BIRD IMPACT ASSESSMENT STUDY

Eskom Distribution Northern Region

BORUTHO MTS POWER LINES AND SUBSTATION

JULY 2011

Prepared by:

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EXECUTIVE SUMMARY

Eskom Distribution Northern Region is in the process of expanding their infrastructure in Limpopo. Three new proposed projects consist of the following infrastructure (see figures 1 and 2 below):

- Construction of approximately 10km, 132 kV loop-in loop-out power line from the existing Witkop-PPRust 132kv power line to the proposed new Borutho MTS.
- Construction of approximately 10km, 132 kV loop-in loop-out power line from the existing Witkop-Sandsloot 132kV power line to the proposed Borutho MTS.
- Construction of approximately 28km, 132kV power line from the existing Potgietersrus Substation to the proposed Borutho MTS.

Because relatively undisturbed areas of woodland still remain, it is possible that many of the remaining Red Data species will still utilize the area from time to time. **Provided that large trees and sensitive riparian vegetation are not removed**, the clearing of woodland under the new line should not have a huge impact. The impact on smaller, non-Red Data species that are potentially breeding in the area that will be cleared for the new power line will be local in extent, in that it will not affect regional or national populations in any significant way. The site of the proposed Borutho Substation is situated in degraded woodland. It is not envisaged that any Red Data species will be displaced by the habitat transformation that will take place as a result of the construction of the Borutho substation. The proposed construction of the new power line and substation should therefore have a **LOW** habitat transformation impact from an avifaunal perspective.

Collisions with the proposed power line.
The storks listed in Table 1 are all vulnerable to collisions with power lines. In the case of water-associated Red Data species such as the Black Stork and Yellow-billed Stork, the ephemeral drainage lines and associated wetlands (see example in figure 5 above), might potentially hold some attraction in times of heavy rains when pools form in the channel, and also for large raptors and vultures that use the pools for drinking and bathing. All the proposed alignments cross directly over several drainage lines, and might therefore pose some potential risk of collisions for these species and other, non-Red Data species such as certain species of ducks, waders and possibly Hamerkops *Scopus umbretta*. Overall, the collision risk is regarded to be **MEDIUM.**

Electrocutions on the proposed 132kV power line.
A mono-pole steel pole will be used for the new 132kV line. Clearance between phases on the same side of the pole structure is normally around 2.2m for this type of design, and the clearance on strain structures is 1.8m. This clearance should be sufficient to prevent phase – phase electrocutions of birds on the towers. The length of the stand-off insulators is likely to be about 1.5 metres. This is relevant as birds such as vultures are able to touch both the conductor and the earthed pole simultaneously potentially resulting in a phase – earth electrocution. This is particularly likely when more than one bird sits on the same pole.

It is likely that Cape Vultures (and other species of vultures, specifically White-backed Vultures) could forage in the area. There are large numbers of cattle in the surrounding area, and should a carcass be available to the birds, they might attempt to roost on the poles. The risk of phase-earth electrocution is therefore evaluated to be **MEDIUM**. It should be mentioned that the pole design holds no inherent electrocution risk for other large **solitary** species such as eagles, as they almost never perch together in large numbers next to each other.

CONCLUSIONS
The proposed construction of the new 132kV Borutho MTS power lines will pose a limited threat to the birds occurring in the vicinity of the new infrastructure. The power lines pose a **medium** collision risk, mostly to non Red Data species and a **medium** electrocution risk, in particular to

vultures. The habitat transformation will have a **low** impact, and should only affect a few non-Red Data species at a local level, provided the large trees and riparian vegetation are not removed.

RECOMMENDATIONS

- Power line: The spans that cross drainage lines should be marked with Bird Flight Diverters on the earth wire of the line, five metres apart, alternating black and white (see Appendix A Sensitivity maps for the areas to be marked with Bird Flight Diverters). Appendix B indicates the preferred Bird Flight Diverters to be used.
- Trees: The removal of large trees should be avoided if at all possible.
- Poles: The poles should be fitted with bird perches on top of the poles to draw birds, particularly vultures, away from the potentially risky insulators (see Figure 8 below).

1. INTRODUCTION & BACKGROUND

Eskom Distribution Northern Region is in the process of expanding their infrastructure in Limpopo. Three new proposed projects consist of the following infrastructure (see figures 1 and 2 below):

- Construction of approximately 10km, 132 kV loop-in loop-out power line from the existing Witkop-PPRust 132kv power line to the proposed new Borutho MTS.
- Construction of approximately 10km, 132 kV loop-in loop-out power line from the existing Witkop-Sandsloot 132kV power line to the proposed Borutho MTS.
- Construction of approximately 28km, 132kV power line from the existing Potgietersrus Substation to the proposed Borutho MTS.

Concern was expressed by Eskom that the proposed infrastructure will impact on birdlife and a bird impact assessment study was therefore requested to investigate the extent of the risk. The terms of reference for the study are as follows:

- Describe the affected environment.
- Indicate how birdlife will be affected.
- Discuss gaps in baseline data.
- List and describe the expected impacts.
- Assess and evaluate the potential of impacts.
- Recommend relevant mitigation measures.

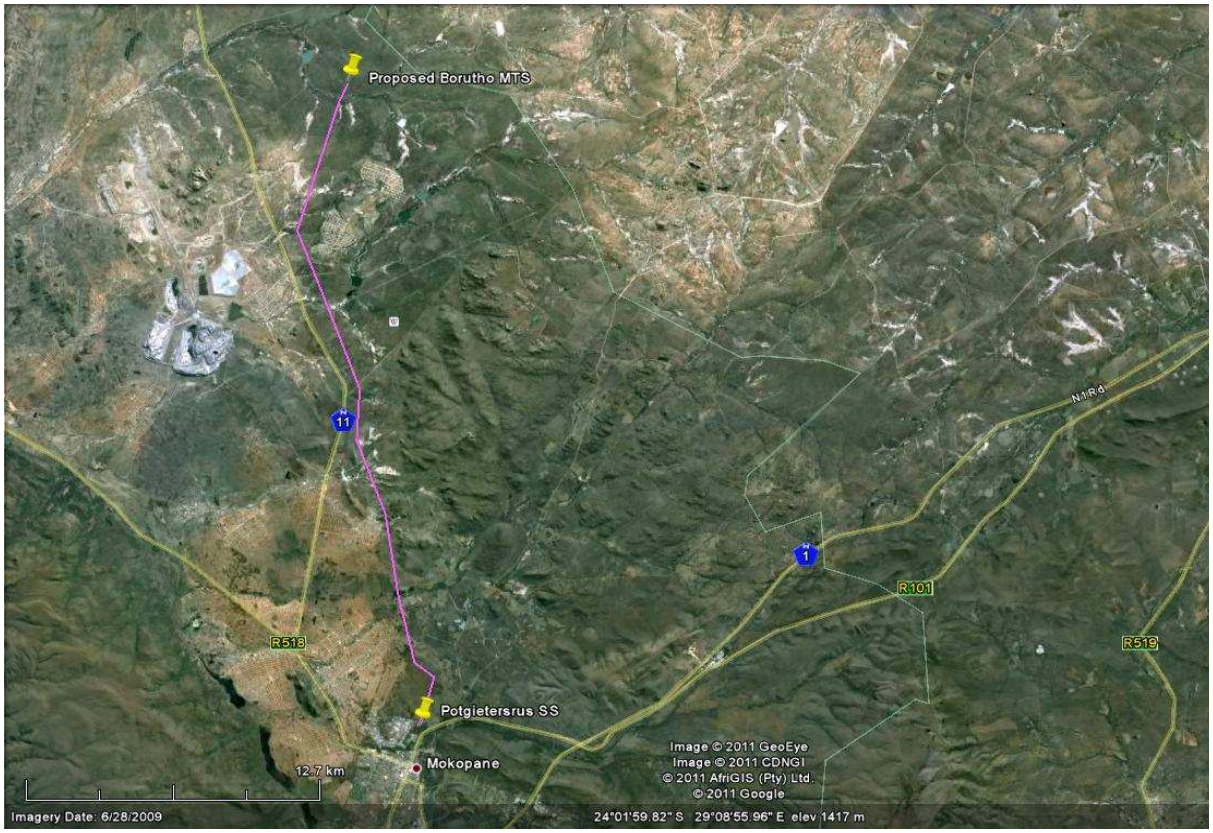

Figure 1: Satellite image of the study area, indicating the proposed alignment of the new Potgietersrus-Borutho 132kV line and the position of the proposed new Borutho substation.

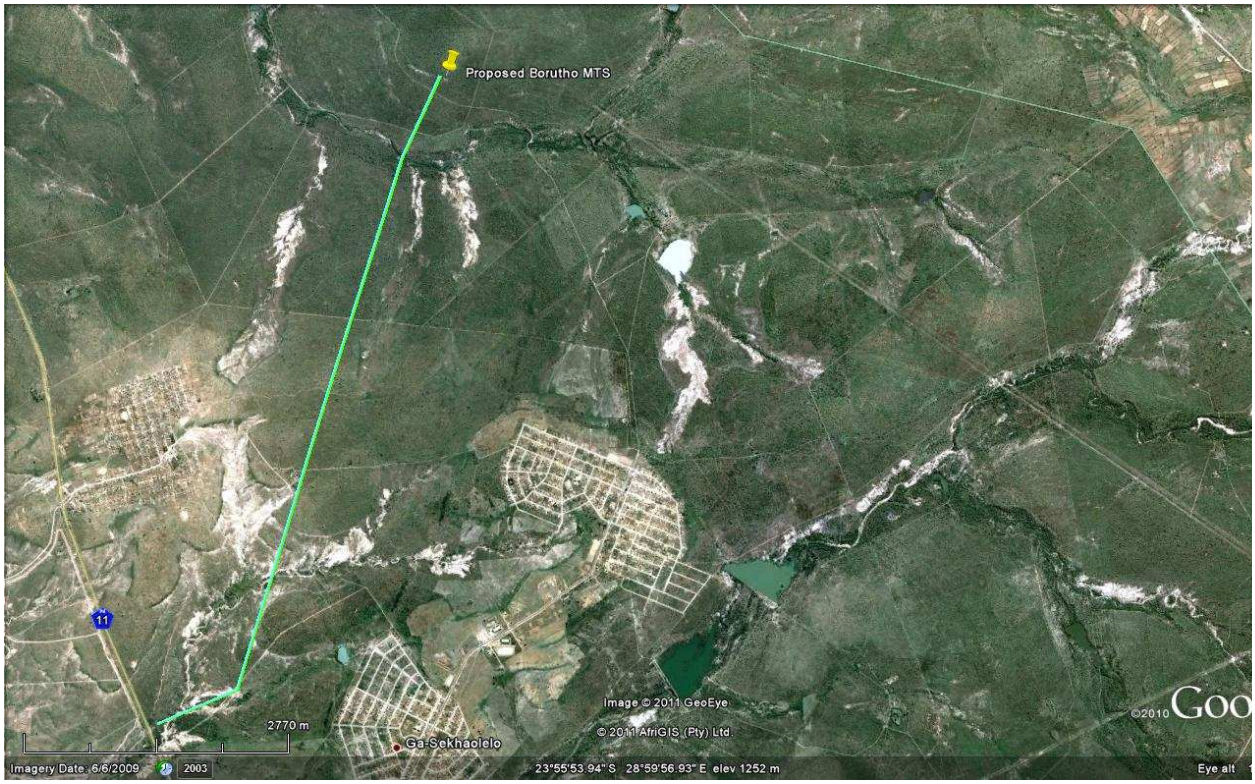

Figure 2: Satellite image of the proposed alignment for approximately 10km 132 kV loop-in loop-out power line from the existing Witkop-Sandsloot 132kV power line to the proposed Borutho MTS, and approximately 10km 132 kV loop-in loop-out power line from the existing Witkop-PPRust 132kV power line to the proposed new Borutho MTS. The alignments are situated directly adjacent to each other.

2 SOURCES OF INFORMATION

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

- Bird distribution data of the Southern African Bird Atlas Project 2 (SABAP2)(http://sabap2.adu.org.za) was obtained for the quarter-degree grid cells (GDGC = the equivalent of a 1:50 000 map) traversed by the proposed line, namely 2328DD, 2428BB and 2429AA.
- The conservation status of all species considered likely to occur in the area was determined as per the most recent iteration of the southern African Red Data list for birds (Barnes 2000), and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).
- The author has travelled and worked extensively on power line projects in the Limpopo Province since 1996. Personal observations of avifauna and bird/habitat associations have therefore also been used to supplement the data that is available from SABAP2, including sightings made during the field trip in July 2011.
- The power line bird mortality incident database of the Eskom - Endangered Wildlife Trust Strategic Partnership (1996 to 2007) 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.
- A classification of the vegetation types in the QDGCs was obtained from the Southern African Bird Atlas Project 1 (SABAP1, Harrison *et al.* (1997).

- Information on the micro habitat level was obtained through visiting the area in July 2011 and obtaining a first-hand perspective. Micro habitats were identified using a combination of ornithological and ecological experience of avifaunal/habitat associations.

3 ASSUMPTIONS & LIMITATIONS

The following assumptions and limitations are applicable in this study:

- In this instance the 2328DD QDGC was not well covered by SABAP2, with data being recorded on only 1 checklist to date. The coverage is better with 2428BB and 2429AA, with 17 and 26 checklists completed respectively. In view of this, the list of Red Data species that could be encountered was supplemented with observations and general knowledge of the area by the author, and by consulting species lists for adjacent QDGCs with similar habitat.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances. However, power line and substation impacts can be predicted with a fair amount of certainty, based on experience gained by the author through the ongoing investigation of localities in southern Africa, since 1996, where birds have interacted with electrical infrastructure.
- It is important to note that, although the predicted impacts are mostly concerned with Red Data species, the non Red Data species will benefit as much from the proposed mitigation measures as they share the same habitat and face the same potential impacts as the Red Data species.
- Predictions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances. However, power line and substation impacts can be predicted with a fair amount of certainty, based on experience gained by the author through the ongoing investigation of localities in southern Africa, since 1996, where birds have interacted with electrical infrastructure.

4 DESCRIPTION OF AFFECTED ENVIRONMENT

4.1 Relevant bird populations

A total of 52 species have been recorded in the 2328DD QDGC on the single checklist for SABAP2, with none of these classified as Red Data species. A total of 213 species were recorded in 2428BB by SABAP2, with 2 classified as Red Data species. In 2429AA a total of 198 species were recorded, of which 2 are classified as Red Data species. Reporting rates are an indication of the relative density of a species on the ground in that it reflects the number of times that a species was recorded relative to the total amount of cards that were completed for the square.

Table 1 provides an important guideline of the species that could **potentially** be encountered anywhere within the QDGCs where suitable habitat is available, and should therefore not be used as a measure of actual densities along the proposed power line alignments. The chances of it occurring along any of the alignments are covered in the last column. Species that could conceivably occur but was not recorded by SABAP2 are also listed (see 3 above).

TABLE 1: Species of conservation concern recorded by SABAP2 in 2328DD, 2428BB, and 2429AA, supplemented with personal observations and general knowledge of the area.

NT = Near threatened, V= Vulnerable,

Species	Conservation Status	Preferred habitat in study area (Harrison *et al* 1997, Barnes 2000, Hockey *et al* 2005, personal observations)	SABAP2 reporting rate 2328DD (%)	SABAP2 reporting rate 2428BB (%)	SABAP2 reporting rate 2429AA (%)	Chance of occurrence at proposed development site
BLACK STORK *Ciconia nigra*	NT	Rivers, dams, cliffs. Could be a visitor to dams and rivers in the area. Sometimes roost on power lines.	-	-	-	Low, where the alignment crosses drainage lines.
MARABOU STORK *Leptoptilos crumeniferus*	NT	Rivers, dams, live-stock carcasses. Could be a visitor to the larger dams and rivers in the area.	-	-	Recorded during field trip near Mokopane	Low, where the alignment crosses drainage lines, and at rubbish dumps.
YELLOW-BILLED STORK *Mycteria ibis*	NT	Rivers, dams. Could be a visitor to the larger dams and rivers in the area.	-	-	-	Low, where the alignment crosses drainage lines.
RED-BILLED OXPECKER *Buphagus erythrorhynchus*	NT	Associated with large ungulates and game in rural areas.	-	5.9	3.8	Low, could occur anywhere in association with livestock
WHITE-BACKED VULTURE *Gyps africanus*	V	Woodland. Roost on transmission lines. Could feed on carcasses in the vicinity of the alignment.	-	-	-	Low, at carcasses.
TAWNY EAGLE *Aquila rapax*	V	Woodland. Could feed on carcasses in the vicinity of the alignment.	-	-	-	Low, anywhere along the alignment in natural woodland
MARTIAL EAGLE *Polemaetus bellicosus*	V	Woodland.	-	-	-	Low, anywhere along the alignment in natural woodland
LAPPET-FACED VULTURE *Torgos tracheliotis*	V	Woodland. Could feed on carcasses in the vicinity of the alignment.	-	-	-	Low, at carcasses of livestock.
CAPE VULTURE Gyps coprotheres	V	The closest roost sites are on cliffs and power lines near Polokwane, but the birds range widely. Could feed on carcasses in the vicinity of the alignment.	-	-	Vagrant	Low, at carcasses of livestock.
SECRETARYBIRD *Saggitarius serpentarius*	NT	Open woodland and old lands.	-	-	-	Low, in open woodland and old lands

LANNER FALCON *Falco biarmicus*	NT	Open grassland and woodland near cliffs or electricity pylons breeding sites.	-	-	-	Low, anywhere along the alignment
LESSER KESTREL *Falco naumanni*	V	Grassland, including old agricultural fields	-	5.9	-	Low, mostly in cleared areas such as old lands

4.2 Vegetation types and bird habitats

It is generally accepted that vegetation structure, rather than the actual plant species, influences bird species distribution and abundance (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 following description makes extensive use of the work of Harrison *et al* (1997). The criteria used by the atlas authors 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.

The QDGCs in the study area are comprised predominantly of woodland (See TABLE 2 below).

TABLE 2: Vegetation types in 2329CA and 2328DB (Harrison *et al* 1997)

Biome	Vegetation type	2328DD	2428BB	2429AA
Savanna	Arid Woodland	31%	21%	12%
Savanna	Moist Woodland	69%	79%	61%
Grassland	Sour grassland	-	-	26%

Woodland (or savanna) is the dominant vegetation type in the study area and it is defined as having a grassy under-storey and a distinct woody upper-storey of trees and tall shrubs (Harrison *et al* 1997). 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 very few bird species are restricted to this biome. It is also relatively well conserved compared to the grassland 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 *Circaetus cinereus*, Black-chested Snake Eagle *Circaetus pectoralis*, and a multitude of medium-sized raptors for example the migratory Steppe Buzzard *Buteo vulpinus*, African Harrier Hawk (Gymnogene) *Polyboroides typus*, Wahlberg's Eagle *Aquila wahlbergi* and African Hawk Eagle *Aquila spilogaster*. Apart from raptors, woodland in its undisturbed state is suitable for a wide range of other power line sensitive birds, including the Red Data Kori Bustard *Ardeotis kori* and Southern Ground-Hornbill *Bucorvus leadbeateri.*

It is immediately obvious that the reporting rates for Red Data species in the three QDGCs that comprise the study area are very low. This could be a function of low observer effort, but it could also be a true reflection of the bird numbers. In the last decade, development, especially mining, has increased rapidly in area, resulting in large scale habitat transformation and high levels of disturbance. However, in accordance with the pre-cautionary principle, it must be assumed that the species mentioned in the preceding paragraph still occur in the study area from time to time, especially in areas where the woodland is still intact, with the exception of the Kori Bustard and Southern Ground-Hornbill. The vegetation in the area where the new line is to be constructed comprises 100% woodland. The state of the vegetation varies from relatively pristine in places to a relatively poor state with evidence of heavy overgrazing and pedestrian traffic very evident near towns and settlements. The satellite images of the study area in figure 1 and

2 above give an indication of the extent of urbanization and industrial development that has taken place in the bigger study area, as well as the impact of live-stock grazing on the area, indicated by the lighter areas between the darker vegetation and the myriad of cattle and pedestrian tracks. Examples of the woodland habitat in the study area are presented below.

Figure 3: Degraded woodland in the study area. This is typical of areas in close proximity to settlements and towns. In the dry season, these areas are often devoid of grass cover.

Figure 4: An example of relatively intact woodland in the study area.

Despite the impacts on the vegetation, pockets of woodland remain where the vegetation is relatively intact and where large trees are still surviving. It is critical that these areas are not further degraded and it is specifically important that no large trees are removed. The trees offer potential roosting, perching and breeding substrate for a variety of birds, and should therefore not be destroyed or harmed.

The study area also contains several ephemeral **drainage lines with associated wetlands/floodplains.** Drainage lines and wetlands are important habitat for birds in that they act as corridors of microhabitat for waterbirds, and the large trees which are associated with drainage lines are important nesting substrate for birds, especially large raptors and vultures. The large pools that form after good rains persist well into the dry season and the fish that are trapped in those pools provide potential sources of food for Red Data species such as Yellow-billed Stork and Black Stork. A host of non-Red Data species is also dependant on drainage lines for food and shelter.

Figure 5: An ephemeral drainage line. In summer, after good rains, the pools of water and associated floodplains are important for a variety of avifauna.

There are also areas of **subsistence agriculture** along the proposed alignment, and many **old lands** which are reverting back to grassland. These areas are important for power line sensitive species – Secretarybirds (Red Data status: near-threatened) and Lesser Kestrel (Red Data status: vulnerable) utilize open areas between woodland for foraging, and other large, non-Red Data power line sensitive species such as White Stork *Ciconia ciconia*, Abdim's Stork *Ciconia abdimii*, Black-chested Snake-eagle *Circaetus pectoralis* and Spur-winged Goose *Plectropteris gabensis* also use freshly ploughed and/or irrigated lands to feed in.

Figure 6: Subsistence agriculture in the study area

5. ASSESSMENT OF IMPACTS

Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and people. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are the electrocution of birds (and other animals) and birds colliding with power lines. Other problems are: electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure; and disturbance and habitat destruction during the construction and maintenance activities associated with electrical infrastructure.

5.1 Loss of breeding, foraging and roosting habitat through habitat transformation.

During the construction phase and maintenance of power lines and substations, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of servitudes. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the site, through the modification of habitat.

Historically (i.e. before the establishment of the current settlements and mines) the area surrounding the proposed power line comprised entirely of undisturbed woodland. As a result it would have supported a number of power line sensitive species, particularly raptor species currently Red Data listed such as Martial Eagle, Tawny Eagle, Bateleur,

Lappet-faced Vulture and also non-raptors such as Southern Ground Hornbill and Kori Bustard. However this area has been transformed to accommodate a change in land use (i.e. agriculture, human settlement and mining) which reduced the number and variety of species originally inhabiting the area, on account of the loss of habitat and decline in food availability. However, because relatively undisturbed areas of woodland still remain, it is possible that many of the remaining Red Data species will still utilize the area from time to time. **Provided that large trees and sensitive riparian vegetation are not removed**, the clearing of woodland under the new line should not have a huge impact. The impact on smaller, non-Red Data species that are potentially breeding in the area that will be cleared for the new power line will be local in extent, in that it will not affect regional or national populations in any significant way.

The site of the proposed Borutho Substation is situated in degraded woodland (see figure 8 below). Evidence of heavy grazing is evident in the depleted grass cover at the sites, and bush encroachment is also present. This habitat type is ubiquitous in the study area and transformation of 1 hectare (100 x 100m) to accommodate the new substation should not impact significantly on birds currently using this area. Due to the mobility of the larger species, they could conceivably move out of the immediate area and forage elsewhere in similar habitat. The species that are most likely to be affected by the loss of habitat are the smaller, common species that are currently resident in that hectare of vegetation. It is not envisaged that any Red Data species will be displaced by the habitat transformation that will take place as a result of the construction of the Borutho substation.

The proposed construction of the new power line and substation should therefore have a **LOW** habitat transformation impact from an avifaunal perspective.

Figure 7: The site of the proposed Borutho Substation

5.2 Collisions with the proposed power line.

The storks listed in Table 1 are all vulnerable to collisions with power lines. In the case of water-associated Red Data species such as the Black Stork and Yellow-billed Stork, the ephemeral drainage lines and associated wetlands (see example in figure 5 above), might potentially hold some attraction in times of heavy rains when pools form in the channel, and also for large raptors and vultures that use the pools for drinking and bathing. All the proposed alignments cross directly over several drainage lines, and might therefore pose some potential risk of collisions for these species and other, non-Red Data species such as certain species of ducks, waders and possibly Hamerkops *Scopus umbretta*. Overall, the collision risk is regarded to be **MEDIUM.**

5.3 Electrocutions on the proposed 132kV power line.

A mono-pole steel pole will be used for the new 132kV line. Clearance between phases on the same side of the pole structure is normally around 2.2m for this type of design, and the clearance on strain structures is 1.8m. This clearance should be sufficient to prevent phase – phase electrocutions of birds on the towers. The length of the stand-off insulators is likely to be about 1.5 metres. This is relevant as birds such as vultures are able to touch both the conductor and the earthed pole simultaneously potentially resulting in a phase – earth electrocution. This is particularly likely when more than one bird sits on the same pole.

It is likely that Cape Vultures (and other species of vultures, specifically White-backed Vultures) could forage in the area. There are large numbers of cattle in the surrounding area, and should a carcass be available to the birds, they might attempt to roost on the poles. The risk of phase-earth electrocution is therefore evaluated to be **MEDIUM**. It should be mentioned that the pole design holds no inherent electrocution risk for other large **solitary** species such as eagles, as they almost never perch together in large numbers next to each other.

6 CONCLUSIONS

The proposed construction of the new 132kV Borutho MTS power lines will pose a limited threat to the birds occurring in the vicinity of the new infrastructure. The power lines pose a **medium** collision risk, mostly to non Red Data species and a **medium** electrocution risk, in particular to vultures. The habitat transformation will have a **low** impact, and should only affect a few non-Red Data species at a local level, provided the large trees and riparian vegetation are not removed.

7 RECOMMENDATIONS

- Power line: The spans that cross drainage lines should be marked with Bird Flight Diverters on the earth wire of the line, five metres apart, alternating black and white (see Appendix A Sensitivity maps for the areas to be marked with Bird Flight Diverters). Appendix B indicates the preferred Bird Flight Diverters to be used.
- Trees: The removal of large trees should be avoided if at all possible.
- Poles: The poles should be fitted with bird perches on top of the poles to draw birds, particularly vultures, away from the potentially risky insulators (see Figure 8 below).

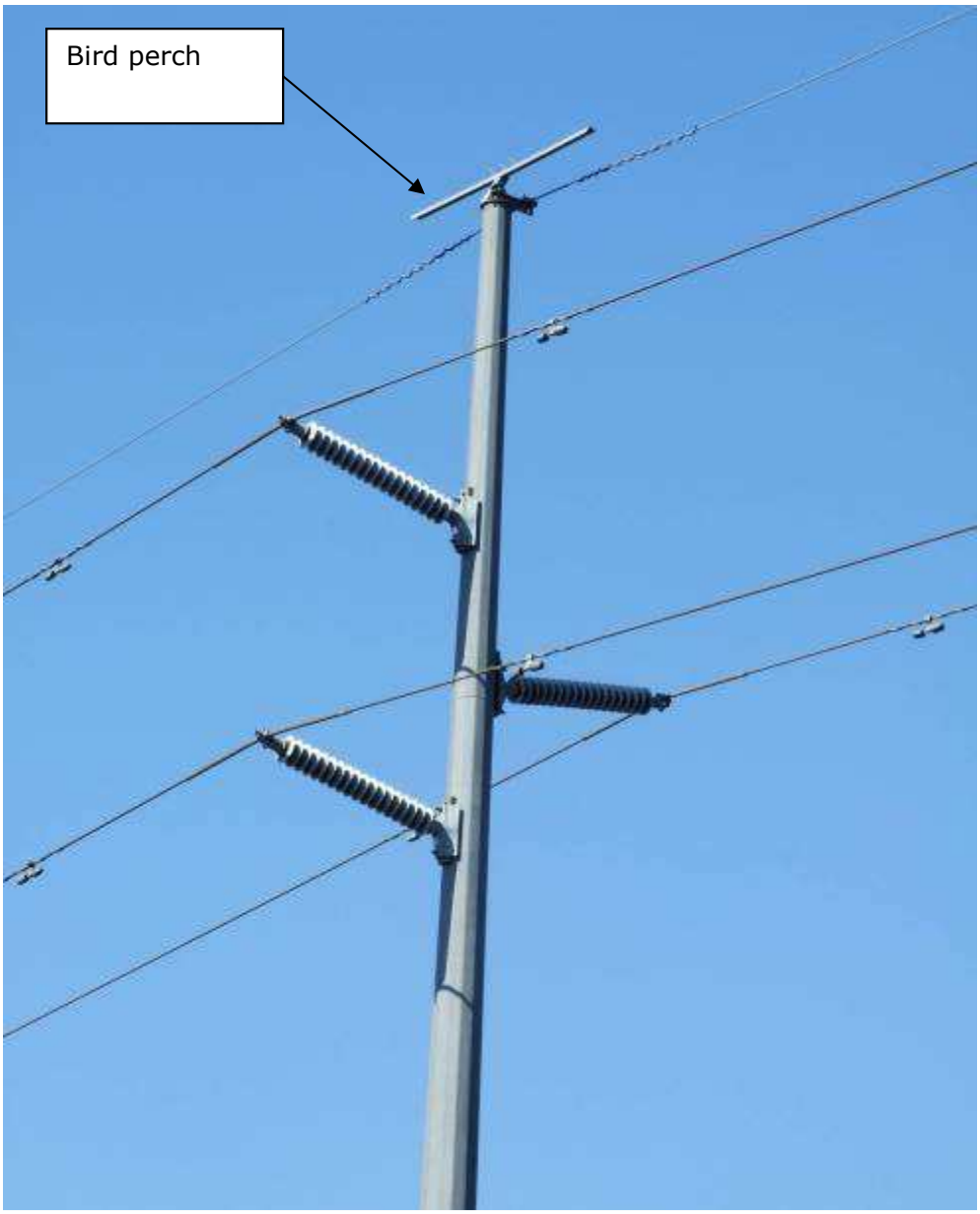

Figure 8: Steel mono-pole with bird perch

6 REFERENCES

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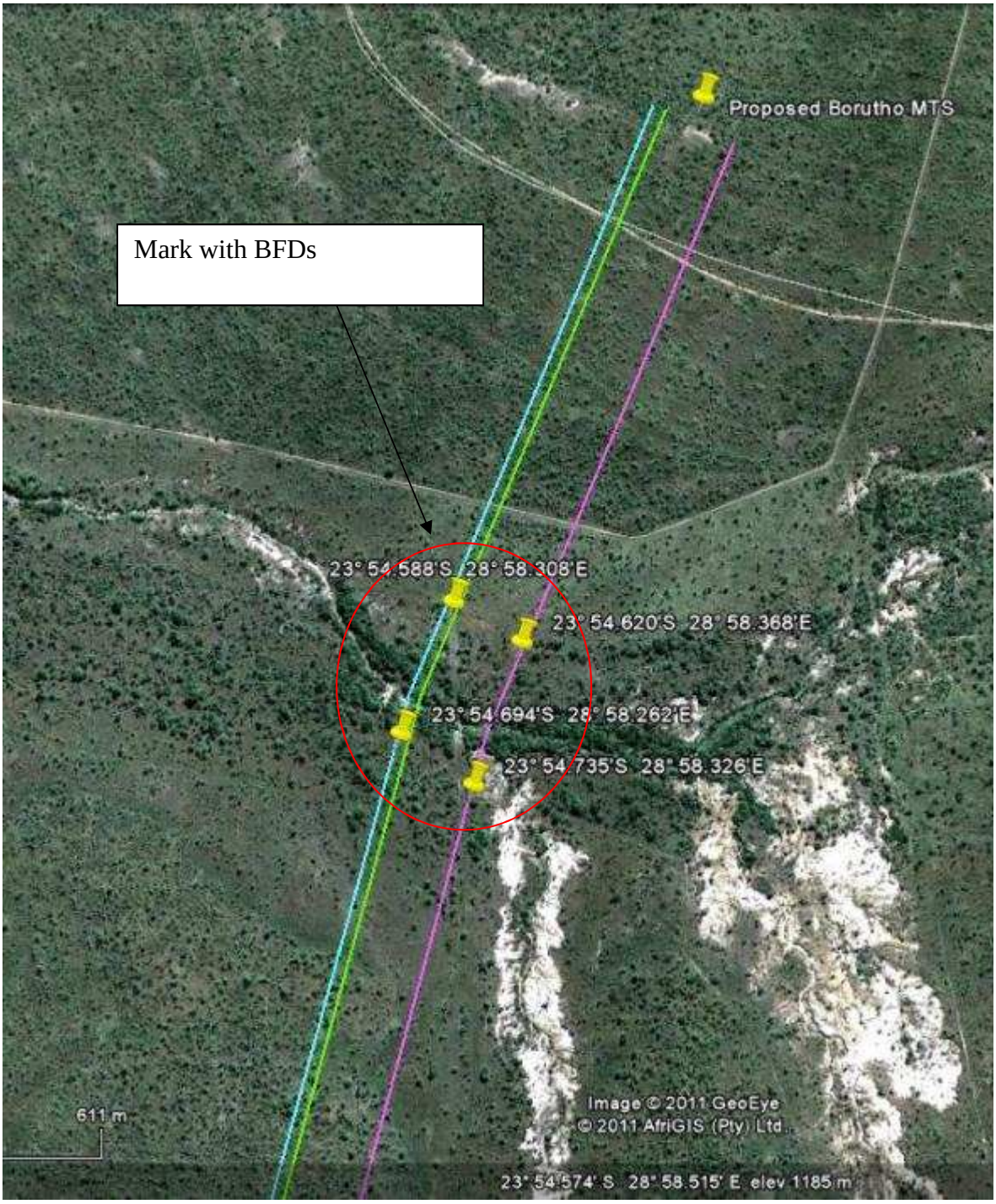
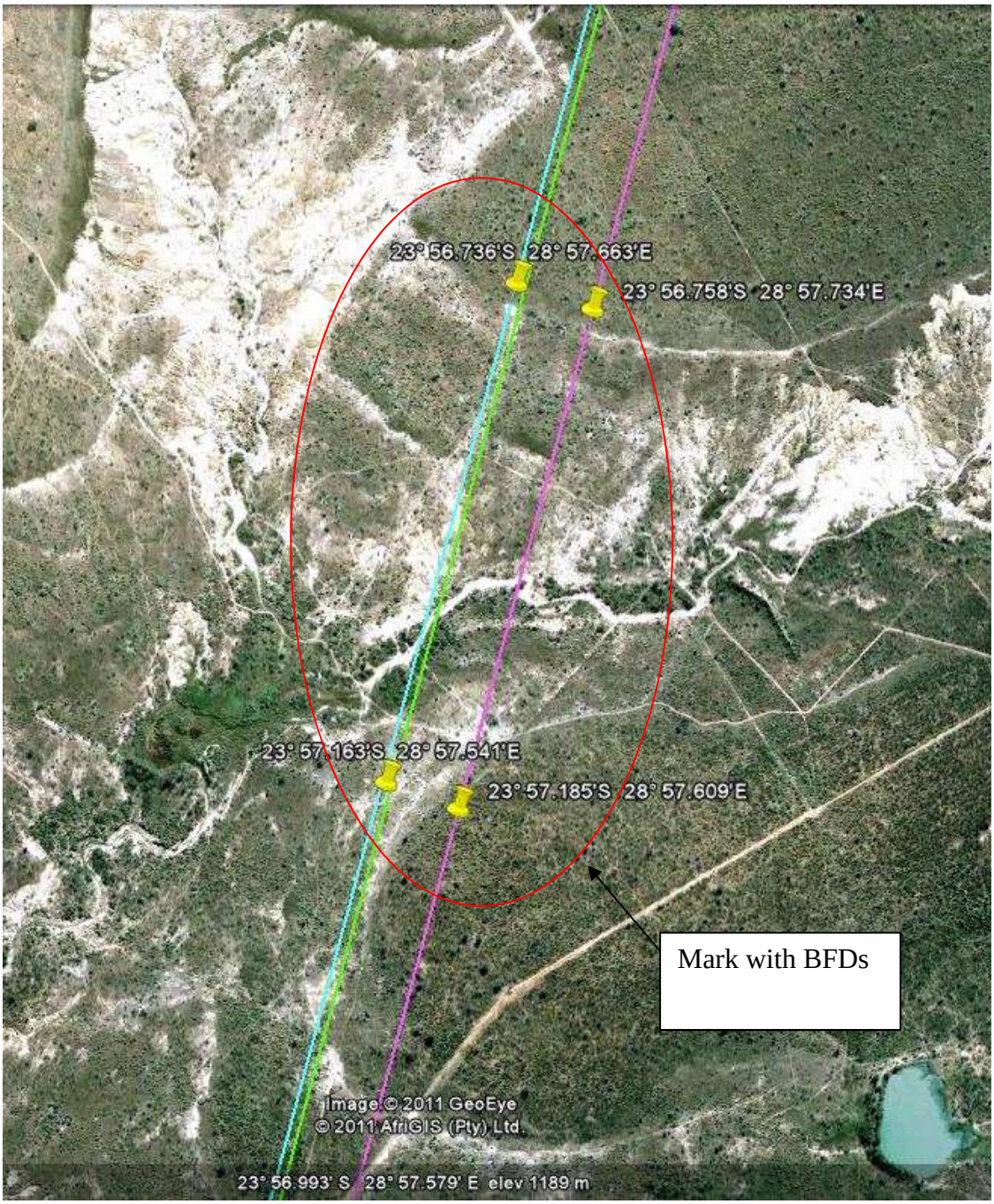
APPENDIX A: SENSITIVITY MAP

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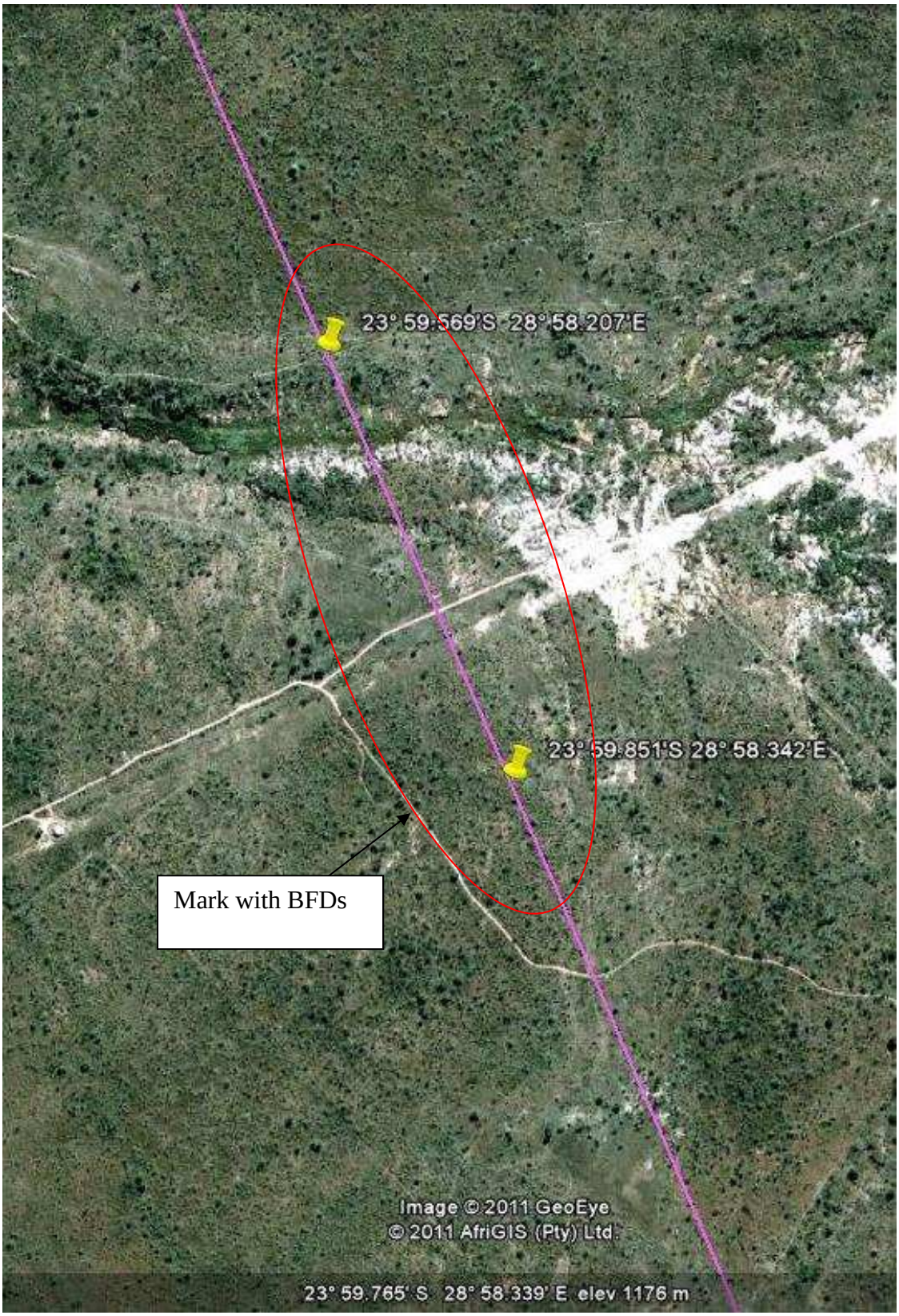
23° 56.758'S 28° 57.734'E
23° 57.163'S 28° 57.541'E
23° 57.185'S 28° 57.609'E
Mark with BFDs
Image © 2011 GeoEye
© 2011 AfriGIS (Pty) Ltd.
23° 56.993' S 28° 57.579' E elev 1189 m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23° 59.851'S 28° 58.342'E
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Image © 2011 GeoEye
© 2011 AfriGIS (Pty) Ltd.
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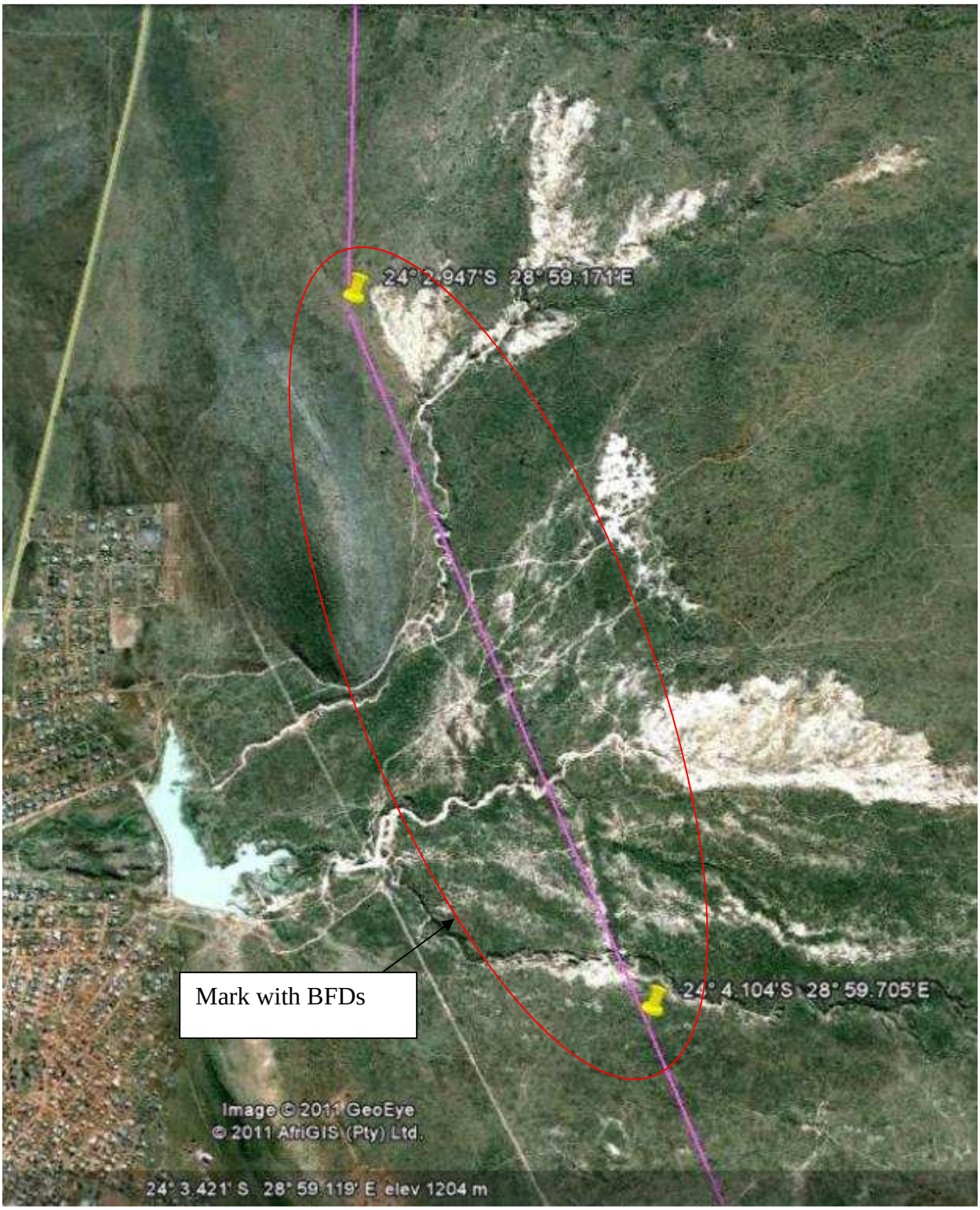
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Image © 2011 GeoEye
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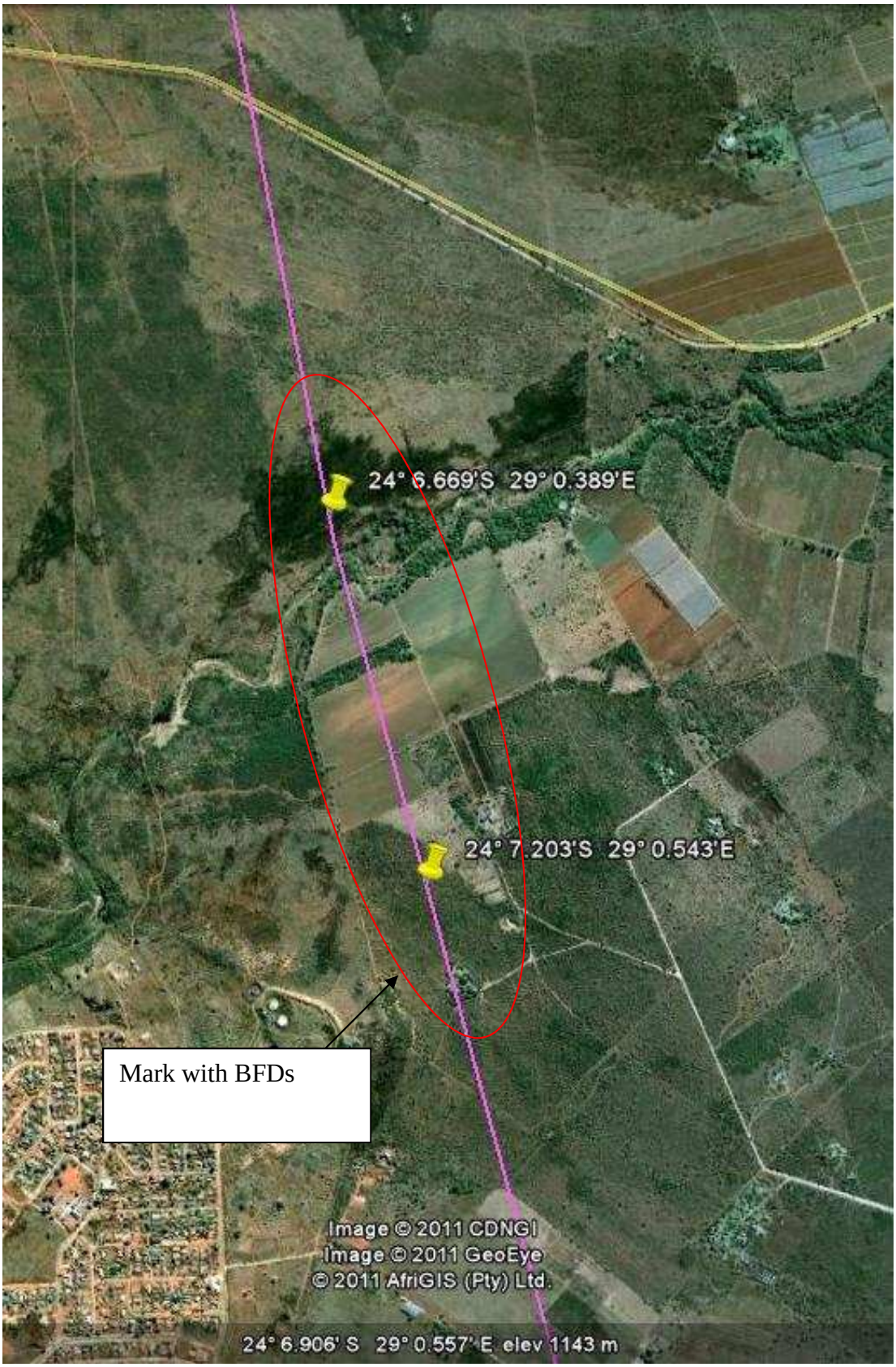
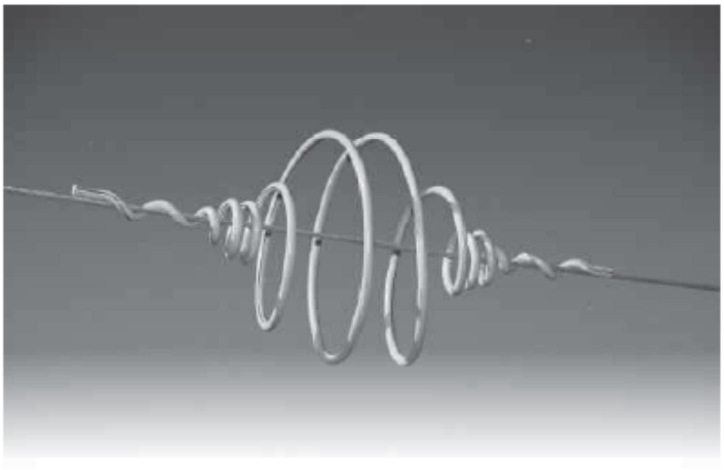

24° 6.669'S 29° 0.389'E
24° 7.203'S 29° 0.543'E
Mark with BFDs
Image © 2011 CDNGI
Image © 2011 GeoEye
© 2011 AfriGIS (Pty) Ltd.
24° 6.906' S 29° 0.557' E elev 1143 m

APPENDIX B: MITIGATION DEVICES

PLP – The connection you can count on

Double Loop Bird Flight Diverter



General Recommendation

The Bird Flight Diverter is designed to make overhead lines visible to birds and provides and economic means of reducing the hazard to both lines and birds. For low and medium voltage construction (up to 40kV) it is applied to the phase conductors (bare or jacketed). For high voltage it is used on the earth wire.

The fitting is light in weight, offers little wind resistance and is easily and quickly applied. The positive grip of the fitting on the conductor ensures that it remains in the applied position and cannot move along the span under vibration.

Visibility: The diverter section increases the visibility profile of the cable or conductor to a degree necessary to ensure safety, but avoids undesirably bulky outline.

Spacing: Spacing distances are not critical and will depend upon local conditions. Since wind resistance is very limited, sufficient fittings can be used to ensure adequate visibility without creating stresses on the line. When marking adjacent spans, overall visibility is improved by staggering the application.

We recommend generally a spacing of 10 or 15 metres.

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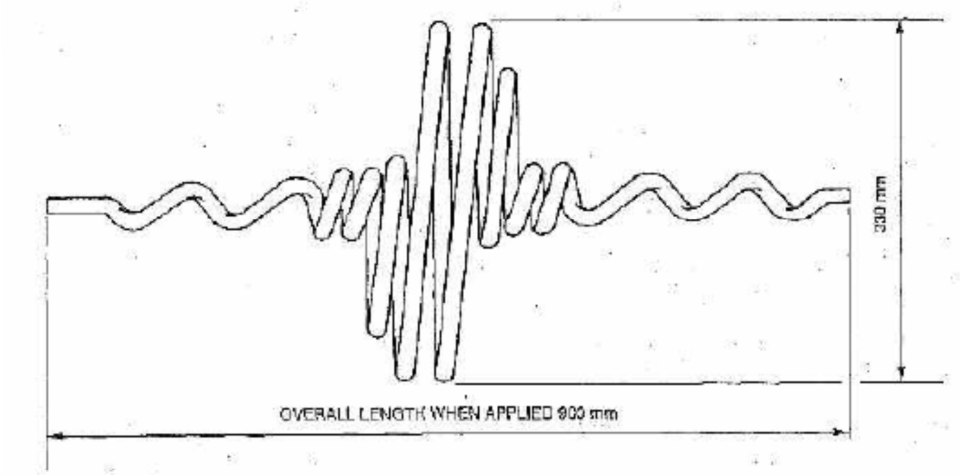
PLP – The connection you can count on

Double Loop Bird Flight Diverter



Material Used: Manufactured from rigid solid high impact polyvinyl chloride, possessing excellent chemical and strength properties and which will retain good physical characteristics within the range of extreme temperatures. Outdoor aging tests indicate that the material does not deteriorate in function or appearance from the effects of severe weather conditions. Industrial fumes and salt water cannot seriously degrade the properties of rigid PVC.

Colour: White or Black

Lay Direction: Bird Flight Diverters are supplied right hand lay for both right hand and left hand lay bare conductors and insulated cables.

CATALOGUE NO.	CONDUCTOR/ E/WIRE DIA. RANGE
BFD 0914/LD2*	9 mm – 14 mm

*Add B or W to denote colour

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