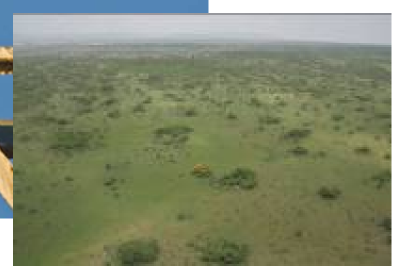
Endangered Wildlife Trust

Matimba-Dinaledi 400kV

Bird Impact Assessment Study



Prepared by:

Chris van Rooyen
Endangered Wildlife Trust
Private Bag X11
Parkview
2122
www.ewt.org.za

Prepared for:

PBA International

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EXECUTIVE SUMMARY

The study area stretches from Matimba sub-station near Lepalala in Limpopo Province to the Dinaledi sub-station near Brits in the North-West Province.

The expected impacts are as follows:

Impact	Species	Location
Collisions	Storks, cranes, bustards, waterbirds, Secretarybirds	River crossings, dams, wetlands, irrigated crops, grassland patches and old lands.
Habitat destruction (removal of large trees) and disturbance of breeding birds	Breeding large raptors, breeding Secretarybirds	Particularly in the commercial farming areas, particularly game and mixed game/cattle farms.
Electrocutions	None	None

A detailed impact assessment matrix is provided on species level and appropriate mitigation measures are suggested to reduce the envisaged impacts.

1 INTRODUCTION

ESKOM has appointed PPA International to undertake an Environmental Impact Assessment for two proposed new Matimba-Dinaledi 400kV transmission lines in order to comply with regulatory requirements of the Environmental Conservation Act (Act 73. of 1989 and associated Regulations). PBA International has appointed the Endangered Wildlife Trust as specialists to investigate the potential bird related impacts associated with proposed lines.

2 BACKGROUND AND BRIEF

The brief for this study can be summarised as follows:

- a description of the study area pertaining to the specialist study (from a site visit and desktop investigation),
- The identification of the sensitive areas from an avian impact point of view, within the corridors that were identified during the Scoping Phase;
- Detailed assessment of impacts according to nature, extent, duration, intensity, probability of occurrence and significance, both before and after proposed mitigation measures;
- Recommendations regarding management and mitigation measures for inclusion in the EMP.

In the course of the study, the brief was elaborated and expanded upon as and when necessary.

3 STUDY AREA

The study area stretches from Matimba sub-station near Lepalala in Limpopo Province to the Dinaledi sub-station near Brits in the North-West Province.

For a map of the study area and the proposed corridors, please see appendix A.

3.1 Description of vegetation types

The Bird Impact Scoping Report dated April 2006 gives a comprehensive overview of the vegetation in the area and its relevance to birds. Although this description is still largely relevant, the applicable quarter degree squares have changed slightly, therefore the vegetation will be discussed again.

The total study area comprises 12 quarter degree squares (1:50 000 map units) which are divided as follows in vegetation types (Harrison *et.al*. 1997):

Table 1: Vegetation types represented in the study area (Harrison *et.al*. 1997)

Vegetation Type	Moist Woodland	Arid Woodland
Percentage	64.6%	35.2%

As can be seen from the above table, the majority of the study area encompasses the moist woodland biome. The remainder comprises the arid woodland. All of it falls within the savanna biome.

It is widely accepted that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (in Harrison *et.al.* 1997). Therefore, the vegetation description below does not focus on lists of plant species, but rather on factors which are relevant to bird distribution. The description makes extensive use of the work of Harrison *et al* (1997). In addition to the vegetation description, the micro habitats available to birds in the study area are described.

The savanna biome is identified here as having a grassy under storey and a distinct woody upper story of trees and tall shrubs. Tree cover can range from sparse to almost closed canopy (only along some drainage lines in the study area). Moist woodland comprises predominantly broadleaved, winter deciduous woodland. Soil types are varied but are generally nutrient poor. The savanna biome contains a large variety of bird species (it is the most species-rich community in southern Africa) but is generally less important from a Red Data bird perspective, as very few bird species are restricted to this biome. The savanna biome is particularly rich in large raptors, and forms the stronghold of Red Data species such as White-backed Vulture, Cape Vulture, Martial Eagle, Tawny Eagle, and Lappet-faced Vulture. Apart from Red Data species, it also serves as the stronghold of several non-Red Data raptor species, such as the Brown Snake Eagle, Black-chested Snake Eagle, and a multitude of medium-sized raptors for example the migratory Steppe Buzzard, African Harrier Hawk (Gymnogene), Wahlberg's Eagle and African Hawk Eagle. The savanna biome, and specifically Moist Woodland, is particularly well represented in the study area.

Whilst much of the distribution and abundance of the bird species in the study area can be explained by the description of vegetation types above, it is even more important to examine the micro habitats available to birds. These are generally evident at a much smaller spatial scale than the vegetation types, and are determined by a host of factors such as vegetation type, topography, land use and man made infrastructure. The following can be described here (see appendix B for examples of the micro-habitat):

- Wetlands and dams: Both wetlands and rivers are of particular importance for birds in the study area, as the area is relatively arid. The study does not contain many important wetlands, but it does contain a few important man-made dams. The most important ones are the Bospoort Dam, Vaalkop Dam, Rooikoppies Dam and Mankwe Dam. These dams are important refuges for a variety of waterbirds, including species such as African Fish Eagle, Black Stork, both species of flamingos, Yellow-billed Stork and Marabou Stork.

- Rivers: The study area contains several rivers, which are obviously important for birds. The rivers are particularly important for stork species such as Black Stork and Yellow-billed Stork and a variety of other waterbirds. Examples of important rivers are the Matlabas and the Krokodil. The riparian habitat along the river provides refuge for shy and skulking species such as the African Finfoot and the White-backed Night Heron.

- Agriculture: The area contains extensive agriculture especially from 2426DD and 2427CC further south east to Dinaledi Substation, an area that is densely populated. Cultivation consists mostly of dry land subsistence, but also intensive irrigation, particularly in 2527 BC and DB. The agricultural activities are important for birds such as Secretarybirds (fallow fields), and White and Abdim's Stork.

- Grassland patches, including old lands: This is important habitat for the few remaining Blue Cranes as well as Kori Bustard and Secretarybird.

- Woodland (mixed bushveld): The majority of habitat in the area is mixed bushveld (Low and Rebello 1996) of variable quality from almost pristine to very degraded. In the commercial hunting farms the habitat is relatively intact (from 2427AC and CB further north to Matimba) albeit suffering from huge bush infestation in patches, while the opposite is the case in some communal areas where the habitat has been subjected to severe grazing pressure. This bushveld represents a great variety of plant communities, with many variations and transitions. The vegetation varies from a dense, short bushveld to a rather open tree savanna, covering the greater part of Limpopo Province and the northern parts of North-West Province. The most important species in this habitat from a powerline perspective is the Kori Bustard which has been recorded from from 2427AC and CB further north to Matimba. This species will be encountered in areas relatively free from human pressure, **particularly in open patches of grassland/old lands within woodland**. This is also a haven for raptors. In the north, outside the study area along the Limpopo in 2327 CA, the Vulnerable Southern Ground Hornbill still exists on farmland, but no records exists of the species within the study area anywhere near the proposed corridors.

- Mountains: The study area does not contain any mountain ranges, but it falls within the sphere of influence of the Magaliesberg and the Waterberg. The most important feature of this habitat (for this study) is the occurrence of important vulture colonies. The most important one is situated on the Kransberg which is part of the Waterberg range and is (partially) in the Marekele National Park, which holds the largest Cape Vulture colony in the world (app. 700 pairs). The Magaliesberg has another three colonies, totalling about 200 pairs. Cape Vultures from both mountain ranges forage extensively over the entire study area, and regularly feeds on carcasses of livestock (pers.obs). This is further confirmed by the high reporting rate for vultures throughout 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 was obtained for each quarter degree square within the study area (marginal overlaps were discounted).
- The Important Bird Areas project data was consulted to establish if any bird areas are located in the study area (Barnes 1998).
- Information on bird occurrence and densities was obtained from the Birds in Reserves Project of the Avian Demography Unit at the University of Cape Town.
- 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).
- 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) and the Vegetation map of South Africa by Low and Rebello (1996).
- The CSIR Land Cover Project was used to identify the land cover in the study area.
- Information on sightings and nests of Southern Ground Hornbill was obtained from the the Ground Hornbill Research & Conservation Project at Mabula near Bela-Bela.
- The corridors were flown with a helicopter to investigate the habitat first hand, and parts of it were visited by foot and in a vehicle.

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.
- Sources of error in the SABAP database, particularly inadequate coverage of some quarter degree squares. This means that the report rates of species may not be an accurate reflection of true densities in quarter degree squares that were sparsely covered (for a full discussion of potential inaccuracies in ASAB data, see Harrison, Allan, Underhill, Herremans, Tree, Parker and Brown, 1997). Unfortunately, some squares were very poorly covered and that data was interpreted with caution.
- 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 SIGNIFICANCE OF THE STUDY AREA FROM A NATIONAL PERSPECTIVE

It is necessary to provide a broader perspective on the study area in order to gain some understanding of the importance of the potential bird impacts on a national scale. What needs to be established is the relative importance of the study area for power line sensitive species, especially Red Data ones, as this will have a bearing both on the expected frequency of the impacts and the significance of those impacts.

The corridors narrowly miss two Important Bird Areas (IBA's), namely SA009 (Northern Turf Thornveld), and SA023 (Pilanesberg). The southern part of the corridors fall within Magaliesberg and Witwatersberg IBA SA025.

The Magaliesberg forms the core of the Magaliesberg and Witwatersberg IBA. Although the proposed alignments do not actually cross the Magaliesberg, its influence extends deeply into the study area, mostly in the form of extensive foraging areas used by the Cape Vultures breeding in the Magaliesberg. The area north of Rustenburg towards Pilanesberg, particularly those areas that comprised the former Bophutatswana homeland, has extensive populations of
23 livestock, particularly donkeys, and carcasses of the latter are scavenged by these large avian scavengers (personal observation).

The greater study area also contains other nature reserves, all of which are important for birds. Vaalkop Dam Nature Reserve is important for waterbirds and regular movement can be expected between Vaalkop Dam and Mankwe Dam in Pilanesberg. None of these reserves are actually crossed by any of the corridors, but bird movement across them will take place between these dams.

6 POWER LINE SENSITIVE SPECIES OCCURRING IN THE STUDY AREA

A total of 18 **power line sensitive** Red Data species have been recorded in the quarter degree squares that are bisected by the two routes. The tables that follow give a list of **power line sensitive** Red Data species with reported densities (Harrison *et.al*. 1997). The squares are broadly arranged in the table from north to south.

Table 2: Power line sensitive Red Data species with reporting rates (%) occurring in the study area between Matimba and Dinaledi. Reporting rates are a measure of the number of times a species was reported relative to the total amount of cards that were completed for the square.

Abbreviations: NT=Near threatened V=Vulnerable

	Status	2327DA	2327CD	2427AA	2427AC	2426DB	2427CA	2426DD	2427CC	2527AB	2527BC	2527BD	2527DB
Cards		**51**	**9**	**10**	**8**	**14**	**9**	**18**	**10**	**10**	**73**	**10**	**239**
African Marsh-Harrier	V												
African Grass-Owl	V												1
Bateleur	V	4		10	25								
Black Stork	NT	8		10	13	7					1		9
Blue Crane	V												1
Cape Vulture	V				13	14	11	6	20	10	10		31
Greater Flamingo	NT	4											2
Kori Bustard	V	4			13	36	11	22					
Lanner Falcon	NT				13		11	11			1		1
Lappet-faced Vulture	V					7		6					
Lesser Flamingo	NT	6											1
Lesser Kestrel	V												
Marabou Stork	NT	2		10		14							
Martial Eagle	V	6			13	14	11	11		10	1		1
Secretarybird	NT	12	22		13	14					12		13
Tawny Eagle	V	6	11	10	13	29		11					
African White-backed Vulture	V	4	11	20	25	36		11	33	10	10	3		10
Yellow-billed Stork	NT	4							10				2

7 PARTICULARS OF LINE DESIGN

Cross-rope suspension towers will be used for the majority of the line. The tower is approximately 45 m high. The average span between towers will be about 450 m. Self-supporting strain towers will be used at bend points along the line.

Important aspects from a bird interaction perspective are the following:

- The design has 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 structure stands 45 metres high at its highest point. The mid-span height of the earth wire will be about 36 metres. The earth wire will be the biggest risk from a bird interaction 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 suspension towers is such that bird streamers are unlikely to be a source of faulting on the line. 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 never had suspected bird streamer faulting (Eskom Transmission Engineering pers.comm).
- There is a possibility that birds will perch on the strain towers, as these are self-supporting towers with ample perching space above the conductors. This could lead to streamer faults, especially if vultures perch on them.

8 NATURE OF EXPECTED 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; Van Rooyen 2003; Van Rooyen 2004). 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. These impacts were discussed in detail in the Scoping Report dated April 2006, therefore the discussion will not be repeated here. A detailed impact assessment at species level is provided as appendix C.

In summary, the expected impacts are as follows:

Impact	Species	Location
Collisions	Storks, cranes, bustards, waterbirds, Secretarybirds	River crossings, dams, wetlands, irrigated crops, grassland patches and old lands.
Habitat destruction (removal of large trees) and disturbance of breeding birds	Breeding large raptors, breeding Secretarybirds	Particularly in the commercial farming areas, particularly game and mixed game/cattle farms.
Electrocutions	None	None

9 IDENTIFYING SENSITIVE AREAS IN THE CORRIDOR

The following factors were taken into account when identifying sensitive areas in the corridors (see discussion of micro-habitat under 3.1):

- Dams and wetlands
- Irrigated crops
- Grassland patches
- Rivers
- Grassland patches (including old lands)
- Settlements and towns (as a factor that reduces the risk)

Appendix D consists of a series of maps indicating sensitive areas in the corridors.

10 RECOMMENDED MITIGATION MEASURES

10.1 Collisions with the earth wire

The most significant impact that is foreseen is collisions with the earth wire of the proposed line. Quantifying this impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from detailed record keeping by the Endangered Wildlife Trust, it is possible to give a measure of what species are likely to be impacted upon, based on historical records. This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for this specific line.

The mitigation of bird impacts caused by power lines is to a large extent determined by the microhabitat within a zone of a hundred metres to about 1km on both sides of the line. This is particularly relevant as far as mitigation for bird collisions are concerned. This can only be done once the alignment has been finalized, and **only by physically travelling the entire**

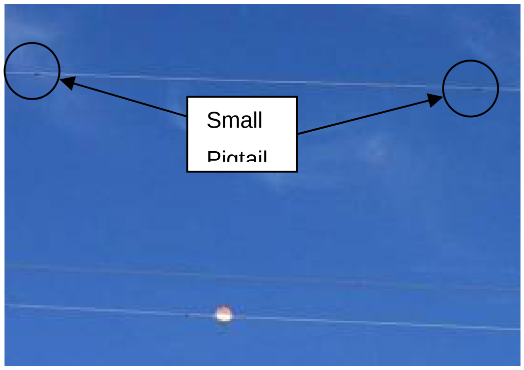
length of the final alignment by vehicle and foot, or with a helicopter at a slow speed. It is standard procedure by the Eskom Transmission Group to perform this procedure with the assistance of the Endangered Wildlife Trust once the line has been surveyed. At that stage, specific spans are demarcated for anti-collision devices, based on a variety of factors (mentioned earlier), and at that stage minor deviations can still be effected. This is also the stage when site specific measures are suggested to prevent habitat destruction for example what areas access roads should avoid.

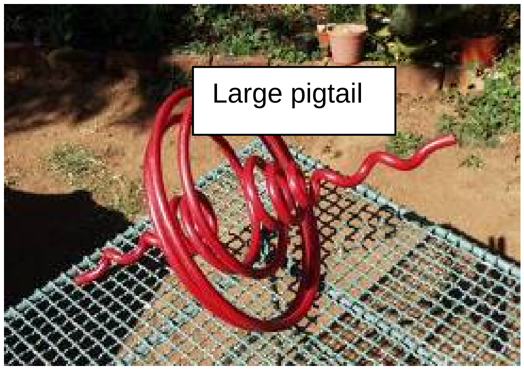
The marking of the earth wire with anti-collision devices is a standard practice world wide to mitigate for avian impacts. This measure has been proved to be reasonably successful in reducing collisions, with success rates of up to 60% reduction in mortality and even more documented (see Ferrer and Janns 1999). There are several devices available in southern Africa for the marking of power lines. Some are dynamic devices (usually called bird flappers), and some are static. Both have advantages and disadvantages. Dynamic devices are very effective in reducing collisions as the birds seem to see them very well (van Rooyen unp. data) probably because of the movement that attracts attention. The disadvantage of dynamic devices is that they are subject to extensive wear and tear, inevitably limiting the lifespan of the device. This has obvious cost implications if a line needs to be re-marked at intervals of a few years. No solution to that problem has been found to date and it must be accepted as a constraint. Figure 1 shows an example of bird flappers currently available on the market.

Figure 1: Example of bird flapper

Static devices are mechanically more durable because they lack the element of wear and tear that moving parts inevitably have. However, in South Africa, static devices, particularly the so called Bird Flight Diverter (also known as the pigtail) has had limited success (Anderson 2001). The most obvious reason seems to be that they are simply less visible, especially the small ones (see figure 2). A better option would be to use the bigger pigtail (see figure 2).

Figure 2: The overhead shield wires of a 66kV line marked with small pigtails.





A new static product that shows great potential is the Inotec BFD88, a reflective stainless steel sphere of 70mm diameter. Experiments have shown the visibility of this device to be superior to coloured (red, yellow, white, black) objects especially during the low light conditions at dawn and dusk when birds may be flying from roosting areas to feeding areas and back. Due to the spherical shape, the device reflects any available light in all directions and is therefore visible from all directions including above or below the diverter. The diverter does not require direct sunlight and is effective during overcast conditions and the low light conditions before sunrise and after sunset (pers obs.). When viewed during these low light conditions the device is particularly visible against dark backgrounds such as the ground, trees or high ground. It is also particularly visible against bright cloud when viewed from below.

Figure 3: Inotec BFD88 Bird Diverter on a line with conventional bird flappers.

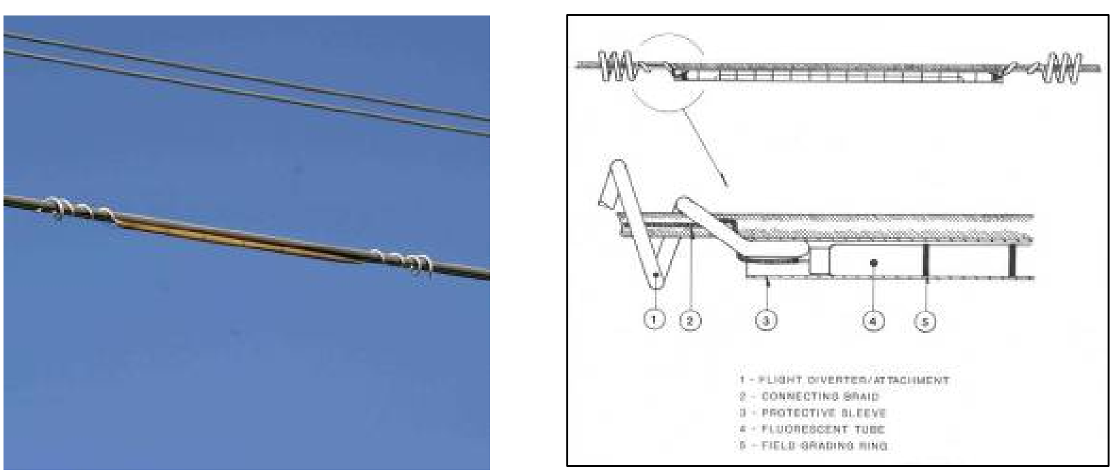
An option could be to string the Inotec NFD88 diverters close enough to form a dotted line on each earth wire on those spans crossing the river (see figure 6 below). **Due to the relatively**

small size of the spheres, it would need to be spaced very close together to make it effective, maximum 5 metres apart on both earth wires.

Figure 4: An example of Inotec BFD88 diverters on a test line at dusk with white conventional bird flappers in between.

In selected areas, specifically large seasonal pans, the phase conductors should be fitted with fluorescent tubes (bird lights) to reduce the risk of nocturnal collisions, which could be a problem with flamingos. The tubes are energized by the ambient electricity field and produce a row of lights a night. This technology has been successfully tried in Botswana and South Africa. The lights need replacement at regular intervals. Currently, only one product is available on the market, the Mace Bird Lite (see figure 5).

Figure 5: The Mace Bird Lite can used to reduce nocturnal collisions



10.2 Habitat destruction of sensitive vegetation, especially large trees.
This is an issue that will have to be addressed in the Environmental Management Plan (EMP). It is imperative that construction methods are used that minimise the impact on vegetation, the removal of large trees should especially be avoided. The role of the Environmental Control Officer will be crucial in this respect to ensure strict compliance with the EMP.

10.3 Disturbance of sensitive species during the construction phase.
This is unavoidable and the best that can be done is to try and keep the disturbance to a minimum.

10.4 Impact of the birds on the proposed power line.
Although this does not form part of the brief, it is important to mention that birds could have an impact on the line, primarily through streamers produced by large raptors and herons roosting at night above the phases on strain towers. They will not be able to roost on the suspension towers, but it could be a problem on the strains. It is suggested that bird guards are fitted to strain towers above the phases as a precautionary measure.

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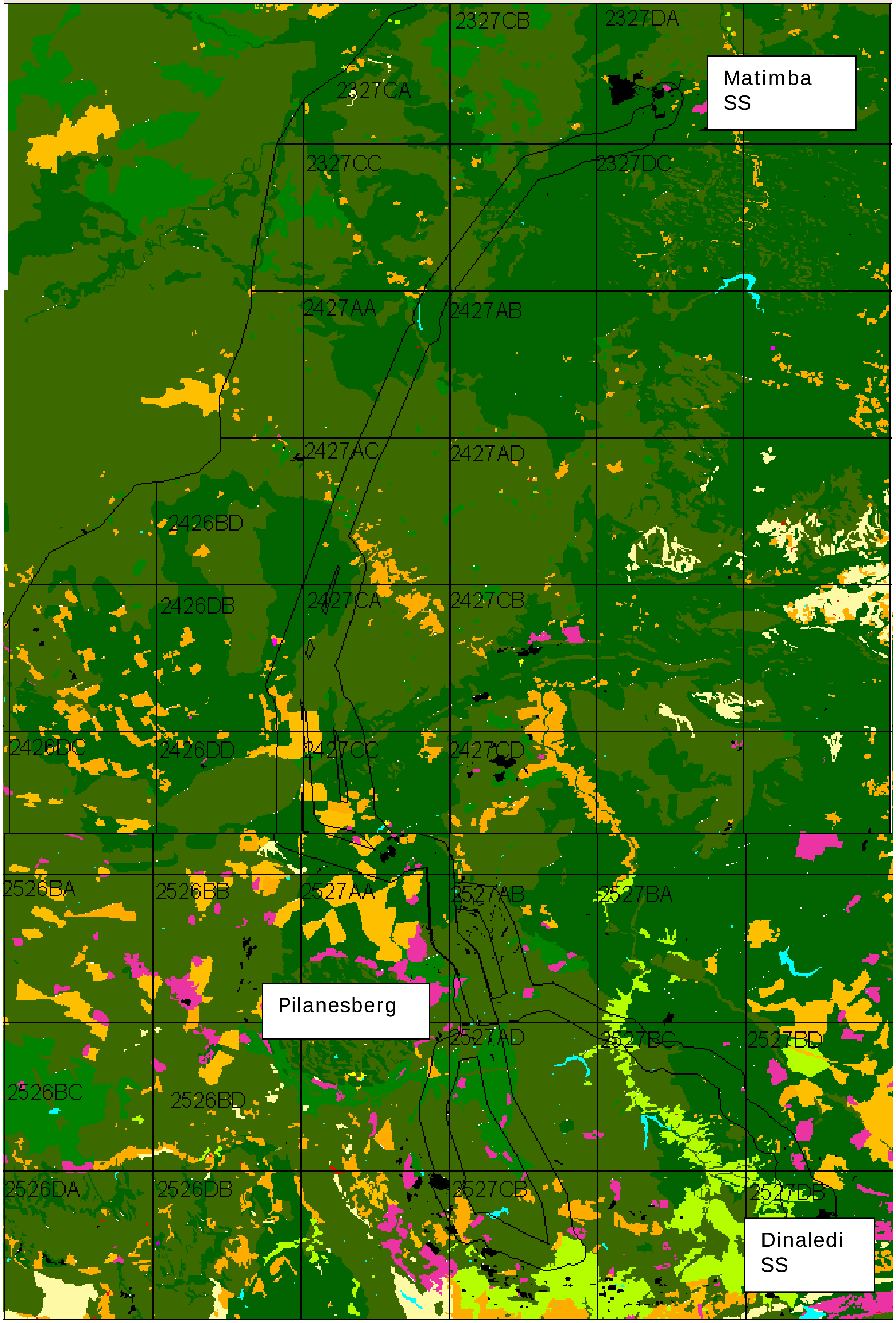
Appendix A: Map of study area against a background of CSIR land cover data



Appendix A: Map of study area against a background of CSIR land cover data

Appendix B: Bird micro-habitats

Figure 1: Typical farm dam in the study area, which is a draw card for various water birds and also utilized by raptors.

Figure 2: Grassland patch/old land in the commercial farming area, favourite foraging areas for Secretarybirds and Kori Bustard.

Appendix B: Bird micro-habitats

Figure 3: Typical settlement in the south of the study area.

Figure 4: Drainage line, ideal habitat for Black Stork

Appendix B: Bird micro-habitats

Figure 5: Example of vegetation clearance under power lines near Matimba

Figure 6: Typical land use near Dinaledi, with intensive commercial small-scale agriculture. This habitat may be attractive to White and Abdim's Stork.

APPENDIX C: Potential impacts on Red Data species recorded in the study area (Harrison et al 1997; Barnes 2000; personal observation)

WOMM = Without mitigation measures
WMM = With mitigation measures

Species	Conservation Status (Barnes 2000)	Nature of impact	Degree of certainty	Expected locality	Duration	Intensity	Extent	Significance	
								WOMM	WMM
Black Stork	Near threatened	Collision with earth wire during operation	Possible	Dams and river crossings, particularly the Matlabas and Crocodile Rivers	Long term	Low	Local	Medium	Low
Tawny Eagle	Vulnerable	Collision with earth wire during operation. Disturbance during construction	Improbable Possible	Near nests in commercial farming area	Long term Short term (construction phase)	Medium Low	Local Local	Medium Medium	Low Medium
Martial Eagle	Vulnerable	Collision with earth wire during operation. Disturbance during construction	Improbable Possible	Near nests in commercial farming area	Long term Short term (construction phase)	Medium Low	Local Local	Medium Medium	Low Medium
Lanner Falcon	Near threatened	No impacts are foreseen							
Kori Bustard	Vulnerable	Collision with earth wire during operation	Probable	In open, flat areas mostly in the grassland patches in the commercial farming areas.	Long term	Low	Regional	Medium	Low

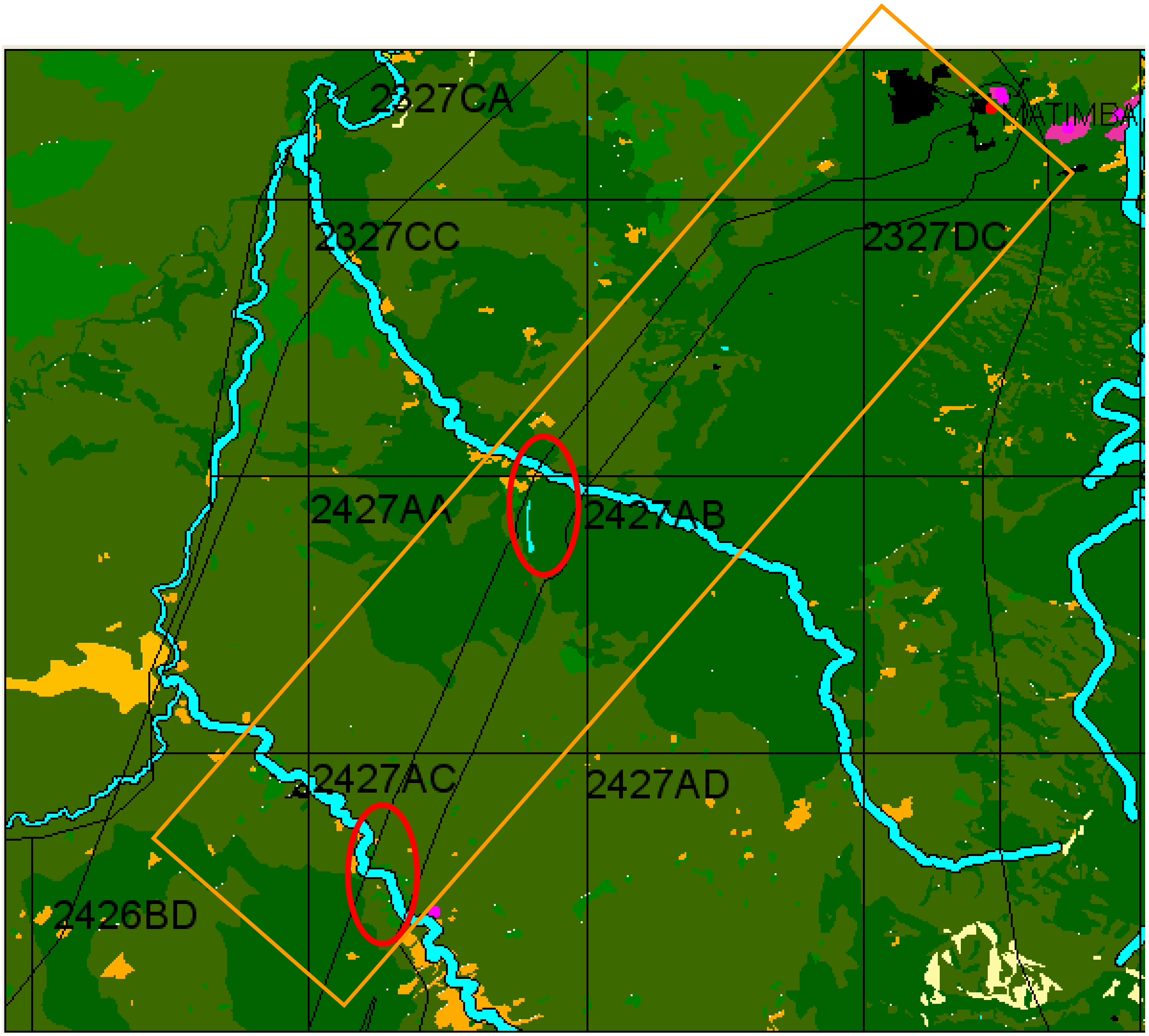
APPENDIX C: Potential impacts on Red Data species recorded in the study area (Harrison et al 1997; Barnes 2000; personal observation)

White-backed Vulture	Vulnerable	Collision with earth wire during operation. Disturbance during construction	Improbable Possible	Near nests in commercial farming area	Long term Short term (construction phase)	Medium Low	Local Local	Medium Medium	Low Medium
Cape Vulture	Vulnerable	Collision with earth wire during operation	Improbable	Anywhere at a carcass.	Long term	Low	Local	Low	Low.
Lappet-faced Vulture	Vulnerable	Collision with earth wire during operation	Improbable	Anywhere at a carcass.	Long term	Low	Local	Low	Low.
Marabou Stork	Near threatened	Collision with earth wire during operation	Possible	Dams and river crossings, particularly the Matlabas and Crocodile Rivers	Long term	Low	Local	Medium	Low
Secretarybird	Near threatened	Collision with earth wire	Possible	In open, flat areas particularly in grassland patches and old lands	Long term	Low	Local	Medium	Low
Lesser Flamingo	Near threatened	Collision with earth wire during operation	Possible	In 2527AD, CB and BD when commuting between large dams i.e. Mankwe, Vaalkop, Bospoort. Rooikoppies	Long term	Low	Regional	Medium	Low
African Mars Harrier	Vulnerable	No impacts are foreseen							
African Grass -owl	Vulnerable	No impacts are foreseen							
Lesser Kestrel	Vulnerable	No impacts are foreseen							

APPENDIX C: Potential impacts on Red Data species recorded in the study area (Harrison et al 1997; Barnes 2000; personal observation)

Blue Crane	Vulnerable	Collision with earth wire	Possible	In open, flat areas particularly in grassland patches and old lands in the south of the study area	Long term	Low	Local	Medium	Low
Bateleur	Vulnerable	No impacts envisaged							

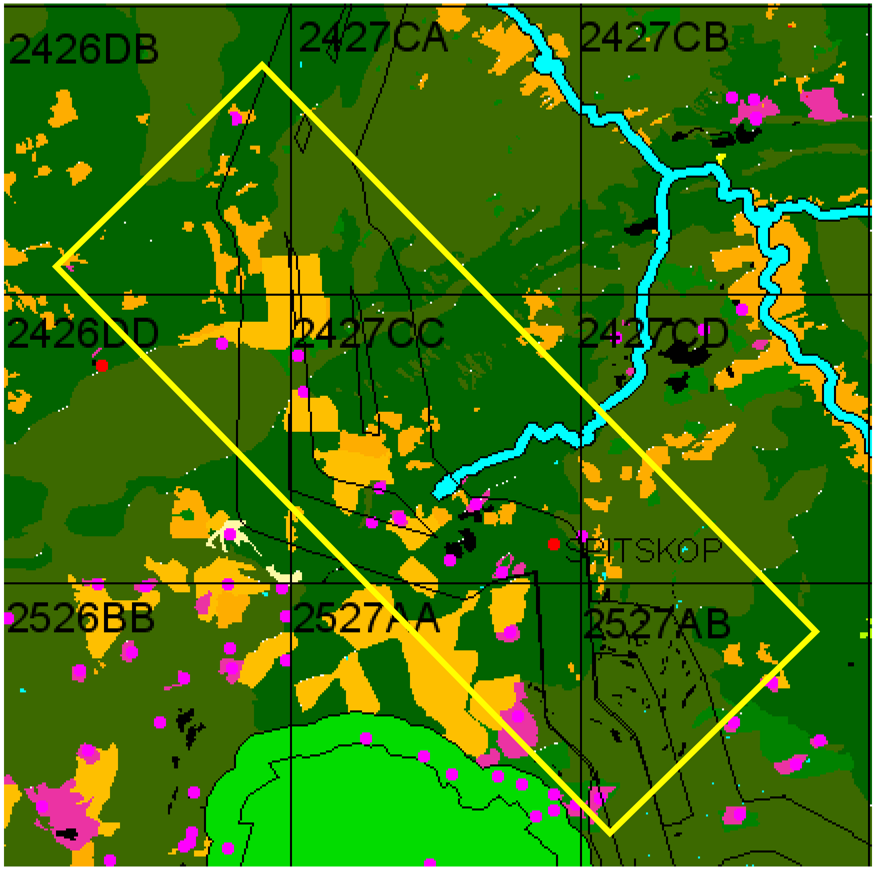
Appendix D: Sensitivity map



Medium sensitivity: Few people and settlements, habitat relatively intact, power line might cause some habitat destruction and disturbance of breeding raptors.

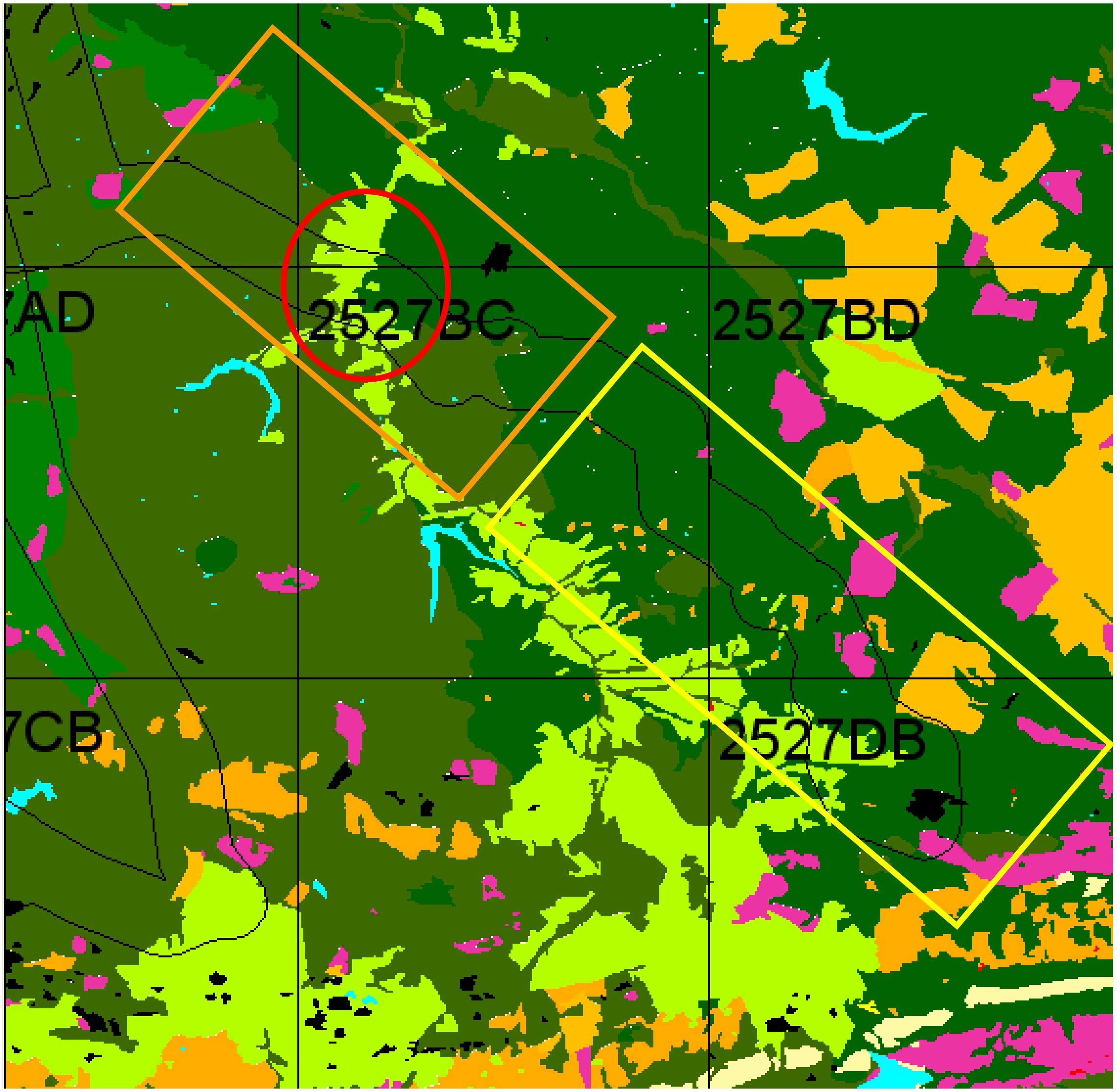
High sensitivity: Wetlands and river crossings.

Appendix D: Sensitivity map



Low sensitivity: Many settlements, intensive subsistence agriculture, little undisturbed habitat for birds

Appendix D: Sensitivity map



Low sensitivity: Many settlements, subsistence agriculture, little undisturbed habitat for birds

High sensitivity: River crossing and associated irrigated crops. High collision risk for storks and may even attract Blue Cranes on occasion.

Medium sensitivity: Relatively untouched areas of woodland with farm dams, may have large raptors breeding and vultures and waterbirds using the farm dams.

APPENDIX E – Criteria for assessment of impacts

CRITERIA	DESCRIPTION OF ELEMENTS THAT ARE CENTRAL TO EACH ISSUE.
Conservation Status	A Red Data species is classified as one of the following according to Barnes *et al* (2000): **Critically endangered** Species faces an extremely high risk of extinction in the wild **Endangered** Species faces a very high risk of extinction in the wild **Vulnerable** Species faces a high risk of extinction in the wild **Near-threatened** Species is close to or likely to become vulnerable in the near future
Nature of impact	**Collision** This is a direct impact that occurs when a bird flies into or collides with the overhead conductors or earth wires of a power line **Electrocution** This is a direct impact that occurs when a bird touches either two live phases, or one live phase and an earthed object simultaneously **Habitat destruction** This is an indirect impact, whereby construction and/or maintenance of the power line destroys or degrades a particular birds habitat **Disturbance** This is an indirect impact, whereby construction and/or maintenance activities disturb the bird, particularly during breeding season
Degree of Certainty	**Definite** More than 90% sure of a particular fact or of the likelihood of an impact occurring.
	Probable Over 70% sure of a particular fact or the likelihood of an impact occurring.
	Possible Only over 40% sure of a particular fact or of the likelihood of an impact occurring.
	Improbable Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Expected Locality	This is a description of the specific locality that the impact is likely to occur at.
Duration	**Long term** Permanent. Beyond decommissioning. Long term (more than 15 years).
	Medium term Reversible over time. Lifespan of project. Medium term (5-15 years).
	Short term Quickly reversible. Less than the project lifespan. Short term (0-5 years).
Intensity or Severity	**High** Destruction of rare or endangered species.
	Medium Significant reduction in species occurrence
	Low Minor change in species occurrence
Magnitude and Significance	**High** Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time consuming or a combination of these. Project must be abandoned in part or totality

	Medium Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur /the impact is substantial in relation to other impacts that might take effect within the bounds of those that could occur, but mitigation is both feasible and fairly easily possible.
	Low Impact is of a low order and therefore likely to have little real effect/ impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur and mitigation is both feasible and fairly easily possible
	No impact Zero impact.

(Adapted from Guideline Document, EIA Regulations, Implementation of sections 21, 22 and 26 of the Environment Conservation Act, A