

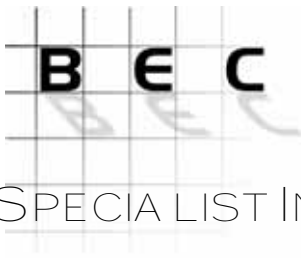
Basic Biodiversity Assessment of the proposed Medupi Reservoir & Pipeline

submitted by



April 2008
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SPECIALIST INVESTIGATOR

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).

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DECLARATION

- All specialist investigators, project investigators and members of companies employed for conducting this particular investigation declare that:
- we consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions;
- at the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development as outlined in this document, except for financial compensation for work done in a professional capacity;
- we will not be affected in any manner by the outcome of the environmental process of which this report forms part of, other than being part of the general public;
- we do not have any influence over decisions made by the governing authorities;
- 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;
- 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 formally register as an Interested and Affected Party; and
- this document and all information contained herein are and will remain the intellectual property of Bathusi Environmental Consulting cc and Riaan A.J. Robbeson. This document, in its entirety or any portion thereof, may not be copied or reproduced in any manner or form, for any purpose without the specific and written consent of Riaan A.J. Robbeson.



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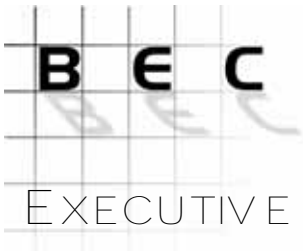


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1 EXECUTIVE SUMMARY

In order to optimise operations at the Medupi Power Station complex Eskom is proposing the relocation of the planned new water reservoir from the Medupi Power Station complex to the adjacent farm Kuipersbult. Pipelines from the water source to the new reservoir as well as from the new reservoir to Medupi Power Station are required.

This assessment aims to present the client with broad descriptions of ecological characteristics of the study area, highlighting sensitive biological and environmental attributes that might be affected adversely.

Areas of surface water (non-perennial streams and a seasonal dam/ pan) are situated east from the proposed reservoir site. Only one area of significant slope is present within the study area, represented by a rocky outcrop. This feature is particularly important as it provides for high spatial heterogeneities that are likely to sustain populations of conservation important plant and fauna species.

Only one major vegetation types is represented in the study area, namely the Limpopo Sweet Bushveld. This vegetation type is not threatened. The presence of at least 64 plant species within the study area was confirmed during the site investigation. SANBI records for the region indicate the presence of 4 Red Data flora species. No Threatened species were observed during the site investigation. A total of four protected tree species were observed within the study area. These species occur throughout the study area and is not restricted to a localized area. In the case of unavoidable impacts on individuals of these species, permits need to be obtained by the client prior to these individuals being damaged or removed.

Seven Red Data fauna species are known to occur in the general area. Sensitive habitat types (ridges and riparian habitat types) are particularly suitable for the presence of Red Listed fauna species.

Ecological habitat types identified in the study area include:

- Natural regional habitat
- Non-perennial streams and seasonal dam;
- Rocky outcrop
- Degraded woodland; and
- Transformed areas.

Significant impacts on the biological environment include:

- Loss of Biodiversity - Destruction of Threatened Species & Habitat;
- Loss of Biodiversity - Destruction of Protected Tree Species; and
- Habitat Degradation - Destruction of Pristine/ Sensitive Habitat Types.



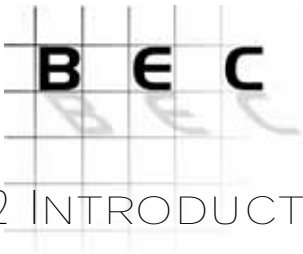
The location of the rocky outcrop renders Alternatives 2 and 3 as 'No-Go' options. Potential impacts on this environmental feature are unacceptable and only Alternative 1 is available as a viable option with lower environmental impact.

A realignment of the pipeline to the south will limit impacts on the seasonal dam/ pan. Care must be taken to also implement a 30m buffer zone around the feature and avoid peripheral impacts on the structure and composition of vegetation on the fringe of the dam.

The following mitigation measures are recommended:

- Ensure absence of RD species by means of final walkthrough during the growing season (November – March);
- Identify and mark all protected tree species during the final walkthrough;
- Obtain relevant permits for removal or cutting of protected tree species;
- Transplant selected trees to adjacent areas where possible;
- Implement rescue operation in areas where Red Data species / Protected trees are present;
- Remove and control the occurrence of invasive species during the operational phase;
- Implement a monitoring programme which aims to assess any significant and long-term impacts on the status of biological attributes, particularly in sensitive areas such as the drainage line and seasonal dam; and
- Move causing activity south of the dam, consider alternative alignment.

Subsequent to the completion of the impact assessment of the alternatives Eskom has indicated an alternative that is more acceptable for their purposes, also taking preliminary results of the biodiversity assessment into consideration. This alternative, although not assessed in the impact evaluation, is regarded suitable for the proposed activity and is not expected to result in higher levels of impacts on the biodiversity and ecology of the area since it is indicated to avoid the sensitive rocky outcrop and seasonal pan areas.



2 INTRODUCTION

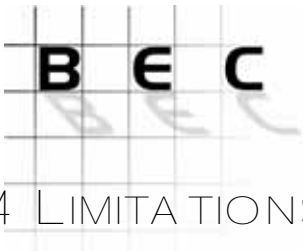
In order to optimise operations at the Medupi Power Station complex (located near Lephalale in Limpopo Province); Eskom Holdings Limited is proposing the relocation of the planned new water reservoir from the Medupi Power Station complex to the adjacent farm Kuipersbult. Pipelines from the water source to the new reservoir as well as from the new reservoir to Medupi Power Station are required to be constructed. The following infrastructure is planned:

- A 400,000m³ capacity water reservoir on the Farm Kuipersbult 511;
- A pipeline (underground) from the existing DWAF water pipeline (water source) at Matimba Power Station to the new reservoir on one of 3 alternatives on the farms Kuipersbult 511, Hanglip 508 and Zwartwater 507 (<10km in length), including pressure-reducing station and a flow meter house;
- Construction and operation of a pipeline (underground) from the new reservoir to the Medupi power station (<5km in length); and
- All infrastructures will be placed in maximum of 15m wide servitude and construction activities will be limited to 45m wide servitude.

3 AIMS & OBJECTIVES

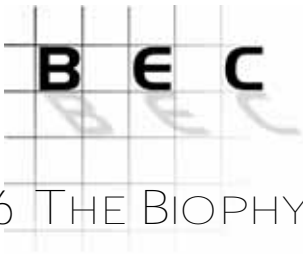
This basic biodiversity assessment aims to present the client with broad descriptions of ecological characteristics of the study area and to highlight sensitive biological and environmental attributes that might be affected adversely by the proposed development. The Terms of Reference for this assessment are to:

- Incorporate results obtained previous investigations into this assessment;
- Present pertinent descriptions of biological attributes of the receiving environment;
- Obtain all relevant PRECIS and Red Data information;
- Describe sensitive ecological habitat in terms of biophysical attributes;
- Present a strategic assessment of identified impacts;
- Make pertinent recommendations with regards to the proposed alignments;
- Make pertinent recommendations with regards to EMP guidelines and mitigation measures; and
- Map all relevant aspects.



4 LIMITATIONS OF THIS INVESTIGATION

- This report is based on a strategic investigation of some parts of the study area. No detailed or long-term investigation of biological attributes and biological diversity that may be present in the study area was conducted for the purpose of this basic assessment.
- 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 these assessments or requests made to them for the purpose of this report.
- Additional information may come to light during a later stage of the process for which no allowance could have been made at the time of this report.
- No definite conclusions may be drawn with regards to biological diversity or conservation strategies as far as this report is concerned.
- BEC withholds the right to amend this report, recommendations and/ or conclusions at any stage of the project should significant information come to light.
- Information contained in this report cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.



6 THE BIOPHYSICAL ENVIRONMENT

6.1 Location

The study area is situated on the farms Kuipersbult 511, Hanglip 508 and Zwartwater 507 in the Limpopo Province and is located approximately 8km west of Lephalale (Figure 1). An aerial image of the study area is presented in Figure 2.

6.2 Surface Water

Areas of surface water are present within the proposed pipeline area; non-perennial streams and a dam/ pan is situated east north-east from the proposed reservoir site. These features are fairly unique habitat types and any adverse impacts are regarded significant.

6.3 Topography and Slopes

A basic assessment of the topography and landforms revealed that only one area of significant slope is present within the study area, represented by a rocky outcrop. This feature is particularly important as it provides for high spatial heterogeneities that are likely to sustain populations of conservation important plant and fauna species.

From a functional point of view, rocky outcrops are important landscape features assisting winged invertebrates in locating potential mating partners. On a landscape scale, the outcrops facilitate animal dispersal to other areas of suitable habitat (so-called "stepping stones") and thereby functioning as important ecological linkages. In addition, faunal populations colonising these patches of outcrops provide a balance through recruitment of individuals (e.g. immigration-emigration) among these patches, thereby maintaining meta-populations dynamics.

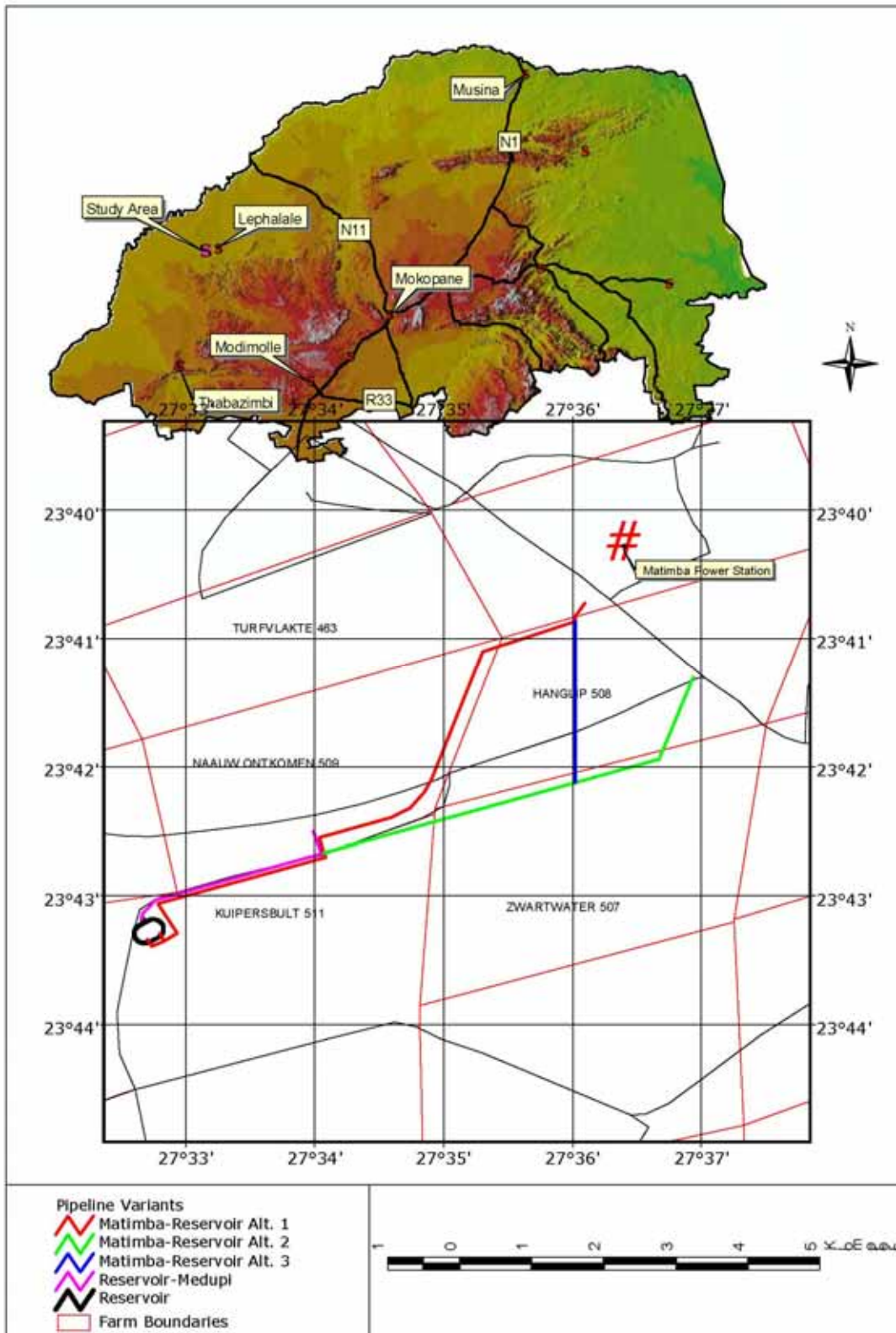


Figure 1: Location of the study area

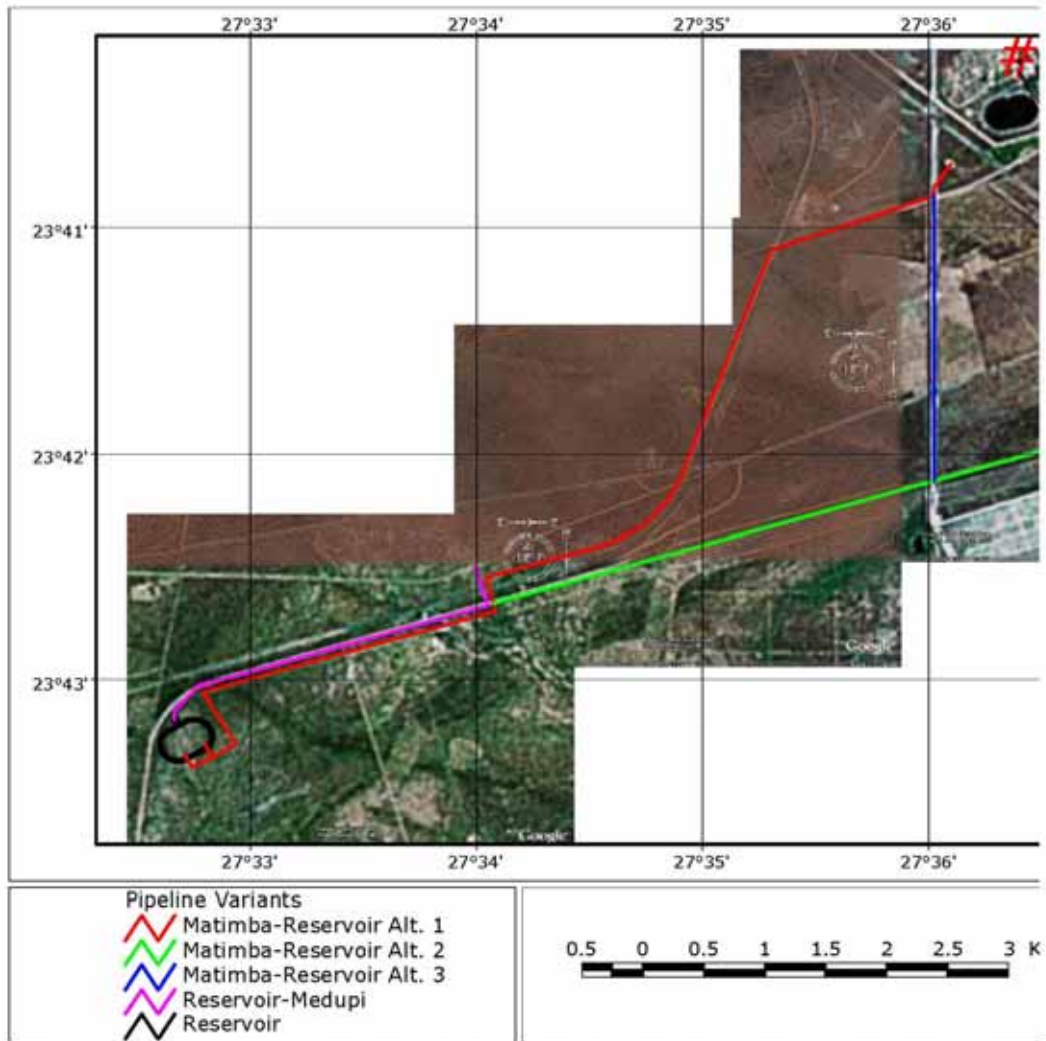


Figure 2: Aerial image of the study area

6.4 Regional Vegetation - VEGMAP

Only one major vegetation types is represented in the study area, namely the Limpopo Sweet Bushveld. This vegetation type is not threatened and although only 1% is formally conserved, much is contained within private nature reserves and game farms.

Table 1: Important taxa for the Limpopo Sweet Bushveld Vegetation Type	
Taxa	Growth Form
<i>Acacia robusta</i>	Tall tree
<i>Acacia burkei</i>	Tall tree
<i>Acacia erubescens</i>	Small tree
<i>Acacia fleckii</i>	Small tree
<i>Acacia nilotica</i>	Small tree
<i>Acacia senegal</i> var. <i>rostrata</i>	Small tree
<i>Albizia anthelmintica</i>	Small tree
<i>Boscia albitrunca</i>	Small tree
<i>Combretum apiculatum</i>	Small tree
<i>Terminalia sericea</i>	Small tree
<i>Catophractes alexandri</i>	Tall shrubs
<i>Dichrostachys cinerea</i>	Tall shrubs
<i>Phaeoptilum spinosum</i>	Tall shrubs
<i>Rhigozum obovatum</i>	Tall shrubs
<i>Cadaba aphylla</i>	Tall shrubs
<i>Combretum hereroense</i>	Tall shrubs
<i>Commiphora pyracanthoides</i>	Tall shrubs
<i>Ehretia rigida</i> subsp. <i>rigida</i>	Tall shrubs
<i>Euclea undulata</i>	Tall shrubs
<i>Grewia flava</i>	Tall shrubs
<i>Gymnosporia senegalensis</i>	Tall shrubs
<i>Acacia tenuispina</i>	Low shrubs
<i>Commiphora africana</i>	Low shrubs
<i>Felicia muricata</i>	Low shrubs
<i>Gossypium herbaceum</i> subsp. <i>africana</i>	Low shrubs
<i>Leucosphaera bainesii</i>	Low shrubs
<i>Digitaria eriantha</i> subsp. <i>eriantha</i>	Graminoids
<i>Enneapogon cenchroides</i>	Graminoids
<i>Eragrostis lehmanniana</i>	Graminoids
<i>Panicum coloratum</i>	Graminoids
<i>Schmidtia pappophoroides</i>	Graminoids
<i>Aristida congesta</i>	Graminoids
<i>Cymbopogon nardus</i>	Graminoids
<i>Eragrostis pallens</i>	Graminoids
<i>Eragrostis rigidior</i>	Graminoids
<i>Eragrostis trichophora</i>	Graminoids
<i>Ischaemum afrum</i>	Graminoids
<i>Panicum maximum</i>	Graminoids
<i>Setaria verticillata</i>	Graminoids
<i>Stipagrostis uniplumis</i>	Graminoids
<i>Urochloa mosambicensis</i>	Graminoids
<i>Acanthosicyos naudinianus</i>	Herbs
<i>Commelina benghalensis</i>	Herbs
<i>Harpagophytum procumbens</i> subsp. <i>transvaalense</i>	Herbs
<i>Hemizygia elliottii</i>	Herbs

<i>Hermbsstaedtia odorata</i>	Herbs
<i>Indigofera daleoides</i>	Herbs
<i>Kleinia fulgens</i>	Succulent herbs
<i>Plectranthus neochilus</i>	Succulent herbs

6.5 Natural Features

The study area is regarded sensitive in terms of the potential presence of Cheetah.

6.6 Land Cover

Except for mining areas located towards the east and north of the study area, the entire area is comprised by natural woodland. Grazing by cattle and game farming is extensively practiced in these parts.

7 BIODIVERSITY

7.1 General Floristic Diversity

PRECIS information (SANBI, 2007) indicates the presence of 309 plant species within the 2327DA ¼ degree grid in which the study area is situated (the dataset is too large to present in this document, but can be presented separately on request).

A basic site investigation revealed the presence of 64 plant species within the study area (Table 2). This list is by no means considered comprehensive since it is based on a single site investigation and not on a long-term investigation that incorporates seasonal variations that might be present. It is however regarded sufficient to highlight the floristic diversity of the study area.

Species Name	Growth Form	Family
<i>Abutilon austro-africanum</i>	Forb	Malvaceae
<i>Acacia erioloba</i>	Tree	Mimosaceae
<i>Acacia erubescens</i>	Tree	Mimosaceae
<i>Acacia gerrardii</i>	Tree	Mimosaceae
<i>Acacia nigrescens</i>	Tree	Mimosaceae
<i>Acacia tortilis</i>	Tree	Mimosaceae
<i>Aristida congesta</i> subsp. <i>barbicollis</i>	Grass	Poaceae
<i>Boscia albitrunca</i>	Shrub	Capparaceae
<i>Boscia foetida</i>	Shrub	Capparaceae
<i>Brachystelma species</i>	Forb	Asclepiadaceae
<i>Bridelia mollis</i>	Shrub	Euphorbiaceae
<i>Bulbostylis burchellii</i>	Sedge	Cyperaceae

<i>Carissa bispinosa</i>	Shrub	Apocynaceae
<i>Cenchrus ciliaris</i> L.	Grass	Poaceae
<i>Ceratotheca triloba</i>	Forb	Pedaliaceae
<i>Combretum apiculatum</i>	Tree	Combretaceae
<i>Combretum hereroense</i>	Shrub	Combretaceae
<i>Combretum zeyheri</i>	Tree	Combretaceae
<i>Commelina erecta</i>	Forb	Commelinaceae
<i>Commiphora africana</i>	Shrub	Burseraceae
<i>Commiphora pyracanthoides</i>	Shrub	Burseraceae
<i>Commiphora</i> species	Shrub	Burseraceae
<i>Crotalaria</i> species	Forb	Fabaceae
<i>Croton gratissimus</i>	Tree	Euphorbiaceae
<i>Dactyloctenium aegyptium</i>	Grass	Poaceae
<i>Dichrostachys cinerea</i>	Shrub	Mimosaceae
<i>Dicoma capensis</i>	Forb	Asteraceae
<i>Ehretia rigida</i>	Shrub	Ehretiaceae
<i>Eragrostis lehmanniana</i>	Grass	Poaceae
<i>Eragrostis pallens</i>	Grass	Poaceae
<i>Euclea undulata</i>	Shrub	Ebenaceae
<i>Evolvulus alsinoides</i>	Forb	Convolvulaceae
<i>Ficus glumosa</i>	Tree	Moraceae
<i>Gomphocarpus fruticosus</i>	Shrub	Asclepiadaceae
<i>Grewia flava</i>	Shrub	Tiliaceae
<i>Grewia retinervis</i>	Shrub	Tiliaceae
<i>Harpagophytum zeyheri</i>	Forb	Pedaliaceae
<i>Heteropogon contortus</i>	Grass	Poaceae
<i>Kiggelaria africana</i>	Tree	Flacourtiaceae
<i>Kyphocarpa angustifolia</i>	Forb	Amaranthaceae
<i>Lannea discolor</i>	Tree	Anacardiaceae
<i>Leucas capensis</i>	Forb	Lamiaceae
<i>Lotononis</i> species	Forb	Fabaceae
<i>Melhania forbesii</i>	Forb	Malvaceae
<i>Melinis repens</i>	Forb	Poaceae
<i>Ozoroa paniculosa</i>	Tree	Anacardiaceae
<i>Panicum maximum</i>	Grass	Poaceae
<i>Peltophorum africanum</i>	Tree	Caesalpiniaceae
<i>Perotis patens</i>	Grass	Poaceae
<i>Pogonarthria squarrosa</i>	Grass	Poaceae
<i>Pterocarpus rotundifolius</i>	Shrub	Fabaceae
<i>Rhigozum brevispinosum</i>	Shrub	Bignoniaceae
<i>Rhynchosia</i> species	Forb	Fabaceae
<i>Schmidtia pappophoroides</i>	Grass	Poaceae
<i>Sclerocarya birrea</i>	Tree	Anacardiaceae
<i>Senna italica</i>	Forb	Fabaceae
<i>Spirostachys africana</i>	Tree	Euphorbiaceae
<i>Sterculia rogersii</i>	Tree	Sterculiaceae
<i>Strychnos madagascariensis</i>	Shrub	Loganiaceae
<i>Tephrosia</i> species	Forb	Fabaceae

<i>Terminalia sericea</i>	Tree	Combretaceae
<i>Urochloa mosambicensis</i>	Grass	Poaceae
<i>Waltheria indica</i>	Forb	Sterculiaceae
<i>Ziziphus mucronata</i>	Shrub	Rhamnaceae

A total of 28 plant families are represented (Table 3). Graminoids are dominant (12 species, 19%).

Family	Number	Percentage
Amaranthaceae	1	2%
Anacardiaceae	3	5%
Apocynaceae	1	2%
Asclepiadaceae	2	3%
Asteraceae	1	2%
Bignoniaceae	1	2%
Burseraceae	3	5%
Capparaceae	2	3%
Caesalpiniaceae	1	2%
Combretaceae	4	6%
Commelinaceae	1	2%
Convolvulaceae	1	2%
Cyperaceae	1	2%
Ebenaceae	1	2%
Ehretiaceae	1	2%
Euphorbiaceae	3	5%
Fabaceae	6	9%
Flacourtiaceae	1	2%
Lamiaceae	1	2%
Loganiaceae	1	2%
Malvaceae	2	3%
Mimosaceae	6	9%
Moraceae	1	2%
Pedaliaceae	2	3%
Poaceae	12	19%
Rhamnaceae	1	2%
Sterculiaceae	2	3%
Tiliaceae	2	3%

The physiognomy of the area is dominated by the woody and shrub layer (55%, 35 species), but a high number of forbs are present (17 species, 27%)

Growth Form	Number	Percentage
Forb	17	27%
Grass	11	17%
Sedge	1	2%
Shrub	18	28%
Tree	17	27%

7.2 Red Data Flora Species

SANBI records for the region indicate the presence of 4 Red Data flora species (Table 5).

Taxon	Family	Summary
<i>Barleria mackenii</i>	Acanthaceae	Least Concern
<i>Barleria rehmannii</i>	Acanthaceae	Data Deficient
<i>Euphorbia waterbergensis</i>	Euphorbiaceae	Threatened
<i>Gossypium herbaceum</i> subsp. <i>africanum</i>	Malvaceae	Least Concern

None of these species were observed during the site investigation. Seasonal and project limitations placed severe restrictions on the location and identifying of these species. No Threatened species were observed during the site investigation, but available habitat in the study area, particularly the Ridges habitat, is considered suitable for some of these species.

7.3 Protected Tree Species

A total of four protected tree species were observed within the study area (Table 6).

Taxon	English Name
<i>Acacia erioloba</i>	Camel Thorn
<i>Boscia albitrunca</i>	Shepard's Tree
<i>Combretum imberbe</i>	Leadwood
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	Marula

These species occur throughout the study area and is not restricted to a localized area. This is mainly the result of the homogeneity of the physical habitat conditions. Protected species do not have a Red Listed status, but has a legal (provincial) protected status and should be afforded consideration during the construction and operational phases of the project. In the case of unavoidable impacts on individuals of these species, permits need to be obtained by the client prior to these individuals being damaged or removed.

Species of importance that were observed during the site investigation are considered well represented in the general region outside the study area. Although the presence of these species will not influence the outcome of this particular assessment, specific recommendations will be made to protect individuals that will be affected by the proposed development.

7.4 General Faunal Diversity

The following fauna species are confirmed for the study area (please note that this list is based on local observations and results obtained from other studies and does not represent sampling within the study area exclusively and results are extrapolated for the study area).

Table 7: Fauna species for the study area			
Order	Family	Biological Name	Common Name
Phylum Arthropoda; Class Insecta			
Coleoptera	Cicindellidae	<i>Mantichora</i> species	Monster Tiger Beetle
Lepidoptera	Nymphalidae	<i>Precis hierta</i>	Yellow Pansy
		<i>Danaus chryssipus</i>	African Monarch
	Pieridae	<i>Eurema brigitta</i>	Broad-bordered Grass Yellow
		<i>Belenois aurota</i>	Brown-veined White
		<i>Catopsilla florella</i>	African Migrant
Hymenoptera	Formicidae	<i>Megaponera foetens</i>	Matebele Ant
Phylum Vertebrata; Class Osteichthyes			
Cypriniformes	Cyprinidae	<i>Labeobarbus marequensis</i>	Lowveld Large-scale Yellowfish
Siluriformes	Schilbeidae	<i>Schilbe intermedius</i>	Silver Catfish
	Clariidae	<i>Clarias gariepinus</i>	Sharptooth Catfish
Cyprinodontiformes	Cichlidae	<i>Oreochromis andersonii</i>	Threespot Tilapia
Phylum Vertebrata, Class Amphibia			
Anura	Petropedetidae	<i>Cacosternum nanum</i>	Bronze Caco
	Rhacophoridae	<i>Chiromantis xerampelina</i>	Southern Foam Nest Frog
Phylum Vertebrata; Class Reptilia			
Testudines	Testudinidae	<i>Geochelone pardalis</i>	Leopard Tortoise
Squamata	Leptotyphlopidae	<i>Leptotyphlops scutifrons</i>	Peters' Thread Snake
		<i>Python natalensis</i>	Southern African Python
	Colubridae	<i>Dispholidus typus</i>	Boomslang
		<i>Thelotornis capensis</i>	Twig Snake
	Elapidae	<i>Naja mossambica</i>	M'fezi
	Viperidae	<i>Bitis arietans</i>	Puff Adder
	Agamidae	<i>Acanthocercus atricollis</i>	Southern Tree Agama
	Lacertidae	<i>Nucras intertexta</i>	Spotted Sandveld Lizard
Varanidae	<i>Varanus albigularis</i>	Rock Monitor	
Phylum Vertebrata; Class Mammalia			
Insectivora	Soricidae	<i>Crocidura cyanea</i>	Reddish-grey Musk Shrew
Rodentia	Bathyergidae	<i>Cryptomys hottentotus</i>	Common Molerat
	Muridae	<i>Tatera leucogaster</i>	Bushveld Gerbil

		<i>Mastomys coucha</i>	Multimammate Mouse
		<i>Saccostomys campestris</i>	Pouched Mouse
	Sciuridae	<i>Xerus inauris</i>	Cape Ground Squirrel
		<i>Paraxerus cepapi</i>	Tree Squirrel
Primates	Cercopithecidae	<i>Papio ursinus</i>	Chacma Baboon
		<i>Cercopithecus aethiops</i>	Vervet Monkey
Pholidota	Manidae	<i>Manis temminckii</i>	Pangolin
Lagomorpha	Leporidae	<i>Pronolagus randensis</i>	Rock Rabbit
		<i>Lepus saxatilis</i>	Scrub Hare
Carnivora	Canidae	<i>Canis mesomelas</i>	Black-backed Jackal
	Viverridae	<i>Galerella sanguinea</i>	Slender Mongoos
		<i>Mungos mungo</i>	Banded Mongoos
		<i>Civettictis civetta</i>	African Civet
	Hyaenidae	<i>Hyaena brunnea</i>	Brown Hyaena
	Protelidae	<i>Proteles cristatus</i>	Aardwolf
	Felidae	<i>Acinonyx jubatus</i>	Cheetah
		<i>Panthera pardus</i>	Leopard
<i>Caracal caracal</i>		Caracal	
Tubulidentata	Orycteropidae	<i>Orycteropus afer</i>	Aardvark
Artiodactyla	Suidae	<i>Phacochoerus africanus</i>	Warthog
	Bovidae	<i>Tragelaphus strepsiceros</i>	Kudu
		<i>Aepyceros melampus</i>	Impala
		<i>Raphicerus campestris</i>	Steenbok
		<i>Sylvicapra grimmia</i>	Common Duiker

7.5 Red Data Fauna Species of the Study Area

The World Conservation Organisation (IUCN) has three threatened categories, namely Critically Endangered (CE), Endangered (EN) and Vulnerable (VU). Species that have been evaluated according to the IUCN criteria and do not fall into one of the threatened categories can be classified as Least Concern (LC), Near Threatened (NT) or Data Deficient (DD). Species classified as Least Concern have been evaluated and do not qualify for the Critically Endangered, Endangered, and Vulnerable or Near Threatened categories. Species that are widespread and abundant are normally included in this category. Species in **red** are known to occur in the general area.

Table 8: Red Listed fauna species for the study area				
Biological Name	Common Name	Status	Restricted Habitat	Habitat
Frogs				
<i>Pyxicephalus adspersus</i>	Giant Bullfrog	NT	seasonal, shallow grassy pans	wetland
Reptiles				
<i>Python natalensis</i>	Southern African Python	VU	open water, rocky areas	wetland & ridge
Free Roaming Mammals				
<i>Acinonyx jubatus</i>	Cheetah	VU	broad	broad
<i>Atelerix frontalis</i>	South African Hedgehog	NT	broad	broad

<i>Cloeotis percivali</i>	Short-eared Trident Bat	CR	caves for breeding	ridges
<i>Crocidura cyanea</i>	Reddish-grey Musk Shrew	DD	broad	broad
<i>Crocidura hirta</i>	Lesser Red Musk Shrew	DD	broad	broad
<i>Elephantulus brachyrhynchus</i>	Short-snouted Elephant-shrew	DD	heavy grass cover	broad
<i>Elephantulus intufi</i>	Bushveld Elephant-shrew	DD	sparse cover, sandy soils	broad
<i>Hyaena brunnea</i>	Brown Hyaena	NT	broad	broad
<i>Laephotis botswanae</i>	Botswana Long-eared Bat	VU	unknown breeding, outcrops	ridges
<i>Lemniscomys rosalia</i>	Single-striped Mouse	DD	heavy grass cover	broad
<i>Leptailurus serval</i>	Serval	NT	moist savanna, tall grass	wetland
<i>Manis temminckii</i>	Pangolin	VU	woody savanna, ant/termites	broad
<i>Mellivora capensis</i>	Honey Badger	NT	broad	broad
<i>Miniopterus schreibersii</i>	Schreiber's Long-fingered Bat	NT	caves for breeding	ridges
<i>Pipistrellus rusticus</i>	Rusty Bat	NT	woody savanna, large trees	broad
<i>Poecilogale albinucha</i>	African Weasel	DD	broad	broad
<i>Pronolagus randensis</i>	Jameson's Red Rock Rabbit	LC	Rocky outcrops	broad
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	NT	caves for breeding	ridges
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	NT	caves for breeding	ridges
<i>Rhinolophus hildebrandtii</i>	Hildebrandt's Horseshoe Bat	NT	caves for breeding	ridges
<i>Suncus lixus</i>	Greater Dwarf Shrew	DD	broad	broad
<i>Tatera leucogaster</i>	Bushveld Gerbil	DD	broad	broad

Sensitive habitat types (ridges and riparian habitat types) are particularly suitable for the presence of Red Listed fauna species. Ridges contain a multitude of micro habitat that is suitable for the presence of Red Listed fauna species and these habitat types that could potentially be affected by the proposed development will highly likely contain some of these species. Jameson's Red Rock Rabbit was observed during the site investigation. A high faunal sensitivity is therefore attributed to this habitat type. Similarly, riparian zones, be it perennial rivers, non-perennial streams or seasonal pans are considered suitable for the presence of sensitive fauna species.

Red Listed fauna species that are likely to occur in the study area are strongly associated with either of these habitat types and cannot exist without the habitat provided by these ecological units. If Data Deficient Red Listed fauna species are excluded from the assessment, most Red Listed fauna species associated with either wetlands or ridges. Only the Cheetah, Reddish-grey Musk Shrew, Brown Hyena, Pangolin and Bushveld Gerbil are not specifically linked to restricted habitat such as wetlands or ridges and are found in natural savanna habitat.



8 ECOLOGICAL HABITAT TYPES OF THE STUDY AREA

The approximate distribution of identified habitat types is illustrated in Figure 3. Figure 4 illustrates the ecological sensitivity of habitat types.

8.1 Natural Regional Habitat

The natural terrestrial habitat of the study area is described as a mosaic of numerous habitat variations which is repeated throughout the study area. In spite of the pristine appearance of the general vegetation of the study area, it is considered to be moderately degraded as a result of high grazing pressure. The over utilised state of the herbaceous layer and encroached state of the woody layer in some places contribute to an estimated moderate floristic status.

Two significant variations are present in the region, namely a broadleaf and *Acacia* variations. The broadleaf variation prevails on deeper, sandy soils that are poor in nutrients as a result of leaching; resulting in sour veld conditions that are characterized by the profusion of tree species such as *Combretum zeyheri*, *C. hereroense*, *Commiphora africana*, *C. mollis*, *Terminalia sericea* and *Boscia albitrunca*. This variation is also frequently situated high on the gently undulating slopes.

In contrast, areas that are characterised by soils with slightly higher clay content are dominated by *Acacia* species. This variation is frequently encountered in bottomland situations. The availability of nutrients in the soil results in more palatable grass species and typically a fine-leaf (*Acacia*) vegetation type. Due to the prevalence of palatable species, higher accessibility and proximity to water, these variations are frequently over-utilized by game and cattle, leading to a depletion of the grass stratum and an increase in the density of the woody layer, typically of the 1.0 to 3.0m class (shrubs and low trees).

Acacia species dominate, including *A. tortilis*, *A. erubescens*, *A. mellifera*, together with *Dichrostachys cinerea* and several *Grewia* species. The herbaceous layer is relative poor in species, providing evidence of the over grazed state of the vegetation. The grass sward is dominated by a few species, including *Urochloa mosambicensis*, *Cenchrus ciliaris*, *Digitaria eriantha*, *Eragrostis pallens*, *Enneapogon scoparius*, *Eragrostis lehmanniana*, *Panicum maximum*, *Pogonarthria squarrosa* and *Schmidtia pappophoroides*.

The likelihood of encountering Red Data species within this area is regarded medium-low. A medium ecological sensitivity is attributed to this habitat type. Protected tree species are present within this habitat type. This habitat type is attributed a moderate ecological sensitivity.



Adverse impacts resulting from the proposed development in this habitat type include:

- Loss of biodiversity - Threatened species and associated habitat;
- Loss of biodiversity – Protected tree species; and
- Habitat degradation – pristine/ sensitive habitat type.

8.2 Non-Perennial Streams and Seasonal Dam

Non-perennial streams and the seasonal dam are situated east north-east from the proposed reservoir site and will potentially be affected by some of the proposed alignments. Large trees, particularly *Spirostachys africana*, are well represented on the fringes of the non-perennial stream. The remainder of the species composition is remarkably similar to surrounding woodland, providing an indication of the fact that non-perennial streams contains a higher incidence of water only in events of exceptionally high rainfall.

The seasonal dam comprises atypical vegetation, mainly as a result of the prolonged moist conditions of the soils. Environmental attributes do not indicate any variation in driving forces behind vegetation development, but the presence of a high incidence of *Spirostachys africana* is considered a characteristic feature of this variation. Similar species composition, particularly the presence of *Spirostachys africana* has been noted in other areas where seasonal pans and depressions are featured. The association of this species with moist soil conditions is marginal, indicated by the similarity of the species composition of surrounding woodland to these areas.

The likelihood of encountering Red Data species, particularly fauna species, within this area is regarded medium-high. A high ecological sensitivity is attributed to this habitat type.

Adverse impacts resulting from the proposed development in this habitat type include:

- Loss of biodiversity - Threatened species and associated habitat;
- Loss of biodiversity – Protected tree species; and
- Habitat degradation – pristine/ sensitive habitat type.

8.3 Rocky Outcrop

This vegetation type is extremely localised and is represented by a single outcrop present in the eastern portion of the proposed line. Vegetation of ridges and outcrops that could potentially be affected by the proposed development is regarded as moderately degraded but nonetheless highly sensitive as it is atypical to the surrounding environment. The dominance of the woody layer is the major physiognomic attribute and a moderate grass and forb diversity is noted. Common environmental parameters include surface rockiness (exceeding 75%), shallow top soils and high slopes (>5%).



Riparian habitat, be it perennial rivers, non-perennial streams or seasonal pans, are considered suitable habitat for sensitive fauna species. Red Listed fauna species that are likely to occur in the study area are strongly associated with these habitat types and cannot exist without the habitat provided by these ecological units. If Data Deficient (DD) Red Listed fauna species are excluded from the assessment, most Red Listed fauna species associated with either wetlands or ridges and outcrops.

Grazing pressure generally determine the floristic status of this habitat type. High slopes and areas of high rockiness are generally less accessible for cattle and are subsequently subjected to lower grazing pressure than surrounding areas where the vegetation is also more palatable. Hence, vegetation that characterises these parts is more pristine, characterised by a moderately diverse and well developed herbaceous layer.

The likelihood of encountering Red Data species within these areas are regarded medium-high. Jameson's Red Rock Rabbit was observed during the site investigation. A high ecological sensitivity is therefore attributed to this habitat.

Adverse impacts resulting from the proposed development in this habitat type include:

- Loss of biodiversity - Threatened species and associated habitat;
- Loss of biodiversity – Protected tree species; and
- Habitat degradation – pristine/ sensitive habitat type.

8.4 Degraded Woodland

This habitat type represents an old borrow pit area. It is assumed that the gravely soil that occur in the area was utilised for road construction purposes in the past. In some instances it is evident that large trees were avoided during the excavation process, but shrubs and the lower stratum were completely decimated. The seral stage of the vegetation that characterises the area is thus representative of the regional vegetation in terms of the woody layer. The shrub and herbaceous layer in these areas are low in density and poor in species diversity, characteristic of areas where topsoil has been removed. Vegetation in other areas was completely destroyed, similar to areas where agricultural practices took place. The woody layer in these particular areas has recovered to a fairly natural state, but the herbaceous layer is indicative of the degraded status with bare areas.

The floristic status of this community is considered low as a result of the secondary vegetation that characterises this community.

The likelihood of encountering Red Data species within these areas are regarded low. Due to the secondary nature, the ecological sensitivity of this habitat is considered low.

No adverse impacts resulting from the proposed development is expected to occur in this habitat type.

8.5 Transformed Habitat

This habitat type represents areas where infrastructure has replaced all natural or semi-natural habitats. No natural elements remain and a low ecological status is attributed to these areas.

The likelihood of encountering Red Data species within these areas are regarded low. Due to the transformed nature, the ecological sensitivity of this habitat is considered low.

No adverse impacts resulting from the proposed development is expected to occur in this habitat type.

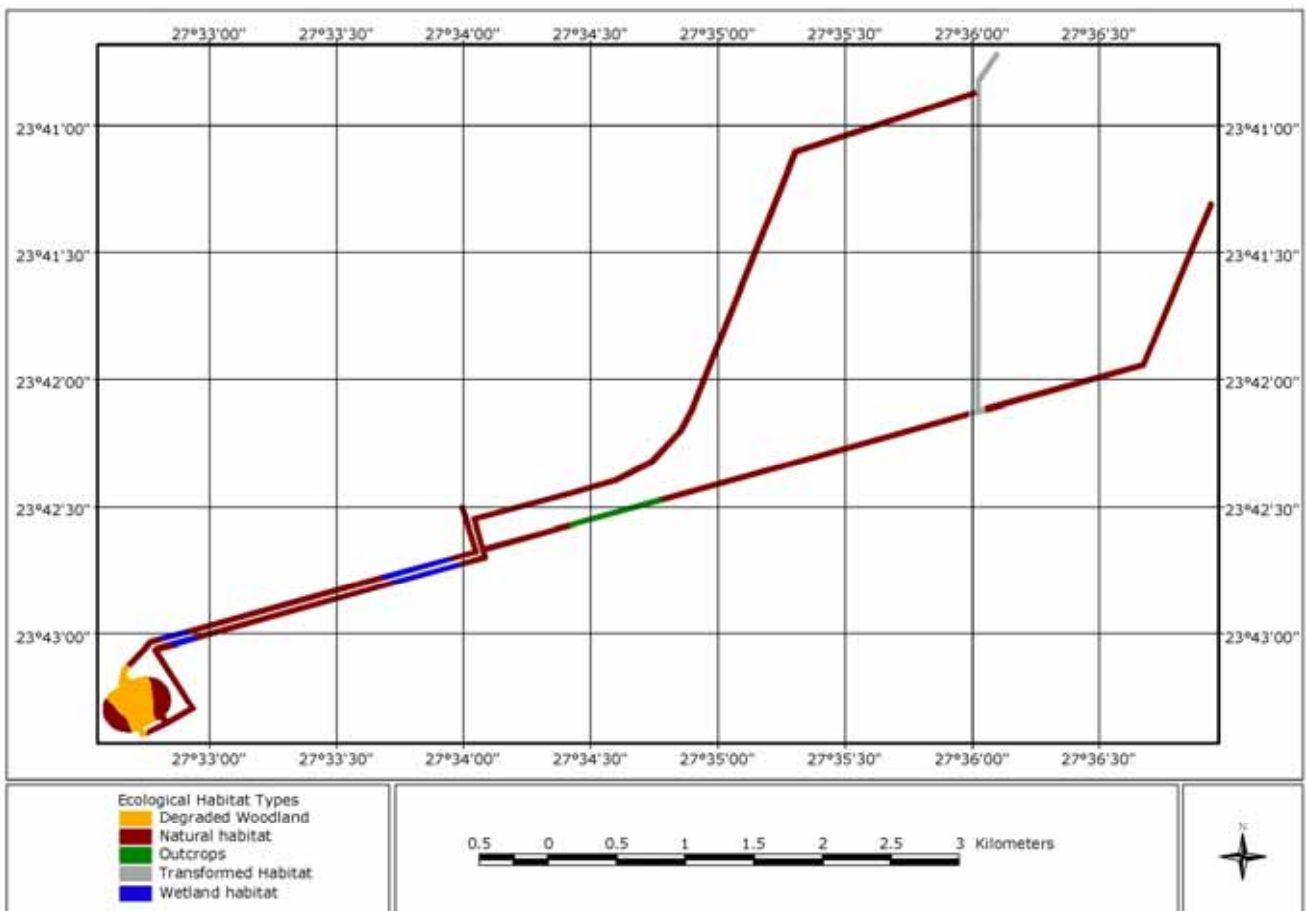


Figure 3: Habitat variations in the study area

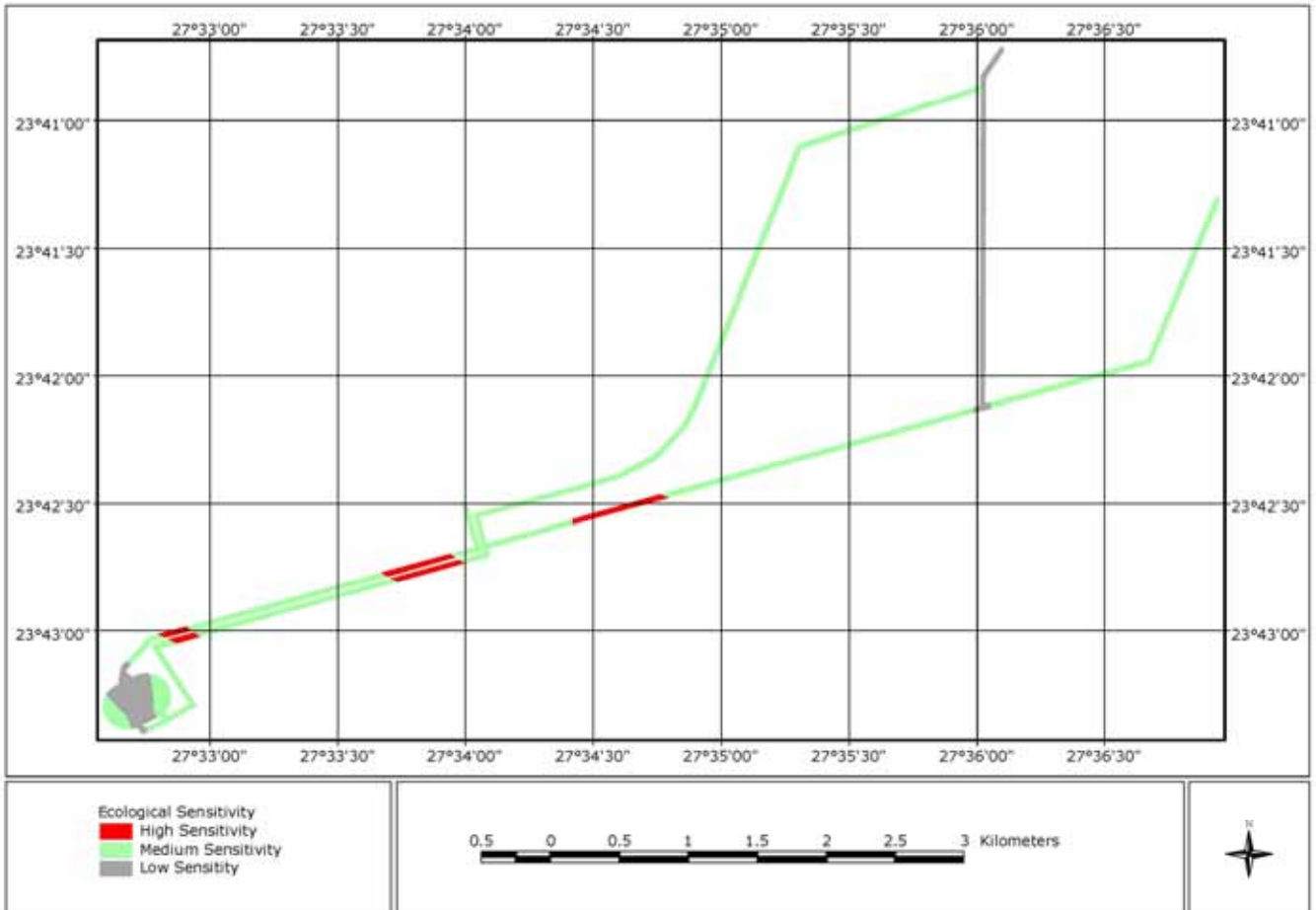


Figure 4: Ecological Sensitivity of habitat variations in the study area

9 IMPACT ASSESSMENT

9.1 Methodology

Issues are assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected and how it will be affected;
- The physical **extent**, wherein it is indicated whether:
 - * 1 - the impact will be limited to the site;
 - * 2 - the impact will be limited to the local area;
 - * 3 - the impact will be limited to the region;
 - * 4 - the impact will be national; or
 - * 5 - the impact will be international;

- The **duration**, wherein it is indicated whether the lifetime of the impact will be:
 - * 1 - of a very short duration (0–1 years);
 - * 2 - of a short duration (2-5 years);
 - * 3 - medium-term (5–15 years);
 - * 4 - long term (> 15 years); or
 - * 5 - permanent;
- The **magnitude of impact on ecological processes**, quantified on a scale from 0-10, where a score is assigned:
 - * 0 - small and will have no effect on the environment;
 - * 2 - minor and will not result in an impact on processes;
 - * 4 - low and will cause a slight impact on processes;
 - * 6 - moderate and will result in processes continuing but in a modified way;
 - * 8 - high (processes are altered to the extent that they temporarily cease); or
 - * 10 - very high and results in complete destruction of patterns and permanent cessation of processes;
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:
 - * 1 - very improbable (probably will not happen);
 - * 2 - improbable (some possibility, but low likelihood);
 - * 3 - probable (distinct possibility);
 - * 4 - highly probable (most likely); or
 - * 5 - definite (impact will occur regardless of any prevention measures);
- the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- the **status**, which is described as either positive, negative or neutral;
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the *degree* to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

$S = (E+D+M)*P$; where

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The **significance weightings** for each potential impact are as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),



- **31-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

9.2 Anticipated Impacts

The following impacts/ issues were identified that could affect the ecology of the study area adversely:

- Loss of Biodiversity - Destruction of threatened species and habitat;
- Loss of Biodiversity - Destruction of Protected Tree Species;
- Habitat Degradation - Destruction of pristine/ sensitive habitat types; and
- Loss of Biodiversity - Changes to the local/ regional biodiversity.

9.3 Nature of Impacts

No impacts were identified that could lead to a beneficial impact on the biological environment of the study area since the proposed development is largely destructive. The following impacts were identified as being deleterious to the environment.

9.3.1 Loss of Biodiversity - Destruction of Threatened Species & Habitat

The loss of threatened species or areas that are suitable for these species is a significant impact on the biodiversity of a region. Threatened species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers as there are generally few of them, but they are extremely important in terms of the biodiversity of an area and high ecological value is placed on the presence of such species in an area.

Threatened species are particularly sensitive to changes in their environment, having adapted to specific habitat requirements. Habitat changes, mostly a result of human interferences and activities, are one of the greatest reasons for these species having a threatened status.

Surface impacts resulting from the proposed activity will lead to changes that will affect these habitats adversely. Effects of this impact will be permanent and recovery or mitigation is generally not perceived as possible.

The likelihood of Red Data flora or fauna species occurring within the study area is regarded moderate-low; hence the likelihood of this impact occurring is regarded low. The highest probability is associated with atypical habitat types such as rocky outcrops and riparian environments. The size of the area that will be affected is furthermore small and it is regarded possible that, in the event that a community of Threatened species are affected by the development, the affected area might be repopulated by the species within



a period of time. The most effective manner in which this impact can be prevented is to avoid areas where Red Data species might occur, i.e. rocky outcrops and riparian environments.

9.3.2 Loss of Biodiversity - Destruction of Protected Tree Species

The National Forests Act, 1998 (Act No 84 of 1998) list certain tree species as being protected. The objective of this list is to provide strict protection to certain species while others require control of harvesting. In terms of the National Forests Act of 1998, these tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the Department of Water Affairs and Forestry (or a delegated authority).

The likelihood of this impact happening is regarded definite, particularly in the natural regional vegetation; numerous protected tree species occur in the study area. It should be noted that all of these species occur extensively in the greater region and the populations are not under any threat as a result of the proposed development. Obtaining relevant permits are nonetheless required and transplanting of some individuals could be considered.

9.3.3 Habitat Degradation - Destruction of Sensitive & Pristine Habitat Types

Sensitive habitat types include the rocky outcrop and the dam/ non-perennial stream. 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 attributed to the floristic communities and faunal assemblages of these areas as they contribute significantly to the biodiversity of a region. Furthermore, these habitat types are generally isolated and are linear in nature. Impact that disrupts this continuous linear nature result in fragmentation and isolation of existing ecological units, affecting the migration potential of some fauna species adversely, pollinator species in particular.

While crossing of the stream is inevitable, it is possible to avoid impacting the dam and the rocky outcrop. The line can be moved to the south in order to avoid the dam and another alternative will be recommended in order to avoid impacts on the rocky outcrop.

9.3.4 Loss of Biodiversity - Changes in Local/ Regional Biodiversity

The transformation of pristine grassland and woodland habitat during the construction process will inevitably result in the establishment of habitat types that are not considered representative of the region. Surrounding areas are frequently invaded by shrubs, woody and weedy pioneer species, affecting the local biodiversity adversely.



Avoiding impacts in sensitive environments will curb this impact to a large extent, while the effective control of invasive species during maintenance operations in the servitude are regarded sufficient to prevent residual impacts in the natural regional habitat type. This impact should be closely monitored by means of an environmental monitoring programme.

9.4 Summary

An assessment of the significance of impacts on the biological environment is compiled only for areas where a moderate or high ecological sensitivity was attributed. These areas include:

- Natural Regional Habitat Type;
- Non-Perennial Stream & Dam; and
- Rocky Outcrop.

Impacts that are of relevance include:

- Loss of Biodiversity - Destruction of Threatened Species & Habitat;
- Loss of Biodiversity - Destruction of Protected Tree Species; and
- Habitat Degradation - Destruction of Pristine/ Sensitive Habitat Types.

The ecological sensitivity of the Degraded Woodland and Transformed Areas habitat types are regarded low and impacts resulting from the proposed development on the biological attributes in these parts are regarded negligent.

The significance of impacts are presented in a table format that is assessed for each of the habitat types respectively, taking cognisance of the respective adverse impacts that were described in Section 9.3.

9.4.1 Natural Regional Habitat

a) Loss of Biodiversity - Destruction of Threatened Species & Habitat

<i>Nature of Impact: Loss of biodiversity - Threatened species and associated habitat</i>		
	<i>Without mitigation</i>	<i>With mitigation</i>
<i>Extent</i>	1	1
<i>Duration</i>	3	2
<i>Magnitude</i>	8	4
<i>Probability</i>	3	1
<i>Significance</i>	36	7
<i>Status (positive or negative)</i>	<i>Negative</i>	<i>Negative</i>
<i>Reversibility</i>	<i>None</i>	<i>None</i>
<i>Irreplaceable loss of resources?</i>	Yes	Yes
<i>Can impacts be mitigated?</i>	Yes	Yes

Mitigation: Ensure absence of RD species by means of final walkthrough, rescue operations where necessary
 Cumulative impacts: None

b) Loss of Biodiversity - Destruction of Protected Tree Species

Nature of Impact: Loss of biodiversity – Protected tree species		
	Without mitigation	With mitigation
Extent	1	1
Duration	3	3
Magnitude	4	2
Probability	5	5
Significance	40	30
Status (positive or negative)	Negative	Negative
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Obtain relevant permits for removal, transplant individuals to adjacent areas where possible		
Cumulative impacts: None		

c) Habitat Degradation - Destruction of Pristine/ Sensitive Habitat Types

Nature of Impact: Habitat degradation – pristine/ sensitive habitat type		
	Without mitigation	With mitigation
Extent	1	1
Duration	4	2
Magnitude	2	0
Probability	3	2
Significance	21	6
Status (positive or negative)	Negative	Negative
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Generic mitigation measures, removal and control of invasive species, implementation of monitoring programme		
Cumulative impacts: None		

9.4.2 Non-Perennial Streams and Seasonal Dam

a) Loss of Biodiversity - Destruction of Threatened Species & Habitat

Nature of Impact: Loss of biodiversity - Threatened species and associated habitat		
	Without mitigation	With mitigation
Extent	1	1
Duration	3	1
Magnitude	8	4

Probability	3	1
Significance	36	6
Status (positive or negative)	Negative	Negative
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Move causing activity south of the dam, consider alternative alignment		
Cumulative impacts: None		

b) Loss of Biodiversity - Destruction of Protected Tree Species

Nature of Impact: Loss of biodiversity – Protected tree species		
	Without mitigation	With mitigation
Extent	1	1
Duration	3	3
Magnitude	3	2
Probability	3	3
Significance	21	18
Status (positive or negative)	Negative	Negative
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Move causing activity south of the dam, consider alternative alignment		
Cumulative impacts: None		

c) Habitat Degradation - Destruction of Pristine/ Sensitive Habitat Types

Nature of Impact: Habitat degradation – pristine/ sensitive habitat type		
	Without mitigation	With mitigation
Extent	3	1
Duration	3	3
Magnitude	4	2
Probability	3	2
Significance	30	12
Status (positive or negative)	Negative	Negative
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Move causing activity south of the dam, consider alternative alignment, generic mitigation measures, removal and control of invasive species, implementation of monitoring programme		
Cumulative impacts: None		

9.4.3 Rocky Outcrop

a) Loss of Biodiversity - Destruction of Threatened Species & Habitat

Nature of Impact: Loss of biodiversity - Threatened species and associated habitat		
	Without mitigation	With mitigation
<i>Extent</i>	1	1
<i>Duration</i>	3	1
<i>Magnitude</i>	8	2
<i>Probability</i>	3	1
Significance	36	4
<i>Status (positive or negative)</i>	<i>Negative</i>	<i>Negative</i>
<i>Reversibility</i>	<i>None</i>	<i>None</i>
<i>Irreplaceable loss of resources?</i>	<i>Yes</i>	<i>Yes</i>
<i>Can impacts be mitigated?</i>	<i>Yes</i>	<i>Yes</i>
<i>Mitigation: Move causing activity south of rocky outcrop, use alternative alignment</i>		
<i>Cumulative impacts: None</i>		

b) Loss of Biodiversity - Destruction of Protected Tree Species

Nature of Impact: Loss of biodiversity – Protected tree species		
	Without mitigation	With mitigation
<i>Extent</i>	1	1
<i>Duration</i>	3	3
<i>Magnitude</i>	4	4
<i>Probability</i>	3	3
Significance	24	24
<i>Status (positive or negative)</i>	<i>Negative</i>	<i>Negative</i>
<i>Reversibility</i>	<i>None</i>	<i>None</i>
<i>Irreplaceable loss of resources?</i>	<i>Yes</i>	<i>Yes</i>
<i>Can impacts be mitigated?</i>	<i>Yes</i>	<i>Yes</i>
<i>Mitigation: Move causing activity south of rocky outcrop, use alternative alignment</i>		
<i>Cumulative impacts: None</i>		

c) Habitat Degradation - Destruction of Pristine/ Sensitive Habitat Types

Nature of Impact: Habitat degradation – pristine/ sensitive habitat type		
	Without mitigation	With mitigation
<i>Extent</i>	1	1
<i>Duration</i>	5	1
<i>Magnitude</i>	6	0
<i>Probability</i>	5	1
Significance	60	2
<i>Status (positive or negative)</i>	<i>Negative</i>	<i>Negative</i>
<i>Reversibility</i>	<i>None</i>	<i>None</i>
<i>Irreplaceable loss of resources?</i>	<i>Yes</i>	<i>Yes</i>

<i>Can impacts be mitigated?</i>	<i>Yes</i>	<i>Yes</i>
<i>Mitigation: Move causing activity south of rocky outcrop, use alternative alignment</i>		
<i>Cumulative impacts: None</i>		

9.5 Alignment Recommendations

The recommended alignments are illustrated in Figure 5. Realignments of the proposed line variants are presented in Figure 6, taking cognisance of buffer zones.

The proposed pipeline runs in an east-west direction while the non-perennial streams flow in a north-south direction. Avoiding the non-perennial streams to the east of the proposed reservoir is therefore not possible and relevant mitigation measures will be recommended for implementation. By moving the pipeline to the south it will however be possible to avoid impacts on the seasonal dam/ pan. Care must be taken to also implement a 30m buffer zone around the feature and avoid peripheral impacts on the structure and composition of vegetation on the fringe of the dam. Alternative 1 is regarded the most suited option in this regard, but will still influence the buffer zone around the seasonal dam. It is therefore recommended to move the pipeline 30m to the south. Moving the line that will connect the reservoir with Medupi will also be required.

The location of the rocky outcrop renders Alternatives 2 and 3 as 'No-Go' options. Potential impacts on this environmental feature are unacceptable and only Alternative 1 is available as a viable option with lower environmental impact. Although not considered a suitable solution, Alternatives 2 or 3 could potentially be moved considerably to the south in order to avoid any impact on the rocky outcrop (including a suitable buffer zone of approximately 50m). This will imply moving the pipeline approximately 100m to the south.

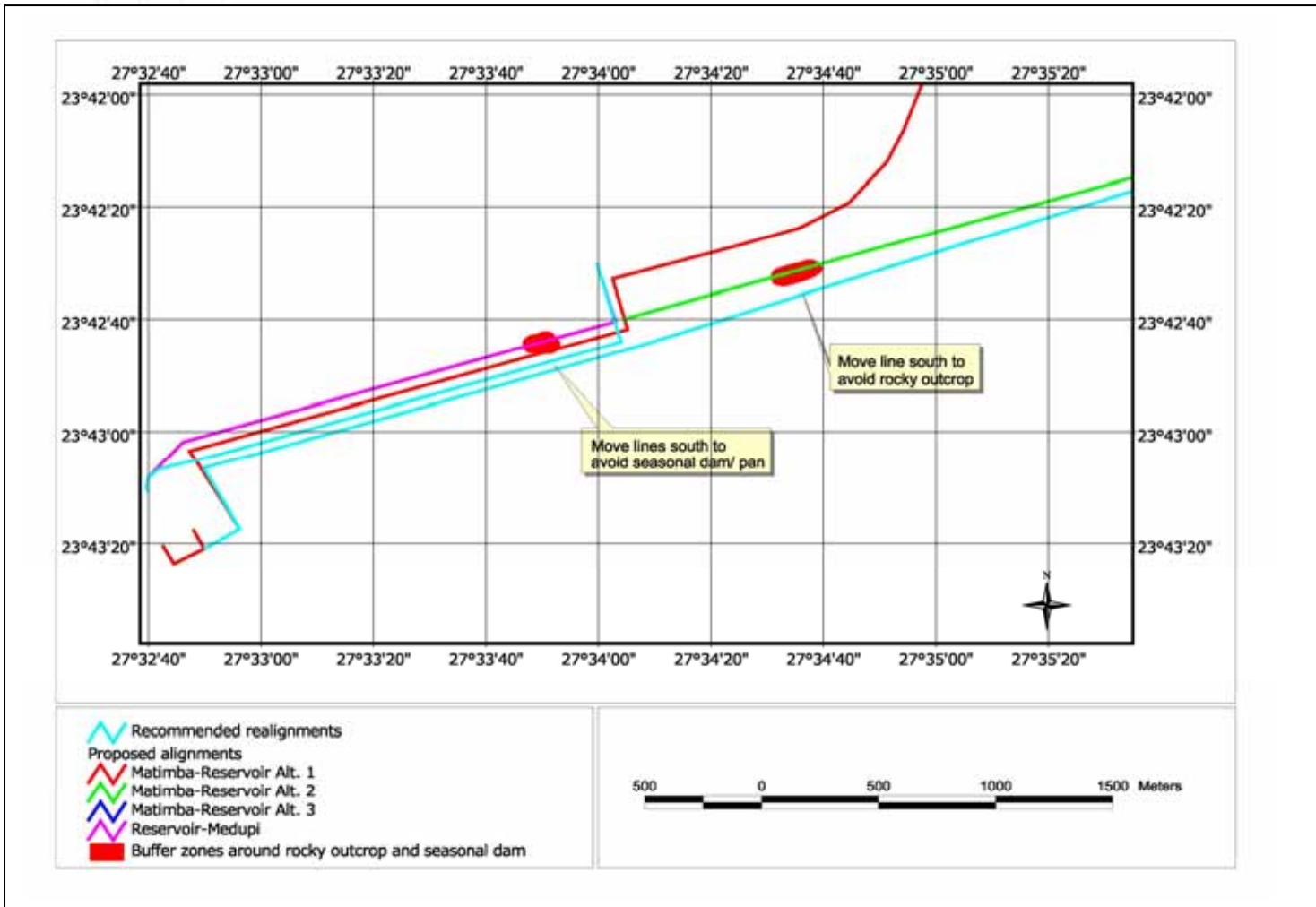


Figure 5: Recommended realignments of the proposed line variants

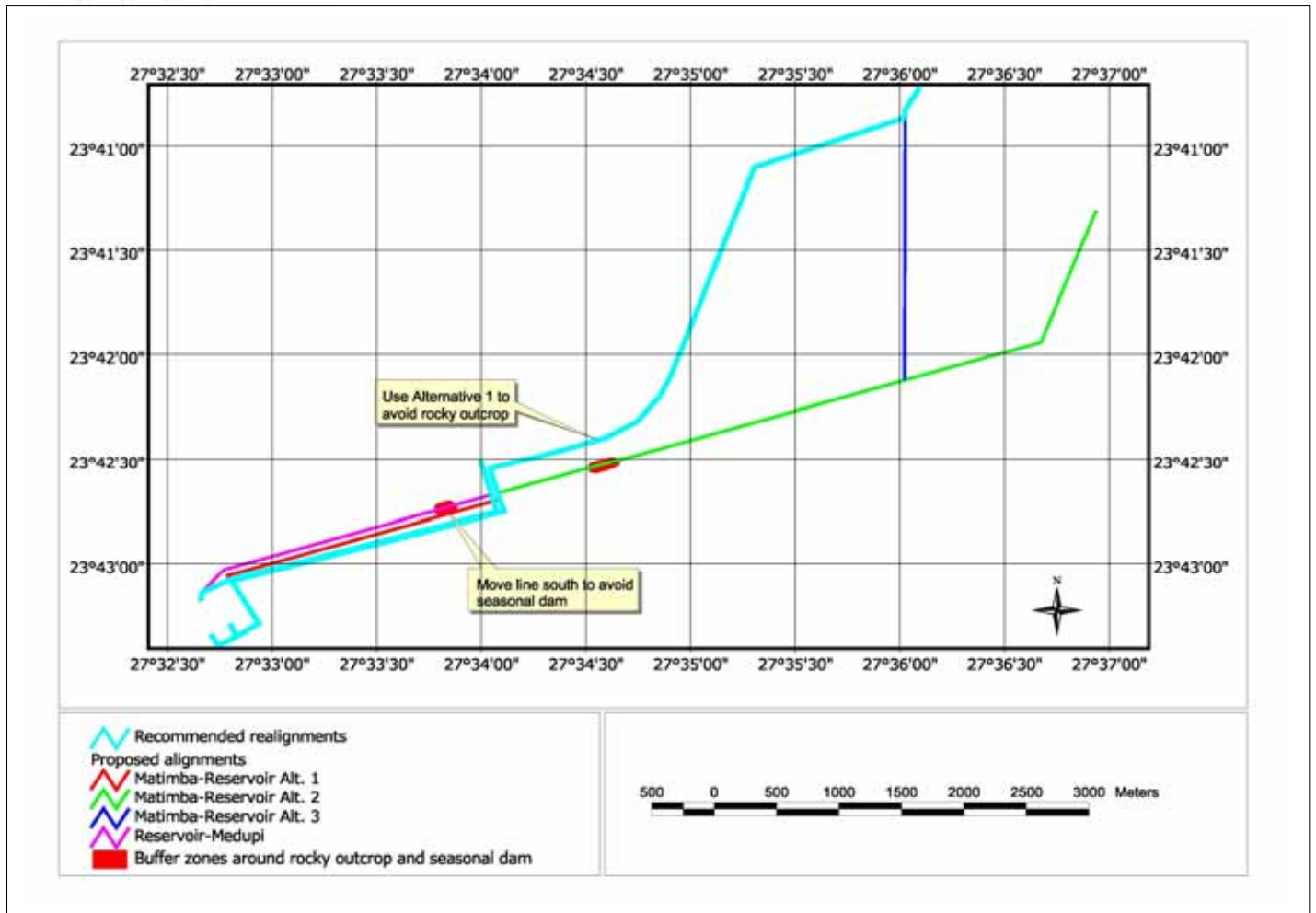
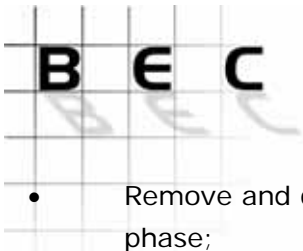


Figure 6: Recommended line with relevant realignments

9.6 Mitigation Measures

Mitigation of certain impacts are regarded possible and will control significant impacts to a large extent. However, expected impacts within the area of the rocky outcrop are regarded unacceptable and the use of Alternative 1 is recommended (see section 9.4). The following mitigation measures are recommended:

- Ensure absence of RD species by means of final walkthrough during the growing season (November – March);
- Identify and mark all protected tree species during the final walkthrough;
- Obtain relevant permits for removal or cutting of protected tree species;
- Transplant selected trees to adjacent areas where possible;
- Implement rescue operation in areas where Red Data species / Protected trees are present;



- Remove and control the occurrence of invasive species during the operational phase;
- Implement a monitoring programme which aims to assess any significant and long-term impacts on the status of biological attributes, particularly in sensitive areas such as the drainage line and seasonal dam; and
- Move causing activity south of the dam, consider alternative alignment

10 MANAGEMENT PLAN

OBJECTIVE: To prevent permanent damage and/or significant impacts to the general environment and sensitive biological and biophysical attributes that might occur in the area. Towards this objective the use of Alternative 1 was recommended together with relevant realignments in order to avoid impacts to the seasonal dam located east of the proposed reservoir.

Project component/s	Planning, construction, rehabilitation, maintenance
Potential Impact	Irreparable damage to sensitive environmental attributes, drainage line, seasonal dam causing decline in environmental status
Activity/risk source	Excavation of line, access roads, maintenance roads, maintenance activities
Mitigation: Target/Objective	Realign pipeline in order to avoid impacting on seasonal dam (planning phase), limit construction activities outside of sensitive sites. Implement monitoring programme at onset of construction phase(weekly inspections) as well as subsequent to construction phase (seasonal)

Mitigation: Action/control	Responsibility	Timeframe
Realignment of recommended pipeline routes	Eskom, Environmental Consultant	Planning phase
Appoint Ecological Control Officer	Eskom	Planning phase
Compile a monitoring programme	ECO	Planning phase
Conduct a final walkthrough in order to: <ul style="list-style-type: none"> • Identify and mark protected tree species; • Locate any possible Red Data species 	Ecologist	Planning phase (summer survey)
Relocate relevant species	Contractor	Pre construction
Implement monitoring programme	Ecologist, ECO	Construction
Ensure compliance to EMP	ECO	Construction phase
Compile rehabilitation programme	Ecologist, ECO	Construction phase
Implement rehabilitation programme	ECO, contractor	Rehabilitation phase
Implement seasonal monitoring programme	Ecologist, ECO	Post construction
Monitor maintenance operations	Ecologist	Maintenance phase



Performance Indicator	Minimal impact in sensitive areas, successful recovery of vegetation in impacted areas post construction phase
Monitoring	Final walkthrough – pre construction Environmental awareness during construction – ECO responsibility Monitoring programme during construction and rehabilitation (weekly), report to Eskom, feedback to Contractor Monitoring programme- post construction, seasonal, report to Eskom

11 ALTERNATIVE ALIGNMENT

Subsequent to the completion of this basic biodiversity impact assessment Eskom has indicated a Alternative 1 is no longer considered technically feasible. A revised alignment taking the preliminary results of this biodiversity assessment into consideration has been proposed. Although not assessed as a separate alternative within the impact evaluation (Section 9), the revised alignment/s is/are regarded suitable for the proposed activity. The revised alternative is furthermore not expected to result in unacceptable or higher levels of impacts on the biodiversity and ecology of the area than the recommended alignment (Figure 6) since it will not impact on the sensitive rocky outcrop and seasonal pan areas. Also, a section of the pipeline will utilise the existing conveyor section, which is 92m in width and which will be able to accommodate the planned pipeline without additional impacts on surrounding woodland. Eskom have furthermore advised that where the pipelines traverse the farm Kuipersbult, this section of the pipeline/s can be routed to avoid any sensitive areas.

This realignment is indicated in Figure 7. Although this alignment is not regarded the preferred alignment in this ecological assessment (compare Figure 6), impacts that are likely to occur from this alignment is not regarded higher than for the original recommended alignment. The two revised alignments are therefore considered acceptable from an ecological perspective, and are supported as they take cognisance of the initial recommendations of this report in terms of the avoidance of areas of identified sensitivity. No additional mitigation measures are required in addition to those already specified in this assessment report.

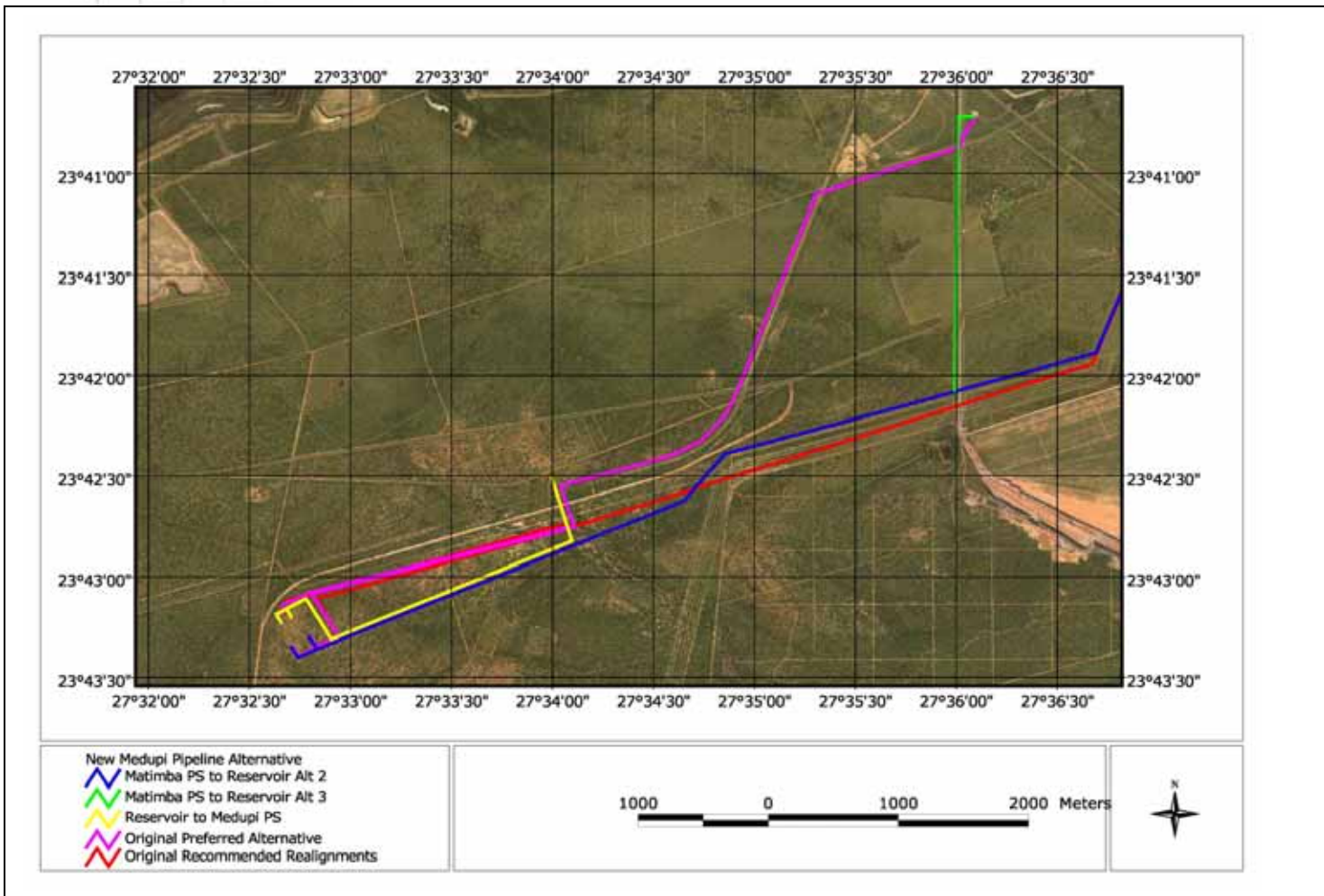


Figure 7: Alternative line variant (map supplied by MetroGIS)