FOSKOR – MERENSKY 275KV POWER LINE

AVIFAUNAL SPECIALIST STUDY

January 2013

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SPECIALIST DETAILS

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

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Professional experience

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Declaration of Independence

The specialist investigator declares that:

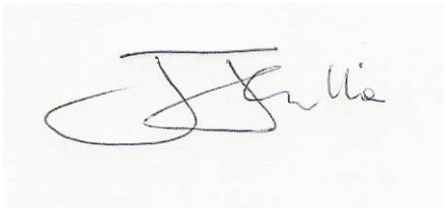
- I act as an independent specialist for this project.
- I consider myself bound by the rules and ethics of the South African Council for Natural Scientific Professions.
- I do not have any personal or financial interest in the project except for financial compensation for specialist investigations completed 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 on the 24th January 2013 by Jon Smallie in his capacity as specialist investigator.



EXECUTIVE SUMMARY

Eskom have identified a need to strengthen the network between the existing Foskor Substation near Phalaborwa, and the existing Merensky Substation near Steelpoort. The proposed project consists of approximately 140km of new 275kV 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 423 species having been recorded by the first Southern African Bird Atlas Project (Harrison *et al*, 1997). Several additional species were recorded by the second bird atlas project in progress, including most importantly the Taita Falcon *Falco fasciinucha*. A fair number of these (36 species) are Red Listed species (Barnes 2000), 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. Most of the vulture and large eagle species identified as key for this study do not have healthy populations in South Africa outside of protected areas. The lowveld protected area complex, adjoining to the Kruger National Park, is therefore an extremely important refuge for these species. The same is true for some of the stork species. This makes it extremely important to protect these species from additional human induced threats within these areas. Presumably these species' ranges have contracted over the years to their current state as a result of anthropogenic threats. If these threats are allowed to occur at high levels within the current ranges we could force even more range contraction and place these species at risk of local extinction. In addition to the lowveld area, the escarpment is also extremely important, due to the presence of breeding Taita Falcons and Cape Vultures *Gyps coprotheres,* amongst many other species. Most of the escarpment is designated as Important Bird Area status, and should be considered as extremely sensitive. It is therefore imperative that this area be handled carefully with respect to this power line.

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 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, wetlands, dams and the main escarpment. Some of these areas will require extensive mitigation due to the high risk of collisions.

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.

The risk of electrical faulting caused by birds is judged to be of medium significance. 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.

This proposed power line route passes through an area that is rich in avifauna, due to its varied geology and vegetation, and the protected status of much of the land (by virtue of game farming). This means that the potential interactions of birds with the power line are likely to be significant. However, given that a power line of this size has to be built between these two substations (we assume that effective network planning has been conducted), the proposed routes do collectively provide opportunity to route the line as wisely as possible with respect to avifauna. **The preference is to build the proposed power line adjacent to the existing line, i.e. Route 1. It is however absolutely essential that the new line be built as close to the existing Foskor Merensky 275kV line as technically possible, and certainly not more than 100m between outer conductors. This is to take advantage of having multiple lines parallel to each other. This is of particular importance in the region of the escarpment, where a very large and important Cape Vulture breeding colony exists 6.8km to the east, and a Taita Falcon breeding site approximately 2km to the west. These two factors mean that there is no room to move away from the existing line with the new line. The broader corridor of 3km cannot be considered in this area, the new line must be built next to the existing one. The findings of this report will differ dramatically if this is not achievable**. **In the area below the escarpment (lowveld), Alternative 5 would also be acceptable from an avifaunal perspective.**
It is also essential that the other recommendations of this report are accepted and implemented, in particular the avifaunal walk through to be done during the site specific Environmental Management Plan for the line.

The issue of building new transmission power lines near Cape Vulture breeding colonies is worthy of discussion here. Although little data exists on Cape Vulture collisions with overhead power lines, it is considered likely that where vultures congregate for any reason (such as at colonies) close to power lines birds are likely to collide with the overhead cables. Unfortunately to date little data in this regard exists, due partly to the lack of focused efforts to systematically patrol such power lines. It is recommended that Eskom give this matter urgent attention and preferably initiate a national programme to monitor existing power lines close to colonies. The findings from such a programme will facilitate more informed impact assessments for power lines in such situations in the future.

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

CONTENTS

1. INTRODUCTION & BACKGROUND

Eskom have identified a need to strengthen the network between the existing Foskor Substation near Phalaborwa, and the existing Merensky Substation near Steelpoort. The proposed project consists of approximately 140km of new 275kV 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 study area is home to an exceptionally broad diversity of bird species, up to 423 species having been recorded by the first Southern African Bird Atlas Project (Harrison *et al,* 1997). A fair number of these (36 species) are Red Listed species (Barnes 2000), and many of these will in fact be at risk of interaction with the proposed power line. Two key issues for this project are the presence of the large Cape Vulture *Gyps coprotheres* breeding colony at Manoutsa, and a breeding pair of Taita Falcon *Falco fasciinucha* – both on the escarpment close to where the proposed power lines must descend. 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 140km in length (depending on which route is selected) and will be 275kV. There are four proposed alternative routes for the power line, as shown in Figure 1a. Later in the project two expanded corridors were added as shown in Figure 1b. No information has been received on the tower structure to be used for the project. 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 causes faults on the line, as explained elsewhere in this report.

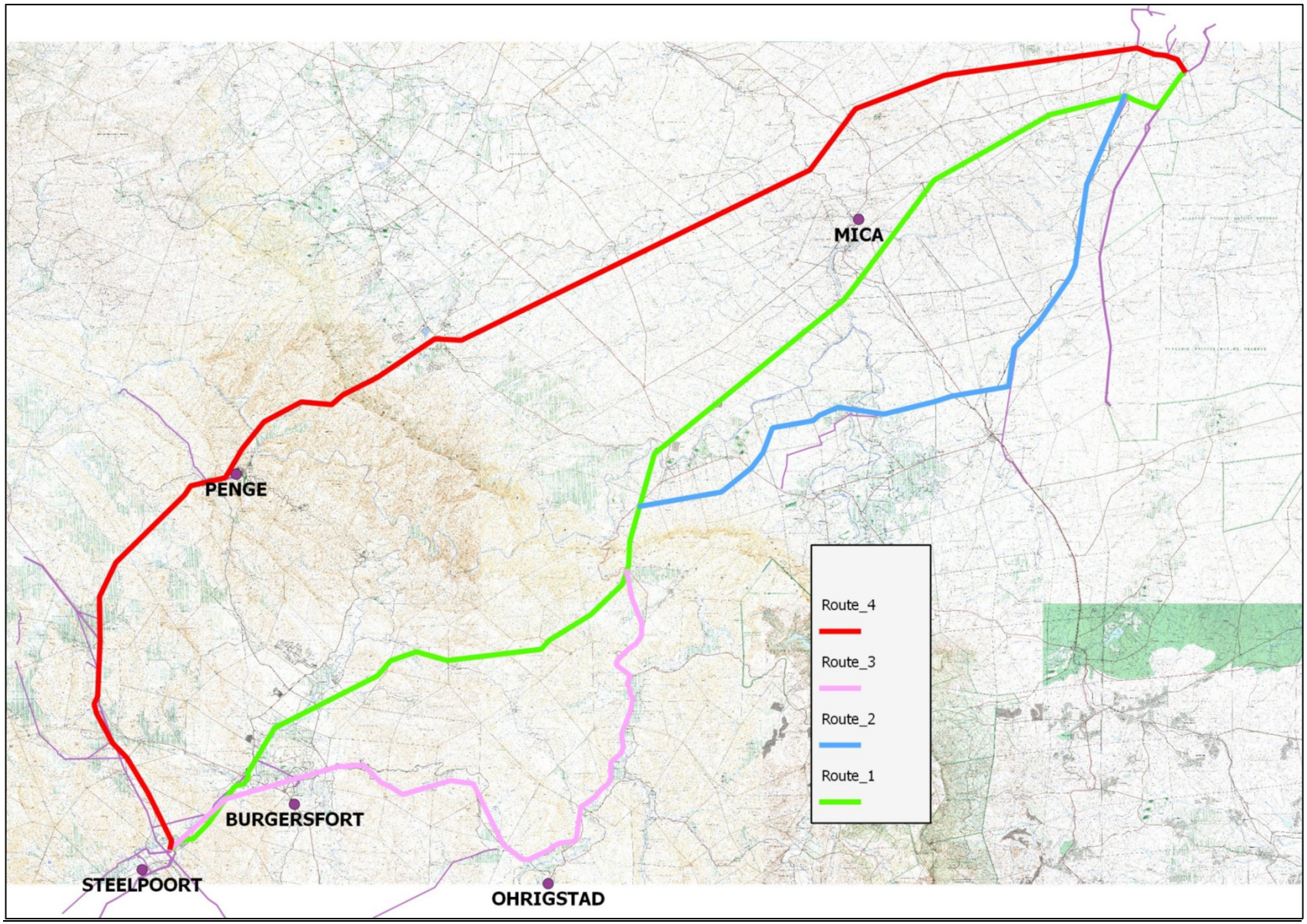


Figure 1a. The general study area and proposed routes for the Foskor Merensky 275kV power line.

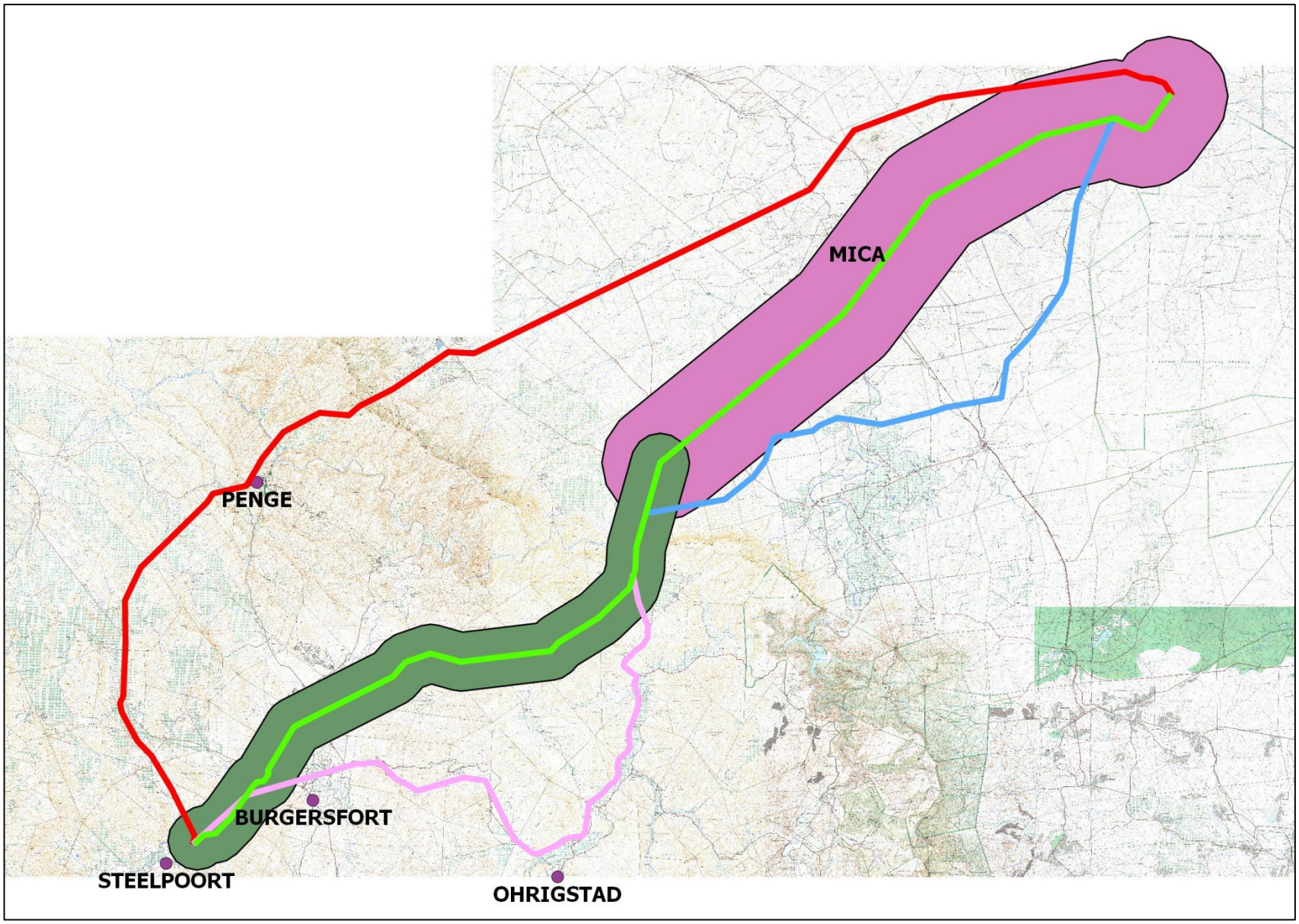


Figure 1b. The general study area and proposed routes for the Foskor Merensky 275kV power line – with corridors added.

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

Bird collision with conductors and earth wires

Various bird species are vulnerable to collision with the earth wires or conductors of overhead power lines. This occurs because the birds can't see the cables, particularly against dark backgrounds, or may not be able to take evasive action quickly enough once they do see the cables. Large birds such as cranes, storks, and bustards are particularly vulnerable due to their large wing span and slow flight characteristics. In recent times vultures have also emerged as vulnerable to collision, particularly when congregating at roosts or feeding sites. Only one site in South Africa has to my knowledge been reported to kill large numbers of Cape Vultures through collision, where a vulture restaurant is placed less than 1km from a transmission line. The birds feed at the feeding site and return to roost on the power line when full and at low light conditions (since food is placed at the site in the late afternoon frequently). The Eskom-Endangered Wildlife Trust Strategic Partnership has to date recorded 983 vulture mortalities (all vulture species, 1996 to 2012) on power lines, of which 812 were caused by electrocution and 98 by collision. For the Cape Vulture specifically a total of 562 birds have been reported killed, with 491 or 87% of these being killed through electrocution. Certain biases exist in this data including: that electrocution victims fall closer to poles and therefore are more likely to be found by maintenance staff; that certain high collision risk sections of power line traverse valleys and steep terrain where detection of carcasses would be unlikely (although the same applies to electrocution to some extent); and various others. However it does seem that based on the actual data collected, electrocution (which is not possible on the proposed power line) is by far the greater threat to Cape Vultures in South Africa. This does not mean that the collision threat should not be addressed by conservationists and Eskom, but it does place the threat in perspective. At the Manoutsa colony, Neser *et al* (2011) recognized electrocution and collision as the number one threat to the birds, and recommended mitigation on surrounding power lines. No data is presented in that report on the extent of this risk. Collision is anticipated to be a possible impact on the proposed power line and is discussed in more detail in Section 5. Falcons, such as the Taita Falcon, are also believed to be at high risk of collision with overhead power lines, although they are underrepresented in the data (probably due to the low likelihood of detecting collision victims).

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. Since the proposed power line routes pass largely through bushveld, this impact could be significant.

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 vultures nesting in the vicinity of the proposed power line alignment. This means that the impact of disturbance could be significant for this project.

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.

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. 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 Southern African Bird Atlas Project (Harrison *et al*, 1997) was obtained for the quarter degree squares which cover the study area, from the Avian Demography Unit of the University of Cape Town, as a means to ascertain which species occur within the study area. The more recent second bird atlas project (SABAP2) was also consulted informally for data on a pentad basis. The coverage of the study area to date by this project is very variable though and not suitable for more formal use. The SABAP2 data was however used to identify additional species not recorded by the SABAP1 (Harrison *et al*, 1997), the most important of which was the Taita Falcon.
- The 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 (Barnes, 2000).
- 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) was examined and is shown in Figure 5.
- The location of Co-ordinated Water bird Counts (CWAC) (Taylor *et al,* 1999) was examined and illustrated in Figure 5.
- A site visit was conducted in November 2011 to examine the micro-habitats available in the area and get an overall idea of what the site looks like. Unfortunately access was not possible to all parts of the study area due to much of it being managed as private game farm, and difficult road access near the escarpment.
- Information on the Manoutsa Cape Vulture breeding colony was obtained from Dr Pat Benson and Kerri Wolter, and information on Taita Falcon was obtained from Dr Andrew Jenkins.
- The Eskom-Endangered Wildlife Trust was consulted to obtain data on vulture collisions on power lines.

4. DESCRIPTION OF RECEIVING ENVIRONMENT

4.1. Vegetation and micro-habitats

This site is comprised of a complex set of vegetation types, particularly in the south. According to Mucina & Rutherford (2006), sixteen separate vegetation types occur on or near the site (Figure 2). The majority of these occur above the escarpment in the south of the study area. In summary, the majority of the study area is classified as bushveld or mopane veld. In the escarpment area grassland, sourveld and even fynbos exist. It is this diversity that gives rise to the diversity of bird species recorded in the area, described elsewhere in this report.

More informative than vegetation type in understanding bird distribution and abundance is the micro habitats available to birds on site. Micro habitats are formed by a number of factors, one of which is vegetation. Others include land use, topography, and other anthropogenic influences.

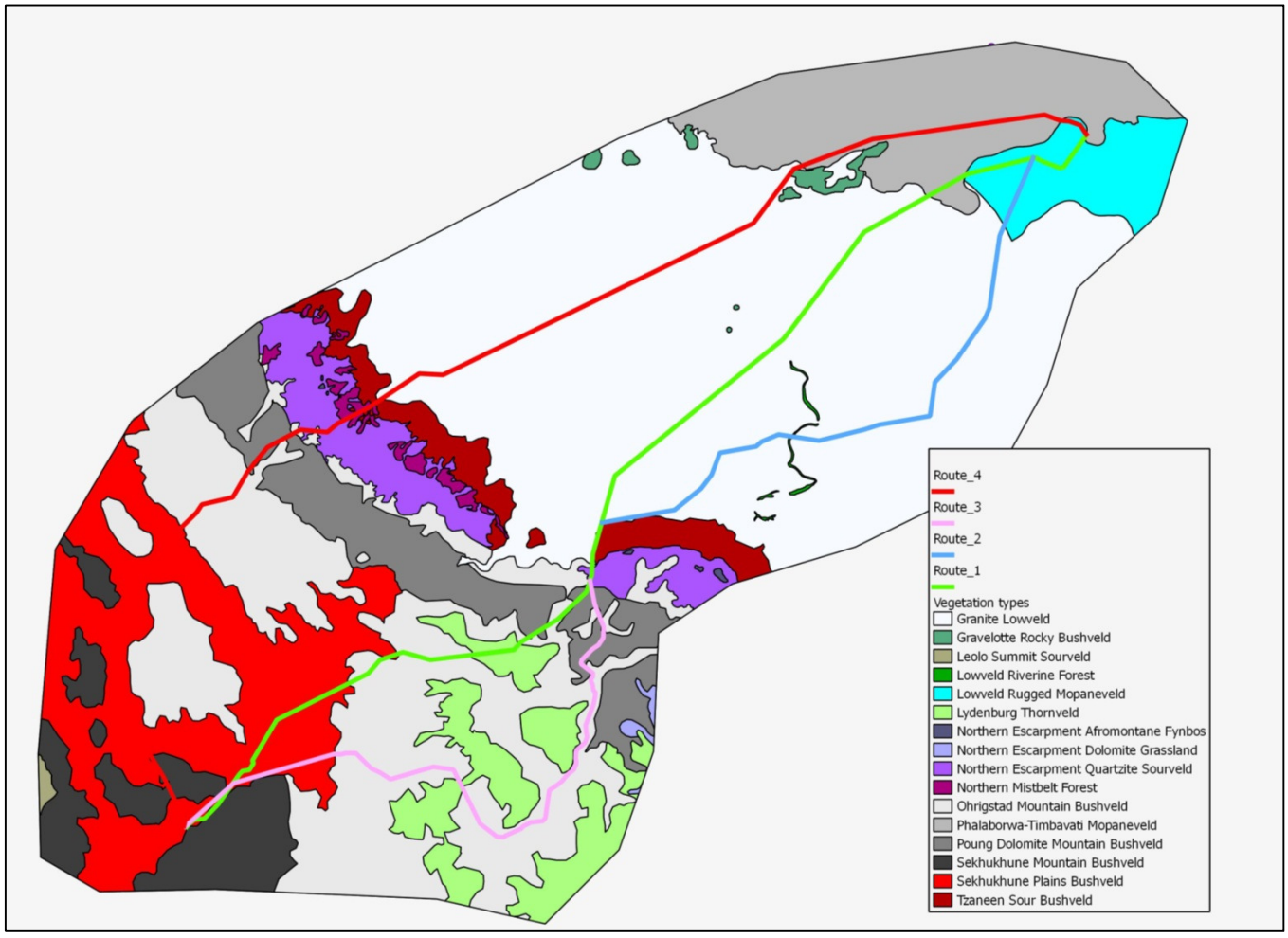


Figure 2. Vegetation classification for the Foskor Merensky 275kV power line study area.

By far the most dominant micro habitat available to birds in the area is woodland or bushveld. Almost all of the natural vegetation remaining in the study area is woodland, and it varies in nature. In the south towards Steelpoort, much of the woodland consists of lower vegetation and appears degraded in places as a result of firewood harvesting and other human impacts (see Figure 3 a, c and i). In the northern lowveld parts of the study area the woodland is taller and appears in better condition, perhaps as a result of being protected in game farms and protected areas (see Figure 3 f). Where reliable water exists, in the form of rivers, some cultivation has taken place. Arable areas are planted to various crops, and in the lowveld to fruit orchards. Orchards are not particularly attractive micro habitats for sensitive bird species, although some crops are, particularly at certain stages of the crop cycle. Several major rivers are crossed by the various power line routes, including the Steelpoort and Olifants Rivers. These areas represent a different vegetation type normally, with riparian species occurring along their banks. This will generally attract slightly different avifauna to the area. River courses also typically form flight paths for various species through the landscape and as such represent high risk areas for bird – power line collision.

a – settlement in the southern section of the study area

b – a typical river crossing in the study area

c – vegetation in the southern parts of the study area

d – an arable land in the Blyde River area

e – the Olifants river close to the base of the escarpment

f – small rocky outcrop, typical woodland in lowveld section

g – a young orchard in the lowveld section

h – the escarpment, near Penge

i – typical low woodland close to Steelpoort

j – the main escarpment close to Strydom tunnel.

Figure 3. Examples of the micro habitats available to avifauna in the Foskor Merensky 275kV power line study area

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 – Harrison *et al*, 1997). Although this data source is quite old it remains the most reliable source of data of this type. Since it was collected over a ten year period, it has covered a far greater range of conditions and seasons than could ever be expected of the field work under the scope of this current impact assessment. Although a more recent second bird atlas project (SABAP2 – http://sapap2.adu.org.za), due to the relatively low coverage of the study area to date, this data was used primarily to supplement Harrison *et al* (1997). Most importantly the SABAP2 recorded the Taita Falcon which was not recorded in the first atlas project and is extremely important to this study, as described elsewhere.

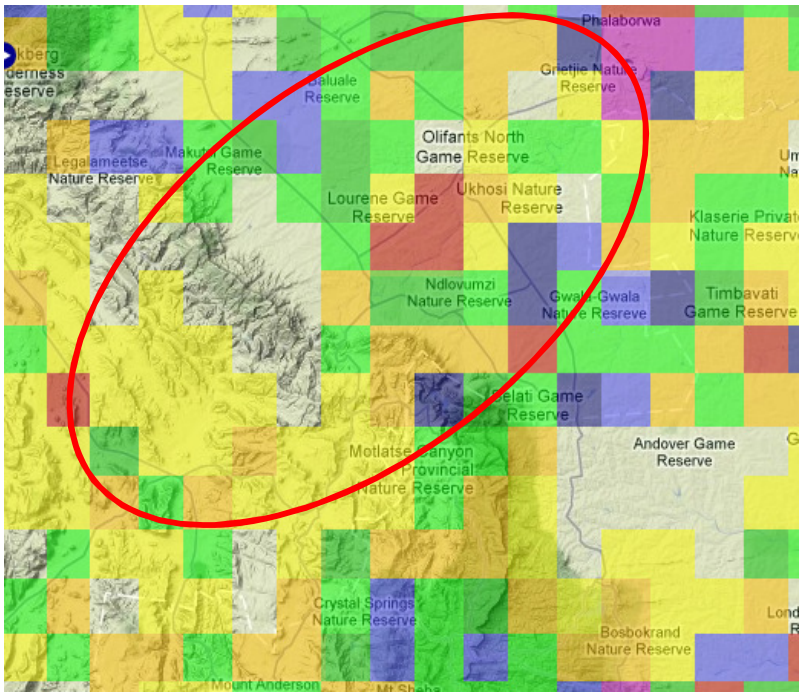


Figure 4. The coverage of the study area by the Southern African Bird Atlas Project 2 (http://sabap2.adu.org.za). Darker colours illustrate more coverage by the atlas, i.e. more counts.

Up to approximately 423 bird species have been recorded across the ten relevant quarter degree squares by the Southern African Bird Atlas Project (Harrison *et al,* 1997). It is important to note that these species could have been recorded anywhere in the relevant quarter degree square, and not necessarily in the exact study area. It does however mean that these species could occur in the proposed study area. Report rates are essentially an expression of the number of times a species was recorded in a square, as a percentage of the number of times that square was counted. The number of cards (shown in Table 1) represents the degree to which the square was counted, the more cards the more times it was counted. In this study area the number of cards ranges from 6 to 124, which is a significant variation and should give us cause to use some of the data with caution, particularly when making comparisons between squares.

Table 1 below shows only the Red Listed species recorded by Harrison *et al* (1997). A total of 36 Red Listed species have been recorded, of which 1 is "Endangered" (the Saddle-billed Stork *Ephippiorhynchus senegalensis*), 18 are "Vulnerable"

and 17 are "Near-threatened". In addition, the White Stork *Ciconia ciconia* and Abdim's Stork *Ciconia abdimii* are treated as threatened species since they are protected internationally under the Bonn Convention on Migratory Species. The Hamerkop *Scopus umbretta* has also been treated as important since it has shown a range contraction in recent times (SABAP2 – http://sabap2.adu.org.za).

Table 2 shows 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. Those species for which this proposed site is of medium or higher importance have been shaded in grey, totaling nineteen of the 36 Red Listed species. These are the species that will form the main focus of this study. This group of species includes: woodland species, such as vultures and large eagles; riverine species, such as African Finfoot *Podica senegalensis* and storks; and open woodland large terrestrials such as Kori Bustard *Neotis kori* and 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 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. In the region of the escarpment, the Taita Falcon *Falco fasciinucha* could also be at risk of collision and disturbance. The Cape Vulture will be at risk of collision, particularly if birds fly along the escarpment frequently, thereby crossing the proposed power line frequently. 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. A prime example of an important species for this study which is not yet Red Listed is the Verreaux's Eagle *Aquila verreauxii*. This species is prevalent in the mountainous parts of the study area, particularly the main escarpment, and could be susceptible to collision with the line.

Most of the vulture and large eagle species identified as key for this study do not have healthy populations in South Africa outside of protected areas. The lowveld protected area complex, adjoining to the Kruger National Park, is an extremely important refuge for these species. The same is true to some extent for some of the stork species. This makes it extremely important to protect these species from additional human induced threats within these areas. Presumably these species' ranges have contracted over the years to their current state as a result of anthropogenic threats. If these threats are allowed to occur at high levels within the current ranges we could force even more range contraction and place these species at risk of local extinction.

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:

Kruger National Park – Important Bird Area (IBA) – SA002:

The Kruger National Park is approximately 320km long on its north-south axis, and 65km wide on its east-west axis. The IBA includes the private game reserves on its western boundary, such as Klaserie, Timbavati, Sabi Sand and several others. At its closest point the IBA western boundary is 1.5km from the nearest alternative route for the proposed power line (see Figure 5). Approximately 40km of proposed power line route lies within 10km of the IBA boundary. The IBA consists predominantly

of undulating flats, with a wide geological diversity giving rise to a diversity of habitats and bird species. The park supports approximately 55% of the bird species recorded in southern Africa (over 490 species). As mentioned elsewhere in this report, the park forms a refuge for various bird species which have suffered from various threats elsewhere in the region. This includes species such as Marabou Stork *Leptoptilus crumeniferus*, Hooded Vulture *Necrosyrtes monachus*, White-backed Vulture *Gyps africanus*, Lappet-faced Vulture *Torgos tracheliotus*, White-headed Vulture *Aegypius occipitalis*, Martial Eagle *Polemaaetus bellicosus*, Bateleur *Terathopius ecaudatus*, Tawny Eagle *Aquila rapax*, Kori Bustard *Neotis kori* and Ground Hornbill *Bucorvus leadbeteri* (Barnes, 1998). Several Drakensberg forest species also migrate down into the park during winter, often along river courses draining off the escarpment.

These factors make this an extremely important IBA in the national context. It is good that the current proposed power line routes avoid the IBA to the west. However in reality, the areas immediately west of the western boundary of Kruger and the IBA are probably almost as important for birds. Every attempt should therefore be made to place the power line as far as possible away from these areas. Unfortunately due to the location of the Foskor Substation, the line has to cross some lowveld bushveld. Given the need for network strengthening in the area, that is unavoidable. This will be discussed in more detail in Section 5.2.

Table 1. Red Listed bird species abundance in the study area for the relevant quarter degree squares as per the Southern African Bird Atlas Project 1 data Harrison *et al,* 1997). Report rates are expressed in decimals, i.e. 0.06 equates to a 6% report rate.

				Report rates									
Roberts #	**Common Name**	***Scientific Name***	**Cons status**	**2431AA (124)**	**2430AC (6)**	**2430AD (17)**	**2430BA (19)**	**2430BB (85)**	**2430BC (25)**	**2430BD (112)**	**2430CA (18)**	**2430CB (40)**	**2430DA(38)**
	Taita Falcon	*Falco faschiinucha*	Globally near-threatened										
88	Saddle-billed Stork	*Ephippiorhynchus senegalensis*	E	0.06	0.00	0.00	0.00	0.11	0.04	0.18	0.00	0.00	0.00
77	White-backed Night-Heron	*Gorsachius leuconotus*	V	0.01	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00
92	Southern Bald Ibis	*Geronticus calvus*	V	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.06	0.00	0.00
121	Hooded Vulture	*Necrosyrtes monachus*	V	0.09	0.00	0.00	0.05	0.02	0.04	0.08	0.00	0.00	0.00
122	Cape Vulture	*Gyps coprotheres*	V	0.08	0.00	0.00	0.26	0.13	0.36	0.59	0.00	0.13	0.03
123	White-backed Vulture	*Gyps africanus*	V	0.29	0.17	0.06	0.42	0.39	0.08	0.40	0.11	0.00	0.00
124	Lappet-faced Vulture	*Aegypius tracheliotos*	V	0.08	0.00	0.00	0.26	0.08	0.04	0.14	0.00	0.00	0.00
125	White-headed Vulture	*Aegypius occipitalis*	V	0.06	0.00	0.00	0.00	0.05	0.00	0.08	0.00	0.00	0.00
132	Tawny Eagle	*Aquila rapax*	V	0.13	0.00	0.00	0.21	0.02	0.12	0.18	0.06	0.00	0.00
140	Martial Eagle	*Polemaetus bellicosus*	V	0.10	0.00	0.00	0.16	0.11	0.04	0.41	0.00	0.00	0.00
146	Bateleur	*Terathopius ecaudatus*	V	0.36	0.00	0.00	0.26	0.41	0.08	0.62	0.00	0.00	0.00
183	Lesser Kestrel	*Falco naumanni*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00
208	Blue Crane	*Anthropoides paradiseus*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.11
229	African Finfoot	*Podica senegalensis*	V	0.04	0.00	0.00	0.00	0.02	0.00	0.45	0.00	0.00	0.03
230	Kori Bustard	*Ardeotis kori*	V	0.01	0.00	0.00	0.05	0.00	0.00	0.02	0.00	0.00	0.00
233	White-bellied Korhaan	*Eupodotis senegalensis*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
393	African Grass-Owl	*Tyto capensis*	V	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
403	Pel's Fishing Owl	*Scotopelia peli*	V	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
463	Southern Ground-Hornbill	*Bucorvus leadbeateri*	V	0.10	0.00	0.00	0.00	0.04	0.04	0.04	0.00	0.00	0.00
84	Black Stork	*Ciconia nigra*	NT	0.02	0.00	0.00	0.00	0.05	0.00	0.41	0.00	0.00	0.05
86	Woolly-necked Stork	*Ciconia episcopus*	NT	0.01	0.00	0.00	0.00	0.00	0.04	0.03	0.00	0.00	0.00
87	African Openbill	*Anastomus lamelligerus*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00

89	Marabou Stork	*Leptoptilos crumeniferus*	NT	0.07	0.00	0.06	0.00	0.02	0.04	0.26	0.00	0.00	0.00
90	Yellow-billed Stork	*Mycteria ibis*	NT	0.06	0.00	0.00	0.00	0.02	0.00	0.03	0.00	0.00	0.00
96	Greater Flamingo	*Phoenicopterus ruber*	NT	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	African Pygmy-Goose	*Nettapus auritus*	NT	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
118	Secretarybird	*Sagittarius serpentarius*	NT	0.02	0.00	0.00	0.00	0.02	0.08	0.41	0.06	0.00	0.05
129	Bat Hawk	*Macheiramphus alcinus*	NT	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
141	African Crowned Eagle	*Stephanoaetus coronatus*	NT	0.01	0.00	0.00	0.00	0.00	0.00	0.15	0.06	0.00	0.00
171	Peregrine Falcon	*Falco peregrinus*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.15	0.00	0.00	0.00
172	Lanner Falcon	*Falco biarmicus*	NT	0.00	0.17	0.00	0.00	0.01	0.04	0.34	0.11	0.00	0.00
238	Black-bellied Bustard	*Lissotis melanogaster*	NT	0.02	0.00	0.00	0.05	0.02	0.04	0.24	0.00	0.00	0.00
259	White-crowned Lapwing	*Vanellus albiceps*	NT	0.00	0.00	0.00	0.00	0.40	0.00	0.02	0.00	0.00	0.00
304	Collared Pratincole	*Glareola pratincola*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
430	Half-collared Kingfisher	*Alcedo semitorquata*	NT	0.00	0.00	0.00	0.00	0.00	0.04	0.46	0.00	0.00	0.05
772	Red-billed Oxpecker	*Buphagus erythrorhynchus*	NT	0.34	0.33	0.53	0.21	0.21	0.04	0.25	0.00	0.38	0.13
81	Hamerkop	*Scopus umbretta*	**	0.56	0.00	0.24	0.37	0.47	0.12	0.66	0.28	0.33	0.55
83	White Stork	*Ciconia ciconia*	BONN	0.08	0.17	0.00	0.00	0.01	0.04	0.22	0.00	0.25	0.42
85	Abdim's Stork	*Ciconia abdimii*	BONN	0.02	0.33	0.00	0.05	0.01	0.04	0.08	0.00	0.10	0.05

Table 2. Red Listed bird species' preferred micro habitats, likelihood of occurring and importance of the site.

Roberts #	**Common Name**	***Scientific Name***	**Cons status**	**Preferred micro habitat**	**Likelihood of occurring on the proposed site**	**Relative importance of site for national populations of species**
	Taita Falcon	*Falco faschiinucha*	Globally near-threatened	Cliffs, gorges	Confirmed breeding	Extremely high
88	Saddle-billed Stork	*Ephippiorhynchus senegalensis*	E	Riverine, floodplain	Probable in the north	Medium in lowveld in north
77	White-backed Night-Heron	*Gorsachius leuconotus*	V	Riverine	Possible	Low
92	Southern Bald Ibis	*Geronticus calvus*	V	Grassland, cliff	Possible on escarpment particularly	Low
121	Hooded Vulture	*Necrosyrtes monachus*	V	Woodland	Probable	Medium in lowveld in north
122	Cape Vulture	*Gyps coprotheres*	V	Woodland, grassland	Probable in the north	Extremely high
123	White-backed Vulture	*Gyps africanus*	V	Woodland	Probable in the north	Medium in lowveld in north
124	Lappet-faced Vulture	*Aegypius tracheliotos*	V	Woodland	Probable in the north	Medium in lowveld in north

125	White-headed Vulture	*Aegypius occipitalis*	V	Woodland	Probable in the north	Medium in lowveld in north
132	Tawny Eagle	*Aquila rapax*	V	Woodland	Probable in the north	Medium in lowveld in north
140	Martial Eagle	*Polemaetus bellicosus*	V	Woodland	Probable in the north	Medium in lowveld in north
146	Bateleur	*Terathopius ecaudatus*	V	Woodland	Probable in the north	Medium in lowveld in north
183	Lesser Kestrel	*Falco naumanni*	V	Grassland, arable land	Possible on higher ground in south	Low
208	Blue Crane	*Anthropoides paradiseus*	V	Grassland, arable land, wetland, dam	Possible on higher ground in south	Low – much larger populations elsewhere in SA
229	African Finfoot	*Podica senegalensis*	V	Riverine	Probable	Medium
230	Kori Bustard	*Ardeotis kori*	V	Open woodland, grassland	Possible	Medium
233	White-bellied Korhaan	*Eupodotis senegalensis*	V	Grassland	Possible but unlikely	Low
393	African Grass-Owl	*Tyto capensis*	V	Grassland, wetland	Possible, particularly in south-east of study area	Low
403	Pel's Fishing Owl	*Scotopelia peli*	V	Riverine	Possible in lowveld in north	Low
463	Southern Ground-Hornbill	*Bucorvus leadbeateri*	V	Open woodland	Possible	Low
84	Black Stork	*Ciconia nigra*	NT	Riverine, cliff	Possible	Medium
86	Woolly-necked Stork	*Ciconia episcopus*	NT	Riverine, floodplain, dam, wetland	Probable in the north	Medium
87	African Openbill	*Anastomus lamelligerus*	NT	Riverine, floodplain, dam, wetland	Probable in the north	Medium
89	Marabou Stork	*Leptoptilos crumeniferus*	NT	Riverine, floodplain, dam, wetland, waste disposal sites	Probable in the north	Medium
90	Yellow-billed Stork	*Mycteria ibis*	NT	Riverine, floodplain, dam, wetland	Probable in the north	Medium
96	Greater Flamingo	*Phoenicopterus ruber*	NT	Dam, floodplain	Possible	Low
114	African Pygmy-Goose	*Nettapus auritus*	NT	Riverine	Possible	Low
118	Secretarybird	*Sagittarius serpentarius*	NT	Open woodland	Probable	Medium
129	Bat Hawk	*Macheiramphus alcinus*	NT	Woodland	Unlikely	
141	African Crowned Eagle	*Stephanoaetus coronatus*	NT	Indigenous forest	Possible in forest on escarpment	Low
171	Peregrine Falcon	*Falco peregrinus*	NT	Cliff, grassland	Possible	Low
172	Lanner Falcon	*Falco biarmicus*	NT	General	Probable	Low
238	Black-bellied Bustard	*Lissotis melanogaster*	NT	Open woodland, grassland	Possible	Low
259	White-crowned Lapwing	*Vanellus albiceps*	NT	Riverine	Possible	Low
304	Collared Pratincole	*Glareola pratincola*	NT	Wetlands, water sources	Unlikely	

430	Half-collared Kingfisher	*Alcedo semitorquata*	NT	Riverine	Possible	Low
772	Red-billed Oxpecker	*Buphagus erythrorhynchus*	NT	Woodland	Possible in woodland areas	Medium
81	Hamerkop	*Scopus umbretta*	**	Riverine, water	Probable throughout	Low – medium
83	White Stork	*Ciconia ciconia*	BONN	Arable land, wetland, dam	Probable throughout	Medium
85	Abdim's Stork	*Ciconia abdimii*	BONN	Arable land, grassland, wetland	Probable throughout	Medium

Wolkberg Forest Belt – Important Bird Area – SA005

This IBA consists of hills and forests in the vicinity of Tzaneen. The eastern route or Route 4 is approximately 1.6km from the IBA's eastern boundary, and runs within 5km of the IBA for approximately 10km. The IBA consists of escarpment, cliffs and gorges, with high altitude mist belt on top, at approximately 1500m above sea level. Despite the area having been targeted for commercial forestry in the past, large patches of good quality indigenous forest still remain. The IBA 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 (*Barnes 1998*)*.

As with Kruger, this area would best be avoided by as far as possible by the proposed power line.

Blyde River Canyon – Important Bird Area – SA010

The Blyde River Canyon is approximately 20km long and up to 700m deep. Routes 1, 2 and 3 all pass through the IBA, for distances of approximately 18, 22 and 16 kilometres respectively. The gorge is flanked by a number of spectacular peaks and sheer cliff faces. Key features include the Blydepoort Dam, patches of indigenous forest, the cliff faces and patches of montane grassland. This general area is the only known breeding area for Taita Falcon *Falco fasciinucha* - arguably now one of South Africa' most rare bird species (only approximately 40 breeding pairs known globally – Jenkins *et al,* 2008). This area has been surveyed several times for this species (Jenkins *et al* 2008; Jenkins 2010; Jenkins 2007). Only one breeding site appears relevant to the proposed power line at this stage, but other sites may exist that have not yet been discovered (Jenkins, pers comm). The area west of where the Olifants River descends the escarpment has not yet been surveyed at all and could conceivably contain more breeding pairs, and other relevant species. Blue Swallow *Hirundo atrocaerulea* also breed in the grasslands, and a large (the worlds' 4th largest) breeding colony of Cape Vulture (539 breeding pairs recorded in 2011, Wolter, Neser & Ronaldson, 2011) is found at the cliffs at Manoutsa. Black Stork *Ciconia nigra* and Peregrine Falcon also breed in the area.

It is far from ideal for a power line of this nature to be built through this IBA. Important Bird Areas are recognized internationally for their importance for the conservation of birds. Any developments within an IBA face likely criticism from BirdLife South Africa and Birdlife International. Since there is already an existing power line of this size, and countless other smaller voltage lines within this IBA, it would however be difficult to argue that no power lines can be built in IBA's. Also the boundaries of IBA's do not always reflect any distinct difference in bird abundance on the ground. For example examining Figure 5 one can see that IBA SA010 has a very abrupt western boundary, which has been drawn in along farm boundaries predominantly. The area immediately west of this boundary, and in fact up until SA005 could be argued to be equally important for the protection of birds, if perhaps a little less well known and studied. In addition, the IBA boundaries should according to BirdLife South Africa be considered soft boundaries. In other words they are a broad indication of where the important bird species reside, and developments outside of the boundaries can still impact on the birds within the IBA itself. The result is that the entire escarpment could be argued to be important for the protection of birds. This would pose a significant challenge to the distribution of electricity to the lowveld.

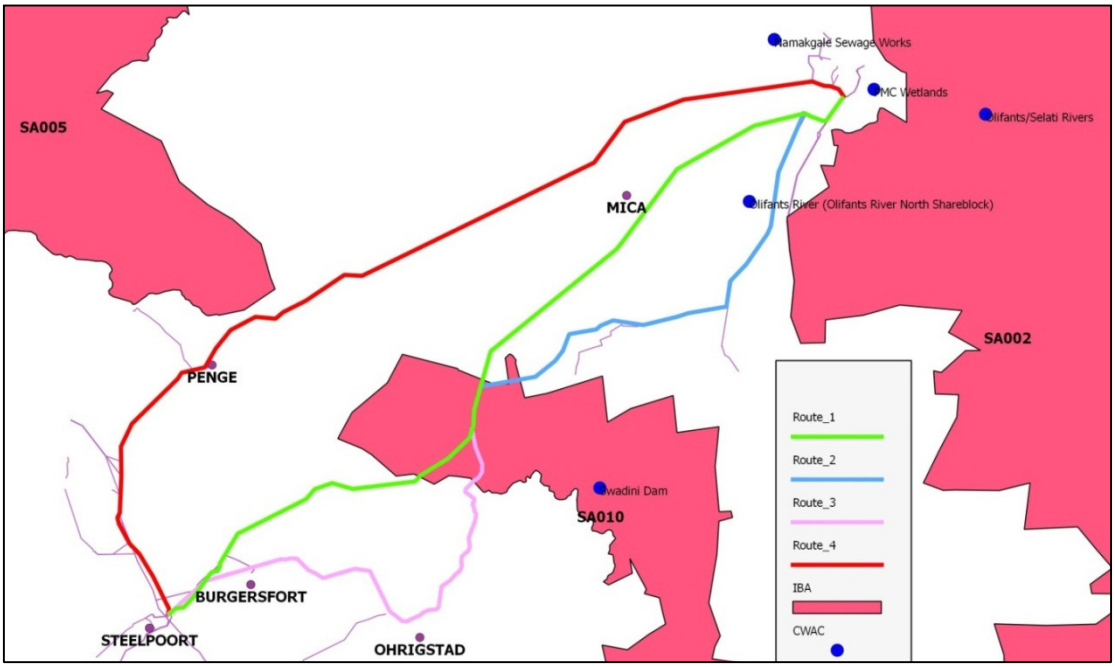


Figure 5. Avifaunal features in the Foskor Merensky 275kV power line study area. Important Bird Areas (IBA) and Co-ordinated Water bird Count (CWAC) locations are shown.

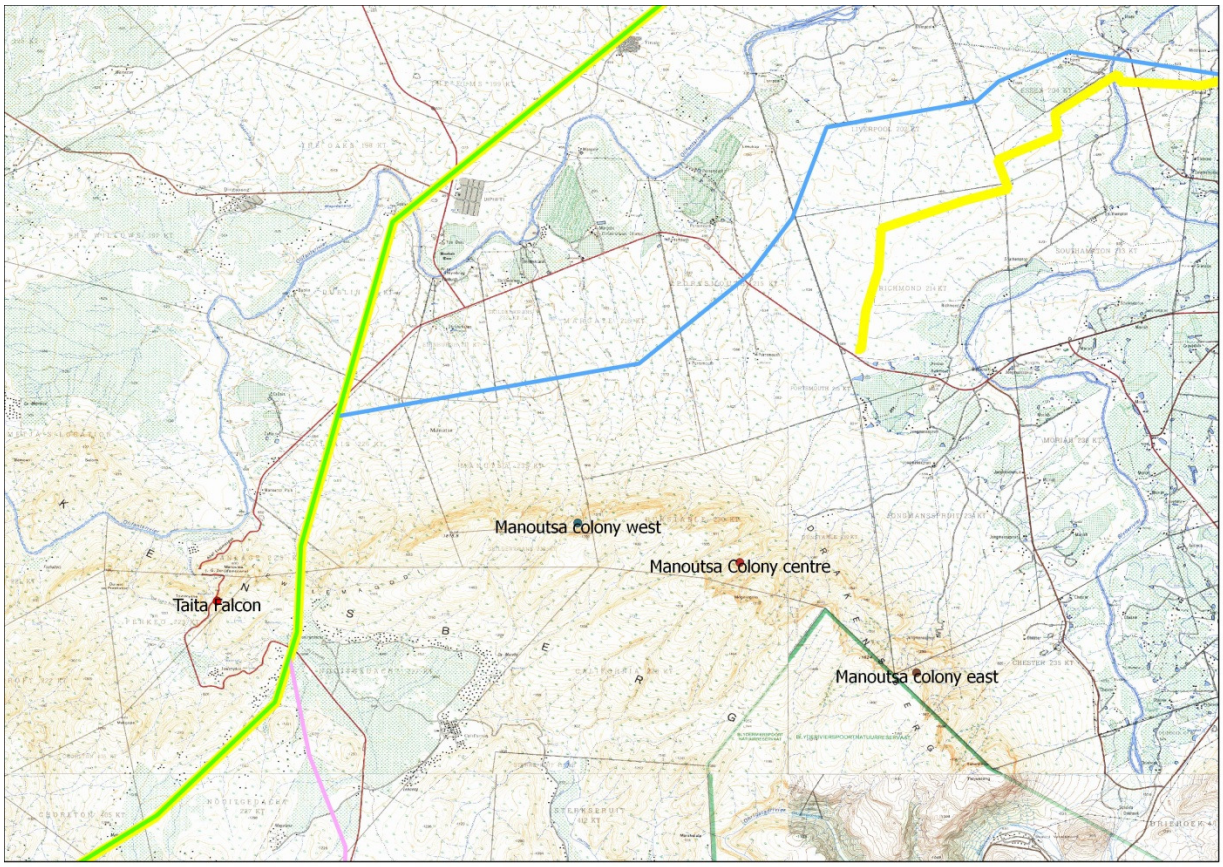


Figure 6. The position of relevant sensitive bird species information relative to Route 1.

Figure 6 illustrates the escarpment area. A known Taita Falcon breeding site is situated approximately 2km west of Route 1. The western part of the Manoutsa Cape Vulture breeding colony is approximately 6.8km east of Route. Route 1 is shown in green and the existing transmission lines in yellow. Route 2 is shown in blue. It is my opinion that this distance is sufficient to prevent disturbance of the colony, so only collision with the power line remains as a potential threat. This has been discussed in Section 2.

Figure 5 also shows the position of Co-ordinated Water bird Count (CWAC) sites close to or in the study area. These are sites where water birds are regularly counted. Although they are not necessarily sensitive features, and are often man made (such as the Namakgale Sewage Works site) they give a good indication of which water associated bird species can be expected in the area. Three such sites exist close to the proposed routes in the north: Namakgale Sewage Works; Olifants River; and PMC Wetlands. The Namakgale Sewage Works site has records for most of the more common water birds, and also Yellow-billed and Marabou Storks, both key species for this study. The Olifants River site has records for African Fish Eagle and Pels Fishing Owl, and the PMC Wetlands site has records for African Fish Eagle, Pels Fishing Owl, Pink-backed Pelican, Marabou Stork, Saddle-billed Stork, Woolly-necked Stork, Yellow-billed Stork, and Greater and Lesser Flamingo. Although these sites are all some distance from the proposed alignments, the data does bear relevance in terms of which bird species can be expected in the broader area.

5. EVALUATION OF IMPACTS AND CHOICE OF ALTERNATIVE

5.1. Evaluation of impacts

The impacts of the proposed development 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 3. Assessment of the impact of Bird collisions on the overhead cables, in particular the earth wires

Nature: **Bird collisions on the overhead cables, in particular the earth wires**		
	Without mitigation	With mitigation
Extent	2	2
Duration	4	4
Magnitude	4	4
Probability	4	2
Significance	**40 (medium)**	**20 (low)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes birds killed	Yes birds killed
Can impacts be mitigated	Yes – through marking relevant sections of power line	
Mitigation: High risk sections of power line will need to be marked with a suitable, effective Eskom approved line marking device on the earth wires as per Eskom standards. These high risk sections of line need to be identified once the		

final route is available and tower positions have been surveyed and finalized. This will need to be done through an avifaunal walk through as part of the site specific EMP. It will be Eskom's responsibility to monitor the effectiveness of this mitigation and add further mitigation if it is not effective enough or if the materials do not last. This detail should be written into the conditions of the Environmental Authorisation. At this stage it is possible to say that all river crossings, the escarpment, and all line close to dams will need to be mitigated. Eskom should also urgently plan and implement a systematic monitoring programme for existing power lines close to Cape Vulture breeding colonies nationally, so that data is obtained on this matter.
Cumulative impacts: The cumulative impacts of power lines on the relevant species (listed elsewhere in this report) will be significant if not managed, since these species mostly already suffer from significant power line mortalities.
Residual impacts: Low – if lines were removed, impact would cease

Table 4. Assessment of the impact of habitat destruction and alteration on birds

Nature: **Habitat destruction and alteration during construction**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	3	3
Probability	4	4
Significance	**32 (medium)**	**32 (medium)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes- bird habitat	Yes-Bird habitat
Can impacts be mitigated	Yes – but only partially, a certain amount of habitat destruction is inevitable	
Mitigation: Standard construction best practices must be followed. A construction EMP must be developed and implemented by an on-site environmental control officer during construction. In this way the impact can be mitigated to an acceptable level. Key issues are location of construction camp, access of large vehicles and heavy machinery to sensitive areas, and control of labour (i.e. preventing firewood harvesting etc). Key sensitive areas include the IBA, the escarpment, river crossings and natural bushveld.		
Cumulative impacts: for the more sensitive habitats near the escarpment this could be quite significant		
Residual impacts: High – if lines were removed, impact would persist		

Table 5. Assessment of the impact of disturbance of birds during construction

Nature: **Disturbance of birds during construction**		
	Without mitigation	With mitigation
Extent	1	1
Duration	2	2
Magnitude	4	4
Probability	3	3

Significance	**21 (Low)**	**21 (Low)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	Possible loss of breeding success	Possible loss of breeding success
Can impacts be mitigated	Yes -partially	
Mitigation: A standard construction EMP must be compiled and implemented by an on site environmental control officer. Care must be taken if any breeding sensitive species are encountered close to the servitude. Case specific advice can be sought from the avifaunal consultant should such sites be found.		
Cumulative impacts: Negligible		
Residual impacts: Low – temporary impact		

Table 6. Assessment of the impact of electrical faulting on the power lines

Nature: **Electrical faulting on the power lines**		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	4
Magnitude	4	3
Probability	4	2
Significance	**36 (Medium)**	**16 (Low)**
Status	Negative-for business	Negative-for business
Reversibility	Reversible	Reversible
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes – quite straight forward	
Mitigation: It is recommended that this issue be assessed when the tower structure is available and appropriate mitigation measures developed at that stage.		
Cumulative impacts: n/a		
Residual impacts: Low		

5.2. Evaluation of alternatives

Table 7 below summarises key facts pertaining to each alternative route. For each route, a score was assigned for each factor based on the alternatives' rank out of the four. For example, Alternatives 1, 2 and 3 pass through the Blyde River Canyon IBA, which is a big disadvantage in terms of avifauna. This particular factor has been weighted with three times the importance of the other factors. The length of each alternative that is adjacent to existing large power lines is also a relevant factor. Placing the new power line adjacent to these existing infrastructures is an advantage in terms of avifaunal impacts, since these are already disturbed areas. In the case of bird collision, it is believed that placing more power lines next to each other makes them more visible to birds, and easier to avoid. The length of line adjacent to 275kV line has also been weighted with three times the importance. When these scores are summed for each alternative, a total score for the route is obtained. The alternative with the lowest total score is then the most preferred alternative from an avifaunal perspective. A wider corridor for Route 1 was added in the later stages of this project on the basis of landowner input. This

corridor has not been assessed as a separate alternative but it rather discussed in the text below Table 7. During January 2013 a new alternative, Alternative 5, was added and has been assessed on a similar basis to the others.

Table 7. Scoring of the key avifaunal factors for the five alternative routes proposed for the Foskor Merensky 275kV power line.

Feature	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
Length (approximate – kilometres)	131 **(1)**	138 **(3)**	154 **(5)**	145 **(4)**	134 (**2**)
Distance through Important Bird Areas (Blyde River Canyon) (approximate – kilometres)	18 **(9)**	22 **(15)**	16 **(6)**	0 **(3)**	18 (**9**)
Distance from Kruger National Park Important Bird Area (approximate – kilometres)	1.6 **(3)**	1.8 **(5)**	1.6 **(3)**	5.2 **(1)**	4.9 (**2**)
Length of line within 10km of Kruger National Park Important Bird Area (approximate – kilometres)	13.4 **(3)**	40 **(5)**	13.4 **(3)**	10.3 **(1)**	11.4 (**2**)
Length of line adjacent to existing 132kV or greater power line	131.0 **(1)**	110.6 **(2)**	76 **(3)**	49.3 **(5)**	63.2 (**4**)
Length of line adjacent to existing 275kV or greater power line	131 **(3)**	69 **(9)**	76 **(6)**	0 **(15)**	63.2 (**12**)
Major river courses crossed	9 (Olifants x 3, Ga-Selati, Steelpoort x 5) **(5)**	8 (Steelpoort x 5, Blyde, Sand, Olifants) **(3)**	6 (Steelpoort x 4, Spekboom, Olifants) **(1)**	8 (Steelpoort, Kubjaname, Makhutswi x 2, Olifants, Ga-Selati x 3) **(3)**	7 (Makhutswi, Ga-Selati, Steelpoort x 5) **(2)**
Total score	**25**	**42**	**27**	**32**	**31**
Ranking	**1 (most preferred)**	**5 (least preferred)**	**2**	**4**	**3**

Table 7 shows that based on final total scores, the preferred route for avifauna would be Alternative 1, with the lowest total score of 25, followed by Alternative 3, with a total score of 27, and Alternative 5 with 31. This preference arises predominantly out of the fact that Alternative 1 is adjacent to an existing 275kV power line for its entire route. This is seen as a significant advantage for avifauna, and outweighs the disadvantage of passing through the Blyde River Canyon IBA. One could argue that since a similar size power line already passes through the IBA, the addition of one more line would not have a significant effect. However this reasoning is tenuous since no data is available on the impact of the existing power

line. It is highly likely that the existing line has been responsible for numerous bird collisions which have gone undetected due to the mountainous terrain. **It is extremely important to note that the preference for Route 1 is only because of the existing line, and that if the new line is not placed as close as technically possibly (not more than 100m) from the existing line this preference would no longer apply and the remaining routes would need to be re-evaluated. In the area just south west of the R36 Route 1 passes through some mountainous terrain that has also not yet been extensively surveyed for species such as Cape Vulture, Taita Falcon and others. The preference for this route then is slightly risky and is again based on the presence of the existing line.** An alternative option would be to take Route 3 from the R36 onwards. Its proximity to the road means that this area has been better covered and has less risk of unknown breeding sites or colonies. Chris van Rooyen however recently found two possible Cape Vulture roost sites at Luwalehubedu just east of the R36 (2012, pers comm), showing that this area is not yet well known in terms of these birds. **Alternative 5 differs from Alternative 1 only in the lowveld area, which is relatively uniform in terms of avifaunal features, at least those that are known to this author at this time. It's position adjacent to the road for most of its length makes good sense in terms of impact mitigation and management as the road is already an existing source of disturbance and to some extent an ecological barrier in this landscape. It is therefore the recommendation of this report that in the area below the escarpment (lowveld), Alternative 5 would also be acceptable from an avifaunal perspective.**

The 6km wide buffer in the area south of the escarpment towards Steelpoort is not acceptable in its northern parts (towards the R36) from an avifaunal perspective, as the new line must be immediately adjacent to the existing line for this route to be acceptable as explained elsewhere in this discussion. The buffer just north of the escarpment is also only provisionally acceptable in that the power line should still be placed adjacent to the existing line and no closer to the Manoutsa colony to the east.

Route 4 is not preferred on the basis of the above scoring, and importantly, the lack of existing knowledge of bird abundance in that remote area near the escarpment. If this route is to be considered seriously extensive further field work, and even possibly aerial survey work will be required in the area. An EIA such as this depends heavily on existing data sources, which are largely available for the more eastern routes over the escarpment (as described elsewhere in this report). If these data are not available though it would be the responsibility of the EIA process to do sufficient work in the area to eliminate uncertainty around which sensitive bird species occur there. Two possible Cape Vulture roosts have been recently identified near Penge by Chris van Rooyen (2012, pers comm). This represents a risk if this route is chosen, and also indicates that our existing state of knowledge in that area is inadequate.

Although in terms of the above scores, Alternatives 2 and 3 appear to differ little from 1 and 4, it is recommended that these two alternatives are not considered further (except for possibly the southern section of Route 3 as explained above), since they both pass through the IBA, but are not adjacent to a 275kV line for their entire length. Alternative 2 also turns east at the bottom of the escarpment thereby running across the front of the Manoutsa Cape Vulture breeding colony. This would not be a preferred route at all as it would pose a risk to these birds.

6. CONCLUSION

This proposed power line route passes through an area that is rich in avifauna, due to its varied geology and vegetation, and the protected status of much of the land (by virtue of game farming). This means that the potential interactions of birds with the power line are likely to be of relatively high significance. However, given that a power line of this size has to be built between these two substations (we assume that effective network planning has been conducted), the proposed routes do collectively provide opportunity to route the line as wisely as possible with respect to avifauna. The preference is to build the proposed power line adjacent to the existing Foskor Merensky 275kV line. However the recently added Alternative 5 would also be acceptable. It is also essential that the other recommendations of this report are accepted and implemented, in particular the avifaunal walk through to be done during the site specific Environmental Management Plan for the line. This walk through will identify sensitive sections of the routes for collision mitigation, and will as far as possible identify any large breeding raptors close to the alignment.

Although little data exists on Cape Vulture collisions with overhead power lines, it is considered likely that where vultures congregate for any reason (such as at colonies) close to power lines birds are likely to collide with the overhead cables. Unfortunately to date little data in this regard exists, due partly to the lack of focused efforts to systematically patrol such power lines. It is recommended that Eskom give this matter urgent attention and preferably initiate a national programme to monitor existing power lines close to colonies. The findings from such a programme will facilitate more informed impact assessments for power lines in such situations in the future.

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

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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 it 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