Gourikwa Proteus 400kV Power line

Avifaunal assessment – Scoping phase

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PROFFESSIONAL DECLARATION

This study was conducted by Jon Smallie in his capacity as biologist of the Endangered Wildlife Trust. Mr Smallie is registered with The South African Council for Natural Scientific Professions (400020/06). The Endangered Wildlife Trust (EWT) are independent consultants to Savannah Environmental (for Eskom Holdings Limited), The EWT has no business, financial, personal or other interest in the activity, application or appeal in respect of which they were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of these specialists performing such work.

The author has eight years of experience in the field of bird interactions with electrical infrastructure and has conducted avifaunal impact assessments for nine transmission line projects and approximately thirty distribution line projects. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information.

EXECUTIVE SUMMARY

The Endangered Wildlife Trust was appointed by Savannah Environmental to conduct an avifaunal assessment for the proposed Gourikwa Proteus 400kV transmission power line, as part of the EIA process.

The study area consists of predominantly flat arable lands in the south, and some remaining isolated pockets of fynbos on the rolling hills in the north. The Southern African Bird Atlas Project (Harrison *et al*, 1997) recorded a total of 157 bird species in the quarter degree square within which the study area falls, i.e. 3421BB. This included seven Red Data species, four 'vulnerable' and three 'near-threatened' according to Barnes (2000). In addition, the White Stork (Protected internationally under the Bonn Convention on Migratory Species) is considered as a threatened species for the purpose of this study. This is a relatively low diversity of bird species, and consequently Red Data species, meaning that in terms of avifauna, this study area is not particularly unique. However, several of the Red Data species recorded here are known to be extremely vulnerable to impacts of power lines, through collision. The Blue Crane, Secretarybird, Denham's Bustard and White Stork are all extremely vulnerable to collision, and several birds of these species have been reported colliding with the existing power lines in the study area previously.

Collision of large terrestrial species such as those mentioned above is therefore anticipated to be the most significant impact. Electrocution of birds is not considered possible on a power line of this size. Disturbance and habitat destruction are not anticipated to be significant since much of the study area is already transformed, and disturbed, and habitat destruction in the natural vegetation remaining is likely to be minimal since an existing servitude exists already. Electrical faulting due to birds is also rated as low significance since the cross rope suspension tower provides no perching space above the conductors. Self support towers with perching space will be the minority on the line.

Three alternative corridors exist for the construction of this power line. Two of the three (2 and 3) alternatives involve construction of the new line in the same corridor as the existing four large lines (two 400kV and two 132kV lines). This placement will partially mitigate for all of the impacts on avifauna, most particularly that of collision, since the more lines are placed together, the more visible the overhead cables become, and risks are kept together rather than spread out across the landscape. The remaining corridor (1) is to the east and will stand alone in the landscape for most of its route. This alternative is not preferred in terms of avifaunal impacts. The most preferred of the corridors is Alternative 3, closely followed by Alternative 2.

Collision of large terrestrial Red Data bird species will be by far the most significant impact of the proposed power line. Provided that the correct alternative is chosen, and then the relevant sections of the power line are comprehensively marked with a suitable anti collision marking device, the EWT are confident that this impact can be reduced to acceptable levels.

1 INTRODUCTION

The Endangered Wildlife Trust (EWT) was appointed by Savannah Environmental to conduct a specialist avifaunal assessment for the proposed Gourikwa Proteus 400kV power line, situated close to Mossel Bay, in the Western Cape Province.

The proposed project includes the construction of a 400 kV transmission power line from the Gourikwa Power station, near PetroSA, to the existing Proteus Substation, a distance of approximately 11km.

Figure 1 shows the layout of the study area, with the position of the three alternatives.

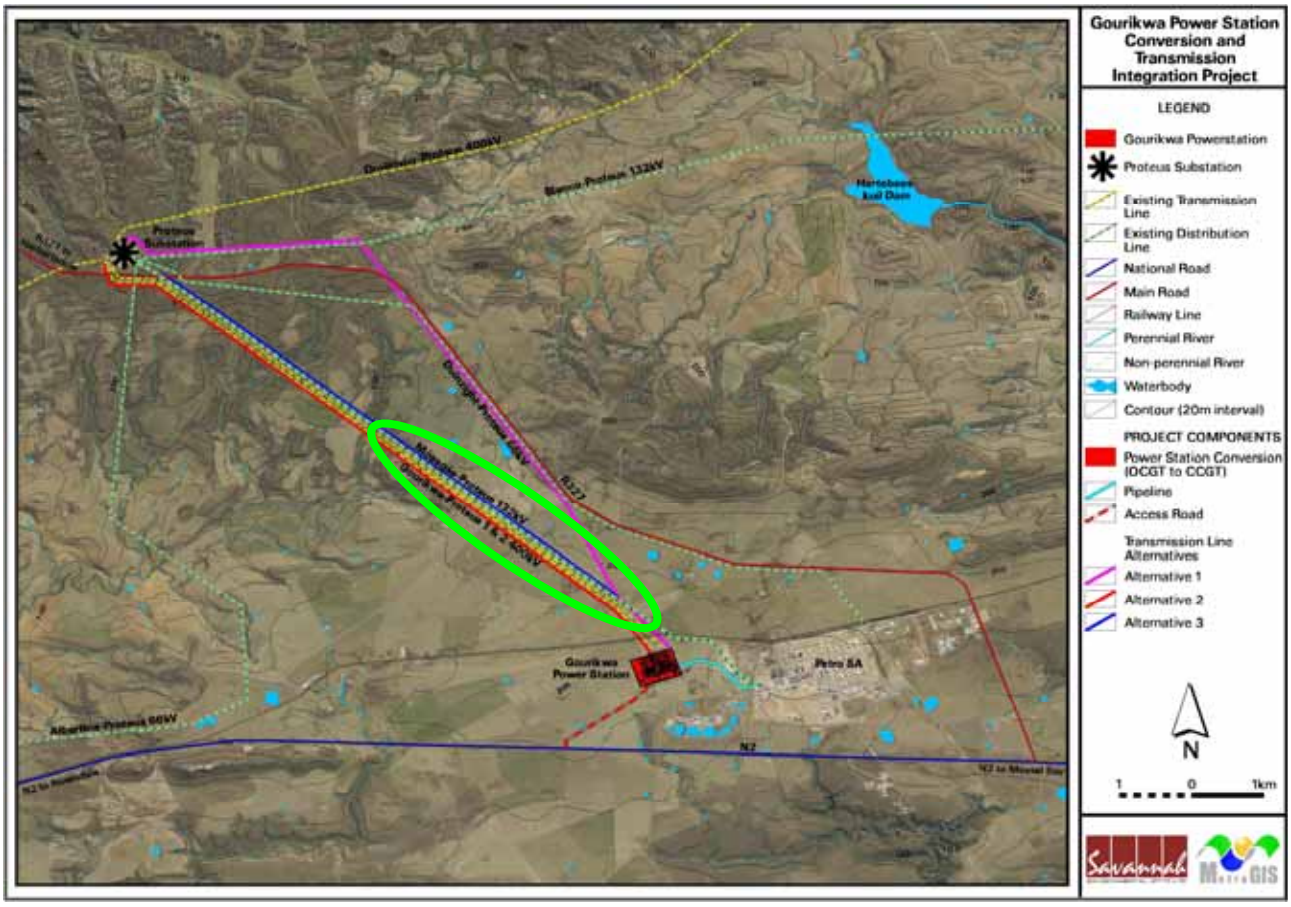

Figure 1: The study area with proposed alignments (map supplied by Savannah Environmental).The area of highest collision risk is shown in the green polygon.

Typically, a development of this type could be expected to impact on the birds of the area through: collision of birds with earth wires and conductors; electrocution of birds on pylons; destruction of bird habitat; disturbance of birds; and birds causing electrical faulting on the power line.

A site inspection for this project was carried out on 10 April 2008.

2 BACKGROUND & BRIEF

The detailed brief supplied to the EWT for the purpose of this study consisted of the following:

Scoping Phase:

- Information on the micro habitat level associated with alternative Transmission line alignments will be obtained first hand through the field trip which will involve visiting the proposed site and driving the proposed Transmission line route as close to the alignment as roads allow and examining any sections of particular concern. Any problem areas identified will be thoroughly investigated if the proposed alignment still crosses these areas.
- The field investigation will enable the acquisition of a first hand perspective of the study area and any relevant issues.
- General impacts that the proposed power line will have on specific species will be described and the general areas that these impacts will most likely occur will be identified.
- Bird sensitive sections of the study area will be mapped.
- The affected environment will be described and the bird communities most likely to be affected will be identified. Different bird micro habitats will be described as well as the species most likely associated with those habitats.
- Typical impacts that could be expected from the development will be listed as well as the expected impact on the bird communities. Impacts will be quantified (if possible) and a full description of predicted impacts (direct and indirect) will be provided.
- Recommendations regarding a preferred alternative for consideration in the EIA phase will be made.

EIA Phase:

- If necessary a detailed field investigation will be conducted for the preferred alignment in order to identify any potentially significant impacts on avifauna. The general impacts identified during scoping will be further investigated and the exact localities of all potential impacts will be determined.
- General recommendations will be made for mitigation for potentially significant impacts.
- If a need for a monitoring programme is evident, it will be highlighted and a programme proposed.

Description of the proposed activities

This project considers three alternative corridors for the placement of the new power line (see Figure 1 for their exact position in the study area):

Alternative 1: The alignment follows the R327 and Duinzight-Proteus 66kV line for most of its length, before following the Blanco-Proteus 132kV line into Proteus Substation. It may be an option for the new line to follow the Blanco-Proteus line on the northern or the southern side.

Alternative 2: The alignment follows the Gourikwa-Proteus 400kV servitude for its entire length.

Alternative 3: The alignment follows the Mossgas-Proteus 132kV servitude for its entire length.

Important aspects of the proposed development from a bird interaction perspective are the following:

- The proposed 400kV power lines have no inherent electrocution risk for large birds because the clearances between live parts and live and earthed components exceed the wingspan of any bird.
- The earth wire will be the biggest risk from a bird collision perspective. Birds in flight tend to see the bundled conductors, and then gain height to avoid them. In the process, the much thinner earth wire is not noticed and the birds may then collide with it (APLIC 1994).
- The design of the cross rope suspension towers is such that bird streamers are unlikely to be a source of faulting on these towers. Birds tend to perch on the highest points first, in this instance the earth peaks. The perching space above the conductors is uncomfortable and restricted. This type of tower has to EWT's knowledge never had suspected bird streamer faulting.
- There is a possibility that birds will perch on the strain towers, as these will be self-supporting towers with ample perching space above the conductors. This could lead to streamer faults.
- Through construction and maintenance activities, a certain amount of vegetation will be removed, thereby impacting on birds through habitat destruction. Likewise, construction and maintenance activities could disturb bird species in the vicinity, particularly whilst breeding.

3 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The study area (see Figure 1) is located in the quarter degree square 3421BB. The southern parts of the square have been transformed extensively for agriculture, resulting in arable lands. The northern part of the study area has been less transformed, most likely due to its more hilly nature. In this area some remnant fynbos remains, although its condition is not considered to be pristine.

3.1 Vegetation types and bird habitats

It is widely accepted that vegetation structure is more critical in determining bird habitat than the actual plant species composition (Harrison *et.al*. 1997). The description of vegetation presented in this study therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present. The description of the vegetation types occurring in the study area makes extensive use of information presented in the Atlas of southern African birds (Harrison *et.al.* 1997). The criteria used to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations (Harrison *et.al.* 1997).

As can be seen in Table 1, the quarter degree square 3421BB is dominated by fynbos vegetation according to the classification by Harrison *et al* (1997).

Table 1. The percentage area of 3421BB that is classified as each biome or vegetation type (Harrison *et.al*. 1997).

Biome	**Vegetation type**	**3421BB**
Fynbos	Fynbos	100%

Fynbos is dominated by low shrubs and can be divided into two categories, fynbos proper and renosterveld. Although fynbos is justifiably treated as one of our most threatened vegetation types, in terms of avifauna, and particularly the larger species vulnerable to power lines, fynbos is not particularly important. Despite having a high diversity of plant species, fynbos has a relatively low diversity of bird species. The only Red Data species recorded in this study area, that is associated with fynbos is the Black Harrier (which may breed in fynbos).

Much of the Fynbos and Renosterveld has been transformed for agriculture, making the above vegetation classification less valuable than the discussion of existing microhabitats below. Whilst this obviously resulted in substantial natural habitat being destroyed, several species have in fact adapted rather well to this transformation. One such species, which is highly relevant to this study, is the Blue Crane. This species has thrived on the (predominantly) wheat lands in the southern and western cape.

Whilst much of the bird species distribution in the study area can be explained in terms of the above broad vegetation description (based on the quarter degree squares), there are many differences in bird species distribution and density that correspond to differences in habitat at the micro level. These “bird micro-habitats” are evident at a much smaller spatial scale than the broader vegetation types or biomes, and can largely only be identified through a combination of field investigation and experience. The habitat that is relevant to the birds may also be broader than merely the vegetation type and structure and may include abiotic elements such as man-made infrastructure. It was therefore important to visit the study area and examine these characteristics first hand.

The following bird micro-habitats were identified along the proposed alignments:

Dams:

There are several small man-made impoundments in the study area, particularly along the eastern alignment. Depending on the water levels and the extent of exposed shoreline, these could also attract a number of bird species. Of particular concern might be Blue Cranes roosting in the shallows of dams, although the dams observed during the site visit did not appear to have the shallows required for this. Roosting Blue Cranes are particularly vulnerable to collision with power lines as they enter and leave the roost in low light conditions when visibility of the power line is low.

Figure 2: An example of a dam in the study area

Arable land:

Arable or cultivated land represents a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often themselves eaten by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. In this study area, most of the southern parts are arable lands. The most important species likely to make use of these areas is the Blue Crane.

The Blue Crane uses arable lands extensively for foraging. A group of this species (20-30) was observed in the study area by Jo-Anne Thomas during their site visit on 27 and 28 March (pers.comm.) and this author observed a family group of four on 10 April 2008. The high bird atlas report rate for this species (Harrison et al, 1997) also bears testimony to its abundance in the area. Other species likely to use the arable lands are the White Stork (summer migrant), Secretarybird and Denham's Bustard (none of which are strictly speaking birds associated with arable lands, but in this study area they are).

Figure 3: An example of an arable land in the study area

Fynbos

This has been adequately described above.

Figure 4: An area of fynbos in the north of the study area

4 STUDY APPROACH

4.1 Sources of information

The study made use of the following data sources:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison, Allan, Underhill, Herremans, Tree, Parker and Brown, 1997) obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which species occur in the study area. A separate data set is obtained for each quarter degree square within the study area, in this case only one i.e. 3421BB.
- Data from the Co-ordinated Waterbird Count (CWAC) project was also used to determine whether any important water bird sites are located in study area (Taylor, Navarro, Wren-Sargent, Harrison and Kieswetter, 1999). No CWAC sites exist within the study area, the closest sites being at the Mossgas Dams, and Hartebeeskuil Dam.
- The Important Bird Areas project data was consulted to establish if any bird areas are located in the study area (Barnes 1998). No important areas exist in or close to the study area.
- The conservation status of all bird species occurring in the aforementioned quarter degree square was determined with the use of The Eskom Red Data book of birds of South Africa, Lesotho and Swaziland (Barnes 2000).

- The power line bird mortality incident database of the Eskom/Endangered Wildlife Trust Strategic Partnership (1996 to present) was consulted to determine which of the species occurring in the study area are typically impacted upon by power lines.
- A classification of the vegetation types in each quarter degree square was obtained from the Southern African Bird Atlas Project (Harrison, Allan, Underhill, Herremans, Tree, Parker and Brown (1997).
- Information on the micro-habitat level was obtained through a visit to the area in a vehicle.
- High resolution imagery from Google Earth was used to further informally examine the study area.

4.2 Limitations & assumptions

This study made the assumption that the above sources of information are reliable. However, the following factors may potentially detract from the accuracy of the predicted results:

- The SABAP data covers the period 1986-1997, which means that some of the data is now more than a decade old. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate (for a full discussion of potential inaccuracies in ASAB data, see Harrison, Allan, Underhill, Herremans, Tree, Parker and Brown, 1997).
- Difficult road access made examination of the study area from the ground exceptionally difficult in some areas, which means that important micro habitat along the alignments, may have been overlooked by the author.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird interactions with power lines cannot be reduced to formulas that will hold true under all circumstances; at most impacts can be predicted with a fair amount of confidence based on field experience.

5 POWER LINE SENSITIVE BIRD SPECIES OCCURRING IN THE STUDY AREA

Table 2 below lists the Red Data (Barnes 2000) bird species recorded in 3421BB. A total of 157 bird species were recorded in this square during the atlas period, in which the square was counted 39 times (Harrison *et al*, 1997). Four of these species are classified as 'vulnerable' and three as 'near threatened' (Barnes, 2000). In addition to the Red Data species, the White Stork is included in Table 2 as it is protected internationally under 'The Bonn Convention on Migratory Species'. As mentioned elsewhere in this report, the atlas data is now relatively old, having been collected during the period leading up to 1997. The spatial scale of the atlas data is relatively large i.e. the quarter degree square. This means that certain species could have been recorded in a square but not necessarily in this study area. This emphasises the importance of the approach taken by this study, in which the micro habitats available along the proposed corridors are evaluated for their potential to be used by Red Data and other species. This "potential for occurrence" of a species, in conjunction with the Atlas data on distribution and abundance provides a strong basis for the assessment on the impact of the proposed

developments. Furthermore, despite its shortcomings, the atlas data remains our best formal, scientifically presented data source for the study area.

Table 2 also describes the preferred micro habitats of each species. With the exception of the Cape Cormorant, all of the species shown there could conceivably occur in the study area. Blue Crane, Denham's Bustard, Secretarybird and White Stork are known to certainly frequent the exact study area, as the existing power lines have previously claimed these species as victims of collisions. As discussed elsewhere in this report, this data from the Southern African Bird Atlas is now relatively outdated. In the case of the Blue Crane, flocks of this species are known to use the area, making it the species of most concern for the purpose of this assessment. The harriers, and the Cape Vulture could possibly use the area from time to time, although it is unlikely to represent an important area for these species.

TABLE 2. Red Data species recorded in 3421BB (Harrison *et.al.* 1997).

Species	**Conservation status**	**3421BB Report rate %**	**Preferred habitat**
Total species		157	
# cards		39	
Cape Vulture	V	3	All over study area, mostly away from disturbance
African Marsh Harrier	V	5	Natural vegetation, wetlands
Blue Crane	V	67	Arable lands, dams
Denham's Bustard	V	41	Arable lands
Cape Cormorant	NT	13	Will not occur in study area
Secretarybird	NT	23	Arable lands and natural vegetation
Black Harrier	NT	26	Natural vegetation, wetlands
White Stork	Bonn	21	Arable lands, wetlands, dams

V = Vulnerable; NT = Near-threatened; Bonn = Bonn Convention on Migratory Species;

The majority of the Red Data species listed above are physically large species, meaning that they are capable of interacting directly with electrical infrastructure through collision, electrocution, nesting, and electrical faulting. All bird species, including even the smaller ones are vulnerable to indirect impact by the proposed development through factors such as disturbance and habitat destruction.

As described below, the primary concern for the proposed power line will be that of collision of birds with the earth wires. The **Red Data species most vulnerable to this impact include the Blue Crane, Secretarybird, Denham's Bustard and White Stork**.

Although this assessment focuses on the impacts on Red Data species as these are the species of highest conservation concern, the impact on the more common species has also been taken into account, although not on an individual species basis. Certain key species known to interact with power lines were assessed, rather than an exhaustive list of all species. It should also be noted that since the impacts are usually the same across various species, the Red Data species

can often be used as surrogate species for the others in terms of impacts and the necessary mitigation.

6 ASSESSMENT OF IMPACTS

6.1 Description of generic avifaunal impacts

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger and Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs and Ledger 1986b; Ledger, Hobbs and Smith, 1992; Verdoorn 1996; Kruger and Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen and Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Below follows a short background discussion of the above impacts.

6.1.1 Electrocutions

Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen and Ledger 1999). However, in the context of overhead lines above 132kV, electrocutions are not a major issue. Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Due to the large size of the clearances on most overhead lines of above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. In fact, transmission lines have proven to be beneficial to many birds, including species such as Bald Ibis, Martial Eagles, Tawny Eagles, African White-backed Vultures, and even occasionally Verreauxs' Eagles by providing safe nesting and roosting sites in areas where suitable natural alternatives are scarce (van Rooyen 2004). Cape Vultures have also taken to roosting on power lines in certain areas in large numbers, while Lappet-faced Vultures are known to use power lines as roosts, especially in areas where large trees are scarce (pers.obs.).

Electrocutions are not envisaged as an impact on the proposed 400kV transmission line as the relevant clearances are large enough.

6.1.2 Collisions

Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. Many of the heavily affected species are Red Data species (EWT unpublished data). Of the top five most affected species in SA, the Blue Crane, White Stork and Cape Vulture are present in this study area. 2001).

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

The existing 132kV lines in the study area have recorded collisions of Blue Cranes and other species previously (EWT Database), giving us reason to expect collision on the new proposed power line to be a significant threat.

6.1.3 Habitat destruction

During the construction phase and maintenance of power lines and substations, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimise the risk of fire under the line, which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat.

In general, much of the proposed study area is disturbed or degraded to some extent already. In this context, habitat destruction associated with construction of the proposed line and substation is not anticipated to be significant. The exception to this statement is the northern area close to Proteus Substation, where some fynbos remains. It appears to already be relatively disturbed, although this could be confirmed by the botanical specialist study.

6.1.4 Disturbance

Similarly, the above-mentioned construction and maintenance activities impact on birds through disturbance, particularly during breeding activities. This could lead to breeding failure if the disturbance happens during a critical part of the breeding season.

Disturbance is not anticipated to be a significant impact on avifauna in most of this study area, since existing disturbance levels are high from existing infrastructure, including the Petro SA refinery.

6.1.5 Impact of birds on quality of supply

A number of mechanisms exist through which birds are able to cause electrical faults on transmission lines. Frequent faulting affects the quality of electrical supply to the end customers. Power utilities aim to maximise the quality of supply to customers at all times.

In the case of a bird streamer induced fault, the fault is caused by the bird releasing a "streamer" of faeces which can constitute an air gap intrusion between the conductor and the earthed structure. The fault appears to flash across the air gap (i.e. between the live conductor and the tower steelwork which is earthed) and *does not* follow an insulator creepage path as observed on pollution faults (See Taylor *et al* 1999 for an exhaustive analysis of the propagation characteristics of the bird streamer mechanism). Bird species capable of producing large or long streamers are more likely to cause streamer faults. Bird stomach volume is important in this respect. Larger birds such as vultures and eagles are capable of holding larger quantities of food and therefore defecating larger volumes.

Bird pollution is a form of pre-deposit pollution. A flashover occurs when an insulator string gets coated with pollutant, which compromises the insulation properties of the string. When the pollutant is wetted, the coating becomes conductive, insulation breakdown occurs and a flashover results. Since this involves a build up of bird faeces or bird pollution and not a once off event such as a streamer, the size of the bird is less important, although still a factor. Obviously the more an insulator string becomes coated with faeces, the more likely a fault. Larger birds and congregations of many birds are likely to result in heavy pollution of insulator strings.

Bird nests may also cause faults through nest material protruding and constituting an air gap intrusion. Crows in particular often incorporate wire and other conductive material into their nests. When nests cause flashovers, the nesting material may catch fire. This in turn can lead to equipment damage or a general veld fire. Apart from the cost of replacing damaged equipment, the resultant veld fire can lead to claims for damages from landowners. Certain species such as crows and large eagles are likely to nest on power line towers such as the proposed power line.

This impact is only possible on the self support towers along the proposed power line, as the cross rope suspension tower does not provide suitable space in the relevant positions.

6.2 Detailed assessment of impacts of the proposed development on avifauna & proposed mitigation measures

Table 3 below shows a summary assessment of the significance of each impact on avifauna according to the criteria supplied by Savannah Environmental. Those impacts identified as being of medium or higher significance will be investigated in more detail during the EIA Phase.

TABLE 3: A summarised evaluation of the impacts of the proposed development on the avifauna of the area.

Nature of impact	**Extent**	**Duration**	**Magnitude**	**Probability**	**Severity scale**	**Significance without mitigation**	**Significance with mitigation**	**Status**
Electrocution of birds on power lines	This impact is practically impossible on the proposed power line due to the large clearances, and is not evaluated further.							
Collision of birds with earth wires Particularly Red Data species such as Blue Crane, White Stork and Denhams Bustard	Local	Permanent	Medium	Highly probable		High	Medium	Negative
Habitat destruction through construction & maintenance of	Local	Permanent	Low	Probable	Low	Low	Low	Negative

Nature of impact	Extent	Duration	Magnitude	Probability	Severity scale	Significance without mitigation	Significance with mitigation	Status
power line and substation								
Disturbance during construction & maintenance of power line and substation	Local	Short term	Low	Possible	Low	Low	Low	Negative
Impact of birds on quality of supply	Local	Permanent	Low	Improbable	Low	Low on cross rope suspension towers Medium on self support	Low Low	Negative for line performance
Nesting of birds on towers	local	Permanent	Low	Improbable	Low	Low	Low	Positive for birds

6.3 Comparison of alternative alignments

The project consists of three alternative corridors. These have been described above and are not repeated here. Due to the close proximity of alternatives to each other, the standard method of comparing alternatives mathematically, based on report rates for relevant bird species, is not possible here. The comparison is therefore made on the basis of physical characteristics of the study area as follows:

Alternative 3 is the most preferred alternative for the following reasons:

- Placing the new line adjacent to existing lines (two 132kV and two 400kV lines) is desirable from an avifaunal perspective as it: reduces the amount of habitat destruction during construction and maintenance since there are existing roads; reduces the amount of disturbance in the landscape as the existing lines are already a disturbance; partially mitigates for the impact of collision, since the more lines are placed together the more visible they become (APLIC, 1994).
- Placing a 400kV line on the outside of this consolidated corridor, would also be advantageous from a bird collision perspective as it would 'shield' the lower inner 132kV line (the existing 132kV lines have recorded numerous collisions of Blue Cranes and other species – EWT Database)

Alternative 2 is the second most preferred alternative for the first reason mentioned above.

Alternative 1 is the least preferred corridor from an avifaunal perspective for the following reasons:

- For most of its route it will be the only line of this size in the vicinity, this introduces new threats into the vicinity
- It appears to pass more farm dams (3 medium size dams compared to one small one on the other three corridors). Dams will attract various bird species associated with water, many of which are vulnerable to collision with overhead cables.

In order to demonstrate the relative preference of the three alternatives from an avifaunal perspective, a score of 1 to 10 was assigned to each alternative. A score of 10 would mean that the corridor is highly preferred, whilst a score of 1 would mean that the corridor is a 'no go' from an avifaunal point of view.

Table 3. Preference scores for the three alternative corridors

Alternative	Preference Score
Alt 1	3
Alt 2	6
Alt 3	7

Table 3 illustrates that there is a significant difference between the preference of the two corridors adjacent to the existing lines, and the one on its own in the landscape, but less difference within the two adjacent to the existing lines.

During the EIA Phase, the above identified impacts will be assessed in more detail for the overall preferred alternative corridor after integration of all specialist input. Particular emphasis will be placed on the impact of collision of birds with the earth wire, as this has been identified as potentially being of high significance. Mitigation measures for the mitigation of the identified significant impacts will also be recommended and explained.

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