PRELIMINARY ECOLOGICAL SURVEY AND HABITAT ASSESSMENT FOR THE PROPOSED P-166 ROAD; WHITE-RIVER-MBOMBELA, MPUMALANGA PROVINCE

Compiled for: Royal HaskoningDHV by:

Vegetation Aspect

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1. Background Information

Prof. L.R. Brown and Mr. C. L. Cook were appointed by Royal HaskoningDHV (previously SSI) to undertake a preliminary ecological assessment for the scoping phase of the proposed EIA for the P-166 road from the north of White River to the south of Mbombela. Four alternatives alignments were proposed for the new P1-66 road linkage. It must be stressed that no comprehensive vegetation or faunal surveys have been undertaken due to severe financial and time constraints as well as access on privately owned properties; but merely a brief assessment of the current ecological status of the proposed road alignments. By surveying the proposed road alignment as well as immediate areas adjacent to the proposed alignment for specialised habitats, as well as the remaining vegetation and specific habitats, one can make an assumption of the possible presence or absence of threatened plant and animal species. An initial site visitation of the proposed alignment was conducted on the 20-21st October 2012. The survey was supplemented by literature investigations; personal records, historic data and previous surveys conducted in the White River-Mbombela areas (2000-2012) as well as in similar habitats.

2. TERMS OF REFERENCE

In order to meet the objectives of the project, the following terms of reference informed the scope of the study:

2.1. Objectives of the Preliminary Ecological Survey

- To provide a basic description of the fauna and vegetation units occurring along the proposed P-166 road alignments. List the prominent plant species (trees, shrubs, grasses and other herbaceous species of special interest) present for vegetation unit and ecosystem delimitation.
- To identify plant and animal/faunal species (mammals, birds reptiles, amphibians) of conservation importance; which could possibly occur along the proposed P-166 road alignments.

2.2 Scope of study

- A brief field survey (2 days) of the proposed P-166 road alignments.
- An assessment of the ecological habitats, evaluating conservation importance and significance with special emphasis on the current status of threatened animal and plant species (Red Data/Listed Species), which could possibly occur along the proposed P-166 road alignments and immediate adjacent areas.
- Prepare an ecological sensitivity map of the proposed P-166 road alignments.
- Documentation of the findings of the study in a report.

3. METHODOLOGY

The proposed route was analysed prior to the field survey for available literature and database information pertaining to the vegetation and threatened species of the study area. The Braun-Blanquet survey technique to describe plant communities as ecological units was used for this study. It allows for the mapping of vegetation and the comparison of the data with similar studies in the area. The vegetation survey was conducted by Prof. LR Brown & Mr CL Cook on 20th & 21st of October 2012. During the field surveys, the remaining natural areas were covered on foot and the majority of the road alignment by vehicle.

3.1 Predictive methods

A 1:50 000 map of the study area was provided showing existing infrastructure and the proposed alignments. This was used as far as possible in order to identify potential "hot-spots" along the proposed three alternative road alignments and reserves, e.g. Patches of undisturbed vegetation, river crossings, forested cliffs and agricultural areas. Satellite imagery of the area was obtained from Google Earth was studied in order to get a three dimensional impression of the topography and land use.

3.2 Literature Survey

A detailed literature search was undertaken to assess the current status of threatened plants well as faunal species that have been historically known to occur in the Mbombela (Nelspruit)-White River 2530CD and 2531BA quarter degree grid cells (QDGC's) as well as 2530_3055, 2525_3055, 2520_3055, 2515_3055 and 2515_3100 pentads for avifuana/birds (SABAP2). The literature search was undertaken utilising *The Vegetation of South Africa, Lesotho and Swaziland* (Mucina & Rutherford 2006) for the vegetation description as well as *National Red List of Threatened Plants of South Africa* (Raimondo *et al,* 2009) as well as internet using POSA (http://posa.sanbi.org). *The Mammals of the Southern African Subregion* (Skinner & Chimimba 2005) and *The Red Data Book of the Mammals of South Africa: A Conservation Assessment* (Friedmann and Daly (editors) 2004) as well as ADU's MammalMap (http://vmus.adu.org.za/vm_sp_list.php accessed on the 14th of October 2012) for mammals. Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (eds). 2005. *Roberts- Birds of Southern Africa VIIth ed*. And BARNES, K.N. (ed.) (2000) *The Escom Red Data Book of Birds of South Africa, Lesotho and Swaziland* for avifauna (birds) as well as internet SABAP2 (http://sabap2.adu.org.za accessed on the 14th of October 2012). The *Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland* (Minter *et al.* 2004) for amphibians as well as SAFAP (. The *Field Guide to the Snakes and other Reptiles of Southern Africa* (Branch 2001) and *South African Red Data Book-Reptiles and Amphibians* (Branch 1988) as well as SARCA ((http://sarca.adu.org.za accessed on the 14th of October 2012) for reptiles.

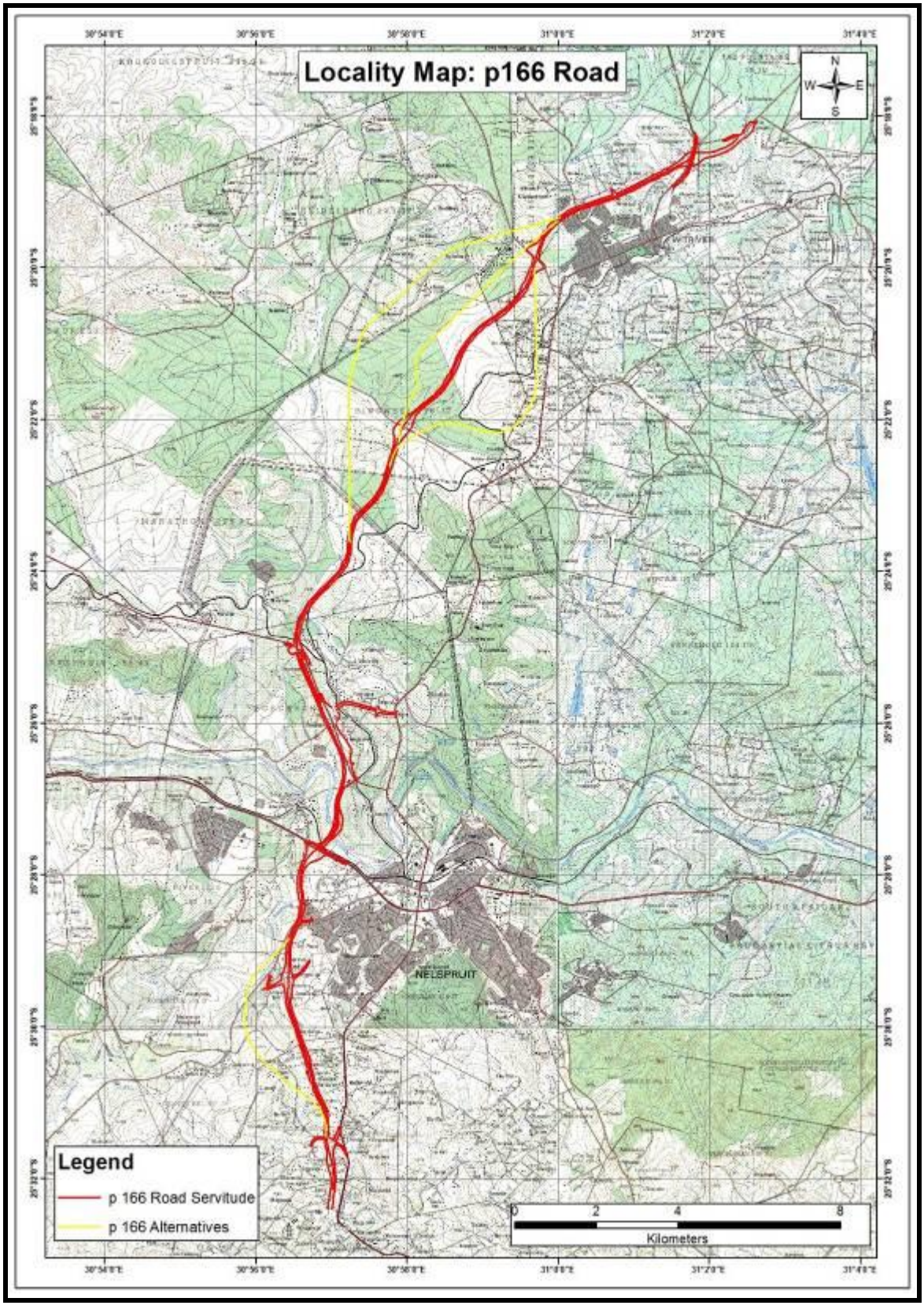


Figure1. A preliminary locality map of the proposed P-166 alignment.

4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

CONDITIONS RELATING TO THIS REPORT

4.1 VEGETATION ASPECT

Approach

Conclusions reached and recommendations made are based not only on occurrence of individual species, but more appropriately on habitats and ecosystem processes. Planning must therefore allow for the maintenance of species, habitats and ecosystem processes, even if Red Data or endemic plant species are absent.

The study area falls within the savanna biome of South Africa and specifically in the **Central Bushveld Bioregion (SVcb)** (Mucina & Rutherford 2006). This bioregion has the highest number of vegetation types of the savannah bioregions. On a smaller scale the study area is located within **Legogote Sour Bushveld (SVI 9)** with a small section of the **Pretoriuskop Sour Bushveld (SVI 10)** (Mucina & Rutherford 2006) also present.

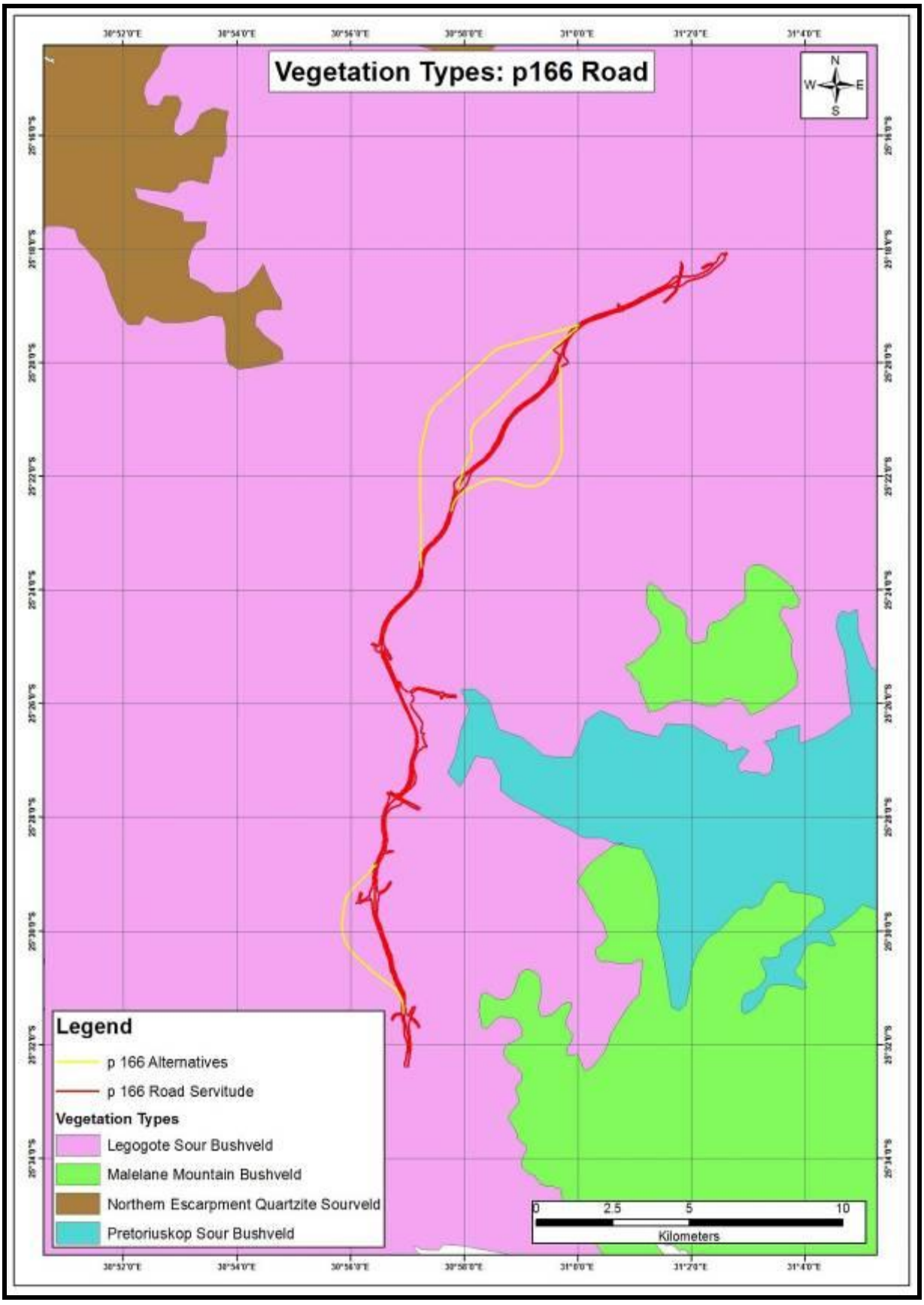


Figure2. Vegetation type of the study area (adapted from Mucina & Rutherford 2006).

Landscape Features

Gently to moderately sloping upper pediment slopes with desne woodlands including many medium to large shrubs often dominated by *Parinari curatelifolia* and *Bauhinia galpinii* with *Hyperthelia dissoluta* and *Panicum maximum* in the undergrowth. Short thicket dominated by *Acacia ataxacantha* occurs on rocky sites. Exposed granite outcrops have low vegetation cover, typically with *Englerophytum magaliesmontanum, Aloe perticola* and *Myrothamnus falbellifolia* (Mucina & Rutherford 2006).

Geology & Soils

The largest part of the area comprises gneiss and migmatite from the Nelspruit suite with large granite outcrops. Soils are of Mispah, Glenrosa and Hutton forms, shallow to deep, sandy or gravely and well drained. Diabase intrusions are common, giving rise to Hutton soils. Dominant land types Ab, Fa and Ae.

Climate

Summer rainfall with dry winters with Mean Annual Precipitation of approximately 667 mm of rain (Figure 3). The area is within the summer rainfall area with the highest rainfall in summer (120 mm – December) and the lowest rainfall during June (2 mm). The average midday temperatures range from 21°C in June to 28°C in January with the coldest temperatures (6°C) during the winter in July (Figure 4).

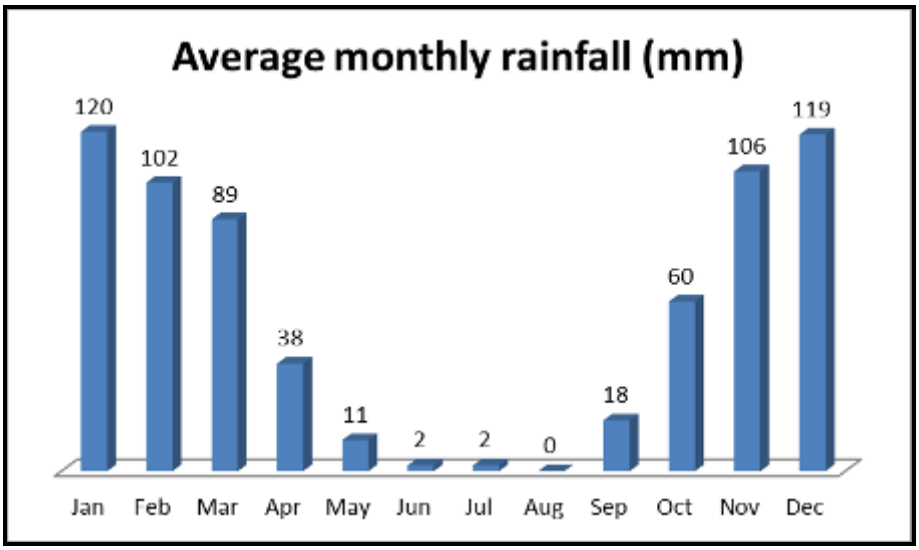


Figure3. Average monthly rainfall for the area.

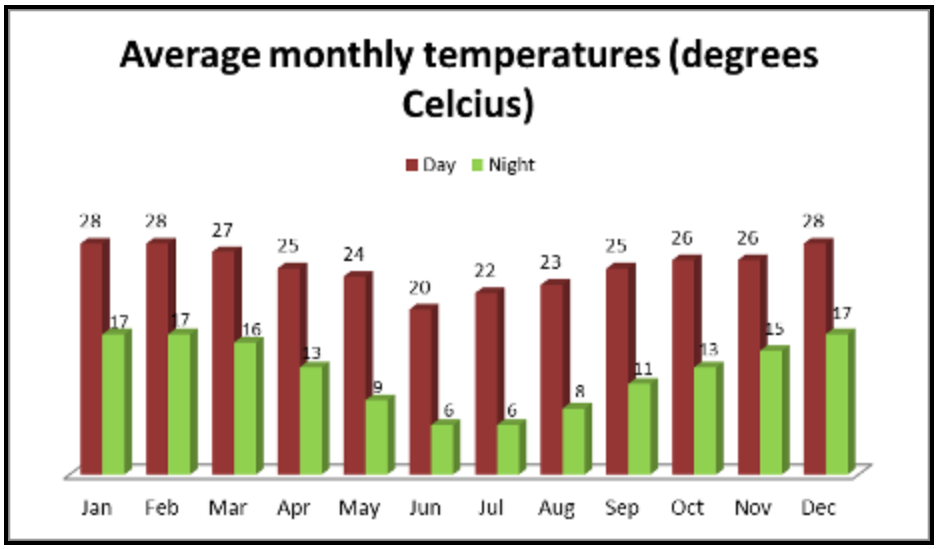


Figure4. Average monthly temperatures for the study area.

4.2 LEGOGOTE SOUR BUSHVELD (SVI 9)

Figure5. A photograph of Legogote Sour Bushveld situated on the dense woodland slopes dominated by various *Acacia* species and poorly vegetated granite domes around Mbombela/Nelspruit.

The vegetation is characterised by the presence of medium to large shrubs that form dense woodland areas on the slopes, while various *acacia* species are present in the lower-lying areas with *Dichrostachys cinerea* prominent in some localities. The large granite outcrops do not have much vegetation cover though smaller forb species do grow in the crevices where soil and litter have collected. Large areas have been transformed due to mainly forest plantations, with some areas transformed due to cultivation of crops. The soil ranges from deep Hutton to shallow but well-drained Mispah.

Dominant taxa in this vegetation type include:

Woody species	*Pterocarpus angolensis, Sclerocarrya birrea, Acacia sieberiana, Acacia caffra, Ximenia caffra, Ficus thonningii, Combretum zeyheri, Schotia brachypetala, Diospyros lycioides, Gymnosporia buxifolia, Terminalia sericea, Englerophytum magalismontanum*

Grasses	*Cymbopogon excavatus, Hyparrhenia hirta, Setaria sphacelata, Hypethelia dissoluta, Andropogon shirensis, Scizachyrium sanguineum, Heteropogon contortus*

Forbs	*Gerbera viridifolia, Waltheria indica, Hypoxis rigidula, Xerophyta retinervis*

Endemic species to this vegetation type:

Aloe simii

Alien species within this vegetation type:

Lantana camara, Solanum mauritianum, Melia azedarach, Psidium guajava

Conservation status: Endangered with target of 19%. Only about 2% statutorily conserved in the Bosbokrand and Barbeton Nature Reserves, and a further 2% in private reserves including the Mbessan and Kaapsehoop Reserves and the Mondi Cycad Reserve. It has been greatly transformed (50%), mainly by plantations and also by cultivated areas and urban developments.

4.3 PRETORIUSKOP SOUR BUSHVELD (SVI 10)

Figure6. Pretoriouskop Sourveld Bushveld situated on a hillslope and is the typical open tree savanna dominated by several tree and shrub species.

The vegetation type is similar to the Legogote Sour Bushveld (SVI 9) but is drier and occurs mostly as open tree savannah that is characterised by the prominence of *Dichrostachys cinerea* and *Terminalia sericea* (Mucina & Rutherford 2006). The area is classified as open savannah with various *Acacia* species present and occurs on the upland areas. The geology is mainly granite from the Nelspruit Suite and the soil is shallow to medium deep. Large areas have been transformed due to cultivation and the development of settlements.

Dominant taxa in this vegetation type include:

Woody species	*Acacia nilotica, Acacia tortilis, Combretum apiculatum, Combretum zeyheri, Peltophorum africanum, Combretum molle, Terminalia sericea, Dichrostachys cinereaStrychnos madagascariensis, Grewia bicolor*

Grasses	*Elionurus muticus, Hyparrhenia hirta, Panicum coloratum, Eragrostis rigidior, Heteropogon contortus*

Forbs	*Waltheria indica, Schkuhria pinnata,,*

Alien species within this vegetation type:

Lantana camara, Solanum mauritianum, Opuntia stricta, Psidium guajava

Conservation status: Least threatened with a conservation target of 19% conserved. Some 40% conserved in the Kruger National Park. About 16% transformed by cultivation and by the development of settlements.

4.4 RED DATA SPECIES

An investigation was also carried out on rare and protected plants that might possibly occur in the region. For this investigation the National Red List of Threatened Plants of South Africa, compiled by the Threatened Species Programme, South African National Biodiversity Institute (SANBI) was used. The actual presence of rare and protected species will be assessed during the summer site survey. A list of red data for the study area was obtained and is included in the Appendix (see Table3) while a list of all endemic species for the study area is included in the Appendix as (Table 4).

Data processing

A classification of vegetation data was done to identify, describe and map vegetation types. The descriptions of the plant communities include the tree, shrub and herbaceous layers.

The **conservation priority** of each vegetation unit was assessed by evaluating the plant species composition in terms of the present knowledge of the vegetation of the Savanna Biome of South Africa.

The following four **conservation priority** categories were used for each vegetation unit:

High: Area with high species richness and habitat diversity; presence of viable populations of red data plant species OR suitable habitat for such species; presence of unique habitats; less than 5% pioneer/alien plant species present. These areas are ecologically valuable and important for ecosystem functioning. This land should be conserved and managed and is not suitable for development purposes.

Medium: An area with a relatively natural species composition; not a threatened or unique ecosystem; moderate species and habitat diversity; between 5-20% pioneer/alien plant species present; that would need moderate to major financial input to rehabilitate to an improved condition; and where low density development could be considered with limited impact on the vegetation / ecosystem. It is recommended that certain sections of the vegetation are maintained**.**

Low-medium: Area with relatively natural vegetation, though a common vegetation type; moderate to low species and habitat diversity; previously or currently degraded or in secondary successional phase; between 20-40% pioneer and/or alien plant species; low ecosystem functioning; low rehabilitation potential.

Low: A totally degraded and transformed area with a low habitat diversity and ecosystem functioning; no viable populations of natural plants; >40% pioneer and/or alien plant species present; very low habitat uniqueness; whose recovery potential is extremely low; and on which development could be supported with with little to no impact on the natural vegetation / ecosystem.

Alien plants are indicated in red, red data/endemic in green.

4.5 RESULTS

Seven distinct vegetation units could be identified (Figures 7a-e) namely:

1. Wetland
2. Sour Bushveld
3. Riverine areas
4. Bushveld
5. Afforested plantations / Developed areas

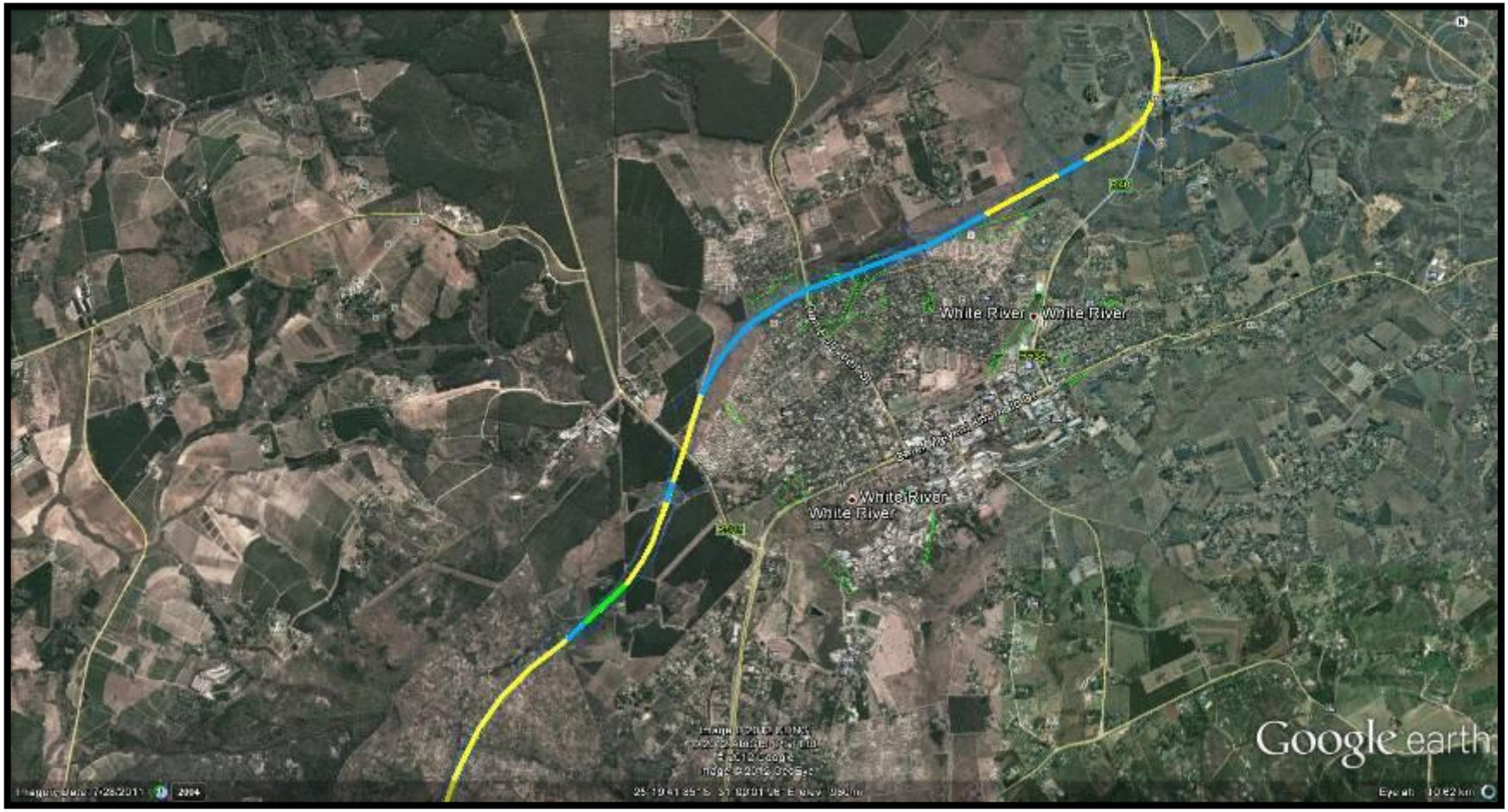


Figure7a. Vegetation units of study area [Wetland (Unit 1) = Blue; Sour Bushveld (Unit 2) = Green; Riverine areas (Unit 3) = Pink; Bushveld (Unit 4) = Orange; Plantations/Developed areas (Unit 5) = Yellow]

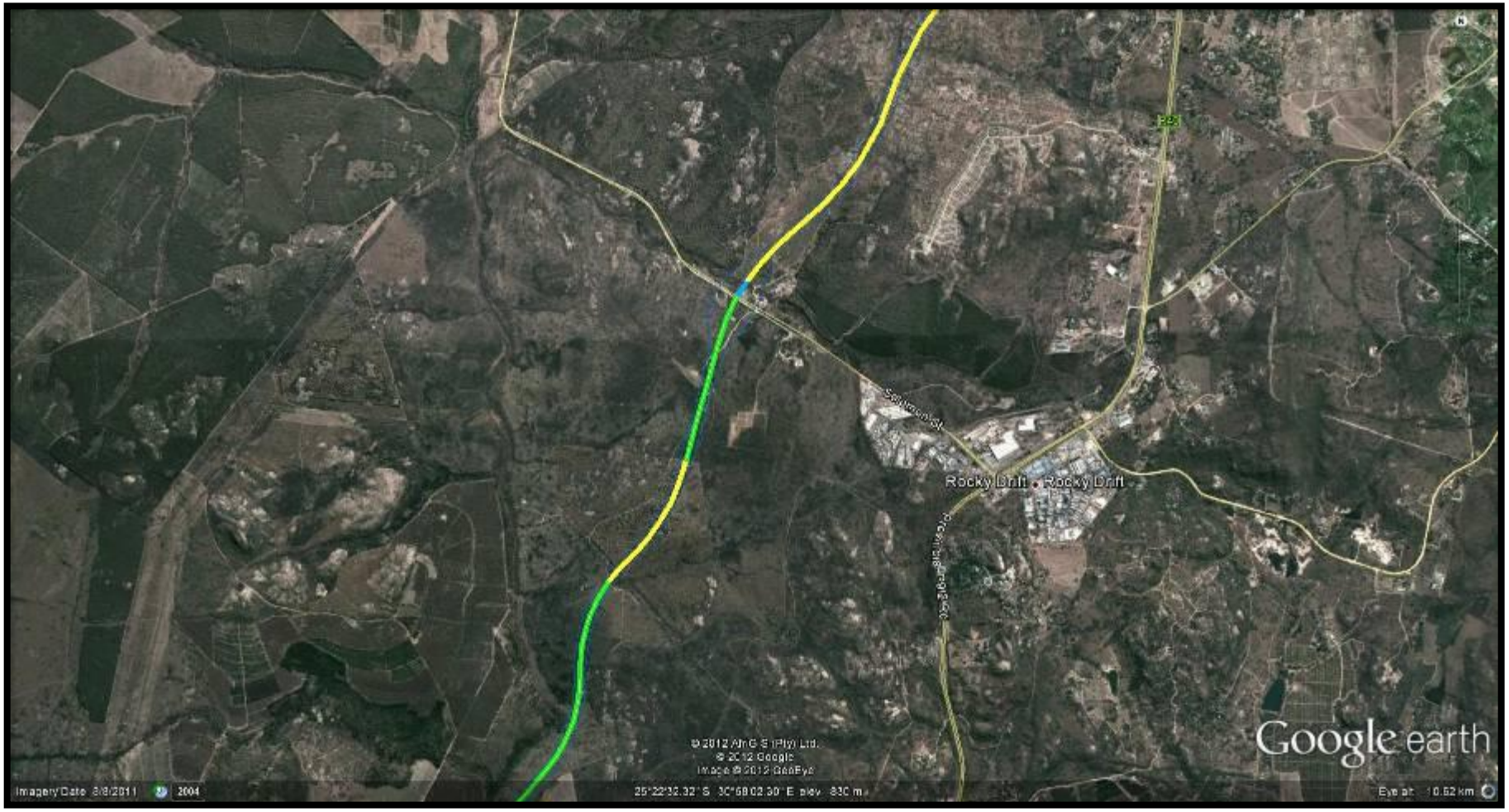


Figure7b. Vegetation units of study area [Wetland (Unit 1) = Blue; Sour Bushveld (Unit 2) = Green; Riverine areas (Unit 3) = Pink; Bushveld (Unit 4) = Orange; Plantations/Developed areas (Unit 5) = Yellow]

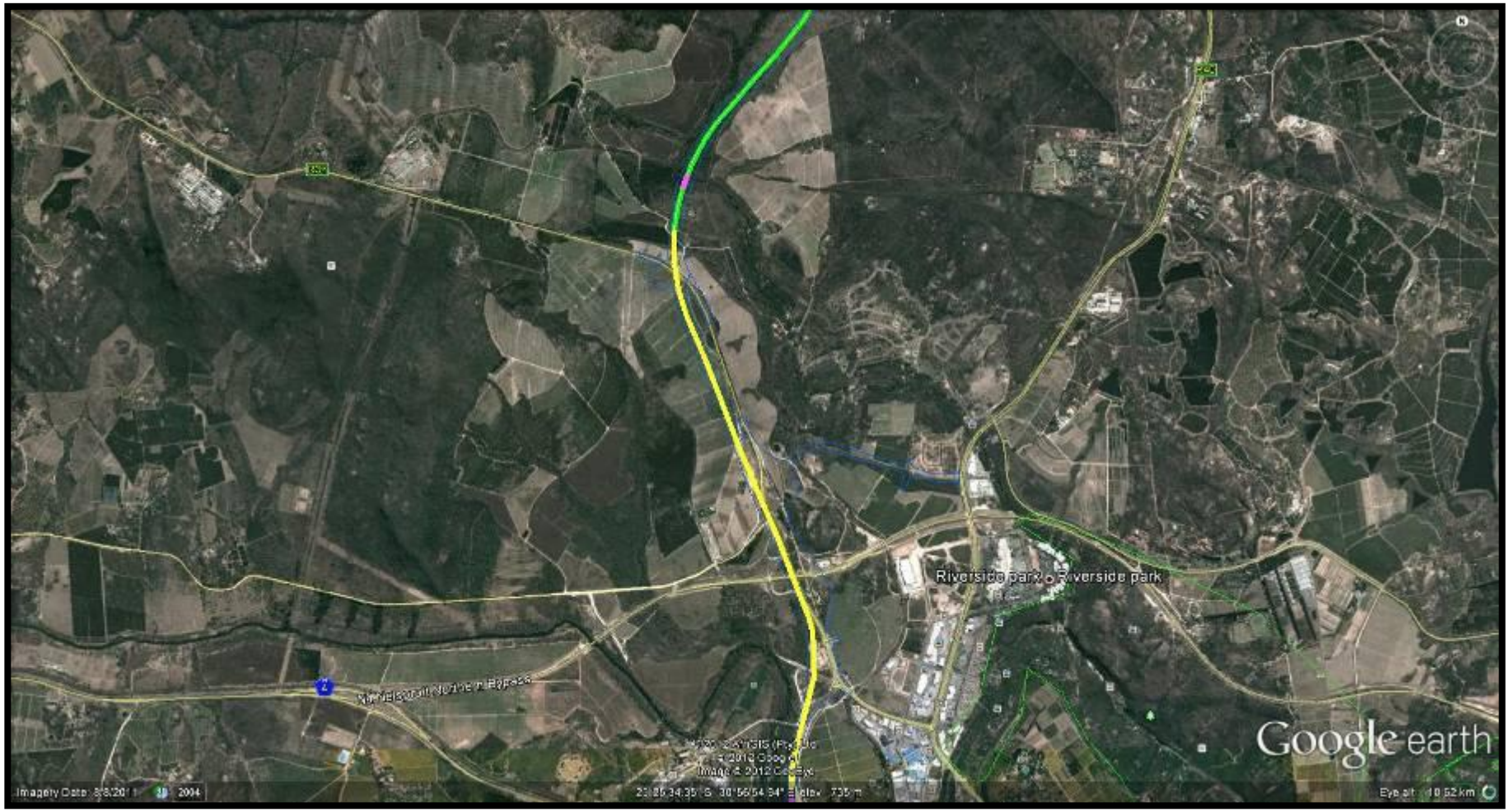


Figure7c. Vegetation units of study area [Wetland (Unit 1) = Blue; Sour Bushveld (Unit 2) = Green; Riverine areas (Unit 3) = Pink; Bushveld (Unit 4) = Orange; Forest/Developed areas (Unit 5) = Yellow]

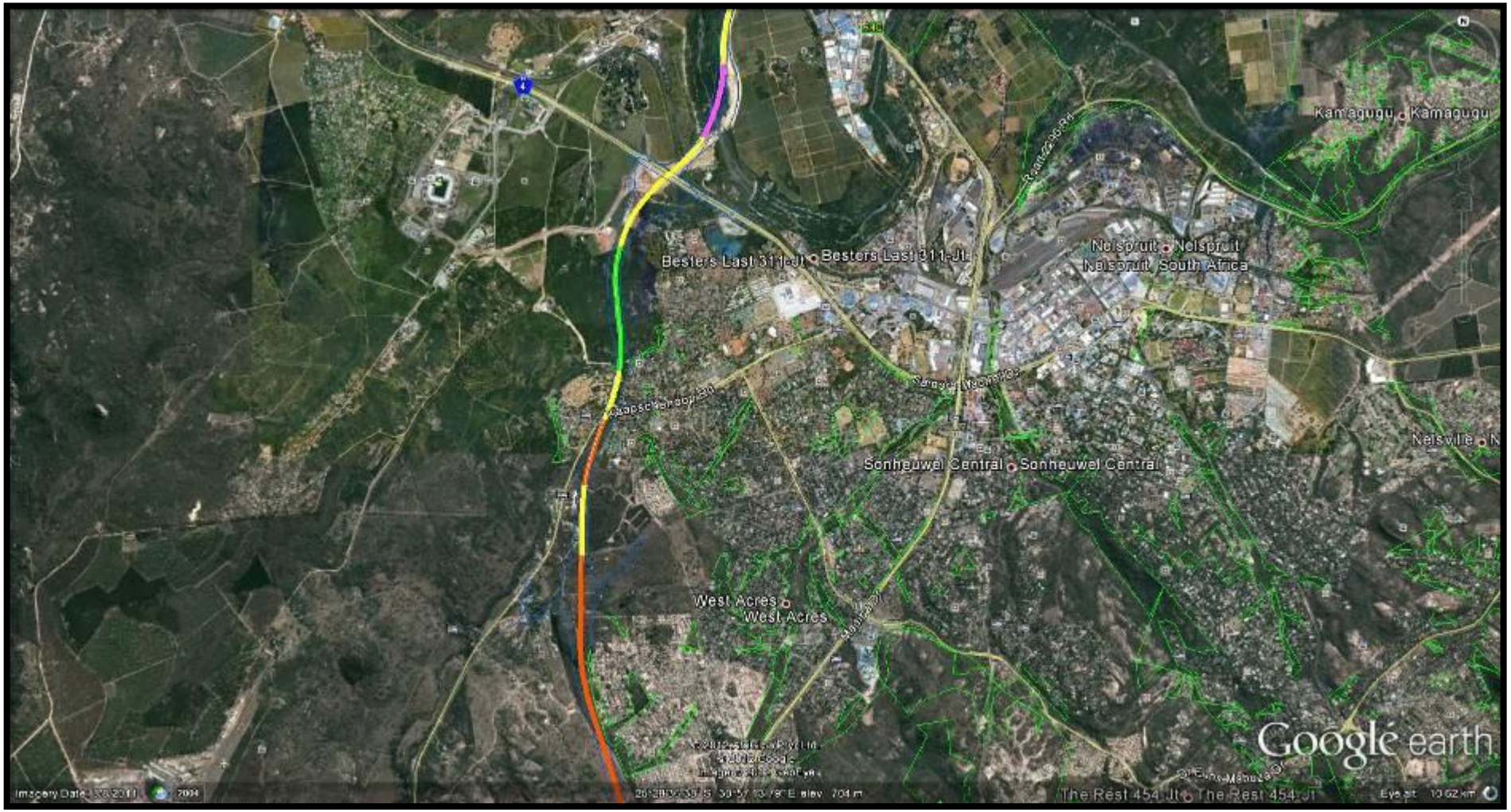


Figure 7d. Vegetation units of study area [Wetland (Unit 1) = Blue; Sour Bushveld (Unit 2) = Green; Riverine areas (Unit 3) = Pink; Bushveld (Unit 4) = Orange; Forest/Developed areas (Unit 5) = Yellow]

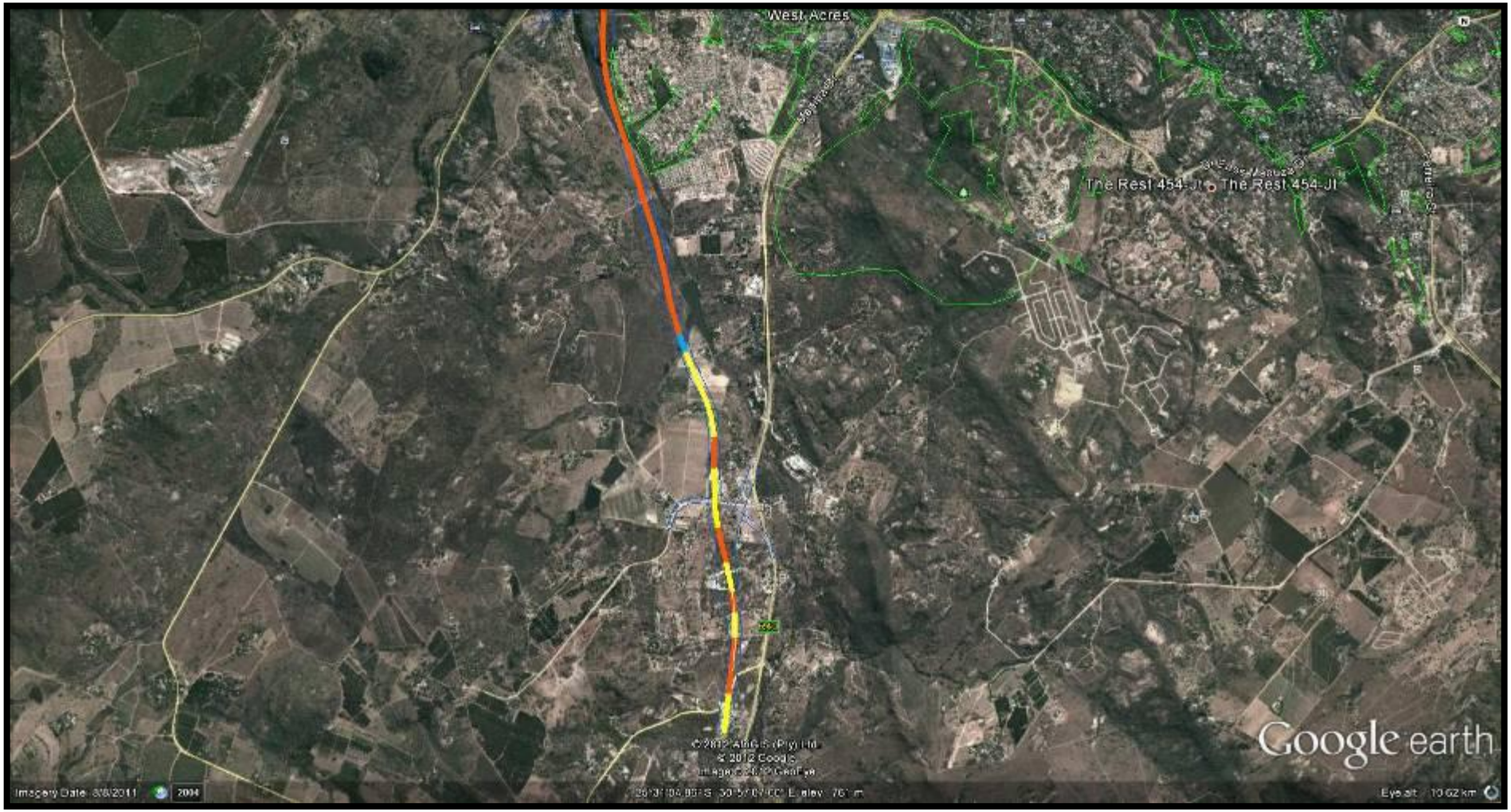


Figure7e. Vegetation units of study area [Wetland (Unit 1) = Blue; Sour Bushveld (Unit 2) = Green; Riverine areas (Unit 3) = Pink; Bushveld (Unit 4) = Orange; Forest/Developed areas (Unit 5) = Yellow]

VEGETATION UNITS

1. Wetlands

Mapping unit	1	**Tree cover**	0%
Soil	Clay	**Shrub cover**	1%
Topography	Broad valley bottom; artificially channelled	**Herb cover**	35-55%
Land use	Cultivation & natural	**Grass cover**	25-35%
Unit status	Slightly degraded wetland	**Rock cover**	2%
Conservation priority	High	**Erosion**	1%
Dominant spp.	*Phragmites mauritianus, Imperata cylindrica, Agrostis lachnantha, Typha capensis, Kyllinga alba, Monopsis decipens*		

This vegetation unit is located on northern part of the study area in the town of White River. The soil is dark grey clay. Few woody species occur covering less than 1% of the area. The herbaceous component is dominant with the forbs covering between 35 and 60% of the area with the grasses between 25-35%. Except for single large rocks in the stream no other rocks were observed.

The vegetation is characterised by typical wetland species such as the grasses *Phragmites mauritianus, Imperata cylindrica, Agrostis lachnantha,* and the forbs *Typha capensis, Kyllinga alba, Monopsis decipens* and various *Cyperus* spp. The declining red data plant *Gunnera perpensa* is also present. The grass and forb layers are dominant and cover up to 80% of the area. Single individual trees such as the exotic *Eucalyptus camaldulensis* are present in this unit.

The vegetation is typical wetland with the permanently wet and seasonal zones present with development on the temporary wet zone in the form of housing developments. The development within the wetland zone due to houses has also resulted in local people planting small crops and other plants directly in the seasonal wet zone of the wetland. It is also in these areas where the natural vegetation has been cleared and the soil worked and the water channelled. Various pioneer plant species such as *Tagetes minuta* and *Bidens pilosa* are present in these areas.

Red data species

Two declining species *Gunnera perpensa* and *Eucomis autumnalis* (Table 1 section IV) was found to be present in the wetland. The habitat is also suitable for various orchid species that were not flowering during the time of the survey.

The following is a list of species identified in this unit:

WOODY SPECIES
Eucalyptus camaldulensis
GRASSES
Agrostis lachnantha
Cynodon dactylon (L.) Pers.
Eragrostis plana
Imperata cylindrica (L.) Raeusch.
Phragmites mauritianus Kunth
FORBS
Ageratum conyzoides
Bidens pilosa L.
Canna indica L.
Conyza albida Spreng.
Cyperus rupestris Kunth
Cyperus species
Eriosema species
Eulophia angolensis (Rchb.f.) Summerh.
Gunnera perpensa L.
Kyllinga alba Nees
Mariscus congestus (Vahl) C.B.Clarke
Monopsis decipiens (Sond.) Thulin
Nephrolepis species
Pteridium aquilinum (L.) Kuhn
Richardia brasiliensis Gomes
Schoenoplectus corymbosus (Roth ex Roem. & Schult.) J.Raynal
Sida alba L.
Tagetes minuta L.
Trachycalymma cucullata (Schltr.) Bullock
Typha capensis (Rohrb.) N.E.Br.
Verbena bonariensis L.
Wahlenbergia undulata (L.f.) A.DC.
Zornia milneana Mohlenbr.

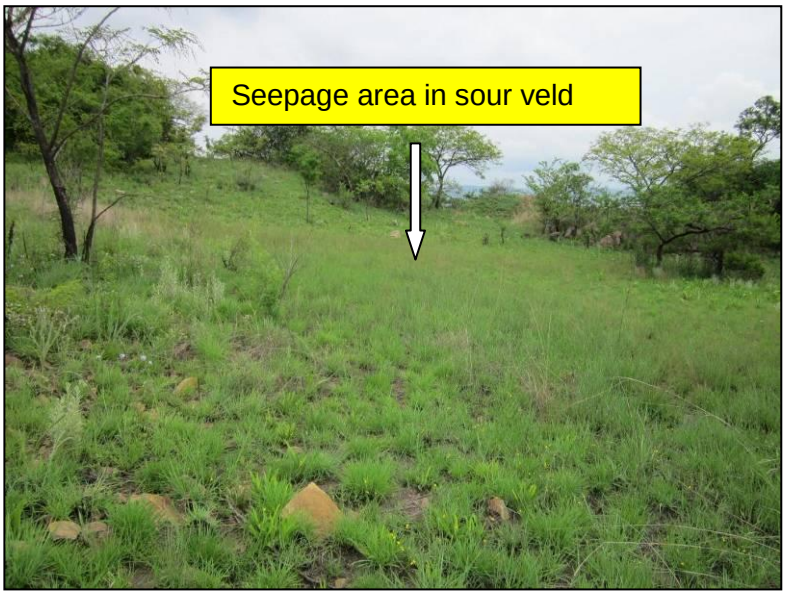
2. Sour Bushveld

Mapping unit	2	**Tree cover**	10-15%
Soil	Sandy loam with clay	**Shrub cover**	40-50%
Topography	Varies (1-5^0)	**Herb cover**	12%
Land use	Natural	**Grass cover**	55-65%
Unit status	Natural woodland / grazing	**Rock cover**	1-15%
Conservation priority	High	**Erosion**	1%
Dominant spp.	*Acacia sieberiana; Pterocarpus angolensis*		

This woodland is occurs on rocky terrain that varies from level to mildly steep rocky outcrops. The soil is shallow on the higher-lying rocky areas and varies from shallow to medium deep in the lower-lying more level areas. Soil texture is sandy to loam with some clay present. The woody layer covers between 10 and 50% of the area. The grasses cover between 55 and 65% and the forbs up to 12% of the area.

The vegetation consists of open to closed woodland with smaller open grassland patches in-between. The trees *Acacia sieberiana* and *Pterocarpus angolensis* dominate the vegetation. Various grass and forb species are present and include *Tristachya rehmannii, Brachiaria serrata, Eragrostis superba, Fuirena pubescens, Monopsis decipiens, Hypoxis iridifolia, H. rigudula* and *Gerbera jamesonii*.

In some places seeps were also found within the grassland patches between the woody species. These seeps provide a moist habitat and also form part of wetlands. The species present within what seems to be seasonal seeps comprise a mixture of terrestrial and moist loving species.



The vegetation is natural with most of the species being climax species. Smaller degraded patches are present, mostly due to human influences, but overall the area has a high species richness and diversity. The woody layer varies from an open to closed canopy thereby providing a variety of habitats for the different plant and insect species present.

Red data species

Two declining species *Crinum macowanii* and *Eucomis atumnnalis* (Table 1 section IV) was found to be present in this unit. Suitable habitat exists for other red data species also.

The following is a list of species identified during the survey:

WOODY SPECIES
Acacia sieberiana DC.
Bauhinia galpinii N.E.Br.
Jacaranda mimosifolia D.Don
Lantana camara L.
Lippia rehmannii H.Pearson
Parinari capensis Harv.
Pterocarpus angolensis
Searsia leptodictya
Zanthoxylum capense (Thunb.) Harv.
GRASSES
Brachiaria serrata (Thunb.) Stapf
Eragrostis curvula (Schrad.) Nees
Eragrostis racemosa (Thunb.) Steud.
Eragrostis superba Peyr.

Hyparrhenia hirta (L.) Stapf
Melinis nerviglumis (Franch.) Zizka
Panicum natalense Hochst.
Themeda traindra
Tristachya rehmannii Hack.
Urochloa panicoides P.Beauv.
FORBS
Acalypha species
Becium obovatum (E.Mey. ex Benth.) N.E.Br.
Bulbostylis hispidula (Vahl) R.W.Haines
Cheilanthes hirta Sw.
Commelina benghalensis L.
Crinum macowanii Baker
Cucumis species
Eriosema salignum E.Mey.
Eucomis autumnalis
Fuirena pubescens (Poir.) Kunth
Gerbera jamesonii Bolus ex Adlam
Helichrysum kraussii Sch.Bip.
Hypoxis iridifolia Baker
Hypoxis rigidula Baker
Ledebouria revoluta (L.f.) Jessop
Monopsis decipiens (Sond.) Thulin
Pellaea calomelanos (Sw.) Link
Pentanissia angustifolia (A.Rich. ex DC.) Verdc.
Tephrosia capensis (Jacq.) Pers.
Thesium utile A.W.Hill
Thunbergia atriplicifolia E.Mey. ex Nees
Trachyandra species
Triumfetta sonderi Ficalho & Hiern
Verbena bonariensis L.
Vernonia natalensis Sch.Bip. ex Walp.
Zornia milneana Mohlenbr.

3. Riverine areas

Mapping unit	3	**Tree cover**	10-20%
Soil	Clay and loam	**Shrub cover**	25%
Topography	N/A	**Herb cover**	6%
Land use	Grazing/washing/drinking	**Grass cover**	1-25%
Unit status	Natural to degraded	**Rock cover**	3-10%
Conservation priority	High	**Erosion**	variable
Dominant spp.	*Various*		

Various riverine areas are present within the proposed route. These areas vary from slightly degraded to heavily degraded due to natural and human impacts.

The more natural rivers along the route (photo above) are characterised by the prominence of various hydrophilic plant species such as *Phragmites, Schoenoplectus corymbosus, Paspalum dilatatum, Cyperus textilis,* while the woody species include *Acacia sieberiana,* and *Acacia ataxacantha*. Unfortunately the category 1 declared alien invader shrub *Lantana camara* has infested large areas thereby displacing large numbers of the indigenous vegetation and together with it animal life.

The riverine systems mostly support a diversity of plant and animal life and are important in the transport and channelling of water. They also provide water to underground systems on which many plant communities depend for their survival especially during the

dry months of the year. From a vegetation point of view large areas are degraded while other have a more natural species composition.

Red data species

No red data species were found within this unit.

The following is a list of species identified during the survey (species in red indicate declared alien invader species):

WOODY SPECIES
Acacia ataxacantha DC.
Acacia sieberiana DC.
Kigelia africana (Lam.) Benth.
Lantana camara L.
Solanum mauritianum Scop.
Zanthoxylum capense (Thunb.) Harv.
GRASSES
Cynodon nlemfuensis Vanderyst
Panicum deustum Thunb.

4. Bushveld

Mapping unit	2	**Tree cover**	5-10%
Soil	Sandy loam with clay	**Shrub cover**	30%
Topography	Varies (1-5^0)	**Herb cover**	5%
Land use	Natural	**Grass cover**	55-65%
Unit status	Degraded woodland	**Rock cover**	15-25%
Conservation priority	Medium	**Erosion**	1%
Dominant spp.	*Acacia sieberiana; Englerophytum magalismontanum;*		

This woodland is occurs on undulating rocky hills and slopes. The soil is shallow and leached though patches that are slightly deeper with loamy soil are present. The woody layer covers between 5 and 35% of the area, the grasses between 55 and 65%, and the forbs up to 12% of the area.

The vegetation consists of open woodland with smaller dense patches on the rocky crests. Large open grassland areas occur between the sparsely spread trees. The trees *Acacia sieberiana* is dominant on the slopes and lower-lying areas while *Englerophtytum magalismontanum* is prominent in the crests. Other species present and include *Eragrostis curvula, Urochloa panicoides, Cephalaria zeyheriana, Eulophia petersii, Selaginella dregei* and *Vernonia natalensis*.

Large sections of this unit are used for grazing while others have been mowed and excavated. Various roads pass through this unit causing together with the houses on the properties, fragmentation of the vegetation. These degraded areas are overgrown with the exotic invasive grass *Pennisetum clandestinum*, while pioneer weedy species such as *Tagetes minuta, Bidens pilosa* and *Conyza albida* are present.

Red data species

The area is mostly degraded and no red data species or suitable habitats were observed during the survey.

The following is a list of species identified during the survey:

WOODY SPECIES
Canthium mundianum Cham. & Schltdl.
Englerophytum magalismontanum (Sond.) T.D.Penn.
Lannea discolor (Sond.) Engl.
GRASSES
Cynodon dactylon
Eragrostis curvula
Pennisetum clandestinum
Urochloa panicoides
FORBS
Acrotome hispida Benth.
Aloe species
Bidens pilosa
Cephalaria zeyheriana Szabó
Chaetacanthus setiger (Pers.) Lindl.
Cheilanthes hirta Sw.
Chlorophytum polyphyllum (Baker) Kativu
Conyza albida

CYPERUS OBTUSIFLORUS VAHL
Eulophia petersii Rchb.f.
Euphorbia species
Kyllinga alba Nees
Sansevieria aethiopica Thunb.
Selaginella dregei (C.Presl) Hieron.
Tagetes minuta
Vernonia natalensis Sch.Bip. ex Walp.

5. Afforested plantations/Developed areas

Mapping unit	6	**Tree cover**	0-100%
Soil	Loamy	**Shrub cover**	0-25%
Topography	Level to mild slopes	**Herb cover**	1%
Land use	Commercial plantations, houses and other developments	**Grass cover**	0-20%
Unit status	Transformed	**Rock cover**	0 %
Conservation priority	Low	**Erosion**	0%
Dominant spp.	N/A		

This vegetation unit occurs on loamy soil with low rock cover all along the proposed P-166 route.

The largest areas have been planted with various *Eucalyptus* spp and *Pinus* spp. for commercial properties or have been developed due to human settlements.

The vegetation is completely transformed due to more than 80% thereof being developed with roads, houses, and plantations. Very little of the natural vegetation of the area has remained. In the areas along the roads of the various human settlements the vegetation is transformed with the grass *Eragrostis curvula* and the anthropogenic grass *Hyparrhenia hirta* present in many areas.

Red data species

No red data species were found within this vegetation unit though.

The following is some of the prominent species present in the area (species in red = exotic invaders):

WOODY SPECIES

Eucalyptus spp.

Pinus spp.

GRASSES

Cynodon dactylon (L.) Pers.

Eragrostis curvula (Schrad.) Nees

Themeda triandra Forssk.

Urochloa panicoides

FORBS

Commelina species

Corchorus asplenifolius Burch.

Oxygonum sinuatum (Hochst. & Steud. ex Meisn.) Dammer

Tagetes minuta L.

Tribulus terrestris L.

Verbena tenuisecta Briq.

Vernonia poskeana Vatke & Hildebr.

4.6 DISCUSSION

VEGETATION TYPES

The vegetation of the study area comprises two vegetation types namely the **Legogote Sour Bushveld (SVI 9)** and the **Pretoriuskop Sour Bushveld (SVI 10)** (Mucina & Rutherford 2006). The largest part of the proposed road alignment will passes through the Legogote Sour Bushveld (SVI 9) which is considered an **endangered** vegetation type. The Pretoriuskop Sour Bushveld (SVI 10) vegetation type is **not threatened** with large areas conserved in the Kruger National Park. This region is economically important in terms of wood production agriculture and especially tourism. Various red data and endemic species have been recorded in the area while invader plants are also a concern. The Legogote Sour Bushveld (SVI 9) is poorly conserved with only 2% statutorily conserved, while 40% of the Pretoriuskop Sour Bushveld (SVI 10) is conserved in the Kruger National Park (Mucina & Rutherford 2006).

THREATENED / PROTECTED PLANTS

Three red data plants *Gunnera perpensa, Eucomis autumnalis* and *Crinum macowanii* were found within vegetation units 1 and 2 respectively.

Gunnera perpensa is a herbaceous flowering plant with relatively large leaves. It can grow up to 1 m tall and is always near or in water. All *Gunnera* species are wind pollinated and their seeds are dispersed by birds. In South Africa the plant also has a medicinal value and is used by many cultures to relieve menstrual pain or expel the placenta after birth. Thus its medicinal value as well the destruction of its habitats due to development and agriculture the numbers of this plant is declining within Mpumalanga Province and elsewhere. Several plants were observed within the channelled valley bottom wetlands around White River.

Eucomis autumnalis was observed within a moist hillslope seepage wetland and usually occurs within the seasonal or temporary wet zones. Widely used in traditional medicine to treat urinary infections and pulmonary ailments, fever and diseases of stock. Popular garden plant. This harvesting for medicinal purposes as well as for urban gardens as well as increased urban development within wetland and moist grassland habitats has led to its numbers declining in nature.

Crinum macowanii is a geophyte that develops from bulbs. The leaves are linear and often dies back in winter. The plant also has medicinal value and it is believed that it has a therapeutic value. Traditionally it has been used to cure ailments and diseases, but lately it has also been used in the treatment of Alzheimers disease. A large dose of the plant could be toxic to humans. This harvesting for medicinal purposes as well as urban development has led to its numbers declining in nature.

The protected tree *Pterocarpus angolensis* is also present in vegetation Unit 2 where it is a co-dominant tree.
This deciduous tree that can grow up to 18 m tall is found the rocky slopes within this unit. The tree is economically important due to the use of its wood for furniture and musical instruments. It also has medicinal properties and is used for the treatment of malaria, pain and eye problems.

5. FAUNAL ASPECT

The preliminary faunal survey focused on habitat availability for mammals, avifauna (birds), reptiles and amphibians of the study area. The preliminary survey focused on the current status of threatened animal species occurring, or likely to occur within the proposed P-166 road servitude and immediate adjacent areas. Faunal surveys should ideally be conducted over extended periods during the summer rainy season between November and March. This is especially pertinent to amphibian surveys; with the majority of frog species being explosive breeders, initiating their short-duration reproductive events after early summer rainfall mainly in November and December. Faunal data was obtained during the 2 day site inspection carried out between the 20th-21st of October 2012 mainly by vehicle as well as selected natural habitats carried out on foot. All animals (mammals (larger), birds, reptiles and amphibians) seen or heard; were recorded. Amphibians were identified by visual observations of adults. Reptiles were actively searched for and identified by actual specimens or observations of specimens during site inspection along the proposed P-166 alignment. The data was supplemented by previous surveys conducted in the area, literature investigations, personal records and historic data. Due to severe financial and time constraints no comprehensive faunal surveys have been conducted and species lists provided in the report are of species most likely to occur within the proposed P-166 alignment using personal species lists (1997-2010), literature surveys and historic distribution data as well as habitat availability as an indicator of species possible presence.

5.1 MAMMALS

Mpumalanga is faunally diverse with approximately 163 mammal species consisting of 98 smaller and 64 larger species. It is the objective of Mpumalanga Parks Board (MPB) to conserve all of these species in situ. High mammalian species richness occurs in savannahs, which could be as a result of the wide variety of habitats available. In Mpumalanga Province, savanna areas with the availability of sufficient cover, karst areas, wetlands, pans and a well-managed mosaic of short and tall grassland, are habitats that significantly contribute towards the ecological requirements of certain mammal species. Certain species in Mpumalanga, towards which conservation efforts for habitat protection should be directed, have been identified. Priority species can be used to emphasise key habitats, which are of conservation concern. These species thus contribute towards identifying priority areas of conservation importance and in determining the conservation value of land. Anthropogenic land conversion and habitat degradation and fragmentation are major threats to the continued existence of endemic and threatened fauna in the province (Cohen & Gomacho 2002).

The settlements surrounding the P-166 road alignment and associated illegal hunting and poaching limits the suitability of these areas for larger mammal species. The collection or harvesting of wood (stumps) and rock material as well as the frequent burning of the vegetation reduces available refuge habitat an exposes remaining smaller terrestrial mammals to increased predation levels. The use of wire snares for high intensity poaching activities will significantly affect remaining smaller mammal species such as rabbits and mongooses. Secondary access roads and vehicles (motor cars, motor cycles, quad bikes) increase access to the open areas as well as potential road fatalities. Major road networks with high vehicular traffic increase the risk of road fatalities (hedgehogs, hares) of mammals. Smaller mammal species are extremely vulnerable to feral cats and dogs.

Agricultural lands are in nature inhospitable environments, and only burrowing small mammals can co-exist in such situations. Rodents such as the Bushveld and Highveld gerbils can at times become pests in agricultural lands when they excavate planted seeds. The Yellow and Slender mongooses can subsist by preying on the few vertebrates managing a precarious existence due to surrounding road networks as well as hunting with dogs and wire snares.

Afforested plantations offer suitable habitat for several larger mammal species such as Bushbuck, Common Duiker, Bushpig, Porcupine. Population sizes are dependent on the amount of hunting and illegal poaching activities.

Figure8. A Slender Mongoose was observed foraging adjacent to the Crocodile River

Threatened species

In 2002 the Endangered Wildlife Trust (EWT) and the IUCN's Conservation Breeding Specialist Group instigated a project to initiate a concerted effort by mammal specialists to assess the status of all mammals in South Africa (Friedmann & Daly 2004).

The primary threats impacting negatively on many mammals include habitat loss and land transformation through deforestation, agriculture, timber planting and urban and industrial development. Poisoning, pollution and hunting have also been listed as having a negative impact on a number of mammals. The result of this collaborative effort was a detailed compilation of knowledge from many specialists; resulting in an updated status of Red List as mammal species. Taxon Data Sheets and distribution maps for each of the **295** species and subspecies of South African mammals were evaluated. Of the total number of species and subspecies evaluated, **57 (19.3%)** were assigned threat categories according to the IUCN Red List criteria (version 3.1). These are divided into:

- **10 (3.4%)** classified as Critically Endangered
- **18 (6.1%)** classified as Endangered and
- **29 (9.8%)** classified as Vulnerable

A total of **53 (18%)** species were assessed as being Data Deficient and therefore a threat category could not be assigned to these species. A total of **38 (12.8%)** species were assessed as being Near Threatened and **147 (49.8%)** as Least Concern.

According to the "South African Red Data Book of Terrestrial Mammals" (Smithers 1986) and Skinner and Smithers (1990) updated by the IUCN Council in December 1995, the study area falls within the distribution ranges of 5 species which are placed into one of known threatened species (Endangered, Vulnerable and Rare). On the basis of the habitat descriptions provided for the above-mentioned threatened species by Skinner and Chimimba (2005), and the high level of human activity (hunting, poaching) within the study area, it is deemed highly unlikely that the study area provides critical habitat for the Endangered Wild Dog (*Lycaon pictus*) as well as the Vulnerable Lion (*Panthera leo*).

Table1. Mammal species of conservation importance possibly occurring on the site using habitat availability and current distribution records according to Skinner and Chimimba (2005) as an indicator of presence.

COMMON NAMES	SCIENTIFIC NAMES	PROVINCIAL STATUS: IUCN 3.1 (2000A)	NATIONAL STATUS: SARDB (1986)	GLOBAL STATUS IUCN (2000B)
*Aardvark (Antbear)	*Orycteropus afer*	-	V*	VU
**Ground Pangolin	*Manis temminckii*	Vu	VU	LR/nt
*Selous' Mongoose	*Paracynictis selousi*		R	R

* SARDB (South African Red Data Book, Smithers 1986): E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate.

IUCN (World Conservation Union): CR = Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient.

Ground Pangolin (*Manis temminckii*) (Smuts, 1832)

Figure9. Ground Pangolin observed by consultant within southern Kruger National Park.

* down-listed to Lower Risk, Least Concern

** down-listed to Lower Risk, Near Threatened (Skinner & Chimimba 2005)

This species is uncommon throughout its known range, which extends from south of the Sahara to the east of Africa and to the northern parts of South Africa. The Ground Pangolin seems to favour areas with moderate temperatures not dropping below 0° C. The ground pangolin is a savanna species and does not occur in the swamps, grasslands, forest or desert. Within this broad category they are catholic in their habitat requirements, occurring in scrub in areas of low rainfall (250mm per year), and various types of savanna woodland, floodplain grassland, bushveld, rocky hills, and on sandveld with a much higher rainfall (up to 1 400mm per annum). Swart *et al.* (1999) have hypothesized that their absence from parts of southern Africa may be due tio the effects of temperature on certain ant activity and the nest characteristics, especially *Anoplolepis custodiens* (primary food source), which escape the cold winter nights by hibernating deep below the soil surface (Skinner & Chimimba 2005).

This solitary species occurs in low numbers, and occupies large home ranges and move between different burrow sites. The Ground pangolin uses the burrow system of Aarvarks, Springhares and Warthogs. The males in the Sabi Sand nature reserve have home ranges of up to 2000ha whereas the female move in areas of 500ha. Their major threat seems to be the muti trade as there is a high demand for their scales. Only one young is born per year, seemingly in the drier months). They are also vulnerable to agricultural developments and seem to be susceptible to insecticides.

The South African Red Data Book for Mammals (Smithers, 1986) classifies the Pangolin as a Threatened species with a **Vulnerable** status and was down-listed to Lower Risk, **Near-Threatened** (Skinner & Chimimba 2005). Freitag & Van Jaarsveld (1997) rank the Pangolin fourth in conservation priority in a list of 197 mammal species for the former Transvaal. No pangolins have as yet survived in captivity, possibly due to their specialised diet. Therefore, breeding these animals in captivity and replacing them in the wild is not possible at this stage (Cohane & Gamacho 2002).

No evidence of any rare or threatened mammal species were observed during the brief field survey but suitable habitat occurs for the Ground Pangolin within the open bushveld areas between White River and Nelspruit. It must be stressed that the Ground Pangolin is an extremely secretive and elusive species which may not be observed over extended field surveys.

5.2 AVIFAUNA (BIRDS)

More than 567 bird species have been recorded in Mpumalanga. Approximately 71 Red Data species, of which 35 are threatened, occur within the area. There are no species endemic to Mpumalanga, but the province is the centre of distribution for two species, which are endemic to South Africa, and accommodates a species that is endemic to the Subregion. The Mpumalanga province is represented by the Grassland, Forest and Savanna biomes. Some of South Africa's endemic and most threatened terrestrial and wetland-associated bird species are significantly dependent on the wetlands, short dense and tall grasslands and woodland regions of the Mpumalanga province. A total of 12 Important Birding Areas (IBAs) occur within the province and most are of critical ornithological importance. The Masibekela wetland, near the Lebombo Mountains in the Lowveld region, holds species that are uncommon in Mpumalanga and support relative large numbers and varieties of rallids.

Species richness in the Lowveld is high, due to a diversity of habitats. The presence or absence of bird species with specific habitat requirements can be indicative of the state of the environment. Bird species that can act as important savanna, grassland and wetland indicators, have been selected, in order to identify priority areas of conservation importance for birds, and to determine the conservation value of land within Mpumalanga Province. Habitat loss and degradation are the primary threats that impact severely on viable populations of these sensitive species (Cohen & Gomacho 2002).

The savanna biome is identified here as having a grassy under storey and a distinct woody upper story of trees and tall shrubs. Tree cover can range from sparse to almost closed canopy (along some non-perennial drainage lines in the study area as well as riparian zone of Crocodile River). The woodland comprises predominantly broadleaved, winter deciduous woodland. Soil types are varied but are generally nutrient poor. The savanna biome contains a large variety of species (it is the most species-rich community in southern Africa) but is generally less important from a Red Data bird perspective, as very few bird species are restricted to this biome.

SENSITIVE OR ENDANGERED SPECIES

Table2: Red Data List bird species previously recorded from the 2530CD and 2531BA grid squares within which the study area is situated and that occur or could possibly within or in the vicinity of the study area according to Harrison *et al.* (1997) based on habitat and food availability on site.

COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS ACCORDING TO THE NEW (1994) IUCN CRITERIA	HABITAT PREFERENCE
Southern Ground-Hornbill	*Bucorvus leadbeateri*	Vulnerable (C1)	Prefers open woodland; also in grassland with a few scattered trees.
Black Stork	*Ciconia nigra*	Near threatened	Cliffs for roosting and breeding, and rivers and dams for foraging.
African Crowned Eagle	*Stephanooaetus coronatus*	Near threatened	Forest and woodland habitats and strongly associated with the Lowveld and escarpment forests of eastern South Africa
Bat Hawk	*Macheiramphus alcinus*		Sparse throughout its distribution through the savannas and known to breed in plantations where it selects large pale-barked *Eucalyptus* trees for nests.
Yellow-billed Stork	*Mycteria ibis*	Near threatened	Always associated with water – dams, wetlands, rivers, marshes, even small pools.
Marabou Stork	*Leptoptilos crumeniferus*	Near Threatened	Aquatic and terrestrial habitats favouring open and semi-arid areas
White-backed Vulture	*Gyps africanus*	Vul(A1a,c,d; A2b,c,d; C1; C2b) nerable	Drier woodlands with tall trees such as *Acacia spp. Ficus spp*.
Cape Vulture	*Gyps coprotheres*	Vulnerable (A1a,c,d; A2b,c,d; C1; C2b)	Linked to cliffs breeding sites in mountainous areas but ranges widely in adjacent areas in search of carcasses.

Martial Eagle	*Polemaetus bellicosus*	Vulnerable (A1a; C1)	Diverse habitats, from open grassland and scrub to woodland. Typically found in flat country
Tawny Eagle *Aquila rapax*	Vulnerable	Vulnerable (A1a; A2b; C1)	Mainly woodlands including lightly wooded bushveld
Bateleur *Terathopius ecaudatus*		Vulnerable	Wider variety of woodland types from open, semi-arid Kalahari to well-developed, relatively mesic broadleaved woodland.
Secretarybird	*Sagittarius serpentarius*	Near Threatened	Secretarybirds are monogamous and solitary nesters. They are territorial with home ranges of 20-230 km^2 around the nest, usually an area of between 50-60 km^2, is defended against conspecifics. Nests are usually placed on top of a thorny tree, frequently in Black Thorn *Acacia melifera*, Umbrella Thorn *Acacia tortilis*, Sweet Thorn *Acacia karroo*, Common Hook Thorn *Acacia caffra*. They may also nest in exotic species such as Black Wattle *Acacia mearnsii* or Pine (*Pinus* sp.).
Black-winged Lapwing	*Vanellus melanopterus*	Near Threatened	Highland plateaux and slopes, fallow fields, meadow pastures, short grassland, from highlands to coastal flats; also on pastures, airfields. Favours recently burned ground with new grass.
Lanner Falcon	*Falco biarmicus*	Near Threatened	Most frequent in open grassland, open or cleared woodland and agricultural areas. Breeding pairs favour habitats where cliffs are available for nesting and roosting sites.
Peregrine	*Falco*	Near Threatened	Breeding pairs favour habitats

Falcoln	*peregrinus*		where cliffs are available for nesting and roosting sites.
Redbilled Oxpecker	*Buphagus erythrorynchus*	Near Threatened	Sharp claws and short legs adapted to clinging on large mammals feeding on tick prey *Rhiphicephalus appendicualtus*
African Finfoot	*Podica senegalensis*	Vulnerable	Streams and rivers with overhanging trees, shrub and reeds.
Half-collared Kingfisher	*Alcedo semitorquata*	Near threatened	Fast-flowing streams with clear water and well-wooded banks. Occurs around dams (pers.obs.)

The savanna biome is particularly rich in large raptors, and forms the stronghold of Red Data species such as Whitebacked Vulture, Cape Vulture, Martial Eagle and Tawny Eagle. Apart from Red Data species, it also serves as the stronghold of several non-Red Data raptor species, such as the Brown Snake Eagle, Blackbreasted Snake Eagle, and a multitude of medium-sized raptors for example the migratory Steppe Buzzard, African Harrier Hawk (Gymnogene), Wahlberg's Eagle and African Hawk Eagle. The savanna biome, and specifically Dry Woodland, is particularly well represented in the study area. Moist woodland tends to have fewer species than dry woodland. Whilst much of the distribution and abundance of the bird species in the study area can be explained by the description of vegetation types above, it is even more important to examine the micro habitats available to birds. These are generally evident at a much smaller spatial scale than the vegetation types, and are determined by a host of factors such as vegetation type, topography, land use and man made infrastructure.

Wetlands and dams: Both wetlands and rivers are of particular importance for birds in the study area, as the area is relatively arid. The study area does contain important wetlands such as the valley bottom adjacent to White River as well as the Crocodile River and several farm dams. These dams are important refuges for a variety of waterbirds, including species such as African Fish Eagle, Black Stork, Yellowbilled Stork and Marabou Stork.

Rivers: The Crocodile River and floodplain are important habitats for birds. The rivers are particularly important for stork species such as Black Stork and Yellowbilled Stork and a variety of other waterbirds. The riparian habitat along the Crocodile River provides refuge for shy and skulking species such as the African Finfoot, and the Whitebacked Night Heron. The eroded macro-channel banks of the Crocodile River could provide favourable nesting, foraging and dispersal habitat for the Half-Collared Kingfisher.

No red data birds were observed due to inclement weather conditions (windy /rain). The open rocky extrusion bushveld, riparian and rivers and palustrine wetland habitats offer suitable habitat for several red listed species. More intensive survey conducted over extended periods are required in order to ascertain the current conservation status of the above-mentioned bird species along the P-166 road alignment.

5.3 REPTILES

Most current knowledge of the reptiles of Mpumalanga is based on a survey done by N.H.G. Jacobsen (1989) providing a detailed account of all reptiles in the then Transvaal province. This survey resulted in descriptions of life histories, habitat requirements and conservation status and maps of the known distributions. Jacobsen's (1989) survey revealed that 154 reptiles occur in the Mpumalanga Province and of these, 86 species are threatened. However, many of these threatened reptiles have relatively wide distributions and thus this study was restricted to Red Data species and species that are largely restricted to Mpumalanga.

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe during field surveys. The majority reptile species are sensitive to severe habitat alteration and fragmentation. Due to the high levels of habitat destruction and degradation in the area due to agricultural and livestock grazing activities coupled with increased levels of disturbances around the villages are all causal factors in the alteration of reptile species occurring on the site and surrounding areas. The rocky crests and summits and wooded hill slopes provide favourable refuges for certain snake and lizard species (rupicolous and arboreal species). The indiscriminate killing of all snake species around the villages reduces populations drastically. The frequent burning of the limited overgrazed grassland vegetation has a high impact on remaining reptiles. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Figure10. A conglomerate of photographs displaying the reptile species observed along the proposed P-166 alignment. A: Southern Tree Agama (*Acanthocercus atricolis*), **B:** Flap-necked Chameleon (*Chamaeleo dilepis*), **C:** Rhombic Night Adder (*Causus rhombeatus*) feeding on a Guttural Toad (*Amietophrynus gutturalis*), **D:** Female Rainbow or Five-Lined Skink (*Trachylepis margaritifer*), **E:** Mole Snake (*Pseudaspis cana*) and **F:** Boomslang (*Dispholidus typus*)

HABITAT AVAIALBLE FOR SENSITIVE OR ENDANGERED SPECIES

Of the 15 reptile species considered for this study, 4 have been recorded exclusively from Mpumalanga. These are Haacke's flat gecko (*Afroedura haackei*), Mariepskop flat gecko (*Afroedura* sp. nov.), Rondavel flat gecko (*Afroedura* sp. nov.) and Wilhelm's flat lizard (*Platysaurus wilhelmi*). Other species considered in this study were: Abel Erasmus Pass flat gecko (*Afroedura* sp. nov.), Forest/Natal purpleglossed snake (*Amblyodipsas concolor*), Lowveld shieldnosed snake (*Aspidelaps scutatus intermedius*), Transvaal dwarf chameleon (*Bradypodion transvaalense* complex), Sungazer/ Giant girdled lizard (*Cordylus giganteus*), Barberton girdled lizard (*Cordylus warreni barbertonensis*), Lebombo girdled lizard (*Cordylus warreni warreni*), Swazi rock snake (*Lamprophis swazicus*), Transvaal flat lizard (*Platysaurus orientalis orientalis*), Montane burrowing skink (*Scelotes mirus*), Breyer's longtailed seps/ Breyer's plated lizard (*Tetradactylus breyeri*). These species are also found in other provinces of South Africa. Of these, only

four are listed in the Red Data Book (Branch 1988). The Swazi rock snake and Breyer's longtailed seps are listed as Rare, the Sungazer is listed as Vulnerable and Haacke's flat gecko as Restricted.

High reptile diversity occurs between Nelspruit and White River with 81 species recorded during the South African Conservation Assessment (SARCA). No red listed reptile species have been recorded within the 2530CD, 2531BA ODGC's. Suitable habitat occurs along the P-166 in the form of large granite boulders with exfoliated cracks and crevices which are suitable habitat for several rupicolous reptile species including Barberton Girdled Lizard (*Cordylus warreni barbertonensis*) and Haacke's Flat Gecko (*Afrodeura haackei*).

Barberton girdled lizard (*Cordylus warreni barbertonensis*)

Vulnerable (VU) B1ab (iii) (IUCN 2000)

In Mpumalanga this species has been recorded in the area around Nelspruit, eastwards to Malelane and southwards to Barberton. A record also exists from Nsulaze kop on the north-eastern border of Swaziland and from the southern border of Swaziland with Kwazulu-Natal. These rizards have been recorded from Acocks' veld types 9,1 0 and 63 and to elevations of 580 – 900m.a.sl. They are rupicolous and favour rocky hillsides with deep cracks in large boulders that are sheltered by trees. Thus, Acocks' veld types, elevation and steep and very steep slopes (from digital soil depth data) were overlayed to determine the predicted distribution. The resultant distribution extends from east of the Blyde River Nature Reserve, southwards towards Malelane and Barberton, along the escarpment through Swaziland and into northern Kwa-zulu Natal. Localities from Barberton Municipal Nature Reserve and southern Kruger National Park have been recorded. It is also predicted to occur in the Barberton Mountainlands, Mthethomusha, Barberton and Songimvelo Nature Reserves (MPB). Jacobsen (1989) considered this species to be relatively secure elsewhere due to their preferred habitat and shy habits.

Haacke's flat gecko (*Afroedura haackei*)

Restricted RDB (1988)

This small to medium sized gecko has only been recorded from a small area north-east of Barberton, which is represented by Acocks' veld type 10. It is also restricted to elevations of 500 - 1000 m.a.s.l. (Jacobsen 1989) and to areas with a mean annual precipitation of 700 - 1000mm. These geckos shelter in crevices formed by exfoliating rocks on steep slopes with shallow soils. These habitat requirements were overlayed with the known distribution to determine the widest possible distribution. This resulted in a disjunct distribution from Barberton to Nelspruit and eastward to the western KNP south of the Sabie River. This species could be locally common in areas of suitable habitat but it is influenced by the removal of vegetation around the rocky outcrops by grazing, burning and woodcutting (Jacobsen 1989). It has been recorded from the KNP (Branch 1988) and occurs within the Crocodilepoort Conservancy. The modelled distribution

predicts that it could also occur in the Mthethomusha, Barberton Mountainlands and the Barberton Nature Reserves (Theron 2002).

Wilhelm's flat lizard (*Platysaurus wilhelmi*)

Vulnerable VU B1 ab(iii)

Endemic to Mpumalanga, this species is restricted to granite outcrops and inselbergs associated with Acocks' veld types 9 and 10. In these areas it lives in narrow crevices formed by exfoliating granite and in crevices between rocks. The lithology types selected for modelling were based on the localities of the farms and information provided by Jacobsen (1989). Lithology types selected were Nelspruit Granite (Zne), Kaap Valley Granite (Zka), Un-named Potassic Granite & Granodiorite (ZB) and Timeball Hill and Rooihoogte Shale (Vt). These were overlayed with Acocks' veld types 9 and 10 to model the predicted distribution. The resulting distribution extends from the south-eastern Kruger National Park to east of the Blyde River Nature Reserve, south towards Barberton and east to Ngodwana. This species is relatively widespread in the southern Kruger National Park, but has not been recorded from any provincial nature Reserve. However, it is predicted that it could occur in the Mthethomusha and Barberton Nature Reserves (MPB) and in the Crocodilepoort Conservancy. Elsewhere commercial exploitation (Jacobsen 1989), urban expansion (Mbombela) and granite mining could threaten it.

Swazi rock snake (*Lamprophis swazicus*)

Rare (RDB 1988)

This is a rare species, which is restricted to the eastern escarpment of Mpumalanga and Swaziland where it has been recorded from Acocks' veld types 8, 9 and 57. It also seems to be restricted to elevations of 1300 – 1900masl, areas with an annual precipitation of above 750mm and to areas that receive late or no frost. All of these variables were overlayed with each other and also with steep and very steep slopes (digital soil depth data) to determine the possible distribution. The resultant distribution extends from the Blyde River Nature Reserve southwards along the escarpment towards Barberton and northwestern Swaziland. In these areas it would usually be found under rock slabs (Branch 1988) on rocky mountains and hillsides as well as rocky outcrops (Jacobsen 1989). It has been recorded from the Malolotja Nature Reserve (Branch 1988) in Swaziland and from the Barberton Mountainlands Nature Reserve. It is predicted that it could also occur in the Ohrigstad and Blyde River Nature Reserves and the northern parts of Songimvelo Game Reserve. Elsewhere the developments of exotic plantations along the escarpment as well as urban sprawl results in habitat destruction and isolate populations (Theron 2002).

Lowveld shield-nosed snake (*Aspidelaps scutatus intermedius*)
Vulnerable VU B1ab (iii)

This species has been recorded from the eastern parts of Northern Province and Mpumalanga. It burrows into sandy soil (Branch 1998) or uses existing rodent burrows (Jacobsen 1989). It occurs in forests and woodlands, represented by Acocks' veld types 10 and 11, at elevations of 200 – 1400 m.a.s.l. Acocks' veld types, Landcover (Degraded Forest and Woodland, Degraded Thicket and Bushland, Forest, Forest and Woodland and Thicket and Bushland), elevation and soil type (loamy sand, sandy, sandy loam and very sandy) were overlayed to model the predicted distribution. The predicted distribution extends eastwards from Nelspruit, towards the southern parts of Kruger National Park and the northern border of Swaziland. This snake is also predicted to occur along the Lebombo Mountains and probably extends into western Mozambique. It occurs throughout the southern Kruger National Park and could occur in the Mthethomusha and Mahushe Shongwe Nature Reserves. Outside the Kruger National Park many individuals are killed on roads (Theron 2002).

5.4 AMPHIBIANS

Amphibians are an important component of South Africa's exceptional biodiversity (Siegfried 1989) and are such worthy of both research and conservation effort. This is made additionally relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but as yet is poorly understood (Wyman 1990; Wake 1991). Amphibians have declined dramatically in many areas of the world. These declines seem to have worsened over the past 25 years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data. Most frogs have a biphasic life cycle, where eggs laid in water develop into tadpoles and these live in the water until they metamorphose into juvenile fogs living on the land. This fact, coupled with being covered by a semi-permeable skin makes frogs particularly vulnerable to pollutants and other environmental stresses. Consequently frogs are useful environmental bio-monitors (bio-indicators) and may acts as an early warning system for the quality of the environment. The Giant Bullfrog (*Pyxicephalus adspersus*) has been chosen as a flagship species for the grassland eco-region (Cook in le Roux 2002)

Breeding in African frogs is strongly dependent on rain, especially in the drier parts of the country where surface water only remains for a short duration. The majority of frog species in Mpumalanga Province can be classified as explosive breeders. Explosive breeding frogs utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles. The general type of reproductive habitat chosen has a strong influence on the entire developmental strategy followed by many species. Most anuran larvae within Mpumalanga inhabit temporary habitats that range from small pools to larger artificial dams/pans situated in lower lying areas or depressions. Unpredictable temporal and spatial distributions and cyclic patterns of nutrient availability are common features of these habitats. Others develop in more complex permanent aquatic habitats as temporary invaders in established communities such as rivers, streams and the artificially created pans/dams. Numerous physical (e.g. distance from shore, oxygen concentration, substrate qualities, water depth and flow rate, site duration, and temperature) and biological (e.g. presence and distribution of vegetation, other tadpoles, other organisms including predators, and the phenology of all organisms) factors influence the spatial and temporal distribution of tadpoles among microhabitats.

The majority of frog species in Mpumalaga Province are classified as explosive breeders completing their short duration reproductive cycle in the early summer months between (November-January). These frog species only emerge after the first heavy summer rainfalls and are dormant during the cold winter months. Explosive breeding frogs utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles. Amphibian surveys by Jacobsen (1989), as well as recent and current surveys suggest that 51 species of amphibians currently occur in the Province of Mpumalanga. The present study concentrated mainly on Red Data species and species that are threatened or have relatively restricted distributions.

Eight species are considered as important for setting conservation priorities in Mpumalanga namely Karroo toad *Vandijkophrynus* (*Bufo*) *gariepensis nubicolus*, Cascade Frog *Hadromophryne* (*Heleophryne*) *natalensisis,* Spotted shovel-nosed Frog *Hemisus guttatus*, Yellow-striped Reed Frog *Hyperolius semidiscus,* Plain Stream Frog *Strongylopus wageri*, Giant Bullfrog *Pycicephalus adspersus*, Greater Leaf-folding Frog *Afrixalis fornasinii* and Whistling Rain Frog *Breviceps sopranus* (Theron 2002). During this brief survey; fieldwork was augmented with species lists compiled from personal records (2000-2012); data from the White River and Nelspruit areas collected for the South African Frog Atlas Project (SAFAP) (1999-2003) and published data, and the list provided in the Appendix (see Table 6) is therefore regarded as likely to be fairly comprehensive.) Thirty-three (33) frog species have been recorded for the combined locus of 2530 CD and 2531 BA.

HABITAT AVAILABLE FOR SENSITIVE OR ENDANGERED SPECIES

No threatened frog species have been recorded within the 2530CD and 2531BA Quarter Degree Grid Cell (QDGC) in which the proposed P-166 road link is situated (Minter *et al.* 2004 and Measey *et al.* 2010). No threatened frog species were observed although ten (10) frog species were recorded during this brief field survey. Frog species recorded included Guttural Toad (*Amietophrynus gutturals*), Bushveld Rain Frog (*Breviceps adspersus*), Boettger's Caco (*Caosternum boettgeri*), Common River Frog (Amietia angolensis), Painted Reed Frog (*Hyperolius marmoratus taeniatus*), Red Toad (*Schismaderma carens*), Bubbling Kassina (*Kassina senegalensis*), Snoring Puddle Frog (*Phrynobatrachus natalensis*), Brown-Backed Tree Frog (*Leptopelis mossambicus*) and Natal Sand Frog (*Tompoterna natalensis*).

Figure11. A conglomerate of photographs displaying the frog species observed along the proposed P-166 alignment. A: Brown-Backed Tree Frog (*Leptopelis mossambicus*); **B:** Russet-backed Sand Frog (*Tomopterna marmorata*), **C:** Snoring Puddle Frog (*Phrynobatrachus natalensis*), **D:** Boettger's Caco (*Cacosternum boettgeri*), **E:** Bushveld Rain Frog (*Breviceps adspersus*), **F:** Painted Reed Frog (*Hyperolius marmoratus taeniatus*), **G:** Common River Frog (*Amietia angolensis*), **H:** Tremelo Sand Frog (*Tomopterna cryptotis*) and **I:** Guttural Toad (*Amietophrynus gutturalis*).

6. SENSITIVITY MAPPING

The vegetation of the study area comprises two vegetation types namely the **Legogote Sour Bushveld (SVI 9)** and the **Pretoriuskop Sour Bushveld (SVI 10)** (Mucina & Rutherford 2006). The largest part of the proposed P-166 road will pass through the Legogote Sour Bushveld (SVI 9) which is considered and **endangered** vegetation type. The Pretoriuskop Sour Bushveld (SVI 10) vegetation type is not threatened with large areas conserved in the Kruger National Park. This region is economically important in terms of wood production agriculture and especially tourism. Various red data and endemic species have been recorded in the area while invader plants are also a concern. The Legogote Sour Bushveld (SVI 9) is poorly conserved with only 2% statutorily conserved, while 40% of the Pretoriuskop Sour Bushveld (SVI 10) is conserved in the Kruger National Park (Mucina & Rutherford 2006).

The proposed P-166 road is located within areas where various forms of land use occur. Large sections are totally transformed due to commercial forest plantations while others were used to establish various settlements. Soil erosion is regarded low to medium with veld degradation evident in grazed and cultivated areas. In terms of alien plants degradation of large patches of land is evident as a result of alien plants replacing natural species of the area. The vegetation type within which the proposed P-166 road is located is regarded as endangered.

The **wetland area (Unit 1)** is located in various sections along the proposed route especially close to the town of White River. This area varies from being moderately to insignificantly impacted due to human induced actions such as planting of crops on a small-scale and alien plants. This has the effect of disturbance to the natural vegetation and ecosystem with water being channelled in some areas and natural vegetation removed. This has however not degraded the total ecosystem and its water carrying/buffering function is still considered high with habitats for a variety of plant and animal species present. Wetlands are considered sensitive ecosystems that are constantly under threat due to human development. They not only act as water reservoirs, but also purify water, buffer an area against floods and provides habitat for various insect and aquatic organisms. Ill-planned human actions in these ecosystems could easily lead to total ecosystem degradation and a loss in biodiversity. Although this unit is somewhat disturbed from a vegetation point of view it still has a high ecosystem functioning and are therefore considered to have a **high conservation value** (Figure 12).

The vegetation of **Unit 2 (Sour Bushveld)** has a high species richness with mostly climax species present. The area is mostly natural with some areas degraded due to human actions such as dumping, topsoil removal etc. In spite of this these rocky areas are characteristic of the Legogote Sour Bushveld (SVI 9) as described by Mucina & Rutherford (2006). The rocky outcrops provide suitable habitats for various plants and animals with the open grassy patches adding to the species diversity. This unit has from a plant ecological and ecosystem functioning point of view a **high conservation value** (Figure 12).

South Africa is an arid country and its water resources are limited. **River systems (Unit 3)** provide water for irrigation, potable water and fish stocks thereby supporting millions of livelihoods throughout the country. These systems also provide nutrient rich soil where palatable plants grow for animals, while many of the river banks and valley bottoms are used for agricultural purposes. River systems also are home to extremely diverse aquatic animal communities and provide suitable habitat for various bird and animal species that inhabit the river banks and corridors. These systems are therefore regarded as sensitive ecosystems and although they are degraded in some places they have a high ecosystem functioning. It is therefore important that these systems are managed in a responsible way so as to ensure that they maintain their ecosystem functioning and biophysical composition and status. Thus these areas are regarded as having a **high conservation value** (Figure 12)**.**

Vegetation **unit 4 (Bushveld)** has a relatively low species richness. The area comprises open woodland (typical savannah) to closed woodland on the higher-lying rocky hills with large granite boulders in some areas. Due to the impact of humans (roads, houses, grazing, small-scale agriculture) large sections are degraded but also fragmented. This from a plant ecological and ecosystem-functioning point of view the area has a medium conservation value and ecosystem functioning (Figure 12).

The vegetation of the **forest plantations and developed areas (Unit 5)** is totally transformed. These areas will not naturally recover and has a **low conservation value** and **ecosystem functioning** (Figure 12).

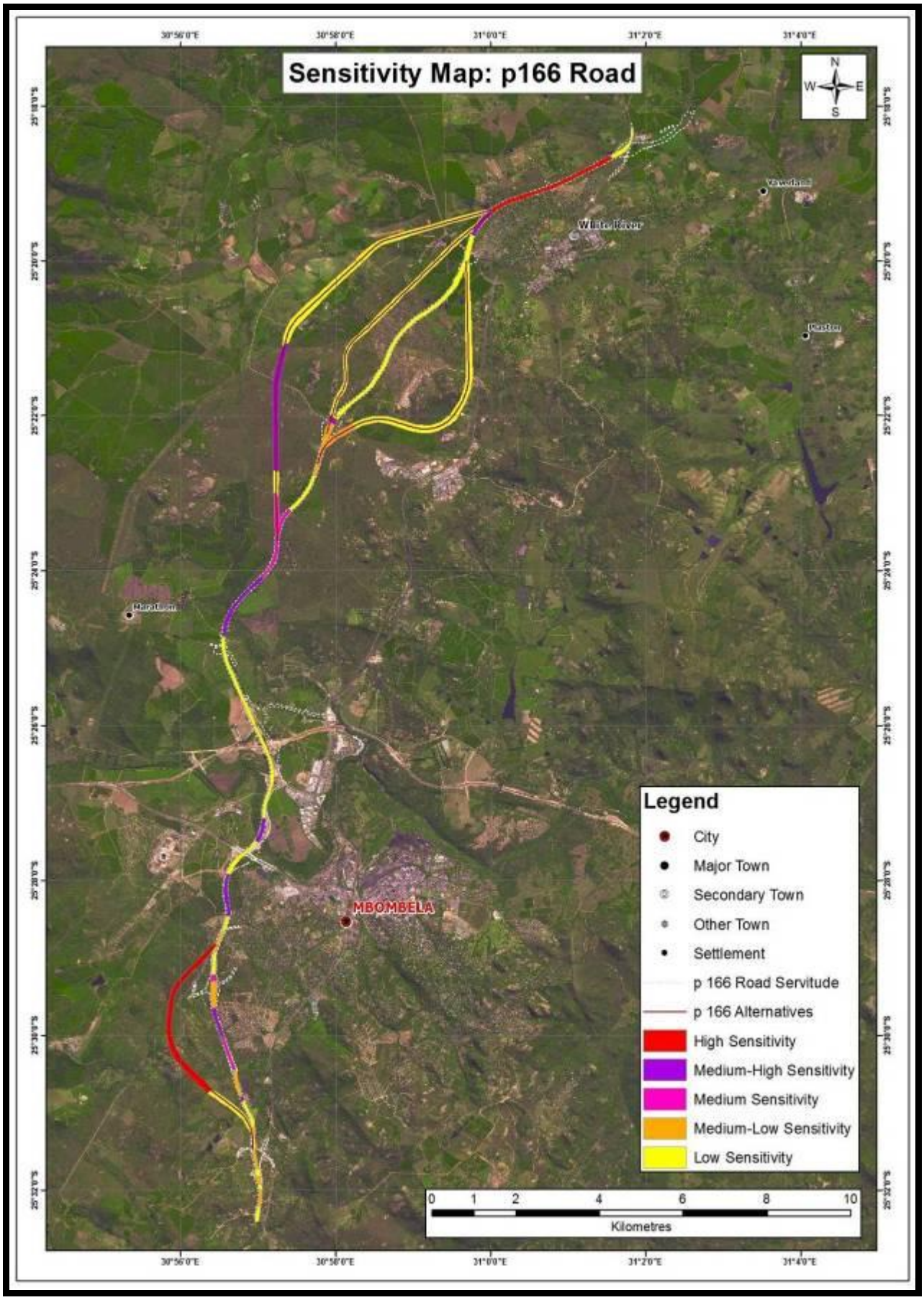


Figure12. Preliminary sensitivity map for the proposed P-166 road

7. GENERIC DESCRIPTION OF POTENTIAL IMPACTS OF PROPOSED P-166 ROAD ON ASSOCIATED FAUNA AND VEGETATION AS WELL AS PROPOSED MITIGATORY MEASURES

The proposed P-166 road and associated increased vehicular traffic may impact on the terrestrial fauna in various ways. The major impacts occurring during the construction phase involve the loss and fragmentation of habitats, with a consequent loss of biodiversity and possibly loss of remnant faunal species or of plant species of conservation concern. This may result from direct land clearance, or occur indirectly via loss or changes in habitats due to consequent changes in drainage patterns, increased fire risk, or secondary impacts associated with socio-economic factors resulting from changes in surrounding land use. During the operational life of the road, small accumulative impacts also occur, including ongoing road mortalities, increased disturbance (noise and light), dust generation, air pollution, chemical contamination from petroleum and rubber products, increased litter, changes in the incidence of fire (more frequent), and the introduction of alien vegetation. All of these factors may impact the surrounding fauna and ecological processes in different ways.

ALTERNATIVE ALIGNMNETS

The largest part of the proposed P-166 road alignment will passes through the Legogote Sour Bushveld (SVI 9) which is considered an endangered vegetation type. The Pretoriuskop Sour Bushveld (SVI 10) vegetation type is not threatened with large areas conserved in the Kruger National Park. Large sections of the proposed P-166 alignment have been transformed through historic agricultural and forestry activities. Large areas have been recently transformed due to urban sprawl. Three red listed plant species were recorded along the proposed P-166 alignment namely *Gunnera perpensa*, *Crinum macowanii* and *Eucomis autumnalis.* These were mainly observed within the seasonal and temporary wet zones of hillslope seepage wetlands as well as valley bottom wetlands situated within the sour bushveld and wetland vegetation units. The protected tree species *Pterocarpus angolensis* and *Sclerocarrya birrea* subsp. *caffra* occurs in large numbers along the P-166 road alignments which bisect open sour bushveld areas.

From an ecological perspective the Phumlani 3 alternative is preferred as it bisects large transformed vegetation units with low conservation potential or likelihood for red listed plant or animal species. The Phumulani 3 alternative only bisects two wetland habitats. The Phumulani 1 alternative bisects 9 wetland habitats as well as rocky slopes which could potential offer suitable habitat for several rupicolous Red Data reptile species namely **Swazi rock snake (*Lamprophis swazicus*), Wilhelm's flat lizard (*Platysaurus wilhelmi*) and Haacke's flat gecko (*Afroedura haackei*). .** The Phumulani 2 alternative bisects a section of rocky hillslope as well as 4 wetland or river crossings which could

potentially offer suitable habitat for the red listed *Gunnera perspensa* and *Eucomis autumnalis*.

The original P-166 alignment is preferred over the Maggiesdal Alternative 1 as this alternative bisects natural larger areas of natural Legogote Sour Bushveld as well as indigenous riparian vegetation along a perennial river. The P-166 alignment runs parallel to a degraded non-perennial drainage line as well as transformed vegetation units. The P-166 alignment is also situated closer to existing high density residential areas which would have resulted in the alteration of the faunal composition due to the associated high levels of anthropogenic activities.

It is recommended that a final walk through of all sensitive habitats of the preferred alignments are undertaken by faunal and floral specialists once the route is adequately marked out by a qualified land surveyor in order to determine possible rare or threatened plant or animal species that would be significantly impacted and to recommend suitable mitigation measures for any on site specific problems.

7.1 HABITAT DESTRUCTION AND ASSOCIATED DISTURBANCES TO REMAINING FAUNAL SPECIES

During the construction phase of the proposed P-166 road, some habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, and the clearing of the road servitudes. As approximately 50% of the preferred alignment occurs within existing road servitude as well as in transformed habitats (old agricultural lands) extremely limited vegetation clearance will be required during the construction and operational phase of the project. Vegetation clearance will be impacted on within the 50% of the alignment within sensitive bushveld, riverine and palustrine wetland habitats. These activities will have an impact on the associated fauna especially ground living and fossorial species occurring along or in close proximity of the servitude, both through modification of habitat and disturbance caused by human activity. The proposed impact will be of **medium to high; short-long term impact** on remaining (albeit) limited faunal species.

MITIGATION AND RECOMMENDATIONS

The following general recommendations are made to minimise the impacts of proposed road construction on the immediate environment and remaining fauna:

- Prior to construction and vegetation clearance a suitably qualified zoologist should closely examine the proposed construction areas (road alignment) for the presence of any animal burrows (including spiders and scorpions), rocky outcrops, logs, stumps and other debris and relocate any affected animals to appropriate habitat away from the road.
- Close site supervision must be maintained during construction.
- During the **CONSTRUCTION** phase workers must be limited to areas under construction within the road servitude and access to the undeveloped areas, especially the surrounding rocky granite hills and woodlands, plaustrine wetlands and Crocodile River must be strictly regulated (“no-go” areas during construction as well as operational activities).
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) and surface water in the area. Mobile toilets must be provided in order to minimize un-authorised traffic of construction workers outside of the designated areas.
- All temporary stockpile areas including litter and dumped material and rubble must be removed on completion of construction. All alien invasive plant should be removed from the road servitude to prevent further invasion.
- Firearms or any other hunting weapons must be prohibited on site.
- Contract employees must be educated about the value of wild animals and the importance of their conservation.
- Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harm remaining faunal species.
- No animals should be intentionally killed or destroyed and poaching and hunting should not be permitted on the site.

Figure13. Black Button Spiders were observed under loosely embedded rocks on the lower slopes of the woody hill adjacent to Mbombela.

SCORPIONS AND SPIDERS

- Several poisonous spiders occur around the site including the Black Button Spider (*Lactrodectus indistincus*). One of the most dangerous spiders in Southern Africa with a neurotoxic venom.
- Several species of scorpions are recorded from the area including *Pseudolychas pegleri*, *Uroplected triangulifer*, *Uroplectes formosus, Opistacanthus vallidus, Opistothalmus macer, Opistothalmus karrooensis, Opistothalmus capensis, Opistothalmus pictus*.
- These scorpions construct burrows or scrapes under rocks as well as found under loose bark, wood piles and other surface debris.
- The majority of these scorpions possess a painful sting they are not of medical importance except *Parubuthus granulatus* which is South Africa's most venomous scorpion species.
- Care should be taken when removing stumps, logs or rock material.
- Any scorpions encountered on the site should be left alone and allowed free access away from the activity or safely removed from the area.
- No scorpions should be intentionally killed. Standard precautions or safety measures includes wearing sturdy leather boots and gloves in the field and close inspection of sleeping areas and bedding, clothes, shoes etc. for any scorpions.
- Stings from mildly venomous scorpions cause localised pain and swelling, with little systematic reaction. The affected limb should be immobilized and an ice pack should be applied, if possible, to the site of the sting. The site of the sting should be cleaned and never cut open.

- Venom sprayed in the eyes (certain *Parabuthus* species are able to spray venom) produces an intense burning sensation and may result in temporary blindness if the eyes are not washed out thoroughly with clean water or some other neutral liquid such as milk

BABOON SPIDERS

Figure14. Several Common Yellow-Banded Baboon Spider (*Harpactira tigrina*) were observed under loosely embedded rocks within the wooded hillslopes adjacent to Mbombela.

- During the construction phase care must be taken not to destroy any trap-door or baboon spider burrows. Prior to excavations a thorough inspection of the cleared areas must be undertaken to determine the presences of any baboon spider burrows, loosely embedded rocks or stumps in the proposed cleared areas. Several species of Baboon and Trapdoor species have been recorded in the area including African Corklid Trapdoor Spiders (*Stasimopus spp*.) Wafer-Lid Trapdoor Spiders (*Ancyloptrypa spp*.), Sheetweb Mygalomorph *Allothele australis*, Front-eyed Trapdoor Spiders (*Ctenolophus spp., Idiops spp.*), Banded Legged Trapdoor Spider (*Poecicilomigas abrahami*), African Tree Trapdoor Spiders (*Moggridgea spp.*), Wishbone Trapdoor Spiders (*Lepthercus dregei*, *Spiroctenus fossorius*), Common Yellow-Banded Baboon Spider (*Harpactira tigrina*).

Conservation

- Of the mygalomorphs, it is mainly the larger Baboon Spiders that are in great demand as pets and are consequently regarded as commercially threatened by the International Union for Conservation of International Trade in Endangered Species (CITES) (De Wet & Schoonbee 1991). The genera *Ceratogyrus, Harpactira* and *Pterinochilus* were added to schedule V11 of the Transvaal Provincial Nature Conservation Ordinance of 1983 as Protected Invertebrate Animals.

SNAKES

- Educational programmes for the contractor's staff must be implemented to ensure that project workers are alerted to the possibility of snakes being found during vegetation clearance. The construction team must be briefed about the management of snakes in such instances.
- Several venomous snake species occur along the proposed route including Boomslang (*Dispholidus typus*), Rinkhals (*Haemachatus haemachatus*), Common or Rhombic Night Adder (*Causus rhombeatus*), Puff Adder (*Bitis arietans*).
- General avoidance of snakes if the best policy if encountered. Snakes should not be harmed or killed and allowed free movement away from the area.
- Safety precaution measure must be implemented especially during the vegetation clearance phase which could result in encounters with several venomous snake species.
- Appropriate foot wear (sturdy leather boots) should be worn in the field.
- Several large termite mounds *Trinervitermes spp.* were observed opposite the proposed road alignment. Termite mounds offer important refuges for numerous frog, lizard and snake species.
- If any termite mounds have to be destroyed a qualified herpetologist must be present in case any blind snakes, or the red data Yellow-bellied house Snake (Rare) or Striped Harlequin Snake is unearthed. Although these species have not been recorded in the grid square they have been recorded in adjacent grid squares.

7.2 VEGETATION/FLORA

All indigenous trees and plants occurring outside the proposed road servitude shall be left undisturbed and permits will be required for the removal of the protected tree species *Sclerrocarya birrea* subsp. *caffra* and *Pterocarpus angolensis*. In terms of the National Forests Act 1998 (Act No 84 of 1998) certain tree species can be identified and declared as protected. The Department of Water Affairs and Forestry (now Department of Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization. The Department of Agriculture, Forestry and Fisheries (DAFF) will have to be approached to obtain the required permits for the removal of any protected tree species.

Management objective

- Minimal disturbance to vegetation where such vegetation does not interfere with construction and the road servitude
- No unnecessary destruction to surrounding vegetation especially in the adjacent natural areas situated in close proximity to the road servitude.

Measurable targets

- Adequate protection of remaining indigenous plant or tree species
- No litigation due to removal of vegetation (protected tree species) without the necessary permits

Mitigation and recommendation

Remaining indigenous plants such as *Aloe ferox* and *Aloe maculata* should be retained or replanted wherever possible. Where herbicides are used to clear vegetation, specimen-specific chemicals should be applied to individual plants only. General spraying should be prohibited.

All alien vegetation should be eradicated within the P-166 road servitude over a five-year period. Invasive species (*Acacia mearnsii, Agave americana, Opuntia ficus-indica, Sesbania punicea, Eucalyptus sp., Solanum mauritianum*) should be given the highest priority. No dumping of any materials in undeveloped open areas and neighbouring properties. Activities in the surrounding open undeveloped areas must be strictly regulated and managed. It is imperative that the construction and operational activities are restricted to the road reserve. This impact is anticipated to be **localised, of a long-term nature and of medium significance**, provided that appropriate mitigation

measures are implemented (e.g. the limitation of vegetation or tree clearance adjacent to the road reserve).

7.3 VEGETATION CLEARANCE

Management objective

- Minimise damage to surrounding vegetation
- Minimise damage to topsoil
- Successful rehabilitation of barren areas

Measurable targets

- No damage to vegetation outside the road servitude
- No loss of topsoil
- No visible erosion three months after completion of the contract
- All disturbed areas successfully rehabilitated three months after completion of the contract

Vegetation clearing of the P-166 road servitude must be kept to a minimum. Several large indigenous and protected tree species occur along the proposed alignment. Any trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed. Stumps shall be treated with herbicide. Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping. Any vegetation cleared shall be removed or flattened and not be pushed to form an embankment.

Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion. This is especially relevant adjacent to the Crocodile River as well as palustrine wetlands. The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier's specifications.

All alien vegetation in the road servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides. Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits (Henderson, 2001). These plants need to be managed and prevented from spreading.

Alien and invasive plant species can be grouped three categories:

- Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in Regulation 15.D of the CARA.
- Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas.
- Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas.

It is recommended that a contractor for vegetation clearing should comply with the following parameters:

- The contractor must have the necessary knowledge to be able to identify indigenous and protected tree species (*Sclerrocarya birrea, Pterocarpus angolensis*), red listed (*Eucomis autumalis, Crinum macowanii, Gunnera perpensa*) as well as species not interfering with the road servitude.
- The contractor must also be able to identify declared weeds and alien species that must be totally eradicated according to the Conservation of Agricultural Resources Act,1983 (Act 43 of 1983).
- The contractor must be in possession of a valid herbicide applicators license.

7.4 EROSION AND SEDIMENT CONTROL

Figure15. Extensive surface, rill and gully erosion occurs adjacent to the proposed road alignments.

- Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent further soil erosion.
- Re-seeding shall be done on disturbed areas especially adjacent to any natural bushveld habitat, riverine or wetland crossing
- In accordance with the Conservation of Agricultural Resources Act, No 43 of 1983, slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced.
- Contour banks shall be spaced according to the original or surrounding topography/slope. The type of soil shall also be taken into consideration.
- Any erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted, and the areas restored to a proper condition.
- The Contractor shall ensure that cleared areas are effectively stabilised to prevent and control erosion. The method of stabilization shall be determined in consultation with the consultant. Consideration and provision shall be made for the following methods:
- Mulch or chip cover

- Straw stabilizing (at the rate of one bale/m² and rotated into the top 100mm of the completed earthworks)

- Watering
- Planting / sodding
- Hand seeding/ sowing
- Hydroseeding
- Soil binders and anti erosion compounds
- Mechanical cover or packing structures
- Gabions & reno mattresses
- Geofabric
- Hessian cover
- Exposed slopes and/or destabilised areas should be landscaped to blend in with the surrounding areas if possible.

7.5 FIRE PREVENTION

The frequent burning of the vegetation will have a high impact on remaining vegetation and associated faunal species. Fires during the winter months will severely impact on the hibernating species, which are extremely sluggish. Fires during the early summer months destroy the emerging reptiles as well as refuge areas increasing predation risks.

Management objective

- Minimise risk of veld fires
- Minimise damage to grazing
- Prevent runaway fires

Measurable targets

- No veld fires started by the Contractor's work force
- No claims from Landowners for damages due to veld fires
- No litigation

Mitigation and recommendations

- **No open fires shall be allowed on site** under any circumstance. The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months.
- During the operational phase the road verges should be regularly maintained with the removal of alien invasive vegetation.

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9. APPENDIX

Table3. List of red data and endemic species for Mpumalamga Province.

FAMILY	SPECIES	THREAT STATUS
AMARYLLIDACEAE	*Crinum macowanii* Baker	Declining
AMARYLLIDACEAE	*Cyrtanthus eucallus* R.A.Dyer	VU
APIACEAE	*Alepidea peduncularis* A.Rich.	DDT
APOCYNACEAE	*Brachystelma campanulatum* N.E.Br.	NT
AQUIFOLIACEAE	*Ilex mitis* (L.) Radlk. var. *mitis*	Declining
ASPHODELACEAE	*Aloe kniphofioides* Baker	VU
ASPHODELACEAE	*Aloe simii* Pole-Evans	CR
ASTERACEAE	*Helichrysum homilochrysum* S.Moore	Rare
CELASTRACEAE	*Elaeodendron croceum* (Thunb.) DC.	Declining
CORNACEAE	*Curtisia dentata* (Burm.f.) C.A.Sm.	NT
CRASSULACEAE	*Kalanchoe alticola* Compton	DDD
EUPHORBIACEAE	*Acalypha caperonioides* Baill. var. *caperonioides*	DDT
FABACEAE	*Indigofera lepida* N.E.Br.	DDT
GUNNERACEAE	*Gunnera perpensa* L.	Declining
GESNERIACEAE	*Streptocarpus cyaneus* S.Moore subsp. longi-tommii Weigend & T.J.Edwards	VU
HYACINTHACEAE	*Ledebouria galpinii* (Baker) S.Venter & T.J.Edwards	EN
HYACINTHACEAE	*Merwilla plumbea* (Lindl.) Speta	NT
HYPOXIDACEAE	*Hypoxis hemerocallidea* Fisch., C.A.Mey. & Av?-Lall.	Declining
IRIDACEAE	*Gladiolus serpenticola* Goldblatt & J.C.Manning	Rare
LAMIACEAE	*Plectranthus esculentus* N.E.Br.	DDD
LAMIACEAE	*Syncolostemon incanus* (Codd) D.F.Otieno	EN
LAURACEAE	*Cryptocarya transvaalensis* Burtt Davy	Declining
MYROTHAMNACEAE	*Myrothamnus flabellifolius* Welw.	DDT
MYRSINACEAE	*Rapanea melanophloeos* (L.) Mez	Declining
ORCHIDACEAE	*Ansellia africana* Lindl.	Declining
ORCHIDACEAE	*Platycoryne mediocris* Summerh.	EN*
ORCHIDACEAE	*Schizochilus cecilii* Rolfe subsp. *culveri* (Schltr.) H.P.Linder	Rare
PASSIFLORACEAE	*Adenia gummifera* (Harv.) Harms var. *gummifera*	Declining
PROTEACEAE	*Faurea macnaughtonii* E.Phillips	Rare
PROTEACEAE	*Leucospermum gerrardii* Stapf	NT
PROTEACEAE	*Protea parvula* Beard	NT
PROTEACEAE	*Protea roupelliae* Meisn. subsp. *hamiltonii* Beard ex	CR

	Rourke	
SANTALACEAE	*Thesium breyeri* N.E.Br.	DDT
WOODSIACEAE	Hypodematium crenatum (Forssk.) Kuhn	VU
ZAMIACEAE	*Encephalartos humilis* I.Verd.	VU
ZAMIACEAE	*Encephalartos laevifolius* Stapf & Burtt Davy	CR
ZAMIACEAE	*Encephalartos lanatus* Stapf & Burtt Davy	VU

Table4. List of endemic species for the study area.

FAMILY	**SPECIES**	**SA ENDEMIC**
ACANTHACEAE	*Barleria rotundifolia* Oberm.	Yes
ACANTHACEAE	*Chaetacanthus costatus* Nees	Yes
AGAPANTHACEAE	*Agapanthus inapertus* P.Beauv. subsp. *hollandii* (F.M.Leight.) F.M.Leight.	Yes
AGAPANTHACEAE	*Agapanthus inapertus* P.Beauv. subsp. *inapertus*	Yes
AMARYLLIDACEAE	*Cyrtanthus eucallus* R.A.Dyer	Yes
AMARYLLIDACEAE	*Cyrtanthus thorncroftii* C.H.Wright	Yes
APIACEAE	*Alepidea peduncularis* A.Rich.	Yes
APIACEAE	*Heteromorpha pubescens* Burtt Davy	Yes
APOCYNACEAE	*Brachystelma bruceae* R.A.Dyer subsp. *hirsutum* R.A.Dyer	Yes
APOCYNACEAE	*Brachystelma oianthum* Schltr.	Yes
APOCYNACEAE	*Ceropegia haygarthii* Schltr.	Yes
ASPHODELACEAE	*Aloe chortolirioides* A.Berger var. *woolliana* (Pole-Evans) Glen & D.S.Hardy	Yes
ASPHODELACEAE	*Aloe kniphofioides* Baker	Yes
ASPHODELACEAE	Aloe petricola Pole-Evans	Yes
ASPHODELACEAE	*Aloe simii* Pole-Evans	Yes
ASTERACEAE	*Aster lydenburgensis* W.Lippert	Yes
ASTERACEAE	*Dimorphotheca spectabilis* Schltr.	Yes
ASTERACEAE	*Geigeria burkei* Harv. subsp. *burkei* var. *hirtella* Merxm.	Yes
ASTERACEAE	*Helichrysum homilochrysum* S.Moore	Yes
ASTERACEAE	*Nolletia rarifolia* (Turcz.) Steetz	Yes
ASTERACEAE	*Senecio glanduloso-pilosus* Volkens & Muschl.	Yes
COMBRETACEAE	*Combretum collinum* Fresen. subsp. *taborense* (Engl.) Okafor	Yes
CONVOLVULACEAE	*Ipomoea bathycolpos* Hallier f.	Yes
CRASSULACEAE	*Crassula compacta* Sch?nland	Yes

CRASSULACEAE	*Crassula lanceolata* (Eckl. & Zeyh.) Endl. ex Walp. subsp. *lanceolata*	Yes
ERICACEAE	*Erica holtii* Schweick.	Yes
EUPHORBIACEAE	*Euphorbia kraussiana* Bernh. var. *kraussiana*	Yes
EUPHORBIACEAE	*Euphorbia vandermerwei* R.A.Dyer	Yes
EUPHORBIACEAE	*Jatropha latifolia* Pax var. *angustata* Prain	Yes
EUPHORBIACEAE	*Jatropha latifolia* Pax var. *latifolia*	Yes
FABACEAE	*Bauhinia natalensis* Oliv. ex Hook.	Yes
FABACEAE	*Eriosema gunniae* C.H.Stirt.	Yes
FABACEAE	*Indigofera lepida* N.E.Br.	Yes
FABACEAE	*Indigofera masonae* N.E.Br.	Yes
FABACEAE	*Indigofera sanguinea* N.E.Br.	Yes
FABACEAE	*Pearsonia obovata* (Schinz) Polhill	Yes
FABACEAE	*Rhynchosia galpinii* Baker f.	Yes
FABACEAE	*Rhynchosia spectabilis* Schinz	Yes
FABACEAE	*Rhynchosia villosa* (Meisn.) Druce	Yes
GERANIACEAE	*Pelargonium transvaalense* R.Knuth	Yes
GESNERIACEAE	*Streptocarpus cyaneus* S.Moore subsp. *polackii* (B.L.Burtt) Weigend & T.J.Edwards	Yes
HYACINTHACEAE	*Ledebouria ovatifolia* (Baker) Jessop	Yes
IRIDACEAE	*Dierama gracile* N.E.Br.	Yes
IRIDACEAE	*Gladiolus ferrugineus* Goldblatt & J.C.Manning	Yes
IRIDACEAE	*Gladiolus vinosomaculatus* Kies	Yes
IRIDACEAE	*Hesperantha schlechteri* (Baker) R.C.Foster	Yes
LAMIACEAE	*Ocimum serratum* (Schltr.) A.J.Paton	Yes
LAMIACEAE	*Plectranthus hadiensis* (Forssk.) Schweinf. ex Spreng. var. *woodii* (G?rke) Codd	Yes
LAMIACEAE	*Syncolostemon punctatus* (Codd) D.F.Otieno	Yes
LAMIACEAE	*Syncolostemon subvelutinus* (G?rke) D.F.Otieno	Yes
MALVACEAE	*Hermannia montana* N.E.Br.	Yes
MALVACEAE	*Sida spinosa* L. var. *spinosa*	Yes
MALVACEAE	*Sterculia murex* Hemsl.	Yes
ORCHIDACEAE	*Habenaria pseudociliosa* Schelpe ex J.C.Manning	Yes
OROBANCHACEAE	*Sopubia cana* Harv. var. g*labrescens* Diels	Yes
PROTEACEAE	*Faurea galpinii* E.Phillips	Yes
ROSACEAE	*Alchemilla rehmannii* Engl.	Yes
ROSACEAE	*Rubus longepedicellatus* (Gust.) C.H.Stirt.	Yes
RUTACEAE	*Zanthoxylum thorncroftii* (I.Verd.) P.G.Waterman	Yes
SANTALACEAE	*Thesium breyeri* N.E.Br.	Yes
SANTALACEAE	*Thesium magalismontanum* Sond.	Yes

SCROPHULARIACEAE	*Jamesbrittenia accrescens* (Hiern) Hilliard	Yes
SCROPHULARIACEAE	*Manulea rhodantha* Hilliard subsp. *aurantiaca* Hilliard	Yes
SCROPHULARIACEAE	*Selago atherstonei* Rolfe	Yes
VITACEAE	*Cissus fragilis* E.Mey. ex Kunth	Yes
VITACEAE	*Cyphostemma anatomicum* (C.A.Sm.) Wild & R.B.Drumm.	Yes
ZAMIACEAE	*Encephalartos humilis* I.Verd.	Yes
ZAMIACEAE	*Encephalartos lanatus* Stapf & Burtt Davy	Yes

Table4. Mammal species recorded during initial faunal survey and supplemented with previous field surveys conducted in similar habitat (2000-2012)

COMMON NAME	SCIENTIFIC NAME
Rusty Pipistrelle	*Pipistrellus rusticus*
Transvaal free-tailed Bat	*Tadarida ventralis*
Egyptian free-tailed Bat	*Tadarida aegyptiaca*
Cape Serotine Bat	*Eptesicus capensis*
Schreibers' Long-Fingered Bat	*Miniopterus schreibersii*
Geoffroy's Horseshoe Bat	*Rhinolophus clivosus*
Eastern Rock Elephant-Shrew	*Elephantulus myurus*
*Scrub Hare	*Lepus saxatilis*
House Mouse	*Mus musculus*
African (Common) Mole-rat	*Cryptomys hottentotus*
Greater Canerat	*Thryonomys swinderianus*
Woodland Dormouse	*Graphiurus murinus*
Rock Dormouse	*Graphiurus platyops*

Spiny Mouse	*Acomys spinosissimus*
Single Striped Mouse	*Lemniscomys rosalia*
*Four-striped Grass Mouse	*Rhabdomys pumilio*
Desert Pygmy Mouse	*Mus indutus*
Pouched Mouse	*Saccostomus campestris*
*Natal Multimammate Mouse	*Mastomys natalensis*
Southern Multimammate Mouse	*Mastomys coucha*
Namaqua Rock Mouse	*Micaelamys namaquensis*
Angoni Vlei Rat	*Otomys angoniensis*
Vlei Rat	*Otomys irroratus*
Grey Climbing Mouse	*Dendromus melanotis*
Chestnut Climbing Mouse	*Dendrobus mystacalis*
African Marsh Rat	*Dasymys incomtus*
House Rat	***Rattus rattus***
*Bushveld Gerbil	*Tatera leucogaster*
*Highveld Gerbil	*Tatera brantsii*
Forest Shrew	*Myosorex varius*
Swamp Musk Shrew	*Crocidura mariquensis*
Tiny Musk Shrew	*Crocidura fuscomurina*
Reddish-Grey Musk Shrew	*Crocidura cyanea*
Lesser Grey-brown Musk Shrew	*Crocidura silacea*

South African Ground Squirrel	*Xenus inauris*
Southern African Hedgehog	*Atelerix frontalis*
Striped Polecat	*Ictonyx striatus*
Small-spotted Genet	*Genetta genetta*
* South African Large-spotted Genet	*Genetta tigrina*
*Marsh Mongoose	*Atilax paludinosus*
Dwarf Mongoose	*Helogale parvula*
*Yellow Mongoose	*Cynictis penicillata*
*Slender Mongoose	*Galerella sanguinea*
White-Tailed Mongoose	*Ichneumia albicauda*
Lesser Bushbaby	*Galago moholi*
*Black-backed Jackal	*Canis mesomelas*
*Cape Porcupine	*Hystrix africaeaustralis*
Smith's Red Rock Rabbit	*Pronolagus saundersiae*
Springhare	*Pedetes capensis*
Aardwolf	*Proteles cristatus*
African Wild Cat	*Felis sylvestris* (*lybica* group)
Serval	*Leptailurus serval*
Caracal	*Felis caracal*
*African Clawless Otter	*Aonyx capensis*

African Striped Weasel	*Poecilogale albinucha*
Striped Polecat	*Ictonyx striatus*
*Common Duiker	*Sylvicarpa grimmia*
Klipspringer	*Oreotragus oreotragus*
Steenbok	*Raphicerus campestris*
Grey Rhebok	*Pelea capreoulus*
Mountain Reedbuck	*Redunca fulvorufula*
*Chacma Baboon	*Papio cynocephalus ursinus*
*Vervet Monkey	*Ceropithecus aethiops*

*observed during brief field survey (October 2012)

Table5. List of 33 frog species found for the combined locus = 2530CD, 2531BA (SAFAP)
33 species found for the combined locus = 2530CD, 2531BA

Family	Genus	Species	Common name	Red list category	Atlas region endemic
Arthroleptidae	*Leptopelis*	*mossambicus*	Brown-Backed Tree Frog	Least Concern	0
Brevicepitidae	*Breviceps*	*adspersus*	Bushveld Rain Frog	Least Concern	0
Brevicepitidae	*Breviceps*	*mossambicus*	Mozambique Rain Frog	Least Concern	0
Bufonidae	*Amietophrynus*	*garmani*	Eastern Olive Toad	Least Concern	0
Bufonidae	*Amietophrynus*	*gutturalis*	Guttural Toad	Least Concern	0
Bufonidae	*Amietophrynus*	*maculatus*	Flat-backed Toad	Least Concern	0
Bufonidae	*Amietophrynus*	*rangeri*	Raucous Toad	Least Concern	0
Bufonidae	*Poyntonophrynus*	*fenoulheti*	Northern Pygmy Toad	Least Concern	0
Bufonidae	*Schismaderma*	*carens*	Red Toad	Least Concern	0
Hemisotidae	*Hemisus*	*marmoratus*	Mottled Shovel-nosed Frog	Least Concern	0
Hyperoliidae	*Afrixalus*	*aureus*	Golden Leaf-folding Frog	Least Concern	0
Hyperoliidae	*Hyperolius*	*marmoratus*	Painted Reed Frog	Least Concern	0
Hyperoliidae	*Hyperolius*	*pusillus*	Water Lily Frog	Least Concern	0
Hyperoliidae	*Kassina*	*senegalensis*	Bubbling Kassina	Least Concern	0
Hyperoliidae	*Semnodactylus*	*wealii*	Rattling Frog	Least Concern	0
Microhylidae	*Phrynomantis*	*bifasciatus*	Banded Rubber Frog	Least Concern	0
Phrynobatrachidae	*Phrynobatrachus*	*mababiensis*	Dwarf Puddle Frog	Least Concern	0
Phrynobatrachidae	*Phrynobatrachus*	*natalensis*	Natal Snoring Puddle Frog	Least Concern	0
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern	0
Pipidae	*Xenopus*	*muelleri*	Tropical Platanna	Least Concern	0
Ptychadenidae	*Hildebrandtia*	*ornata*	Ornate Frog	Least Concern	0
Ptychadenidae	*Ptychadena*	*anchietae*	Plain Grass Frog	Least Concern	0
Ptychadenidae	*Ptychadena*	*mossambica*	Broad-banded Grass Frog	Least Concern	0
Ptychadenidae	*Ptychadena*	*porosissima*	Dwarf Grass Frog	Least Concern	0
Pyxicephalidae	*Amietia*	*angolensis*	Common or Angola River Frog	Least Concern	0
Pyxicephalidae	*Cacosternum*	*boettgeri*	Boettger's Caco	Least Concern	0
Pyxicephalidae	*Cacosternum*	*nanum*	Bronze Caco	Least Concern	0
Pyxicephalidae	*Pyxicephalus*	*edulis*	African Bullfrog	Least Concern	0
Pyxicephalidae	*Strongylopus*	*fasciatus*	Striped Steam Frog	Least Concern	0
Pyxicephalidae	*Tomopterna*	*cryptotis*	Tremelo Sand Frog	Least Concern	0
Pyxicephalidae	*Tomopterna*	*marmorata*	Russet-backed Sand Frog	Least Concern	0
Pyxicephalidae	*Tomopterna*	*natalensis*	Natal Sand Frog	Least Concern	0
Rhacophoridae	*Chiromantis*	*xerampelina*	Southern Foam Nest Frog	Least Concern	0

Table6. Reptile (82) species found for the combined locus = 2530CD, 2531BA Southern African Reptile Conservation Assessment (SARCA)

Family	Genus	Species	Subspecies	Common name	Red list category	Atlas region endemic
Agamidae	*Acanthocercus*	*atricollis*	*atricollis*	Southern Tree Agama	Not Evaluated	0
Agamidae	*Agama*	*aculeata*	*distanti*	Distant's Ground Agama	Not Evaluated	1
Agamidae	*Agama*	*atra*		Southern Rock Agama	Not Evaluated	0
Atractaspididae	*Amblyodipsas*	*concolor*		Natal Purple-glossed Snake	Not Evaluated	1
Atractaspididae	*Amblyodipsas*	*polylepis*	*polylepis*	Common Purple-glossed Snake	Not Evaluated	0
Atractaspididae	*Aparallactus*	*capensis*		Black-headed Centipede-eater	Not Evaluated	0
Atractaspididae	*Atractaspis*	*bibronii*		Bibron's Stiletto Snake	Not Evaluated	0
Boidae	*Python*	*natalensis*		Southern African Python	Not Evaluated	0
Chamaeleonidae	*Bradypodion*	*transvaalense*		Wolkberg Dwarf Chameleon	Not Evaluated	1
Chamaeleonidae	*Chamaeleo*	*dilepis*	*dilepis*	Common Flap-neck Chameleon	Not Evaluated	0
Colubridae	*Boaedon*	*capensis*		Brown House Snake	Not Evaluated	0
Colubridae	*Crotaphopeltis*	*hotamboeia*		Red-lipped Snake	Not Evaluated	0
Colubridae	*Dasypeltis*	*scabra*		Rhombic Egg-eater	Not Evaluated	0
Colubridae	*Dipsadoboa*	*aulica*		Marbled Tree Snake	Not Evaluated	0
Colubridae	*Dispholidus*	*typus*	*typus*	Boomslang	Not Evaluated	0
Colubridae	*Gonionotophis*	*capensis*	*capensis*	Common File Snake	Not Evaluated	0
Colubridae	*Gonionotophis*	*nyassae*		Black File	Not	0

				Snake	Evaluated	
Colubridae	*Hemirhagerrhis*	*nototaenia*		Eastern Bark Snake	Not Evaluated	0
Colubridae	*Lycodonomorphus*	*rufulus*		Brown Water Snake	Not Evaluated	0
Colubridae	*Lycophidion*	*capense*	*capense*	Cape Wolf Snake	Not Evaluated	0
Colubridae	*Philothamnus*	*hoplogaster*		South Eastern Green Snake	Not Evaluated	0
Colubridae	*Philothamnus*	*semivariegatus*		Spotted Bush Snake	Not Evaluated	0
Colubridae	*Prosymna*	*bivittata*		Two-striped Shovel-snout	Not Evaluated	0
Colubridae	*Prosymna*	*stuhlmannii*		East African Shovel-snout	Not Evaluated	0
Colubridae	*Psammophis*	*angolensis*		Dwarf Sand Snake	Not Evaluated	0
Colubridae	*Psammophis*	*crucifer*		Cross-marked Grass Snake	Not Evaluated	0
Colubridae	*Psammophis*	*mossambicus*		Olive Grass Snake	Not Evaluated	0
Colubridae	*Psammophis*	*subtaeniatus*		Western Yellow-bellied Sand Snake	Not Evaluated	0
Colubridae	*Psammophylax*	*rhombeatus*	*rhombeatus*	Spotted Grass Snake	Not Evaluated	0
Colubridae	*Psammophylax*	*tritaeniatus*		Striped Grass Snake	Not Evaluated	0
Colubridae	*Rhamphiophis*	*rostratus*		Rufous Beaked Snake	Not Evaluated	0
Colubridae	*Telescopus*	*semiannulatus*	*semiannulatus*	Eastern Tiger Snake	Not Evaluated	0
Colubridae	*Thelotornis*	*capensis*	*capensis*	Southern Twig Snake	Not Evaluated	0
Cordylidae	*Chamaesaura*	*aenea*		Coppery Grass Lizard	Not Evaluated	1
Cordylidae	*Cordylus*	*jonesii*		Jones' Girdled Lizard	Not Evaluated	0
Cordylidae	*Cordylus*	*vittifer*		Common Girdled Lizard	Not Evaluated	0
Cordylidae	*Platysaurus*	*intermedius*	*wilhelmi*	Wilhelm's	Not	1

				Flat Lizard	Evaluated	
Crocodylidae	*Crocodylus*	*niloticus*		Nile Crocodile	Lower Risk: Least Concern	0
Elapidae	*Aspidelaps*	*scutatus*	*intermedius*	Intermediate Shield Cobra	Not listed	1
Elapidae	*Dendroaspis*	*polylepis*		Black Mamba	Not Evaluated	0
Elapidae	*Hemachatus*	*haemachatus*		Rinkhals	Not Evaluated	0
Elapidae	*Naja*	*annulifera*		Snouted Cobra	Not Evaluated	0
Elapidae	*Naja*	*mossambica*		Mozambique Spitting Cobra	Not Evaluated	0
Gekkonidae	*Chondrodactylus*	*turneri*		Turner's Gecko	Not Evaluated	0
Gekkonidae	*Hemidactylus*	*mabouia*		Common Tropical House Gecko	Not Evaluated	0
Gekkonidae	*Homopholis*	*walbergii*		Wahlberg's Velvet Gecko	Not Evaluated	0
Gekkonidae	*Lygodactylus*	*capensis*	*capensis*	Common Dwarf Gecko	Not Evaluated	0
Gekkonidae	*Lygodactylus*	*ocellatus*		Spotted Dwarf Gecko	Not listed	0
Gekkonidae	*Lygodactylus*	*ocellatus*	*ocellatus*	Spotted Dwarf Gecko	Not Evaluated	1
Gekkonidae	*Pachydactylus*	*vansoni*		Van Son's Gecko	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*flavigularis*		Yellow-throated Plated Lizard	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*major*	*major*	Rough-scaled Plated Lizard	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*nigrolineatus*		Black-lined Plated Lizard	Not Evaluated	0
Gerrhosauridae	*Gerrhosaurus*	*validus*	*validus*	Common Giant Plated Lizard	Not Evaluated	0
Lacertidae	*Heliobolus*	*lugubris*		Bushveld Lizard	Not Evaluated	0
Lacertidae	*Ichnotropis*	*squamulosa*		Common Rough-scaled Lizard	Not Evaluated	0

Lacertidae	*Nucras*	*ornata*		Ornate Sandveld Lizard	Not Evaluated	0
Leptotyphlopidae	*Leptotyphlops*	*distanti*		Distant's Thread Snake	Not Evaluated	0
Leptotyphlopidae	*Leptotyphlops*	*incognitus*		Incognito Thread Snake	Not Evaluated	0
Leptotyphlopidae	*Leptotyphlops*	*scutifrons*	*conjunctus*	Eastern Cape Thread Snake	Not listed	0
Leptotyphlopidae	*Myriopholis*	*longicauda*		Long-tailed Thread Snake	Not Evaluated	0
Pelomedusidae	*Pelomedusa*	*subrufa*		Marsh Terrapin	Not Evaluated	0
Pelomedusidae	*Pelusios*	*sinuatus*		Serrated Hinged Terrapin	Not Evaluated	0
Scincidae	*Acontias*	*plumbeus*		Giant Legless Skink	Not Evaluated	0
Scincidae	*Afroablepharus*	*walbergii*		Wahlberg's Snake-eyed Skink	Not Evaluated	0
Scincidae	*Mochlus*	*sundevallii*	*sundevallii*	Sundevall's Writhing Skink	Not Evaluated	0
Scincidae	*Scelotes*	*bidigittatus*		Lowveld Dwarf Burrowing Skink	Not Evaluated	1
Scincidae	*Scelotes*	*mirus*		Montane Dwarf Burrowing Skink	Not Evaluated	1
Scincidae	*Trachylepis*	*capensis*		Cape Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*margaritifer*		Rainbow Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*punctatissima*		Speckled Rock Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*striata*		Striped Skink	Not Evaluated	0
Scincidae	*Trachylepis*	*varia*		Variable Skink	Not Evaluated	0
Testudinidae	*Stigmochelys*	*pardalis*		Leopard Tortoise	Not Evaluated	0
Typhlopidae	*Afrotyphlops*	*bibronii*		Bibron's	Not	0

				Blind Snake	Evaluated	
Typhlopidae	*Megatyphlops*	*schlegelii*		Schlegel's Beaked Blind Snake	Not Evaluated	0
Varanidae	*Varanus*	*albigularis*	*albigularis*	Rock Monitor	Not Evaluated	0
Varanidae	*Varanus*	*niloticus*		Water Monitor	Not Evaluated	0
Viperidae	*Bitis*	*arietans*	*arietans*	Puff Adder	Not Evaluated	0
Viperidae	*Bitis*	*atropos*		Cape Berg Adder	Not Evaluated	0
Viperidae	*Causus*	*defilippii*		Snouted Night Adder	Not Evaluated	0
Viperidae	*Causus*	*rhombeatus*		Rhombic Night Adder	Not Evaluated	0