Endangered Wildlife Trust

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Bird Impact Assessment Study

Scoping Report

400kV Transmission line

Aries - Garona

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Prepared by:

Jon Smallie

Endangered Wildlife Trust

Private Bag X11

Parkview

2122

South Africa

Tel: +27(0)11 486 1102

Fax: +27(0)11 486 1506

Cell: +27(0)82 444 8919

email: jons@ewt.org.za

EXECUTIVE SUMMARY

Eskom intend to construct a new 400kV power line from the existing Garona Substation near Groblershoop in the north east, to the existing Aries Substation near Kenhardt in the south west. Tswelopele Environmental Pty (Ltd) were appointed as the main consultants for this project, and subsequently appointed the Endangered Wildlife Trust (EWT) to conduct the specialist bird impact assessment study.

Three days of field work were conducted and after considering all potential alignments for the line within the broader buffer area, two preferred alignments were agreed upon and plotted (FIGURE 2). For the purpose of this report, these two alignments were evaluated and assessed.

The preferred 2 alignments from a bird impact perspective are Alternative 2B and Alternative 1B. This is primarily due to their shorter length and proximity to existing infrastructure. More details regarding this selection are within the main report.

The impacts of the proposed line on birds have been assessed in detail on an individual species basis for Red Data species and on a family level for non Red Data species in APPENDICES A & B respectively. Those impacts that were rated overall as being of MEDIUM significance are described below:

Collision with earth wire:

- Kori Bustard in the natural vegetation along the alignment, particularly drainage lines with woody vegetation
- Ludwig's Bustard in natural vegetation along the alignment particularly the flat areas such as the pans and "wetlands"
- Secretarybird almost throughout the study area
- Black Stork in river valleys and wetlands
- Greater Flamingo at open water sources such as dams and pans
- White Stork – particularly in arable lands and wetlands
- Abdim's Stork at open water, arable lands and wetlands
- Assorted non Red Data water birds and ibises in close association with water sources such as the river crossings
- Assorted non Red Data korhaans in the natural vegetation areas

Mitigation

- All sections of line crossing drainage lines should be marked, only on the one relevant span
- All sections of line through or adjacent to the priority flats and wetlands, including one span either side
- Line crossing the Hartbeesrivier and Orange River and associated arable lands should be marked, including one span either side
- Line crossing or adjacent to any dams or open water sources should be marked, including one span either side
- Since it would be impractical to mark the line through all the natural vegetation areas to mitigate for collision of species such as Secretarybird, it is rather suggested that the line be patrolled annually and areas where collisions have occurred can then be marked reactively
- Marking of the line should be according to the technical specifications contained in APPENDIX E (drawn up by Jose Clara from Trans Africa Projects)
- **Due to the sensitivity of the "wetland"/pan/flats areas, the difficulty in distinguishing them from the surrounding habitat, and their apparent absence from the land cover and land use data sets - it will be necessary for the EWT to conduct a final "walk through" assessment once the exact alignment has been**

surveyed and each tower position has been pegged. This will allow the identification of exact spans of line that will need to be marked with a suitable marking device

Nesting on power line towers:

- Assorted smaller non Red Data raptor species throughout the study area (positive impact)
- Sociable Weavers particularly in vicinity of Groblershoop

Mitigation

- The raptor nests should not require any management and should be left alone as far as possible
- The Sociable Weaver nests should be monitored closely and if they begin to pose problems then EWT should be consulted for recommendations on how best to manage them. Nest management recommendations may include nest removal in cases where no other species are breeding on the same nest, for example Pygmy Falcons and assorted other raptors. EWT is currently investigating the issue of Sociable Weaver nests on steel towers in other areas and should have a proven set of recommendations by the time Aries Garona is constructed.

Disturbance while breeding:

- Martial Eagle in natural vegetation areas
- Assorted non Red Data raptor species such as Black Eagle, particularly close to the ridges

Mitigation

- All construction and maintenance activities should conform to generally accepted environmental best practice guidelines at all times. In particular, construction camps should preferably be placed in the towns and not close to natural vegetation so as to minimize the impact of illegal activities such as hunting, snaring firewood collection etc.
- The ECO for the project should attempt to identify any breeding pairs of raptors (or any other bird species) and report them to the EWT as early as possible in the construction phase so as to allow adequate recommendations to be made with respect to minimising the impact on these birds.

1. INTRODUCTION

1.1 Background to the current study

Eskom intend to construct a new 400kV power line from the existing Aries Substation near Kenhardt to the existing Garona Substation near Groblershoop. FIGURE 1 below shows the position of the line in the national grid. It is immediately evident just how important a link it is in terms of connecting different sections of the grid.

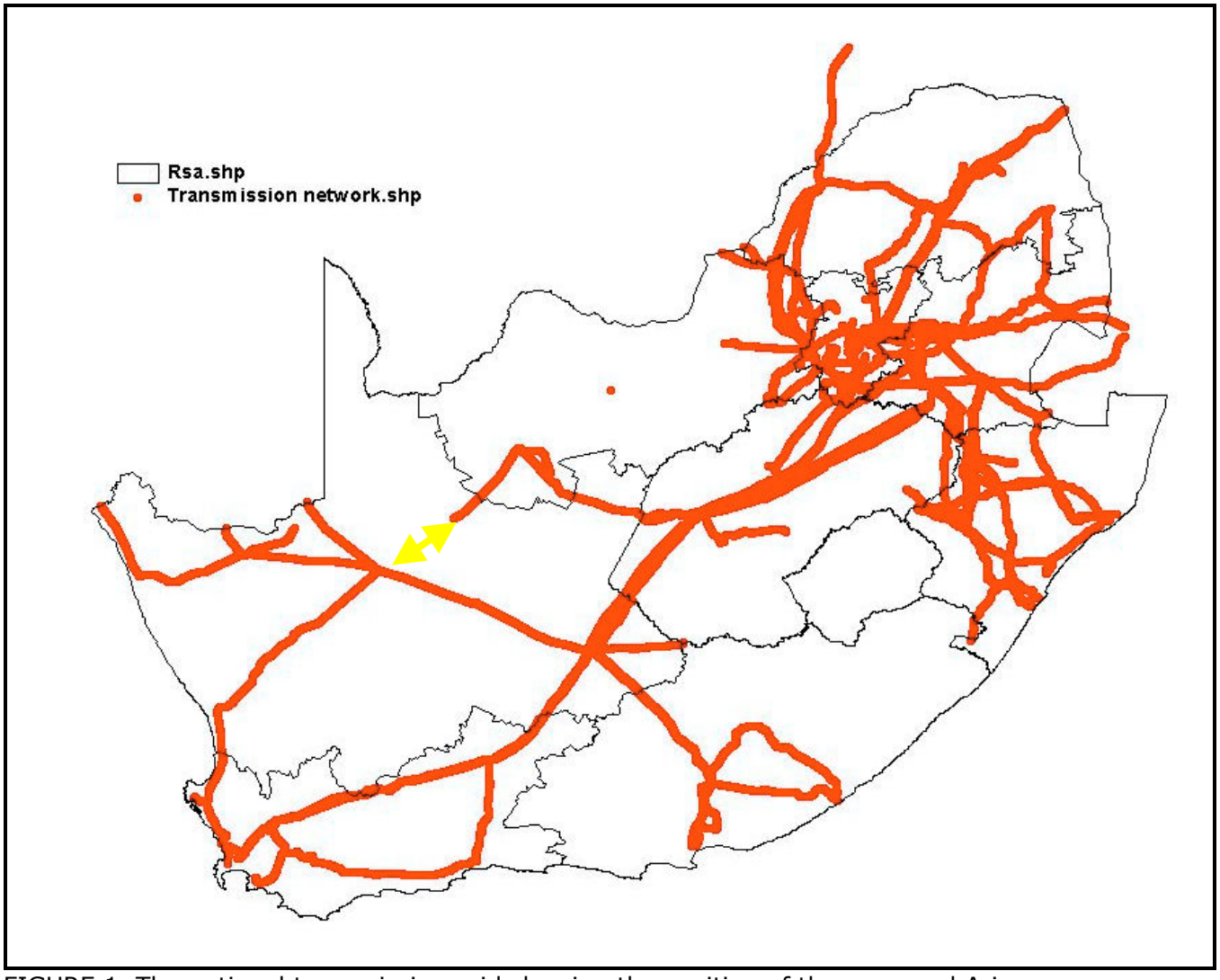

FIGURE 1. The national transmission grid showing the position of the proposed Aries – Garona 400kV project.

Tswelopele Environmental Pty (Ltd) were appointed as the main consultants for this project, and subsequently appointed the Endangered Wildlife Trust (EWT) to conduct the specialist bird impact assessment study. Field work was undertaken in September 2005.

1.2 Terms of reference

The terms of reference for the EWT study, as per the original quotation were as follows:

- Mapping of sensitive areas
- Description of existing environment, bird communities, micro habitats
- List and describe expected impacts
- Highlight and discuss gaps in baseline data
- Assessment and evaluation of impacts
- Recommend relevant mitigation measures
- Indicate a monitoring program if necessary

1.3 Sources of information

The study made use of the following data sources:

- Bird distribution data of The Atlas of southern African birds (Harrison *et al*, 1997), obtained from the Avian Demography Unit of the University of Cape Town, in order to ascertain which bird species occur in the study area. A separate data set was obtained for each quarter degree square with which the study area overlaps substantially (marginal overlaps were discounted). For the position of the quarter degree squares within the study area – see FIGURE 2 below.
- The conservation status of all bird species occurring in the aforementioned quarter degree squares was then 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 and the extent to which they are impacted on.
- The experience of the authors in investigating bird mortalities on existing power lines across South Africa since 1996 was also used extensively.
- A description of the vegetation types occurring in the study area was obtained from The Atlas of Southern African birds (Harrison *et al,* 1997).
- Information on the micro habitat level was obtained first hand through the field trip which involved flying the study area with helicopter, and then driving as much as possible of the study area on the ground, examining areas of particular concern.
- The field investigation enabled the acquisition of a first hand perspective of the study area and any relevant issues.

1.4 Assumptions & limitations

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

- The Atlas of southern African birds (ASAB) data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate – for a full discussion of potential inaccuracies in the ASAB data see Harrison *et al* 1997. As discussed elsewhere in this report, the coverage of the study area by counters was relatively low.
- No long term, verified data of species distribution on *micro habitat* level along the proposed power line route exists, except what was observed during the field visit.

General comment: Predictions in this study are based on experience of these and similar bird species in different parts of South Africa. Bird behaviour can not be reduced to formulas that will hold true under all circumstances. However, power line impacts can be predicted with a fair amount of certainty, based on experience gained by the authors through the investigation of more than 400 localities in southern Africa where birds have interacted with power lines since 1996.

2. DESCRIPTION OF BASELINE CONDITIONS

2.1 Vegetation description

FIGURE 2 shows the land cover of the study area, at a broad level. It is clear that most of the study area is classified as "Shrubland and low fynbos" with some small areas of "Thicket and bushland" and "Forest and woodland" mainly along the ridges and water courses.

It is widely accepted within the ornithological community that vegetation structure is more critical in determining bird habitat, than the actual plant species composition (in 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 following description makes extensive use of information presented in the Atlas of southern African birds (Harrison *et al,* 1997). This source presents a vegetation classification intermediate between that of Acocks' 70 "Veld types" (1953) and Rutherford & Westfall's seven "biomes" (1986). It is important to note that no new vegetation unit boundaries were created, use was made only of previously published data.

TABLE 1 below shows that almost all squares are 100% composed of Nama Karoo vegetation, with one square 2821DD having 1% Southern Kalahari vegetation. These vegetation types are described in more detail below.

2.1.1 Nama Karoo Biome
Nama Karoo

The Nama Karoo vegetation largely consists of low shrubs and grasses. Trees such as *Acacia karoo* and the exotic mesquite *Prosopis glandulosa* are largely restricted to the watercourses, where they often form dense stands. The Nama Karoo has a much higher proportion of grasses and trees than the Succulent Karoo.

The Karoo (both Succulent and Nama Karoo biomes) supports a high diversity of bird species that are endemic to southern Africa. This is due to the fact that the open areas support ground dwelling species, whilst the watercourses with their taller trees support species that would normally be found in Arid Woodland. An example of such a species is the Kori Bustard – which has been recorded in this study area.

2.1.2 Woodland Biome
Southern Kalahari

This vegetation type grows on rolling dunes and consists of shrubland with *Acacia* and *Boscia albitrunca* trees along the watercourses and in valleys. Grass cover varies significantly and is dependant on rainfall and grazing. Whilst many bird species which are widespread in moister woodland avoid the Kalahari, which is significant in itself, few species

are endemic to these areas. The most limiting factor in the distribution of bird species in the Kalahari vegetation types seems to be the relative absence of surface water. Two species that utilize Southern Kalahari extensively are the Namaqua Sandgrouse and Sociable Weaver both of which have been recorded throughout this study area.

2.2 Bird micro habitats

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 are determined by factors such as land use, vegetation and manmade infrastructure. They can largely only be identified through a combination of field investigation and experience and it is therefore extremely important to visit the study area first hand.

The following bird micro habitats were identified during the field investigation. Examples can be seen in APPENDIX C and the positioning of some of them in the study area can be seen in FIGURE 2 below.

2.2.1 Arable lands

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 eaten themselves 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, this is particularly the case, as the remainder of the landscape is so arid and devoid of surface water or greenery of any type.

The only arable lands in this study area are along the Orange River, almost all under irrigation and as such most definitely represent almost the only source of "green" and moisture in this landscape for much of the year. Whilst some crops are more suitable than others for birds, most of these lands are under a rotational system whereby at some point in the year or over several years a crop will be planted that is suitable to certain bird species. The exception to this is the vineyards, which are obviously a long lived crop that is unlikely to change for a long time. However since the vineyards are interspersed with other crops types, the entire arable area along the river is considered extremely sensitive from a bird angle.

Bird species likely to make use of these areas include the White and Abdims' Stork, and assorted non Red Data species such as geese, water birds, Helmeted Guineafowl and many others.

2.2.2 Plains or flats – including "wetlands"

These areas are conspicuously flat and may hold water in places after rainfall events. Drainage lines and river courses generally bisect the plains, and sometimes these drainage lines have been dammed. Large bare patches of partially exposed soil are often evident. In this study area, the plains are often bisected by "wetland systems" as pictured in APPENDIX

C. The land cover map in FIGURE 2 shows no wetlands in the study area, however, they are undoubtedly present and may not have been evident at a large enough scale to be represented by the land cover data set.

From a bird collision perspective, the plains or flat areas are important for a number of reasons: they are often surrounded by ridges or kopjes, which are higher and form a dark background, against which the earth wires of a power line are obscured; many collision sensitive species such as bustards prefer these areas. Studies on existing 400kV power lines elsewhere in the Karoo found almost all carcasses of birds (Ludwigs' Bustards and Blue Cranes) that had collided with the lines on these flat areas (Smallie & van Rooyen, 2003).

2.2.3 Rocky ridges/kopjes

These areas are extremely rocky and are usually derived from dolerite. In this area of the Karoo, the kopjes are relatively small in size. Extensive populations of Kokerbome occur on these kopjes, particularly just south of Kenhardt.

In terms of collision these areas are much less important than the plains. However these kopjes form important habitat for species such as Black Eagle. It has been shown elsewhere in the karoo that both Black and Martial Eagles favour breeding on or adjacent to these ridges (Smallie & van Rooyen 2003). Further, a number of collisions of Black Eagles have been reported in the past, on power lines crossing ridges, most likely due to this species habit of hunting low along the rock line on these ridges.

The proposed two alignments largely avoid crossing any ridges or kopjes. They do pass through narrow gaps in the ridge lines just south of Kenhardt and again just south of Groblershoop ("Neus se Berg").

2.2.4 ***Rivers/drainage lines***

Most rivers in southern Africa are in the east and extreme south, in the higher rainfall areas. Thirteen species of water bird are mostly restricted to riverine habitat in southern Africa. The map distribution of these species correlates with the river courses in southern Africa.

In this arid Karoo/Kalahari landscape, although many of the water courses seldom contain water, these systems are important, as they have a different vegetation composition to the remainder of the plains, often including woody species such as *Acacia spp.* These drainage lines also serve as important flight paths for many bird species even when dry. Two main rivers are crossed by the proposed line – the Hartbeesrivier and the Orange River.

2.2.5 ***Dams***

Many thousands of earthen and other dams exist in the southern African landscape. Whilst dams have altered flow patterns of streams and rivers, and affected many bird species detrimentally, a number of species have benefited from their construction. The construction of these dams has probably resulted in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall. These include the African Fish Eagle, pelicans, darters and cormorants. Many species from these families occur in this study area.

Most importantly, in this arid landscape, dams are used as roost sites by some bird species. This has serious implications for their interaction with power lines, as the birds would then leave the roost in the early morning during low light conditions, and arrive at the roost in

the late evening, again during low light conditions. During these conditions, the earth wires of a power line are almost invisible and the chance of collision is much greater.

The present proposed alignments do not pass close to any dams to our knowledge, however a few small dams do exist in the study area and must be considered if the alignment changes at all.

2.2.6 Bushland and thicket

As discussed above, this occurs mainly along drainage lines and water courses, and also on the ridges and broken ground. The position of these areas can clearly be seen on the land cover map in FIGURE 2. It is clear that it is in the minority in this area in terms of land covers.

Bird species likely to make use of these areas include the Martial Eagle, Kori Bustard and Secretarybird.

2.3 Bird species present in the study area

TABLE 2 below shows the Red Data bird species reported for each quarter degree square in the study area (Harrison *et al* 1997). The report rates are essentially a percentage of the number of counts conducted in the square that recorded that particular species. A total of 8 (3 Vulnerable and 5 Near-threatened) Red Data species have been recorded, and the White and Abdims' Stork have been included here as they are internationally protected under the Bonn Convention on Migratory Species. Of these 10 species, all except one, the Sclaters' Lark, are known to interact directly with power line infrastructure. All of the 10 species, including the Sclaters' Lark could potentially be impacted on through habitat destruction and disturbance. In addition to the report rates of each species, the micro habitats that the species is most likely to use have been listed in TABLE 2. These micro habitat preferences are based on the authors extensive personal experience as well as personal communication with other ornithologists.

Of particular concern for this study are the species known to be vulnerable to collision with overhead cables ie the Kori and Ludwigs' Bustard, Secretarybird, Greater Flamingo, and the 3 stork species, namely Black, Abdims' and White Stork. Both bustard species have been fairly well recorded in the study area, whilst the storks have only been recorded in 2921AC see FIGURE 2. Interestingly the Ludwig's Bustard has highest report rates in the two southern most squares ie 2920BD and 2921AC, both south of Kenhardt. These two squares are two of the better counted squares with 16 and 30 cards submitted respectively so our confidence in these report rates is relatively high. The Kori Bustard appears to have a more uniform distribution through the study area. Although the Secretarybird has only been recorded in one square, it is likely that it occurs throughout the study area but was not detected during the counting.

It must be stressed again that the squares in this study area have not been well counted during the data collection phase of the Atlas of southern African Birds Project (Harrison *et al* 1997) – with number of cards submitted per square ranging from 4 to 30. The report rates must therefore be viewed with some caution, and it is possible that some species were missed altogether. One glaring example is that the White Stork has not been recorded in 2821DD, the square through which the Orange River flows. One would certainly expect to find White Storks along the river in the arable lands, particularly the lucerne lands that exist. Despite the uncertainty regarding the species lists and report rates, the assessment of impacts and the proposed mitigation measures are unlikely to be affected since fortunately most sensitive areas are sensitive due to the presence of more than one species. For example, this study will recommend the marking of the earth wires on the section

of line crossing the Orange River due to the abundance of non Red Data water bird species in this area. If in fact White Storks do occur there (contrary to the data) they will obviously also be safeguarded by the proposed mitigation.

Another species that will interact with the proposed power line in a slightly different manner is the Sociable Weaver which is known to make use of electrical and telephonic infrastructure for nesting substrate. These nests can become massive and place a large weight on the pole or tower. An example of such a nest can be seen in APPENDIX C. Numerous nests were seen in this study area, particularly from just south of Groblershoop to Garona Substation. Whilst this nesting poses no threat to the Sociable Weaver, it does present a fire risk as the nests consist of a huge amount of very dry material. Interestingly, in other areas these nests have been seen to be used for nesting by Pygmy Falcons, and larger raptors have been seen to nest on top of these nests.

TABLE 1. Percentage of each biome & vegetation type represented in each quarter degree square in the study area. (Harrison *et al* 1997)

Biome	**Vegetation type**	**2821 CD**	**2821 DC**	**2821 DD**	**2920 BD**	**2921 AA**	**2921 AB**	**2921 AC**	**2921 AD**	**2921 BA**
Nama Karoo	Nama Karoo	100	100	99	100	100	100	100	100	100
Woodland	Southern Kalahari	-	-	1	-	-	-	-	-	-

TABLE 2. Red data bird species, and their report rates, present in each quarter degree square in the study area (Harrison *et al* 1997).

Species	**Conservation status**	**2821 CD**	**2821 DC**	**2821 DD**	**2920 BD**	**2921 AA**	**2921 AB**	**2921 AC**	**2921 AD**	**2921 BA**	**Preferred micro habitats**
# cards		9	5	13	16	9	10	30	13	4	
Total # species		87	76	106	81	71	63	157	68	55	
Martial Eagle	V	11	-	-	-	-	30	3	-	-	Plains, drainage lines, ridges
Kori Bustard	V	11	20	-	13	-	20	7	-	-	Plains, drainage lines
Ludwig's Bustard	V	11	-	-	75	-	-	17	-	-	Plains
Lanner Falcon	NT	67	-	15	13	-	-	17	15	-	All over
Secretarybird	NT	-	20	-	-	-	-	-	-	-	Plains, drainage lines
Black Stork	NT	-	-	-	-	-	-	10	-	-	Rivers, dams, ridges
Greater Flamingo	NT	-	-	-	-	-	-	7	-	-	Dams
Sclater's Lark	NT	-	-	-	-	-	-	-	-	25	Plains
White Stork	Bonn	-	-	-	-	-	-	10	-	-	Arable lands, river, dams, wetlands
Abdim's Stork	Bonn	-	-	-	-	-	-	13	-	-	Arable lands, river, dams, wetlands

V = Vulnerable
NT = Near-threatened
Bonn Convention – protected internationally under the Bonn Convention on Migratory Species

Report rates are essentially a percentage of the number of counts conducted in the square that recorded that particular species.

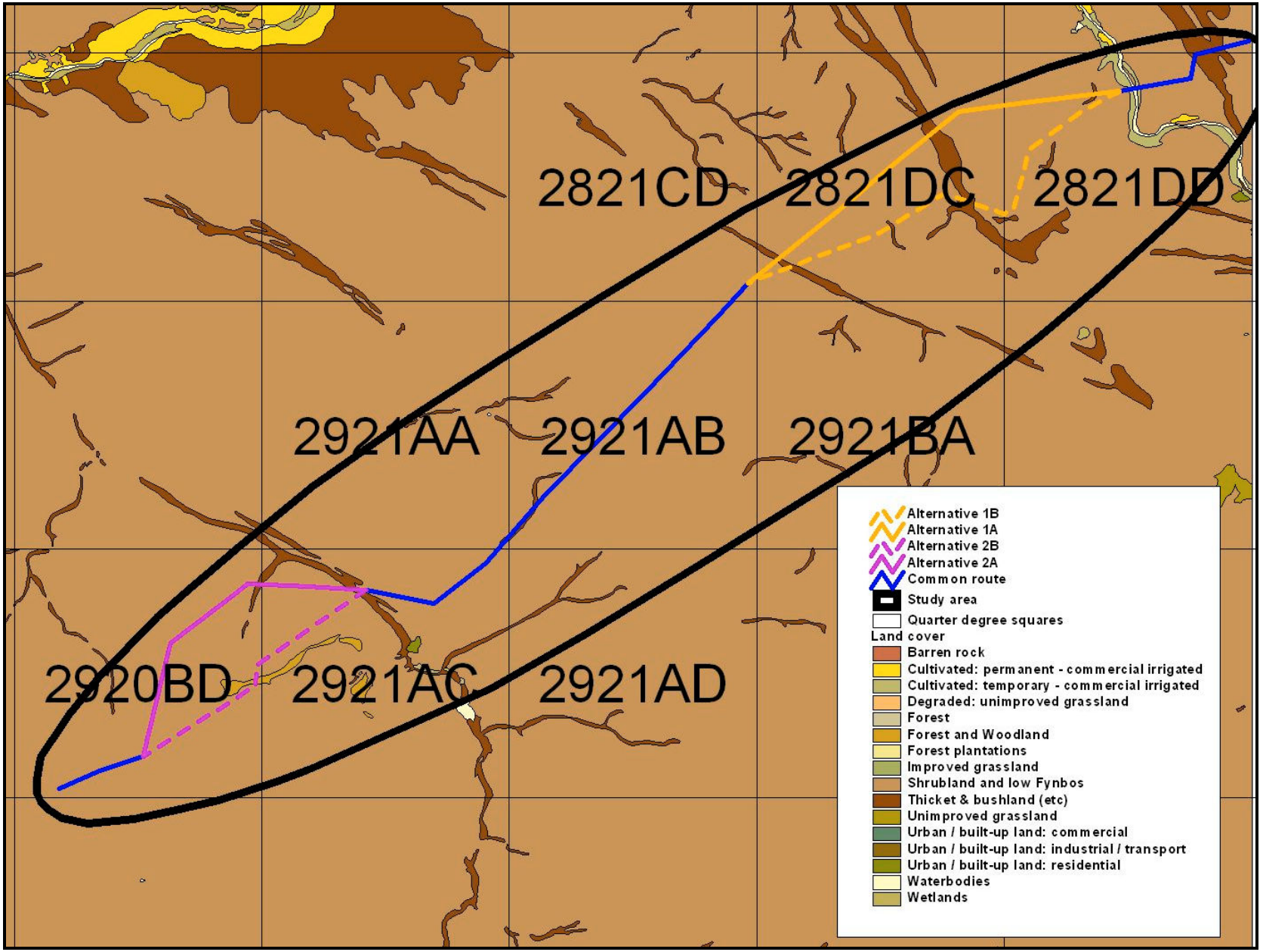

FIGURE 2. The study area, showing position of quarter degree squares, alignments and land cover (ENPAT data).

3. PREDICTIVE METHODS

The following methods were employed in predicting the impacts of the proposed power line on birds:

- A 1:50 000 map of the study area was obtained showing existing infrastructure and the proposed alignments. This was used as far as possible in order to identify potential sensitive areas along the corridors e.g. river crossings, wetlands, dams, agricultural areas and areas where bird mortalities may have occurred on existing power lines in the past.
- The Atlas of southern African Birds (ASAB) (Harrison *et al* 1997) species lists and vegetation classifications of each of the quarter degree squares (or 1: 50 000 map units), within which the alternatives are located were obtained from the Avian Demography Unit at the University of Cape Town. These were used to determine which power line sensitive species were recorded in the area during the Atlas period, and which species could potentially occur there in future.
- The area was visited for 3 days to obtain a first-hand perspective of the proposed routes and birdlife. An attempt was made to travel the entire study area as far as was practically possible both by air and by road, and to visit all potential hot-spots identified from the 1:50 000 maps.
- The impacts were predicted on the basis of extensive experience since 1996 in gathering and analysing data on wildlife impacts with power lines throughout southern Africa (see van Rooyen & Ledger 1999 for an overview of methodology), supplemented with local knowledge and first hand data.

4. EVALUATION OF IMPACTS

4.1 Generic description of 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 & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger *et.al..* 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities.

Electrocutions

Electrocution of birds on overhead lines is an emotional issue as well as 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 & Ledger 1999). However, in the context of overhead lines above 132 kV, 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 Martial Eagles *Polemaetus bellicosus*, Tawny Eagles *Aquila rapax*, African Whitebacked Vultures *Gyps africanus*, and even occasionally Verreaux's Eagles *Aquila verreauxii* 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 (van Rooyen 2004a), while Lappet-faced Vultures are also known to using power lines as roosts, especially in areas where large trees are scarce (pers.obs.).

On the proposed tower structure (cross rope suspension) there is no nesting or perching substrate above the conductors so there is little chance of birds impacting on the electrical supply through these mechanisms.

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 water birds. These species are mostly heavy-bodied birds with limited maneuverability, 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. FIGURE 3 below shows the number of collisions reported per species on transmission lines from August 1996 to present (EWT Database). Most of the heavily affected species are Red Data species. Four of the top seven most affected species ie the Ludwig's Bustard, White Stork, Greater Flamingo and Kori Bustard are all present in this study area. It should be noted that these are only the reported mortalities, it is suspected that a large number of mortalities go unreported. It is also important to note that the mortalities recorded by Anderson (2001) as discussed below are not included in the EWT database, shown in FIGURE 3 below.

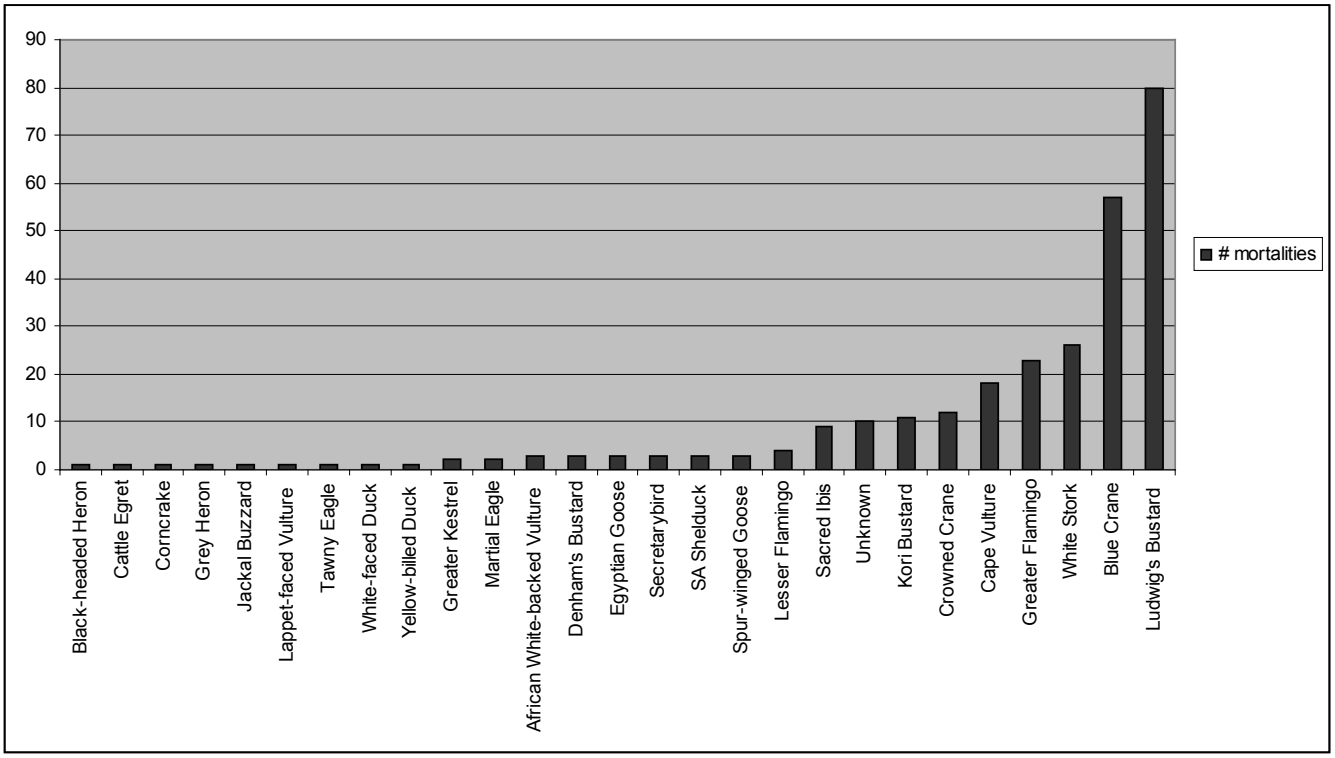

FIGURE 3 – Number of reported collisions per species on transmission lines from August 1996 to the present (EWT Database).

Although significant in itself, FIGURE 3 is not a true reflection of the extent of the problem, because none of the collision localities were closely monitored over a substantial period of time. Where long term monitoring did happen, the picture is disturbing. In one instance, where bi-monthly monitoring did take place, a single 10 km section of 132kV distribution line killed 59 Blue Cranes, 29 Ludwig's Bustard, and 13 White Storks in a three year period (van Rooyen unpubl. data). In 2004, fifty-four Blue Crane carcasses were discovered near Graaf-Reinett in the Northern Cape province under 3.7km of distribution line.

Data collected in the Northern Cape between 1997 and 1999 provides further evidence of the gravity of the problem. During an initial clearing of transects, a total of 194 large bird carcasses were found under 40km of Transmission line (220 and 400kV) near De Aar in the Northern Cape. Subsequent monitoring of 140 km of power lines (transects of 10km each from 22kV up to 400kV) in the same area over a period of 12 months produced another 196 carcasses (mostly cranes and bustards), the majority under transmission lines (Anderson 2001).

The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Using computer modeling, the South African Crane Working Group recently estimated that an annual mortality rate of 150 adult Blue Cranes could reduce the eastern population of Blue Cranes (app. 2000 individuals in Mpumalanga and KwaZulu-Natal) by 90% by the end of the 21st century (McCann *et al* 2001). At that stage the population would be functionally extinct.

From the figures quoted above, it is clear that power lines are a major contributory cause of avian mortality among power line sensitive species, especially Red Data species. Furthermore, the cumulative effects of power lines and other sources of unnatural mortality might only manifest itself decades later, when it might be too late to reverse the trend. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

Habitat destruction

During the construction phase and maintenance of power lines, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes. 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 minimize the risk of fire under the line which can result in electrical flashovers.

Disturbance

Activities during the construction phase may have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude. Of particular concern would be the construction camps, where disturbance levels would in all probability be high.

Impact of birds on the quality of electrical supply

Through perching and nesting on power line towers, many of the larger bird species can cause electrical faults through their faeces, and nest material. However, on the structure proposed for this line, it is not possible for these birds to perch or nest directly above the live hardware, so this impact is not anticipated to be significant at all. Some species will however still nest within the "columns" of the towers (such as Sociable Weaver). The proposed "cross rope suspension tower" can be seen in APPENDIX C.

4.2 Evaluation of expected impacts on bird species in this study area and recommended mitigation measures

Generally speaking, it is unavoidable that birds get killed through interaction with infrastructure, including power lines, despite the best possible mitigation measures. It is therefore important to direct risk or impact assessments and mitigation efforts towards species that have a high biological significance, in order to achieve maximum results with the available resources at hand. A pure scientific approach would only consider the effects of deaths on the sustainability of the population, but society places other values on certain species, e.g. aesthetic or commercial, which cannot be accounted for in a pure scientific approach.

TABLE 3. Generic description of the main impacts of this proposed line on birds.

Nature of impact	**Likely affected species**	**Expected Locality**	**Magnitude & significance**
Electrocution on pylons	This is not possible on the proposed tower structure	-	-
Collision with conductors and earth wires	Bustards, storks, flamingoes, Secretarybird, korhaans	Wetlands, pans, arable lands, river crossings, dams	Medium
Habitat destruction during construction and maintenance	All species	All natural habitat	Low
Disturbance during construction and maintenance	All species	Full length of line	Low
Impact by birds on quality of electrical supply. NOTE: this is an impact **by birds on the line**, not by the line on birds as with the other impacts	Raptors, crows, Sociable Weaver. Whilst these species may nest on the towers, they cannot nest in positions that can affect the live hardware. The Sociable Weaver will tend to nest relatively low down in the tower.	Almost anywhere along the line	Low

TABLE 3 shows the predicted generic impacts that the proposed line will have on the birds in the study area.

During the EIA phase these impacts were assessed in more detail on an individual species basis for Red Data species and on a family level for non Red Data species in APPENDICES A & B respectively. Those impacts that were rated overall as being of MEDIUM significance are described below. This assessment was done for the study area as a whole (ie all alternatives collectively):

Collision with earth wire:

- Kori Bustard in the natural vegetation along the alignment, particularly drainage lines with woody vegetation
- Ludwig's Bustard in natural vegetation along the alignment particularly the flat areas such as the pans and "wetlands"

- Secretarybird almost throughout the study area
- Black Stork in river valleys and wetlands
- Greater Flamingo at open water sources such as dams and pans
- White Stork – particularly in arable lands and wetlands
- Abdim's Stork at open water, arable lands and wetlands
- Assorted non Red Data water birds and ibises in close association with water sources such as the river crossings
- Assorted non Red Data korhaans in the natural vegetation areas

Mitigation

- All sections of line crossing drainage lines should be marked, only on the one relevant span
- All sections of line through or adjacent to the priority flats and wetlands, including one span either side
- Line crossing the Hartbeesrivier and Orange River and associated arable lands should be marked, including one span either side
- Line crossing or adjacent to any dams or open water should be marked, including one span either side
- Since it would be impractical to mark the line through all the natural vegetation areas to mitigate for collision of species such as Secretarybird, it is rather suggested that the line be patrolled annually and areas where collisions have occurred can then be marked reactively
- Marking of the line should be according to the technical specifications contained in APPENDIX E (drawn up by Jose Clara from Trans Africa Projects)
- **Due to the sensitivity of the "wetland"/pan/flats areas, the difficulty in distinguishing them from the surrounding habitat, and their apparent absence from the land cover and land use data sets - it will be necessary for the EWT to conduct a final "walk through" assessment once the exact alignment has been surveyed and each tower position has been pegged. This will allow the identification of exact spans of line that will need to be marked with a suitable marking device**

Nesting on power line towers:

- Assorted smaller non Red Data raptor species throughout the study area (positive impact)
- Sociable Weavers particularly in vicinity of Groblershoop

Mitigation

- The raptor nests should not require any management and should be left alone as far as possible
- The Sociable Weaver nests should be monitored closely and if they begin to pose problems then EWT should be consulted for recommendations on how best to manage them. Nest management recommendations may include nest removal in cases where no other species are breeding on the same nest, for example Pygmy Falcons and assorted other raptors. EWT is currently investigating the issue of Sociable Weaver nests on steel towers in other areas and should have a set of proven recommendations by the time Aries Garona is constructed.

Disturbance while breeding:

- Martial Eagle in natural vegetation areas
- Assorted non Red Data raptor species such as Black Eagle, particularly close to the ridges

Mitigation

- All construction and maintenance activities should conform to generally accepted environmental best practice guidelines at all times. In particular, construction camps should preferably be placed in the towns and not close to natural vegetation so as to minimize the impact of illegal activities such as hunting, snaring firewood collection etc.
- The ECO for the project should attempt to identify any breeding pairs of raptors (or any other bird species) and report them to the EWT as early as possible in the construction phase so as to allow adequate recommendations to be made with respect to minimising the impact on these birds.

The above impacts (those identified as being of atleast MEDIUM significance on a per Red Data species basis (APPENDIX A) were then rated for each alternative and the central section below:

Alternative 1A

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Collision of various species with earth wires	No	Negative	1	4	8	4	52
	Yes	Negative	1	4	4	4	36
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Nesting of certain species on power line towers	No	Positive	1	4	6	2	44
	No corrective measures needed as it is a positive impact on birds						
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Disturbance while breeding	No	Negative	2	2	6	3	30
	Yes	Negative	2	2	4	3	24
Mitigation measures	• Site specific mitigation measures have been detailed above						

Alternative 1B

Impact	*Corrective measures*	*Impact*	*Significance*

		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Collision of various species with earth wires	No	Negative	1	4	6	4	44
	Yes	Negative	1	4	2	4	28
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Nesting of certain species on power line towers	No	Positive	1	4	6	2	44
	No corrective measures needed as positive impact						
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Disturbance while breeding	No	Negative	2	2	4	3	24
	Yes	Negative	2	2	2	3	18
Mitigation measures	• Site specific mitigation measures have been detailed above						

Central section

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Collision of various species with earth wires	No	Negative	1	4	8	4	52
	Yes	Negative	1	4	4	4	36
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Nesting of certain species on power line towers	No	Positive	1	4	6	2	44

	No corrective measures needed as positive impact
Mitigation measures	• Monitor Sociable Weaver nesting

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Disturbance while breeding	No	Negative	2	2	6	3	30
	Yes	Negative	2	2	4	3	24
Mitigation measures	• Site specific mitigation measures have been detailed above						

Alternative 2A

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Collision of various species with earth wires	No	Negative	1	4	8	4	52
	Yes	Negative	1	4	4	4	36
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Nesting of certain species on power line towers	No	Positive	1	4	6	2	44
	No corrective measures needed as positive impact						
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Disturbance while breeding	No	Negative	2	2	6	3	30
	Yes	Negative	2	2	4	3	24
Mitigation measures	• Site specific mitigation measures have been detailed above						

Alternative 2B

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Collision of various species with earth wires	No	Negative	1	4	6	4	44
	Yes	Negative	1	4	2	4	28
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Nesting of certain species on power line towers	No	Positive	1	4	6	2	44
	No corrective measures needed as positive impact						
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Disturbance while breeding	No	Negative	2	2	4	3	24
	Yes	Negative	2	2	2	3	18
Mitigation measures	• Site specific mitigation measures have been detailed above						

Alternative 2C

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Collision of various species with earth wires	No	Negative	1	4	8	4	52
	Yes	Negative	1	4	4	4	36
Mitigation measures	• Site specific mitigation measures have been detailed above						

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Nesting of certain species on power line towers	No	Positive	1	4	6	2	44
	No corrective measures needed as positive impact						

Mitigation measures	• Site specific mitigation measures have been detailed above

Impact	*Corrective measures*	*Impact*					*Significance*
		Nature	*Extent*	*Duration*	*Magnitude*	*Probability*	
Disturbance while breeding	No	Negative	2	2	6	3	30
	Yes	Negative	2	2	4	3	24
Mitigation measures	• Site specific mitigation measures have been detailed above						

Summary of impacts ratings per alternative (without mitigation)

Alternative	**Collision significance score**	**Nesting significance score**	**Disturbance significance score**
1A	52	44	30
1B	44	44	24
Central section	52	44	30
2A	52	44	30
2B	44	44	24
2C	52	44	30

5 IDENTIFICATION OF PREFERRED ALTERNATIVE

5.1 Description of the proposed alignments

The position of the alternatives can be seen in FIGURE 2 above.

Common route/ central section
From Aries Substation the alignment travels north east parallel to the district road for approximately 9km.

From the join just north of the Hartbeesrivier it runs eastwards for approximately 7km to the railway line and then turns to north east and runs parallel to the railway for approximately 45km before splitting into 1A & 1B.

From the join at the R64 it travels more or less eastwards for approximately 16km parallel to the railway line.

Alternative 1A
From the split it travels north of the "Vaalkop" and then through a neck between Tierkop and Rooikop. It then goes east to the join.

Alternative 1B
From the split it passes along a more southerly route and around the south of "Neus se berg". It then runs adjacent to the railway line and district road to the join.

Alternative 2A
From the split it travels northwards around "Luyt se Kop" before swinging east to join the common route just north of the Hartbeesrivier.

Alternative 2B
From the split it more or less follows the district road and railway, and passes through a neck in the "Äasvoelkop". It then travels north east to the join.

Alternative 2C
From Aries Substation it follows a more easterly route, passing to the east of Aasvoelkop and past Kenhardt.

5.2 Sensitive (bird) areas identified during field investigation

Hartbeesrivier crossing near Kenhardt

This river must be crossed at some point by the proposed line. It is a smallish river which was not flowing at the time of the field investigation. Despite not always containing water, this river is important because it represents an area with different vegetation to the surrounding areas. Vegetation here is taller and denser and represents a different micro habitat to the surrounding areas.

Wetlands/pans

These areas exist throughout the landscape in this broader area, despite not showing on the land cover map in FIGURE 2. The wetlands are most prevalent in the middle section of the study area, between Kenhardt and Groblershoop. Photographs of these areas can be seen in APPENDIX C. These areas are flat and low lying and generally have slightly greener, taller vegetation. Importantly, water tends to stand and collect in these areas after significant rainfall events. These areas are favoured by large terrestrial bird species such as Ludwig's Bustard. For further detail see the section on micro habitats.

Orange River crossing

The Orange River is by far the most significant river in the study area, and possibly the only significant water source. It represents important habitat for many bird species associated with water. River courses in general represent important flight paths for many bird species, therefore posing a collision risk. The proposed crossing of the Orange River by this alignment is in a relatively good position as it is adjacent to an existing railway bridge, and is also situated at a relatively narrow section of the river and associated floodplain.

Arable lands adjacent to Orange River

As described above under micro habitats, many bird species are attracted to, and make extensive use of arable lands as feeding areas. The Orange River floodplain is the only area in this study area with any arable lands. As such it can potentially be extremely attractive to many bird species depending on what crop is planted. For example, vineyards (of which there are many) would not be attractive at all to most large power line sensitive bird species. However, Lucerne lands would be extremely attractive to species such as the White Storks and Abdim's Stork, both extremely collision sensitive bird species. However, birds are likely to move around extensively within the

cultivated areas, and the fact that they may not feed in vineyards for example, does not mean that they will not fly over them to get to the other areas.

For the purposes of this study, the entire cultivated area adjacent to the Orange River, irrespective of its crop type, is considered sensitive and is earmarked for mitigation.

5.3 Evaluation and selection of alternative alignments

As discussed above, it is anticipated that the main impact of this line on birds will be that of collision of birds with the earth wires. The main sensitive areas from a bird impact perspective have been discussed above. Usually the alternatives would be compared mathematically by multiplying the distance that each alternative passes through each square by the species report rates of that square. However, the poor coverage of this area during the bird atlas project means that this exercise would not be very meaningful. Instead the alternatives have been compared through broad observations, and the scores assigned to impacts for each alternatives as done above under 4.2.

Alternative 1A versus 1B

1B is preferred over 1A for the following reasons:

- It has a lower overall significance rating for collision with earth wires as per section 4.2 above
- It has a lower overall significance rating for disturbance of breeding species
- There is approx 3km difference in length (2A = 47km, 2B = 43km).
- East of the "Neus se berg" ridge line 2B is considerably closer to the railway line and district road – within approx 1km for approx 19km. This is an advantage in terms of disturbance as explained above. Adjacent to Neus se berg the line is close to the railway line and road which is an advantage in terms of disturbance levels.
- Just west of "Neus se berg" there seems to be little difference between the two alternatives, both cross and pass close to several wetlands. It appears that 1A may cross slightly more wetland tongues, although this is not conclusive.

Alternative 2A versus 2B

2B is preferred over 2A for the following reasons:

- It has a lower overall significance rating for collision with earth wires as per section 4.2 above.
- It has a lower overall significance rating for disturbance of breeding species
- It is closer to the existing district road and rail way line – these are existing sources of disturbance that should already discourage sensitive bird species from the area to some extent. In the vicinity of Aasvoelkop it passes through the ridge line close to the disturbance of the railway line.
- It is shorter in length – 2B = approx 29km, 2A = approx 35km. This is particularly important in these two squares ie 2920BD & 2921AC which have the highest report rate for Ludwig's Bustard and relatively high for Kori Bustard. The length of line through these squares should if possible be kept to a minimum.

6. CONCLUSIONS & RECOMMENDATIONS

The most significant anticipated impact of this line on birds is that of collision with the earth wire. The most sensitive areas in this respect are the Hartbeesrivier crossing, the "wetland" or pan

areas, the arable lands adjacent to the Orange River, and the Orange River crossing itself. Fortunately the alignment currently crosses the rivers and arable lands at relatively good, narrow points.

The preferred alternative from a bird impact perspective is Alternative 1B and then Alternative 2B. Site specific mitigation measures have been detailed for the identified impacts.

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