AP1	SAB AP2	Taylor et al 2015	TOPS list	IUCN 2017	Endemic /near
Parrot, Cape	<i>Poicephalus robustus</i>	1	1	EN	CE	LC	1
Vulture, Cape	<i>Gyps coprotheres</i>	1	1	EN	E	EN	
Vulture, White-backed	<i>Gyps africanus</i>	1	1	EN	E	EN	
Stork, Saddle-billed	<i>Ephippiorhynchus senegalensis</i>	1	1	EN	E	LC	
Marsh-harrier, African	<i>Circus ranivorus</i>	1	1	EN	P	LC	
Ground-hornbill, Southern	<i>Bucorvus leadbeateri</i>	1	1	EN	P	VU	
Eagle, Tawny	<i>Aquila rapax</i>	1	1	EN	VU	LC	
Bateleur	<i>Terathopius ecaudatus</i>	1		EN	VU	NT	
Eagle, Martial	<i>Polemaetus bellicosus</i>	1	1	EN	VU	VU	
Vulture, Hooded	<i>Necrosyrtes monachus</i>		1	EN		EN	
Cormorant, White-breasted	<i>Phalacrocorax carbo</i>	1	1	EN		LC	1
Hawk, Bat	<i>Macheiramphus alcinus</i>	1	1	EN		LC	
Stork, Yellow-billed	<i>Mycteria ibis</i>	1	1	EN		LC	
Crane, Blue	<i>Anthropoides paradiseus</i>	1		NT	E	VU	1
Bustard, Kori	<i>Ardeotis kori</i>		1	NT	VU	NT	
Bustard, Black-bellied	<i>Lissotis melanogaster</i>	1	1	NT		LC	
Courser, Double-banded	<i>Rhinoptilus africanus</i>	1	1	NT		LC	
Flamingo, Greater	<i>Phoenicopterus ruber</i>	1	1	NT		LC	
Ground-thrush, Orange	<i>Zoothera gurneyi</i>	1	1	NT		LC	
Kingfisher, Half-collared	<i>Alcedo semitorquata</i>	1	1	NT		LC	

Lark, Short-clawed	<i>Certhilauda chuana</i>	1	1	NT		LC	
Roller, European	<i>Coracias garrulus</i>	1	1	NT		LC	
Stork, Abdim's	<i>Ciconia abdimii</i>	1	1	NT		LC	
Stork, Marabou	<i>Leptoptilos crumeniferus</i>	1	1	NT		LC	
Duck, Maccoa	<i>Oxyura maccoa</i>	1	1	NT		NT	
Falcon, Red-footed	<i>Falco vespertinus</i>	1		NT		NT	
Flamingo, Lesser	<i>Phoenicopterus minor</i>	1		NT		NT	
Harrier, Pallid	<i>Circus macrourus</i>	1	1	NT		NT	
Pratincole, Black-winged	<i>Glareola nordmanni</i>		1	NT		NT	
Pelican, Pink-backed	<i>Pelecanus rufescens</i>	1		VU	E	LC	1
Grass-owl, African	<i>Tyto capensis</i>	1	1	VU	VU	LC	
Stork, Black	<i>Ciconia nigra</i>	1	1	VU	VU	LC	
Ibis, Southern Bald	<i>Geronticus calvus</i>	1	1	VU	VU	VU	1
Vulture, Lappet-faced	<i>Torgos tracheliotus</i>	1	1	VU		EN	
Eagle, Verreaux's	<i>Aquila verreauxii</i>	1	1	VU		LC	
Falcon, Lanner	<i>Falco biarmicus</i>	1	1	VU		LC	
Finfoot, African	<i>Podica senegalensis</i>	1	1	VU		LC	
Flufftail, Striped	<i>Sarothrura affinis</i>		1	VU		LC	
Korhaan, White-bellied	<i>Eupodotis senegalensis</i>	1	1	VU		LC	
Night-Heron, White-backed	<i>Gorsachius leuconotus</i>	1		VU		LC	
Painted-snipe, Greater	<i>Rostratula benghalensis</i>	1	1	VU		LC	
Pygmy-Goose, African	<i>Nettapus auritus</i>	1		VU		LC	
Blackcap, Bush	<i>Lioptilus nigricapillus</i>		1	VU		NT	
Bustard, Denham's	<i>Neotis denhami</i>	1		VU		NT	
Eagle, African Crowned	<i>Stephanoaetus coronatus</i>	1	1	VU		NT	
Secretarybird	<i>Sagittarius serpentarius</i>	1	1	VU		VU	
Falcon, Peregrine	<i>Falco peregrinus</i>	1	1		VU		
Kestrel, Lesser	<i>Falco naumanni</i>	1	1		VU		
Eagle, Booted	<i>Aquila pennatus</i>	1	1			LC	
Eagle-owl, Cape	<i>Bubo capensis</i>	1				LC	
Fish-eagle, African	<i>Haliaeetus vocifer</i>	1	1			LC	
Heron, Rufous-bellied	<i>Ardeola rufiventris</i>		1			LC	
Bishop, Yellow	<i>Euplectes capensis</i>	1	1				1
Bush-shrike, Orange-breasted	<i>Telophorus sulfureopectus</i>	1	1				1
Chat, Buff-streaked	<i>Oenanthe bifasciata</i>	1	1				1
Cisticola, Tinkling	<i>Cisticola rufilatus</i>	1	1				1
Flycatcher, Fairy	<i>Stenostira scita</i>	1	1				1
Francolin, Grey-winged	<i>Scleroptila africanus</i>	1					1

Honey-buzzard, European	<i>Pernis apivorus</i>	1	1	1
Lark, Melodious	<i>Mirafrā cheniana</i>	1	1	1
Prinia, Drakensberg	<i>Prinia hypoxantha</i>	1	1	1
Rock-thrush, Cape	<i>Monticola rupestris</i>	1	1	1
Rock-thrush, Sentinel	<i>Monticola explorator</i>	1	1	1
Starling, Pied	<i>Spreo bicolor</i>	1	1	1
Sunbird, Greater Double-collared	<i>Cinnyris afer</i>	1	1	1
Sunbird, Southern Double-collared	<i>Cinnyris chalybeus</i>	1	1	1
Swallow, White-throated	<i>Hirundo albigularis</i>	1	1	1
Tchagra, Southern	<i>Tchagra tchagra</i>	1		1
Thrush, Groundscraper	<i>Psophocichla litsipsirupa</i>	1	1	1
Weaver, Cape	<i>Ploceus capensis</i>	1	1	1
White-eye, Cape	<i>Zosterops virens</i>	1	1	1
Widowbird, Long-tailed	<i>Euplectes progne</i>	1	1	1
Apalis, Bar-throated	<i>Apalis thoracica</i>	1	1	
Apalis, Yellow-breasted	<i>Apalis flavida</i>	1	1	
Avocet, Pied	<i>Recurvirostra avosetta</i>	1	1	
Babbler, Arrow-marked	<i>Turdoides jardineii</i>	1	1	
Babbler, Southern Pied	<i>Turdoides bicolor</i>	1	1	
Barbet, Acacia Pied	<i>Tricholaema leucomelas</i>	1	1	
Barbet, Black-collared	<i>Lybius torquatus</i>	1	1	
Barbet, Crested	<i>Trachyphonus vaillantii</i>	1	1	
Batis, Cape	<i>Batis capensis</i>	1	1	
Batis, Chinspot	<i>Batis molitor</i>	1	1	
Bee-eater, Blue-cheeked	<i>Merops persicus</i>	1	1	
Bee-eater, European	<i>Merops apiaster</i>	1	1	
Bee-eater, Little	<i>Merops pusillus</i>	1	1	
Bee-eater, Southern Carmine	<i>Merops nubicoides</i>	1		
Bee-eater, Swallow-tailed	<i>Merops hirundineus</i>	1	1	
Bee-eater, White-fronted	<i>Merops bullockoides</i>	1	1	
Bishop, Southern Red	<i>Euplectes orix</i>	1	1	
Bishop, Yellow-crowned	<i>Euplectes afer</i>	1	1	
Bittern, Dwarf	<i>Ixobrychus sturmii</i>	1	1	
Bittern, Little	<i>Ixobrychus minutus</i>	1	1	
Bokmakierie, Bokmakierie	<i>Telophorus zeylonus</i>	1	1	
Boubou, Southern	<i>Laniarius ferrugineus</i>	1	1	
Brownbul, Terrestrial	<i>Phyllastrephus terrestris</i>	1	1	
Brubru, Brubru	<i>Nilaus afer</i>	1	1	

Buffalo-weaver, Red-billed	<i>Bubalornis niger</i>	1	1
Bulbul, African Red-eyed	<i>Pycnonotus nigricans</i>		1
Bulbul, Dark-capped	<i>Pycnonotus tricolor</i>	1	1
Bunting, Cape	<i>Emberiza capensis</i>	1	1
Bunting, Cinnamon-breasted	<i>Emberiza tahapisi</i>	1	1
Bunting, Golden-breasted	<i>Emberiza flaviventris</i>	1	1
Bunting, Lark-like	<i>Emberiza impetuani</i>	1	1
Bush-shrike, Black-fronted	<i>Telophorus nigrifrons</i>	1	1
Bush-shrike, Gorgeous	<i>Telophorus quadricolor</i>	1	1
Bush-shrike, Grey-headed	<i>Malaconotus blanchoti</i>	1	1
Bush-shrike, Olive	<i>Telophorus olivaceus</i>	1	1
Buttonquail, Kurrichane	<i>Turnix sylvaticus</i>	1	1
Buzzard, Forest	<i>Buteo trizonatus</i>	1	1
Buzzard, Jackal	<i>Buteo rufofuscus</i>	1	1
Buzzard, Lizard	<i>Kaupifalco monogrammicus</i>	1	1
Buzzard, Steppe	<i>Buteo vulpinus</i>	1	1
Camaroptera, Green-backed	<i>Camaroptera brachyura</i>	1	1
Camaroptera, Grey-backed	<i>Camaroptera brevicaudata</i>	1	1
Canary, Black-throated	<i>Crithagra atrogularis</i>	1	1
Canary, Brimstone	<i>Crithagra sulphuratus</i>	1	1
Canary, Cape	<i>Serinus canicollis</i>	1	1
Canary, Forest	<i>Crithagra scotops</i>	1	1
Canary, Yellow	<i>Crithagra flaviventris</i>	1	1
Canary, Yellow-fronted	<i>Crithagra mozambicus</i>	1	1
Chat, Anteating	<i>Myrmecocichla formicivora</i>	1	1
Chat, Arnot's	<i>Myrmecocichla arnoti</i>	1	
Chat, Familiar	<i>Cercomela familiaris</i>	1	1
Cisticola, Cloud	<i>Cisticola textrix</i>	1	1
Cisticola, Croaking	<i>Cisticola natalensis</i>	1	1
Cisticola, Desert	<i>Cisticola aridulus</i>	1	1
Cisticola, Lazy	<i>Cisticola aberrans</i>	1	1
Cisticola, Levillant's	<i>Cisticola tinniens</i>	1	1
Cisticola, Rattling	<i>Cisticola chiniana</i>	1	1
Cisticola, Red-faced	<i>Cisticola erythrops</i>	1	1
Cisticola, Wailing	<i>Cisticola lais</i>	1	1
Cisticola, Wing-snapping	<i>Cisticola ayresii</i>	1	1
Cisticola, Zitting	<i>Cisticola juncidis</i>	1	1
Cliff-chat, Mocking	<i>Thamnolaea cinnamomeiventris</i>	1	1

Cliff-swallow, South African	<i>Hirundo spilodera</i>	1	1
Coot, Red-knobbed	<i>Fulica cristata</i>	1	1
Cormorant, Reed	<i>Phalacrocorax africanus</i>	1	1
Coucal, Burchell's	<i>Centropus burchellii</i>	1	1
Coucal, White-browed	<i>Centropus superciliosus</i>	1	
Courser, Bronze-winged	<i>Rhinoptilus chalcopterus</i>	1	1
Courser, Temminck's	<i>Cursorius temminckii</i>	1	1
Crake, African	<i>Crecopsis egregia</i>	1	1
Crake, Baillon's	<i>Porzana pusilla</i>		1
Crake, Black	<i>Amaurornis flavirostris</i>	1	1
Crake, Corn	<i>Crex crex</i>		1
Crested-flycatcher, Blue-mantled	<i>Trochocercus cyanomelas</i>	1	1
Crombec, Long-billed	<i>Sylvietta rufescens</i>	1	1
Crow, Cape	<i>Corvus capensis</i>	1	1
Crow, Pied	<i>Corvus albus</i>	1	1
Cuckoo, African	<i>Cuculus gularis</i>	1	1
Cuckoo, African Emerald	<i>Chrysococcyx cupreus</i>	1	1
Cuckoo, Black	<i>Cuculus clamosus</i>	1	1
Cuckoo, Common	<i>Cuculus canorus</i>	1	1
Cuckoo, Diderick	<i>Chrysococcyx caprius</i>	1	1
Cuckoo, Great Spotted	<i>Clamator glandarius</i>	1	1
Cuckoo, Jacobin	<i>Clamator jacobinus</i>	1	1
Cuckoo, Klaas's	<i>Chrysococcyx klaas</i>	1	1
Cuckoo, Levallant's	<i>Clamator levallantii</i>	1	1
Cuckoo, Red-chested	<i>Cuculus solitarius</i>	1	1
Cuckoo, Thick-billed	<i>Pachycoccyx audeberti</i>		1
Cuckoo-shrike, Black	<i>Campephaga flava</i>	1	1
Cuckoo-shrike, Grey	<i>Coracina caesia</i>	1	1
Cuckoo-shrike, White-breasted	<i>Coracina pectoralis</i>	1	
Darter, African	<i>Anhinga rufa</i>	1	1
Dove, African Mourning	<i>Streptopelia decipiens</i>	1	
Dove, Laughing	<i>Streptopelia senegalensis</i>	1	1
Dove, Lemon	<i>Aplopelia larvata</i>	1	1
Dove, Namaqua	<i>Oena capensis</i>	1	1
Dove, Red-eyed	<i>Streptopelia semitorquata</i>	1	1
Dove, Rock	<i>Columba livia</i>	1	1
Dove, Tambourine	<i>Turtur tympanistria</i>	1	1
Drongo, Fork-tailed	<i>Dicrurus adsimilis</i>	1	1

Drongo, Square-tailed	<i>Dicrurus ludwigii</i>	1	1
Duck, African Black	<i>Anas sparsa</i>	1	1
Duck, Comb	<i>Sarkidiornis melanotos</i>	1	1
Duck, Fulvous	<i>Dendrocygna bicolor</i>	1	1
Duck, Mallard	<i>Anas platyrhynchos</i>		1
Duck, White-backed	<i>Thalassornis leuconotus</i>	1	1
Duck, White-faced	<i>Dendrocygna viduata</i>	1	1
Duck, Yellow-billed	<i>Anas undulata</i>	1	1
Eagle, Lesser Spotted	<i>Aquila pomarina</i>	1	1
Eagle, Long-crested	<i>Lophaetus occipitalis</i>	1	1
Eagle, Steppe	<i>Aquila nipalensis</i>	1	
Eagle, Wahlberg's	<i>Aquila wahlbergi</i>	1	1
Eagle-owl, Spotted	<i>Bubo africanus</i>	1	1
Eagle-owl, Verreaux's	<i>Bubo lacteus</i>	1	
Egret, Cattle	<i>Bubulcus ibis</i>	1	1
Egret, Great	<i>Egretta alba</i>	1	1
Egret, Little	<i>Egretta garzetta</i>	1	1
Egret, Yellow-billed	<i>Egretta intermedia</i>	1	1
Eremomela, Burnt-necked	<i>Eremomela usticollis</i>	1	1
Eremomela, Green-capped	<i>Eremomela scotops</i>	1	1
Eremomela, Yellow-bellied	<i>Eremomela icteropygialis</i>	1	1
Falcon, Amur	<i>Falco amurensis</i>	1	1
Finch, Cuckoo	<i>Anomalospiza imberbis</i>	1	1
Finch, Cut-throat	<i>Amadina fasciata</i>	1	1
Finch, Red-headed	<i>Amadina erythrocephala</i>	1	1
Finch, Scaly-feathered	<i>Sporopipes squamifrons</i>	1	1
Firefinch, African	<i>Lagonosticta rubricata</i>	1	1
Firefinch, Jameson's	<i>Lagonosticta rhodopareia</i>	1	1
Firefinch, Red-billed	<i>Lagonosticta senegala</i>	1	1
Fiscal, Common (Southern)	<i>Lanius collaris</i>	1	1
Flufftail, Buff-spotted	<i>Sarothrura elegans</i>	1	1
Flufftail, Red-chested	<i>Sarothrura rufa</i>	1	1
Flycatcher, African Dusky	<i>Muscicapa adusta</i>	1	1
Flycatcher, Ashy	<i>Muscicapa caerulescens</i>	1	1
Flycatcher, Fiscal	<i>Sigelus silens</i>	1	1
Flycatcher, Marico	<i>Bradornis mariquensis</i>	1	1
Flycatcher, Pale	<i>Bradornis pallidus</i>	1	1
Flycatcher, Southern Black	<i>Melaenornis pammelaina</i>	1	1

Flycatcher, Spotted	<i>Muscicapa striata</i>	1	1
Francolin, Coqui	<i>Peliperdix coqui</i>	1	1
Francolin, Crested	<i>Dendroperdix sephaena</i>	1	1
Francolin, Red-winged	<i>Scleroptila levaillantii</i>	1	1
Francolin, Shelley's	<i>Scleroptila shelleyi</i>	1	1
Go-away-bird, Grey	<i>Corythaixoides concolor</i>	1	1
Goose, Egyptian	<i>Alopochen aegyptiacus</i>	1	1
Goose, Spur-winged	<i>Plectropterus gambensis</i>	1	1
Goshawk, African	<i>Accipiter tachiro</i>	1	1
Goshawk, Dark Chanting	<i>Melierax metabates</i>	1	1
Goshawk, Gabar	<i>Melierax gabar</i>	1	1
Goshawk, Southern Pale Chanting	<i>Melierax canorus</i>	1	1
Grassbird, Cape	<i>Sphenoeacus afer</i>	1	1
Grebe, Great Crested	<i>Podiceps cristatus</i>	1	1
Grebe, Little	<i>Tachybaptus ruficollis</i>	1	1
Greenbul, Sombre	<i>Andropadus importunus</i>	1	1
Greenbul, Yellow-bellied	<i>Chlorocichla flaviventris</i>	1	1
Greenbul, Yellow-streaked	<i>Phyllastrephus flavostriatus</i>	1	1
Green-pigeon, African	<i>Treron calvus</i>	1	1
Greenshank, Common	<i>Tringa nebularia</i>	1	1
Guineafowl, Crested	<i>Guttera edouardi</i>		1
Guineafowl, Helmeted	<i>Numida meleagris</i>	1	1
Gull, Grey-headed	<i>Larus cirrocephalus</i>	1	1
Hamerkop, Hamerkop	<i>Scopus umbretta</i>	1	1
Harrier, Montagu's	<i>Circus pygargus</i>		1
Harrier-Hawk, African	<i>Polyboroides typus</i>	1	1
Hawk, African Cuckoo	<i>Aviceda cuculoides</i>	1	1
Hawk-eagle, African	<i>Aquila spilogaster</i>	1	1
Helmet-shrike, Retz's	<i>Prionops retzii</i>	1	1
Helmet-shrike, White-crested	<i>Prionops plumatus</i>	1	1
Heron, Black	<i>Egretta ardesiaca</i>	1	1
Heron, Black-headed	<i>Ardea melanocephala</i>	1	1
Heron, Goliath	<i>Ardea goliath</i>	1	1
Heron, Green-backed	<i>Butorides striata</i>	1	1
Heron, Grey	<i>Ardea cinerea</i>	1	1
Heron, Purple	<i>Ardea purpurea</i>	1	1
Heron, Squacco	<i>Ardeola ralloides</i>	1	1
Hobby, Eurasian	<i>Falco subbuteo</i>	1	1

Honeybird, Brown-backed	<i>Prodotiscus regulus</i>	1	1
Honeyguide, Greater	<i>Indicator indicator</i>	1	1
Honeyguide, Lesser	<i>Indicator minor</i>	1	1
Honeyguide, Scaly-throated	<i>Indicator variegatus</i>	1	1
Hoopoe, African	<i>Upupa africana</i>	1	1
Hornbill, African Grey	<i>Tockus nasutus</i>	1	1
Hornbill, Crowned	<i>Tockus alboterminatus</i>	1	
Hornbill, Damara	<i>Tockus damarensis</i>	1	
Hornbill, Hybrid Damara/Red-billed	<i>Tockus damarensis/erythrorhynchus</i>	1	
Hornbill, Red-billed	<i>Tockus erythrorhynchus</i>	1	1
Hornbill, Southern Yellow-billed	<i>Tockus leucomelas</i>	1	1
Hornbill, Trumpeter	<i>Bycanistes bucinator</i>	1	
House-martin, Common	<i>Delichon urbicum</i>	1	1
Ibis, African Sacred	<i>Threskiornis aethiopicus</i>	1	1
Ibis, Glossy	<i>Plegadis falcinellus</i>	1	1
Ibis, Hadeda	<i>Bostrychia hagedash</i>	1	1
Indigobird, Dusky	<i>Vidua funerea</i>	1	1
Indigobird, Purple	<i>Vidua purpurascens</i>	1	1
Indigobird, Village	<i>Vidua chalybeata</i>	1	1
Jacana, African	<i>Actophilornis africanus</i>	1	1
Kestrel, Greater	<i>Falco rupicoloides</i>	1	1
Kestrel, Rock	<i>Falco rupicolus</i>	1	1
Kingfisher, Brown-hooded	<i>Halcyon albiventris</i>	1	1
Kingfisher, Giant	<i>Megaceryle maximus</i>	1	1
Kingfisher, Grey-headed	<i>Halcyon leucocephala</i>	1	1
Kingfisher, Malachite	<i>Alcedo cristata</i>	1	1
Kingfisher, Pied	<i>Ceryle rudis</i>	1	1
Kingfisher, Striped	<i>Halcyon chelicuti</i>	1	1
Kingfisher, Woodland	<i>Halcyon senegalensis</i>	1	1
Kite, Black	<i>Milvus migrans</i>	1	1
Kite, Black-shouldered	<i>Elanus caeruleus</i>	1	1
Kite, Yellow-billed	<i>Milvus aegyptius</i>	1	1
Korhaan, Northern Black	<i>Afrotis afraoides</i>		1
Korhaan, Red-crested	<i>Lophotis ruficrista</i>	1	1
Lapwing, African Wattled	<i>Vanellus senegallus</i>	1	1
Lapwing, Blacksmith	<i>Vanellus armatus</i>	1	1
Lapwing, Crowned	<i>Vanellus coronatus</i>	1	1
Lapwing, White-crowned	<i>Vanellus albiceps</i>	1	

Lark, Dusky	<i>Pinarocorys nigricans</i>	1	1
Lark, Flappet	<i>Mirafra rufocinnamomea</i>	1	1
Lark, Monotonous	<i>Mirafra passerina</i>	1	1
Lark, Pink-billed	<i>Spizocorys conirostris</i>		1
Lark, Red-capped	<i>Calandrella cinerea</i>	1	1
Lark, Rufous-naped	<i>Mirafra africana</i>	1	1
Lark, Sabota	<i>Calendulauda sabota</i>	1	1
Lark, Spike-heeled	<i>Chersomanes albofasciata</i>	1	1
Longclaw, Cape	<i>Macronyx capensis</i>	1	1
Longclaw, Yellow-throated	<i>Macronyx croceus</i>	1	1
Mannikin, Bronze	<i>Spermestes cucullatus</i>	1	1
Mannikin, Magpie	<i>Spermestes fringilloides</i>		1
Mannikin, Red-backed	<i>Spermestes bicolor</i>	1	1
Marsh-harrier, Western	<i>Circus aeruginosus</i>	1	1
Martin, Banded	<i>Riparia cincta</i>	1	1
Martin, Brown-throated	<i>Riparia paludicola</i>	1	1
Martin, Rock	<i>Hirundo fuligula</i>	1	1
Martin, Sand	<i>Riparia riparia</i>	1	1
Masked-weaver, Lesser	<i>Ploceus intermedius</i>	1	1
Masked-weaver, Southern	<i>Ploceus velatus</i>	1	1
Moorhen, Common	<i>Gallinula chloropus</i>	1	1
Moorhen, Lesser	<i>Gallinula angulata</i>		1
Mousebird, Red-faced	<i>Urocolius indicus</i>	1	1
Mousebird, Speckled	<i>Colius striatus</i>	1	1
Myna, Common	<i>Acridotheres tristis</i>		1
Neddicky, Neddicky	<i>Cisticola fulvicapilla</i>	1	1
Night-Heron, Black-crowned	<i>Nycticorax nycticorax</i>	1	1
Nightingale, Thrush	<i>Luscinia luscinia</i>		1
Nightjar, European	<i>Caprimulgus europaeus</i>	1	1
Nightjar, Fiery-necked	<i>Caprimulgus pectoralis</i>	1	1
Nightjar, Freckled	<i>Caprimulgus tristigma</i>	1	1
Nightjar, Pennant-winged	<i>Macrodipteryx vexillarius</i>	1	
Nightjar, Rufous-cheeked	<i>Caprimulgus rufigena</i>	1	1
Nightjar, Square-tailed	<i>Caprimulgus fossii</i>	1	1
Olive-pigeon, African	<i>Columba arquatrix</i>	1	1
Openbill, African	<i>Anastomus lamelligerus</i>	1	
Oriole, African Golden	<i>Oriolus auratus</i>	1	1
Oriole, Black-headed	<i>Oriolus larvatus</i>	1	1

Oriole, Eurasian Golden	<i>Oriolus oriolus</i>	1	
Osprey, Osprey	<i>Pandion haliaetus</i>	1	1
Ostrich, Common	<i>Struthio camelus</i>	1	1
Owl, Barn	<i>Tyto alba</i>	1	1
Owl, Marsh	<i>Asio capensis</i>	1	1
Owlet, Pearl-spotted	<i>Glaucidium perlatum</i>	1	1
Oxpecker, Red-billed	<i>Buphagus erythrorhynchus</i>	1	1
Palm-swift, African	<i>Cypsiurus parvus</i>	1	1
Paradise-flycatcher, African	<i>Terpsiphone viridis</i>	1	1
Paradise-whydah, Long-tailed	<i>Vidua paradisaea</i>	1	1
Parrot, Brown-headed	<i>Poicephalus cryptoxanthus</i>	1	
Parrot, Grey-headed Parrot	<i>Poicephalus fuscicollis</i>	1	1
Peacock, Common	<i>Pavo cristatus</i>		1
Penduline-tit, Cape	<i>Anthoscopus minutus</i>	1	1
Penduline-tit, Grey	<i>Anthoscopus caroli</i>	1	1
Petronia, Yellow-throated	<i>Petronia superciliaris</i>	1	1
Pigeon, Speckled	<i>Columba guinea</i>	1	1
Pipit, African	<i>Anthus cinnamomeus</i>	1	1
Pipit, Buffy	<i>Anthus vaalensis</i>	1	1
Pipit, Bushveld	<i>Anthus caffer</i>	1	1
Pipit, Long-billed	<i>Anthus similis</i>	1	1
Pipit, Plain-backed	<i>Anthus leucophrys</i>	1	1
Pipit, Striped	<i>Anthus lineiventris</i>	1	1
Pipit, Tree	<i>Anthus trivialis</i>	1	1
Plover, Caspian	<i>Charadrius asiaticus</i>	1	
Plover, Common Ringed	<i>Charadrius hiaticula</i>	1	
Plover, Kittlitz's	<i>Charadrius pecuarius</i>	1	1
Plover, Three-banded	<i>Charadrius tricollaris</i>	1	1
Plover, White-fronted	<i>Charadrius marginatus</i>		1
Pochard, Southern	<i>Netta erythrophthalma</i>	1	1
Prinia, Black-chested	<i>Prinia flavicans</i>	1	1
Prinia, Karoo	<i>Prinia maculosa</i>	1	
Prinia, Tawny-flanked	<i>Prinia subflava</i>	1	1
Puffback, Black-backed	<i>Dryoscopus cubla</i>	1	1
Pygmy-Kingfisher, African	<i>Ispidina picta</i>	1	1
Pytilia, Green-winged	<i>Pytilia melba</i>	1	1
Pytilia, Orange-winged	<i>Pytilia afra</i>	1	
Quail, Common	<i>Coturnix coturnix</i>	1	1

Quail, Harlequin	<i>Coturnix delegorguei</i>	1	1
Quailfinch, African	<i>Ortygospiza atricollis</i>	1	1
Quelea, Red-billed	<i>Quelea quelea</i>	1	1
Rail, African	<i>Rallus caerulescens</i>	1	1
Raven, White-necked	<i>Corvus albicollis</i>	1	1
Reed-warbler, African	<i>Acrocephalus baeticatus</i>	1	1
Reed-warbler, Great	<i>Acrocephalus arundinaceus</i>	1	1
Robin, White-starred	<i>Pogonocichla stellata</i>	1	1
Robin-chat, Cape	<i>Cossypha caffra</i>	1	1
Robin-chat, Chorister	<i>Cossypha dichroa</i>	1	1
Robin-chat, Red-capped	<i>Cossypha natalensis</i>	1	1
Robin-chat, White-browed	<i>Cossypha heuglini</i>	1	1
Robin-chat, White-throated	<i>Cossypha humeralis</i>	1	1
Rock-thrush, Short-toed	<i>Monticola brevipes</i>	1	1
Roller, Broad-billed	<i>Eurystomus glaucurus</i>	1	1
Roller, Lilac-breasted	<i>Coracias caudatus</i>	1	1
Roller, Purple	<i>Coracias naevius</i>	1	1
Ruff, Ruff	<i>Philomachus pugnax</i>	1	1
Rush-warbler, Little	<i>Bradypterus baboecala</i>	1	1
Sandgrouse, Burchell's	<i>Pterocles burchelli</i>	1	1
Sandgrouse, Double-banded	<i>Pterocles bicinctus</i>	1	1
Sandpiper, Common	<i>Actitis hypoleucos</i>	1	1
Sandpiper, Curlew	<i>Calidris ferruginea</i>	1	
Sandpiper, Green	<i>Tringa ochropus</i>		1
Sandpiper, Marsh	<i>Tringa stagnatilis</i>	1	1
Sandpiper, Pectoral	<i>Calidris melanotos</i>		1
Sandpiper, Wood	<i>Tringa glareola</i>	1	1
Saw-wing, Black (Southern race)	<i>Psalidoprocne holomelaena</i>	1	1
Scimitarbill, Common	<i>Rhinopomastus cyanomelas</i>	1	1
Scops-owl, African	<i>Otus senegalensis</i>	1	
Scops-owl, Southern White-faced	<i>Ptilopus granti</i>	1	1
Scrub-robin, Bearded	<i>Cercotrichas quadrivirgata</i>		1
Scrub-robin, Brown	<i>Cercotrichas signata</i>	1	1
Scrub-robin, Kalahari	<i>Cercotrichas paena</i>	1	1
Scrub-robin, White-browed	<i>Cercotrichas leucophrys</i>	1	1
Seedeater, Streaky-headed	<i>Crithagra gularis</i>	1	1
Shikra, Shikra	<i>Accipiter badius</i>	1	1
Shoveler, Cape	<i>Anas smithii</i>	1	1

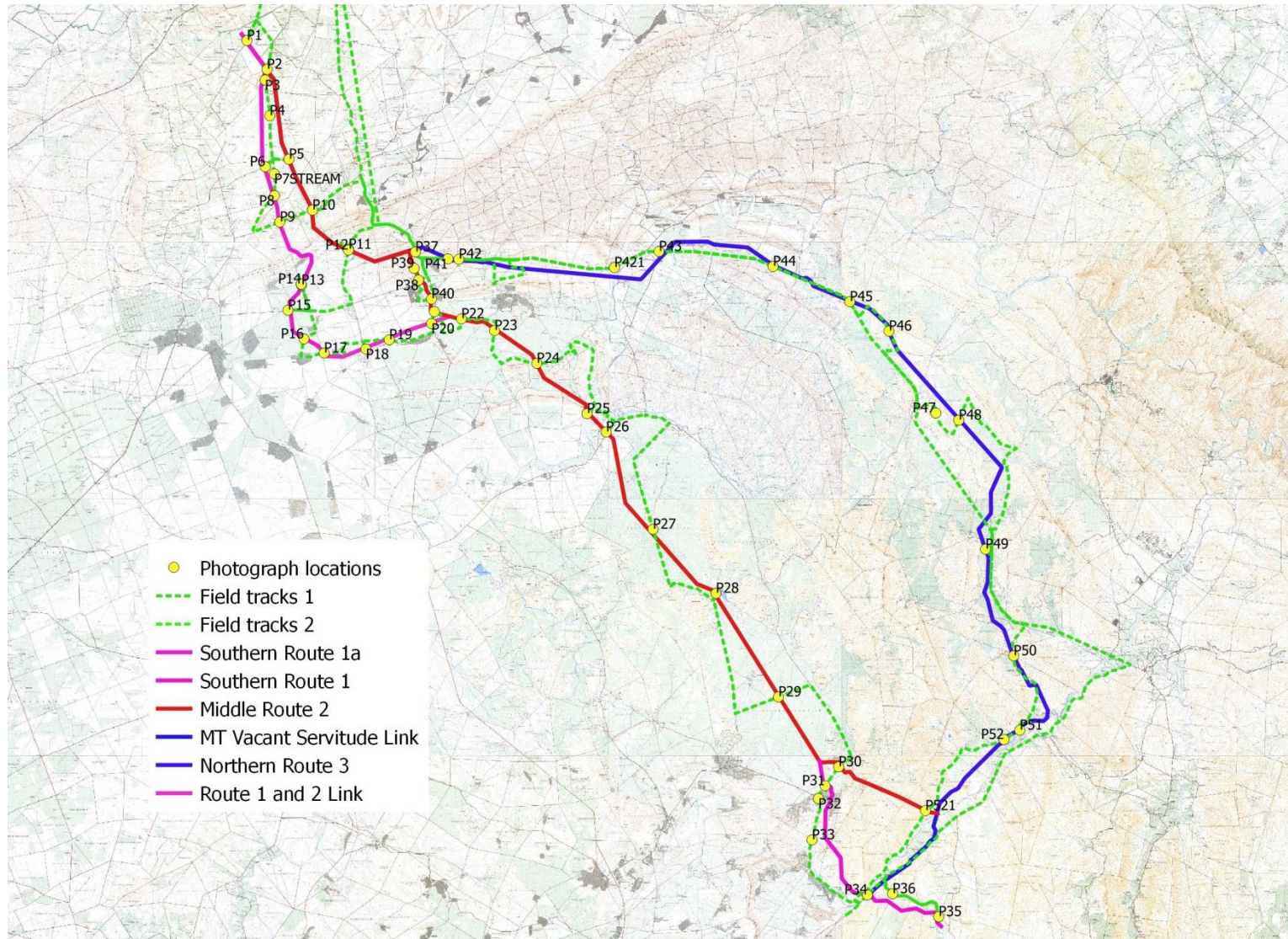
Shrike, Crimson-breasted	<i>Laniarius atrococcineus</i>	1	1
Shrike, Lesser Grey	<i>Lanius minor</i>	1	1
Shrike, Magpie	<i>Corvinella melanoleuca</i>	1	1
Shrike, Red-backed	<i>Lanius collurio</i>	1	1
Shrike, Southern White-crowned	<i>Eurocephalus anguitimens</i>	1	1
Snake-eagle, Black-chested	<i>Circaetus pectoralis</i>	1	1
Snake-eagle, Brown	<i>Circaetus cinereus</i>	1	1
Snipe, African	<i>Gallinago nigripennis</i>	1	1
Sparrow, Cape	<i>Passer melanurus</i>	1	1
Sparrow, Great	<i>Passer motitensis</i>	1	1
Sparrow, House	<i>Passer domesticus</i>	1	1
Sparrow, Northern Grey-headed	<i>Passer griseus</i>	1	
Sparrow, Southern Grey-headed	<i>Passer diffusus</i>	1	1
Sparrowhawk, Black	<i>Accipiter melanoleucus</i>	1	1
Sparrowhawk, Little	<i>Accipiter minullus</i>	1	1
Sparrowhawk, Ovambo	<i>Accipiter ovampensis</i>	1	1
Sparrowhawk, Rufous-chested	<i>Accipiter rufiventris</i>	1	1
Sparrowlark, Chestnut-backed	<i>Eremopterix leucotis</i>	1	1
Sparrowlark, Grey-backed	<i>Eremopterix verticalis</i>	1	1
Sparrow-weaver, White-browed	<i>Plocepasser mahali</i>	1	1
Spoonbill, African	<i>Platalea alba</i>	1	1
Spurfowl, Natal	<i>Pternistis natalensis</i>	1	1
Spurfowl, Red-necked	<i>Pternistis afer</i>	1	
Spurfowl, Swainson's	<i>Pternistis swainsonii</i>	1	1
Starling, Burchell's	<i>Lamprotornis australis</i>	1	1
Starling, Cape Glossy	<i>Lamprotornis nitens</i>	1	1
Starling, Greater Blue-eared	<i>Lamprotornis chalybaeus</i>	1	1
Starling, Red-winged	<i>Onychognathus morio</i>	1	1
Starling, Violet-backed	<i>Cinnyricinclus leucogaster</i>	1	1
Starling, Wattled	<i>Creatophora cinerea</i>	1	1
Stilt, Black-winged	<i>Himantopus himantopus</i>	1	1
Stint, Little	<i>Calidris minuta</i>	1	1
Stonechat, African	<i>Saxicola torquatus</i>	1	1
Stork, White	<i>Ciconia ciconia</i>	1	1
Stork, Woolly-necked	<i>Ciconia episcopus</i>	1	1
Sugarbird, Gurney's	<i>Promerops gurneyi</i>	1	1
Sunbird, Amethyst	<i>Chalcomitra amethystina</i>	1	1
Sunbird, Collared	<i>Hedydipna collaris</i>	1	1

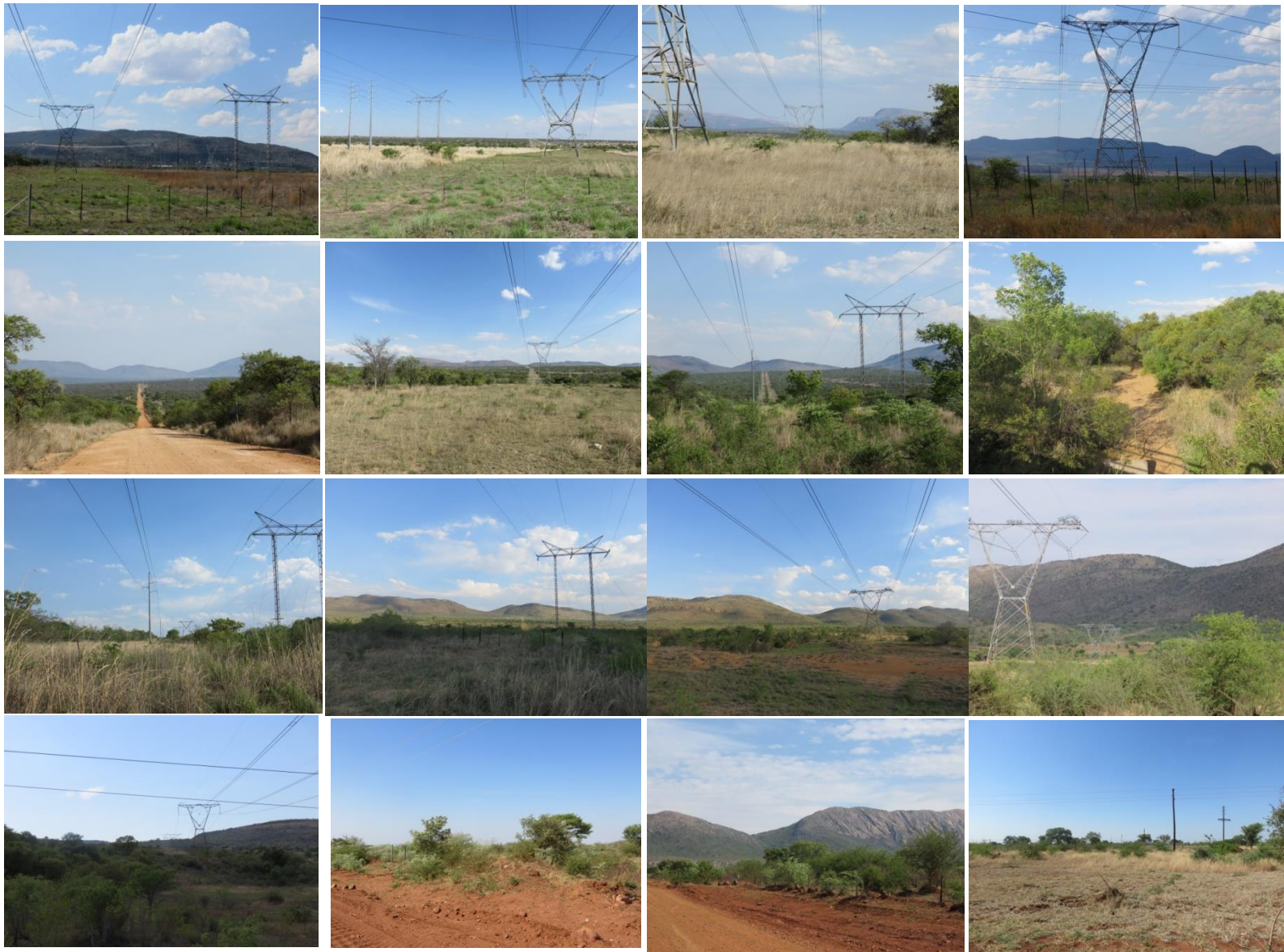
Sunbird, Malachite	<i>Nectarinia famosa</i>	1	1
Sunbird, Marico	<i>Cinnyris mariquensis</i>	1	1
Sunbird, Scarlet-chested	<i>Chalcomitra senegalensis</i>	1	1
Sunbird, White-bellied	<i>Cinnyris talatala</i>	1	1
Swallow, Barn	<i>Hirundo rustica</i>	1	1
Swallow, Greater Striped	<i>Hirundo cucullata</i>	1	1
Swallow, Grey-rumped	<i>Pseudhirundo griseopyga</i>		1
Swallow, Lesser Striped	<i>Hirundo abyssinica</i>	1	1
Swallow, Pearl-breasted	<i>Hirundo dimidiata</i>	1	1
Swallow, Red-breasted	<i>Hirundo semirufa</i>	1	1
Swallow, Wire-tailed	<i>Hirundo smithii</i>	1	1
Swamphen, African Purple	<i>Porphyrio madagascariensis</i>	1	1
Swamp-warbler, Lesser	<i>Acrocephalus gracilirostris</i>	1	1
Swift, African Black	<i>Apus barbatus</i>	1	1
Swift, Alpine	<i>Tachymarptis melba</i>	1	1
Swift, Common	<i>Apus apus</i>	1	1
Swift, Horus	<i>Apus horus</i>	1	1
Swift, Little	<i>Apus affinis</i>	1	1
Swift, White-rumped	<i>Apus caffer</i>	1	1
Tchagra, Black-crowned	<i>Tchagra senegalus</i>	1	1
Tchagra, Brown-crowned	<i>Tchagra australis</i>	1	1
Teal, Cape	<i>Anas capensis</i>	1	1
Teal, Hottentot	<i>Anas hottentota</i>	1	1
Teal, Red-billed	<i>Anas erythrorhyncha</i>	1	1
Tern, Whiskered	<i>Chlidonias hybrida</i>	1	1
Tern, White-winged	<i>Chlidonias leucopterus</i>	1	1
Thick-knee, Spotted	<i>Burhinus capensis</i>	1	1
Thick-knee, Water	<i>Burhinus vermiculatus</i>	1	1
Thrush, Karoo	<i>Turdus smithi</i>	1	1
Thrush, Kurrichane	<i>Turdus libonyanus</i>	1	1
Thrush, Olive	<i>Turdus olivaceus</i>	1	1
Tinkerbird, Yellow-fronted	<i>Pogoniulus chrysoconus</i>	1	1
Tit, Ashy	<i>Parus cinerascens</i>	1	1
Tit, Southern Black	<i>Parus niger</i>	1	1
Tit-babbler, Chestnut-vented	<i>Parisoma subcaeruleum</i>	1	1
Tit-flycatcher, Grey	<i>Myioparus plumbeus</i>	1	1
Trogon, Narina	<i>Apaloderma narina</i>	1	1
Turaco, Knysna	<i>Tauraco corythaix</i>	1	1

Turaco, Livingstone's	<i>Tauraco livingstonii</i>	1	
Turaco, Purple-crested	<i>Gallirex porphyreolophus</i>	1	1
Turaco, Schalow's	<i>Tauraco schalowi</i>	1	
Turtle-dove, Cape	<i>Streptopelia capicola</i>	1	1
Twinspot, Green	<i>Mandingoa nitidula</i>	1	1
Vulture, Palm-nut	<i>Gypohierax angolensis</i>		1
Wagtail, African Pied	<i>Motacilla aguimp</i>	1	1
Wagtail, Cape	<i>Motacilla capensis</i>	1	1
Wagtail, Grey	<i>Motacilla cinerea</i>	1	1
Wagtail, Mountain	<i>Motacilla clara</i>	1	1
Wagtail, Yellow	<i>Motacilla flava</i>		1
Warbler, Barratt's	<i>Bradypterus barratti</i>	1	1
Warbler, Broad-tailed	<i>Schoenicola brevirostris</i>	1	1
Warbler, Dark-capped Yellow	<i>Chloropeta natalensis</i>	1	1
Warbler, Garden	<i>Sylvia borin</i>	1	1
Warbler, Icterine	<i>Hippolais icterina</i>	1	1
Warbler, Marsh	<i>Acrocephalus palustris</i>	1	1
Warbler, Olive-tree	<i>Hippolais olivetorum</i>		1
Warbler, River	<i>Locustella fluviatilis</i>		1
Warbler, Sedge	<i>Acrocephalus schoenobaenus</i>	1	1
Warbler, Willow	<i>Phylloscopus trochilus</i>	1	1
Waxbill, Black-faced	<i>Estrilda erythronotos</i>	1	1
Waxbill, Blue	<i>Uraeginthus angolensis</i>	1	1
Waxbill, Common	<i>Estrilda astrild</i>	1	1
Waxbill, Grey	<i>Estrilda perreini</i>	1	
Waxbill, Orange-breasted	<i>Amandava subflava</i>	1	1
Waxbill, Swee	<i>Coccopygia melanotis</i>	1	1
Waxbill, Violet-eared	<i>Granatina granatina</i>	1	1
Weaver, Golden	<i>Ploceus xanthops</i>	1	1
Weaver, Red-headed	<i>Anaplectes rubriceps</i>	1	1
Weaver, Spectacled	<i>Ploceus ocularis</i>	1	1
Weaver, Thick-billed	<i>Amblyospiza albifrons</i>	1	1
Weaver, Village	<i>Ploceus cucullatus</i>	1	1
Wheatear, Capped	<i>Oenanthe pileata</i>	1	1
Wheatear, Mountain	<i>Oenanthe monticola</i>	1	
White-eye, Orange River	<i>Zosterops pallidus</i>	1	
Whitethroat, Common	<i>Sylvia communis</i>	1	1
Whydah, Pin-tailed	<i>Vidua macroura</i>	1	1

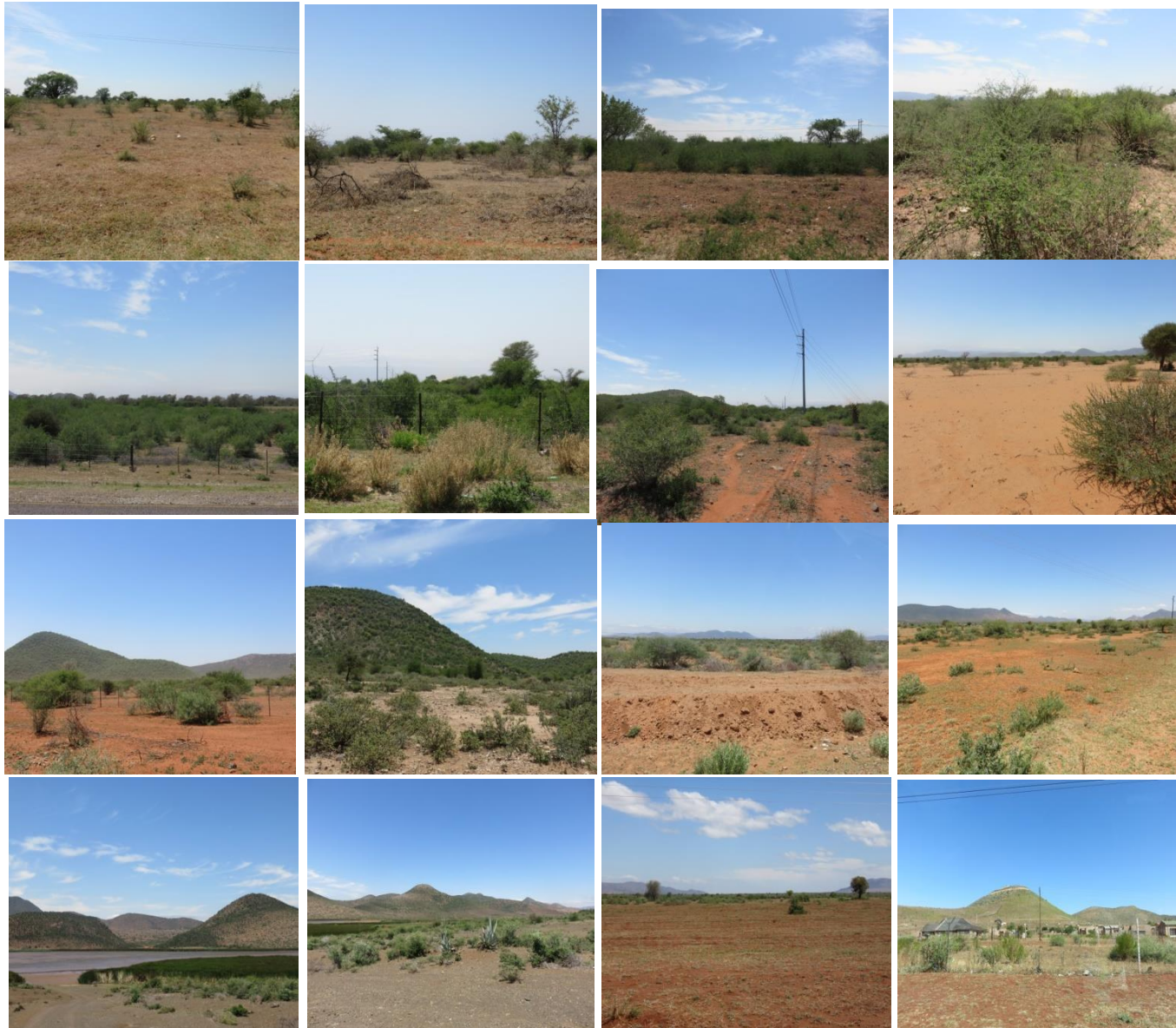
Whydah, Shaft-tailed	<i>Vidua regia</i>	1	1
Widowbird, Fan-tailed	<i>Euplectes axillaris</i>	1	1
Widowbird, Red-collared	<i>Euplectes ardens</i>	1	1
Widowbird, White-winged	<i>Euplectes albonotatus</i>	1	1
Wood-dove, Blue-spotted	<i>Turtur afer</i>	1	1
Wood-dove, Emerald-spotted	<i>Turtur chalcospilos</i>	1	1
Wood-hoopoe, Green	<i>Phoeniculus purpureus</i>	1	1
Woodland-warbler, Yellow-throated	<i>Phylloscopus ruficapilla</i>	1	1
Wood-owl, African	<i>Strix woodfordii</i>	1	1
Woodpecker, Bearded	<i>Dendropicos namaquus</i>	1	1
Woodpecker, Bennett's	<i>Campethera bennettii</i>	1	1
Woodpecker, Cardinal	<i>Dendropicos fuscescens</i>	1	1
Woodpecker, Golden-tailed	<i>Campethera abingoni</i>	1	1
Woodpecker, Olive	<i>Dendropicos griseocephalus</i>	1	1
Wren-warbler, Barred	<i>Calamonastes fasciolatus</i>	1	1
Wren-warbler, Stierling's	<i>Calamonastes stierlingi</i>	1	1
Wryneck, Red-throated	<i>Jynx ruficollis</i>	1	1

### APPENDIX 3. FIELD TRACKS, PHOTOGRAPH LOCATIONS & PHOTOGRAPHS

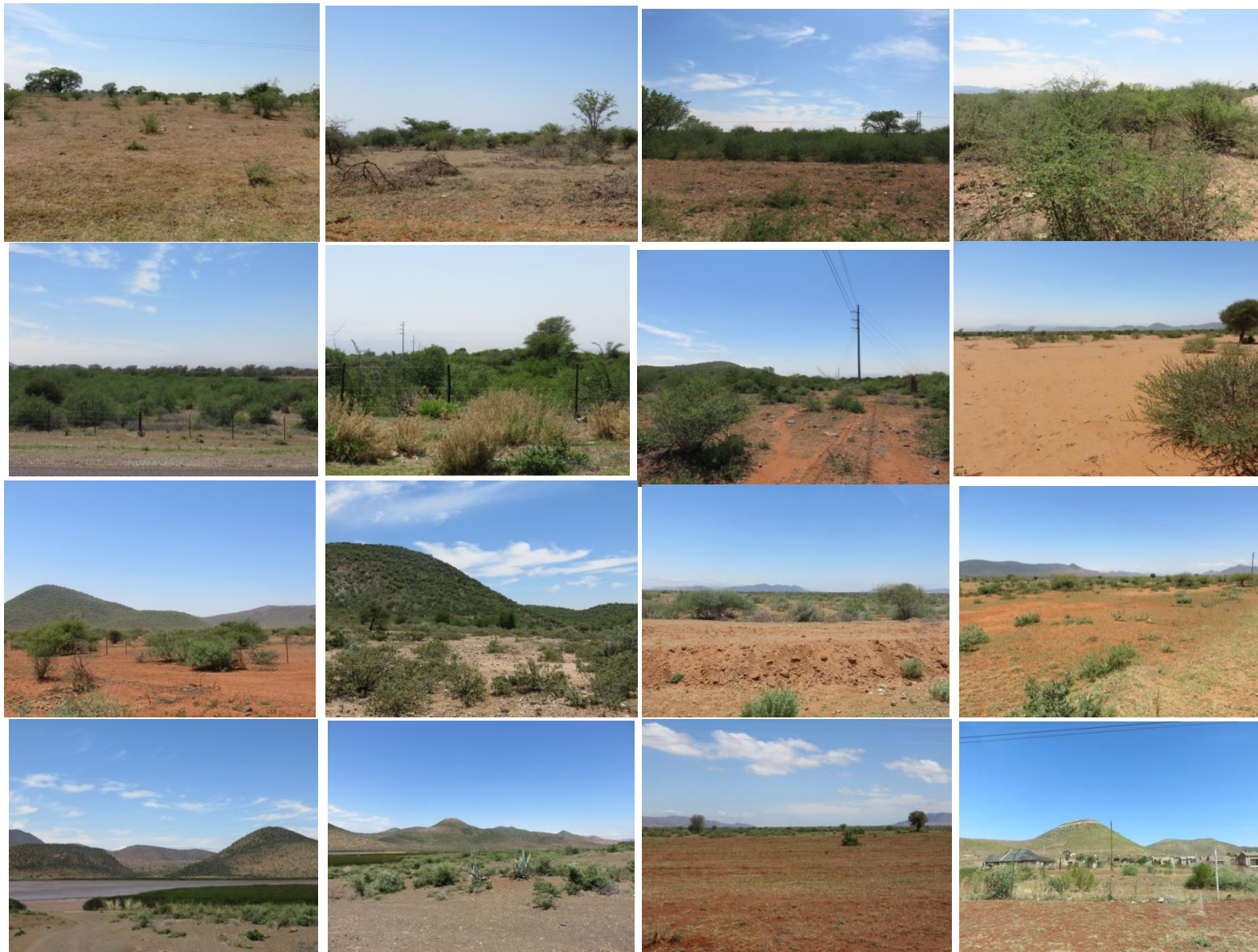




Top left to bottom right: P1, P1a, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11



From top left to bottom right: P16, P17, P18 P19, P20, P21, P22, P23, P24, P25, P26, P27, P28, P28a, P29, P30



From top left to bottom right: P30a, P31, P32, P33, P34, P35, P36, P37, P38, P39, P40, P41, P2, P43, P44, P45



From top left to bottom right: P45, P46, P47, P48, P49, P50, P51, P52, P521

## APPENDIX 4 – BIRD SPECIES RECORDED ON SITE BY THIS ASSESSMENT

Species primary name	Species tertiary name	Latitude	Longitude
African Hoopoe	<i>Upupa africana</i>	-24.251894	29.463234
Barn Swallow	<i>Hirundo rustica</i>	-24.317529	29.566177
Black-headed Heron	<i>Ardea melanocephala</i>	-24.592166	29.865332
Black-shouldered Kite	<i>Elanus caeruleus</i>	-24.282796	29.465585
Blacksmith Lapwing	<i>Vanellus armatus</i>	-24.592246	29.86534
Black-winged Stilt	<i>Himantopus himantopus</i>	-24.592108	29.865296
Blue Waxbill	<i>Uraeginthus angolensis</i>	-24.256392	29.468267
Brown-hooded Kingfisher	<i>Halcyon albiventris</i>	-24.719008	30.196522
Cape Sparrow	<i>Passer melanurus</i>	-24.295776	29.550003
Cape Turtle Dove	<i>Streptopelia capicola</i>	-24.330324	29.572238
Cape White-eye	<i>Zosterops virens</i>	-24.111253	29.384785
Capped Wheatear	<i>Oenanthe pileata</i>	-24.295776	29.550003
Common Buzzard	<i>Buteo buteo</i>	-24.23739	29.379388
Common Moorhen	<i>Gallinula chloropus</i>	-24.592174	29.86537
Common Myna	<i>Acridotheres tristis</i>	-24.287749	29.544449
Common Ostrich	<i>Struthio camelus</i>	-24.092593	29.381784
Common Starling	<i>Sturnus vulgaris</i>	-24.296587	29.422257
Crested Francolin	<i>Dendroperdix sephaena</i>	-24.253534	29.464187
Egyptian Goose	<i>Alopochen aegyptiaca</i>	-24.592169	29.865344
European Bee-eater	<i>Merops apiaster</i>	-24.131404	29.387016
Fork-tailed Drongo	<i>Dicrurus adsimilis</i>	-24.054866	29.389641
Greater Striped Swallow	<i>Cecropis cucullata</i>	-24.293852	29.547444
Grey Go-away-bird	<i>Corythaixoides concolor</i>	-24.172008	29.387373
Grey-headed Bushshrike	<i>Malaconotus blanchoti</i>	-24.088902	29.382091
Hadedda Ibis	<i>Bostrychia hagedash</i>	-24.092593	29.381784
Helmeted Guineafowl	<i>Numida meleagris</i>	-24.157336	29.388248
House Sparrow	<i>Passer domesticus</i>	-24.295776	29.550003
Klaas's Cuckoo	<i>Chrysococcyx klaas</i>	-24.282332	29.658978
<b>Lanner Falcon</b>	<b><i>Falco biarmicus</i></b>	<b>-24.819668</b>	<b>30.110232</b>
Laughing Dove	<i>Spilopelia senegalensis</i>	-24.287722	29.544415
Lesser Striped Swallow	<i>Cecropis abyssinica</i>	-24.298248	29.422817
Levaillant's Cisticola	<i>Cisticola tinniens</i>	-24.28652	29.544357

Little Grebe	<i>Tachybaptus ruficollis</i>	-24.592166	29.865332
Namaqua Dove	<i>Oena capensis</i>	-24.818135	30.112308
Pale Chanting Goshawk	<i>Melierax canorus</i>	-24.690314	29.942214
Pied Avocet	<i>Recurvirostra avosetta</i>	-24.592174	29.865372
Pied Crow	<i>Corvus albus</i>	-24.060636	29.388735
Red-billed Teal	<i>Anas erythrorhyncha</i>	-24.592174	29.86537
Red-eyed Dove	<i>Streptopelia semitorquata</i>	-24.293309	29.546707
Red-knobbed Coot	<i>Fulica cristata</i>	-24.592205	29.865329
Rock Kestrel	<i>Falco rupicolus</i>	-24.069709	29.38716
Rufous-naped Lark	<i>Mirafra africana</i>	-24.293078	29.465267
Sabota Lark	<i>Calendulauda sabota</i>	-24.253329	29.46396
Scaly-feathered Finch	<i>Sporopipes squamifrons</i>	-24.295718	29.549979
Southern Fiscal	<i>Lanius collaris</i>	-24.25347	29.464115
Speckled Mousebird	<i>Colius striatus</i>	-24.338127	29.578044
Speckled Pigeon	<i>Columba guinea</i>	-24.090312	29.381734
<b>Tawny Eagle</b>	<b><i>Aquila rapax</i></b>	<b>-24.26695</b>	<b>29.67279</b>
Tawny-flanked Prinia	<i>Prinia subflava</i>	-24.253532	29.464187
Three-banded Plover	<i>Charadrius tricollaris</i>	-24.591772	29.864812
Village Weaver	<i>Ploceus cucullatus</i>	-24.287707	29.544448
Western Cattle Egret	<i>Bubulcus ibis</i>	-24.69112	29.939763
White-bellied Sunbird	<i>Cinnyris talatala</i>	-24.17199	29.387381
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	-24.592174	29.865372
White-browed Sparrow-Weaver	<i>Plocepasser mahali</i>	-24.287749	29.544449
White-fronted Bee-eater	<i>Merops bullockoides</i>	-24.334964	29.571883
Yellow-billed Duck	<i>Anas undulata</i>	-24.20772	29.490518
Yellow-billed Kite	<i>Milvus aegyptius</i>	-24.58434	29.82764
<b>Yellow-billed Stork</b>	<b><i>Mycteria ibis</i></b>	<b>-24.592246</b>	<b>29.86534</b>