APPENDIX D: SPECIALIST REPORTS

APPENDIX D.1: AVI-FAUNA

BIRD IMPACT ASSESSMENT STUDY

Eskom Distribution Northern Region

KABOKWENI 132kV POWER LINE

OCTOBER 2010

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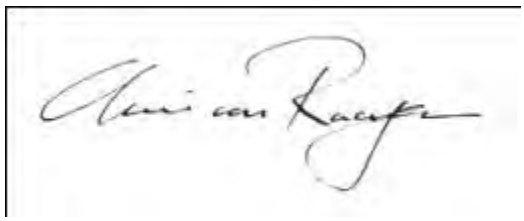
18 October 2010:

DECLARATION OF INDEPENDENCE

I, Chris van Rooyen as duly authorised representative of Chris van Rooyen Consulting, hereby confirm my independence as a specialist and declare that neither I nor Chris van Rooyen Consulting have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which the Environmental Evaluation Unit of the University of Cape Town was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Environmental Impact Assessment for the proposed Kabokweni 132kV power line.



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Christiaan Stephanus van Rooyen
Title / Position: Director
Qualification(s): BA LLB
Experience (years/ months): 14 years and 7 months

EXECUTIVE SUMMARY

The Kabokweni area currently experiences low voltages during peak hours because the reticulation networks have become inadequate to maintain good quality of supply. Eskom has therefore decided to construct a 6km-long 132kV line from Kabokweni Substation to a proposed 2x20MVA transformer substation. The substation will be referred to as Hlau-Hlau Substation. In 2006 the author completed a Bird Impact Scoping Study for the proposed project. This study re-examines the conclusions of that report.

CONCLUSIONS

The proposed Kabokweni 132kV power line will pose a limited threat to the birds occurring in the vicinity of the new infrastructure. More specifically, the power line poses a **low - medium** collision risk, mostly to non Red Data species and a **low** electrocution risk, in particular to vultures. The habitat transformation will also 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 harmed.

PREFERRED ALIGNMENT

A preferred alignment from a bird impact assessment perspective would be one that avoids natural woodland or wetland as much as possible, and/or, is situated within the zone of influence of factors that lessen the risk of interactions e.g close to existing roads or within urban areas. Option 2 comes the closest to this ideal (see Appendix B), it is therefore the preferred alignment from a bird impact perspective. Due to the significant impacts that are already evident in the study area, the overall impact on birds should be low, regardless of which option is used, therefore Option 1 would also be an acceptable alternative.

RECOMMENDATIONS

The following recommendations are put forward for consideration:

- 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.
- The sections of the line that will require marking with Bird Flight Diverters are indicated in Appendix B.

1 INTRODUCTION & BACKGROUND

The Kabokweni area currently experiences low voltages during peak hours because the reticulation networks have become inadequate to maintain good quality of supply. Eskom has therefore decided to construct a 6km-long 132kV line from Kabokweni Substation to a proposed 2x20MVA transformer substation. The substation will be referred to as Hlau-Hlau Substation. In 2006 the author completed a Bird Impact Scoping Study for the proposed project. This study re-examines the conclusions of that report. See Figure 1 below for a map of the study area, indicating the proposed alignments.

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.
- Assess the alternative alignments from a bird impact perspective.
- Recommend relevant mitigation measures.

Figure 1: Satellite image of the study area, indicating the proposed alignments (Source: Eskom/Google Earth).

2 SOURCES OF INFORMATION

The following sources of information were used in this study:

- A 1:50 000 map of the study area was provided showing existing infrastructure and the proposed alignments. These, together with high resolution Google Earth satellite imagery, were used in order to identify potential "hot-spots" along the corridors e.g. patches of undisturbed vegetation, river crossings, wetlands and dams and agricultural areas.
- Atlas of southern African Birds (SABAP) (Harrison *et.al.* 1997) species lists and vegetation classifications for the Quarter-Degree Grid Cells (QDGCs) (or 1: 50 000 map units), 2531AC, within which the corridors are located, were obtained from the Avian Demography Unit at University of Cape Town. These were used to determine what power line sensitive species were recorded in the area during the Atlas period, and which species could potentially occur there in future.
- The SABAP data was supplemented with SABAP2 data for the relevant QDGC where the study area is situated. This data is much more recent, as SABAP2 was only launched in May 2007, and should therefore be more accurate. For SABAP, Quarter-Degree Grid Cells (QDGCs) (also called quarter degree squares) were the geographical sampling units. QDGCs are grid cells that cover 15 minutes of latitude by 15 minutes of longitude (15. × 15.), which correspond to the area shown on a 1:50 000 map. For SABAP2 the sampling unit has been reduced to pentad grid cells (or pentads); these cover 5 minutes of latitude by 5 minutes of longitude (5. × 5.). Each pentad is approximately 8 × 7.6 km. This finer scale has been selected for SABAP2 to obtain more detailed information on the occurrence of species and to give a clearer and better understanding of bird distributions. There are nine pentads in a QDGC.
- The area was inspected for a day to obtain a first-hand perspective of the proposed routes and birdlife. An attempt was made to travel the entire alternative as far as was practically possible, and to visit all potential hot-spots.
- The impacts were predicted on the basis of 14 years of experience 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. Extensive use was made of personal experience of the bird life in the study area, with which the author is intimately familiar with by virtue of having worked in the area on several power line projects since 1996.

3 ASSUMPTIONS & LIMITATIONS

The following assumptions and limitations are applicable in this study:

This study is based on the assumption that the above sources of information are adequately reliable. However, there are factors that may potentially detract from the accuracy of the predicted results:

- The SABAP data covers the period 1986-1997. Bird distribution patterns fluctuate continuously according to availability of food and nesting substrate.
- Fortunately, the new SABAP2 project has gathered data for the study area to supplement the SABAP data, therefore the SABAP data was used as a baseline, supplemented with general knowledge of the birdlife in the area.
- Sources of error in the SABAP database, particularly inadequate coverage of some quarter degree squares, may have resulted in an inaccurate reflection of both the species diversity and/or the species densities in the relevant squares. This means that the reporting rates of some species may not be an accurate reflection of the true densities in quarter degree squares that were sparsely covered during the data collecting period, as was the case with several of the squares (for a full discussion of potential inaccuracies in SABAP data, see Harrison *et al*, 1997). In this instance, the

relevant QDGC namely 2531AC was quite well covered, with 79 checklists completed. To supplement this, the list of Red Data species that could be encountered was supplemented with observations and general knowledge of the area by the author, as well as by consulting SABAP2 species lists (combined total of 85 checklists).

- 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 256 species have been recorded in the 2531AC QDGS by SABAP with a total of 8 of these being classified as Red Data species (Barnes 2000). For SABAP2, the total species comes to 272 with 10 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. **Reporting rates are not taken as a measure of actual densities, but only as a broad guideline**. Table 1 below provides an important guideline of the Red Data species that could **potentially** be encountered anywhere within the QDGC where **suitable** habitat is available, and should therefore not be used as a measure of actual densities on the ground.

TABLE 1: Species of conservation concern recorded by SABAP and SABAP2 in 2531AC, supplemented with personal observations and general knowledge of the avifauna of the area.

NT = Near threatened, V= Vulnerable, EN=Endangered

Species	Conservation Status (Barnes 2000)	Preferred habitat (Harrison *et al* 1997, Barnes 2000, Hockey *et al* 2005, personal observations)	SABAP Reporting rate (%)	SABAP2 Reporting rate (%)	Chance of occurrence at proposed development site
BLACK STORK *Ciconia nigra*	NT	Rivers, large dams, cliffs	1.3	1.2	Low
TAWNY EAGLE *Aquila rapax*	V	Open woodland to semi-desert	1.3	-	Low
MARTIAL EAGLE *Polemaetus bellicosus*	V	Open woodland to semi-desert	1.3	-	Low
AFRICAN CROWNED EAGLE *Stephanoaetus coronatus*	NT	Tall closed canopy forest, riparian forests and forested gorges in grassland	-	4.7	Very low
PEREGRINE FALCON *Falco peregrinus*	NT	Restricted to areas with large cliffs. Juveniles wander widely	-	1.2	Low
LANNER FALCON *Falco biarmicus*	NT	Open grassland and woodland near cliffs or electricity pylons breeding sites	1.3	4.7	Medium
AFRICAN FINFOOT *Podica senegalensis*	VU	Slow-flowing streams with overhanging branches	1.3	-	Very low
AFRICAN GRASS-OWL *Tyto capensis*	VU	Normally associated with pristine, well managed grasslands usually in close proximity of water, but	1.3	-	Very low

		also in alien vegetation structurally resembling tall grass.			
BROAD-TAILED WARBLER *Schoenicola brevirostris*	NT	Tall, rank grass along drainage lines.	1.3	5.9	Medium
RED-BILLED OXPECKER *Buphagus erythrorhynchus*	NT	Savanna woodland and bushveld with large ungulates.	-	2.4	Medium
BATELEUR *Terathopius ecaudatus*	V	Savanna woodland and bushveld	-	1.2	Low
HALF-COLLARED KINGFISHER *Alcedo semitorquata*	NT	Fast-flowing streams with clear water and well-wooded banks.	10.1	1.2	Medium
SECRETARYBIRD *Sagittarius serpentarius*	NT	Grassland, old agricultural lands, open woodland	-	1.2	Very low

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 majority of the habitat in the study area is comprised of woodland (see Table 2 below).

TABLE 2: Vegetation types in 2531AC (Harrison *et al* 1997)

Biome	**Vegetation type**	**2531AC**
Woodland	Arid woodland	9%
Woodland	Moist Woodland	91%

4.2.1 Woodland

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 *Gyps africanus*, Cape Vulture *Gyps coprotheres*, Martial Eagle, Tawny Eagle, and Lappet-faced Vulture *Torgos tracheliotis*. 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 likely that most of the species mentioned in the preceding paragraph still occur in the study area from time to time in suitable habitat, in areas where the woodland is still intact, with the exception of the Kori Bustard and Southern Ground-Hornbill. The state of the vegetation along the alignment varies from relatively intact in places, particularly in kloofs and on steep slopes, to a relatively poor state with evidence of heavy overgrazing and pedestrian traffic very evident near towns, industries and settlements. The satellite images of the study area in Figure 1 above give an indication of the extent of urbanization 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 bird habitats in the study area are presented in Appendix A.

Despite the impacts on the vegetation, important 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.

4.2.2 Drainage lines

The study area also contains an ephemeral drainage line with an associated wetland**.** Drainage lines and wetlands are important habitat for birds in that they act as corridors of microhabitat for waterbirds e.g. the Red Data Black Stork and Half-collared Kingfisher. 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 the Black Stork. A host of non-Red Data species is also dependant on drainage lines for food and shelter. It must be noted though that the drainage line and wetland in the study area are heavily impacted by cattle, pedestrian traffic and general urbanization (see Appendix A).

4.2.3 Agricultural lands

There are patches of agriculture and old lands along the proposed alignments. These areas are potentially important for power line sensitive species – Secretarybirds (Red Data status: near-threatened) often utilize open areas between woodland for foraging, and other large, non-threatened 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.

Appendix A contains a photographic record of the bird habitats 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 (Van Rooyen & Ledger 1999).

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) the area surrounding the proposed power line comprised entirely of undisturbed woodland. As a result it may have supported a number of power line sensitive species, particularly raptor species currently Red Data listed such as Martial Eagle, Tawny Eagle, Lappet-faced Vulture and also non-raptors such as Southern Ground Hornbill and Kori Bustard. However this area has long been transformed to accommodate a change in land use (i.e. agriculture and human settlements) 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 likely that many of the remaining Red Data species will still utilize the area from time to time. **Provided that large trees are not removed**, the clearing of woodland under the new line will not have a huge impact, especially in view of the already extensive impact that intensive urbanization have had on the vegetation layer. Furthermore, the clearing of the woodland coupled with the provision of perching space as a result of the electricity poles, might even draw in raptors. 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 should not affect regional or national populations in any significant way.

The proposed Hlau-Hlau substation will be situated in an agricultural clearing. It is unlikely that the larger species mentioned in this paragraph will be significantly adversely affected by the construction of the substation and the resultant loss of one hectare of agricultural land. This type of habitat is fairly well represented in the area and 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 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 Hlau-Hlau substation.

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

5.2 Collisions with the proposed power line

The larger storks and raptors listed in Table 1 are all vulnerable to collisions with power lines, e.g. the Black Stork, White-backed Vulture, Tawny Eagle, Bateleur, Martial Eagle and the Secretarybird in particular. The ephemeral drainage line and associated wetland might potentially hold some attraction for storks and other water birds 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, although the latter is likely to be deterred by the dense human settlements and associated disturbance levels. Other, non-Red Data species such as certain species of ducks, waders and possibly Hamerkops *Scopus umbretta* are also at risk of collisions where the proposed alignment crosses drainage lines and associated

floodplains. Overall, the collision risk is regarded to be **LOW-MEDIUM.** See Appendix B for a sensitivity map, indicating where the potential for collisions are located.

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 on a 132kV design is 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 White-backed Vultures could from time to time 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. However, the density of the human population, and the associated levels of disturbance, acts as a deterrent. The risk of electrocution is therefore evaluated to be **LOW**. It should be mentioned that the pole design holds no inherent electrocution risk for other large **solitary** species such as the majority of eagles. The Red Data species that have been recorded in the area are not gregarious, and will not perch together in large numbers next to each other.

6 CONCLUSIONS

The proposed Kabokweni 132kV power line will pose a limited threat to the birds occurring in the vicinity of the new infrastructure. More specifically, the power line poses a **low - medium** collision risk, mostly to non Red Data species and a **low** electrocution risk, in particular to vultures. The habitat transformation will also 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 harmed.

7 PREFERRED ALIGNMENT

A preferred alignment from a bird impact assessment perspective would be one that avoids natural woodland or wetland as much as possible, and/or, is situated within the zone of influence of factors that lessen the risk of interactions e.g close to existing roads or within urban areas. Option 2 comes the closest to this ideal (see Appendix B), it is therefore the preferred alignment from a bird impact perspective. Due to the significant impacts that are already evident in the study area, the overall impact on birds should be low, regardless of which option is used, therefore option one would also be an acceptable alternative.

8 RECOMMENDATIONS

The following recommendations are put forward for consideration:

- 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 2 below).

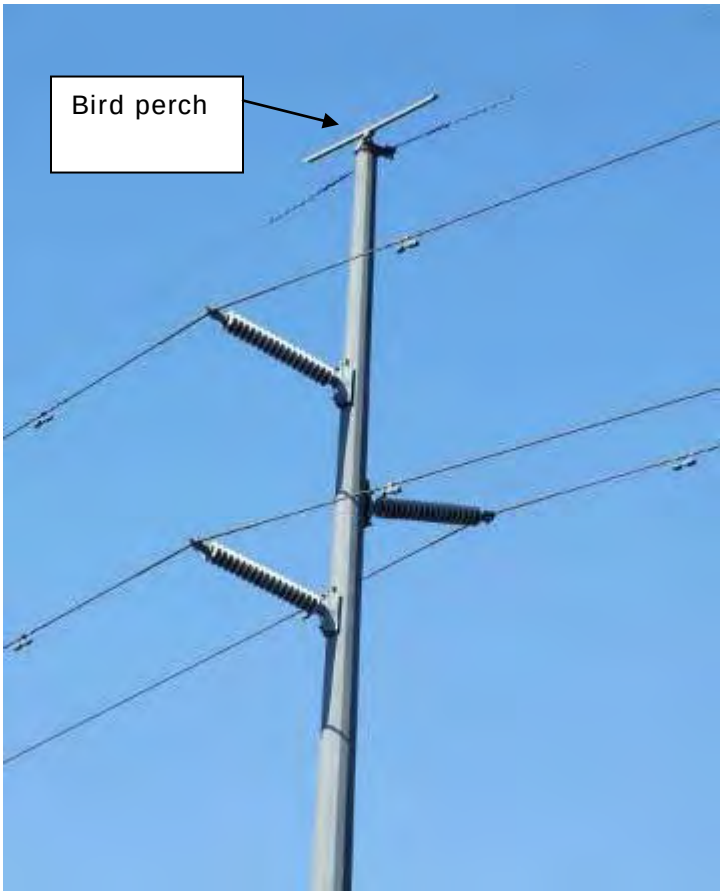

Figure 2: Steel mono-pole with bird perch

- The sections of the line that will require marking with Bird Flight Diverters are indicated in Appendix B.

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8 REFERENCES

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APPENDIX A BIRD HABITATS

Figure 1: Kabokweni Substation

Figure 2: An example of the impact of urbanization on the natural woodland in the study area.

APPENDIX A BIRD HABITATS

Figure 3: The drainage line and associated wetland in the study area.

Figure 4: Another view of the drainage line. Note the large tree and agricultural fields in the background.

APPENDIX A BIRD HABITATS

Figure 5: The site of the proposed Hlau-Hlau substation in an agricultural clearing.

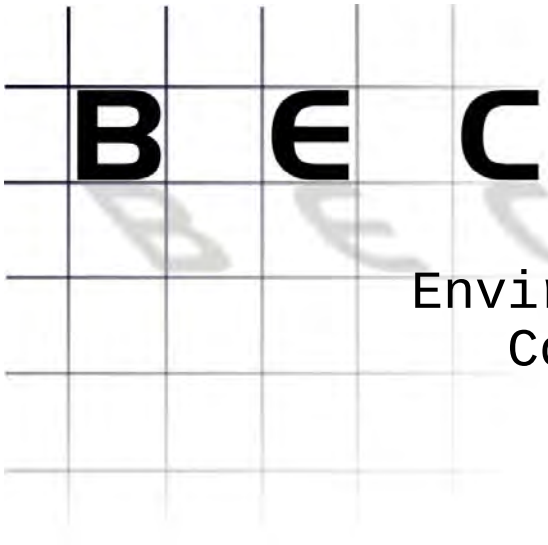
APPENDIX B SENSITIVITY MAP

APPENDIX D.2: BIODIVERSITY

Project code: SSI – KTL - 2011/08

Basic Floristic Assessment for the proposed 132kV Transmission Line between Kabokweni Substation & the proposed Hlau-Hlau Substation, Mpumalanga Province

compiled by



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October 2010

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I PROJECT DETAILS

Client:	SSI Engineers and Environmental Consultants (Pty) Ltd
Report name:	Strategic Floristic Basic Assessment for the proposed 132kV Line between the existing Kabokweni Substation and the proposed new Hlau-Hlau Substation, Mpumalanga Province.
Report type:	Floristic Basic Assessment Report
BEC Project number:	SSI – KTL – 2011/08
Authority Reference:	N/A
Compiled by:	Riaan A. J. Robbeson (Pr.Sci.Nat.), Bathusi Environmental Consulting cc

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III SPECIALIST INVESTIGATORS

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'.*

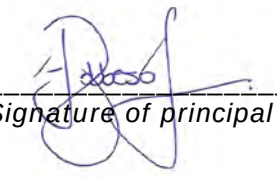
Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg 14).

Floristic Investigator:	**Riaan Robbeson (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of Expertise:	Botanical Scientist & Ecological Scientist
Registration Number:	*400005/03*
Affiliation:	Grassland Society of Southern Africa
Membership Status:	Professional Member
Membership Number:	*667.08/08*

IV DECLARATION OF INDEPENDENCE

All specialist investigators, project investigators and members of companies employed for conducting this biodiversity investigation declare that:

- we act as independent ecologists compiling this report
- we consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions;
- at the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development or activity as outlined in this document, other than financial compensation for work performed in a professional capacity in terms of the Environmental Impacts Assessment Regulations, 2005;
- we will not be affected in any manner by the outcome of the environmental process of which this report forms part of, other than being part of the general public;
- we do not have any influence over decisions made by the governing authorities;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2005;
- will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- we do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience; and
- should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.



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Signature of principal ecologist:

Bathusi Environmental Consulting cc (CK1999/052182/23)

_____
Name of company:

29th October 2010

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Date:

V LEGISLATION

Compliance with provincial, national and international legislative aspects is strongly advised during the planning, assessment, authorisation and execution of this particular project. Legislative aspects taken cognisance of during the compilation of this report included the following, but may not necessarily be limited to the following:

Table 1: Legislative guidance for this project	
Biodiversity Act (No. 10 of 2004)	To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.
Conservation of Agricultural Resources Act 43 of 1983	The conservation of soil, water resources and vegetation is promoted. Management plans to eradicate weeds and invader plants must be established to benefit the integrity of indigenous life.
Constitution of the Republic of South Africa (Act 108 of 1996)	The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.
Convention on Biological Diversity, 1995	International legally binding treaty with three main goals; conserve biological diversity (or biodiversity); ensure sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.
Convention on International Trade in Endangered Species of Wild Life and Fauna	International agreement between governments, drafted as a result of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 33,000 species of animals and plants.
Environmental Conservation Act (No. 73 of 1989)	To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.
National Environmental Management Act (No. 107 of 1998)	Requires adherence to the principles of Integrated Environmental Management (IEA) in order to ensure sustainable development, which, in turn, aims to ensure that environmental consequences of development proposals be understood and adequately considered during all stages of the project cycle and that negative aspects be resolved or mitigated and positive aspects enhanced.
National Environmental Management Act (No 10 of 2004)	Restriction of activities involving alien species, restricted activities involving certain alien species totally prohibited and duty care relating to listed invasive species.

Table 1: Legislative guidance for this project	
National Forest Act, 1998 (No 84 of 1998)	Cutting, disturbing, damaging or destroying any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of the subsection published by the Minister in the Gazette. The sections include protected tree species, a particular tree, a group of trees or particular woodland to be a protected tree, group of trees, woodland or species. In terms of section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire of dispose of any protected tree, except under a licence granted by the Minister.
Protected Areas Act (No. 57 of 2003)	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

VI GLOSSARY OF TERMS

Alternatives: A possible course of action, in place of another, that would meet the same purpose and need but which would avoid or minimize negative impacts or enhance project benefits. These can include alternative locations/sites, routes, layouts, processes, designs, schedules and/or inputs. The "no-go" alternative constitutes the 'without project' option and provides a benchmark against which to evaluate changes; development should result in net benefit to society and should avoid undesirable negative impacts.

Biome: Any major ecological community of organisms, usually characterized by a dominant vegetation type.

Cumulative impacts: The combined or additive effects on biodiversity or ecosystem services over time or in space. They may seem to be insignificant when seen in isolation, but collectively they have a significant effect

Direct impacts: Those that take place at the same time and in the same space as the activity, e.g. clearing of natural vegetation for agriculture.

Direct, indirect and cumulative impacts: Decision makers need to know the direct, indirect and cumulative impacts of a proposed activity on the environment, if they are to take informed decisions in line with sustainable development.

Do-nothing Alternative: The option of not undertaking the proposed alternative.

Ecologically sensitive ecosystem: One where relatively even minor disturbances may result in substantial and significant changes.

Ecosystems: Include living (e.g. plants, animals) and non-living (e.g. minerals, soil, water) components, which can be defined in terms of distinguishing characteristics (e.g. a wetland ecosystem, a freshwater ecosystem, a terrestrial ecosystem, a forest ecosystem, etc.).

Endemic or range-restricted species or ecosystem: One whose distribution is confined to a particular and often very limited geographical region.

Environment: Broadly covers our surroundings and the characteristics of those surroundings that influence our health and wellbeing. That is, the environment includes all living organisms (plants, animals and other life), the physical environment (land, water and air), as well as social, economic and cultural conditions. Sometimes we speak of 'the natural environment' and 'the built environment', to differentiate between natural and man-made systems.

Habitat: The place or type of site where an organism or population naturally occurs.

Indigenous: Native to a particular area.

Impact assessment: A process that is used to identify, predict and assess the potential positive and negative impacts of a proposed development (including reasonable alternatives) on the environment, also proposing appropriate management actions and monitoring programmes. Impact assessment is used to inform decision-making by the project proponent, relevant authorities and financing institutions. The process includes some or all of the following components: screening, scoping, impact assessment and decision-making.

Indirect impacts: Occur later in time or at a different place from the activity, e.g. extraction of groundwater for irrigation leads to changes in the water table and affects distant water users.

Irreplaceable loss: When it results in the loss of a resource without substitute, and which cannot be replaced. An impact leading to irreplaceable loss of biodiversity is, by definition, irreversible

Irreversible impact: One that arguably cannot be reversed in time (e.g. decrease in area of a specific vegetation type, loss of genetic diversity through reduction in size of populations of a particular species). Some, but not all, irreversible impacts will lead to irreplaceable loss of biodiversity. They may, or may not, be acceptable to society or stakeholders in terms of their current values

Issue: A context-specific question that asks "what, or how severe, will the impact of some activity/aspect of the development be on some element of the environment?"

Natural resources: Include living and non-living materials that can be exploited or used by people. Natural resources form part of ecosystems, and our living natural resources contribute to biodiversity. Some people use 'natural resources' to mean the same thing as biodiversity or ecosystem services.

Precautionary Principle: States that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Protected area: As defined by National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003).

Protected species or ecosystem: One that is protected by law from particular activities and land uses.

Red Data Book' or 'Red List': Provides information on threatened species.

Significance: A term used to evaluate how severe an impact would be, taking into account objective or scientific data as well as human values. A specific significance rating should not be confused with the acceptability of the impact (i.e. an impact of low significance is not automatically "acceptable").

Species: A group of plants, animals, micro-organisms or other living organisms that are morphologically similar; that share inheritance from common ancestry; or whose genes are so similar that they can breed together and produce fertile offspring.

Sustainable development: Development that meets the needs of the current generation without compromising the ability of future generations to meet their own needs and aspirations, or improving the quality of human life while living within the carrying capacity of supporting ecosystems".

Threatened species or ecosystem: Species/ Ecosystems that are at risk of going extinct in its natural range. It may be 'critically endangered' at extremely high risk, 'endangered' at very high risk, or 'vulnerable' at high risk. Species or ecosystems at low or no risk are not 'threatened', and fall into the 'near threatened' or 'least concern' categories.

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2 EXECUTIVE SUMMARY

2.1 Biophysical Environment

The proposed power line will be located between the existing Kabokweni and the new Hlau-Hlau Substation, located in the Mbombela Local Municipality. Urban settlement characterise much of the area with limited areas of natural remaining woodland habitat, mostly confined to areas that are inaccessible to the community die to high slopes.

The study area is situated within the Komati/ Crocodile Catchment Area. Aquatic habitat types of the study area include rivers and streams. No known wetlands, springs or major dams occur within close proximity of any of the line or substation alternatives. A visual assessment of parts of the larger rivers revealed that the general status of the riparian habitat in the region is regarded poor. Infestation by exotic vegetation is noted and the water quality appears to be poor because of the dumping of litter and waste and the domestic use of the rivers. In addition, informal sand mining operations are affecting the status of the larger rivers in the area and unidentified construction activities are also currently taking place within the larger river.

A visual assessment of the region revealed that the study area comprises various areas where significant slopes are present. Areas of significant slopes are regarded as sensitive in terms of biodiversity attributes. The altitude of the study area ranges between 600 and 700m above sea level. The study area is situated within the Savanna Biome, comprising the following VEGMAP vegetation types:

- Legogote Sour Bushveld (Endangered status);
- Malelane Mountain Bushveld (Least Threatened status); and
- Pretoriuskop Sour Bushveld (Least Threatened status).

The study area falls entirely within the Nelspruit Granites and represents Intrusive rocks of Potassic granite and granodioritic origin while the Ae132 and Fa341 land types are represented. The Kruger National Park is located approximately 14km to the east of the proposed development and is unlikely to be affected by the proposed development.

Classification of the Terrestrial Biodiversity Classification categories (Figure 7) of the study area is as follows:

- Areas of Least Concern – natural areas with most choices, including for development (restricted development); and
- Areas with No Natural Habitat Remaining – transformed areas that do not contribute to meeting conservation targets (no restrictions).

The proposed activity correlates to Land Use no. 12 (Linear Engineering Structures).
Aspects that were identified as being important in terms of biodiversity on a regional scale include the following aspects:

- All areas of surface water, including streams and rivers;
- All areas of significant slopes (existing database are inadequate in this regard); and
- Legogote Sour Bushveld vegetation type, comprising a relative small portion of the northern section of the proposed lines.

The impact of the proposed lines are not expected to contribute to the loss or cumulative impacts on any of biophysical aspects on a local or regional scale, in spite of the alteration of habitat that is associated with powerlines in a woodland environment.

2.2 Flora

The study area is situated within the 2531AC ¼-degree grid. Available SANBI information indicates the known presence of approximately 544 plant species within this grid, reflecting the high diversity associated with this region. A dissemination of the floristic diversity indicates the woodland physiognomy of the region, being dominated by a well-developed woody layer with a diverse undergrowth of herbs, grasses, geophytes and Cyperoid species.

The species diversity of the region is represented by 118 plant families, dominated by Fabaceae, Asteraceae, Poaceae, Malvaceae, Cyperaceae and Rubiaceae.

Because of the high levels of transformation and other human influences, the vegetation of the region is characterised by mosaical appearances, displaying numerous 'fence effects' across the study area, caused by different management strategies. Physiognomic variation of the vegetation indicates the presence of a range of vegetation units along the proposed sub-Transmission line alternatives. Criteria used to identify these units include physiognomy, land use, state of degradation and general environmental attributes. Based on preferred criteria the following units were identified:

- Terrestrial woodland vegetation/ Hills/ Rocky Outcrops (Medium-High sensitivity);
- Riparian vegetation (Medium-High sensitivity);
- Secondary/ degraded vegetation (Medium-Low sensitivity); and
- Settlement areas (Low sensitivity).

SANBI records for the region indicate the presence of 14 flora species of conservation importance. Various individuals of *Sclerocarya birrea* (Marula) was observed within the study area. It is also likely that species such as *Combretum imberbe* (Leadwood), *Philenoptera violaceae* (Apple-leaf) and *Pterocarpus angolensis* (Wild Teak) and *Breonadia salicina* (Matumi) could be present within the study area, as they are known to occur in the general region. These individuals are protected under the National Forest Act, 1998 (No 84 of 1998) and it should be noted that an application needs to be submitted prior to the damage, cutting, pruning or removing of any individual. A number of declared weeds and exotic species occur in the region of the study area.

Option 1 is recommended as the preferred option.

The preferred option is recommended based on the extent of sensitive habitat (rocky outcrops/ hills) that will be affected as well as the nature of the crossing of the major river in the area. Protected trees (*Sclerocarya birrea*) occurring extensively throughout the region, will be affected with either of the options, and therefore do not affect the recommendation.

The proposed Hlau-Hlau Substation is located in an agricultural field where no natural habitat remains. No aspects of sensitivity are present within this area and the construction and operational activities are not expected to result in significant impact on the floristic environment.

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive as it involves the removal of vegetation and alteration of habitat. Impacts were placed in three categories, namely:

- **Direct impacts:**
  - Destruction of threatened and protected flora species;
  - Destruction of sensitive/ pristine habitat types;
- **Indirect Impacts:**
  - Floristic species changes subsequent to development;
  - Impacts on surrounding habitat/ species;
- **Cumulative Impacts:**
  - Impacts on SA's conservation obligations & targets (VEGMAP vegetation types);
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation.

Mitigation measures are generally aimed at limiting the extent of surface impacts during the construction phase. The loss of vegetation associated with the clearance of servitude is not expected to result in significant impacts on the flora on a local or regional scale. It is however recommended that a final walk-through be conducted in order to georeference and mark all protected tree species within the approved servitude as an application need to be submitted prior to any damage to these individuals.

3 TERMS OF REFERENCE

The major objective of this Basic Floristic Assessment is to establish the potential presence/ absence of floristically sensitive areas or species within the proposed project alternatives and to recommend a preferred alignment based on results of the field assessments and available desktop knowledge.

The Terms of Reference for this floristic investigation are as follows:

- Obtain all relevant Précis and Red Data flora information;
- Conduct a photo analysis of the proposed area;
- Identify preliminary floristic variations;
- Survey preliminary habitat types to obtain a broad understanding of the floristic diversity;
- Assess the potential presence of Red Data flora species according to information obtained from SANBI;
- Incorporate existing knowledge of the study area, including the MBCP database;
- Describe broad habitat variations present in the study area in terms of biophysical attributes and phytosociological characteristics;
- Compile a floristic sensitivity analysis;
- Incorporate results into the Basic Impact Evaluation;
- Map all relevant aspects;
- Recommend a preferred alignment; and
- Present all results in a suitable format.

4 INTRODUCTION

Destructive activities in a natural environment require vigilance to ensure that the biological and cultural heritage of future generations is not adversely affected by activities of today. Concern is growing about the consequences of biodiversity losses for ecosystem functioning, for the provision of ecosystem services, and for human well being.

Why is Biodiversity Conservation Important? Biodiversity sustains life on earth. An estimated 40 percent of the global economy is based on biological products and processes. Biodiversity has allowed massive increases in the production of food and other natural materials, which in turn have fed the (uncontrolled) growth and development of human societies. Biodiversity is also the basis of innumerable environmental services that keep humans and the natural environment alive – from the provision of clean water and watershed services to the recycling of nutrients and pollination.

Current pressures on and losses of biodiversity are unfortunately threatening to undermine the functionality of natural ecological processes and adaptive responses of the environment. The last few centuries have witnessed brutal increases in the rate at which biodiversity is being altered by humanity. With uncontrolled growth of human population, consumption needs have increased exponentially as well as the drive to extract more economically valuable resources at ever-faster rates. Natural habitats that harbour some of the world's most valuable biodiversity are being lost at increasingly faster and over progressively wider areas, while managed lands are undergoing increasing simplification.

Adopting 'biodiversity friendly' practices remains challenging within the entire developmental sphere, especially for small companies and peripheral players. This is partly because governments, while perhaps committed on paper to biodiversity, have found it difficult to create the right incentives and apply the necessary regulations in a way that could encourage all players to conserve biodiversity.

Humanity faces the challenge of supporting the needs of growing populations from a rapidly shrinking natural resource base. Achieving a balance while doing this will require a better understanding and recognition of conservation and development imperatives and this is only a step towards more strategic and integrated approach to land use planning and management that helps societies make better-informed decisions. Evidence illustrate how management tools, rehabilitation and restoration processes, together with improved scientific knowledge, can help conserve biodiversity; also highlighting that mutual benefits can result from stronger collaboration between the mining and conservation sectors. Good practice, collaboration and innovative thinking can advance biodiversity conservation worldwide while ensuring that the minerals and products that society needs are produced responsibly.

In 1992, the Convention of Biological Diversity, a landmark convention, was signed by more than 90 % of all members of the United Nations. The enactment of the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004), together with the abovementioned treaty, focuses on the preservation of all biological diversity in its totality, including genetic variability, natural populations, communities, ecosystems up to the scale of landscapes. Hence, the local and global focus changed to the sustainable utilisation of biological diversity.

Bathusi Environmental Consultants (BEC) has been appointed as independent floristic specialists to conduct a strategic basic assessment of the environment that will be affected by this proposed development.

5 LIMITATIONS OF THIS INVESTIGATION

Although care was taken to ensure the proper investigation the study area, it is only reasonable to expect that not all areas could be investigated in detail and not all species could be located or identified during a single survey that was ultimately conducted during the winter period. Because rare and endemic species normally do not occur in great densities and because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible and results are ultimately based on estimations.

Results presented in this report are based on a snapshot investigation of the study area and not on the detailed long-term investigation of all environmental attributes and the varying degrees of biological diversity that may be present in the study area. No concrete conclusions may therefore be drawn concerning biological diversity or conservation strategies as far as this study area is concerned.

It is emphasised that information, as presented in this document, only have bearing on the site as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.

Furthermore, additional information may become known during a later stage of the process or development. This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.

6 APPROACH TO THIS BASIC FLORISTIC ASSESSMENT

While a proper knowledge of the flora of the study area is not negotiable to the ultimate success of this project, an attempt was made to remove any subjective opinions that might be held on any part of the study area as far as possible. Inherent characteristics of a project of this nature implies that no method will be foolproof, mainly as a result of shortcomings in available databases and lack of site specific detail that could be obtained from limited detailed site investigations conducted over a short period of time. It is an unfortunate fact that inherent sensitivities within certain areas are likely to exist that could not be captured or illustrated during the process. This is a shortcoming of every scientific study that has ever been conducted, as it simply is not possible to know everything or to consider aspects to a level of molecular detail. However, the approach followed in this study is considered effective in presenting objective comments on the comparison of biodiversity sensitivities of different parts of the study area.

In order to present an objective opinion of the floristic sensitivity of the study area and how this relates to the suitability/ unsuitability of any area within the site in terms of the proposed development, all opinions and statements presented in this document are based on the following aspects, namely:

- A desk-top assessment of all available biological and biophysical data;
- Specialist interpretation of available data, or known sensitivities of certain regional attributes;
- Augmentation of existing knowledge by means of site specific and detailed field surveys;
- A GIS analysis, mapping and description of results obtained from the process; and
- An objective impact evaluation process, estimating potential impacts on floristic and biophysical attributes.

This investigation therefore aims to:

- Determine the floristic sensitivity of the receiving environment as it relates to the construction and operation of the substation plant and power lines in a natural environment;
- Highlight the known level of floristic information of the region;
- Highlight flora species of conservation importance that are likely to occur within the study area;
- Estimate/ evaluate the level of potential impacts of the construction and operation of proposed power lines on the floristic resources of the study area;
- Apply the Precautionary Principal throughout the assessment[1].

[1] (www.pprinciple.net/the_precautionary_principle.html).

6.1 Assessment of Biophysical Attributes

Available databases of biophysical attributes are implemented to identify regional areas of importance as it relates to biodiversity. Biophysical attributes that are known to be associated with floristic aspects of importance, conservation potential or natural status of the environment were implemented to compile the ecological sensitivity analysis of the study area. These attributes include the following:

- Areas of known biological importance (ENPAT, MBCP);
- Areas of surface water (ENPAT);
- Degradation classes (ENPAT Land Cover Classes);
- Regional vegetation types (VEGMAP);
- Land cover categories (ENPAT); and
- Ridges and outcrops.

6.2 Floristic Assessment

6.2.1 ***General Floristic Attributes***

The vegetation investigation is based on a variation of the Braun-Blanquet method whereby vegetation is stratified on aerial images with physiognomic[2] characteristics as a first approximation. These initial stratifications are then briefly surveyed for floristic diversity during a site investigation and ultimately subjected to a desktop analysis to establish differences/ similarities between observed units.

In preparation for the site survey, physiognomic homogenous units are identified and delineated on digital aerial photos, using standard aerial photo techniques. A site visit was conducted to examine the general floristic attributes and -diversity of the study area.

A desktop analysis of sample data was conducted to establish differences/ similarities between delineated vegetation units, which were subsequently described in terms of species composition and dominance as well as driving (developmental) environmental parameters. Preliminary results and species lists that are provided should be interpreted with normal liabilities in mind.

Use is also made of existing floristic information that is captured in two main databases, namely the PRECIS data obtained from the SANBI website as well as VEGMAP information.

[2] Physiognomy refers to the visual appearance of vegetation in terms of different growth classes, biomass, height, etc.

6.2.2 ***Red Data Flora Probabilities***

Red Listed flora information, as presented by SANBI was used as a point of departure for this assessment. A snapshot investigation of an area represents a severe limitation in terms of locating and identification potential Red Data flora species, particular emphasis is placed on the identification of habitat deemed suitable for the possible presence of Red Listed plant species. Associating the suitability of the habitat to known habitat types of Red Data flora species a level of sensitivity can be ascribed to habitat types. The probabilities of these particular species occurring in the area are estimated, taking the habitat preferences of these species into account.

6.2.3 ***Floristic Sensitivity***

The aim of this exercise is to determine the inherent sensitivity of vegetation communities by means of the comparison of weighted floristic attributes. Results of this exercise are not 'stand-alone' and will eventually be presented in conjunction with results obtained from the faunal investigation.

The first step in the process is the identification of **Sensitivity Criteria**. These criteria represent floristic attributes of the area that contribute towards the inherent sensitivity/ degradation of the different vegetation types. A **Weighting** is applied to each of the Sensitivity Criterion and this is determined by means of ranking of each criterion against all other Sensitivity Criteria, placing the criteria on a scale of increasing importance from 1 to 10, where 10 represents the highest importance category and 1 the lowest.

Each vegetation unit is subjectively rated on a scale of 1 to 10 (**Sensitivity Values**) in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are multiplied with the respective Criteria Weighting, which emphasises the importance/ triviality that the individual Sensitivity Criteria have on the status of each community. **Ranked Values** are then added and expressed as a percentage of the maximum possible value (**Floristic Sensitivity Value**) and placed in a particular class, namely:

High	80% – 100%
Medium – high	60% – 80%
Medium	40% – 60%
Medium – low	20% – 40%
Low	0% – 20%

This method is considered effective in highlighting sensitive areas, based on observed floristic attributes rated across the spectrum of communities. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics, e.g. human impacts, size, fragmentation are important in assessing the status of the various communities.

High Sensitivity Index Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological effective manner. These areas can be compared to nature reserves and even well managed farm areas. Low Sensitivity Index Values indicate areas of lower ecological status or importance in terms of vegetation attributes, or areas that have been negatively affected by human impacts or poor management. Sensitivity Criteria employed in assessing the floristic sensitivity of separate units may vary between different areas, depending on location, type of habitat, size, etc. As part of this analysis the following factors were assumed as important in determining the sensitivity of vegetation units of this particular site:

- Habitat suitability for the potential presence of Red Listed species;
- Landscape or habitat significance;
- Floristic status;
- Plant species diversity; and
- Ecological performance/fragmentation.

6.3 Impact Evaluation

To ensure a direct comparison between various specialist studies, six standard rating scales are defined and used to assess and quantity identified impacts. The rating system used for evaluating impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on three criteria, namely:

- The relationship of the impact/issue to temporal scales;
- The relationship of the impact/issue to spatial scales; and
- The severity of the impact/issue.

These three criteria are combined to describe the overall importance rating, namely the significance.

6.3.1 ***Temporal Scale***

The temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact:

- Short term - less than 5 years;
- Medium term - between 5 and 15 years;
- Long term - between 15 and 30 years; or
- Permanent - over 30 years and resulting in a permanent and lasting change that will always be there.

6.3.2 ***Spatial Scale***

The spatial scale defines physical extent of the impact:

- Individual - applies to person/s in the area;
- Household - applies to households in the area;
- Localised - small scale impacts- from a few hectares in extent to local district area;
- Regional – Provincial;
- National - South Africa; or
- International – applies outside of South Africa's borders.

6.3.3 ***Severity/Beneficial Rating Scale***

The severity scale is used in order to evaluate how severely negative, or beneficial, a specific impact would be on a particular affected system or a particular affected party. It attempts to remove any value judgements from the assessment, although it does rely on the professional judgement of the specialist:

- Very severe - an irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated;
- Severe - long term impacts on the affected system(s) or party(ies) that could be mitigated, but would be difficult, expensive or time consuming or some combination thereof;
- Moderately severe - medium to long term impacts on the affected system(s) or party(ies), that could be mitigated;
- Slight - medium or short term impacts on the affected system(s) or party(ies) with easy, cheap, less time consuming or not necessary mitigation measures required; or
- No effect - the system(s) or party(ies) is not affected by the proposed development.

6.3.4 ***Significance Scale***

This aspect evaluates the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgement. A five-point significance scale has been applied:

- Very High - considered by society as constituting a major and usually permanent change to the natural environment, and usually result in severe or very severe effects;
- High - usually result in long-term effects on the natural environment, need to be considered by society as constituting an important and usually long-term change to the natural environment. Society would probably view these impacts in a serious light;

- Moderate - usually result in medium to long-term effects on the natural environment, need to be considered by society as constituting an important and usually medium term change to the natural environment. These impacts are real but not substantial;
- Low - usually result in medium to short-term effects on the natural environment, need to be considered by the public and/or the specialist as constituting a unimportant and usually short term change to the natural environment. These impacts are not substantial and are likely to have little real effect; or
- No Significance - no primary or secondary effects at all that are important to scientists or the public.

Impacts are evaluated prior and subsequent to the application of mitigation measures as well as during the construction and operational phases of the project.

7 THE BIOPHYSICAL ENVIRONMENT

7.1 Location

The proposed sub-Transmission line will be located between the existing Kabokweni Substation (approximate GPS location S 25.34817° & E31.12045°) and the new Hlau-Hlau Substation (approximate GPS location S 25.37217° & E31.14238°) (Figure 1). The proposed sub-Transmission line is located in the Mbombela Local Municipality, within the Kabokweni, Ngodini and Hlau-Hlau settlements. A Google Earth image of the region is presented in Figure 2.

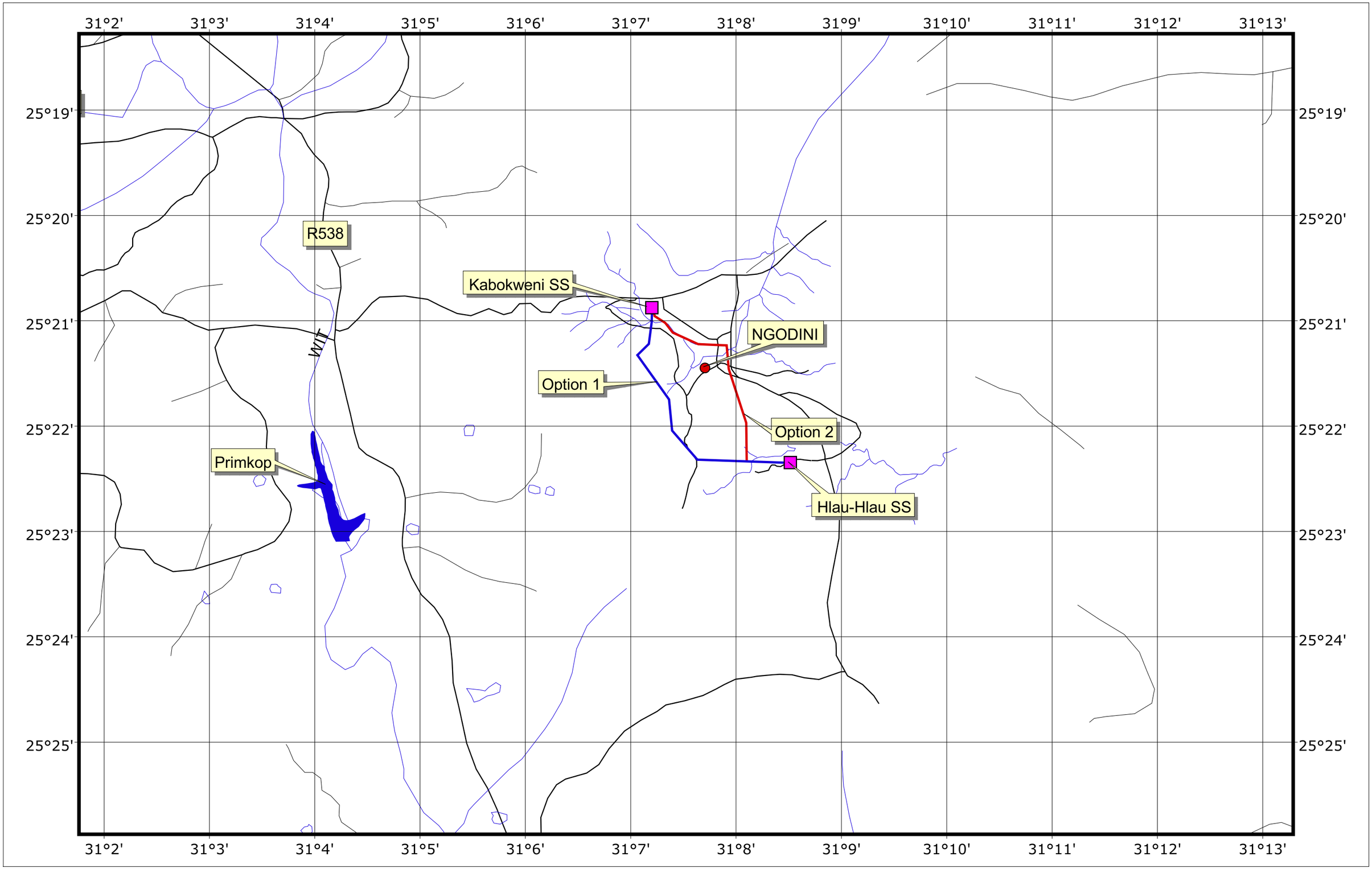
7.2 Land Cover & Land Use of the Region

Ground truthing of the region during the survey period revealed several discrepancies between the actual status and captured data within the ENPAT datasets (Figure 3). The extent of the urban settlement areas have increased significantly since the original data capturing and much of the area comprises informal settlement areas where small households and plots have been established (compare Figure 2). This represents the increase in the Ngodini rural area. Consequently the extent of natural habitat have decreased significantly, exhibiting the classical effects of nearby settlements that relies on the natural environment for much of their energy needs in the form of firewood obtained from nearby trees. Similarly, the absence of formal services has resulted in the degradation of the environment due to litter, dumping, increase in road infrastructure, erosion, etc.

Some areas that are inaccessible to the community due to high slopes or distance away from the settlement represents the remaining natural woodland habitat of the region.

In terms of biodiversity, a clear distinction is made between areas that are affected or inhabited by humans and areas where the infrastructure, or effects of humanity, is largely absent. Much of the endemic biodiversity of an area disappears as the impacts of human occupation of a region increases. This is mainly the result of habitat transformation and decimation of resources required by animals and plants.

Figure 1: Regional setting of the study area



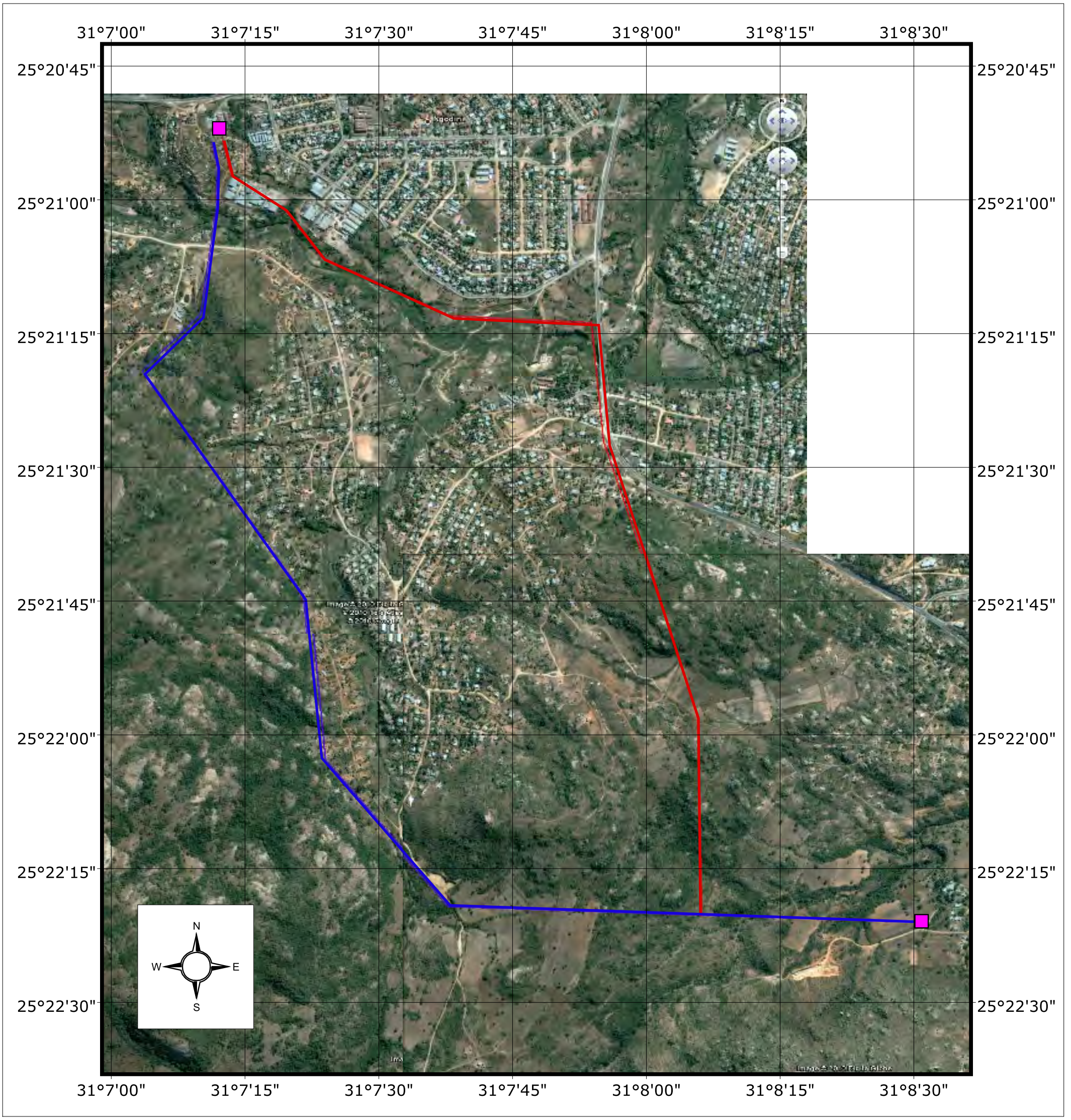
Option 1
Option 2
Dams
Rivers

Towns
Small roads
Roads
National Roads

1 0 1 2 3 4 5 6 7 8 9 10 11 Kilometers

N
W
E
S

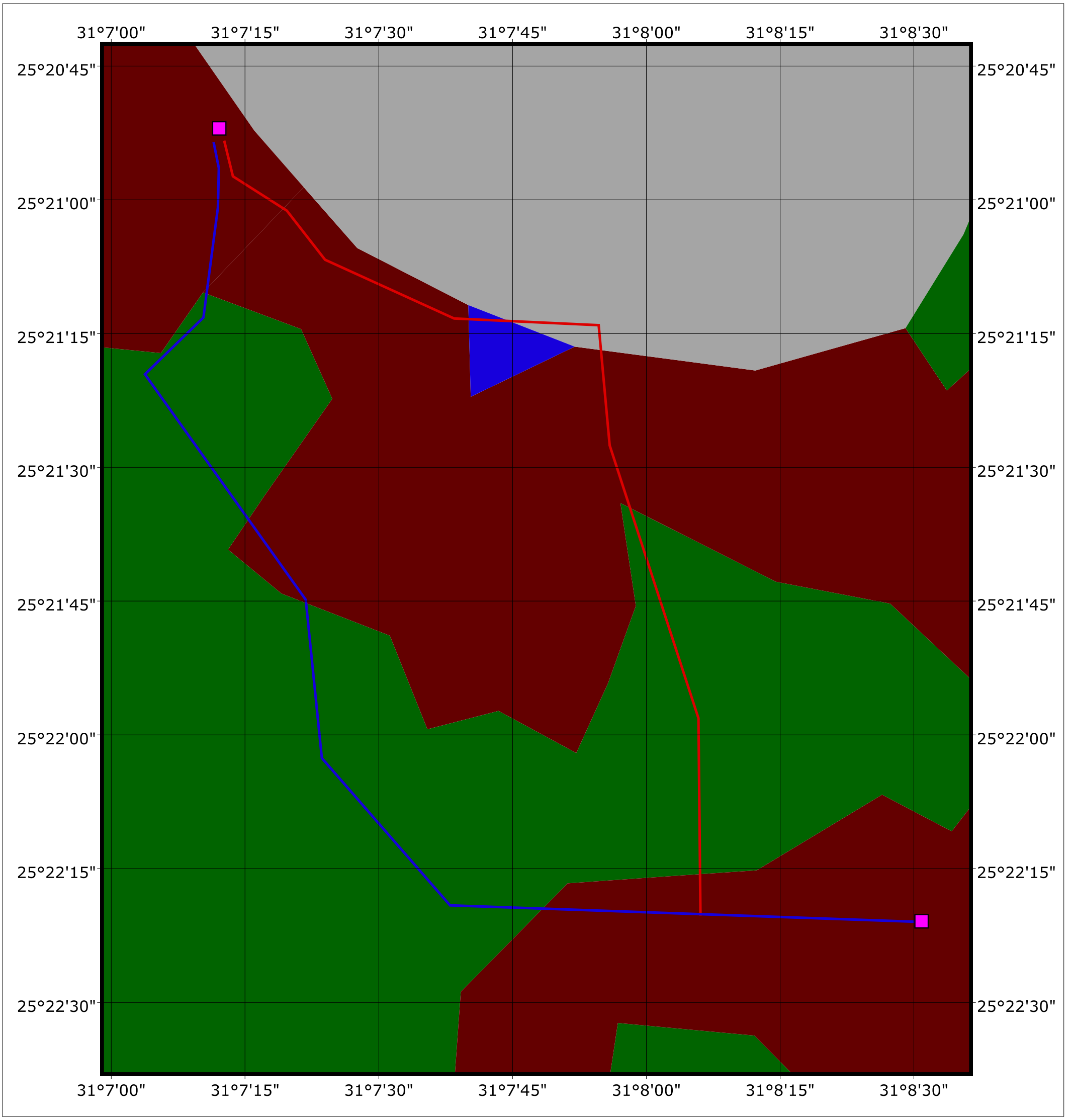
Figure 2: Google Earth image of the region



Option 1
Option 2

0.5 0 0.5 1 1.5 Kilometers

Figure 3: Land cover categories of the study area


31°7'00"
31°7'15"
31°7'30"
31°7'45"
31°8'00"
31°8'15"
31°8'30"
25°20'45"
25°21'00"
25°21'15"
25°21'30"
25°21'45"
25°22'00"
25°22'15"
25°22'30"
Option 1
Option 2
0.5
0
0.5
1
1.5 Kilometers
Land Cover Categories
Degraded forest and woodland
Thicket & bushland (etc)
Urban / built-up land
Waterbodies
N
W
E
S

7.3 Surface Water

Areas of surface water contribute significantly towards the local and regional biodiversity of any area due to the atypical habitat that is available within ecotonal habitat types on the fringes of aquatic habitat types. These ecotones (areas or zones of transition between aquatic and terrestrial habitat types) are frequently occupied by species that occur in both the bordering habitat types. In addition, many flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas and exhibits extremely narrow habitat variation tolerance levels. These areas therefore generally comprise high biodiversity in relative small areas. These areas are also traversed by all terrestrial animals that utilise water sources on a frequent basis. Ecotonal interface areas form narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering species richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds. All areas of surface water are therefore regarded highly important in terms of biodiversity attributes.

The study area is situated within the Komati/ Crocodile Catchment Area. Aquatic habitat types of the study area include rivers and streams. No known wetlands, springs or major dams occur within close proximity of any of the line or substation alternatives. The physical heterogeneity of parts of the study area is reflected in the numerous smaller streams and drainage lines that are encountered throughout the region. A visual assessment of parts of the larger rivers revealed that the general status of the riparian habitat in the region is regarded poor. Infestation by exotic vegetation is noted and the water quality appears to be poor because of the dumping of litter and waste and the domestic use of the rivers. In addition, informal sand mining operations are affecting the status of the larger rivers in the area and unidentified construction activities are currently taking place within the larger river.

Because of the relative poor water quality of the aquatic environment, the rivers are ultimately not expected to contribute as much to the regional biodiversity as could be expected in an areas with lower impacts. The regional distribution of areas of surface water is illustrated in Figure 4.

Figure 4: Areas of surface water in the region of the study area

31°7'00" 31°7'15" 31°7'30" 31°7'45" 31°8'00" 31°8'15" 31°8'30"

25°20'45"
25°21'00"
25°21'15"
25°21'30"
25°21'45"
25°22'00"
25°22'15"
25°22'30"

N
W E
S

Option 1
Option 2

0.5 0 0.5 1 1.5 Kilometers

Rivers

7.4 Ridges & Topography

Varied topography is recognised as one of the most powerful influences contributing to the high biodiversity of southern Africa. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The richness and diversity of flora has been found to be significantly higher in sites with high geomorphological heterogeneity and it can reasonably be assumed that associated faunal communities will also be significantly more diverse in spatially heterogeneous environments.

Ridges and rocky outcrops are characterised by high spatial heterogeneity due to the range of differing aspects (north, south, east, west and variations thereof), slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. Temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. It follows that ridges will be characterized by a particularly high biodiversity.

Many Red Data/ threatened species of plants and animals inhabit ridges. Due to their threatened status, Red Data species require priority conservation efforts in order to ensure their future survival. Ridges may have a direct effect on temperature/radiation, surface airflow/wind, humidity and soil types. Ridges also influence fire in the landscape, offering protection for those species that can be described as “fire-avoiders”. Because of the influence of topography on rainfall, many streams originate on ridges and control water inputs into wetlands. The protection of the ridges in a natural state will thus ensure the normal functioning of ecosystem processes. In contrast, development of a ridge will alter these major landscape processes. For example, water runoff into streams and wetlands will increase.

A visual assessment of the region revealed that the study area comprises various areas where significant slopes are present. These areas are however not reflected in the ENPAT database, which was based on a high contour interval (100m). With the use of more detailed data (20m or 5m), the identification of smaller areas of significant slopes will be possible. The study area is situated within the “Strongly Undulating Lands” topographical category. Areas of significant slopes are regarded as sensitive in terms of biodiversity attributes. Ridges will be identified and mapped as part of the floristic assessment (Section 8). The altitude of the study area ranges between 600 and 700m above sea level.

7.5 Regional Vegetation - VEGMAP

The following VEGMAP (Mucina & Rutherford, 2006) vegetation types will be affected by the proposed development (Figure 5):

- Legogote Sour Bushveld;
- Malelane Mountain Bushveld; and
- Pretoriuskop Sour Bushveld.

The study area is situated within the Savanna Biome, characterised by a herbaceous layer that is usually dominated by grass species and a discontinuous to sometimes very open tree layer. The woody component often forms an irregular series of interlocking, often low, canopies with openings and sometimes little distinction can be made between tall shrubs and small trees. 'Savanna grasslands' may grade into 'Tree savanna', 'Shrub savanna', Savanna woodland' or 'Savanna parkland'. Structure of the woody component of savanna is important to animals – for example tree height, which determines the available browse, dense woody entanglements forming impenetrably barriers, availability of shade and protection against predators or scavengers, etc.

Floristically similar vegetation can be structurally different, but there is often an excellent correlation between vegetation patterns and soil types, with much floristic variation along rainfall gradients, even with similar substrates. In addition, there are most often major differences in the herbaceous layer under canopies and areas between tree canopies; woody plants can serve as sites of protection for certain grass species. Soil nutrient enrichments and increased soil organic matter is found underneath trees, especially large ones, due to various mechanisms including leaf litter, stem flow and throughfall of rain and N-fixation under leguminous trees. Thinning or even total removal of savanna trees is a common practice to counter the apparent suppression of herbaceous plants to improve grazing.

7.5.1 ***Legogote Sour Bushveld***

Original area (ha)	353,814ha
Remaining area	178,073ha
% Protected	1%
Threat Status	Endangered

This vegetation type consists of dense woodland along the upper pediment slopes dominated by tree species such as *Parinari curatellifolia, Bauhinia galpinii, Combretum zeyheri, Faurea saligna* and *Acacia caffra*. It gives way to open woodland on the plains that were historically dominated by *Acacia sieberiana* var. *woodii* and tall graminoids such as *Hyperthelia dissoluta, Hyparrhenia cymbaria* and *H. hirta*.

Exposed granite outcrops represent a prominent feature in the north and east of the study site and comprise of a low vegetation cover with *Englerophytum magalismontanum* and

various succulent growth forms such as *Aloe spicata* and *A. petricola* (a localised species, albeit common around Nelspruit). Legogote Sour Bushveld provides habitat for four tree species currently protected in terms of the National Forests Act, 1998 (Act No. 84 of 1998); namely *Sclerocarya birrea* subsp. *caffra* (Marula), *Combretum imberbe* (Leadwood), *Philenoptera violaceae* (Apple-leaf) and *Pterocarpus angolensis* (Wild Teak). It also provides habitat for the endemic and "critically endangered" succulent *Aloe simii*.

This vegetation type is Endangered and only about 2% is statutorily conserved in the Bosbokrand and Barberton Nature Reserves. At least a further 2% is conserved in private reserves including the Mbesan and Kaapsehoop Reserves and Mondi Cycad Reserve. It has been greatly transformed (50%), mainly by plantations and also by cultivated areas and urban development. Scattered alien plants include *Lantana camara, Psidium guajava* and *Solanum mauritianum*. Erosion is very low to moderate. At places on the footslopes, this vegetation becomes very dense and is transitional to forest in kloofs on the eastern slopes of the escarpment.

Tall Trees:
Pterocarpus angolensis and *Sclerocarya birrea* subsp. *caffra*.

Small Trees:
Acacia davyi, A. sieberiana var. *woodii, Combretum zeyheri, Erythrina latissima, Parinari curatellifolia, Terminalia sericea, Trichilia emetica, Vernonia amygdalina, Acacia caffra, Antidesma venosum, Erythroxylum emarginatum, Faurea rochetiana, F. saligna, Ficus burkei, F. glumosa, F. ingens, F. petersii, Heteropyxis natalensis, Peltophorum africanum, Piliostigma thonningii, Pterocarpus rotundifolius* and *Schotia brachypetala*.

Succulent Tree:
Euphorbia ingens

Tall Shrubs:
Diospyros lycioides subsp. *sericea, Erythroxylum delagoense, Olea europaea* subsp. *africana, Pachystigma macrocalyx, Pseudarthria hookeri* var. *hookeri* and *Searsia pentheri*.

Low Shrubs:
Diospyros galpinii, Flemingia grahamiana, Agathisanthemum bojeri, Eriosema psoraleoides, Gymnosporia heterophylla, Hemizygia punctata, Indigofera filipes, Myrothamnus flabellifolius and *Searsia rogersii*.

Succulent Shrubs:
Aloe petricola, Euphorbia vandermerwei and *Huemia kirkii.*

Woody Climbers:
Acacia ataxacantha, Bauhinia galpinii, Helinus integrifolius and *Sphedamnocarpus pruriens* subsp*. pruriens.*

Graminoids:
Bothriochloa bladhii, Cymbopogon caesius, C. nardus, Hyparrhenia cymbaria, H. poecilotricha, Hyperthelia dissoluta, Panicum maximum, Andropogon schirensis, Paspalum scrobiculatum and *Schizachyrium sanguineum.*

Herbs:
Gerbera ambigua, G. viridifolia, Hemizygia persimilis, Hibiscus sidiformis, Ocimum gratissimum and *Waltheria indica.*

Succulent herbs:
Orbea carnosa subsp*. carnosa* and *Stapelia gigantea.*

Geophytic Herbs:
Gladiolus hollandii and *Hypoxis rigidula*.

7.5.2 ***Malelane Mountain Bushveld***

Original area (ha)	116,701ha
Remaining area	111,526ha
% Protected	39%
Threat Status	Least Threatened

This woodland occupies the high lying areas north of Malelane and Kaapmuiden, including Berg-en-Dal Restcamp areas as far north as the area of the hill Sithongwane in the Kruger National Park. Also includes the Krokodilpoortberge both north and south of the Crocodile Gorge. The vegetation comprises open savanna on mountains and higher-lying slopes, with an open to dense, short mountain bushveld on rocky outcrops and lower-lying areas. Altitude and aspect are important in determining species composition in this mountainous terrain.

The conservation status of this vegetation type is Least threatened. About 39% is statutorily conserved in the Kruger National Park and a further 6% conserved in the Mthethomusha Nature Reserve. At least is 4% transformed, mainly by cultivation and urban and built-up areas. Scattered alien plants include *Lantana camara, Jacaranda mimosifolia, Melia azedarach, Solanum mauritianum, Sesbania punicea, Ricinus communis* and *Psidium guajava*. This mountainous unit is similar to the Legogote Sour Bushveld, but which has a wetter and cooler climate. Two broad groups of plant communities are recognised, namely the high-lying open savannas and the low-lying closed savannas. The transition between these two community complexes is at an altitude of about 700m.

Low-lying closed savanna

- **Tall Trees**

Pterocarpus angolensis

- **Small Trees**

Acacia caffra, A. davyi, Combretum molle, Dombeya rotundifolia, Faurea saligna, Heteropyxis natalensis, Kirkia wilmsii, Sterculia murex, Acacia swazica, Combretum collinum subsp*. suluense, C. zeyheri, Englerophytum magalismontanum, Ficus abutilifolia, Maytenus undata* (woodland form)*, Mimusops zeyheri, Pterocarpus rotundifolius, Searsia leptodictya, Terminalia sericea* and *Vitex obovata subsp. wilmsii.*

- **Succulent Tree**

Euphorbia cooperi

- **Tall Shrubs**

Acalypha glabrata, Croton madandensis, Diospyros lycioides subsp*. sericea, Grewia monticola, Olea europaea* subsp*. africana* and *Strychnos spinosa*.

- **Low Shrubs**

Barleria rotundifolia, Orthosiphon labiatus and *Polygala producta.*

- **Succulent Shrub**

Aloe spicata

- **Woody Climbers**

Bauhinia galpinii, Dalbergia armata and *Pterolobium stellatum.*

- **Woody Succulent Climber**

Senecio pleistocephalus

- **Herbaceous Climbers**

Coccinia rehmannii and *Rhynchosia caribaea.*

- **Graminoids**

Bothriochloa radicans, Enneapogon scoparius, Eragrostis rigidior, Eustachys paspaloides, Heteropogon contortus, Themeda triandra, Tristachya leucothrix and *Urochloa mosambicensis.*

- **Geophytic Herb**

Drimia altissima

- **Succulent Herb**

Plectranthus cylindraceus

- **Epiphytic Succulent Herb**

Ansellia africana

High-lying open savanna

- **Small Trees**

Acacia davyi, Combretum molle, Heteropyxis natalensis, Hippobromus pauciflorus, Sterculia murex, Acacia natalitia, Bersama lucens, Combretum kraussii, Cussonia spicata, Ekebergia capensis, Faurea rochetiana, Ficus ingens, Pavetta edentula, Searsia leptodictya and *Vitex obovata* subsp*. wilmsii.*

- **Tall Shrubs**

Olea capensis subsp*. enervis, Canthium inerme, Searsia pentheri* and *Vernonia myriantha.*

- **Low Shrubs**

Flemingia grahamiana, Helichrysum kraussii, Acalypha villicaulis, Asparagus virgatus, Diospyros galpinii, Helichrysum lepidissimum, Polygala producta, Tenrhynea phylicifolia and *Vernonia crataegifolia.*

- **Succulent Shrub**

Aloe spicata

- **Woody Climber**

Dalbergia armata

- **Graminoids**

Bothriochloa radicans, Enneapogon scoparius, Eragrostis rigidior, Andropogon eucomus, Eustachys paspaloides, Heteropogon contortus, Panicum natalense, Themeda triandra, Tristachya leucothrix, Urochloa mosambicensis.

- ***Herbs***

Becium obovatum and *Indigofera sanguinea.*

- **Geophytic Herb**

Drimia altissima

- **Succulent Herb**

Stapelia gigantea

- **Epiphytic Succulent Herb**

Ansellia africana

7.5.3 ***Pretoriuskop Sour Bushveld***

Original area (ha)	94,291ha
Remaining area	78,944ha
% Protected	40%
Threat Status	Least Threatened

It is described as an open tree savanna dominated by *Terminalia sericea* and *Dichrostachys cinerea* with a dense grassy layer dominated by *Hyperthelia dissoluta*, *Elionurus muticus* and *Hyparrhenia hirta*. The composition of this particular vegetation type provide habitat for two tree species currently protected in terms of the National Forests Act, 1998 (Act No. 84 of 1998): *Sclerocarya birrea* subsp. *caffra* (Marula) and *Breonadia salicina* (Matumi).

Of particular importance is the infestation of the area by a number of invasive species, e.g. *Eucalyptus* species, *Arundo donax* (Giant Reed), *Lantana camara* (Lantana), *Passiflora subpeltata* (Granadilla), *Caesalpinia decapetala* (Mauritius Thorn), and *Ipomoea alba* (Moonflower). The natural vegetation consists of common species with fairly widespread geographic distributional patterns. Typical canopy constituents found along the Crocodile River comprised of species such as *Ficus sycomorus* (Sycamore Fig), *Syzygium cordatum* (Waterberry) and *Rauvolfia caffra* (Quinine Tree) with a dominant substrata composed of *Acacia ataxacantha* Flame Thorn), *Dombeya pulchra* (Silver Dombeya) and *Vernonia adoensis* var. *kotschyana*.

This vegetation type is not currently under severe threat and some 40% is statutorily conserved in the Kruger National Park. A very small area is also conserved in the private Mthethomusha Nature Reserve. About 16% is transformed by cultivation and development of settlements.

Tall Trees:
Sclerocarya birrea subsp. *caffra*

Small Trees:
Combretum apiculatum, C. zeyheri, Peltophorum africanum, Piliostigma thonningii, Terminalia sericea, Antidesma venosum, Combretum collinum subsp. *gazense, C. molle, Ficus petersii, Parinari curatellifolia, Pterocarpus angolensis* and *Ximenia caffra.*

Tall Shrubs:
Dichrostachys cinerea, Gymnosporia senegalensis, Strychnos madagascariensis, Grewia bicolor, G. monticola, Strychnos spinosa and *Turrea nilotica.*

Low Shrubs:
Agathisanthemum bojeri, Aptosimum lineare, Barleria obtusa, Gymnosporia glaucophylla, Melhania rehmannii and *Sida chrysantha.*

Succulent Shrub:
Aloe petricola

Woody Climber:
Bauhinia galpinii

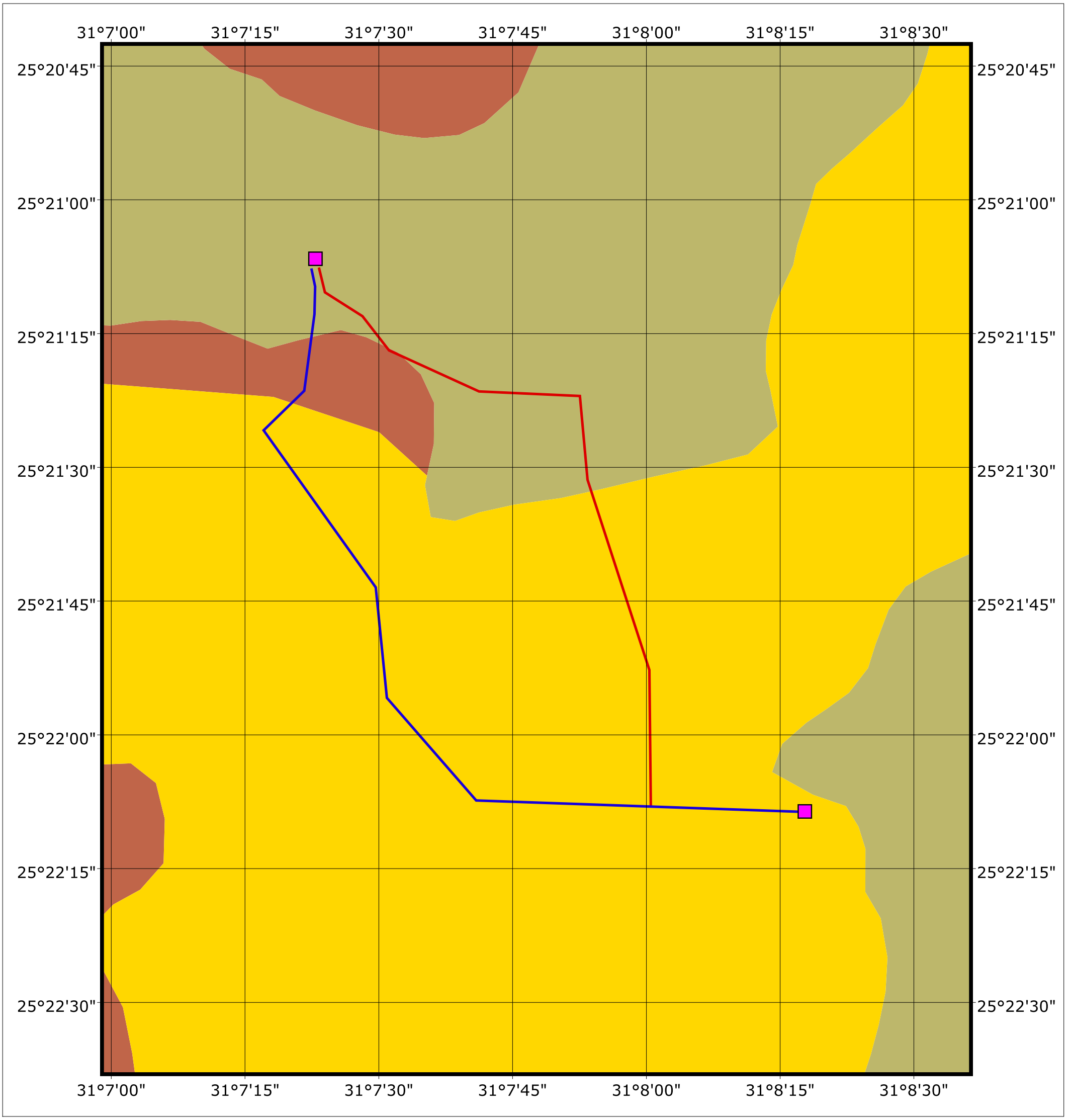
Graminoids:
Aristida congesta, Digitaria eriantha subsp. *eriantha, Elionurus muticus, Eragrostis rigidior, Heteropogon contortus, Hyparrhenia hirta, Hyperthelia dissoluta, Panicum coloratum, Pogonarthria squarrosa, Bothriochloa radicans, Diheteropogon amplectens, Eragrostis atrovirens, E. lappula, Hyparrhenia filipendula, Melinis repens, Perotis patens, Setaria sphacelata* and *Urochloa mosambicensis.*

Herbs:
Chamaecrista mimosoides and *Tricliceras glanduliferum.*

7.6 Geology

The study area falls entirely within the Nelspruit Granites and represents Intrusive rocks of Potassic granite and granodioritic origin (Geological Survey – Republic of South Africa, 1984 & ENPAT, 2001).

Figure 5: Regional vegetation types (VEGMAP)



Option 1
Option 2

0.5 0 0.5 1 1.5 2 2.5 Kilometers

Vegmap Vegetation Types
- Legogote Sour Bushveld
- Malelane Mountain Bushveld
- Pretoriuskop Sour Bushveld

N
W
E
S

7.7 Conservation Areas

The Kruger National Park is located approximately 14km to the east of the proposed development and is unlikely to be affected by the proposed development.

7.8 Land Types

The Ae132 and Fa341 land types are represented within the proposed sub-Transmission line (Land Type Survey Staff, 1987) (ENPAT, 2001) (Figure 6).

A- land type units refer to yellow and red soils without water tables and belonging in one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin or Clovelly. The map units refer to land that does not qualify as a plinthic catena and in which one or more of the above soil forms occupy at least 40% of the study area.

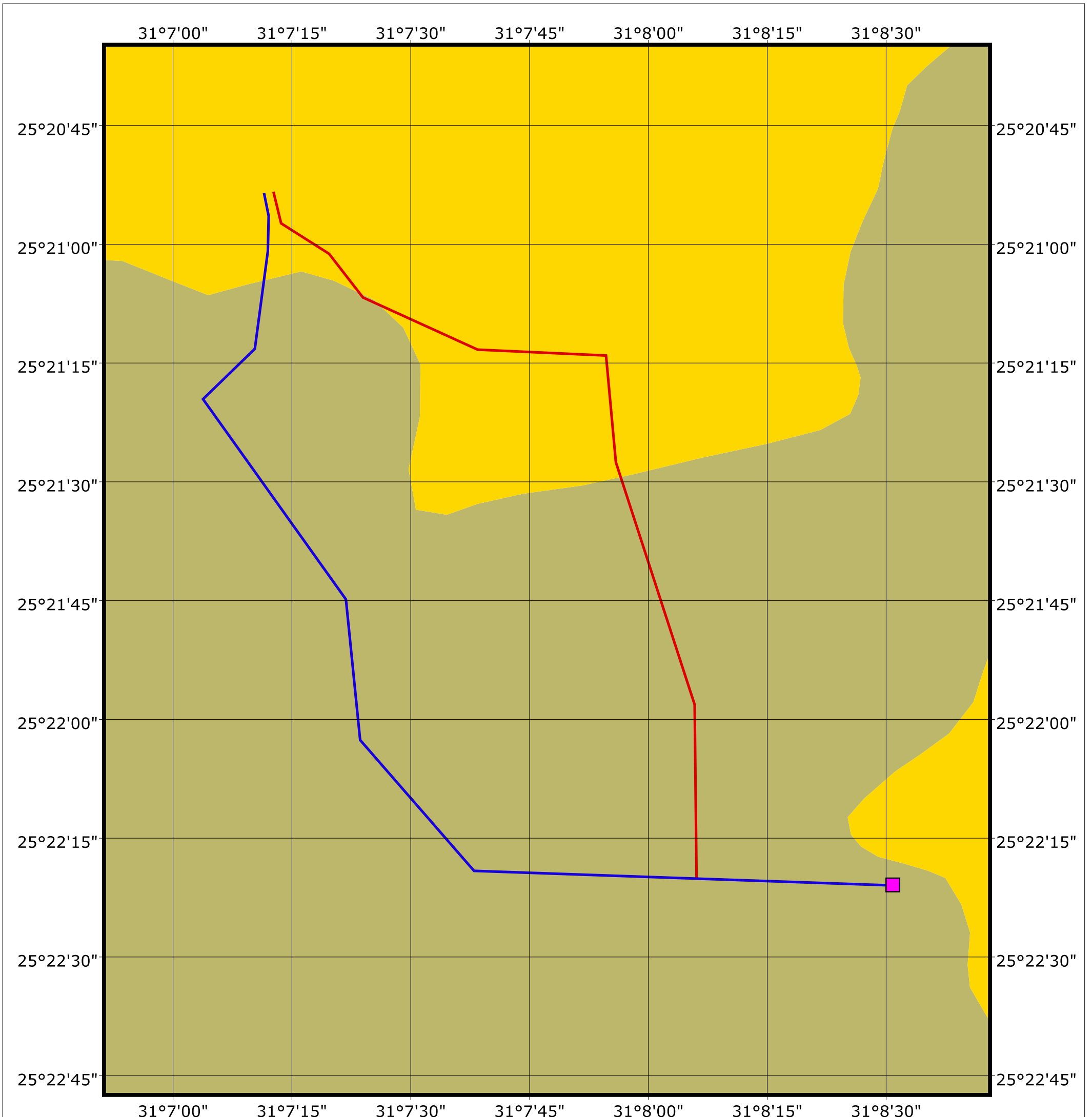
In Ae land types (red, high base status, >300mm deep, no dunes), yellow soils occupy less than 10% of the area while dystrophic and/ or mesotrophic soils occupy a larger area than high base status red-yellow apedal soils. Slopes within the Ae132 land type varies from 0 to 10%. Upland areas (crests and midslopes) are mostly dominated by the Hutton, Cartref, Clovelly and Fernwood soil formations, while bottomland areas are dominated by Fernwood, Cartref, Longlands and Avalon soil formations. Clay content of the A-horizon is typically low, varying from 2 – 12%. The northern and eastern parts of the proposed sub-Transmission line are represented by the Ae132 land type unit.

The F- group is intended to accommodate pedologically young landscapes that are not predominantly rock and not predominantly alluvial or Aeolian and in which the dominant soil forming processes have been rock weathering, the formation of orthic topsoil horizons and, commonly, clay alluvium, giving rise typically to lithocutanic horizons. Soil forms, which epitomize these processes, are Glenrosa and Mispah.

Soil formations of the Fa341 land type unit, located across the central and southern portions of the proposed sub-Transmission line, typically display high percentages of rock, Mispah and Glenrosa soil formations in upland positions (crests and midslopes). Bottomland areas are characterized by Hutton, Estcourt and Clovelly formations. Clay content of the A-horizon is typically low, varying between 5 and 15%. The strongly undulating character of the general area is displayed in the high slopes that may be encountered, from 12 to 40%, which may be as high as 100% in some areas (cliffs).

Soils within the study area are classified as either “Soils of poor suitability for arable agriculture where climate permits” or “Not suitable for agriculture or commercial forestry; suitable for conservation, recreation or water catchments”.

Figure 6: Soil types of the general area



Option 1
Option 2

0.5 0 0.5 1 1.5 2 Kilometers

Soil Types
Ae132
Fa341

N
W
E
S

7.9 MBCP Categories

Classification of the Terrestrial Biodiversity Classification categories (Figure 7) of the study area is as follows:

- Areas of Least Concern – natural areas with most choices, including for development; and
- Areas with No Natural Habitat Remaining – transformed areas that do not contribute to meeting targets.

The general area is classified as either 'No natural habitat remaining' or 'Areas of Least Concern'. The proposed activity correlates to Land Use no. 12 (Linear Engineering Structures). Guidelines suggest restricting permissible land uses within each biodiversity conservation category are as follows:

- Areas of Least Concern - All land uses permitted, although several might require restrictions; and
- The MBCP also identifies the 35.8% of the Province that has 'No natural habitat remaining' and which has very little biodiversity value. The general mechanism of applying these guidelines therefore rely on reinforcing the use of EIA procedures and regulations by means of specialist biodiversity surveys by locally knowledgeable experts.

Restrictions pertaining to Linear Engineering Structures in terms of MBCP are illustrated in Figure 8. Areas that are classified as 'Restricted' are not automatically excluded according to the Mpumalanga Biodiversity Conservation Plan (MBCP) or that the application will automatically be denied, but rather that specialists studies clearly need to indicate that the proposed development will not adversely affect any sensitive floristic attributes that occur, or potentially could occur, within the study area. Specialist studies are furthermore required to show that the proposed development will not to cumulative impacts, regional degradation and habitat transformation and the loss of biodiversity on a local or regional scale.

Figure 7: Mpumalanga C-Plan Biodiversity Sensitivities

31°6'30" 31°6'45" 31°7'00" 31°7'15" 31°7'30" 31°7'45" 31°8'00" 31°8'15" 31°8'30" 31°8'45" 31°9'00"

25°20'45" 25°21'00" 25°21'15" 25°21'30" 25°21'45" 25°22'00" 25°22'15"

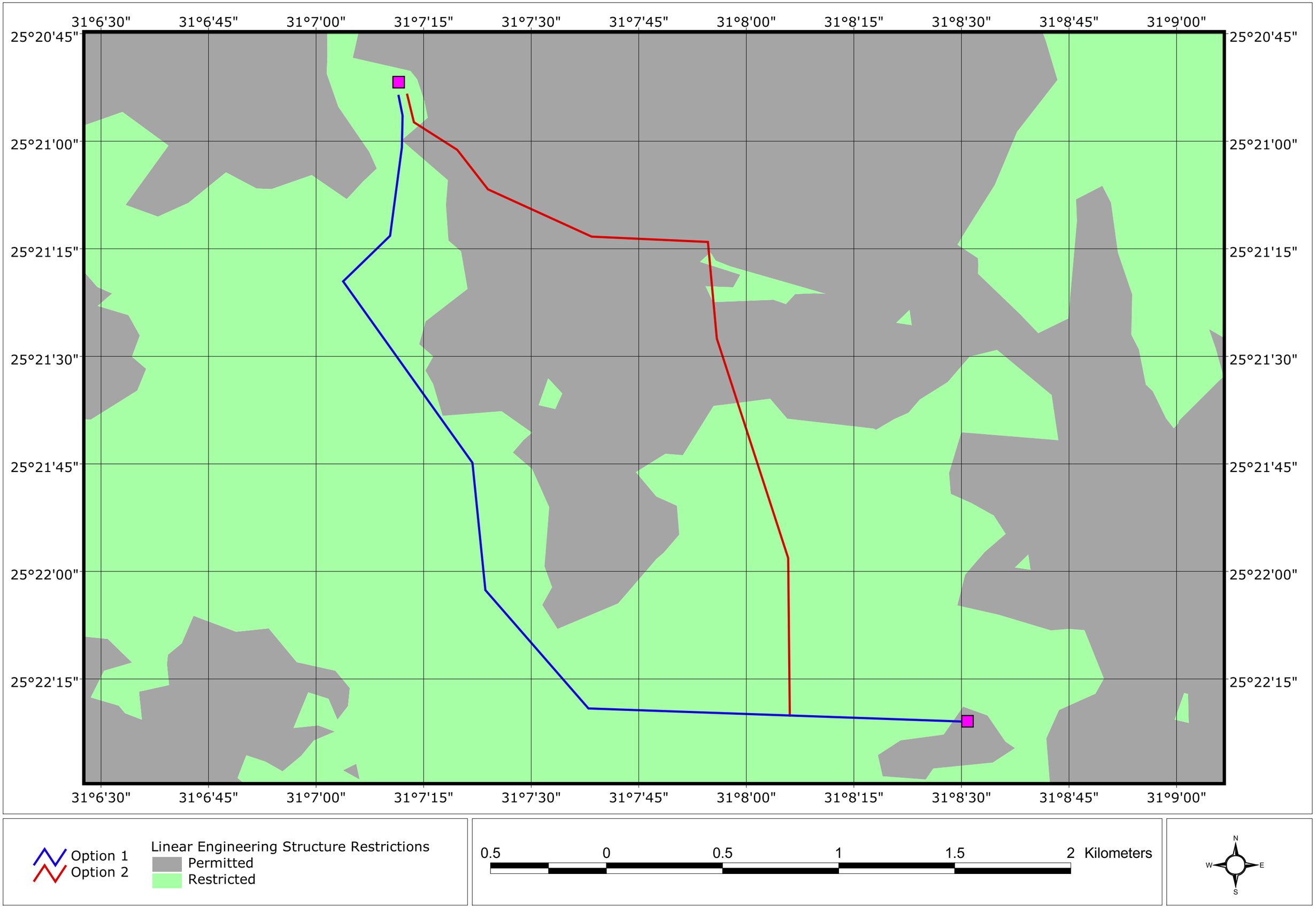
Option 1
Option 2

MBCP Terrestrial Biodiversity Assessment
Least Concern
No Natural Habitat Remaining

0.5 0 0.5 1 1.5 2 Kilometers

N
W E
S

Figure 8: MBCP Linear Engineering Structures restrictions


31°6'30"
31°6'45"
31°7'00"
31°7'15"
31°7'30"
31°7'45"
31°8'00"
31°8'15"
31°8'30"
31°8'45"
31°9'00"
25°20'45"
25°21'00"
25°21'15"
25°21'30"
25°21'45"
25°22'00"
25°22'15"
Option 1
Option 2
Linear Engineering Structure Restrictions
Permitted
Restricted
0.5
0
0.5
1
1.5
2
Kilometers
N
W
E
S

7.10 Biophysical Sensitivities

Aspects that were identified as being important in terms of biodiversity on a regional scale include the following aspects:

- All areas of surface water, including streams and rivers;
- All areas of significant slopes (existing database are inadequate in this regard); and
- Legogote Sour Bushveld vegetation type, comprising a relative small portion of the northern section of the proposed lines.

The remainder of the area reflects the effects of nearby settlements, including habitat destruction and transformation on a large scale.

The impact of the proposed lines are not expected to contribute to the loss or cumulative impacts on any of these biophysical aspects on a local or regional scale, in spite of the alteration of habitat that is associated with powerlines in a woodland environment.

8 FLORISTIC ATTRIBUTES OF THE STUDY AREA

8.1 Regional Diversity

The study area is situated within the 2531AC ¼-degree grid. Available SANBI information indicates the known presence of approximately 544 plant species within this grid (POSA, 2009) (Addendum 1), reflecting the high diversity associated with this region. The Savanna Biome is known to support more than 5,700 plant species, exceed only by the Fynbos Ecoregion in species richness. The Grassland Biome, in spite of a general homogeneous appearance, is occupied by approximately 3,370 plant species. While the species richness of the study area might not necessarily reflect this high species richness, it is still regarded diverse on a local and regional scale.

A dissemination of the floristic diversity indicates the woodland physiognomy of the region. This layer is dominated by a well-developed woody layer consisting of trees (95 species, 17.5%), shrubs (30 species, 5.5%), dwarf shrubs (56 species, 10.3%) and climbers (58 species, 10.7%). A diverse undergrowth is present, consisting of herbs (172 species, 31.6%), grasses (26 species, 4.8%), geophytes (52 species, 9.6%) and Cyperoid species (22 species, 4.0) (Table 2).

Table 2: Flora growth forms for 2531AC

Growth forms	Total	Percentage
Bryophyte	6	1.1%
Carnivore	2	0.4%
Climber	58	10.7%
Creeper	1	0.2%
Cyperoid	22	4.0%
Dwarf shrub	56	10.3%
Epiphyte	4	0.7%
Geophyte	52	9.6%
Graminoid	26	4.8%
Helophyte	8	1.5%
Herb	172	31.6%
Lichen	1	0.2%
Parasite	4	0.7%
Scrambler	2	0.4%
Shrub	30	5.5%
Succulent	5	0.9%
Tree	95	17.5%
Total	**544**	

The species diversity of the region is represented by 118 plant families, dominated by Fabaceae (74 species), Asteraceae (46 species), Poaceae (26 species), Malvaceae (25 species) and Cyperaceae and Rubiaceae with 22 species respectively.

8.2 Floristic Habitat types

Because of the high levels of transformation and other human influences, the vegetation of the region is characterised by mosaical appearances, displaying numerous 'fence effects' across the study area, caused by different management strategies. Physiognomic variation of the vegetation indicates the presence of a range of vegetation units along the proposed sub-Transmission line alternatives. Criteria used to identify these units include physiognomy, land use, state of degradation and general environmental attributes. Based on preferred criteria the following units were identified:

- Terrestrial woodland vegetation/ Hills/ Rocky Outcrops;
- Riparian vegetation;
- Secondary/ degraded vegetation; and
- Settlement areas.

Broad characteristics were delineated from Google Earth images, indicated in Figures 9.

8.2.1 ***Terrestrial Woodland Vegetation/ Hills/ Rocky Outcrops***

This vegetation type constitutes areas of natural, undisturbed woodland vegetation and excludes areas of degradation, infrastructure (settlements, roads and cultivated fields) or major riparian fringes. Representative portions of this vegetation type also occur on severe slopes and rocky outcrops that, because of slopes and shallow soils, are unsuitable for the construction of informal houses/ settlements and road infrastructure.

The physiognomy is typical of bushveld of the region with a shrubby woody layer characterized by high species diversity. The average height of the dominant vegetation is in the 2 to 3m class. Common occurring woody species may include *Combretum* species*, Maytenus heterophylla, Dombeya rotundifolia, Ozoroa paniculosa, Pterocarpus rotundifolius, Grewia* species, *Euclea crispa* and *Bauhinia galpinii*.

Some variations are recognized within this vegetation unit and is generally attributed to variation of the terrain units (midslopes and footslopes), with associated soil depth, slope and aspects. Localized areas of extreme slopes are present on slopes of the hills and ridges and are generally characterized by sparse vegetation due to the absence of sufficient soil substrate. Some non-perennial streams are included in this vegetation unit. Due to a narrow streambed and high slopes, the vegetation that typifies the riparian element is extremely narrow.

The presence of surrounding settlements has placed a high pressure on this vegetation type through wood harvesting for fire and building purposes (paddocks and houses) as well as severe grazing by cattle and goats. Furthermore, due to the presence of numerous cultivated fields and degraded areas, some alien and invasive species were observed in various localities.

A medium-high floristic sensitivity is attributed to this vegetation type for two reasons, namely the presence of natural woodland vegetation that is considered to be under pressure from surrounding communities as well as the association of this vegetation type with sensitive topographical features (rocky outcrops and non-perennial streams. The potential impact of the proposed development is expected to be moderate on sensitive floristic elements contained within this vegetation type, but should be viewed in relation to impacts from surrounding activities, which is regarded severe.

8.2.2 ***Riparian vegetation***

Banks are well defined and steep, while the streambeds are flat and composed of exposed rock in places. The habitat is considered sensitive, in spite of a degraded physiognomy, particularly in areas located in the direct vicinity of settlements. Factors that contribute to degradation of this unit include woodcutting, erosion caused by various foot crossings, intensive grazing by cattle and the presence of alien and invasive plant species.

The physiognomy is characteristic of degraded riparian areas with a high incidence of invasive and encroacher species in some areas, but a well-developed wooded layer does occur in localised areas. The herbaceous layer appears relatively species poor in degraded areas, consisting mostly of species not generally associated with undisturbed variations of similar vegetation types. This habitat is however expected to be species rich in areas that are not disturbed.

A medium-high floristic sensitivity is attributed to this vegetation type.

8.2.3 ***Secondary / Degraded vegetation***

Areas included in this vegetation type include road servitudes, localized cultivated fields and any area consisting of vegetation that constitutes a secondary or climax vegetation. Also included in this vegetation type are woodland areas located adjacent to settlements where the woody layer has been severely affected because of woodcutting. This practice results not only in a severely altered structure of the woody layer, but also in significant changes in the herbaceous species composition due to competitive abilities of grasses in low shade condition as well as increased accessibility for grazing cattle, leading to selective grazing of palatable species. The current grass layer is composed mostly of pioneer species as well as species that indicate poor veld condition.

Some characteristics of fallow cultivated fields includes poor species richness, the areas being dominated by few species, particularly grasses, as well as the absence of woody species, although some low shrubs may occur. Localized fields are, mostly, actively cultivated and contain crops of varying nature.

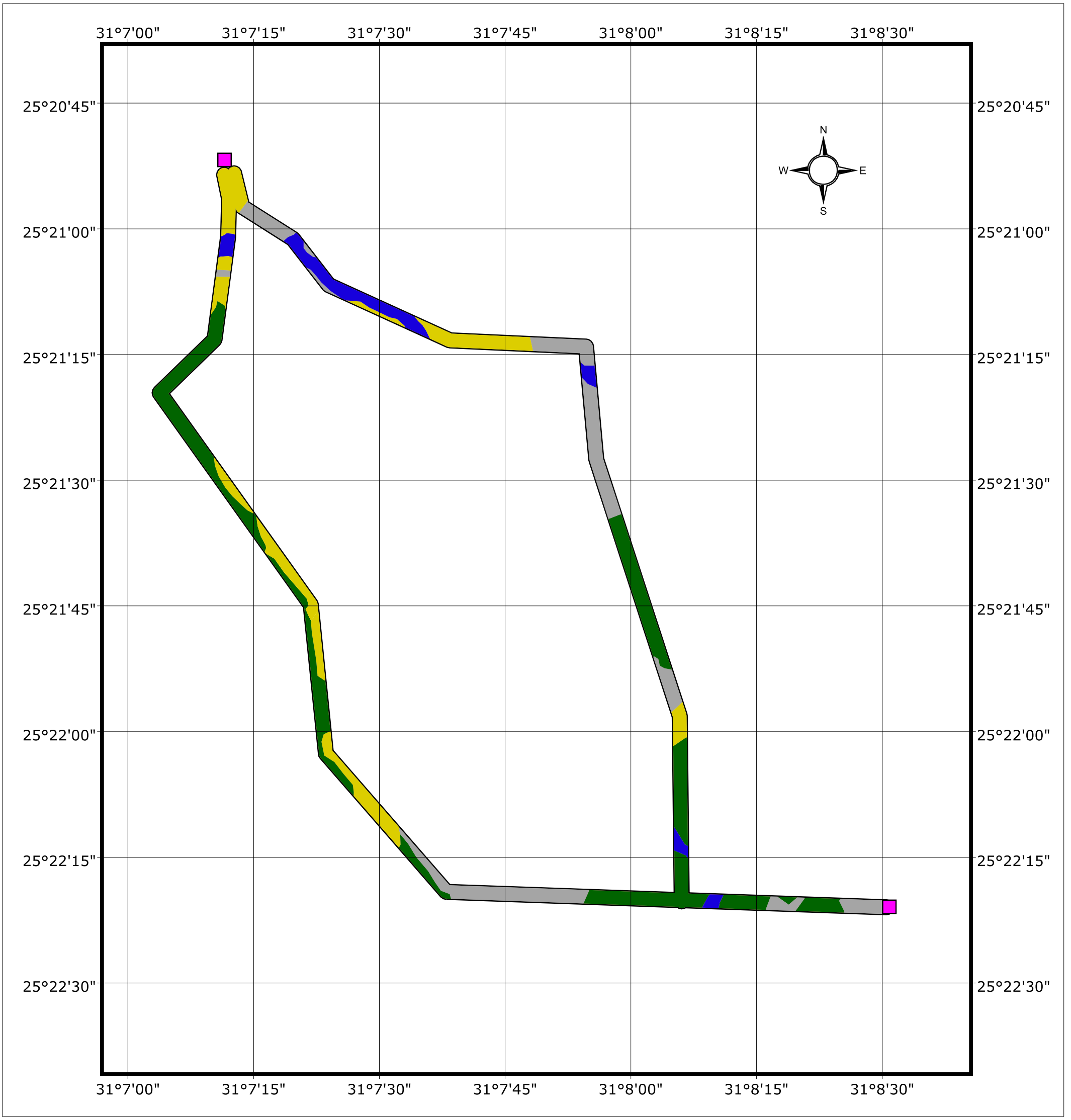
The woody component of road servitudes are severely degraded with the lower structure nearly completely destroyed. Some of the larger trees, particularly *Sclerocarya birrea*, are however frequently encountered. The proximity of settlement areas directly adjacent to road servitudes contribute to the degraded status of these areas by the introduction of alien and invasive plant species as well as harvesting of woody species.

A low floristic diversity is characteristic and a medium-low floristic sensitivity is attributed to this vegetation type.

8.2.4 ***Settlement areas***

Some large trees (mostly *Sclerocarya birrea*) represent the only remnants of original, natural vegetation within the more established parts of the settlements, but all other vegetation structures are destroyed. On the extremities of the settlements, where the houses are scattered, the land use is more agronomical and some natural vegetation remains. The species composition of these areas is however still dominated by species not generally associated with natural vegetation. A low floristic sensitivity is therefore attributed to these areas.

Figure 9: Floristic habitat types of the study area



Floristic Habitat Types

- Riparian vegetation
- Secondary/ degraded vegetation
- Settlement areas/ Transformed Habitat
- Terrestrial woodland vegetation/ Hills/ Rocky Outcrops

0.25 0 0.25 0.5 Kilometers

8.3 Flora Species of Conservation Importance

- A taxon is Critically Endangered when the best available evidence indicates that it meets any of the five IUCN criteria for Critically Endangered, and is therefore facing an extremely high risk of extinction in the wild.
- A taxon is Near Threatened when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.
- A taxon is Vulnerable when best available evidence indicates that it meets any of the five IUCN criteria for Vulnerable, and is therefore facing a high risk of extinction in the wild.
- A taxon is Declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population.
- A taxon is DDD when there is inadequate information to assess its risk of extinction, but the taxon is well defined. Data Deficient is not a category of threat. However, listing of taxa in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.
- A taxon is DDT when taxonomic problems hinder its distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- A taxon is Near Threatened when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.

SANBI records for the region indicate the presence of 14 flora species of conservation importance (Table 3).

Table 3: Red Data flora species of the region

Taxon	Family	Status	Probability
Acalypha caperonioides var. *caperonioides*	Euphorbiaceae	DDT	Medium-low
Alepidea peduncularis	Apiaceae	DDT	Medium-low
Aloe kniphofioides	Asphodelaceae	VU	Low
Aloe simii	Asphodelaceae	CR	Low
Ansellia africana	Orchidaceae	Declining	Low
Disa extinctoria	Orchidaceae	NT	Low
Elaeodendron transvaalense	Celastraceae	NT	Medium-low
Encephalartos laevifolius	Zamiaceae	CR	Low
Hypoxis hemerocallidea	Hypoxidaceae	Declining	Medium-low
Ilex mitis var. *mitis*	Aquifoliaceae	Declining	Medium-low
Myrothamnus flabellifolius	Myrothamnaceae	DDT	Medium-low
Plectranthus esculentus	Lamiaceae	DDD	Low
Protea curvata	Proteaceae	VU	Low
Siphonochilus aethiopicus	Zingiberaceae	CR	Low

The location and identification of Red Data flora species is a specialist field, unlike many faunal species, mainly because of the following:

- Complex morphological and anatomical characteristics;
- Lack of suitable reference material;
- Low abundance, small populations; and
- Poor public knowledge.

8.4 Protected Tree Species

Various individuals of *Sclerocarya birrea* (Marula) was observed within the study area. It is also likely that species such as *Combretum imberbe* (Leadwood), *Philenoptera violaceae* (Apple-leaf) and *Pterocarpus angolensis* (Wild Teak) and *Breonadia salicina* (Matumi) could be present within the study area, as they are known to occur in the general region. These individuals are protected under the National Forest Act, 1998 (No 84 of 1998) and it should be noted that an application needs to be submitted prior to the damage, cutting, pruning or removing of any individual.

8.5 Alien & Invasive Species

Invading alien organisms pose the second largest threat to biodiversity after direct habitat destruction (UNEP, 2002). Invasive species are a threat to indigenous species through the following mechanisms:

- displacement by direct competition;
- reduction of structural diversity;
- disruption of the prevailing vegetation dynamics;
- impacts on fire regimes due to increases in biomass;
- alteration of local hydrology; and
- modification of nutrient cycling (Van Wilgen and Van Wyk, 1999).

CARA (2001) makes provision for four groups of problem plants:

- Declared weeds (Category 1 plants) – alien species prohibited on any land or water surface in South Africa; must be controlled or eradicated where possible;
- Declared invaders (Category 2 plants, commercial and utility plants) – alien species allowed only in demarcated areas providing there is a permit and that steps are taken to prevent their spread;
- Declared invaders (Category 3 plants, ornamentals) – alien species that may no longer be planted; existing plants may remain provided that all reasonable steps are taken to prevent their spread; prohibited within the floodline of watercourses and wetlands; and
- Declared indicators of bush encroachment – indigenous species that under certain circumstances e.g. overgrazing may cause bush densification.

The following species occur in the region of the study area:

Table 4: Declared invasive and exotic flora species for the general region	
Species	**Status**
Acacia ataxacantha	Declared indicator of encroachment
Acacia hebeclada subsp. *hebeclada*	Declared indicator of encroachment
Acacia karroo	Declared indicator of encroachment
Acacia mearnsii	Category 2
Acacia nigrescens	Declared indicator of encroachment
Acacia nilotica subsp. *kraussiana*	Declared indicator of encroachment
Acacia podalyriifolia	Category 3
Amaranthus hybridus subsp. *hybridus* var. *erythrostachys*	Weed
Berkheya insignis	Weed
Bryum dichotomum	Weed
Bryum pycnophyllum	Weed
Bryum viridescens	Weed
Canna x generalis	Category 1
Cardiospermum grandiflorum	Category 1
Cestrum aurantiacum	Category 1
Ipomoea indica	Category 1
Ipomoea purpurea	Category 3
Lantana camara	Category 1
Melia azedarach	Category 1
Myriophyllum aquaticum	Category 1
Phytolacca octandra	Weed
Plumbago zeylanica	Weed
Psidium guajava	Category 2
Richardia brasiliensis	Weed
Rubus x proteus	Category 1
Sesbania punicea	Category 1
Tithonia rotundifolia	Category 1

8.6 Floristic Sensitivity

Floristic sensitivity calculations are presented in Table 5 and illustrated in Figure 10.

Table 5: Floristic sensitivity estimations for the respective habitat types

Criteria	RD species	Landscape sensitivity	Ecology Status	Species diversity	Functionality / fragmentation	TOTAL	SENSITIVITY INDEX	SENSITIVITY CLASS
Community	**Criteria Ranking**							
Terrestrial woodland vegetation/ Hills/ Rocky Outcrops	6	8	7	8	7	227	71%	**Medium-High**
Riparian vegetation	5	10	5	5	5	200	63%	**Medium-High**
Secondary/ degraded vegetation	2	4	3	3	4	97	30%	**Medium-Low**
Settlement areas/ Transformed Habitat	0	0	1	1	1	14	4%	**Low**

Figure 10: Floristic sensitivities of habitat types within the study area

31°7'00" 31°7'15" 31°7'30" 31°7'45" 31°8'00" 31°8'15" 31°8'30"

25°20'45" 25°21'00" 25°21'15" 25°21'30" 25°21'45" 25°22'00" 25°22'15" 25°22'30"

N W E S

Floristic Sensitivity
- Low
- Medium-High
- Medium-Low

0.25 0 0.25 0.5 0.75 1 1.25 1.5 1.75 2 Kilometers

8.7 Discussion

Option 1 is recommended as the preferred option.

In assessing the floristic sensitivity associated with the two options, it is necessary to evaluate the status of, particularly, the Medium-High sensitivity habitat within the proposed corridors (riparian & natural woodland/ hills/ outcrops). While both of the options traverses such habitat, the sensitivity of certain woodland areas is slightly negated by the proximity of Low and Medium-Low sensitivity habitat to some parts. Option 1 is specifically mentioned in this regard, as this option traverses the western part of Ngodi settlement along the edge of the community where houses and stands interface with remaining natural environment. Habitat along these parts are, although indicated as relative pristine, bears evidence of impacts from the nearby settlement and will in all likelihood be occupied within a relative short period of time as the current settlement expands. Furthermore, Option 1 also does not traverse significant hills or outcrops, in contrast with Option 2 that traverses across 2 significant outcrops in the central and southern parts of the study area. Construction activities, particularly the construction of servitude roads towards the footprint areas, represents a major concern in all areas of significant slopes as a result of erosion potential, hence a high sensitivity is ascribed to Option 2 in this regard. In contrast, Option 1 is located on the edge of the settlement area where numerous existing roads will facilitate construction operations and few new roads will be required in areas where slopes do not represent a serious consideration.

Option 2, in terms of surface water, runs parallel to a river for an extensive part of the corridor, implying that several footprint areas will be located within, or in close proximity to the streambed. Although this might technically be feasible, it represents a significant impact on the status of the river and biota associated with this habitat type. Perpendicular crossings are preferred as the extent of riparian habitat that will be affected by the removal of woodland vegetation is minimised.

Considering the extent of natural woodland habitat that will be affected, very little difference is noted between the two options. The preferred option is therefore recommended based on the extent of sensitive habitat (rocky outcrops/ hills) that will be affected as well as the nature of the crossing of the major river in the area. Protected trees (*Sclerocarya birrea*) are present within both the options and will be affected with either of the options, therefore not affecting the recommendation.

The proposed Hlau-Hlau Substation is located in an agricultural field where no natural habitat remains. No aspect of sensitivity is present within this area and the construction and operational activities are not expected to result in significant impact on the floristic environment.

9 BIODIVERSITY IMPACT EVALUATION

Results of the biophysical and floristic assessments are holistically interpreted in order to assess the potential impact on the ecological environment. Potential impacts resulting from the proposed development might be unacceptable should no suitable mitigation measures be implemented, or even with the implementation of mitigation measures.

The impact assessment is aimed at presenting a description of the nature, extent significance and potential mitigation of identified impacts on the biological environment. A summary of these discussions are presented in Section 9.4 in the form of Impact Rating Matrix for each identified impact within the respective habitat types.

9.1 Identification of Impacts

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive as it involves the removal of vegetation and alteration of habitat.

Impacts resulting from the construction and operation of this development on ecological attributes of the study area are largely restricted to the physical impacts on biota or the habitat in which they occur. Direct impacts, such as habitat destruction and modifications, are regarded immediate, long-term and of high significance. These impacts are mostly measurable and easy to assess, as the effects thereof is immediately visible and can be determined to an acceptable level of certainty. In contrast, the effect of indirect impacts is not immediately evident and can consequently not be measured immediately. A measure of estimation is therefore necessary in order to evaluate these impacts. Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities. Seven impacts were identified that are of relevance to this particular development. These impacts might not occur simultaneously, or the extent of impact might be limited and the relevance of these impacts will firstly be determined prior to being implemented in the Impact Assessment. Impacts were placed in three categories, namely:

- **Direct impacts:**
  - Destruction of threatened and protected flora species;
  - Destruction of sensitive/ pristine habitat types;
- **Indirect Impacts:**
  - Floristic species changes subsequent to development;
  - Impacts on surrounding habitat/ species;
- **Cumulative Impacts:**
  - Impacts on SA's conservation obligations & targets (VEGMAP vegetation types);
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation.

Other, more subtle impacts on biological components, such as changes in local, regional and global climate, increase in acid rain, ground water deterioration, etc. are impacts that cannot be quantified to an acceptable level of certainty and is mostly subjective in nature as either little literature is available on the topic or contradictory information exist.

The relevance of respective impacts to the proposed development is assessed in the following section.

9.2 Nature of Impacts

9.2.1 ***Destruction of Threatened & Protected Flora Species***

This impact is regarded a direct impact as it results in the physical damage or destruction of Red Data or Protected species or areas that are suitable for these species, representing a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they represent an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are one of the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest drawbacks in terms of limiting this particular impact is that extremely little information is available in terms of the presence, distribution patterns, population dynamics and habitat requirements of Red Data flora species in the study area. In order to assess this impact, it is necessary to assess the presence/ distribution of habitats frequently associated with these species. Furthermore, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, resultant impacts will be largely limited.

The presence of some protected tree species within the study area was confirmed during the site investigation. Furthermore, the likelihood of Red Data flora species occurring within the parts of the study area is likely as some areas were found to be moderately suitable for some of these species. The likelihood

of this impact occurring is therefore regarded moderate and will therefore be evaluated in the Impact Evaluation.

9.2.2 Destruction of Sensitive/ Pristine Habitat Types

The loss of pristine habitat types or habitat that are regarded sensitive as a result of restricted presence in the larger region (atypical habitat) represents a potential loss of habitat and biodiversity on a regional scale. Sensitive habitat types include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

Furthermore, these habitat types are generally isolated and are frequently linear in nature, such as rivers and ridges. Any impact that disrupts this continuous linear nature will risk fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

Microhabitat conditions are changed because of the removal of the vegetation layer, affecting shade conditions, habitat competition, germination success of the herbaceous layer, etc. and are likely to result in the establishment of a species composition that is entirely different from original conditions. Immediate surrounds, in many cases, are also frequently invaded by species of an invasive nature, particularly shrubs.

Relative small parts of the study area are regarded highly sensitive and are highly likely to be occupied by a diverse species composition as well as flora species of conservation importance. The likelihood of this impact occurring is therefore regarded moderate and is therefore be included as part of the Impact Evaluation.

9.2.3 Floristic Species Changes Subsequent to Development

This impact is regarded an indirect impact. The transformation of natural habitat during the construction process will inevitably result in the establishment of habitat types that are not considered representative of the region. While impacts are generally regarded to be of low severity, impacted areas are frequently invaded by species not normally associated with the region (exotic and invasive species). In addition, many species that are not necessarily abundant in the region will increase in abundance because of more favourable habitat conditions being created because of habitat manipulation activities (encroacher species). This effect is more pronounced in the floristic component, but changed habitat conditions in the habitat will inevitably imply minor changes in the faunal component that occupies the habitat.

If left unmitigated, this risk will result in decreased habitat, increased competition and lower numbers of endemic biota, the genetic pool of species might eventually be influenced by the introduction of non-endemic species. Different faunal assemblages and plant communities have developed separate gene structures as a result of habitat selection and geographical separation and the introduction of individuals of the same species that might be genetically dissimilar to the endemic species might lead to different genetic selection structures, eventually affecting the genetic structure of current populations and assemblages.

Construction will result in alteration of the vegetation in parts of the study area where natural vegetation occurs and it is likely that the current vegetation will become infested with weeds and invasive species because of the activity. This impact will therefore be evaluated as part of the Impact Evaluation.

9.2.4 Impacts on Surrounding Habitat/ Species

Surrounding areas and species present in the direct vicinity of the study area could be affected by indirect impacts resulting from construction and operation activities. This indirect impact could potentially include all of the above impacts, depending on the sensitivity and status of surrounding habitat and species as well as the extent of impact activities. Considering the type of development, the extent of this impact is expected to be relative small.

The indirect nature of this impact dictates that potential impacts spreading from the proposed development into bordering areas is likely to affect natural habitat adversely. This impact is relevant and will therefore be included as part of the Impact Evaluation.

9.2.5 Impacts on SA's Conservation Obligations & Targets

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas. The importance of regional habitat types is based on the conservation status ascribed to vegetation types, including Endangered and Least Threatened vegetation types. Furthermore, no declared conservation areas will be affected by the proposed development.

Loss of parts of the natural vegetation is not expected to result in any direct or indirect impact on the conservation status of the regional vegetation types and no declared conservation areas will be directly affected. This impact is therefore omitted from the impact evaluation.

9.2.6 Increase in Local & Regional Fragmentation/ Isolation of Habitat

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known, or is not immediately visible. When they do become visible, they frequently are beyond repair. Linear developments affect the migratory success of animals in particular. An important mitigation measure in this regard is to utilise existing causal factors of habitat fragmentation, such as the edges of the settlement areas.

The general region is characterised by high levels of transformation and the introduction of this type of developments is expected to result in minimal increase in the regional fragmentation and habitat isolation. Cumulative effects of habitat transformation are nonetheless regarded relevant, albeit insignificant, and this impact is therefore included as part of the Impact Assessment.

9.2.7 Increase in Environmental Degradation

Cumulative impacts associated with this type of development will lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor.

Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the development dictates that the biological environment is unlikely to be affected by effluents, spillages or any chemical that is extracted or transported. Considering the level of degradation in the surrounds, this impact is unlikely to contribute to increased levels of degradation and is therefore omitted from Impact Evaluation.

9.3 Evaluation of Impacts – Construction Phase

CONSTRUCTION PHASE							
Option 1	**Biodiversity Impacts**		**RD Flora**	**Sensitive Habitat**	**Species changes**	**Surrounding habitat**	**Fragmentation / Isolation**
	Before Mitigation	**Temporal Scale**	Permanent	Long Term	Medium Term	Medium Term	Short Term
		Spatial Scale	International	Localised	Localised	Localised	Localised
		Severity	Very Severe	Moderate	Slight	Slight	Slight
		Significance	Very High	Low	Low	Low	Low
		Status	Negative	Negative	Negative	Negative	Negative
	After Mitigation	**Temporal Scale**	Permanent	Long Term	Medium Term	Medium Term	Short Term
		Spatial Scale	Localised	Localised	Localised	Localised	Localised
		Severity	Moderate	Slight	Slight	Slight	Slight
		Significance	Moderate	Low	Low	Low	Low
		Status	Negative	Negative	Negative	Negative	Negative
Option 2	**Biodiversity Impacts**		**RD Flora**	**Sensitive Habitat**	**Species changes**	**Surrounding habitat**	**Fragmentation / Isolation**
	Before Mitigation	**Temporal Scale**	**Permanent**	**Long Term**	**Medium Term**	**Medium Term**	**Short Term**
		Spatial Scale	International	Localised	Localised	Localised	Localised
		Severity	Very Severe	Moderate	Slight	Slight	Slight
		Significance	Very High	High	Moderate	Moderate	High
		Status	Negative	Negative	Negative	Negative	Negative
	After Mitigation	**Temporal Scale**	Permanent	Long Term	Medium Term	Medium Term	Short Term
		Spatial Scale	Localised	Localised	Localised	Localised	Localised
		Severity	Severe	Moderate	Slight	Slight	Slight
		Significance	Moderate	Moderate	Moderate	Moderate	Moderate
		Status	Negative	Negative	Negative	Negative	Negative

9.4 Evaluation of Impacts – Operational Phase

OPERATIONAL PHASE							
Option 1	**Biodiversity Impacts**		**RD Flora**	**Sensitive Habitat**	**Species changes**	**Surrounding habitat**	**Fragmentation / Isolation**
	Before Mitigation	**Temporal Scale**	**Permanent**	**Long Term**	**Medium Term**	**Medium Term**	**Short Term**
		Temporal Scale	Medium Term	Medium Term	Medium Term	Medium Term	Short Term
		Spatial Scale	Regional	Localised	Localised	Localised	Localised
		Severity	Moderate	Moderate	Moderate	Moderate	Slight
		Significance	Low	Low	Low	Low	Low
	After Mitigation	**Temporal Scale**	**Permanent**	**Long Term**	**Medium Term**	**Medium Term**	**Short Term**
		Spatial Scale	Localised	Localised	Localised	Localised	Localised
		Severity	Moderate	Slight	Slight	Slight	Slight
		Significance	Moderate	Low	Low	Low	Low
		Status	Negative	Negative	Negative	Negative	Negative
Option 2	**Biodiversity Impacts**		**RD Flora**	**Sensitive Habitat**	**Species changes**	**Surrounding habitat**	**Fragmentation / Isolation**
	Before Mitigation	**Temporal Scale**	**Permanent**	**Long Term**	**Medium Term**	**Medium Term**	**Short Term**
		Spatial Scale	Regional	Regional	Localised	Localised	Localised
		Severity	Severe	Moderate	Severe	Moderate	Slight
		Significance	Moderate	Moderate	Moderate	Moderate	Moderate
		Status	Negative	Negative	Negative	Negative	Negative
	After Mitigation	**Temporal Scale**	Permanent	Long Term	Medium Term	Medium Term	Short Term
		Spatial Scale	Regional	Localised	Localised	Localised	Localised
		Severity	Moderate	Moderate	Moderate	Moderate	Slight
		Significance	Moderate	Moderate	Moderate	Moderate	Moderate
		Status	Negative	Negative	Negative	Negative	Negative

9.5 Recommended Mitigation Measures

The most important mitigation measure is the exclusion of sensitive areas from the proposed development. By limiting development to areas of lower ecological sensitivity, most of the impacts associated with high significance events will be avoided altogether. The following mitigation measures are recommended.

9.5.1 ***General & Compliance***

Mitigation Measure 1 - Appoint the Environmental Control Officer (ECO) prior to start of construction. Responsibilities should include, but not be limited to, ensuring adherence to EMP guidelines, guidance of activities, planning, reporting. Responsibilities will include:

- Land Management Plan;
- Fire Management Plan;
- Project Monitoring Plan;
- Waste Management Plan;
- Water Management Plan;

Mitigation Measure 2 - Establish the Terms of Reference for the ECO prior to the onset of the construction phase;

Mitigation Measure 3 - The following activities that must be prohibited are to be communicated during the induction process:

- The irresponsible use of welding equipment, oxy-acetylene torches and other naked flames which could result in veld fires or constitute a hazard;
- Indiscriminate disposal of rubbish or rubble;
- Littering on site;
- Spillage of potential pollutants, such as petroleum products;
- Collection of firewood;
- Lighting of fires for cooking, heating or other purposes outside designated areas, and failure to exterminate any fires;
- Burning of general waste material under any circumstances, unless done in an on-site licensed smokeless incinerator;
- Burning of cleared vegetation under any circumstances;
- Interference with any wildlife, fauna or flora;
- Poaching of any description;
- Use of any ablution facility other than those provided;
- The use of rivers, streams, dams or any watercourses/surface water for washing or abluting purposes;
- Entering areas outside of demarcated construction areas without relevant permissions;

Mitigation Measure 4 - Ensure that contractors are aware of all specifications, legal constraints and environmental standards and procedures pertaining to the project specifically with regards to the environment;

Mitigation Measure 5 - Conduct a pre-construction walkdown of the approved corridor in order to mark and georeference all protected tree species within the servitudes and development areas. Submit relevant applications for impacts on these individuals;

Mitigation Measure 6 - Should any contractor/ operator/ person be in breach of any of the specifications contained in the EMP, the Site Director will, in writing, instruct the entity responsible for the incident of non-compliance regarding corrective and/or remedial action required, specify a timeframe for implementation of these actions, implement a penalty and/or indicate that work will be suspended should non-compliance continue;

Mitigation Measure 7 - Prevent actions that will harm or may cause harm to the environment, and take steps to prevent pollution of any site or degrade the natural environment;

Mitigation Measure 8 - Ensure proper contractor education in terms of environmental aspects pertaining to the natural environment prior to any work being conducted on-site. This should be part of the ECO responsibilities;

Mitigation Measure 9 - Compile and implement environmental monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Environmental monitoring should be conducted at least twice per year (Summer, Winter);

Mitigation Measure 10 - Limit construction-, maintenance- and inspection activities to dry periods in order to curb occurrence/ augmentation of erosion in areas of existing erosion, destabilizing of substrate in areas of high slopes, riparian zones, etc;

Mitigation Measure 11 - Frequent and effective dust-suppression is advised, particularly along dirt roads;

Mitigation Measure 12 - Ensure off site storage of hazardous materials, chemicals, fuels, oils, etc. in order to prevent accidental spillage, contamination or pollution;

Mitigation Measure 13 - Develop emergency maintenance operational plan to deal with any event of contamination, pollution or spillages, particularly in proximity to sensitive areas;

Mitigation Measure 14 - Final inspection subsequent to construction in order to ensure adherence to EMP guidelines, completion of localised/ remaining areas of impact, monitoring of rehabilitation success, etc.

9.5.2 ***Roads & Crossings***

Mitigation Measure 15 - Prohibit construction of new access roads. Use should be made of existing roads as far as possible, ensuring proper maintenance/ upgrade. Alternative methods of construction/ access to sensitive areas is recommended;

Mitigation Measure 16 - Access to construction areas is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted;

Mitigation Measure 17 - No vehicles should be allowed to cross rivers or streams in any area other than an approved crossing, taking care to prevent any impact (particularly erosion) in surrounding habitat;

Mitigation Measure 18 - Any new road needed during the construction or operational phases of the project may only be constructed in areas where the general slope of the land does not exceed 4%, also ensuring the correct placement and construction of water diversion berms;

Mitigation Measure 19 - Access roads shall only be constructed where necessary at watercourses, on steep slopes or where boulders prohibit vehicular traffic. The ECO would need to determine if any other passing would be required in such cases;

Mitigation Measure 20 - Construction of new bridges/ crossings/ access roads across non-perennial streams and larger rivers is regarded a prohibited activity, use should be made of existing crossings, ensuring proper maintenance/ upgrade;

Mitigation Measure 21 - Vehicular traffic shall not be allowed in permanently wet areas, no damage shall be caused to wet areas. Where necessary, alternative methods of construction shall be used to avoid damage to wet areas;

Mitigation Measure 22 - Any work or access near or in a permanent drainage system may have implications in terms of the National Water Act, 1998 (Act No. 36 of 1998), and therefore may well require the application of a Water Use License. Therefore, the contractor must in consultation with the ECO, assess all areas along the alignment well in advance in order to ensure the relevant Water Use License is applied for where required;

9.5.3 ***Construction***

Mitigation Measure 23 - No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required;

Mitigation Measure 24 - Demarcate construction areas by semi-permanent means in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to prevent spread of impacts;

Mitigation Measure 25 - Construction sites/camps need a detailed ecological assessment prior to construction;

9.5.4 ***Sanitation***

Mitigation Measure 26 - Abluting anywhere other than in provided toilets shall not be permitted. Under no circumstances shall use of the veld be permitted;

Mitigation Measure 27 - Provide temporary on-site ablution, sanitation, litter and waste management and hazardous materials management facilities until such time that permanent facilities are provided;

9.5.5 ***Vegetation & Rehabilitation***

Mitigation Measure 28 - All individuals/ stands of Protected trees must be clearly and visibly marked prior to the start of construction or maintenance procedures. It is recommended that a walk-through of the approved servitude be conducted prior to construction activities commencing;

Mitigation Measure 29 - Should impacts on Protected tree individuals be unavoidable, obtain necessary and required approval per application for damage/ removal/ cutting/ pruning of Protected tree species from Department of Forestry, as per National Forests Act (Act No. 84 of 1998) under Government Notice GN 1012 of 2004 and GN 767 of 2005;

Mitigation Measure 30 - Marking should be done by means of semi-permanent (removable) marker tape;

Mitigation Measure 31 - Information pertaining to these plants should be included in the induction for all workers and contractors;

Mitigation Measure 32 - Cutting/ pruning/ damaging of any Protected tree species should not be allowed under any circumstances without proper approval;

Mitigation Measure 33 - Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible;

Mitigation Measure 34 - Disturbance of vegetation must be limited to areas of construction;

Mitigation Measure 35 - The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO;

Mitigation Measure 36 - Cut vegetation (grass and shrubs) only if required. No clearing of vegetation or soil by grading machinery shall be undertaken;

Mitigation Measure 37 - Use of branches of trees and shrubs for fire making purposes is strictly prohibited;

Mitigation Measure 38 - The establishment and regrowth of alien vegetation must be controlled after the removal of grass;

Mitigation Measure 39 - All declared aliens must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), namely:

- Uprooting, felling or cutting;
- Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer;
- The application of control measures regarding the utilisation and protection of veld in terms of regulation 9 of the Act;
- The application of control measures regarding livestock reduction or removal of animals in terms of regulations 10 and 11of the Act;
- Any other method or strategy that may be applicable and that is specified by the executive officer by means of a directive.

Mitigation Measure 40 - According to the Conservation of Agricultural Resource Act (No. 43 of 1983) as amended, the person applying herbicide must be adequately qualified and certified as well as registered with the appropriate authority to apply herbicides.

Mitigation Measure 41 - Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation. The grass mix should consist of indigenous grasses adapted to the local environmental conditions;

Mitigation Measure 42 - The revegetated areas should be temporarily fenced to prevent damage by grazing animals;

Mitigation Measure 43 - Re-vegetated areas showing inadequate surface coverage (less than 30% within eight months after re-vegetation) should be prepared and re-vegetated from scratch;

Mitigation Measure 44 - Damage to re-vegetated areas should be repaired promptly;

Mitigation Measure 45 - Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish;

Mitigation Measure 46 - Weed control methods should be confirmed with the ECO to prevent any undesirable secondary impacts;

Mitigation Measure 47 - Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and protecting the agricultural resources and soil conservation works are regulated by

the Conservation of Agricultural Resources Act, No. 43 of 1983 and should be addressed on a continual basis;

Mitigation Measure 48 - Re-vegetated areas should be monitored every four months for the first 12 months and once a year thereafter for the maintenance period of two years; and

Mitigation Measure 49 - Remove invasive and alien vegetation. The implementation of a monitoring programme in this regard is recommended, being the responsibility of the ECO/ ecologist;

9.5.6 ***Soils & Rehabilitation***

Mitigation Measure 50 - Remove and store topsoil separately in areas where excavation/ degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate regrowth of species that occur naturally in the area;

Mitigation Measure 51 - Ensure proper surface restoration and resloping in order to prevent erosion, taking cognisance of local contours and landscaping;

9.5.7 ***Fires***

Mitigation Measure 52 - All provisions of the Occupational Health and Safety Act, 85 of 1993 and the National Veld and Forestry Fire Act, must be adhered to by the holder of the authorisation. The applicant/holder shall be responsible for ensuring compliance with the conditions contained in the RoD by any person acting on his behalf, including but not limited to, an agent, servant, employee or any person rendering a service to the applicant in respect of the activity, including but not limited to, contractors and consultants;

Mitigation Measure 53 - The Project team will compile a Fire Management Plan (FMP) and Contractors directed by the ECO will submit a FMP. The Project FMP shall be approved by local Fire Protection Association, and shall include *inter alia* aspects such as relevant training, equipment on site, prevention, response, rehabilitation and compliance to the National Veld and Forest Fire Act, Act No. 101 1998. This FMP should form part of the EMP;

Mitigation Measure 54 - Prevent open fires, provide demarcated fire-safe zones, facilities and fire control measures;

Mitigation Measure 55 - Fire fighting equipment shall be available on all vehicles during the duration of the construction and maintenance activities; and

Mitigation Measure 56 - Smoking will only be permitted in designated areas where the appropriate safety equipment is available. This will include a sand bucket for depositing stubs and a fire extinguisher.

10 PHOTOGRAPHIC RECORDS

Photo 1: Image of river (2005)

Photo 2: Image of river (2010), note degradation of woody layer

Photo 3: Subsistence farming in the Ngodini area

Photo 4: Effect of wood removal on the tree stratum

Photo 5: Status of river (2005)

Photo 6: Status of river (2010), note removal of trees

Photo 7: View from Kabokweni Substation

Photo 8: View towards smaller tributary (Option 2)

Photo 9: View towards rocky outcrop (Option 2)

Photo 10: View of proposed Hlau-Hlau substation

11 ADDENDUM 1 – PLANT SPECIES OF THE 2531AC ¼ DEGREE GRID

Taxon	Family	Status	Growth Form
Abutilon sonneratianum (Cav.) Sweet	Malvaceae	LC	Shrub
Acacia ataxacantha DC.	Fabaceae	LC	Climber
Acacia burkei Benth.	Fabaceae	LC	Tree
Acacia gerrardii Benth. subsp. gerrardii var. gerrardii	Fabaceae	LC	Tree
Acacia hebeclada DC. subsp. hebeclada	Fabaceae	LC	Tree
Acacia karroo Hayne	Fabaceae	LC	Tree
Acacia luederitzii Engl. var. retinens	Fabaceae	LC	Tree
Acacia mearnsii De Wild.	Fabaceae		Tree
Acacia nigrescens Oliv.	Fabaceae	LC	Tree
Acacia nilotica subsp. kraussiana	Fabaceae	LC	Tree
Acacia podalyriifolia A.Cunn. ex G.Don	Fabaceae		Tree
Acacia schweinfurthii var. schweinfurthii	Fabaceae	LC	Climber
Acacia swazica Burtt Davy	Fabaceae	LC	Tree
Acalypha caperonioides var. caperonioides	Euphorbiaceae	DDT	Dwarf shrub
Acalypha depressinerva (Kuntze) K.Schum.	Euphorbiaceae	LC	Dwarf shrub
Acalypha glabrata Thunb. var. glabrata	Euphorbiaceae	LC	Tree
Acalypha glabrata Thunb. var. pilosa Pax	Euphorbiaceae	LC	Tree
Acalypha indica L. var. indica	Euphorbiaceae	LC	Dwarf shrub
Acalypha peduncularis E.Mey. ex Meisn.	Euphorbiaceae	LC	Dwarf shrub
Acanthospermum australe (Loefl.) Kuntze	Asteraceae		Herb
Acokanthera rotundata (Codd) Kupicha	Apocynaceae	LC	Tree
Acridocarpus natalitius A.Juss. var. natalitius	Malpighiaceae		Climber
Acrotome hispida Benth.	Lamiaceae	LC	Herb
Adenia digitata (Harv.) Engl.	Passifloraceae	LC	Climber
Adenia hastata (Harv.) Schinz var. glandulifera	Passifloraceae	LC	Climber
Adenostemma caffrum DC. var. caffrum	Asteraceae	LC	Herb
Adiantum capillus-veneris L.	Pteridaceae	LC	Geophyte
Aeollanthus rehmannii Gürke	Lamiaceae	LC	Herb
Aeschynomene rehmannii var. leptobotrya	Fabaceae	LC	Dwarf shrub
Afrosciadium platycarpum	Apiaceae		Herb
Agathisanthemum bojeri Klotzsch subsp. bojeri	Rubiaceae	LC	Herb
Agelanthus transvaalensis	Loranthaceae	LC	Parasite
Ageratum houstonianum Mill.	Asteraceae		Herb
Albizia petersiana subsp. evansii	Fabaceae	LC	Tree
Alectra orobanchoides Benth.	Orobanchaceae	LC	Herb
Alepidea peduncularis A.Rich.	Apiaceae	DDT	Herb
Aloe ecklonis Salm-Dyck	Asphodelaceae	LC	Herb
Aloe greatheadii var. davyana	Asphodelaceae	LC	Herb
Aloe kniphofioides Baker	Asphodelaceae	VU	Geophyte
Aloe parvibracteata Schönland	Asphodelaceae	LC	Herb
Aloe simii Pole-Evans	Asphodelaceae	CR	Herb
Alternanthera sessilis (L.) DC.	Amaranthaceae		Herb
Amaranthus hybridus subsp. hybridus var. erythrostachys	Amaranthaceae		Herb
Andropogon eucomus Nees	Poaceae	LC	Graminoid
Aneilema aequinoctiale (P.Beauv.) Loudon	Commelinaceae	LC	Herb
Annona senegalensis Pers. subsp. senegalensis	Annonaceae	LC	Tree
Anredera cordifolia (Ten.) Steenis	Basellaceae		Climber
Ansellia africana Lindl.	Orchidaceae	Declining	Epiphyte
Antidesma venosum E.Mey. ex Tul.	Phyllanthaceae	LC	Tree
Apodytes dimidiata E.Mey. ex Arn. subsp. dimidiata	Icacinaceae	LC	Tree
Argyrolobium speciosum Eckl. & Zeyh.	Fabaceae	LC	Herb
Aristea angolensis Baker subsp. angolensis	Iridaceae	LC	Herb
Aristea torulosa Klatt	Iridaceae	LC	Herb
Asclepias albens (E.Mey.) Schltr.	Apocynaceae	LC	Herb
Asclepias aurea (Schltr.) Schltr.	Apocynaceae	LC	Herb
Ascolepis capensis (Kunth) Ridl.	Cyperaceae	LC	Cyperoid
Asparagus buchananii Baker	Asparagaceae	LC	Climber

Asparagus cooperi Baker	Asparagaceae	LC	Dwarf shrub
Asparagus plumosus Baker	Asparagaceae	LC	Dwarf shrub
Asparagus virgatus Baker	Asparagaceae	LC	Shrub
Asplenium aethiopicum (Burm.f.) Bech.	Aspleniaceae	LC	Epiphyte
Atalaya alata (Sim) H.M.L.Forbes	Sapindaceae	LC	Tree
Athrixia phylicoides DC.	Asteraceae	LC	Shrub
Baccharoides adoensis var. kotschyana	Asteraceae	LC	Herb
Barbula indica	Pottiaceae		Bryophyte
Barleria obtusa Nees	Acanthaceae	LC	Dwarf shrub
Basananthe triloba (Bolus) W.J.de Wilde	Passifloraceae	LC	Climber
Bauhinia galpinii N.E.Br.	Fabaceae	LC	Climber
Berchemia zeyheri (Sond.) Grubov	Rhamnaceae	LC	Tree
Berkheya insignis (Harv.) Thell.	Asteraceae	LC	Herb
Blechnum punctulatum Sw. var. punctulatum	Blechnaceae	LC	Geophyte
Blepharis subvolubilis C.B.Clarke	Acanthaceae	LC	Dwarf shrub
Bonatea polypodantha (Rchb.f.) L.Bolus	Orchidaceae	LC	Geophyte
Brachiaria humidicola (Rendle) Schweick.	Poaceae	LC	Graminoid
Brachycorythis pubescens Harv.	Orchidaceae	LC	Geophyte
Brachystelma filifolium (N.E.Br.) Peckover	Apocynaceae	LC	Geophyte
Brachystelma macropetalum (Schltr.) N.E.Br.	Apocynaceae	LC	Herb
Breonadia salicina (Vahl) Hepper & J.R.I.Wood	Rubiaceae	LC	Tree
Bridelia cathartica G.Bertol. subsp. cathartica	Phyllanthaceae	LC	Tree
Bridelia micrantha (Hochst.) Baill.	Phyllanthaceae	LC	Tree
Brownleea coerulea Harv. ex Lindl.	Orchidaceae	LC	Geophyte
Bryum dichotomum Hedw.	Bryaceae		Bryophyte
Bryum pycnophyllum (Dixon) Mohamed	Bryaceae		Bryophyte
Bryum viridescens Welw. & Duby	Bryaceae		Bryophyte
Campylopus robillardei Besch.	Dicranaceae		Bryophyte
Canna x generalis L.H.Bailey	Cannaceae		Herb
Canthium inerme (L.f.) Kuntze	Rubiaceae	LC	Tree
Cardiospermum grandiflorum Sw.	Sapindaceae		Climber
Cassytha filiformis L.	Lauraceae		Herb
Cenchrus ciliaris L.	Poaceae	LC	Graminoid
Cephalanthus natalensis Oliv.	Rubiaceae	LC	Shrub
Ceratotheca triloba (Bernh.) Hook.f.	Pedaliaceae	LC	Herb
Cestrum aurantiacum Lindl.	Solanaceae		Tree
Chaetacanthus setiger (Pers.) Lindl.	Acanthaceae	LC	Dwarf shrub
Chamaecrista capensis (Thunb.) E.Mey. var. capensis	Fabaceae	LC	Herb
Chamaecrista mimosoides (L.) Greene	Fabaceae	LC	Herb
Chascanum hederaceum var. hederaceum	Verbenaceae	LC	Herb
Cheilanthes viridis (Forssk.) Sw. var. glauca	Sinopteridaceae	LC	Geophyte
Chironia krebsii Griseb.	Gentianaceae	LC	Herb
Chironia palustris Burch. subsp. palustris	Gentianaceae	LC	Herb
Chironia palustris subsp. transvaalensis	Gentianaceae	LC	Herb
Chlorophytum galpinii (Baker) Kativu var. galpinii	Anthericaceae	LC	Herb
Chlorophytum haygarthii J.M.Wood & M.S.Evans	Anthericaceae	LC	Herb
Cleome macrophylla (Klotzsch) Briq.	Capparaceae	LC	Herb
Cleome monophylla L.	Capparaceae	LC	Herb
Clutia monticola S.Moore var. monticola	Euphorbiaceae	LC	Dwarf shrub
Coccinia adoensis (A.Rich.) Cogn.	Cucurbitaceae	LC	Climber
Coddia rudis (E.Mey. ex Harv.) Verdc.	Rubiaceae	LC	Shrub
Combretum apiculatum Sond. subsp. apiculatum	Combretaceae	LC	Tree
Combretum collinum Fresen. subsp. suluense	Combretaceae	LC	Tree
Combretum kraussii Hochst.	Combretaceae	LC	Tree
Combretum molle R.Br. ex G.Don	Combretaceae	LC	Tree
Combretum zeyheri Sond.	Combretaceae	LC	Tree
Commelina africana L. var. krebsiana	Commelinaceae	LC	Herb
Commelina africana L. var. lancispatha C.B.Clarke	Commelinaceae	LC	Herb
Commelina diffusa Burm.f. subsp. scandens	Commelinaceae	LC	Helophyte
Commiphora neglecta I.Verd.	Burseraceae	LC	Succulent
Convolvulus natalensis Bernh. ex Krauss	Convolvulaceae	LC	Herb

Conyza ulmifolia (Burm.f.) Kuntze	Asteraceae	LC	Herb
Coptosperma supra-axillare (Hemsl.) Degreef	Rubiaceae	LC	Shrub
Corallocarpus bainesii (Hook.f.) A.Meeuse	Cucurbitaceae	LC	Climber
Corchorus confusus Wild	Malvaceae	LC	Herb
Coreopsis lanceolata L.	Asteraceae		Herb
Crassocephalum x picridifolium (DC.) S.Moore	Asteraceae		Herb
Crassula brevifolia Harv. subsp. brevifolia	Crassulaceae	LC	Dwarf shrub
Crossandra greenstockii S.Moore	Acanthaceae	LC	Dwarf shrub
Crotalaria lanceolata E.Mey. subsp. lanceolata	Fabaceae	LC	Herb
Crotalaria recta Steud. ex A.Rich.	Fabaceae	LC	Herb
Crotalaria virgulata Klotzsch subsp. grantiana	Fabaceae	LC	Herb
Cucumis anguria L. var. longaculeatus J.H.Kirkbr.	Cucurbitaceae	LC	Climber
Cyanotis speciosa (L.f.) Hassk.	Commelinaceae	LC	Herb
Cynodon nlemfuensis Vanderyst	Poaceae		Graminoid
Cynoglossum lanceolatum Forssk.	Boraginaceae	LC	Herb
Cyperus compressus L.	Cyperaceae	LC	Cyperoid
Cyperus cyperoides (L.) Kuntze subsp. cyperoides	Cyperaceae	LC	Cyperoid
Cyperus denudatus L.f. var. denudatus	Cyperaceae	LC	Cyperoid
Cyperus esculentus L. var. esculentus	Cyperaceae	LC	Cyperoid
Cyperus latifolius Poir.	Cyperaceae	LC	Cyperoid
Cyperus longus L. var. tenuiflorus (Rottb.) Boeck.	Cyperaceae	LC	Cyperoid
Cyperus papyrus L.	Cyperaceae	LC	Cyperoid
Cyphia elata Harv. var. elata	Lobeliaceae	LC	Herb
Cyphia stenopetala Diels	Lobeliaceae	LC	Climber
Cyphostemma humile subsp. dolichopus	Vitaceae	LC	Scrambler
Cyphostemma simulans	Vitaceae	LC	Climber
Cyrtanthus breviflorus Harv.	Amaryllidaceae	LC	Geophyte
Cyrtanthus contractus N.E.Br.	Amaryllidaceae	LC	Geophyte
Cyrtanthus galpinii Baker	Amaryllidaceae	LC	Geophyte
Dalbergia armata E.Mey.	Fabaceae	LC	Climber
Desmodium gangeticum (L.) DC.	Fabaceae	LC	Dwarf shrub
Desmodium salicifolium (Poir.) DC. var. salicifolium	Fabaceae	LC	Dwarf shrub
Desmodium setigerum (E.Mey.) Benth. ex Harv.	Fabaceae	LC	Climber
Dichilus lebeckioides DC.	Fabaceae	LC	Dwarf shrub
Dichilus reflexus (N.E.Br.) A.L.Schutte	Fabaceae	LC	Dwarf shrub
Dichrostachys cinerea (L.) Wight & Arn. subsp. nyassana	Fabaceae	LC	Tree
Dicoma anomala Sond. subsp. gerrardii	Asteraceae	LC	Herb
Digitaria ciliaris (Retz.) Koeler	Poaceae		Graminoid
Digitaria ternata (A.Rich.) Stapf	Poaceae	LC	Graminoid
Dioscorea cotinifolia Kunth	Dioscoreaceae	LC	Climber
Dioscorea sylvatica Eckl. var. rehmannii	Dioscoreaceae		Climber
Diospyros galpinii (Hiern) De Winter	Ebenaceae	LC	Dwarf shrub
Diospyros lycioides Desf. subsp. guerkei	Ebenaceae	LC	Tree
Diospyros lycioides Desf. subsp. sericea	Ebenaceae	LC	Tree
Diospyros whyteana (Hiern) F.White	Ebenaceae	LC	Tree
Dipcadi marlothii Engl.	Hyacinthaceae	LC	Geophyte
Disa extinctoria Rchb.f.	Orchidaceae	NT	Geophyte
Disa woodii Schltr.	Orchidaceae	LC	Geophyte
Dissotis canescens (E.Mey. ex R.A.Graham) Hook.f.	Melastomataceae	LC	Herb
Dolichos trilobus L. subsp. transvaalicus Verdc.	Fabaceae	LC	Climber
Dombeya cymosa Harv.	Malvaceae	LC	Tree
Dombeya pulchra N.E.Br.	Malvaceae	LC	Shrub
Dombeya rotundifolia (Hochst.) Planch. var. rotundifolia	Malvaceae	LC	Tree
Dracaena aletriformis (Haw.) Bos	Dracaenaceae	LC	Succulent
Dryopteris inaequalis (Schltdl.) Kuntze	Dryopteridaceae	LC	Geophyte
Duvernoia aconitiflora A.Meeuse	Acanthaceae	LC	Shrub
Dyschoriste rogersii S.Moore	Acanthaceae	LC	Dwarf shrub
Eichhornia crassipes (Mart.) Solms	Pontederiaceae		Herb
Ekebergia pterophylla (C.DC.) Hofmeyr	Meliaceae	LC	Tree
Elaeodendron transvaalense (Burtt Davy) R.H.Archer	Celastraceae	NT	Tree
Eleusine coracana subsp. africana	Poaceae	LC	Graminoid

Eleusine indica (L.) Gaertn.	Poaceae	LC	Graminoid
Encephalartos laevifolius Stapf & Burtt Davy	Zamiaceae	CR	Tree
Englerophytum magalismontanum (Sond.) T.D.Penn.	Sapotaceae	LC	Tree
Enteropogon monostachyus subsp. africanus	Poaceae		Graminoid
Eragrostis capensis (Thunb.) Trin.	Poaceae	LC	Graminoid
Eragrostis curvula (Schrad.) Nees	Poaceae	LC	Graminoid
Eragrostis patens Oliv.	Poaceae	LC	Graminoid
Erianthemum dregei (Eckl. & Zeyh.) Tiegh.	Loranthaceae	LC	Parasite
Erica woodii Bolus var. woodii	Ericaceae	LC	Dwarf shrub
Eriocaulon dregei Hochst.	Eriocaulaceae	LC	Helophyte
Eriosema burkei Benth. ex Harv. var. burkei	Fabaceae	LC	Herb
Eriosema cordatum E.Mey.	Fabaceae	LC	Herb
Eriosema ellipticifolium Schinz	Fabaceae	LC	Herb
Eriosema pauciflorum Klotzsch var. pauciflorum	Fabaceae	LC	Herb
Eriosema psoraleoides (Lam.) G.Don	Fabaceae	LC	Dwarf shrub
Eriosema transvaalense C.H.Stirt.	Fabaceae	LC	Herb
Eriospermum cooperi Baker var. cooperi	Eriospermaceae	LC	Geophyte
Eriospermum flagelliforme (Baker) J.C.Manning	Eriospermaceae	LC	Geophyte
Erythrina latissima E.Mey.	Fabaceae	LC	Tree
Erythroxylum delagoense Schinz	Erythroxylaceae	LC	Tree
Erythroxylum emarginatum Thonn.	Erythroxylaceae	LC	Tree
Ethulia conyzoides L.f. subsp. conyzoides	Asteraceae		Herb
Eugenia capensis (Eckl. & Zeyh.) Sond. subsp. a	Myrtaceae	LC	Dwarf shrub
Eugenia natalitia Sond.	Myrtaceae	LC	Tree
Eulophia adenoglossa (Lindl.) Rchb.f.	Orchidaceae	LC	Geophyte
Eulophia angolensis (Rchb.f.) Summerh.	Orchidaceae	LC	Geophyte
Eulophia clitellifera (Rchb.f.) Bolus	Orchidaceae	LC	Geophyte
Eulophia ensata Lindl.	Orchidaceae	LC	Geophyte
Eulophia foliosa (Lindl.) Bolus	Orchidaceae	LC	Geophyte
Eulophia hians Spreng. var. hians	Orchidaceae	LC	Geophyte
Eulophia hians Spreng. var. inaequalis	Orchidaceae	LC	Geophyte
Eulophia petersii (Rchb.f.) Rchb.f.	Orchidaceae	LC	Geophyte
Eulophia streptopetala Lindl.	Orchidaceae	LC	Geophyte
Euphorbia gueinzii Boiss. var. albovillosa (Pax) N.E.Br.	Euphorbiaceae	LC	Dwarf shrub
Euphorbia knuthii Pax subsp. knuthii	Euphorbiaceae	LC	Dwarf shrub
Euphorbia serpens Kunth	Euphorbiaceae		Herb
Euphorbia striata Thunb. var. striata	Euphorbiaceae	LC	Dwarf shrub
Euphorbia trichadenia Pax var. trichadenia	Euphorbiaceae	LC	Dwarf shrub
Euphorbia vandermerwei R.A.Dyer	Euphorbiaceae	LC	Dwarf shrub
Euryops pedunculatus N.E.Br.	Asteraceae	LC	Shrub
Evolvulus alsinoides (L.) L.	Convolvulaceae	LC	Herb
Fadogia tetraquetra var. grandiflora	Rubiaceae	LC	Herb
Faurea rochetiana (A.Rich.) Chiov. ex Pic.Serm.	Proteaceae	LC	Tree
Ficus glumosa Delile	Moraceae	LC	Succulent
Ficus stuhlmannii Warb.	Moraceae	LC	Tree
Fimbristylis complanata (Retz.) Link	Cyperaceae	LC	Cyperoid
Fimbristylis dichotoma (L.) Vahl subsp. dichotoma	Cyperaceae	LC	Cyperoid
Flagellaria guineensis Schumach.	Flagellariaceae	LC	Climber
Flemingia grahamiana Wight & Arn.	Fabaceae	LC	Herb
Floscopa glomerata	Commelinaceae	LC	Helophyte
Freesia grandiflora (Baker) Klatt	Iridaceae	LC	Geophyte
Fuirena pubescens (Poir.) Kunth var. pubescens	Cyperaceae	LC	Cyperoid
Fuirena stricta Steud. var. stricta	Cyperaceae	LC	Cyperoid
Gamochaeta pensylvanica (Willd.) Cabrera	Asteraceae		Herb
Gazania krebsiana Less. subsp. serrulata	Asteraceae	LC	Herb
Geigeria burkei Harv. subsp. burkei var. elata	Asteraceae	LC	Herb
Geigeria burkei Harv. subsp. burkei var. zeyheri	Asteraceae	LC	Herb
Geigeria burkei Harv. subsp. fruticulosa	Asteraceae	LC	Herb
Gerbera ambigua (Cass.) Sch.Bip.	Asteraceae	LC	Herb
Gerbera viridifolia (DC.) Sch.Bip.	Asteraceae	LC	Herb
Gladiolus dalenii Van Geel subsp. dalenii	Iridaceae	LC	Geophyte

Gladiolus densiflorus Baker	Iridaceae	LC	Geophyte
Gladiolus hollandii L.Bolus	Iridaceae	LC	Geophyte
Gladiolus longicollis Baker subsp. platypetalus	Iridaceae	LC	Geophyte
Gladiolus papilio Hook.f.	Iridaceae	LC	Geophyte
Gladiolus woodii Baker	Iridaceae	LC	Geophyte
Gloriosa modesta (Hook.) J.C.Manning & Vinn.	Colchicaceae	LC	Climber
Gloriosa superba L.	Colchicaceae	LC	Climber
Gnidia microcephala Meisn.	Thymelaeaceae	LC	Dwarf shrub
Gnidia nodiflora Meisn.	Thymelaeaceae	LC	Dwarf shrub
Gomphocarpus glaucophyllus Schltr.	Apocynaceae	LC	Herb
Gomphocarpus physocarpus E.Mey.	Apocynaceae	LC	Herb
Gossypium herbaceum L. subsp. africanum	Malvaceae	LC	Shrub
Graderia scabra (L.f.) Benth.	Orobanchaceae	LC	Herb
Graderia subintegra Mast.	Orobanchaceae	LC	Herb
Grewia occidentalis L. var. occidentalis	Malvaceae	LC	Tree
Grewia subspathulata N.E.Br.	Malvaceae	LC	Shrub
Gymnosporia buxifolia (L.) Szyszyl.	Celastraceae	LC	Tree
Gymnosporia senegalensis (Lam.) Loes.	Celastraceae	LC	Tree
Habenaria falcicornis subsp. caffra	Orchidaceae	LC	Geophyte
Halleria lucida L.	Scrophulariaceae	LC	Tree
Haplocarpha scaposa Harv.	Asteraceae	LC	Herb
Helichrysum athrixiifolium (Kuntze) Moeser	Asteraceae	LC	Herb
Helichrysum caespititium (DC.) Harv.	Asteraceae	LC	Herb
Helichrysum chrysargyrum Moeser	Asteraceae	LC	Herb
Helichrysum difficile Hilliard	Asteraceae	LC	Herb
Helichrysum mixtum (Kuntze) Moeser var. mixtum	Asteraceae	LC	Herb
Helichrysum mutabile Hilliard	Asteraceae	LC	Herb
Helichrysum nudifolium (L.) Less. var. oxyphyllum	Asteraceae	LC	Herb
Helichrysum nudifolium (L.) Less. var. pilosellum	Asteraceae	LC	Herb
Helichrysum panduratum O.Hoffm. var. transvaalense	Asteraceae	LC	Herb
Helichrysum stenopterum DC.	Asteraceae	LC	Herb
Helinus integrifolius (Lam.) Kuntze	Rhamnaceae	LC	Climber
Hermannia cristata Bolus	Malvaceae	LC	Dwarf shrub
Hermannia grandifolia N.E.Br.	Malvaceae	LC	Herb
Hermannia stellulata (Harv.) K.Schum.	Malvaceae	LC	Herb
Heterocentron macrostachyum Naudin	Melastomataceae		Shrub
Heteropyxis natalensis Harv.	Heteropyxidaceae	LC	Tree
Hibiscus aethiopicus L. var. ovatus Harv.	Malvaceae	LC	Herb
Hibiscus calyphyllus Cav.	Malvaceae	LC	Dwarf shrub
Hibiscus cannabinus L.	Malvaceae	LC	Herb
Hibiscus lunarifolius Willd.	Malvaceae	LC	Herb
Hibiscus schinzii Gürke	Malvaceae	LC	Herb
Homalium dentatum (Harv.) Warb.	Salicaceae	LC	Tree
Hyparrhenia filipendula var. pilosa	Poaceae	LC	Graminoid
Hypoestes forskaolii (Vahl) R.Br.	Acanthaceae	LC	Herb
Hypoxis filiformis Baker	Hypoxidaceae	LC	Geophyte
Hypoxis hemerocallidea	Hypoxidaceae	Declining	Geophyte
Hypoxis iridifolia Baker	Hypoxidaceae	LC	Geophyte
Hypoxis rigidula Baker var. pilosissima Baker	Hypoxidaceae	LC	Geophyte
Hypoxis rigidula Baker var. rigidula	Hypoxidaceae	LC	Geophyte
Ilex mitis (L.) Radlk. var. mitis	Aquifoliaceae	Declining	Tree
Indigofera colutea (Burm.f.) Merr. var. colutea	Fabaceae	LC	Herb
Indigofera hilaris Eckl. & Zeyh. var. hilaris	Fabaceae	LC	Herb
Indigofera oxalidea Welw. ex Baker	Fabaceae	LC	Herb
Indigofera sanguinea N.E.Br.	Fabaceae	LC	Herb
Indigofera tristoides N.E.Br.	Fabaceae	LC	Shrub
Indigofera vicioides var. rogersii	Fabaceae	LC	Herb
Ipomoea albivenia (Lindl.) Sweet	Convolvulaceae	LC	Climber
Ipomoea bathycolpos Hallier f.	Convolvulaceae	LC	Herb
Ipomoea cairica (L.) Sweet var. cairica	Convolvulaceae	LC	Climber
Ipomoea crassipes Hook. var. crassipes	Convolvulaceae	LC	Herb

Ipomoea indica (Burm.f.) Merr.	Convolvulaceae		Climber
Ipomoea oblongata E.Mey. ex Choisy	Convolvulaceae	LC	Herb
Ipomoea obscura (L.) Ker Gawl. var. obscura	Convolvulaceae	LC	Herb
Ipomoea purpurea (L.) Roth	Convolvulaceae		Climber
Isolepis costata Hochst. ex A.Rich.	Cyperaceae	LC	Cyperoid
Jasminum fluminense Vell. subsp. fluminense	Oleaceae	LC	Climber
Jasminum multipartitum Hochst.	Oleaceae	LC	Climber
Jasminum stenolobum Rolfe	Oleaceae	LC	Climber
Jatropha hirsuta Hochst. var. oblongifolia Prain	Euphorbiaceae	LC	Dwarf shrub
Juncus oxycarpus E.Mey. ex Kunth	Juncaceae	LC	Helophyte
Justicia betonica L.	Acanthaceae	LC	Dwarf shrub
Kalanchoe brachyloba Welw. ex Britten	Crassulaceae	LC	Succulent
Kalanchoe longiflora Schltr. ex J.M.Wood	Crassulaceae	LC	Dwarf shrub
Kalanchoe rotundifolia (Haw.) Haw.	Crassulaceae	LC	Dwarf shrub
Kirkia wilmsii Engl.	Kirkiaceae	LC	Tree
Kleinia galpinii Hook.f.	Asteraceae	LC	Succulent
Kniphofia fluviatilis Codd	Asphodelaceae	LC	Herb
Kohautia amatymbica Eckl. & Zeyh.	Rubiaceae	LC	Herb
Kohautia virgata (Willd.) Bremek.	Rubiaceae	LC	Herb
Kraussia floribunda Harv.	Rubiaceae	LC	Tree
Kyllinga erecta Schumach. var. erecta	Cyperaceae	LC	Cyperoid
Kyllinga melanosperma Nees	Cyperaceae	LC	Cyperoid
Kyllinga odorata Vahl	Cyperaceae	LC	Cyperoid
Lactuca inermis Forssk.	Asteraceae	LC	Herb
Laggera crispata (Vahl) Hepper & J.R.I.Wood	Asteraceae	LC	Herb
Lantana camara L.	Verbenaceae		Shrub
Lantana rugosa Thunb.	Verbenaceae	LC	Shrub
Ledebouria cooperi (Hook.f.) Jessop	Hyacinthaceae	LC	Geophyte
Ledebouria marginata (Baker) Jessop	Hyacinthaceae	LC	Geophyte
Leersia hexandra Sw.	Poaceae	LC	Graminoid
Leptocarydion vulpiastrum (De Not.) Stapf	Poaceae	LC	Graminoid
Lindernia pulchella (Skan) Philcox	Scrophulariaceae	LC	Herb
Lindernia wilmsii (Engl. & Diels) Philcox	Scrophulariaceae	LC	Herb
Lipocarpha chinensis (Osbeck) Kern	Cyperaceae	LC	Cyperoid
Lippia wilmsii H.Pearson	Verbenaceae	LC	Shrub
Litogyne gariepina (DC.) Anderb.	Asteraceae	LC	Dwarf shrub
Lotononis eriantha Benth.	Fabaceae	LC	Herb
Loudetia flavida (Stapf) C.E.Hubb.	Poaceae	LC	Graminoid
Ludwigia palustris (L.) Elliott	Onagraceae		Herb
Macledium zeyheri (Sond.) S.Ortíz subsp. zeyheri	Asteraceae	LC	Herb
Macrotyloma axillare (E.Mey.) Verdc. var. axillare	Fabaceae	LC	Climber
Maesa lanceolata Forssk.	Maesaceae	LC	Tree
Mariscus uitenhagensis Steud.	Cyperaceae	LC	Cyperoid
Microsorum punctatum (L.) Copel.	Polypodiaceae	LC	Epiphyte
Miscanthus junceus (Stapf) Pilg.	Poaceae	LC	Graminoid
Mohria vestita Baker	Anemiaceae	LC	Geophyte
Momordica foetida Schumach.	Cucurbitaceae	LC	Climber
Monocymbium ceresiiforme (Nees) Stapf	Poaceae	LC	Graminoid
Mucuna coriacea Baker subsp. irritans	Fabaceae	LC	Climber
Mundulea sericea (Willd.) A.Chev. subsp. sericea	Fabaceae	LC	Tree
Murdannia simplex (Vahl) Brenan	Commelinaceae	LC	Herb
Myriophyllum aquaticum (Vell.) Verdc.	Haloragaceae		Herb
Myrothamnus flabellifolius Welw.	Myrothamnaceae	DDT	Dwarf shrub
Neonotonia wightii (Wight. ex Arn.) J.A.Lackey	Fabaceae	LC	Climber
Nesaea cordata Hiern	Lythraceae	LC	Herb
Nesaea radicans var. floribunda	Lythraceae	LC	Herb
Nidorella auriculata DC.	Asteraceae	LC	Herb
Ochna natalitia (Meisn.) Walp.	Ochnaceae	LC	Tree
Ocimum gratissimum. subsp. gratissimum var. gratissimum	Lamiaceae	LC	Herb
Ocimum obovatum subsp. obovatum var. galpinii	Lamiaceae	LC	Herb
Ocimum serratum (Schltr.) A.J.Paton	Lamiaceae	LC	Shrub

Olax dissitiflora Oliv.	Olacaceae	LC	Tree
Oldenlandia affinis subsp. fugax	Rubiaceae	LC	Herb
Oldenlandia cephalotes (Hochst.) Kuntze	Rubiaceae	LC	Herb
Oldenlandia lancifolia var. scabridula	Rubiaceae	LC	Herb
Olea europaea L. subsp. africana (Mill.) P.S.Green	Oleaceae	LC	Tree
Ophioglossum gomezianum Welw. ex A.Braun	Ophioglossaceae	LC	Geophyte
Ophioglossum rubellum Welw. ex A.Braun	Ophioglossaceae	LC	Geophyte
Ormocarpum trichocarpum (Taub.) Engl.	Fabaceae	LC	Tree
Orthosiphon suffrutescens (Thonn.) J.K.Morton	Lamiaceae	LC	Herb
Oxalis smithiana Eckl. & Zeyh.	Oxalidaceae	LC	Geophyte
Panicum maximum Jacq.	Poaceae	LC	Graminoid
Panicum repens L.	Poaceae	LC	Graminoid
Pappea capensis Eckl. & Zeyh.	Sapindaceae	LC	Tree
Parinari capensis Harv. subsp. capensis	Chrysobalanaceae	LC	Dwarf shrub
Parmotrema dilatatum (Vain.) Hale	Parmeliaceae		Lichen
Paspalum urvillei Steud.	Poaceae		Graminoid
Pavetta gracilifolia Bremek.	Rubiaceae	LC	Shrub
Pearsonia aristata (Schinz) Dummer	Fabaceae	LC	Herb
Pearsonia sessilifolia (Harv.) Dummer subsp. filifolia	Fabaceae	LC	Herb
Pearsonia sessilifolia (Harv.) Dummer subsp. sessilifolia	Fabaceae	LC	Dwarf shrub
Pelargonium alchemilloides (L.) L'Hér.	Geraniaceae	LC	Dwarf shrub
Pelargonium luridum (Andrews) Sweet	Geraniaceae	LC	Geophyte
Peltophorum africanum Sond.	Fabaceae	LC	Tree
Pentanisia prunelloides subsp. prunelloides	Rubiaceae	LC	Herb
Pentas angustifolia (A.Rich. ex DC.) Verdc.	Rubiaceae	LC	Herb
Persicaria attenuata subsp. africana K.L.Wilson	Polygonaceae	LC	Helophyte
Persicaria decipiens (R.Br.) K.L.Wilson	Polygonaceae	LC	Helophyte
Persicaria limbata (Meisn.) H.Hara	Polygonaceae		Helophyte
Persicaria senegalensis forma albotomentosa	Polygonaceae		Herb
Phaulopsis imbricata (Forssk.) Sweet subsp. imbricata	Acanthaceae	LC	Herb
Philenoptera violacea (Klotzsch) Schrire	Fabaceae	LC	Tree
Phyllanthus parvulus Sond. var. parvulus	Phyllanthaceae	LC	Dwarf shrub
Phytolacca octandra L.	Phytolaccaceae		Herb
Pittosporum viridiflorum Sims	Pittosporaceae	LC	Tree
Plectranthus cylindraceus Hochst. ex Benth.	Lamiaceae	LC	Herb
Plectranthus esculentus N.E.Br.	Lamiaceae	DDD	Herb
Plectranthus spicatus E.Mey. ex Benth.	Lamiaceae	LC	Herb
Plectranthus verticillatus (L.f.) Druce	Lamiaceae	LC	Herb
Pleopeltis macrocarpa (Bory ex Willd.) Kaulf.	Polypodiaceae	LC	Epiphyte
Plumbago zeylanica L.	Plumbaginaceae		Shrub
Polygala hottentotta C.Presl	Polygalaceae	LC	Dwarf shrub
Polygala producta N.E.Br.	Polygalaceae	LC	Dwarf shrub
Polygala transvaalensis Chodat subsp. transvaalensis	Polygalaceae	LC	Herb
Polygala virgata Thunb. var. decora (Sond.) Harv.	Polygalaceae	LC	Dwarf shrub
Pouzolzia mixta Solms var. mixta	Urticaceae	LC	Shrub
Protea curvata N.E.Br.	Proteaceae	VU	Tree
Pseudarthria hookeri Wight & Arn. var. hookeri	Fabaceae	LC	Dwarf shrub
Pseudognaphalium undulatum (L.) Hilliard & B.L.Burtt	Asteraceae	LC	Herb
Psidium guajava L.	Myrtaceae		Tree
Psychotria capensis subsp. capensis var. capensis	Rubiaceae	LC	Tree
Psydrax obovata (Eckl. & Zeyh.) Bridson subsp. obovata	Rubiaceae	LC	Tree
Ptaeroxylon obliquum (Thunb.) Radlk.	Ptaeroxylaceae	LC	Tree
Pterocarpus angolensis DC.	Fabaceae	LC	Tree
Pterocelastrus echinatus N.E.Br.	Celastraceae	LC	Tree
Pterolobium stellatum (Forssk.) Brenan	Fabaceae	LC	Climber
Putterlickia pyracantha (L.) Szyszyl.	Celastraceae	LC	Shrub
Pycnostachys reticulata (E.Mey.) Benth.	Lamiaceae	LC	Herb
Pycreus mundii Nees	Cyperaceae	LC	Cyperoid
Pycreus muricatus (Kük.) Napper	Cyperaceae	LC	Cyperoid
Pycreus nitidus (Lam.) J.Raynal	Cyperaceae	LC	Cyperoid
Ranunculus multifidus Forssk.	Ranunculaceae		Herb

Raphionacme hirsuta (E.Mey.) R.A.Dyer	Apocynaceae	LC	Geophyte
Rauvolfia caffra Sond.	Apocynaceae	LC	Tree
Rhoicissus tridentata subsp. tridentata	Vitaceae		Shrub
Rhynchosia caribaea (Jacq.) DC.	Fabaceae	LC	Climber
Rhynchosia hirta (Andrews) Meikle & Verdc.	Fabaceae	LC	Climber
Rhynchosia minima (L.) DC. var. minima	Fabaceae	LC	Climber
Rhynchosia monophylla Schltr.	Fabaceae	LC	Herb
Rhynchosia sordida (E.Mey.) Schinz	Fabaceae	LC	Dwarf shrub
Rhynchosia sublobata (Schumach.) Meikle	Fabaceae	LC	Climber
Rhynchosia totta (Thunb.) DC. var. totta	Fabaceae	LC	Climber
Richardia brasiliensis Gomes	Rubiaceae		Herb
Riocreuxia torulosa Decne. var. torulosa	Apocynaceae	LC	Climber
Rotheca louwalbertsii	Lamiaceae	LC	Herb
Rotheca myricoides (Hochst.) Steane & Mabb.	Lamiaceae	LC	Tree
Rubus pinnatus Willd.	Rosaceae	LC	Scrambler
Rubus rigidus Sm.	Rosaceae	LC	Shrub
Rubus x proteus C.H.Stirt.	Rosaceae		Shrub
Ruttya ovata Harv.	Acanthaceae	LC	Shrub
Satyrium parviflorum Sw.	Orchidaceae	LC	Geophyte
Schistostephium heptalobum (DC.) Oliv. & Hiern	Asteraceae	LC	Shrub
Schizocarphus nervosus (Burch.) Van der Merwe	Hyacinthaceae	LC	Geophyte
Schizoglossum cordifolium E.Mey.	Apocynaceae	LC	Herb
Schoenoplectus brachyceras (Hochst. ex A.Rich.) Lye	Cyperaceae	LC	Cyperoid
Sclerocarya birrea subsp. caffra	Anacardiaceae	LC	Tree
Searsia leptodictya forma leptodictya	Anacardiaceae		Tree
Searsia pyroides var. integrifolia	Anacardiaceae	LC	Tree
Searsia pyroides (Burch.) Moffett var. pyroides	Anacardiaceae	LC	Shrub
Searsia rehmanniana (Engl.) Moffett var. rehmanniana	Anacardiaceae	LC	Tree
Searsia rogersii (Schönland) Moffett	Anacardiaceae	LC	Dwarf shrub
Secamone parvifolia (Oliv.) Bullock	Apocynaceae	LC	Climber
Senecio coronatus (Thunb.) Harv.	Asteraceae	LC	Herb
Senecio gerrardii Harv.	Asteraceae	LC	Herb
Senecio latifolius DC.	Asteraceae	LC	Herb
Senecio polyanthemoides Sch.Bip.	Asteraceae	LC	Herb
Senecio polyodon DC. var. polyodon	Asteraceae	LC	Herb
Sesamum orientale L.	Pedaliaceae		Herb
Sesbania punicea (Cav.) Benth.	Fabaceae		Tree
Sesbania sesban subsp. sesban var. nubica	Fabaceae	LC	Tree
Setaria rigida Stapf	Poaceae	LC	Graminoid
Setaria sphacelata var. sphacelata	Poaceae	LC	Graminoid
Sida alba L.	Malvaceae	LC	Dwarf shrub
Sida cordifolia L. subsp. cordifolia	Malvaceae	LC	Dwarf shrub
Sida dregei Burtt Davy	Malvaceae	LC	Dwarf shrub
Siphonochilus aethiopicus (Schweinf.) B.L.Burtt	Zingiberaceae	CR	Geophyte
Smilax anceps Willd.	Smilacaceae	LC	Climber
Solanum nigrum L.	Solanaceae		Herb
Solanum panduriforme E.Mey.	Solanaceae	LC	Dwarf shrub
Solanum seaforthianum var. disjunctum	Solanaceae		Climber
Sopubia cana Harv. var. glabrescens Diels	Orobanchaceae	LC	Herb
Sorghastrum stipoides (Kunth) Nash	Poaceae	LC	Graminoid
Sphedamnocarpus pruriens subsp. pruriens	Malpighiaceae	LC	Climber
Sporobolus africanus (Poir.) Robyns & Tournay	Poaceae	LC	Graminoid
Stachytarpheta mutabilis (Jacq.) Vahl	Verbenaceae		Shrub
Sterculia murex Hemsl.	Malvaceae	LC	Tree
Strychnos madagascariensis Poir.	Strychnaceae	LC	Tree
Strychnos spinosa Lam. subsp. spinosa	Strychnaceae	LC	Tree
Stylochaeton natalensis Schott	Araceae	LC	Herb
Syncolostemon canescens (Gürke) D.F.Otieno	Lamiaceae		Herb
Syncolostemon transvaalensis (Schltr.) D.F.Otieno	Lamiaceae	LC	Herb
Syngonanthus wahlbergii var. wahlbergii	Eriocaulaceae	LC	Herb
Syzygium cordatum subsp. cordatum	Myrtaceae	LC	Tree

Tapinanthus quequensis (Weim.) Polhill & Wiens	Loranthaceae	LC	Parasite
Tarchonanthus trilobus var. galpinii	Asteraceae	LC	Tree
Tephrosia acaciifolia Baker	Fabaceae	LC	Herb
Tephrosia rhodesica Baker f. var. rhodesica	Fabaceae	LC	Dwarf shrub
Tephrosia semiglabra Sond.	Fabaceae	LC	Herb
Teramnus labialis (L.f.) Spreng. subsp. labialis	Fabaceae	LC	Climber
Terminalia phanerophlebia Engl. & Diels	Combretaceae	LC	Tree
Terminalia sericea Burch. ex DC.	Combretaceae	LC	Tree
Tetradenia galpinii (N.E.Br.) Phillipson & C.F.Steyn	Lamiaceae		Herb
Tetradenia riparia (Hochst.) Codd	Lamiaceae	LC	Shrub, succulent,
Thelypteris confluens (Thunb.) C.V.Morton	Thelypteridaceae	LC	Geophyte
Themeda triandra Forssk.	Poaceae	LC	Graminoid
Thesium exile N.E.Br.	Santalaceae	LC	Herb
Thesium multiramulosum Pilg.	Santalaceae	LC	Herb
Thesium utile A.W.Hill	Santalaceae	LC	Herb
Thunbergia alata Bojer ex Sims	Acanthaceae	LC	Climber
Thunbergia amoena C.B.Clarke	Acanthaceae	LC	Creeper
Thunbergia atriplicifolia E.Mey. ex Nees	Acanthaceae	LC	Dwarf shrub
Thunbergia pondoensis Lindau	Acanthaceae	LC	Climber
Tithonia rotundifolia (Mill.) S.F.Blake	Asteraceae		Herb
Trachyandra gerrardii (Baker) Oberm.	Asphodelaceae	LC	Geophyte
Tragia minor Sond.	Euphorbiaceae	LC	Dwarf shrub
Tragia rogersii Prain	Euphorbiaceae	LC	Dwarf shrub
Tragia rupestris Sond.	Euphorbiaceae	LC	Climber
Trema orientalis (L.) Blume	Celtidaceae	LC	Tree
Tricalysia lanceolata (Sond.) Burtt Davy	Rubiaceae	LC	Tree
Trichilia emetica Vahl subsp. emetica	Meliaceae	LC	Tree
Trichostomum brachydontium Bruch	Pottiaceae		Bryophyte
Tricliceras laceratum (Oberm.) Oberm.	Turneraceae	LC	Herb
Tricliceras schinzii subsp. schinzii var. juttae	Turneraceae	LC	Herb
Triumfetta pilosa var. tomentosa	Malvaceae	LC	Shrub
Triumfetta rhomboidea Jacq. var. rhomboidea	Malvaceae	LC	Herb
Triumfetta welwitschii var. hirsuta	Malvaceae	LC	Herb
Triumfetta welwitschii Mast. var. welwitschii	Malvaceae	LC	Herb
Trochomeria debilis	Cucurbitaceae	LC	Climber
Trochomeria hookeri Harv.	Cucurbitaceae	LC	Climber
Tulbaghia ludwigiana Harv.	Alliaceae	LC	Herb
Turraea obtusifolia Hochst.	Meliaceae	LC	Climber
Tylophora anomala N.E.Br.	Apocynaceae	LC	Climber
Tylosema fassoglense (Schweinf.) Torre & Hillc.	Fabaceae	LC	Climber
Utricularia livida E.Mey.	Lentibulariaceae	LC	Carnivore
Utricularia scandens Benj.	Lentibulariaceae	LC	Carnivore
Vangueria cyanescens Robyns	Rubiaceae		Tree
Vangueria infausta Burch. subsp. infausta	Rubiaceae	LC	Tree
Verbena bonariensis L.	Verbenaceae		Herb
Vigna unguiculata subsp. stenophylla	Fabaceae	LC	Climber
Vigna unguiculata subsp. unguiculata var. unguiculata	Fabaceae	LC	Climber
Vigna vexillata (L.) A.Rich. var. vexillata	Fabaceae	LC	Climber
Viscum subserratum Schltr.	Viscaceae	LC	Parasite
Vitellariopsis marginata	Sapotaceae	LC	Tree
Vitex obovata E.Mey. subsp. obovata	Lamiaceae	LC	Tree
Vitex obovata E.Mey. subsp. wilmsii	Lamiaceae	LC	Tree
Wahlenbergia virgata Engl.	Campanulaceae	LC	Herb
Waltheria indica L.	Malvaceae	LC	Herb
Withania somnifera (L.) Dunal	Solanaceae	LC	Dwarf shrub
Xenostegia tridentata subsp. angustifolia	Convolvulaceae	LC	Herb
Xyris rehmannii L.A.Nilsson	Xyridaceae	LC	Helophyte
Zaluzianskya angustifolia Hilliard & B.L.Burtt	Scrophulariaceae	LC	Herb
Zanthoxylum capense (Thunb.) Harv.	Rutaceae	LC	Tree
Zinnia peruviana (L.) L.	Asteraceae		Herb

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