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Strategic Biodiversity Scoping Assessment for the EMP amendment for the Sekoko Waterberg Coal Mine, Limpopo Province

compiled by

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I PROJECT DETAILS

Client:	Savannah Environmental (Pty) Ltd, on behalf of Sekoko Coal (Pty) Ltd
Report name:	Strategic Terrestrial Biodiversity Scoping Assessment for the proposed EMP amendment for the Sekoko Waterberg Coal Mine, Limpopo Province
Report type:	Biodiversity Scoping Assessment
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Report Version:	2012.12.10.1
Authority Reference:	N/A
Compiled by:	Riaan A. J. Robbeson (Pr.Sci.Nat.), Bathusi Environmental Consulting

II SPECIALIST INVESTIGATORS

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

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

Table 1: Contributing Biodiversity Specialists	
Botanical Investigator:	**Riaan Robbeson (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of Expertise:	Botanical Scientist & Ecological Scientist
Registration Number:	*400005/03*
Affiliation:	Grassland Society of Southern Africa
Membership Status:	Professional Member
Membership Number:	*667.08/08*
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Qualification:	M.Sc. (Conservation Biology), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of expertise:	Ecological Scientist & Zoological Scientist
Registration number:	*400204/05*

III RESERVED COPYRIGHT

IV DECLARATION OF INDEPENDENCE

Individual declarations attached as addendums. All specialist investigators, project investigators and members of companies employed for conducting this biodiversity investigation declare that:

- We act as independent specialist consultants conducting the assessment and compiling the report;
- We consider ourselves bound to the rules and ethics of the South African council for natural scientific professions;
- Bathusi Environmental Consulting cc is not a subsidiary, legally or financially, of either the proponent or Savanna Environmental;
- At the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development or activity as outlined in this document, other than fair financial compensation for work performed in a professional capacity;
- We will not be affected in any manner by the outcome of the environmental process of which this assessment forms part of, other than being part of the general public;
- We do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience; and
- We do not have any influence over decisions made by the governing authorities;
- Undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the environmental impact assessment regulations, 2005; and
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.

Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.

Signature of principal ecologist:

Bathusi Environmental Consulting cc (CK1999/052182/23)

Name of company:

19th December 2012

Date:

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1 EXECUTIVE SUMMARY

Sekoko Coal (Pty) Ltd (Sekoko) is applying for a Mining Right on seven (7) farms in the Waterberg region of the Limpopo Province. The farms are situated in the Lephalale Local Municipality, which falls under the jurisdiction of the Waterberg District and include the following:

- Smitspan 306LQ;
- Massenberg 305LQ;
- Minnasvlakte 258LQ;
- Hooikraal 315LQ;
- Olieboomfontein 220LQ;
- the northern section of Duikerfontein 263LQ; and
- the northern section of Swanepoelpan 262LQ.

The initial focus of activity will be opencast and underground mining on Smitspan and the construction of mine-related infrastructure and wash plant on the far northern portions of Massenberg adjacent to Smitspan. Coal will initially be mined using opencast, roll-over method via truck and shovel and underground mining using board-and-pillar mining approaches.

Savannah Environmental has been appointed as the Environmental Assessment Practitioner (EAP) to undertake a Scoping and Environmental Impact Assessment to identify and assess all potential environmental impacts associated with the proposed project for the area. Bathusi Environmental Consulting cc was appointed as independent ecologists to conduct an ecological investigation of the study area and compile an impact rating report for the terrestrial biodiversity component of this project. This particular report forms part of the Scoping Phase.

1.1 Biophysical Attributes

The study area is situated in the Lephalale District Municipality, which comprises approximately 1,960,140ha of which approximately 94.4% is regarded untransformed. Land use in the region varies between game farming and cattle farming. Extremely little arable agriculture is practiced, mainly because of low rainfall and poor soils that predominate in the region, although some evidence of old agricultural fields are visible in some parts. All of the farms are characterised by natural woodland habitat with little transformation.

The region is relative water scarce with an indicated average rainfall of approximately 460mm per annum (measured at Matimba Power Station). The rainy season is generally from November to March, but rainfall is slightly unreliable and rather severe drought conditions tend to occur about 12% annually. No large rivers or drainage lines are present in any of the farms and surface water is mostly restricted to small, temporary pans, which only hold water for short periods subsequent to raining events. However, ill-defined, non-perennial drainage lines are present, but only flow for short periods after severe raining events. Because of the flat topography of the region, no significant drainage is expected and available water is more likely to disappear into the sandy soils that prevail in the region. The Limpopo River is the most

significant river of the region and is situated approximately 10km northwest from the farm Olieboomfontein.

The study sites are situated in a topographically homogenous region, described by the ENPAT (2003) database as Plains. Slopes are flat; most often less than 2% in a northwestern direction and altitude is approximately 900m above sea level. The geology of the study area comprises the Karoo Shales. The Ah85 and Ah86 land type units are spatially represented in the study areas (Land Type Survey Staff, 1987).

No biosphere, conservancy or other declared area of conservation are present in the immediate surroundings of the study area. The closest area of conservation is the D'Njala Nature Reserve, situated approximately 30km to the east.

1.2 Botanical Assessment

Vegetation of the region is defined by Mucina and Rutherford (2006) as the Limpopo Sweet Bushveld. It comprehends short, open woodland dominated by *Acacia mellifera* and *Dichrostachys cinerea* as well as taller tree species such as *A. robusta*, *A. burkei* and *Terminalia sericea*. It is not threatened (Least Threatened) and although only 1% is formally conserved, much is contained within private nature reserves and game farms.

The lack of floristic knowledge of the region is emphasised by the paucity of data records for this area (38 recorded species). An estimation of approximately 90 plant taxa per farm is considered reasonable, based on results of recent surveys in the general region. A total of 194 Red Data (Threatened) plant taxa are known to occur in Limpopo Province. Data records indicate only one plant species of conservation importance occurring in the region. However, considering the poor floristic knowledge of the region, it is reasonable to assume that more plant taxa of conservation importance will be present. However, 10 provincially protected species are known to persist in the general region.

The following (visually apparent) macro-habitat types were recorded in the study areas:

- *Acacia mellifera* floodplains & small drainage lines – situated in lowland areas, typified by slightly clayey soils, a predominance of *Acacia mellifera* as a result of severe utilisation and species specific exclusion. These areas are temporarily inundated subsequent to raining events. Protected trees, including *Boscia, Combretum,* etc., persist in this habitat type A medium-high floristic sensitivity is ascribed;
- Degraded woodland – historic cultivated lands that have reverted through natural succession, dominated by *Acacia* and *Dichrostachys* species. Typically low phytodiversity and habitat variation, embedded occurrences within the natural woodland. A medium-low floristic sensitivity is ascribed;
- Historic agricultural fields – recent disturbances of the woodland vegetation, typically dominated by grass sward with woody component absent or as low shrubs, comprising *Acacia* and *Dichrostachys* species. A medium-low floristic sensitivity is ascribed;
- Linear infrastructure – roads, railways, etc. A low floristic sensitivity is ascribed;

- Natural woodland – dominant habitat type of the region, exhibiting low habitat variances and subtle changes that result mostly from substrate variations. Various protected tree species persist, *Sclerocarya birrea* and *Acacia erioloba* becomes dominant in some localities. This woodland type is representative of the regional Limpopo Sweet Bushveld ecological type. Extremely low fragmentation and isolation factors noted on a local and regional scale; a medium high sensitivity is ascribed to these parts. A medium-high floristic sensitivity is ascribed; and
- Wooded clumps – localised areas of dense wooded stands were recorded. These areas are typically situated near drainage areas and are frequently dominated by *Spirostachys africana*. A medium-high floristic sensitivity is ascribed

Natural woodland/ savanna vegetation of the study area and the surrounds is regarded representative of the regional vegetation types, exhibiting little divergence from the species composition, diversity and vegetation structure described by Mucina and Rutherford (Vegmap, 2006). Previous studies conducted in the region reflected the homogenous nature of the vegetation, with the only **significant** (visible, artificial) variation noted from historically cultivated fields. However, visual observations revealed that natural woodland habitat does vary on a local and regional scale, although not immediately discernible from aerial imagery. These variations are likely to be driven by localised variations in soil characteristics and management strategies. Associated with the observed disparity in the tree layer are slight variations in the composition and abundance of the shrub and grass sward, which is most likely to be a reflection of varying soil characteristics, utilisation intensity and management strategies.

The only significant physiognomic (natural) variation to the natural woodland is the floodplains and associated hydromorphic variations of *Acacia mellifera* that result from competitive exclusion and severe, seasonal utilisation. Alluvial plains are generally not regarded sensitive because of the absence of unique and scarce floristic characteristics and the condition and status of these parts are more likely to be described as slightly deteriorated due to the high utilisation levels that renders the species diversity relative low. The ecological contribution of these variations in terms of local and regional habitat diversity and ecosystem services are however regarded important. It is however important to note that this variation is not present as isolated habitat; a high connectivity is noted on a local and regional scale. It is therefore reasonable to accept that the functionality of this habitat type is optimal under current conditions.

1.3 Faunal Assessment

Biological diversity everywhere is at great risk as a direct result of an ever-expanding and uncontrolled human population and its associated activities. The savanna regions of Limpopo Province are no exception and the presence of resources, such as coal, has led to the significant transformation, degradation and fragmentation of the region's grasslands. Farming and land management have also had a significant impact on the faunal diversity of the region; it is believed by some to be the most damaging sector of human activity affecting wild nature (Balmford *et al* 2012).

For the purposes of this assessment, six macro habitat types were identified, each of which was assessed in terms of sensitivity concerning likely impacts associated with opencast coal mining. Faunal sensitivity estimations incorporated a range of ecological and biodiversity characteristics in order to present a comparison of the six habitats in terms of relative faunal and biodiversity sensitivity. Based on these ecological and biodiversity considerations, the following estimations resulted:

- *Acacia mellifera* floodplains — high faunal sensitivity
- Degraded woodland — medium faunal sensitivity
- Historic agricultural lands — medium-low faunal sensitivity
- Linear infrastructure — low faunal sensitivity
- Natural woodland — medium-high faunal sensitivity
- Wooded clumps — high faunal sensitivity

Natural woodland, which comprises most of the study area, is estimated to have a medium-high faunal sensitivity. Habitat diversity is a particularly important attribute pertaining to faunal sensitivity. Variable habitat types, such as the *Acacia mellifera* floodplains, are often host to a variety of Red Data taxa; for example, the presence of the Giant Bullfrog has been confirmed for seasonal pans that contain surface water during the rainy season in the region. Other Red Data species are considered potential inhabitants of farms with wetland habitat because of the presence of seasonal surface water and wetland related habitat is therefore regarded important on a local and regional scale.

One hundred and twenty-three Red Data species from five categories are known to occur in the Limpopo Province and the ¼-degree grid 2327CB. Estimations for the Probability of Occurrence (PoC) for Red Data fauna taxa for the study area yielded the following results:

- 80 species have a low PoC;
- 7 species have a moderate-low PoC;
- 11 species have a moderate PoC;
- 6 species have a moderate-high PoC; and
- 4 species have a high PoC.

Eighteen Red Data species have been confirmed for the region in which the study area is located during recent studies and based on information provided by landowners.

The Limpopo Province includes six provincially listed protected species; it is estimated that four of the six species are unlikely to occur in the study area, while two species are considered at least moderately likely to occur in the study area. Importantly, protected baboon spiders have recently been confirmed for the surrounding area, and in particular within the project farms. At least four protected baboon spider species are known from the Limpopo Province, including:

- *Ceratogyrus bechuanicus* (Starbust Horned Baboon Spider);
- *Ceratogyrus brachycephalus* (Rhino-horned Baboon Spider);
- *Ceratogyrus darlingi* (horned baboon spiders); and
- ***Augacephalus junodii* (*Pterinochilus junodi*) (golden baboon spider), confirmed**

1.4 Scoping Assessment & Recommendations

No impacts were identified that could lead to a beneficial effect on the biological environment since the proposed development is largely destructive, involving the alteration of natural habitat. A list of potential and likely impacts was compiled from a generic list of impacts derived from previous projects of this nature and from a literature review of the potential impacts of this type of development on the natural environment, including:

- Direct impacts on flora species of conservation importance;
- Direct impacts on protected flora species;
- Direct impacts on fauna species of conservation importance;
- Direct impacts on common fauna species / faunal assemblages (including migration patterns, corridors, etc);
- Human - Animal conflicts;
- Loss or degradation of natural vegetation / pristine habitat (including ecosystem functioning);
- Loss / degradation of surrounding habitat;
- Impacts on SA's conservation obligations & targets;
- Increase in local and regional fragmentation/ isolation of habitat; and
- Increase in environmental degradation, pollution (air, soils, surface water).

In order to assess the nature and extent of identified and potential impacts on the natural environment and to address existing information gaps and satisfy legal requirements of EIA investigations, it is suggested that an over-arching approach be followed to allow for the capture of maximum data and adequate subsequent analysis thereof. The suggested approach is based on separate austral winter and summer surveys during which a scientific approach to data assimilation will be followed. Botanical and faunal data will ultimately be captured in point samples (relevèes) placed in a stratified random mean across the entire study area. Acquired data will be holistically analysed to illustrate the ecological interaction of plants and animals. Data analysis will be performed by PC-ORD for Windows, Version 6.07 (2011), allowing for an analysis through TWINSPAN, DECORANA, etc. Allowance will be made for *ad hoc* observations in order to compile comprehensive species lists.

2 TERMS OF REFERENCE

Objectives of this Biodiversity Scoping Assessment are to establish the presence/ absence, variability and preliminary ecological sensitivity of macro habitat types within the proposed project areas. Brief comments on sensitive or conservation important biodiversity attributes and/ or species that may be present within the area will be provided. Results will ultimately be incorporated into the Scoping Assessment that will highlight expected and likely impacts on the natural environment.

The Terms of Reference for the floristic assessment are as follows:

- Obtain all relevant Précis and Red Data flora information;
- Conduct a photo analysis of the proposed area;
- Identify floristic variations;
- Survey habitat types to obtain a broad understanding of the floristic diversity;
- Assess the potential presence of Red List flora species according to information obtained from SANBI;
- Incorporate existing knowledge of the region into the assessment;
- Describe broad habitat variations present in the study area in terms of biophysical attributes and phytosociological characteristics;
- Compile species list of species recorded on site and its ecological importance (red data, medicinal uses etc;
- Compile a floristic sensitivity analysis;
- Incorporate results into the Biodiversity Scoping Evaluation;
- Map all relevant aspects;
- Provide pertinent recommendations; and
- Present all results in a suitable format.

The Terms of Reference for the faunal assessment are as follows:

- Obtain available faunal distribution records and Red Data faunal information
- Survey the site to obtain a broad overview of available faunal habitat types;
- Assess the potential presence of Red Data fauna species;
- Incorporate existing knowledge of the region;
- Describe the status of available habitat in terms of faunal attributes, preferences and conservation potential;
- Compile species list of species recorded on site and its ecological importance
- Compile a faunal sensitivity analysis;
- Incorporate results into the Biodiversity Scoping Evaluation;
- Map all relevant aspects; and
- Present all results in a suitable format.

3 INTRODUCTION

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

Why is biodiversity conservation important? Biodiversity sustains life on earth. An estimated 40 percent of the global economy is based on biological products and processes (www.unep.org). Biodiversity has allowed massive increases in the production of food and other natural materials, which in turn have fed the (uncontrolled) growth and development of human societies. Biodiversity is also the basis of innumerable environmental services that keep humans and the natural environment alive, from the provision of clean water and watershed services to the recycling of nutrients and pollination (ICMM, 2004).

Current pressures on and losses of biodiversity are unfortunately threatening to undermine the functionality of natural ecological processes and adaptive responses of the environment. The last few centuries have witnessed brutal increases in the rate at which biodiversity is being altered by humanity. With uncontrolled growth of human population, consumption needs have increased exponentially as well as the drive to extract more economically valuable resources at ever-faster rates. Natural habitats that harbour some of the world's most valuable biodiversity are being lost at increasingly faster and over progressively wider areas, while managed lands are undergoing increasing simplification. Implementing 'biodiversity friendly' practices remains challenging within the entire developmental sphere, especially for smaller companies and peripheral players. This is partly because governments, while perhaps committed on paper to biodiversity, have found it difficult to create the right incentives and apply the necessary regulations in a way that could encourage all players to conserve biodiversity (ICMM, 2004).

Humanity faces the challenge of supporting the needs of growing populations from a rapidly shrinking natural resource base. Achieving a balance while doing this will require a better understanding and recognition of conservation and development imperatives and this is only a step towards more strategic and integrated approach to land use planning and management that helps societies make better-informed decisions. Evidence illustrate how management tools, rehabilitation and restoration processes, together with improved scientific knowledge, can help conserve biodiversity; also highlighting that mutual benefits can result from stronger collaboration between the mining and conservation sectors. Good practice, collaboration and innovative thinking can advance biodiversity conservation worldwide while ensuring that the minerals and products that society needs are produced responsibly (ICMM, 2004).

In 1992, the Convention of Biological Diversity, a landmark convention, was ratified by more than 90% of all members of the United Nations. The enactment of the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004), together with the abovementioned treaty, focuses on the preservation of all biological diversity in its totality, including genetic

variability, natural populations, communities, ecosystems up to the scale of landscapes. Hence, the local and global focus changed to the sustainable utilisation of biological diversity.

4 BRIEF PROJECT OVERVIEW

Sekoko Coal (Pty) Ltd (Sekoko) is applying for a Mining Right on seven (7) farms in the Waterberg region of the Limpopo Province. Sekoko holds valid new order Prospecting Rights to these seven farms in the Waterberg totalling approximately 7,000ha, situated adjacent to the Exxaro Grootegeluk Colliery. The initial focus of activity will be the opencast and underground mining on Smitspan and the construction of mine-related infrastructure and wash plant on the far northern portions of Massenberg adjacent to Smitspan. The focus for all the environmental studies has therefore been on these two farms, including Minnasvlakte and Hooikraal. The current mining right application will be made to incorporate all seven farms.

Coal will initially be mined using opencast, roll-over method via truck and shovel and underground mining using board-and-pillar mining approaches, accessing underground seams via the opencast pits. All mining will be conducted by independent contractors. However, these activities will be managed by an in-house management team at Sekoko. The initial phase will be around 20 years, being extended to 45 years for the four farms and exceeding 60 years with the overall area.

As per the Minerals and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA), an Environmental Management Plan (EMP) for this area needs to be compiled and submitted to DMR for approval. This EMP report will include information on the baseline environment, any potential impacts which could arise from this project and related activities and the proposed mitigation measures to protect and/or manage these negative impacts.

5 THE BIOPHYSICAL ENVIRONMENT

5.1 Location

The Waterberg Coal Mine is situated approximately 34 km west of Lephalale (formerly known as Ellisras) in the Limpopo Province of South Africa. The mine is situated in the Lephalale Local Municipality, which falls under the jurisdiction of the Waterberg District Municipality. The following farms are included in the application:

- Smitspan 306LQ;
- Massenberg 305LQ;
- Minnasvlakte 258LQ;
- Hooikraal 315LQ;
- Olieboomfontein 220LQ;
- the northern section of Duikerfontein 263LQ; and
- the northern section of Swanepoelpan 262LQ.

The topographical locality of the respective farms is indicated in Figure 1.

5.2 Land Cover & Land Use of the Region

Land use often determines land cover; it is an important factor contributing to the condition of the land and this variety of land uses has varying effects on the integrity of the land (*pers. obs*.). Land cover categories of the general region are illustrated in Figure 2. For the purpose of this assessment, land cover are categorised into classes that represent natural habitat and land cover that originated from habitat degradation and transformation, mostly from anthropogenic activities. Areas that are characterised by high levels of transformation and habitat degradation are generally more suitable for development purposes as it is unlikely that biodiversity attributes of conservation importance will be present or affected by development. Conversely, areas that are characterised by extensive untransformed and pristine habitat are generally not regarded suitable options for development purposes.

The study area is situated in the Lephalale District Municipality, which comprises approximately 1,960,140ha of which approximately 94.4% is regarded untransformed. Land use in the region varies between game farming and cattle farming that utilises the natural savanna habitat. Extremely little arable agriculture is practiced, mainly because of relative low rainfall and poor soils that predominate in the region. However, evidence of old agricultural fields are visible in some parts of the farms. All of the farms are characterised by natural woodland habitat with little transformation.

Current and potential increase in development (and habitat transformation) results from mining, the construction of new power stations, the proposed Mafuta CTL Plant from SASOL and the resulting urban sprawl that is already evident. These activities place high and irreversible pressure on the natural environment of the region.

Figure 1: Regional setting of the study area (courtesy of Savanna)

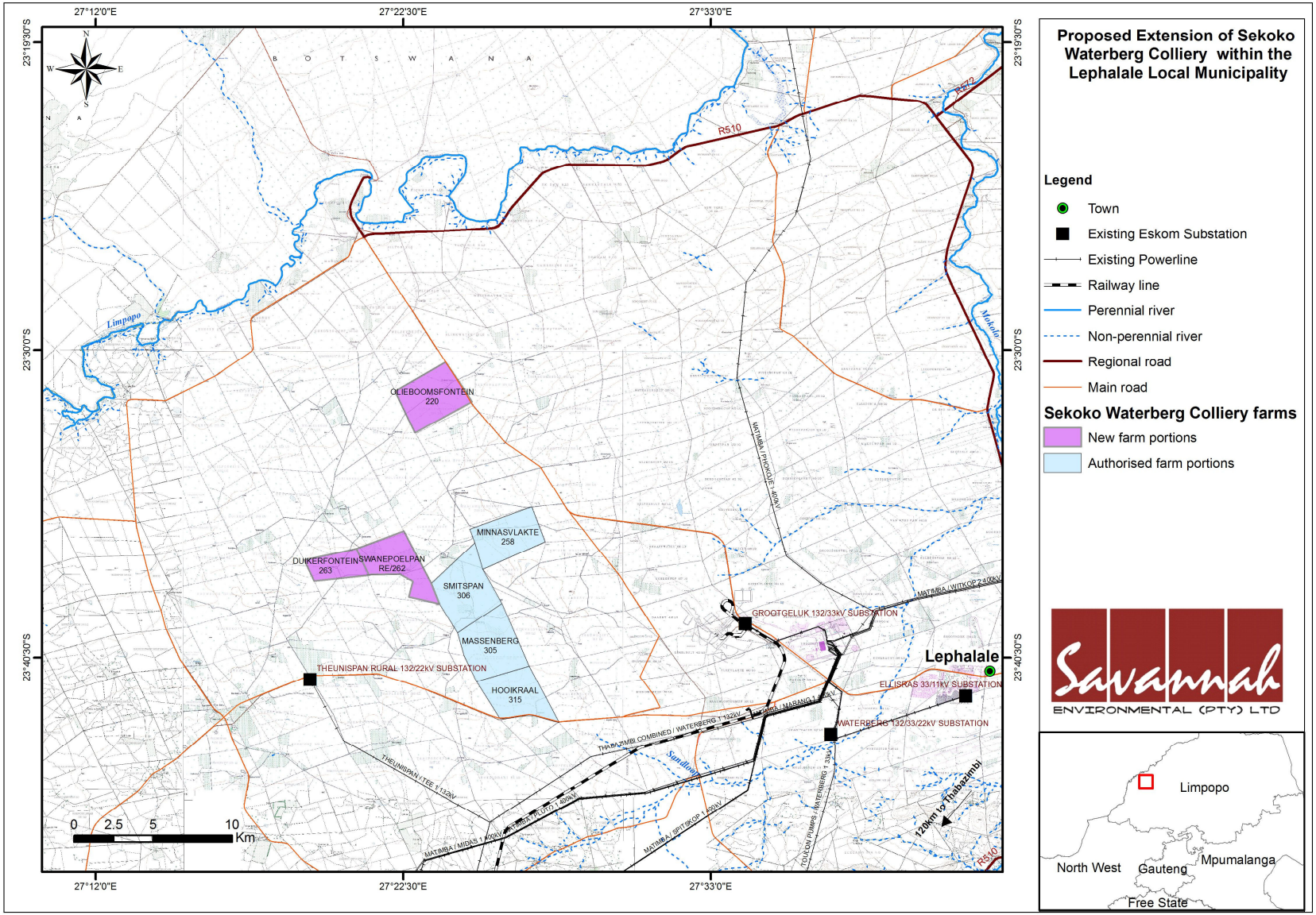
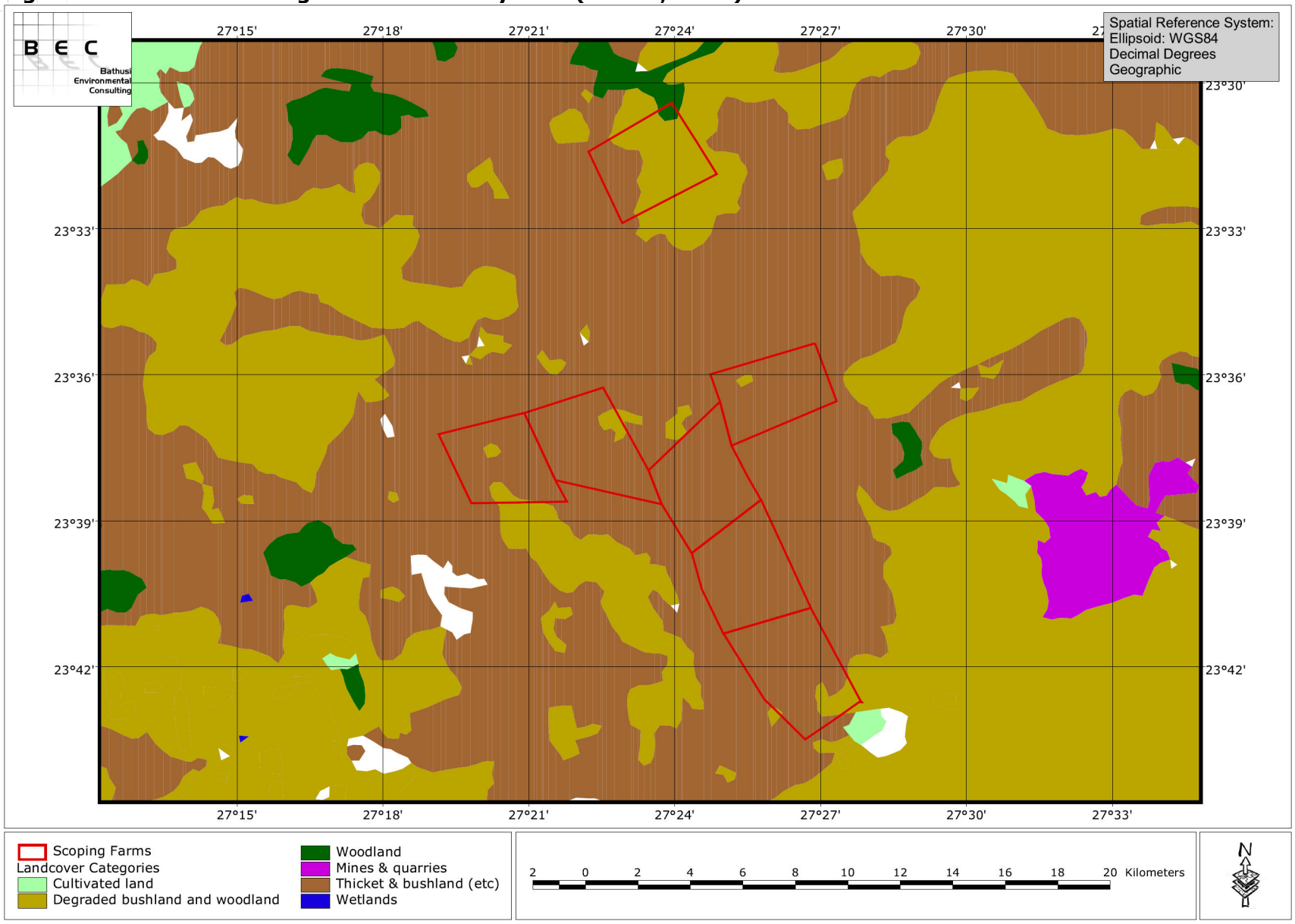


Figure 2: Land cover categories of the study area (ENPAT, 2001)



5.3 Surface Water

Water, salt and processes linked to concentration of both are the major controls of the creation, maintenance and development of peculiar habitats. Habitats formed in and around flowing and stagnant freshwater bodies, experiences waterlogging (seasonal or permanent) and flooding (regular, irregular or catastrophic), leading to formation of special soil forms. Habitats with high levels of salt concentration form a highly stressed environment for most plants and often markedly affect the composition of plant communities. Invariably, both waterlogged and salt-laden habitats appear as 'special', deviating strongly from the typical surrounding zonal vegetation. They are considered to be of azonal character (Mucina & Rutherford, 2006). Water, in conjunction with geology, soil, topography and climate, is responsible for the creation of remarkably many types of habitats. Water chemistry, temperature and temporary changes in both, together with the amount of water (depth of water column), timing of occurrence (regular tides or irregular floods) and speed of its movement (discharge, flow and stagnation) are the major factors shaping the ecology of biotic communities occupying such habitats (Mucina & Rutherford, 2006).

Areas of surface water contribute significantly towards the local and regional biodiversity through atypical habitat that is present within ecotonal areas. Ecotones (areas or zones of transition between different habitat types) are occupied by species occurring in both the bordering habitats, and are generally rich in species due to the confluence of habitats. In addition to daily visitors that utilise the water sources on a frequent basis, some flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas, exhibiting extremely low tolerance levels towards habitat variation. Ecotonal interface areas form narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering the high species richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds.

The study farms are situated in a water scare area. The rainy season is generally from November to March, with the peak rainfall measured in January. The average annual rainfall at Matimba Power Station is approximately 460mm. Rainfall is however slightly unreliable and rather severe drought conditions tend to occur about 12% annually. No large rivers or drainage lines are present in any of the farms and surface water is mostly restricted to temporary pans, which only contain water for short periods subsequent to raining events. However, a few small and ill-defined non-perennial drainage lines are present, but only flow for short periods after severe raining events. Because of the flat topography of the region, no significant drainage is evident and available water is more likely to disappear into the sandy soils that prevail in the region. The Limpopo River is the most significant river of the region and is situated approximately 10km towards the northwest of the farm Olieboomfontein.

5.4 Topography, Relief and Slopes

The presence of variable habitat types is important in terms of providing in habitat preferences and requirements of numerous fauna and flora taxa. Hills and ridges have generally been shown to be rich in biodiversity, also representing an important habitat type for sensitive species.

The study farms are situated in a topographically homogenous region, described by the ENPAT (2003) database as Plains. Slopes are flat; generally less than 2% in a northwestern direction, and altitude is approximately 900m above sea level.

5.5 Geology

The geology of the study area comprises the Karoo Shales. Shales in the Waterberg coalfields are situated in a fault trough. The basal part is composed of yellowish and reddish shale and reddish-brown mudstone that was apparently deposited in a valley in the pre-Karoo landscape. The middle part consists of white, cross-bedded, feldspathic grit and sandstone, with locally developed bands of conglomerate, and interbeds of shale sandstone, sandy and carbonaceous shale, with four seams of coal developed in the topmost portion. The upper part consists of dark grey to black, carbonaceous shale, in which some seven seams of coal and a few lighter-coloured interbeds of sandy shale are present (Geological Survey, 1989).

5.6 Land Types

Although it is not in the scope of this report to present a detailed description of the soil types of the area, a basic description will suffice for this assessment as the association of habitat types and land types (soils) are typical of grassland vegetation.

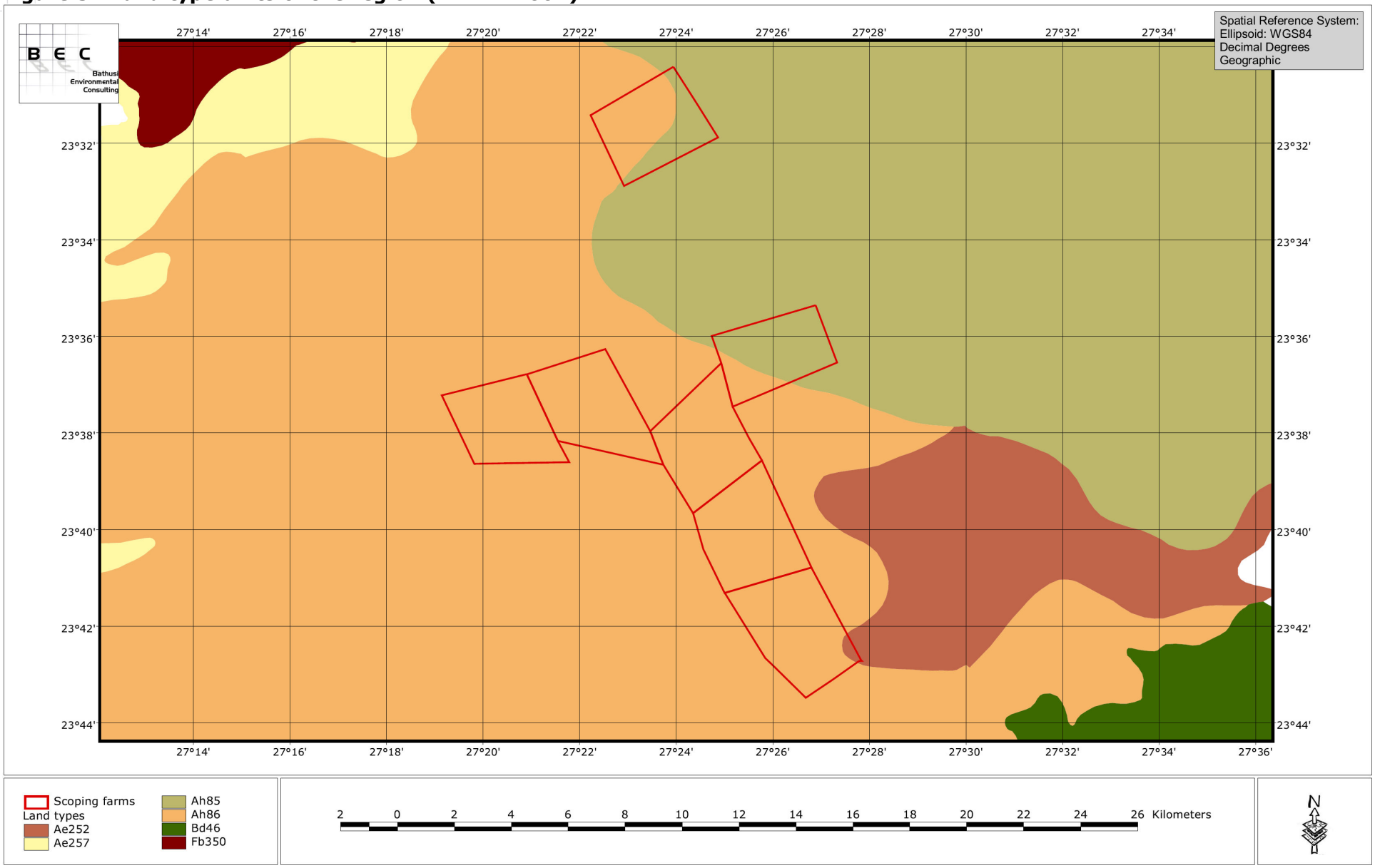
The study areas are situated within the Ah85 and Ah86 land type units (Figure 3) (Land Type Survey Staff, 1987).

Map units Aa to Ai refer to yellow and red soils without water tables and belonging in one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin and Clovelly. The map units refer to land that does not qualify as a plinthic catena and in which one or more of the above soil forms occupy at least 40% of the area. Ah (red and yellow soils, high base status) indicates land with red and yellow soils, each of which covers more than 10% of the area while dystrophic and/or mesotrophic soils occupy a larger area than high base status red-yellow apedal soils (Land Type Survey Staff, 1987).

5.7 Declared Areas of Conservation

No biosphere, conservancy or other declared area of conservation are present in the immediate surroundings of the study area. The closest area of conservation is the D'Njala Nature Reserve, situated approximately 30km to the east.

Figure 3: Land type units of the region (ENPAT 2001)



6 BOTANICAL ASSESSMENT

6.1 Regional Floristic Traits

Vegetation of the region is defined by Mucina and Rutherford (2006) as the Limpopo Sweet Bushveld. This vegetation type extends from the lower reaches of the Crocodile and Marico Rivers down into the Limpopo River valley. It comprehends short, open woodland dominated by *Acacia mellifera* and *Dichrostachys cinerea* as well as taller tree species such as *A. robusta*, *A. burkei* and *Terminalia sericea*. The high palatability of the graminoid stratum makes this vegetation type highly suitable for game and cattle farming land uses.

This vegetation type is not threatened (Least Threatened) and although only 1% is formally conserved, much is contained within private nature reserves and game farms. Approximately 5% is transformed by cultivation. Though limited by low rainfall, this is a good area for game and cattle farming due to the relatively high grazing capacity of sweet veld, but overgrazing frequently occurs. The Central Bushveld endemic herb *Piaranthus atrosanguinalis* occurs in this vegetation type. Important taxa include the following.

- **Trees**

Acacia robusta, A. burkei, Acacia erubescens, A. fleckii, A. nilotica, A. senegal var. *rostrata, Albizia anthelmintica, Boscia albitrunca, Combretum apiculatum* and *Terminalia sericea.*

- **Tall Shrubs**

Catophractes alexandri, Dichrostachys cinerea, Phaeoptilum spinosum, Rhigozum obovatum, Cadaba aphylla, Combretum hereroense, Commiphora pyracanthoides, Ehretia rigida subsp. *rigida, Euclea undulata, Grewia flava* and *Gymnosporia senegalensis.*

- **Low Shrubs**

Acacia tenuispina, Commiphora africana, Felicia muricata, Gossypium herbaceum subsp. *africanum* and *Leucosphaera bainesii.*

- **Graminoids**

Digitaria eriantha subsp. *eriantha, Enneapogon cenchroides, Eragrostis lehmanniana, Panicum coloratum, Schmidtia pappophoroides, Aristida congesta, Cymbopogon nardus, Eragrostis pallens, E. rigidior, E. trichophora, Ischaemum afrum, Panicum maximum, Setaria verticillata, Stipagrostis uniplumis* and *Urochloa mosambicensis.*

- **Herbs**

Acanthosicyos naudinianus, Commelina benghalensis, Harpagophytum procumbens subsp. *transvaalense, Hemizygia elliottii, Hermbstaedtia odorata, Indigofera daleoides, Kleinia fulgens* and *Plectranthus neochilus.*

6.2 Regional Phytodiversity

Information obtained from the SANBI database (POSA, 2012) indicates the known presence of only 38 plant species within the ¼-degree grid that is spatially represented in the study area (2327CB). The lack of floristic knowledge of the region is emphasised by the paucity of data records for this area. An estimation of approximately 90 species per farm is considered reasonable, based on results of recent surveys in the general region.

6.2.1 Flora species of Conservation Importance of the Region

South Africa's Red List system is based on the IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001), amended to include additional categories to indicate species that are of local conservation concern. The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). No such species is known to occur in the ¼-degree grids in which the study areas are located.

- A species is Threatened when it is included in one of the Critically Endangered (Possibly Extinct), Critically Endangered, Endangered or Vulnerable categories

A total of 194 Red Data (Threatened) plant taxa are known to occur in Limpopo Province. Data records indicate only one plant species of conservation importance occurring in the region. However, considering the poor floristic knowledge of the region, it is reasonable to assume that other plant taxa of conservation importance will be present.

Table 2: Plant species of conservation value within the region of the study area

Binomial Name	***Family***	***Status***
Corchorus psammophilus	Malvaceae	Threatened

The following species provincially protected species were also observed during the brief site investigations, or are known to occur in the region (Table 4).

Table 3: Plant species of conservation value within the region of the study area

Binomial Name	***Family***	***Status***
Acacia erioloba	Fabaceae	Declining, Protected tree
Adansonia digitata	Bombaceae	Protected tree
Adenium oleifolium	Apocynaceae	Protected species
Aloe littoralis	Asphodelaceae	Protected species
Ammocharis coranica	Amaryllidaceae	Protected species
Boscia albitrunca	Capparaceae	Protected tree
Combretum imberbe	Combretaceae	Protected tree
Securidaca longipedunculata	Polygalaceae	Protected tree
Sclerocarya birrea subsp. *africana*	Anacardiaceae	Protected tree
Spirostachys africana	Euphorbiaceae	Protected tree

The presence of a community of Manketti tree to the east of the study areas is known. Based on international distribution data, this species is currently not afforded a national or provincial conservation status. However, because of a high scarcity factor within South Africa (confined to

only a small area in the Lephalale region), this species is regarded highly for the purpose of this (and subsequent) investigations. This species is regarded more important than other protected trees that occur widespread in the region and preference ratings for respective sites will take cognisance of the presence/ absence of this species.

Local umbrella species[1] are considered during this stage of the process in order to identify areas of concern that should be targeted for protection during subsequent processes and developments.

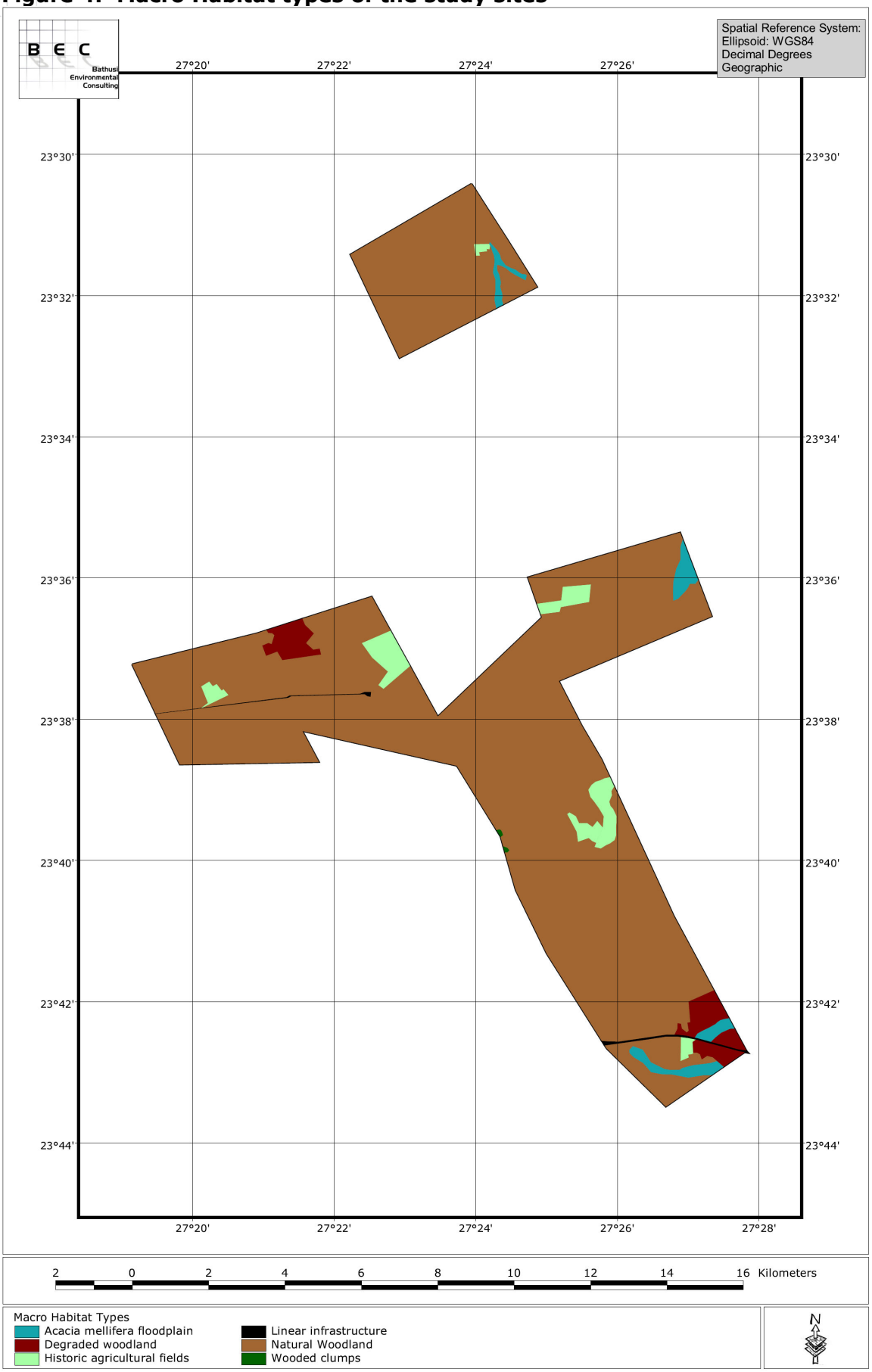
6.3 Macro Habitat types & Discussion

The following (visually apparent) macro-habitat types were recorded in the study areas:

- *Acacia mellifera* floodplains & small drainage lines – situated in lowland areas, typified by slightly clayey soils, a predominance of *Acacia mellifera* as a result of severe utilisation and species specific exclusion. These areas are temporarily inundated subsequent to raining events. Protected trees, including *Boscia, Combretum,* etc., occur frequently in this habitat type;
- Degraded woodland – historic cultivated lands that have reverted through natural succession, dominated by *Acacia* and *Dichrostachys* species. Typically low phytodiversity and habitat variation, embedded occurrences within the natural woodland;
- Historic agricultural fields – recent disturbances of the woodland vegetation, typically dominated by grass sward with woody component absent or as low shrubs, comprising *Acacia* and *Dichrostachys* species;
- Linear infrastructure – roads, railways, etc.;
- Natural woodland – dominant habitat type of the region, exhibiting low habitat variances and subtle changes that result mostly from substrate variations. Various protected tree species persist, *Sclerocarya birrea* and *Acacia erioloba* becomes dominant in some localities. This woodland type is representative of the regional Limpopo Sweet Bushveld ecological type. Extremely low fragmentation and isolation factors noted on a local and regional scale; a medium high sensitivity is ascribed to these parts.; and
- Wooded clumps – localised areas of dense wooded stands were recorded. These areas are typically situated near drainage areas and are frequently dominated by *Spirostachys africana*.

[1] Species that are selected for making conservation related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat.

Figure 4: Macro Habitat types of the study sites



6.4 Floristic Sensitivity

The floristic sensitivity of the natural woodland habitat of the region is regarded medium-high. This is in spite of a Least Threatened conservation status that is ascribed to the regional vegetation (Limpopo Sweet Bushveld). The known presence of several protected tree species, the likely presence of plants of conservation importance, as well as the untransformed nature of the region as a whole, renders the sensitivity to the proposed project relative high. Extremely limited areas of transformation are present within the various study sites and land use is consistent with high biodiversity levels and biodiversity conservation efforts on a regional scale.

Habitat sensitivities are categorised as follows:

Low No natural habitat remaining; this category is usually represented by developed areas, nodal and linear infrastructure, areas of agriculture or cultivation, areas where exotic species dominate exclusively, mining land (particularly surface mining), etc. The possibility of these areas reverting to a natural state is regarded impossible, even with the application of detailed and expensive rehabilitation activities. Similarly, the likelihood of plant species of conservation importance occurring in these areas is regarded negligent.

Medium – low All areas where the natural habitat has been degraded, with the important distinction that the vegetation has not been decimated and a measure of the original vegetation remain, albeit dominated by secondary climax species. The likelihood of plant species of conservation importance occurring in these areas is regarded low. These areas also occur as highly fragmented and isolated patches, typical to cultivated fields, areas that have been subjected to clearing activities and areas subjected to severe grazing pressure. The species composition of these areas is typically low and is frequently dominated by a low number of species, or invasive plants.

Medium: Indigenous natural habitat that comprehend habitat with a high diversity, but characterised by moderate to high levels of degradation, fragmentation and habitat isolation. Also include areas where flora species of conservation importance could potentially occur, but habitat is regarded marginal;

Medium – high Indigenous natural vegetation that comprehend a combination of the following attributes:

- The presence of habitat that is suitable for the presence of these species;
- Areas that are characterised by a high/ moderate-high intrinsic floristic diversity;
- Areas characterised by moderate to low levels of habitat fragmentation and isolation;
- Regional vegetation types that are included in the lower conservation categories, particularly prime examples of these vegetation types;
- Low to moderate levels of habitat transformation;
- A moderate to high ability to respond to disturbance factors;

It may also include areas that are classified as protected habitat, but that are of a moderate status; and

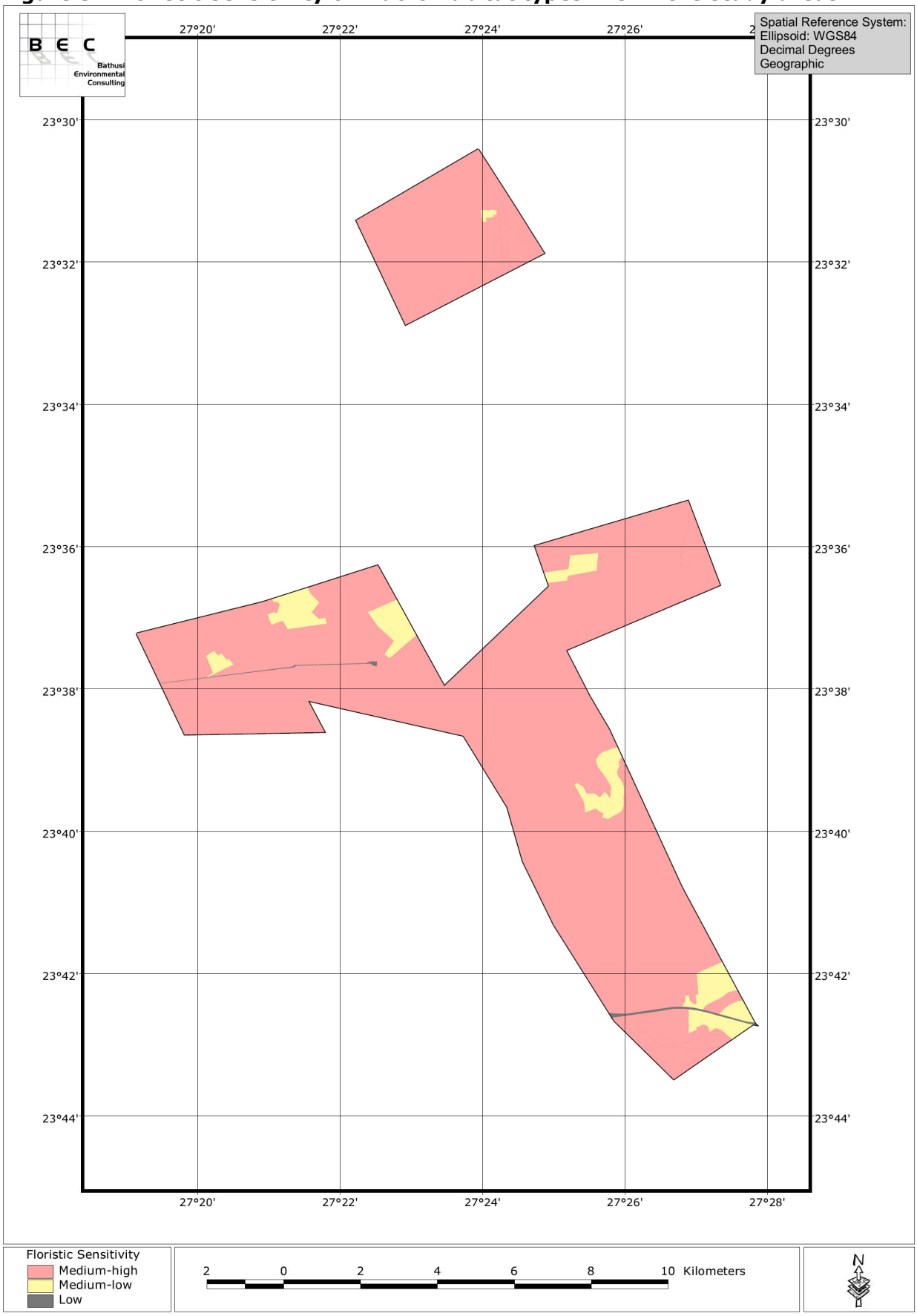
High Indigenous natural vegetation that comprehend for a combination of the following attributes:

- The presence of plant species of conservation importance, particularly threatened categories (Critically Endangered, Endangered, Vulnerable);
- Areas where 'threatened' plants are known to occur, or habitat that is highly suitable for the presence of these species;
- Regional vegetation types that are included in the 'threatened' categories (Critically Endangered, Endangered, Vulnerable), particularly prime examples of these vegetation types;
- Habitat types are protected by national or provincial legislation (Lake Areas Act, National Forest Act, draft Ecosystem List of NEM: BA, Mountain Catchment Areas Act, Ridges Development Guideline, Integrated Coastal Zone Management Act, etc.);
- Areas that have an intrinsic high floristic diversity (species richness, unique ecosystems), with particular reference to Centres of Endemism;

These areas are also characterised by low transformation and habitat isolation levels and contribute significantly on a local and regional scale in the ecological functionality of nearby and dependent ecosystems, with particular reference to catchment areas, pollination and migration corridors, genetic resources. A major reason for the high conservation status of these areas is the low ability to respond to disturbances (low plasticity and elasticity characteristics).

Table 4: Botanical sensitivity estimations for the respective habitat types								
Criteria	**RD species**	**Landscape sensitivity**	**Status**	**Species diversity**	**Functionality/ fragmentation**	**TOTAL**	**SENSITIVITY INDEX**	**SENSITIVITY CLASS**
Community	**Criteria Ranking**							
Acacia mellifera floodplains	8	9	6	4	10	238	74%	**medium-high**
Degraded Woodland	4	4	4	3	5	126	39%	**medium-low**
Historic agricultural fields	3	3	3	4	4	104	33%	**medium-low**
Linear infrastructure	2	1	2	2	1	53	17%	**low**
Natural woodland	8	6	8	8	10	246	77%	**medium-high**
Wooded clumps	8	8	7	6	10	246	77%	**medium-high**

Figure 5: Floristic sensitivity of macro habitat types within the study areas



6.5 Discussion

Existing transformation of natural habitat within the proposed site alternatives is mostly confined to roads and associated infrastructure, while degradation is noted in the presence of old agricultural fields. Some of these historic lands have reverted to 'degraded woodland' through successional seres; currently exhibiting a secondary climax status with moderately dense *Acacia tortilis* and *Dichrostachys cinerea* thickets. Natural woodland/ savanna vegetation of the study area and the surrounds is regarded representative of the regional vegetation types, exhibiting little divergence from the species composition, diversity and vegetation structure described by Mucina and Rutherford (Vegmap, 2006). The status of the vegetation within the study sites is therefore regarded as primary climax woodland.

The vegetation comprehends homogenous woodland with imbedded variations that are typified by subtle disparities in the dominance of trees and shrubs. Previous studies done in the region also reflected the homogenous nature of the vegetation, with the only **significant** (visible, artificial) variation noted from historically cultivated fields. However, visual observations revealed that the woodland does vary on a local and regional scale, but these variations are not immediately discernible on aerial imagery and is likely to be driven by localised variations in soil characteristics. Observed soil qualities include red vs. yellow-brown soils and variations in the clay content of the A-horizon. The sandy plains are typically deciduous broadleaved woodland with locally dominant stands of *Terminalia sericea, Burkea africana, Acacia erioloba, Ochna pulchra, Combretum apiculatum* and *C. zeyheri* that result from interspecific competition. Associated with the observed disparity in the tree layer are slight variations in the composition and abundance of the shrub and grass sward, which is most likely to be a reflection of varying soil characteristics, utilisation intensity and management strategies.

Various protected tree species were recorded in the savanna habitat, including *Acacia erioloba, Boscia albitrunca* and *Securidaca longipedunculata.* These species occur at relative high densities across the region. Lower densities of *Combretum imberbe, Spirostachys africana* and *Sclerocarya birrea* were observed.

The use of fire is not a preferred or often-employed management utility in the region, mainly because of the nutrient poor soils and slow recovery rate of the vegetation subsequent to fire. This management principle of prolonged fire exclusion, coupled with high stocking rates, resulted in (localised) severe encroachment of the shrub layer and the depletion of the grass sward. It also creates conditions that are suited to intensive runaway fire conditions because of high fuel loads during periods of extreme drought. One area (farm Olieboomfontein) was affected by a recent fire, with resultant damage to the vegetation that was moderately severe; many of the larger trees succumbed in the resultant hot blaze. This was unlikely to be the case with lower fuel loads.

The only significant physiognomic (natural) variation to the natural woodland is the floodplains and associated hydromorphic variations of *Acacia mellifera* that result from competitive exclusion. Soils in these parts tend to be relative high in clay content, rendering the moisture

retaining characteristics more efficient than the surrounding sandy plains. Vegetation, particularly the grass sward that typifies these areas, is 'sweet' and palatable. Naturally, the grazing of the grass sward is intense, particularly during the winter period. These areas are therefore characterised by bare soils in-between dense stands of *A. mellifera.* Protected trees that were observed within this habitat type include *Boscia albitrunca, Combretum imberbe* and *Spirostachys africana.*

Alluvial plains are generally not regarded sensitive because of the absence of unique and scarce floristic characteristics and the condition and status of these parts are more likely to be described as slightly deteriorated due to the high utilisation levels that renders the species diversity relative low. The ecological contribution of these variations in terms of local and regional habitat diversity and ecosystem services are however regarded important. Atypical habitat provides in the habitat requirements of numerous faunal taxa that are not available in the surrounding terrestrial woodland habitat types, rendering the faunal component of these areas relative unique on a local and regional scale.

It is important to note that these *Acacia mellifera* floodplains have resulted from hydromorphic conditions, but the deteriorated condition is ascribed to long-term management strategies and the implementation of fences that caused secondary seres to develop. Historically these areas would have exhibited species composition and abundances characteristics different from the current. Fences effectively halted natural migration patterns of animals towards the larger rivers during dry (winter) periods, which normally afforded these parts protection and recovery time between periods of high grazing intensity of the summer periods. The implementation of fences currently results in year-round grazing and browsing, effectively depleting the herbaceous layer for long periods of the year. It is however important to note that this variation is not present as isolated habitat; a high connectivity is noted on a local and regional scale. It is therefore reasonable to accept that the functionality of this habitat type is optimal under current conditions.

7 FAUNAL ASSESSMENT

7.1 Regional Faunal Diversity

It is important to view the study area on an ecologically relevant scale; consequently, all sensitive animal species (specific faunal groups) known from the Limpopo Province are included in this assessment (except for the avifauna which focuses on the ¼-degree grid in which the study areas are situated). Data on all faunal groups are lacking (notably for most of the invertebrate groups), as a result, only data sets on specific faunal groups allow for habitat sensitivity analyses based on the presence/absence of sensitive faunal species (Red Data species) and their specific habitat requirements. At present, the following faunal groups are included in these analyses:

- Butterflies (Invertebrata: Insecta: Lepidoptera – Nymphalidae, Lycaenidae, Hesperiidae, Pieridae andPapilionidae). References used include the IUCN Red List (2011) – http://www.iucnredlist.organd the South African Butterfly Conservation Assessment (SABCA, 2011) – http://sabca.adu.org.za;
- Frogs (Amphibia: Anura). References used include the Atlas and Red Data Book of the South Africa, Lesotho and Swaziland, the Giant Bullfrog Conservation Group (2011) – http://www.up.ac.za/bullfrog and a Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- Reptiles (Reptilia: Testudines and Squamata). References used include the IUCN Red List (2011) and the South African Reptile Conservation Assessment (SARCA, 2011) – http://sarca.adu.org.za;
- Birds: All bird groups (Roberts VII Multimedia: Birds of Southern Africa, PC Edition); and
- Terrestrial Mammals (Mammalia: Insectivora, Chiroptera, Primates, Lagomorpha, Pholidota, Rodentia, Carnivora, Tubulidentata, Proboscidea, Hyracoidea, Perissodactyla and Artiodactyla). References used include the Red Data Book of the Mammals of South Africa: A Conservation Assessment (Endangered Wildlife Trust - 2004).

As more data become available, additional faunal groups are likely to be added to these assessments. Dragonflies and Damselflies (Invertebrata: Insecta: Odonata) are some examples of future inclusions.

7.2 Red Data Fauna Assessment

In order to assess the probability of occurrence (PoC) of Red Data species not recorded in the study area during the field assessment, the following criteria were employed:

- the size of the study area;
- the location and connectivity of the study area with regards to other natural faunal habitats; and,
- the presence / absence, status and diversity of natural faunal habitats within the study area.

These criteria were used in conjunction with existing distribution records of Red Data species as well as their known habitat requirements to estimate their likelihood of occurring in the study area.

A total of 125 Red Data species from five categories (IUCN) are known to occur in the Limpopo Province (Invertebrates, Reptiles, Frogs and Mammals) and the ¼-degree grids 2327CB and 2327DA (birds), included in the following conservation categories:

- 27 species are listed as Data Deficient (DD);
- 43 species are listed as Near Threatened (NT);
- 40 species are listed as Vulnerable (VU);
- 8 species are listed as Endangered (EN);
- 4 species are listed as Critically Endangered (CR); and
- 1 species is classified as Extinct (EX).

Estimations for the PoC for Red Data fauna taxa for the study area yielded the following results (Table 7):

- 80 species have a low PoC;
- 7 species have a moderate-low PoC;
- 11 species have a moderate PoC;
- 6 species have a moderate-high PoC; and
- 4 species have a high PoC.

Eighteen Red Data species have been recorded (refer Table 4, confirmed species indicated in **bold**), or are known to occur, in the study area. It must however be noted that some species were reintroduced to the area as game farming stock (i.e. they are not considered free roaming on the farms investigated).

Table 5: Red Data fauna assessment for the study area (PoC)

Species Details			***Probability Assessment***
Binomial Name	***Colloquial Name***	***RD Status***	
Butterflies			
Alaena margaritacea	Wolkberg Zulu	Critically Rare	low
Aloeides stevensoni	Stevenson's Copper	Vulnerable	low
Charaxes guderiana guderiana	Blue-spangled Charaxes	Vulnerable	low
Dingana clara	Clara's Widow	Vulnerable	low
Erikssonia edgei	Eriksson's Copper	Critically Rare	low
Lepidochrysops lotana	Lotana Blue	Critically Rare	low
Metisella meninx	Marsh Sylph	Vulnerable	low
Pseudonympha swanepoeli	Swanepoel's Brown	Critically Rare	low
Frogs			
Breviceps sylvestris	Northern Forest Rain Frog	Vulnerable	low
Pyxicephalus adspersus	**Giant Bullfrog**	**Near Threatened**	**confirmed**
Reptiles			
Acontias kgalagadi subtaeniatus	Stripe-bellied Blind Legless Skink	Data Deficient	moderate-low
Acontias richardi	Richard's Blind Legless Skink	Near Threatened	low

Table 5: Red Data fauna assessment for the study area (PoC)

Species Details			***Probability Assessment***
Binomial Name	***Colloquial Name***	***RD Status***	
Acontias rieppeli	Woodbush Legless Skink	Endangered	low
Afroedura multiporis multiporis	Woodbush Flat Gecko	Vulnerable	low
Australolacerta rupicola	Soutpansberg Rock Lizard	Near Threatened	low
Chamaesaura aenea	Coppery Grass Lizard	Near Threatened	low
Chamaesaura macrolepis	Large-scaled Grass Lizard	Near Threatened	low
Chirindia langi occidentalis	Soutpansberg Worm Lizard	Vulnerable	low
Crocodylus niloticus	Nile Crocodile	Vulnerable	moderate
Homopholis mulleri	Muller's Velvet Gecko	Vulnerable	low
Homoroselaps dorsalis	Striped Harlequin Snake	Near Threatened	low
Kininyx natalensis	Natal Hinged Tortoise	Near Threatened	low
Lamprophis fuscus	Yellow-bellied House Snake	Near Threatened	low
Lygodactylus graniticolus	Granite Dwarf Gecko	Near Threatened	low
Lygodactylus methueni	Methuen's Dwarf Gecko	Vulnerable	low
Lygodactylus nigropunctatus incognitus	Cryptic Dwarf Gecko	Data Deficient	low
Lygodactylus nigropunctatus montiscaeruli	Makgabeng Dwarf Gecko	Data Deficient	low
Lygodactylus ocellatus soutpansbergensis	Soutpansberg Dwarf Gecko	Near Threatened	low
Platysaurus monotropis	Orange-throated Flat Lizard	Endangered	low
Platysaurus relictus	Soutpansberg Flat Lizard	Near Threatened	low
Pseudocordylus transvaalensis	Northern Crag Lizard	Near Threatened	low
Scelotes limpopoensis albiventris	White-bellied Dwarf Burrowing Skink	Near Threatened	low
Tetradactylus breyeri	Breyer's Long-tailed Seps	Vulnerable	low
Tetradactylus eastwoodae	Eastwood's Long-tailed Seps	Extinct	low
Xenocalamus transvaalensis	Speckled Quill-snouted Snake	Data Deficient	low
Birds			
Phoenicopterus roseus	Greater Flamingo	Near Threatened	low
Phoenicopterus minor	Lesser Flamingo	Near Threatened	low
Mycteria ibis	Yellow-billed Stork	Near Threatened	moderate
Ciconia nigra	**Black Stork**	**Near Threatened**	**moderate-low**
Ephippiorhynchus senegalensis	Saddle-billed Stork	Endangered	low
Leptoptilos crumeniferus	Marabou Stork	Near Threatened	moderate
Gorsachius leuconotus	White-backed Night Heron	Vulnerable	low
Pelecanus rufescens	Pink-backed Pelican	Vulnerable	low
Sagittarius serpentarius	**Secretarybird**	**Near Threatened**	**high**
Gyps africanus	**White-backed Vulture**	**Vulnerable**	**confirmed**
Gyps coprotheres	Cape Vulture	Vulnerable	moderate
Trigonoceps occipitalis	White-headed Vulture	Vulnerable	confirmed
Torgos tracheliotus	Lappet-faced Vulture	Vulnerable	confirmed
Terathopius ecaudatus	Bateleur	Vulnerable	confirmed
Circus macrourus	Pallid Harrier	Near Threatened	moderate-low
Aquila rapax	**Tawny Eagle**	**Vulnerable**	**high**
Hieraaetus ayresii	Ayres's Hawk-Eagle	Near Threatened	low
Polemaetus bellicosus	**Martial Eagle**	**Vulnerable**	**confirmed**
Falco naumanni	**Lesser Kestrel**	**Vulnerable**	**moderate**
Falco biarmicus	**Lanner Falcon**	**Near Threatened**	**high**
Ardeotis kori	**Kori Bustard**	**Vulnerable**	**confirmed**
Podica senegalensis	African Finfoot	Vulnerable	low
Vanellus albiceps	White-crowned Lapwing	Near Threatened	moderate-low
Rostratula benghalensis	Greater Painted-snipe	Near Threatened	moderate-low
Glareola nordmanni	Black-winged Pratincole	Near Threatened	moderate
Alcedo semitorquata	Half-collared Kingfisher	Near Threatened	low
Bucorvus leadbeateri	Southern Ground-Hornbill	Vulnerable	moderate

Table 5: Red Data fauna assessment for the study area (PoC)

Species Details			***Probability Assessment***
Binomial Name	***Colloquial Name***	***RD Status***	
Buphagus erythrorhynchus	**Red-billed Oxpecker**	**Near Threatened**	**high**
	Mammals		
Amblysomus hottentotus	Hottentot's Golden Mole	Data Deficient	low
Calcochloris obtusirostris	Yellow Golden Mole	Vulnerable	low
Neamblysomus gunningi	Gunning's Golden Mole	Endangered	low
Neamblysomus juliane	Juliana's Golden Mole	Vulnerable	low
Atelerix frontalis	South African Hedgehog	Near Threatened	moderate
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	Data Deficient	moderate
Elephantulus intufi	**Bushveld Elephant-shrew**	**Data Deficient**	**moderate-**
Petrodromus tetradactylus	Four-toed Elephant-shrew	Endangered	low
Myosorex cafer	Dark-footed Forest Shrew	Data Deficient	low
Myosorex varius	Forest Shrew	Data Deficient	low
Crocidura cyanea	Reddish-grey Musk Shrew	Data Deficient	moderate-high
Crocidura fuscomurina	Tiny Musk Shrew	Data Deficient	low
Crocidura hirta	Lesser Red Musk Shrew	Data Deficient	moderate
Crocidura maquassiensis	Maquassie Musk Shrew	Vulnerable	low
Crocidura mariquensis	Swamp Musk Shrew	Data Deficient	low
Crocidura silacea	Lesser Grey-brown Musk Shrew	Data Deficient	low
Suncus infinitesimus	Least Dwarf Shrew	Data Deficient	low
Suncus lixus	Greater Dwarf Shrew	Data Deficient	low
Suncus varilla	Lesser Dwarf Shrew	Data Deficient	low
Cloeotis percivali	Percival's Short-eared Trident Bat	Vulnerable	moderate
Hipposideros gigas	Giant Leaf-nosed Bat	Near Threatened	moderate-low
Rhinolophus blasii	Blasius's Horseshoe Bat	Near Threatened	moderate
Rhinolophus swinnyi	Swinny's Horseshoe Bat	Near Threatened	low
Nycteris woodi	Wood's Slit-faced Bat	Near Threatened	low
Miniopterus natalensis	Natal Long-fingered Bat	Near Threatened	moderate-high
Neoromicia melckorum	Kruger Serotine	Data Deficient	low
Cercopithecus mitis	Samango Monkey	Vulnerable	low
Cercopithecus mitis erythrarchus	Samango Monkey	Vulnerable	low
Cercopithecus mitis labiatus	Samango Monkey	Endangered	low
Manis temminckii	**Pangolin**	**Vulnerable**	**confirmed**
Graphiurus platyops	Rock Dormouse	Data Deficient	low
Cricetomys gambianus	Giant Rat	Vulnerable	low
Dendromus nyikae	Nyika Climbing Mouse	Near Threatened	low
Tatera leucogaster	**Bushveld Gerbil**	**Data Deficient**	**high**
Lemniscomys rosalia	Single-striped Mouse	Data Deficient	moderate-high
Dasymys incomtus	Water Rat	Near Threatened	low
Mus neavei	Thomas' Pygmy Mouse	Data Deficient	low
Grammomys cometes	Mozambique Woodland Mouse	Data Deficient	low
Grammomys dolichurus	Woodland Mouse	Data Deficient	low
Panthera pardus	Leopard	Near Threatened	confirmed
Panthera leo	Lion	Vulnerable	low
Leptailurus serval	Serval	Near Threatened	moderate
Acinonyx jubatus	**Cheetah**	**Vulnerable**	**confirmed**
Felis nigripes	Black-footed Cat	Vulnerable	low
Crocuta crocuta	Spotted Hyaena	Near Threatened	low
Parahyaena brunnea	**Brown Hyaena**	**Near Threatened**	**confirmed**
Paracynictis selousi	Selous' Mongoose	Data Deficient	low
Rhynchogale melleri	Meller's Mongoose	Data Deficient	low
Canis adustus	Side-striped Jackal	Near Threatened	low

Table 5: Red Data fauna assessment for the study area (PoC)			
Species Details			***Probability Assessment***
Binomial Name	***Colloquial Name***	***RD Status***	
Lycaon pictus	African Wild Dog	Endangered	low
Mellivora capensis	**Honey Badger**	**Near Threatened**	**confirmed**
Poecilogale albinucha	African Striped Weasel	Data Deficient	moderate
Lutra maculicollis	Spotted-necked Otter	Near Threatened	low
Loxodonta africana	African Savanna Elephant	Vulnerable	low
Diceros bicornis	Black Rhinoceros	Critically Rare	low
Ceratotherium simum	White Rhinoceros	Near Threatened	low
Hippopotamus amphibius	Common Hippopotamus	Vulnerable	low
Neotragus livingstonianus	Livingstone's Suni	Vulnerable	low
Raphicerus sharpei	Sharp's Grysbok	Near Threatened	low
Hippotragus equinus	Roan Antelope	Vulnerable	low
Hippotragus niger	**Southern Sable Antelope**	**Vulnerable**	**confirmed**
Damaliscus lunatus	**Western Tsessebe**	**Endangered**	**confirmed**

7.3 Protected Faunal Taxa

The Limpopo Province includes six provincially listed protected species (www.speciesstatus.sanbi.org – NEMBA status, refer Table 8).

Table 6: Protected faunal taxa of the Limpopo Province (PoC)			
Species Details			***Probability Assessment***
Binomial Name	***Colloquial Name***	***NEMBA status***	
Aonyx capensis	African Clawless Otter	Protected	low
Atelerix frontalis	South African Hedgehog	Protected	moderate
Bucorvus leadbeateri	Southern Ground-Hornbill	Protected	moderate
Ceratotherium simum	White Rhinoceros	Protected	low
Circus ranivorus	African Marsh Harrier	Protected	low
Connachaetus gnou	Black Wildebeest	Protected	low

It is estimated that four of the six species listed in Table 7 are unlikely to occur in the study area. Two species are considered at least moderately likely to occur in the study area. Importantly, protected baboon spiders have recently been confirmed for the surrounding area. At least four protected baboon spider species are known from the Limpopo Province (Araneae: Theraphosidae), including the following:

- *Ceratogyrus bechuanicus* (Starbust Horned Baboon Spider);
- *Ceratogyrus brachycephalus* (Rhino-horned Baboon Spider);
- *Ceratogyrus darlingi* (horned baboon spiders); and
- ***Augacephalus junodi* (*Pterinochilus junodi*) (golden baboon spiders), confirmed during the scoping investigation, farm Massenberg.**

7.4 Faunal Habitat Sensitivity

For the purposes of the proposed project, six faunal habitats were identified during the scoping site visit; these correspond with the six macro habitat types identified in the floristic assessment. Respective faunal habitat types were assessed in terms of sensitivity pertaining to the anticipated impacts associated with the proposed opencast coal-mining project. Faunal sensitivity estimations employed various ecological and biodiversity characteristics in order to present a comparison of the six habitats in terms of relative faunal and biodiversity sensitivity. Cognisance was taken of the following characteristics:

- Habitat status: degree to which the faunal habitats of the study area has been transformed or degraded;
- Habitat diversity: relative diversity of natural faunal habitats within each alternative presented;
- Habitat linkage: relative level of linkage between the natural faunal habitats of the alternatives and the surrounding habitats of the region;
- Red Data habitat: the relative presence of red data habitat within the study areas that are likely to host red data animals species known from the region and
- General faunal sensitivity: relative overall faunal sensitivity relating to biodiversity and ecological integrity.

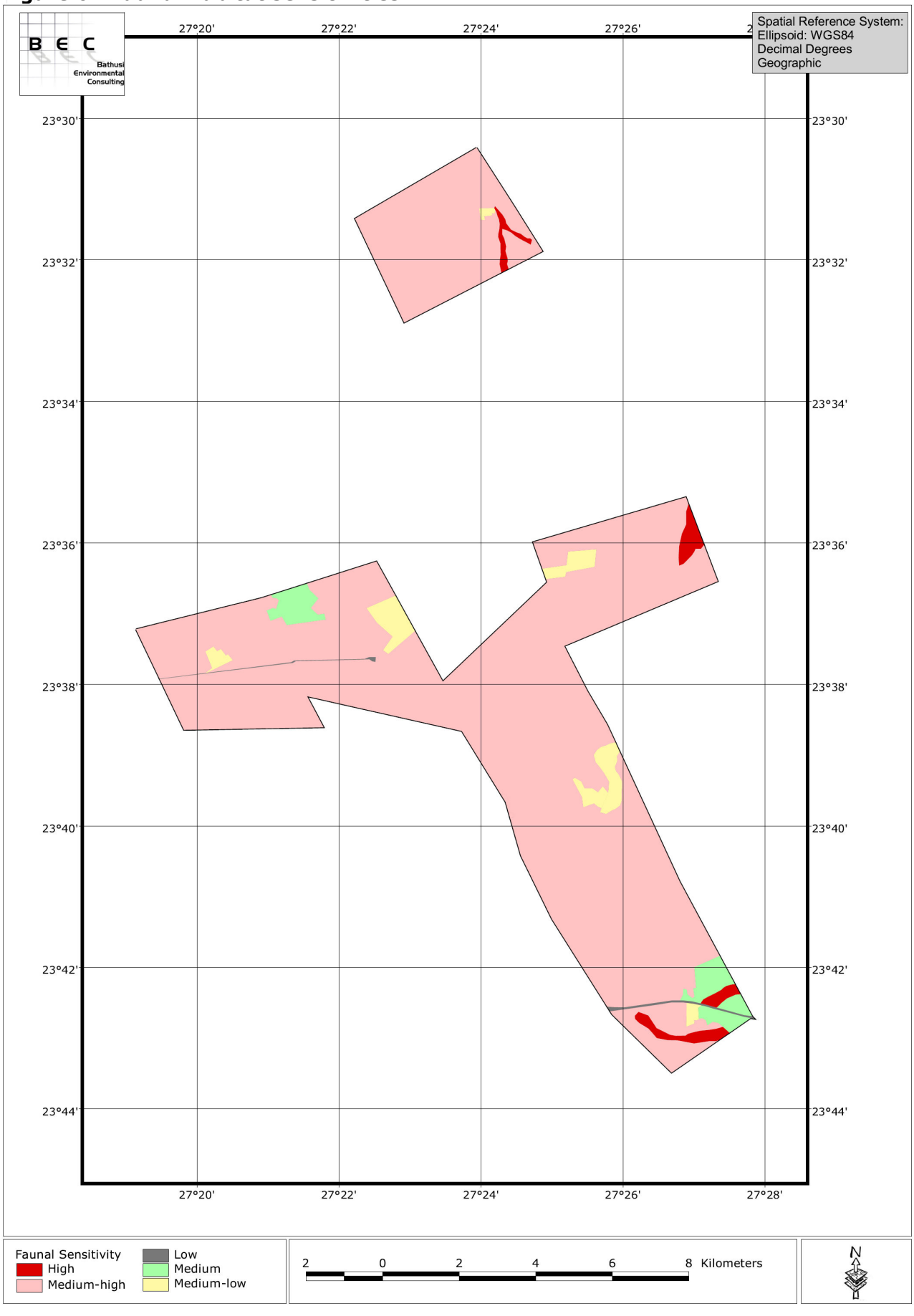
Based on these ecological and biodiversity considerations, the following estimations resulted:

Table 7: Faunal sensitivities of macro habitat types

Habitat Type	*Status*	*Diversity*	*Linkage*	*RD*	*Sens*	*Ave*	*Sens Class*
Acacia mellifera floodplains	9	8	9	8	9	86%	**high**
Degraded woodland	6	6	6	6	5	58%	**medium**
Historic agricultural fields	4	4	5	3	3	38%	**medium-low**
Linear infrastructure	1	1	1	1	1	10%	**low**
Natural woodland	9	7	7	7	8	76%	**medium-high**
Wooded clumps	9	8	8	9	9	86%	**high**

Most of the study area is estimated to have a medium-high faunal sensitivity – natural woodland (refer Figure 5).

Figure 6: Faunal habitat sensitivities



7.5 Discussion

The six study sites are situated near the Grootegeluk Coal Mine and Medupi Power Station in the Limpopo Province. Because of the proximity of the farms to each other, it is expected that the faunal composition of the respective farms will not vary significantly across the various farms. It is therefore reasonable to expect that the faunal sensitivities of the identified macro habitat types will be largely similar across the various farms. However, the nature of the woodland habitat of the Limpopo Sweet Bushveld implies that localised compositional and ecological differences will invariably exist within each of the macro habitat types, which will manifest as slight variations in faunal sensitivities relevant to the anticipated impacts of the proposed project. This will be addressed in more detail during the impact assessment phase of the project.

Regional attributes that are pertinent for this faunal assessment include the presence of significant rivers (albeit located some distance from the proposed sites), such as the Limpopo and Mokolo River systems to the north and east of the project area respectively, as well as the presence of regional road infrastructure that results in limited habitat fragmentation. Ecological and biodiversity aspects such as linkage, habitat status and general faunal sensitivity are influenced by regional attributes such as the above-mentioned.

Habitat diversity is a vital feature pertaining to faunal sensitivity estimation. Habitats such as the *Acacia mellifera* floodplains are often also host to a variety of Red Data taxa; the presence of the Giant Bullfrog has been confirmed for seasonal/ temporary pans that have surface water during the rainy season in the region. Other Red Data species are considered potential inhabitants of farms with wetland habitat because of the presence of seasonal surface water. Golden Baboon Spiders have been recorded in the study area as well as in selected localities in the surrounding region. It is therefore likely that this, and other baboon spider species, will persist in all suitable habitats within the study sites.

Relative sensitivity analyses are ultimately based on an interpretation of regional and site-specific ecological characteristics and biodiversity contributions. During the scoping phase, these factors cannot be quantified to an acceptable level of certainty, but the final estimations are based known ecological parameters combined with field knowledge of the study area region, its animals and their habitat requirements.

8 ECOLOGICAL SENSITIVITY

The following regional attributes are also evaluated to establish the regional importance of the proposed development areas:

- The presence of Threatened and/or Protected:
  - plant species (Yes);
  - animal species (Yes);
  - ecosystems (No);
- Critical conservation areas, including:
  - areas of high biodiversity (No)
  - centres of endemism (No)
- Important Ecological Processes, including:
  - Corridors (No);
  - Mega-conservancy networks (No);
  - Rivers and wetlands (No); and
  - Important topographical features (No).

High Sensitivity Values generally reflect vegetation that are considered pristine, unaffected by human influences, also exhibiting high diversity, particularly with the presence of flora species of conservation importance. These areas are comparable to nature reserves and well managed farm areas. Low Sensitivity Values indicate areas of lower ecological status or importance in terms of vegetation attributes, or areas that have been negatively affected by human impacts or poor management.

9 IDENTIFICATION & DESCRIPTIONS OF POTENTIAL & LIKELY IMPACTS

9.1 Identification of Impacts

No impacts were identified that could lead to a beneficial impact on the biological environment since the proposed development is largely destructive, involving the alteration of natural habitat.

Impacts resulting from the proposed development on ecological attributes are largely restricted to the physical effects. Direct impacts include any effect on populations of individual species of conservation importance and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of conservation consideration. In addition, impacts on sensitive or protected habitat are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are immediately visible and can be determined to an acceptable level of certainty.

In contrast, indirect impacts are not immediately evident and can consequently not be measured at a specific moment in time; the extent of the effect is frequently at a scale that is larger than the actual site of impact. A measure of estimation, or extrapolation, is therefore necessary in order to evaluate the importance of these impacts. Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities.

A list of potential and likely impacts was compiled from a generic list of impacts derived from previous projects of this nature and from a literature review of the potential impacts of this type of development on the natural environment. The following impacts were identified:

- Direct impacts on flora species of conservation importance;
- Direct impacts on protected flora species;
- Direct impacts on fauna species of conservation importance;
- Direct impacts on common fauna species/ faunal assemblages (including migration patterns, corridors, etc);
- Human - Animal conflicts;
- Loss or degradation of natural vegetation/ pristine habitat (including ecosystem functioning);
- Loss/ degradation of surrounding habitat;
- Impacts on SA's conservation obligations & targets;
- Increase in local and regional fragmentation/ isolation of habitat; and
- Increase in environmental degradation, pollution (air, soils, surface water).

9.2 Nature of Impacts

- **Direct Impacts on Threatened Flora Species**

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

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

One of the greatest limitations in terms of mitigating or preventing this particular impact, is the paucity of species specific information that describe their presence, distribution patterns, population dynamics and habitat requirements. To allow for an accurate assessment, it is usually necessary to assess the presence / distribution, habitats requirements, etc. associated with these species in detail and over prolonged periods; something that is generally not possible during EIA investigation such as this. However, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, potential impacts will largely be limited.

The likelihood of Red Data or protected flora species occurring within the study area is high and the conservation of these areas is likely to provide protection of plant species of conservation importance.

- **Direct Impacts on Protected Flora Species**

Results of the preliminary investigation revealed the presence of numerous protected trees within the respective alternative sites. Notwithstanding which option is preferred, a number of protected tree species will be impacted on during the construction phase. However, a relative low diversity and abundance of protected trees were indicated on the preferred option. Similar to Red Data plants, these species do not contribute significantly towards the local and regional biodiversity, but their presence indicates a relative pristine status of the habitat. Preservation of these species is a social obligation in light of increasing pressure on these species that causes a continuous decline and an eventual inclusion in conservation categories.

- **Direct Impacts on Threatened Fauna Species**

The presence of several Red Data fauna species (reintroduced as well as free-roaming species) on these properties has been confirmed and any disturbance therefore represents a direct and significant impact on these species. While some of them are highly mobile and will ultimately be able to avoid impacts that result from the proposed development, some will not be able to avoid effects of microhabitat destruction, with particular reference to Baboon Spiders that are known to persist on some of the farms. A direct approach, which is likely to be hugely costly, can be implemented in order to capture and relocate some animals to adjacent suitable habitat. Similar to Red Data plants, the presence of Red Data animal species is seen as a significant attribute to the biodiversity of an area. Any impact is therefore viewed as significant. Additional aspects that will be affected include migration patterns and suitable habitat for breeding and foraging purposes.

- **Direct impacts on Common Fauna Species/ Faunal Assemblages**

The presence of diverse faunal assemblages on most of the properties has been established. Considering the low levels of habitat transformation and degradation on a local scale, animal species are likely to evacuate towards adjacent areas of natural habitat during periods of high impact. While the tolerance levels of most animal species is generally of such a nature that surrounding areas will suffice in their habitat requirements, some species are not able to relocate, such as ground living and small species. The proposed development will result in severe impacts on these species.

In light of the low fragmentation and habitat isolation levels of the region, it is reasonable to assume that the animals utilising habitat within the proposed areas will also migrate extensively across the region for various reasons. Foraging, available water, food sources, breeding patterns and seasonal climate changes include some of the more obvious explanations for migration of animals.

While most of the larger mammal species (ungulates) are restricted in their movement by fences, small and medium sized animals, that include predators, burrowing species, small mammals, invertebrate species, reptiles, amphibians, etc. utilises all available natural habitat as either corridors or habitat. The loss of an area as large, as this property, will affect the migration and daily movement patterns of a number of species that are present in the immediate region.

- **Human - Animal conflict/ Displacement of fauna**

It should be noted that animals generally avoid contact with human structures, but do grow accustomed to structures after a period. While the structures are visible, injuries and death of animals could potentially occur because of accidental contact. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to road kills, particularly amongst nocturnal animals that abound in the study area.

The presence of personnel within the development area during construction and maintenance periods will inevitably result in limited, contact with animals. While most of the larger animal

species are likely to move away from humans, encounters with snakes, spiders and scorpions remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, poisoning, trapping, etc.

Furthermore, the creation of artificial habitat and the abundance of litter and spoils that are associated with any construction and development site will attract prey species such as rodents, exotic birds and pets (feral cats and dogs). Strongly associated with the presence of these animals are predators that include venomous snakes, larger raptors, wild feline species (Cerval, Leopard, Caracal, etc.), Jackal, Hyaena, etc. These species are frequently regarded with false beliefs and killed for little reason. Much information can be drawn from the nearby development of Medupi Power Station.

While most of the significant impacts are associated with habitat clearance that precede the actual development phase, this impact is also particularly relevant during the period when construction activity peaks and worker numbers are high.

- **Loss or Degradation of Natural Vegetation/ Sensitive Habitat**

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

The vegetation is indicated to be highly representative of the regional vegetation type and is, for most parts, in a pristine condition, implying that the species composition, structure and other floristic attributes does not indicate variance on a local or regional scale.

The larger region is furthermore characterised by low transformation and fragmentation factors. Therefore, the existing ecological connectivity is significant in the functioning of the regional and local ecological processes. Indirect effects resulting from construction and operational activities on processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function.

- **Impacts on Surrounding Habitat/ Species & Ecosystem Functioning**

Surrounding areas and species present in the direct vicinity of the study area could potentially be affected by indirect impacts resulting from construction and operational activities. This indirect impact also includes adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.
- Migration routes will be affected within Manketii Nature Reserve

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function. Furthermore, regional ecological processes, particularly aquatic processes that is dependent on the status and proper functioning of the drainage line, is regarded important. It is well known that the status of a catchment is largely determined by the status of the upper reaches of the rivers. Small drainage lines might be insignificant on a regional scale, but the combined status of numerous such small drainage lines will determine the quality of larger rivers further downstream.

- **Impacts on SA's Conservation Obligations & Targets**

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas or threatened areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types (VEGMAP, 2006) and because impacts that result in irreversible transformation of natural habitat is regarded significant, a significant disruption of ecosystem functioning is assumed in the Endangered and Vulnerable vegetation types that occupy the study area.

Considering the potential loss of natural vegetation within the study area, a significant impact is expected on the conservation status of the regional vegetation type.

- **Increase in Local & Regional Fragmentation / Isolation of Habitat**

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

The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are usually beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular; this will result in major impacts on the Manketti Nature Reserve. Corridors to allow animal movement and migration needs to be considered during the EIA phase and specialist investigations.

The general region is characterised by high levels of transformation and habitat fragmentation. However, in spite of this fragmented nature, a measure of connectivity is still present along the wetland habitat types and grassland portions that are not actively cultivated. This connectivity is critical in the preservation of pollinator species that provide important ecological services. The isolation of parcels of natural habitat is likely to contribute to loss of genetic variability, decrease in diversity and accentuated impacts from surrounding land uses.

- **Cumulative Increase in Environmental Degradation, Pollution**

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the development is such that pollution and degradation of the surrounding areas is reasonably expected. This is evident from similar surrounding development activities.

10 EIA RECOMMENDATIONS

In order to address existing information gaps and satisfy legal requirements of EIA investigations, it is suggested that an over-arching approach be followed to allow for the capture of maximum data and adequate subsequent analysis thereof. The approach suggested here is based on separate austral winter and summer surveys during which a scientific approach to data assimilation will be followed. Botanical and faunal data will ultimately be captured in point samples (releveès) placed in a stratified random mean across the entire study area. Acquired data will be holistically analysed to illustrate the ecological interaction of plants and animals. Data analysis will be performed by PC-ORD for Windows, Version 6.07 (2011), allowing for an analysis through TWINSPAN, DECORANA, etc.

10.1 Botanical Impact Assessment

10.1.1 Sampling Approach

The number of sample plots to be distributed in a given area depends on various factors, such as the scale of the classification, environmental heterogeneity and the accuracy required for the classification (Bredenkamp 1982).

Stratification of sample plots will be based on visual observations made during the initial site investigation as well as aerial imagery. The Zurich-Montpellier approach of phytosociology (Braun-Blanquet 1964) will be followed, which is a standardised and widely used sampling technique for general vegetation surveying in South Africa. During the surveys, all plant species in the sample plots and the cover and / or abundance of each species will be estimated according to the following Braun-Blanquet cover abundance scale:

+ infrequent, with less than one percent cover of total sample plot area;
1 frequent, with low cover, or infrequent but with higher cover, 1-5% cover of the total sample plot area;
2 abundant, with 5-25% cover of total sample plot area:
2A - >5-12%;
2B - >12-25%;
3 >25-50% cover of the total sample plot area, irrespective of the number of individuals;
4 >50- 75% cover of the total sample plot area, irrespective of the number of individuals; or
5 >75% cover of the total sample plot area, irrespective of the number of individuals.

In addition, a relevant selection of the following biophysical attributes will be recorded within each relevè:

- Altitude- and longitude positions for each relevè - obtained from a GPS;
- Soil characteristics, including colour, clay content, etc;
- Topography (crests, scarps, midslopes, footslopes, valley bottoms, floodplains or drainage lines);
- Altitude, slope and aspect;

- Rockiness, estimated as a percentage;
- Rock size; and
- General observations (including the extent of erosion, utilisation, disturbances of the vegetation management practices, etc).

In addition to species captured within the sample plots, general observations will be made in order to compile a comprehensive species list that will include taxa that, because of low abundance levels, are unlikely to be captured within the sample areas. Particular reference is made to Red Data plants, which normally do not occur at great densities.

10.1.2 Data Processing

The combined floristic and faunal data sets will be subjected to the Two- Way Indicator Species Analysis technique (TWINSPAN) (Hill 1979) and subsequently refined by Braun-Blanquet procedures. TWINSPAN will be applied to derive a first approximation of the vegetation units. These classifications will be further refined by the application of Braun-Blanquet procedures to determine the plant communities.

A phytosociological table showing the vegetation lines will be used to compile a synoptic table of the datasets. A synoptic table summarises and confirm the vegetation types/ habitat types and variations. Relevant descriptions will follow from the data analysis, based on the presence/ absence and abundance of taxa.

10.2 Faunal Impact Assessment

Field investigations commonly employed for EIA studies are normally limited by time and budget and scientific approaches generally have to be adapted to allow for these limitations. Ecology and biodiversity are growing fields of science and much is still unknown. While lists of mammals and birds for the study area exist, these could not be sourced before completion of this document. As always, information on the herpetofauna and invertebrates of the region and farms is lacking in detail and significant information gaps exist in this regard.

It is therefore strongly recommended that the following EIA study methods be implemented to gain an ecological understanding of the study area as well as the biodiversity contribution of the study area within a regional and provincial context.

10.2.1 Invertebrates

Invertebrates are by far the most important animals present anywhere. They are very useful bio-indicators and include meaningful surrogates, flagships and diversity indicators. The invertebrate studies will be twofold:

- Firstly, sweep samples and/ or beating and pitfall samples of invertebrates would be used to compare sample plots in terms of species richness (number of species) and species diversity (relative abundances between species groups). Species found in these samples will also be included in the species inventory; and
- Secondly, a species inventory of the study area/s will be compiled using above-mentioned methods as well as active searches for scorpions (under rocks and using UV-lights), for butterflies (using a hand-held net) and beetles (under rocks, bark hand-netting etc.)

10.2.2 Herpetofauna

Frogs will be sampled using species-specific calls of males as identification; also, active searches for active adults during early evenings. Snakes, lizards and other reptiles will be sampled by active searches in likely habitats (under rocks, in inactive termitaria etc.)

10.2.3 Birds

Assessing avifaunal diversity of an area includes three components:

- Suitable visual observations
- Audio observations; and
- Habitat assessments.

A large number of bird species are highly visible and easily identifiable using visual observations. Binoculars are used to assist the observer in identifying smaller and more cryptic species. Many bird species are cryptically coloured and can only be identified using sound; calls of many cryptic bird species are species-specific and very useful in compiling a species inventory list of the area under investigation.

Ideally, various field assessments during all seasons of the year are needed to start to create an "avifauna image" of the study area that supports the reality of bird communities in the area. Since this is never accomplished in reality, habitat assessments are used to create a "model" of the bird communities likely to be found in the area investigated. Fortunately, much data is available on the birds of Southern Africa; distribution records, habitat requirements etc. By assessing the available habitat within the study area (with focus on habitat characteristics available and diversity and quality of habitats present), all bird species (including Red Data birds) are assessed in terms of likelihood of occurring within the study area. The final stage of the avifaunal study is using the image created of the avifaunal communities of the study area in assessing the impacts of the proposed project on the avifauna of the study area. Impacts are weighed and mitigations measures proposed where possible.

10.2.4 Mammals

Visual sightings as well as ecological indicators such as tracks, dung, calls and diggings will be used to compile a species inventory of the mammals of the study area. Additionally, small mammal live traps, motion detection cameras and night surveys will be used to sample for rodents and insectivores.

10.2.5 Ecology

Species inventory lists and indications of species richness and -diversity recorded with the aid of above-mentioned methods will be used to interpret the relative ecological status of the study area/s and to compare areas and variations in faunal habitats present. These comparisons are done in liaison with the vegetation characteristic in order to gain an ecological understanding of the study area and the potential impacts of the study area/s.

11 PHOTOGRAPHIC RECORDS

Photo 1: Typical savanna, locally dominant *Terminalia sericea* (Silver cluster leaf)

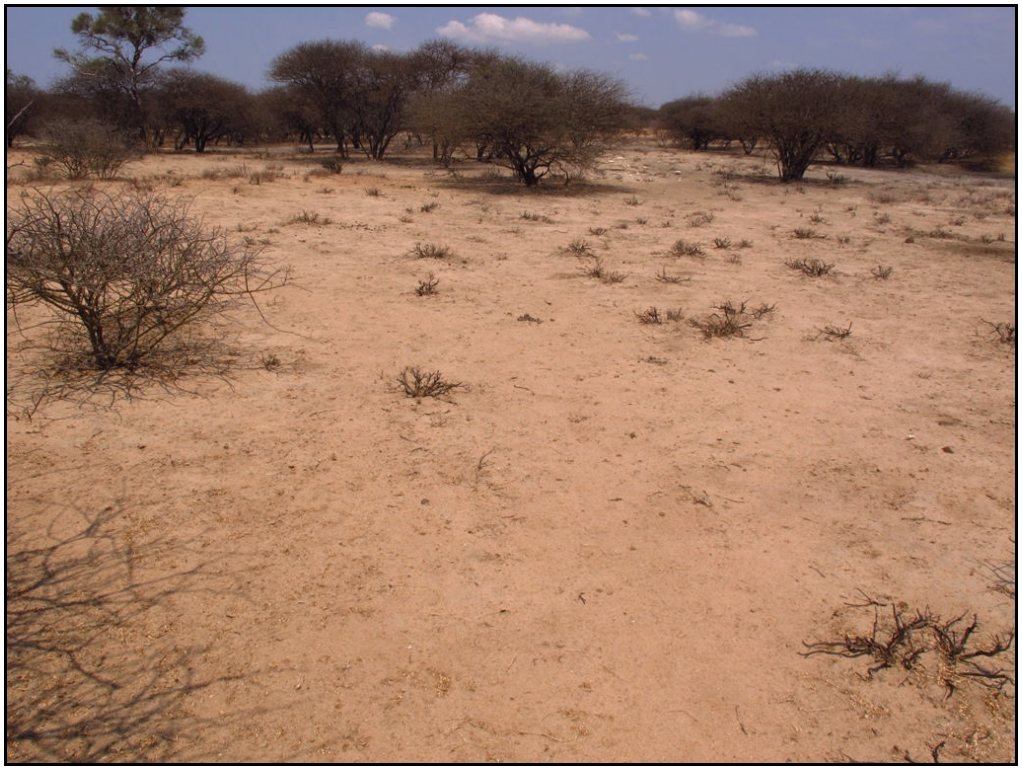


Photo 2: Open habitat within the alluvial plains

Photo 3: Typical savanna, locally dominant *Combretum apiculatum* (Red Bushwillow)

Photo 4: Example of the protected *Acacia erioloba* (Camel Thorn)

Photo 5: Example of the protected *Boscia albitrunca* (Shepherd's Tree)

12 APPENDIX 1 - METHOD STATEMENT

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

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

- A desk-top assessment of all available biological and biophysical data;
- Augmentation of existing knowledge by means of site specific and detailed field surveys;
- Specialist interpretation of available data, or known sensitivities of certain regional attributes; and
- An objective scoping assessment, estimating potential impacts on biological and biophysical attributes.

12.1 Assessment Philosophy

The objective of the scoping phase study is to review botanical and faunal patterns within the study area and the surrounds in order to identify any sensitive areas that should be avoided during development, also allowing for technical adjustments based on results of the scoping surveys. The study areas will ultimately be scrutinised in more detail during the EIA phase of the assessment.

The overall goal of this scoping assessment is to establish a reference point for the biophysical and biological attributes and sensitivities of the study area by means of the Ecosystem Approach Principles and the Landscape Ecology Approach. This approach is advocated by the Convention on Biological Diversity (www.cbd.int), recognizing that people and biodiversity are part of the broader ecosystems on which they depend, and that it should thus be assessed in an integrated way. Effective conservation of landscape heterogeneity (sensitive habitat types/ ecosystems frequently associated with biodiversity elements of high sensitivity or conservation importance) effectively implies the conservation/ protection of species that are highly sensitive to changes in the environment.

It is inevitable that these approaches (www.umass.edu/landeco/about/landeco.pdf) will not function effectively in all cases since extremely localised and small areas of sensitivity might occur scattered in any region and cannot always be captured on available databases or might have been missed during the site investigations. Therefore, the compilation of basic species lists and the identification of localised ecological habitat by means of a basic site investigation will be implemented to augment initial results. It is important to identify areas of sensitivity on a local scale and, where possible, communities or species that are considered sensitive to influences arising from the proposed development. The Precautionary Principal is applied throughout the assessment[2].

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species.

12.2 Botanical Assessment

The botanical assessment was compiled by R. A. J. Robbeson (Pr.Sci.Nat.).

12.2.1 General Botanical Attributes

In preparation for the site survey, physiognomic homogenous units are identified and delineated on digital aerial photos, using standard aerial photo techniques (downloaded from www.googleearth.com and georectified on Arcview 3.2). A brief site visit was conducted to examine the general floristic attributes and diversity of the study area and the development alternatives. Objectives of this particular investigation included the verification and ground truthing of preliminary habitat types and making preliminary assessments of the status and sensitivity of available habitat types. These preliminary sensitivity observations will ultimately be relayed to the ranking of preferred alternatives for the proposed development.

It is not the intention of this report to provide a comprehensive list of species that occur on the site; this aspect will be addressed in more detail in the EIA phase of the project.

12.2.2 Plant taxa of Conservation Importance

The purpose of listing Red Data plant species is firstly to provide information on the potential occurrence of species of special concern in the study area that may be affected by the proposed development. Secondly, the potential occurrence of these species can then be assessed in terms of their habitat requirements in order to determine whether they have a likelihood of occurring in habitats that may be affected by the proposed infrastructure. Red Listed flora information, as presented by SANBI was used as a point of departure for this

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

assessment. A snapshot investigation of an area, such as this particular investigation, represents a severe limitation in terms of locating and identification potential Red Listed flora species. Particular emphasis is therefore placed on the identification and assessment of habitat deemed suitable for the potential presence of Red Listed.

It should be noted that Red List species are, by nature, rare and difficult to locate. Compiling a list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. Notwithstanding the application of the Precautionary Principle, there is always the likelihood that a species that is not included in a list might be unexpectedly present in an area.

12.3 Faunal Assessment

The faunal assessment was compiled by D. Kamffer (Pr.Sci.Nat.).

12.3.1 Ecological Status

The extent to which a site is ecologically connected to surrounding areas is an important determinant of its sensitivity. Systems with a high degree of landscape connectivity or with extensive grassland and drainage systems amongst one another are perceived to be more sensitive and will be those contributing to important faunal sensitivity or overall preservation of faunal diversity. A basic site investigation will reveal the current ecological status of available habitat types. A preliminary assessment will be presented in this report, but will ultimately be canvassed during the EIA phase of the project. A major objective of this part of the project is to identify areas that are regarded important on a local or regional scale that are likely to have a bearing on the project.

12.3.2 Red Listed Fauna Probabilities

Three parameters are used to assess the Probability of Occurrence of Red Listed species that could potentially occur in the study area:

- Habitat requirements (HR) - Red Listed animals have specific habitat requirements and the presence of these habitat characteristics in the study area is evaluated.
- Habitat status (HS) - The status or ecological condition of available habitat in the study area is assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Listed species (especially wetland-related habitats where water quality plays a major role); and
- Habitat linkage (HL) - Movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to surrounding habitats and adequacy of these linkages are evaluated for the ecological functioning of Red Listed species within the study area.

12.4 Ecological Sensitivity

The aim of this exercise is to present an opinion on the inherent sensitivity of macro habitat types by means of the comparison of weighted floristic attributes. Results of this exercise are not final and could possibly be modified during the EIA phase of the project when more detail pertaining to the environment becomes available.

Ecological sensitivity is determined through a subjective estimation that takes cognisance of observations and records compiled during the reconnaissance survey of the study area as well as available information in the form of GIS infobases and historic biodiversity surveys that were conducted on the study area and in the immediate region. This method is considered effective in highlighting sensitive areas, based on observed floristic attributes rated across the spectrum of communities. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics, e.g. human impacts, size, fragmentation are important in assessing the status of the various communities.

High Sensitivity Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological effective manner. These areas are comparable to nature reserves and even well managed farm areas. Low Sensitivity Index Values indicate areas of lower ecological status or importance in terms of vegetation attributes, or areas that have been negatively affected by human impacts or poor management. Sensitivity Criteria employed in assessing the floristic sensitivity of separate units may vary between different areas, depending on location, type of habitat, size, etc.

In short, the general approach in estimating the ecological sensitivity of macro habitat types is therefore based on a evaluation of the following criteria:

- Threatened and/or Protected:
  - plant species;
  - animal species;
  - ecosystems;
- Critical conservation areas, including:
  - areas of high biodiversity
  - centres of endemism
- Important Ecological Processes, including:
  - Corridors;
  - Mega-conservancy networks;
  - Rivers and wetlands; and
  - Important topographical features.

13 APPENDIX 2 - LIMITATIONS OF THIS INVESTIGATION

- Findings, results, observations, conclusions and recommendations presented in this report are based on the authors' best scientific and professional knowledge as well as information available to them at the time of compiling this report.
- This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.
- Results presented in this report are based on a snapshot investigation of the study area and not on detailed and long-term investigations of all environmental attributes and the varying degrees of biological diversity that may be present in the study area.
- In particular, rare and endemic species normally do not occur in great densities and, because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible. Results are ultimately based on estimations and specialist interpretation of imperfect data.
- It is emphasised that information, as presented in this document, only have bearing on the site as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.
- Furthermore, additional information may become known during a later stage of the process or development. The authors therefore reserve the right to modify aspects of the report including the recommendations should new information may become available from ongoing research or additional work in this particular area, or pertaining to this investigation.
- This report should always be considered as a whole. Reading and representing portions of the report in isolation could lead to incorrect conclusions and assumptions. In case of any uncertainty, the authors should be contacted to clarify any viewpoints, recommendations and/ or results.
- Not all areas could be accessed during the respective site investigations. Results are extrapolated to include these properties, but no responsibility could be taken should discrepancies be indicated at a later stage. It is strongly recommended that these areas be subjected to a basic site investigation to confirm initial results.

14 APPENDIX 3 - LEGISLATION

This report has been prepared in terms of the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 385 Section 33 – Specialist reports and reports on specialised processes under the Act. Relevant clauses of the above regulation include:

Regulation 33.(1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialised process.

Regulation 33.(2): A specialist report or a report on a specialised process prepared in terms of these Regulations must contain:

(a) Details of (i) The person who prepared the report, and
(ii) The expertise of that person to carry out the specialist study or specialised process;

(b) A declaration that the person is independent in a form as may be specified by the competent authority;

(c) An indication of the scope of, and the purpose for which, the report was prepared;

(d) A description of the methodology adopted in preparing the report of carrying out the specialised process;

(e) A description of any assumptions made and any uncertainties or gaps in knowledge;

(f) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;

(g) Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;

(h) A summary and copies of any comments that were received during any consultation process;

(i) Any other information requested by the competent authority.

Compliance with provincial, national and international legislative aspects is strongly advised during the planning, assessment, authorisation and execution of this particular project. Legislative aspects of which cognisance were taken during the compilation of this report are summarised, but not necessarily limited to, in Table 2.

Table 8: Legislative guidance for this project

Legislation	Relevance
Biodiversity Act (No. 10 of 2004)	To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.
Conservation of Agricultural Resources Act 43 of 1983	The conservation of soil, water resources and vegetation is promoted. Management plans to eradicate weeds and invader plants must be established to benefit the integrity of indigenous life.

Constitution of the Republic of South Africa (Act 108 of 1996)	The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.
Convention on Biological Diversity, 1995	International legally binding treaty with three main goals; conserve biological diversity (or biodiversity); ensure sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.
Environmental Conservation Act (No. 73 of 1989)	To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.
National Environmental Management Act (No. 107 of 1998)	Requires adherence to the principles of Integrated Environmental Management (IEA) in order to ensure sustainable development, which, in turn, aims to ensure that environmental consequences of development proposals be understood and adequately considered during all stages of the project cycle and that negative aspects be resolved or mitigated and positive aspects enhanced.
National Environmental Management Act (No 10 of 2004)	Restriction of activities involving alien species, restricted activities involving certain alien species totally prohibited and duty care relating to listed invasive species.
Protected Areas Act (No. 57 of 2003)	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.

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