PROPOSED UPGRADE OF NATIONAL ROUTE R574

(KM 0,0 to KM 38,8)

BIODIVERSITY ASSESSMENT

Terrestrial Ecological Assessment (Fauna and Flora) and Aquatic (Wetland) Ecological Assessment for the Proposed Upgrade of the Existing National Route R574 from Groblersdal (KM 0,0) to Morwaneng (KM 38,8) situated in the Elias Motsoaledi Local Municipality of the Sekhukhune District Municipality, Limpopo Province

Compiled by

FLORI SCIENTIFIC SERVICES

JANUARY 2022

PROJECT INFORMATION

PROJECT TITLE: Upgrade National Route R574

STUDY NAME: Biodiversity Impact Assessment

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EXECUTIVE SUMMARY

Background

The South African National Roads Agency Soc Limited (SANRAL) is in the process of planning the proposed upgrade of the National Route R574 from Groblersdal (Km 0,0) to Morwaneng (Km 38,8). The proposed project includes the upgrade of the existing road surface; general widening of the road shoulder; and widening of the road surface in certain areas. The project is situated within the Elias Motsoaledi Local Municipality of the Sekhukhune District Municipality, Limpopo Province.

Chameleon Environmental (Pty) Ltd was appointed as the lead independent environmental assessment practitioner (EAP) for the project. Flori Scientific Services cc was appointed to conduct a biodiversity assessment for the project, which includes a terrestrial ecological (fauna and flora) assessment and an aquatic (wetland) assessment.

Site investigations were conducted on 18 & 19 October 2021.

Location of the study area

The Study Site is the existing National Route R574 from the T-Intersection with the R33 (Km 0,0), which is just east of the Town of Groblersdal, up until the end of the R574 in Morwaneng at the T-Intersction with the R579 (Km 38,8). The length of the study site is 38,8km. The study site (R579) is situated within the Elias Motsoaledi Local Municipality of the Sekhukhune District Municipality, Limpopo Province.

The study site includes the actual road, road shoulder and road reserve. The road reserve is an area usually less than 50m in width each side of the edge of the asphalt.

TERRESTRIAL ECOLOGY

Vegetation

The eastern and middle sections of the study site (about 2/3) are within the Central Bushveld Bioregion of the Savanna Biome and the eastern section (about 1/3) is in the Mesic Highveld Grassalnd Bioregion of the Grassland Biome. Within these bioregoins the study site (R574) is within the original extent of the veldtypes of Central Sandy Bushveld, Loskop Thornveld and Rand Highveld Grassland.

The vegetation of the study site is mostly transformed, altered and highly degraded. The vegetation present in the study site is within the road reserve and consists mainly of grasses and a few herbaceous plants. The road reserve is routinely cut and burnt thereby altering and degrading the natural vegetation. Most of the study site runs through villages and townships where the natural environment has been totally transformed and highly degraded.

There are no areas of pristine vegetation present within the study site itself. The areas of good vegetation are confined to patches and are typically not within the study site itself, but in nearby open vacant fields, or on nearby hills. Even at the river / stream crossings the vegetation is badly degraded.

Most of the watercourses in the study area are small intermittent (seasonal) streams or seasonal drainage lines with no naturally occurring riparian vegetation

Protected Trees

Only one protected tree, namely the Marula (*Sclerocarya birrea*), was found to be present within the study site. There are a few scattered trees along the road in the road reserve.

Fauna

No red data listed (RDL) faunal species or species of conservation concern (SCC) where observed in the study area or immediate surroundings during site investigations. Due to the transformed and altered habitat of the entire study site and much of the close by areas that are urbanised, it is unlikely that any of these species will be found permanently within the study area.

No large- or medium-sized mammals were observed during field investigations. A few small burrows were found occasional within the road reserve, which appear to be used by small field mice and other rodents such as rock mouse (*Aethomys namaquensis*), striped mouse (*Rhabdomys pumilio*), multimate mouse (*Mastomus natalensis*) and bushveld gerbil (*Tatera leucogaster*).

In open, less populated areas outside of the study area some evidence was found of scrub hare (*Lepus sacatilis*) and possibly yellow mongoose (*Cynictis penicillata*).

It is impossible to conduct an accurate survey of faunal species and their presence during limited site investigations. Therefore, standard and acceptable probability assessments were conducted for mammals. The Faunal Red Data Sensitivity Index Score (RDSIS) assessment delivered a rating for the study area of 'Low / Medium', showing the low potential / likelihood for the occurrence of RDL and/or SCC in the study area.

AQUATIC ECOLOGY

Watercourses in the study area

There are eight main watercourses (rivers or streams) that the study site (R574) crosses over. Starting from KM 0,0, near Groblersdal these are: Bloed, Rulokwane, Puleng, Puleng tributary, Ga-Makatle, Gemsbokspruit tributary, Gemsbokspruit and Malekani.

There are no significant or independent wetlands in the study site.

Drainage areas

The table below is a summary of the drainage areas and catchment regions in which the study site is situated.

Level	Category
Primary Drainage Area (PDA)	B
Quaternary Drainage Area (QDA)	B32F, B32J, B51A, B51B
Water Management Area (WMA) – Old	Olifants
Water Management Area (WMA) – New	Olifants (WMA 2)
Sub-Water Management Area	Middle Olifants
Catchment Management Agency (CMA)	Olifants (CMA 2)
Wetland Vegetation Ecoregion	Central Bushveld & Mesic Highveld Grassland
RAMSAR Site	No
River FEPA	Yes (Bloed, Puleng, Gemsbok)
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory	No
National Strategic Water Source Area (SWSA)	No
Provincial Important Water Source Area (WSA)	No

Priority areas

The study site (R574) runs along the northern boundary of the Mahtrombi Nature Reserve in the east near Morwaneng. The Kwaggavoetpad Nature Reserve and the Mesic Grasslands NPAES are both south of the study site. The study site (road) crosses over three river FEPAs, namely Bloed, Puleng and Gemsbok. The site does not infringe on any other priority areas.

Priority areas include formal and informal protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; national fresh water ecosystem priority areas (NFEPAs) and national protected areas expansion strategy (NPAES) focus areas.

Sensitivity analyses

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit / habitat, whether it is floristic or faunal in nature. The table below shows the actual ecological sensitivity of the various habitats within the study area.

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Thornveld	Medium / Low	Medium / Low	Medium / Low
Bushveld	Medium / Low	Medium / Low	Medium / Low
Hills	Medium	Medium	Medium
Watercourses	Medium	Medium	Medium

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

Sensitivity of the Study Area

The study site is an existing transformed and highly degraded environment. Most of the study site (R574) also runs through built up villages and townships with high levels of transformed, altered and degraded natural environments. In reality there are no sensitive areas within the study site itself. That is, the existing asphalt / hard-surfaced road and road reserve.

The only sensitive areas along the study site route, which can be negatively impacted on during, in particular, the construction phase are the watercourse crossings and the 'cutting' area.

Most of the watercourses are small and badly degraded by are all, by default, viewed and approached as 'sensitive'. The cutting is within a CBA area and there are some protected trees on the cliff top that might be impacted.

However, although there are some 'sensitive' areas there are no areas that need to be completely avoided. In other words, there are no 'no-go' zones in the study area.

The entire study site has a sensitivity rating of 'Low' with the exception of the eight watercourse crossings and the cutting have sensitivity ratings of 'High'. There are no areas of 'Medium' sensitivity.

Fatal flaws

There are no fatal flaws in terms of the natural environment and the project should be allowed to proceed. Mitigating measures put forward in this report, and other relevant reports should however form part of the conditions and be implemented.

Buffer Zones

The only bufferzones required for the project are along the watercourses. Obviously work on crossings has to be done and this acceptable. However, a 32m buffer zone (no-go zone) form the edge of the stream banks should be implemented along all watercourses (upstream and downstream). No movement of vehicles and contractors is allowed in this 32m buffer zone, including the setup of temporary laydown areas, portable toilets, site offices, parking of vehicles, etc. The only exception is when actual work is done on the road, bridges and/or culverts crossing over that watercourse. Even then the footprint and movement of vehicles, equipment and people must be limited and kept within the work zone only.

There are no buffer zones for normal stormwater culverts and pipes under the road. This is in areas where culverts and pipes are simply used to prevent the road from impeded and impounding general surface flow of stormwater / rainfall.

Conclusions

- The only biodiversity areas of 'high' sensitivity encountered within the study site are the larger watercourse crossings and a section near Motetema where the road goes up a slight rise and onto higher lying ground / plateau. This is in the area where the 'cutting' for widening of the road will need to take place. The area of the Gemsbokspruit (stream) and Mahtrombi Nature Reserve are shown as having animal and plant sensitivities of 'Medium'. This was verified as such during site investigations (ground-truthing).
- There are no 'no-go zones' along the study site that might trigger a 'fatal flaw' in terms of the project brief and scope.
- There are no 'high' sensitive habitats present on site.
- No red data listed (RDL) fauna species were found to be present and / or breeding within the study area boundaries, but it is likely that a few might occasional move through the area.
- Site investigations were conducted during the summer (wet) season of the region and the findings and availability of field data is sufficient to reached acceptable findings and outcomes from the assessment.
- There are no obvious fatal flaws in terms of the natural environment.
- Taking all findings and recommendations into account it is the reasonable opinion of the author / specialist that the activity may be authorised. The project and related activities may proceed to the next phase.

Recommendations

- Recommended mitigating measures as proposed in this study and report should be implemented if the findings of this report are to remain pertinent.
- The only bufferzones required for the project are along the watercourses. Obviously work on crossings has to take place and this acceptable. However, a 32m buffer zone, from the edge of the stream banks should be implemented along all watercourses (upstream and downstream). No buffer zones are necessary in areas of normal stormwater culverts and pipes that are simply installed to prevent impeding and impounding general surface flow of rainfall.
- A final walkdown is recommended in the area of the cutting to determine how many protected trees will be impacted. Thereafter a tree permit / plant permit application will be required to obtain permission.
- Mitigating measures include the following:

- Any temporary storage, lay-down areas or accommodation facilities to be setup in existing disturbed areas only.
- Ensure small footprint during construction phase.
- 32m Buffer zones, from the edge of the banks of all watercourses need to be implemented. These are 'No-Go' zones in terms movement of vehicles and contractors. The only areas of exception are the work areas and footprints at the road crossings of watercourses.
- No temporary site offices or lay-down areas are allowed within 50m of the edge of any watercourses. 6. No temporary site offices or lay-down areas are allowed on top of any rocky hills or along any steep hill slopes. All laydown areas must be on flat, plains / surfaces and must be within disturbed areas as far as possible. No areas of trees may be specifically cleared for a laydown area or temporary office site.
- All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment;
- All excess materials brought onto site for construction must be removed after construction.
- No open trenches or mounds of soils to be left.
- A rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase of the project. This includes access roads and temporary laydown / site office areas.
- There are a few marula trees within the road reserve. These are protected trees and a permit will be required if any need to be removed. However, it seems unlikely that any will need to be removed.
- A General Authorisation (GA) process will be required for work on the stream crossings.

REPORT REQUIREMENTS

Below are the requirements for specialist reports as per Protocols for Specialist Studies (Government Gazette No. 43855, 30 October 2020) and Appendix 6 of the Environmental Impact Assessment Regulations (Gazette No. 40772, 7 April 2017, as amended). A specialist report prepared in terms of these regulations must contain the following as highlighted in the table below:

Requirement	Page No
(a) details of— (i) the specialist who prepared the report;	x
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	x
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	x
c) an indication of the scope of, and the purpose for which, the report was prepared;	1
(cA) an indication of the quality and age of base data used for the specialist report;	1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	54
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Entire Report
(g) an identification of any areas to be avoided, including buffers;	Entire Report
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	52
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	2
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Entire Report
(k) any mitigation measures for inclusion in the EMPr;	54
(l) any conditions for inclusion in the environmental authorisation;	54
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	70
(n) a reasoned opinion —	
(i) whether the proposed activity, activities or portions thereof should be authorised;	59
(iA) regarding the acceptability of the proposed activity or activities; and	55
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	59
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	3
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None
(q) any other information requested by the competent authority.	None

EXPERTISE AND EXPERIENCE OF SPECIALIST

NAME: Johannes Maree, ***MSc, MBA, Pr.Sci.Nat.***

EXPERTISE

Qualifications & Expertise in: Terrestrial Ecology, Aquatic Ecology and Avifaunal Assessments.

2 Masters degrees (MSc & MBA); 2 Diplomas (Business & Public Speaking).

Co-Authored two books: Cut Flowers of the World. 2010 (1st ed) & 2020 (2nd ed), Briza, Pretoria.

SAQA accreditation in training, assessing & service provision (AgriSeta).

Registered with South African Council for Natural Scientific Professions (SACNASP). Registration number: 400077/91

22 years' experience in technical and managerial positions, project management and consultancy.

19 years' experience in writing of articles, books, training material, training & presentations.

14 years direct experience in EIAs.

Has conducted hundreds of field investigations and compiled hundreds of specialist reports for EIAs, including ecological assessments (fauna & flora), wetland assessments and avifauna impact assessments. Projects include power lines, roads, quarries, developments, mines and wind farms.

DECLARATION

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the 2014 NEMA Environmental Impact Assessment (EIA) Regulations (as amended on 7 April 2017).

I, **Johannes Oren Maree**, do hereby declare that I:

Act as an independent specialist in compiling this report;

Do not have any financial interests, or stand to gain in any way in the undertaking of this activity, other than remuneration for work performed;

Do not have any vested interest in the proceeding activity or project;

Have no, neither will engage in, conflicting interests in the undertaking of this activity;

Undertake to disclose, to the competent authority, any material information that has, or may have, the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required; and

Will provide competent authority access to my information regarding the report and investigations, whether such information is favourable to the applicant or not.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

BA	Basic Assessment
CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DEA	Department of Environmental Affairs (Old name of DEFF)
DFFE	Department of Fisheries, Forestry and the Environment (New name for DEA)
DWA	Department of Water Affairs (Old name for DWS)
DWS	Department Water and Sanitation
EAP	Environmental Authorised Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance & Sensitivity
EMC	Environmental Management Class
EMF	Environmental Management Framework
HGM	Hydrogeomorphic
IBA	Important Bird Area(s)
IUCN	International Union for Conservation of Nature
MAP	Mean Annual Precipitation
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
PES	Present Ecological State
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
RDSIS	Faunal Red Data Sensitivity Index Score
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
SANBI	South African National Biodiversity Institute
SWSA	Strategic Water areas of South Africa
WMA	Water Management Areas
WRC	Water Research Commission
WUL	Water Use Licence
WULA	Water Use Licence Application

1 BACKGROUND

1.1 Project overview

The South African National Roads Agency Soc Limited (SANRAL) is in the process of planning the proposed upgrade of the National Route R574 from Groblersdal (Km 0,0) to Morwaneng (Km 38,8). The proposed project includes the upgrade of the existing road surface; general widening of the road shoulder; and widening of the road surface in certain areas. The project is situated within the Elias Motsoaledi Local Municipality of the Sekhukhune District Municipality, Limpopo Province.

Chameleon Environmental (Pty) Ltd was appointed as the lead independent environmental assessment practitioner (EAP) to undertake an Environmental Impact Assessment (EIA) for the proposed project. Flori Scientific Services cc was appointed by Chameleon Environmental to conduct a biodiversity assessment for the project, which includes a terrestrial ecological (fauna and flora) assessment and an aquatic (wetland) assessment.

Site investigations were conducted on 18 & 19 October 2021.

1.2 Scope of work

The scope of work was understood to be as follows:

- Conduct a biodiversity impact assessment for the study area;
- Conduct site visits and investigations;
- Compile a biodiversity report, which addresses potential impacts on the natural environment;
- Determine if there are any fatal flaws, high sensitive areas, no-go zones, etc.;
- Identify and delineate any sensitive areas / habitats, recommend buffers (if required); and
- Provide recommendations and mitigating measures, if and where necessary.

1.3 Quality and age of base data

The data used for desktop screening and background information is taken from sources routinely used by practitioners and is of a high standard of quality and accuracy.

The source and age of the data used included the following:

- Screening Tool: Department of Fisheries, Forestry and the Environment (DFFE) – (www.screening.environment.gov.za).
- Threatened ecosystems: South African National Biodiversity Institute - (www.bgis.sanbi.org).
- Protected areas: Protected Areas Register (PAR): DFFE – (https://portal.environment.gov.za).
- RDL species: Red List of South Africa Plants (latest update) – (www.redlist.sanbi.org).
- Veldtypes and ecosystems: Mucina & Rutherford, 2006, 2010. Updated 2012, 2018.
- National Wetland Map (Map 5) – SANBI & Water Research Commission (WRC).
- Endangered Wildlife Trust (EWT) – latest data sets – (www.ewt.org.za).

- SANBI data sets – latest updated website data - (www. bgis.sanbi.org).
- Limpopo Conservation Plan (Version 2) - (www.bgis.sanbi.org).
- Sekhukhune District Bioregional Plan (2018).

1.4 Assumptions and limitations

The assumptions and limitations for the assessment are as follows:

- All information regarding the proposed project and related activities as provided by the Client are taken to be accurate.
- Site investigations were conducted over two days on the 18 & 19 October 2021, which falls within the wet (summer) season for the region.
- During site investigations all areas were easily accessed. There were no areas that could not be investigated or accessed. Permission to private property, where necessary, was obtained prior to visits.
- The study site is small in terms of actual footprint; is mostly transformed existing hard surface asphalt road and road reserve; and with limited variation in biodiversity. The field investigations conducted are therefore sufficient for informed conclusions and recommendations.
- The site investigations and study are considered adequate for the project and no further specialist environmental studies are considered necessary or recommended.
- Precise buffer zones, regulated zones, etc. or exact GPS positions cannot be made using generalised corridors or kml files on Google Earth. However, buffer zones and delineations drawn are accurate to within a few metres, but might need to be refined in certain areas depending on engineering requirements or queries.
- The latest data sets were used as background information and desktop review / screening assessment for the project. The data sets were verified and refined during field investigations (ground-truthing).
- **NOTE**: Recommendations put forward in the report are based on actual biodiversity and specialist findings, but this does not mean that legal requirements don't still apply. In other words, recommendations do not negate legal requirements as set out in various acts such as NEMA (Act 107 of 1998) and NEMBA (Act 10 of 2004). For example, a buffer zone of 15 m from the edge of a watercourse might be recommended as adequate, but this does not negate the fact that such activities still trigger regulations such as the 32m from a watercourse, as set out in Listed Activities.
- Equipment used: Standard soil augers; hand-held Garmin GPS instrument; EC & pH hand-held meters; IPhone 12 for photographs, MacBook Pro and Epson PC Laptops; Google earth maps, 1:50 000 South African topographical maps.
- Computer packages used: MS Word; MS Excel; Adobe Photoshop, ARC GIS (10.8); Google Earth; and Garmin Base Maps

1.5 Consultation process for the study

Emails were exchanged and telephone conversations held with the lead EAP (Chameleon Environmental) regarding the project. Landowners were contacted via the lead EAP as well as directly to arrange access to their private properties for site investigations, if required. During site visits no landowners accompanied Specialists to the relevant sites.

2 METHODOLOGY

2.1 Desktop assessment

A literature review was conducted regarding the main vegetation types and fauna of the general region and of the specific study area. The primary guidelines and datasets used were from Mucina & Rutherford (eds) (2006, 2010, updated 2012); the South African National Biodiversity Institute (SANBI: www.bgis.sanbi.org); and Endangered Wildlife Trust (www.ewt.org.za). Background data regarding soils, geology, climate and general ecology were also obtained from existing datasets and relevant organisations. Specialist studies that were conducted in the area on similar or different projects were also previewed, if and where available.

Red data and protected species listed by the National Environmental Management: Biodiversity Act (Act No. 10 of 2004), as well as in other authoritative publications were consulted and taken into account. Alien invasive species and their different Categories (1, 2 & 3) as listed by the Conservation of Agricultural Resources Act (Act No. 43 of 1983) and the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) were also consulted.

2.2 Site Investigations

During site investigations cognisance was taken of the following environmental features and attributes:

- Biophysical environment, including regional and site-specific vegetation.
- Habitats ideal for potential red data listed (RDL) fauna and flora species;
- Watercourses, including wetlands and artificial systems such as farm dams.

Digital photographs and GPS reference points of importance where recorded and used throughout the report where relevant.

2.3 Floral Sensitivity

The methodology used to estimate the floristic sensitivity is aimed at highlighting floristically significant attributes and is based on subjective assessments of floristic attributes. Floristic sensitivity is determined across the spectrum of communities that typify the study area. Phytosociological attributes (species diversity, presence of exotic species, etc.) and physical characteristics (human impacts, size, fragmentation, etc.) are important in assessing the floristic sensitivity of the various communities.

Criteria employed in assessing the floristic sensitivity vary in different areas, depending on location, type of habitat, size, etc. The following factors were considered significant in determining floristic sensitivity:

- Habitat availability, status and suitability for the presence of Red Data species
- Landscape and/or habitat sensitivity
- Current floristic status
- Floristic diversity
- Ecological fragmentation or performance.

Floristic Sensitivity Values are expressed as a percentage of the maximum possible value and placed in a particular class or level, namely:

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

High Sensitivity Index Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological sustainable manner. Nature reserves and well-managed game farms typify these areas. Low Sensitivity Index Values indicate areas of poor ecological status or importance in terms of floristic attributes, including areas that have been negatively affected by human impacts or poor management.

Each vegetation unit is subjectively rated on a sensitivity scale of 1 to 10, in terms of the influence that the particular Sensitivity Criterion has on the floristic status of the plant community. Separate Values are multiplied with the respective Criteria Weighting, which emphasizes the importance or triviality that the individual Sensitivity Criteria have on the status of each community.

Ranked Values are then added and expressed as a percentage of the maximum possible value (Floristic Sensitivity Value) and placed in a particular class or level, namely:

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

2.4 Faunal Sensitivity

Determining the full faunal component of a study area during a short time scale of a few field trips can be highly limiting. Therefore, the different habitats within the study area and nearby surrounding areas

were scrutinised for attributes that are deemed to be suitable for high diversity of fauna, as well as for Red Data species. Special consideration was given to habitats of pristine condition and high sensitivity.

Areas of faunal sensitivity were calculated by considering the following parameters:

- Habitat status – the status or ecological condition of the habitat. A high level of habitat degradation will often reduce the likelihood of the presence of Red Data species.
- Habitat linkage – 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 Data species within the study area
- Potential presence of Red Data species – Areas that exhibit habitat characteristics suitable for the potential presence of Red Data species are considered sensitive.

The same Index Values, Sensitivity Values and Categories used for the floral sensitivity ratings are used for the faunal sensitivity ratings. The same Go, No-Go criteria and ratings used for the flora component are also used for the faunal component.

2.5 Faunal Red Data Sensitivity Index Score (RDSIS)

Field investigations limited to a few days can seldom, if ever, be comprehensive in terms of identifying all faunal species, let alone Red Data Listed (RDL) Species and/or priority species. Included is the reality that many faunal species are highly mobile and might be moving in and out of an area, which makes observing these species sometimes incidental and fortunate, depending largely on time and chance. Added to this are the species that are primarily nocturnal in nature.

For the above reasons, the Red Data Sensitivity Index Scoring (RDSIS) method for fauna is widely used by specialists involved in EIAs, specialist studies, etc. The RDSIS methodology provides a calculated indication for the potential of certain red data or priority species occurring in the study area. The index is based on historical data, present presence of ideal habitat and food sources, general inferences on the landuses of the region and the Specialist's knowledge and experience.

2.5.1 Probability of Occurrence (POC)

Known distribution range (D), habitat suitability of the site (H) and availability of food sources (F) on site is determined for each of the species. Each of these variables is expressed a percentage (where 100% is a perfect score). The average of these scores provides a POC score for each species.

The POC is calculated as follows:

POC = (D+H+F) / 3

The POC value is then categorised as follows:

- 0-20% = Low
- 21-40% = Low / Medium
- 41-60% = Medium
- 60-80% = Medium/High
- 81-100% = High

2.5.2 Total Species Score (TSS)

Species with a POC score of more than 60% (Medium/High) are considered when applying the RDSIS. A weighting factor is assigned to the different IUCN categories providing species with a higher conservation status, a higher score. This weighting factor is then multiplied with the POC to calculate the total species score (TSS) for each species.

The weighting assigned to each category rating is as follows:

Status Category	Abbreviation	Weighting
Data deficient	DD	0,2
Rare	RA	0,5
Near Threatened	NT	0,7
Vulnerable	VU	1,2
Endangered	EN	1,7
Critically Endangered	CR	2,0

The TSS is calculated as follows:

TSS = (IUCN weighting x POC) where POC is > 60%.

2.5.3 Average Total Species & Average Threatened Taxa Score

The average of the Total Species (TSS) potentially occurring on the site is calculated. The average of all the Threatened Taxa (TT) (Near threatened, Vulnerable, Endangered and Critically Endangered) TSS scores are also calculated. The average of these two scores (Av.TSS and Av.TT) is then calculated in order to add more weight to threatened taxa with POC higher than 60%.

The average is calculated as follows:

Average = (Av.TSS [TSS / Total Species] + Av.TT [TT TTS / No. of species]) / 2

2.5.4 Red Data Sensitivity Index Score (RDSIS)

The average score obtained above and the sum of the percentage of species with a POC of >60% of the total number of Red Data Listed species listed for the area is then calculated. The average of these two scores, expressed as a percentage, gives the RDSIS for the area investigated.

The RDSIS is calculated as follows:

RDSIS = (Average + [Spp. with POC >60% / Total No. of Spp*100]) / 2

The RDSIS Category ratings are categorised as follows:

RDSIS Score	Category Rating
0 – 20%	LOW
21 – 40%	LOW / MEDIUM
41 – 60%	MEDIUM
61 – 80%	MEDIUM / HIGH
81 – 100%	HIGH

2.6 Present Ecological State (PES)

The Present Ecological State (PES) is the current (present) ecological condition (state) in which the watercourses are found, prior to any further developments or impacts from the proposed project. The PES of watercourses found in the study area is just as important to determine, as are the potential impacts of the proposed development. The PES of a watercourse is assessed relative to the deviation from the Reference State (also known as the Reference Condition).

The reference state is the original, natural or pre-impacted condition of the system. The reference state is not a static condition but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES Method (DWA, 2005) was used to establish the present state (integrity) of the unnamed drainage line in the study area. The methodology is based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The criteria used for assessing the PES of watercourses are found in Table 1. The scores for the various attributes are found in Table 2. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a watercourse.

Table 3 provides guidelines for determining the category of the Present Ecological Status (PES) based on the total score determined during assessments. This approach is based on the assumption that extensive degradation of any of the attributes may determine the PES of the watercourse (DWA, 2005).

Table 1: Habitat assessment criteria

Rating Criteria	Relevance
Hydrology	
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural lands. Changes in flow regime (timing, duration, frequency), volumes, and velocity, which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water quality	
Water Quality Modification	From point or diffuse sources. Measured directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats.
Geomorphology & Hydraulics	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities, which reduce or changes wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation of Biota	Overgrazing, over fishing, over harvesting of plant material, etc.

Table 2: Scoring guidelines for habitat assessment

Scoring guidelines per criteria	
Natural / unmodified	5
Mostly natural	4
Moderately modified	3
Largely modified	2
Seriously modified	1
Critically modified (totally transformed)	0

Table 3: Wetland integrity categories

Category	Mean Score	Description
A	>4	Unmodified, natural condition.
B	>3 to 4	Largely natural with few modifications, but with some loss of natural habitats.
C	>2,5 to 3	Moderately modified, but with some loss of natural habitats.
D	2 to 2,5	Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.
E	>0	Seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
F	0	Critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The integrity of watercourses with a category rating of F, E & D were deemed to be Low. Category rating of C was deemed to be Medium, while Category ratings of B & A were deemed to be High.

2.7 Ecological Importance and Sensitivity

Ecological importance and sensitivity (EIS) looks at the importance of the wetland, watercourse or water ecosystem in terms of biodiversity and maintenance. The determination is not just based on the identified watercourse in isolation, but also its' importance in terms of supplying and maintaining services to the larger catchment and water systems up and downstream.

The ecological sensitivity (ES) part of the EIS looks at how sensitive the system is to changes in services and environmental conditions. The Recommended Environmental Management Class (REMC) is the recommended state to which the watercourse should be returned to or maintained at. The EIS categories and descriptions are outlined in the table below (Table 4).

A high REMC relates to ensuring a high degree of sustainability and a low risk of ecosystem failure occurring. A low REMC would ensure marginal sustainability, but with a higher risk of ecosystem failure. The REMC is based on the results obtained from assessing the ecosystem / watercourse / wetland in

terms of EIS, PES and function, and the desire to with realistic recommendations and mitigating actions to return the system to a certain level of functionality and original state.

Table 4: EIS Categories and Descriptions

EIS Categories	Median Range	Category
Wetlands that are considered ecologically important and sensitive on a **national or international** level. The biodiversity of these wetlands is usually very sensitive to flow & habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	Very high 3 - 4	A
Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	High 2 - 3	B
Wetlands that are considered to be ecologically important and sensitive on a **provincial or local** scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	Moderate 1 - 2	C
Wetlands that are not ecologically important and sensitive on any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	Low 0 - 1	D

2.8 Impact Assessment

2.8.1 Criteria for the classification of an impact

Scale (Extent)

Considering the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact.

- Site: Within the construction site
- Local: Within a radius of 2 km of the construction site
- Regional: Provincial (and parts of neighbouring provinces)
- National: The whole of the country
- International: Impact is across countries

Duration

Indicates what the lifetime of the impact will be.

- Immediate: The impact will either disappear with mitigation or will be mitigated through natural process in a time span shorter than the construction phase.
- Short-term: The impact will either disappear with mitigation or will be mitigated through natural process within 0 – 5 years.
- Medium-term: The impact will either disappear with mitigation or will be mitigated through natural process within 5 – 15 years.
- Long-term: The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. Impact ceases after the operational life of the activity.
- Permanent: The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.

Magnitude (Intensity)

Describes whether an impact is destructive or benign.

- Low: Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.
- Medium: Effected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way.
- High: Natural, cultural and social functions and processes are altered to extent that they temporarily cease.
- Very high / Unknown: Natural, cultural and social functions and processes are altered to extent that they permanently cease.

Probability

Probability is the description of the likelihood of an impact actually occurring.

- Improbable: Likelihood of the impact materialising is very low.
- Low probability / possible: The impact may occur.
- Medium probability: It is more than likely that the impact will occur.
- Highly probable: High likelihood that the impact will occur.
- Definite / Unknown: The impact will definitely (most certainly) occur, or is unknown and therefore needs to be afforded a high probability score.

Significance

Significance (environmental significance) constitutes the overall risk and is determined through a synthesis of impact characteristics. It is an indication of the importance of the impact in terms of both the physical extent and the time scale and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Status

Status gives an indication of the perceived effect of the impact on the area.

- Positive (+): Beneficial impact.
- Negative (-): Harmful or adverse impact.
- Neutral Impact (0): Neither beneficial nor adverse.

It is important to note that the status of an impact is assigned based on the *status quo.* That is, should the project not proceed. Therefore not all negative impacts are equally significant. The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented

2.8.2 Scoring Method

The impact assessment takes into account the nature, scale and duration of the effects on the natural environment and whether such effects are positive (beneficial) or negative (detrimental). A scoring method (rating system) is applied to the potential impact on the affected environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each issue the following criteria are used and points awarded as shown below in Table 5.

Table 5: Scoring method for impact assessment

Magnitude (Intensity)	**Duration**
10 - Very high/unknown	5 - Permanent
8 - High	4 - Long-term (Impact ceases after operational life of activity)
6 - Moderate	3 - Medium-term (5-15 years)
4 - Low	2 - Short-term (0-5 years)
2 - Minor	1 - Immediate
0 - None	0 - None
Scale (Extent)	**Probability**
5 – International	5 – Definite / Unknown
4 – National	4 – Highly probable
3 – Regional	3 – Medium probability
2 – Local	2 – Low probability
1 - Site only	1 – Improbable
0 – None	0 – None

Once the above factors had been ranked for each impact, the overall risk (environmental significance) of each impact will be assessed using the following formula:

Significance (SP) = [Magnitude (M) + Duration (D) + Scale(S)] x Probability (P)

The maximum value is 100 significance points (SP). Environmental impacts will be rated as either that of High, Moderate or Low significance on the following basis:

- SP ≥60: Indicates **high** environmental significance;
- SP 31 ≥ 59: Indicates **moderate** environmental significance;
- SP ≤ 30: Indicates **low** environmental significance.

3 RECEIVING ENVIRONMENT

3.1 Study Site Location

The Study Site is the existing National Route R574 from the T-Intersection with the R33 (Km 0,0), which is just east of the Town of Groblersdal, up until the end of the R574 in Morwaneng at the T-Intersction with the R579 (Km 38,8). The length of the study site is 38,8km. The study site (R579) is situated within the Elias Motsoaledi Local Municipality of the Sekhukhune District Municipality, Limpopo Province.

The study site includes the actual road, road shoulder and road reserve. The road reserve is an area usually less than 50m in width each side of the edge of the asphalt (Figure 1, Figure 2, Figure 3).

However, during field investigations the broader areas was also investigated, with focus on any unique or sensitive habitats, ecosystems, etc. that the project might potentially impact on.

The GPS coordinates of the main landmarks within the project area are as follows:

- Groblersdal CBD: 25° 9'53.60"S; 29°23'54.55"E. 25°.
- Morwaneng CBD: 25° 0'40.31"S; 29°44'52.43"E.
- Start of Project on R547 (KM 0,0): 25° 8'50.82"S; 29°26'14.28"E.
- End of Project on R547 (KM 38,8): 25° 0'32.97"S; 29°44'37.32"E.
- Quarter Degree Square (QDS): 2529AB & 2529BA.
- Quaternary Drainage Area (QDA): B32F, B32J, B51A, B51B.

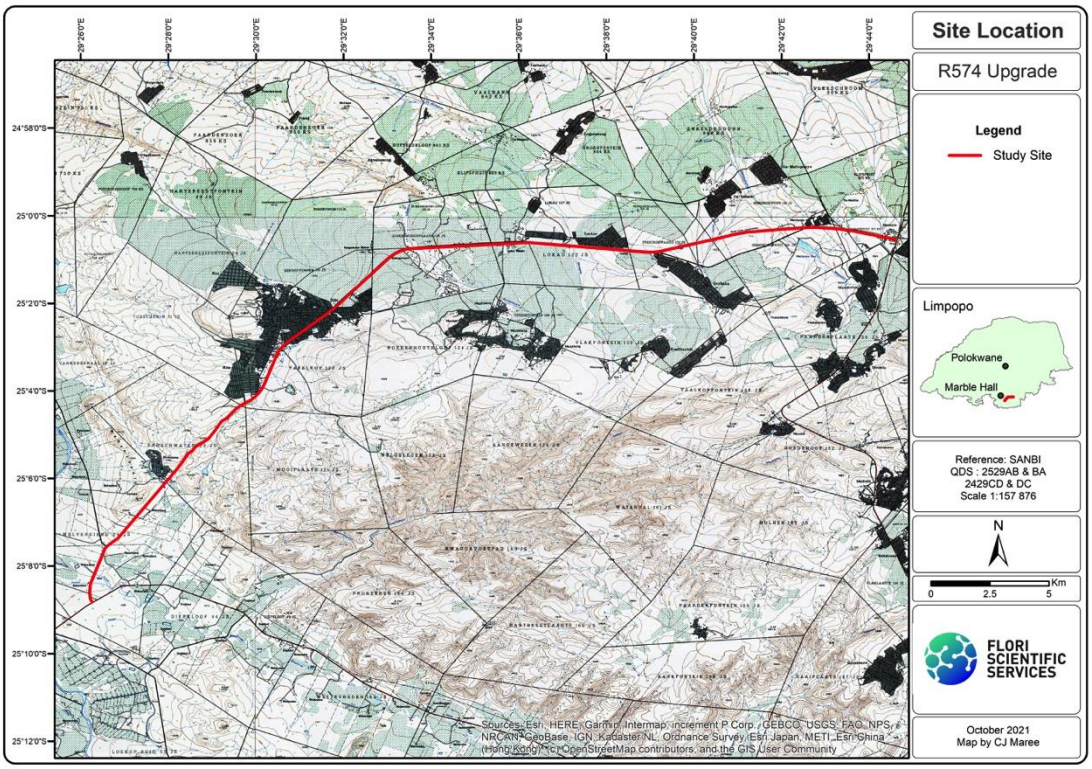


Figure 1: Study Site Location (Topo Cadastral Map)

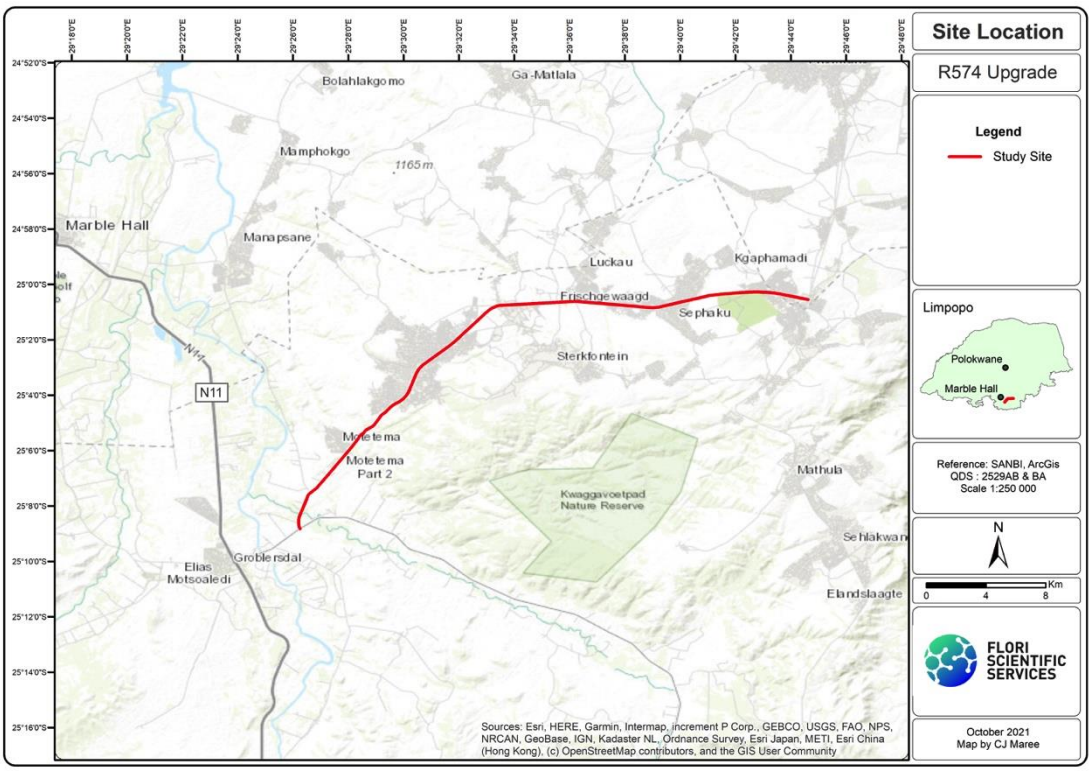


Figure 2: Study Site Location (Base Map)

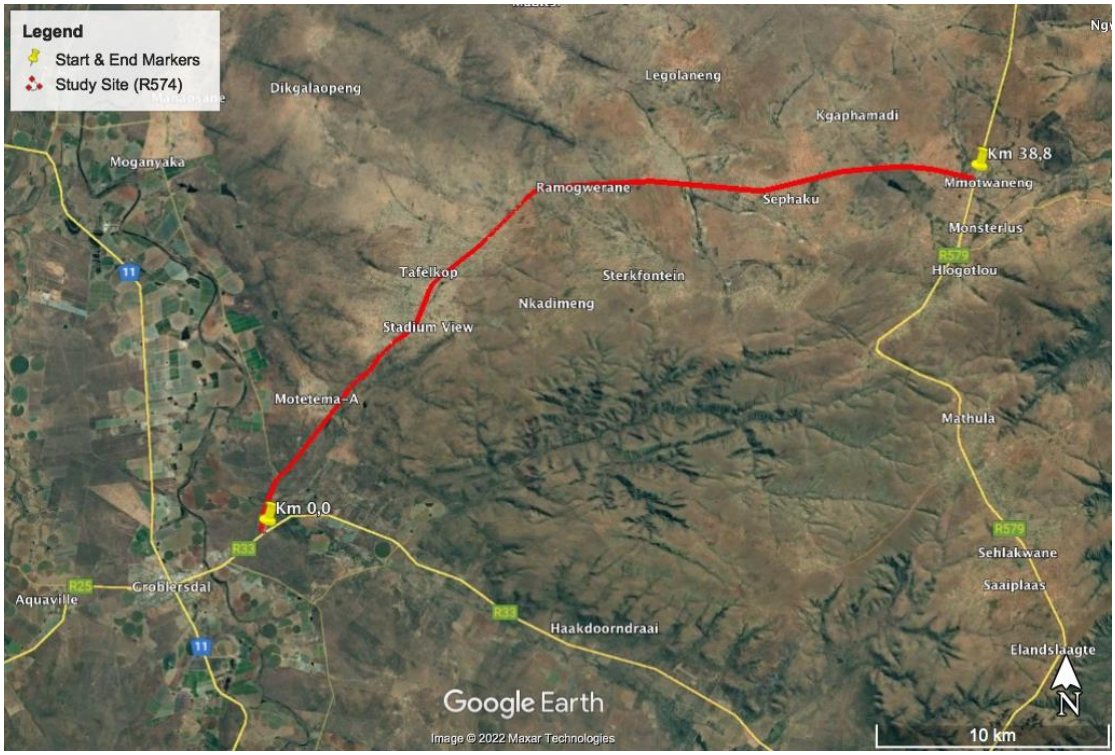


Figure 3: Study Site Location (Google Earth)

3.2 Topography

The topography of the region is that of undulating plains and hills. The lowest point along the R574 is at Bloed River, near the start of the study site, at an elevation above average sea level of 915 m. From the start of the route at KM 0,0 the road continues to climb ever higher, while undulating up and down small hills and eventually onto a large plateau. The highest point is at Morwaneng, at the end of the route, where the elevation is about 1 632 m. The average slope (gradient) across the study site is approximately 3,4% (i.e. 3,4 m across a 100 m area).

3.3 Climate

The study site is situated within the summer rainfall region of South Africa and within the medium rainfall region of 401 mm to 600 mm per annum (Figure 4). The average annual rainfall for the nearby Town of Groblersdal is approximately 497 mm (en.climate-data.org). The average annual rainfall across the Sekhukhune District Municipality is typically below 600 mm. Sekhukhune district is characterised by relatively poor and unreliable rainfall, frequent droughts and periodic flooding (www.researchgate.net).

The climate is warm to hot during the summer months, with some days becoming very hot, while temperatures are typically moderate to cold, but seldom very cold, in winter. The warm summers are long, while the winters are usually short, dry and with mostly clear skies. There are always winter days of colder temperatures with light frost in the early morning hours, especially in the low lying areas

around streams and between mountains. The study site is situated within the Temperate Interior Climatic Zone of South Africa, but close to the outer edge of the Cold Interior (Figure 5).

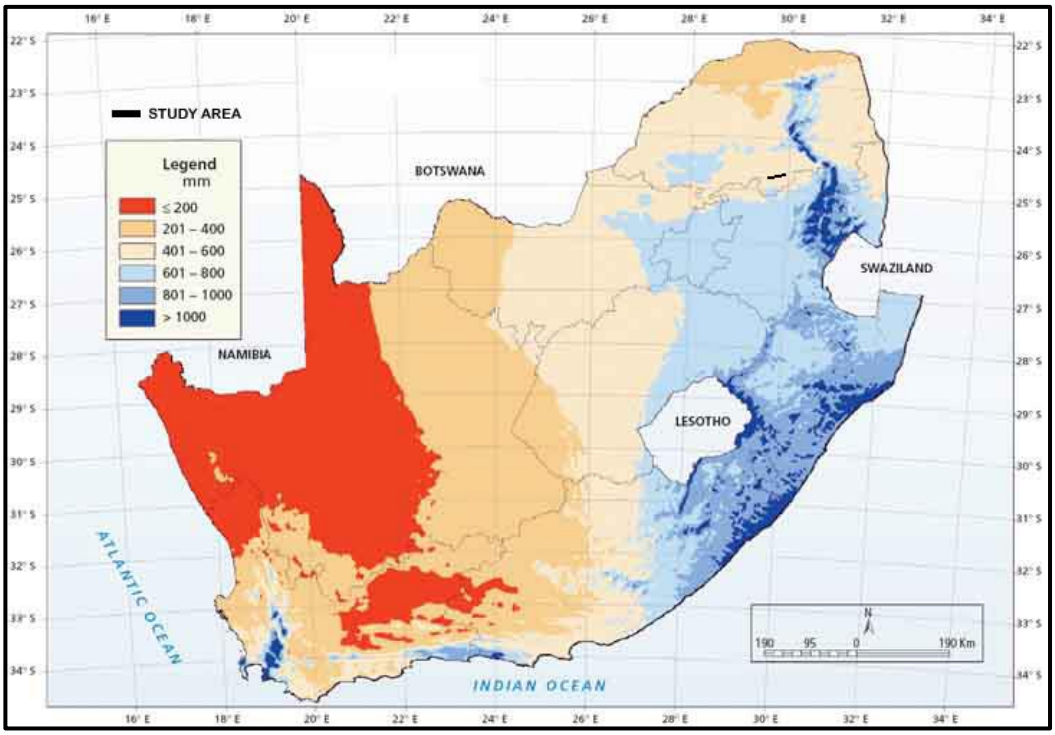


Figure 4: Rainfall Regions of South Africa

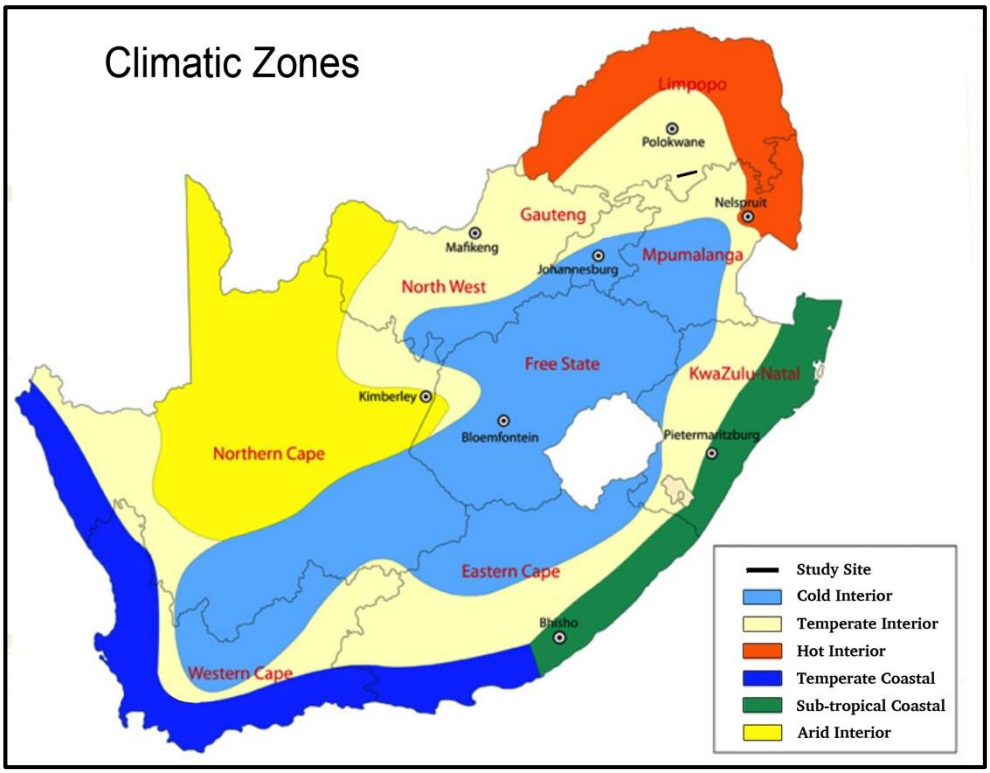


Figure 5: Broad Climatic Zones of South Africa

3.4 Landuse

The landuse or landcover of the study site is that of an existing hard surface asphalt road (R574), along with the road reserve. The landcover of the greater area in which the study site is situated is that of open bushveld, commercial farmlands, small plots of subsistence farming and scattered rural villages / townships. The biggest landuse or landcover across the area is that of large and medium sized villages / townships that have tended to extend and merge into each other.

4 TERRESTRIAL ECOLOGY

4.1 Vegetation

4.1.1 General Vegetation of the region

South Africa is divided up into nine major Biomes. The study site and the surrounding area are within the Savanna Biome and the Grassland Biome. The Savanna (Bushveld) Biome is typically characterised by a lower layer of grasses, middle layer of shrubs and an upper layer of trees, while the Grassland Biome is characterised by the mostly absent upper layer of trees and scattered middle layer of shrubs, except in rocky areas or rocky outcrops (koppies) (Figure 6).

Mucina & Rutherford (2010) divided the Savanna Biome (Bushveld Biome) into six bioregions, namely: Central Bushveld, Mopane, Lowveld, Sub-Escarpment Savanna, Eastern Kalahari Bushveld; and Kalahari Duneveld. The Grassland Biome is divided into four bioregions, namely: Drakensberg Grassland, Dry Highveld Grassland, Mesic Highveld Grassland, and Sub-Escarpment Grassland.

The eastern and middle sections of the study site (about 2/3) are within the **Central Bushveld Bioregion** of the Savanna Biome and the eastern section (about 1/3) is in the **Mesic Highveld Grassalnd Bioregion** of the Grassland Biome. Within these bioregoins the study site (R574) is within the original extent of the veldtypes of **Central Sandy Bushveld, Loskop Thornveld and Rand Highveld Grassland** (Figure 7).

The vegetation hierarchy of the study site is shown in Table 6 below.

Table 6: Vegetation hierarchy of the study area

Category Description	Classification
Biome	Savanna & Grassland
Bioregion	Central Bushveld & Mesic Highveld Grassland
Veldtype	Central Sandy Bushveld, Loskop Thornveld & Rand Highveld Grassland
Status	Central Sandy Bushveld – Least Concern / Least Threatened Loskop Thornveld – Least Concern / Least Threatened

	Rand Highveld Grassland - Vulnerable

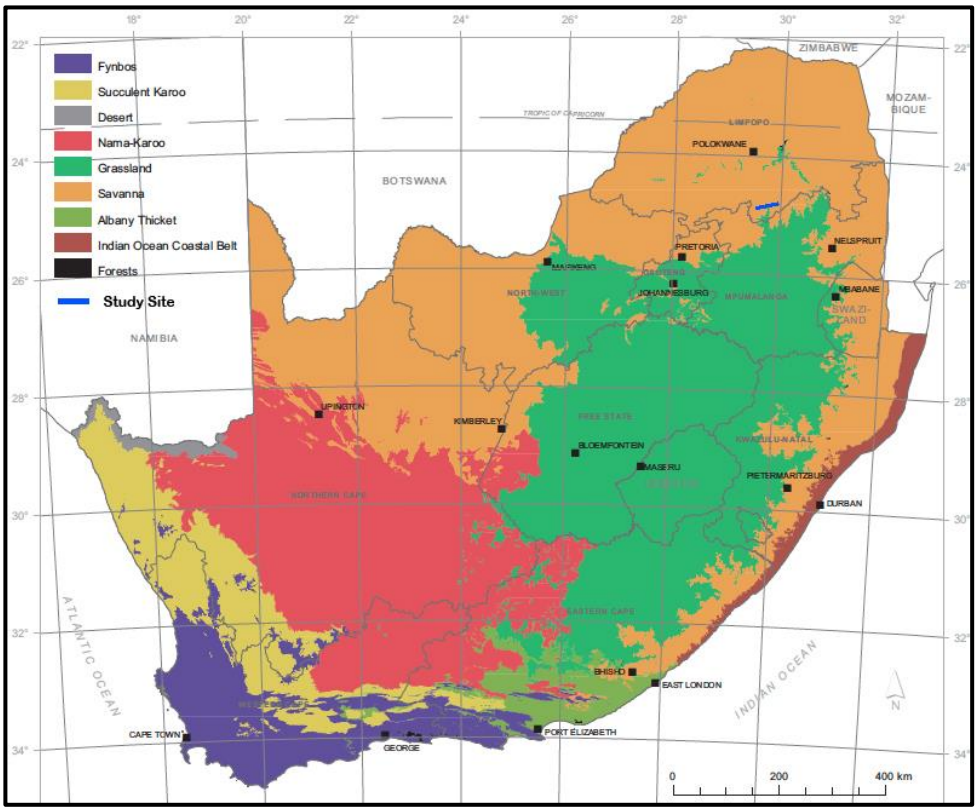


Figure 6: Biomes of South Africa

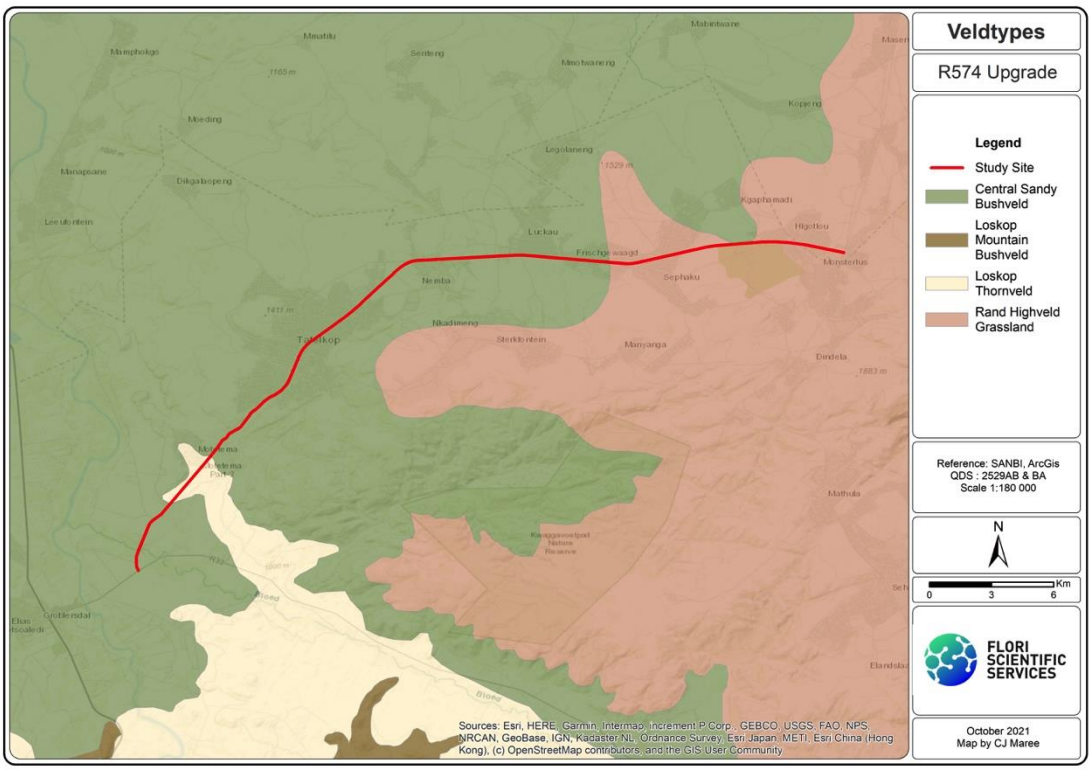


Figure 7: Veldtypes

Central Sandy Bushveld is characterised by low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on deep sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broad-leaved *Combretum* woodland on shallow rocky or gravelly soils. Species of Vachellia (*Acacia*), *Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. *Vachellia* (*Acacia*) *tortilis* may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover is found on dystrophic sands (Mucina & Rutherford, 2010).

Loskop Thornveld is characterised by valleys and plains of parts of the upper Olifants River catchment. The veldtype tends to be open, deciduous to semi-deciduous, tall, thorny woodland, usually dominated by thorn trees (Vachellia / *Acacia*) species (Mucina & Rutherford, 2010).

Rand Highveld Grassland is characterised by highly variable landscape with extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes. Most common grasses on the plains belong to the genera *Themeda*, *Eragrostis*, *Heteropogon* and *Elionurus*. High diversity of herbs, many of which belong to the Asteraceae, is also a typical feature. Rocky hills and ridges carry sparse (savannoid) woodlands with *Protea caffra* subsp. *caffra*, *Protea welwitschii*, *Vachellia* (=*Acacia*) *caffra* and *Celtis africana*, accompanied by a rich suite of shrubs among which the genus *Searsia* (especially *Searsia (=Rhus*) *magalismonata*) is most prominent (Mucina & Rutherford, 2010).

The study site is within the municipal demarcation of Sekhukhune District Municipality, but is outside and west of Sekhukhune Land, and area known for its high levels of plant endemism and which has been described as a lowveld enclave surrounded by highveld and middleveld (Siebert & van Wyk, 2001).

4.1.2 Vegetation of the Study Site

The vegetation of the study site is mostly transformed, altered and highly degraded. The vegetation present in the study site is within the road reserve and consists mainly of grasses and a few herbaceous plants. The road reserve is routinely cut and burnt thereby altering and degrading the natural vegetation. Most of the study site runs through villages and townships where the natural environment has been totally transformed and highly degraded.

There are no areas of pristine vegetation present within the study site itself. The areas of good vegetation are confined to patches and are typically not within the study site itself, but in nearby open vacant fields, or on nearby hills. Even at the river / stream crossings the vegetation is badly degraded. Most of the watercourses in the study area are small intermittent (seasonal) streams or seasonal drainage lines with no naturally occurring riparian vegetation.

Table 7: Photos of the study site and vegetation

	R574 showing some grasses within the road reserve with trees in picture growing outside of the study site on open farmlands
	Marula tree (protected tree) growing in the road reserve. There are a few scattered marula trees along the study site.

	Large fig tree in the road reserve. Although not a protected tree there are a few such trees that should be avoided if possible.
	The area of the proposed cutting where the road needs to be broadened. This is probably the most sensitive area (along with watercourse crossings) in the study area.
	Another view of the rocky hill, which is earmarked to be cut to broaden the road.

	Study Site (R574) running through a typical urban area. There are numerous urban areas (townships and villages) along the study site such as this where the natural environment has been transformed and degraded.
	Another urban area showing no natural vegetation left. Flowering alien jacaranda trees can be seen along the road.
	Study site in the area of Morwaneng at the end of the route. The trees in picture are alien pine trees and the environment has been totally transformed.

4.2 Priority Floral Species

No Red Data Listed (RDL) species (endangered, threatened or vulnerable) were observed during field investigations in the study area. However, it is possible, although highly unlikely, that some might occur.

4.3 Threat Status

It is sometimes difficult to establish the actual threat status or conservation status of a veldtype (ecosystem) as various sources differ. According to the SANBI terrestrial ecosystem threat status assessment (Skowno, et. al., 2019) the threat status of the veldtypes in which the study site is situated are as shown below in Table 8.

The process and plan for updating the national listing of threatened ecosystems / gazette has not yet been finalized. As part of the process, a provincial level comparison between the NEMBA 2011 list of threatened ecosystems and the preliminary 2018 Red List of Ecosystems was produced, which will lay the foundation for discussion on the update of regulations linked to the new list of threatened terrestrial ecosystems.

Table 8: Veldtype status

Veldtype	Status	Description
Central Sandy Bushveld	Least Threatened (LT) / Least Concern (LC)	Less than 3% statutorily conserved spread thinly across many nature reserves including the Doorndraai Dam and Skuinsdraai Nature Reserves. An additional 2% conserved in other reserves including the Wallmansthal SANDF Property and a grouping of private reserves, which include most of the Nylsvlei freshwater wetlands. About 24% transformed, including about 19% cultivated and 4% urban and built-up areas. Much of the veldtype / ecosystem in the broad arc south of the Springbokvlakte is heavily populated by rural communities. Several alien plants are widely scattered but often at low densities; these include *Cereus jamacaru*, *Eucalyptus* species, *Lantana camara*, *Melia azedarach*, *Opuntia ficus-indica* and *Sesbania punicea*. Erosion very low to high, especially in some places northeast of Groblersdal (Mucina & Rutherford, 2006, 2010)
Loskop Thornveld	Least Threatened (LT) / Least Concern (LC)	About 11% statutorily conserved in the Loskop Dam Nature Reserve. About a quarter of the area already transformed, mainly for agricultural crops requiring irrigation. The most common crops include maize, cotton, citrus, grapes and wheat (winter crop). There has been a dramatic increase in the establishment of vineyards. Old lands are invaded by

		Acacia tortilis and *Hyparrhenia hirta*. Alien plants, for example *Cereus jamacaru*, *Opuntia ficus-indica*, *Melia azedarach*, *Lantana camara* and *Solanum seaforthianum*, have invaded various parts of this unit (Mucina & Rutherford, 2006, 2010).
Rand Highveld Grassland	Vulnerable (VU)	Poorly conserved (only about 1%). Small patches protected in statutory reserves (Kwaggavoetpad, Van Riebeeck Park, Bronkhorstspruit, Boskop Dam Nature Reserves) and in private conservation areas (e.g. Doornkop, Zemvelo, Rhenosterpoort and Mpopomeni). Almost half has been transformed mostly by cultivation, plantations, urbanisation or dam-building. Cultivation may also have had an impact on an additional portion of the surface area of the unit where old lands are currently classified as grasslands in landcover classifications and poor land management has led to degradation of significant portions of the remainder of this unit. Scattered aliens (most prominently *Acacia mearnsii*) occur in about 7% of this unit (Mucina & Rutherford, 2006, 2010).

Table 9 below gives a basic description of each of the status categories, while Figure 8 shows the categories in a hierarchical format (IUCN Redlist, 2010).

The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or protected. The main purpose for the listing of threatened ecosystems is an attempt to reduce the rate of ecosystem and species destruction and habitat loss, leading to extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems (SANBI).

Table 9: Ecosystem Status: Simplified explanation of categories used

STATUS	% Transformed	Effect on Ecosystem
Least Threatened (LT)	0-20% (<20% loss)	No significant disruption of ecosystem functions
Vulnerable (VU)	20-40% (>20% loss)	Can result in some ecosystem functions being altered
Endangered (EN)	40-60% (>40% loss)	Partial loss of ecosystem functions
Critically Endangered (CR)	>60% or BT Index for that specific veldtype	Species loss. Remaining habitat is less than is required to represent 75% of species diversity

Source: South African National Spatial Biodiversity Assessment Technical Report. Volume 1: Terrestrial Component. 2004. SANBI. Mucina & Rutherford (eds) (2010).

Note: BT stands for the Biodiversity Threshold and is an index value that differs for each veldtype. In other words, because the composition, recovery rate, etc. differs for each veldtype there will be a different threshold (in this case percentage transformed) at which species become extinct and ecosystems breakdown. That is, at which point the veldtype is critically endangered. For the grassland vegetation units discussed the index value (BT) is broadly given as 60% and greater.

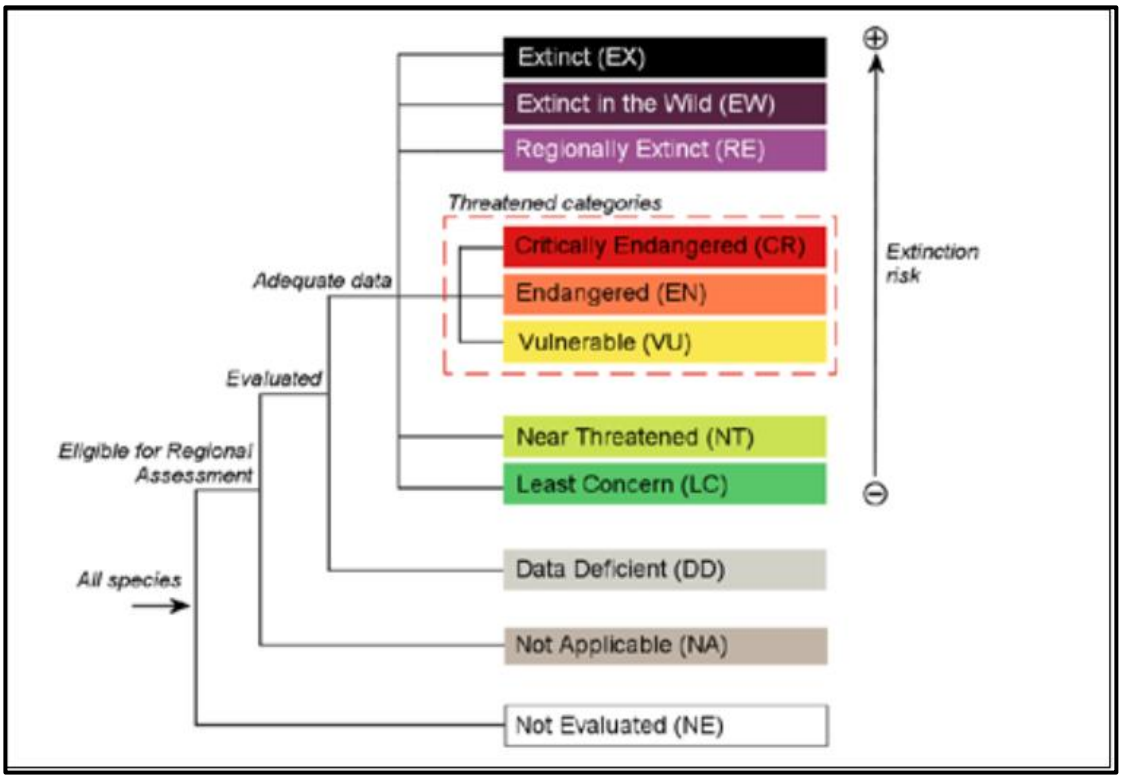


Figure 8: Structure of categories used at the regional level

4.4 Alien plants identified on site

There are a few alien plants in the study area that are common to the region. The herbaceous plants are especially prevalent in disturbed areas. Tree species such as syringa (*Melia azedarach*), gum trees (*Eucalyptus spp.*), grey poplar (*Populus x canescens*) and blackwattle (*Acacia mearnsii*) are also present. Alien plant species, some of which are invasive, occur scattered throughout the area, especially in disturbed areas. The alien plant species encountered in the study area are recorded, along with their category rating, in Table 10. The categories are as set out in the Conservation Act of Agricultural Resources Act, 1983 (CARA) (Act 43 of 1983).

Table 10: Alien plants identified in the study area

Botanical Name	Common Name	Category
Acacia mearnsii	Blackwattle	2

Argemone ochroleuca	White-flowered Mexican poppy	1
Bidens pilosa	Blackjacks	-
Campuloclinium macrocephalum	Pompom weed	1
Cereus jamacaru	Queen-of-the-night	1
Conyza canadensis	Horseweed fleabane	-
Datura ferox	Large thorn-apple	1
Eucalyptus spp & cultivars	Gum trees; Eucalyptus	2
Macfadyena unguiscati	Cat's claw creeper	1
Melia azedarach	Syringa	3
Opuntia ficus-indica	Prickly pear	1
Populus x canescens	Grey poplar	2
Sesbania punicea	Red sesbania	1
Solanum elaeagnifolium	Silverleaf bitter apple	1
Tagetes minuta	Khakibos, kahki weed	-
Verbena bonariensis	Vervain	-

4.5 Protected tree species identified in the study area

Only one protected tree, namely the Marula (*Sclerocarya birrea*), was found to be present within the study site. There are a few scattered trees along the road in the road reserve.

4.6 Fauna

4.6.1 Mammals

No large- or medium-sized mammals were observed during field investigations. A few small burrows were found occasional within the road reserve, which appear to be used by small field mice and other rodents such as rock mouse (*Aethomys namaquensis*), striped mouse (*Rhabdomys pumilio*), multimate mouse (*Mastomus natalensis*) and bushveld gerbil (*Tatera leucogaster*). In open, less populated areas outside of the study area some evidence was found of scrub hare (*Lepus sacatilis*) and possibly yellow mongoose (*Cynictis penicillata*). There are many common species of wild animals and mammals present in the area of the greater Sekhukhune District, and many more with a historical distribution in the area, but these are more and more restricted to less accessible areas such as mountains, rocky ravines, etc. The study site is within a mostly densely populated area with numerous settlements and villages where the presence of large and medium sized mammals are scarce.

It is impossible to conduct an accurate survey of faunal species and their presence during limited site investigations. Therefore, standard and acceptable probability assessments were conducted (as mentioned in the methodology and as shown below) for mammals to give an indication of potential presence and sensitivities. Other species likely present in the wider area of the mountains, ravines and nature reserve include: Steenbok (*Raphicerus campestris*), Tree squirrel (*Paraxerus cepapi*), Yellow

Mongoose (*Cynictis penicillata*), and Porcupine (*Hystrix africaeaustralis*). Duiker species (Sub-family: Cephalophinae), shrew species (*Graphiurus* spp.), rats and mice. black-backed jackal (*Canis mesomelas*), and possibly even caracal (rooikat) (*Caracal caracal*).

4.6.2 RDSIS for Mammals in the Study Area

The Red Data Sensitivity Index Score (RDSIS) was calculated for the study area using the methodology described above in the chapter on Methodology. The species of conservation concern for Mammal species for the region are shown in the table below, along with their IUCN threat status (**Error! Reference source not found.**). The IUCN Red List of Threatened Species was consulted via the official website (www.iucnredlist.org).

The Probability of Occurrence (POC) is the probability of the animal/s occurring in the study area. The calculated POC of the mammal species is calculated by taking the animal's historical distribution, present habitat availability and present food source into account. The calculated POC for the priority mammal species are shown in the table below (Table 11).

Table 11: Probability of Occurrence (POC): Mammals

Scientific Name	Common Name	IUCN Status	POC (%)	POC Value
Acinonyx jubatus	Cheetah	VU	20	Low
Amblysomus gunningi	Gunning's Golden mole	VU	0	Low
Atelerix frontalis	Hedgehog	NT	70	Medium/High
Ceratotherium simum	White rhinoceros	NT	0	Low
Cloeotis percivali	Short-eared trident bat	CR	53	Medium
Diceros bicornis	Black rhinoceros	CR	0	Low
Felis lybica	African wild cat	VU	83	Medium/High
Loxodonta africana	African elephant	VU	0	Low
Lutra macuicollis	Spotted-necked otter	NT	60	Medium/High
Lycaon pictus	African wild dog	EN	0	Low
Miniopteris schreibersi	Schreibers's long-fingered bat	NT	57	Medium
Myotis tricolor	Temminck's hairy bat	LC	50	Medium
Mystomys albicaudatus	White tailed mouse / rat	EN	0	Low
Neamblysomus julianae	Juliana's Golden Mole	EN	0	Low
Panthera leo	Lion	VU	0	Low
Rhinolophus blasii	Blasius's Horseshoe Bat	LC	23	Low/Medium
Rhinolophus clivosus	Geoffroy's Horseshoe bat	NT	57	Medium
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	30	Low/Medium
Rhinolophus hildebrandtii	Hildebrandt's Horseshoe Bat	LC	53	Medium

The Red Data Sensitivity Index Score (RDSIS) for the study area's potential Red Data Listed (RDL) mammals (species of conservation concern (SCC)) yielded an average score of 36,5%, indicating a

'**Low/Medium**' index score of importance or occurrence with regards to RDL & SCC mammal species within the general vicinity of the study area. All species with a Probability of Occurrence (POC) of 60% or more have an increased probability of either permanently or occasionally inhabiting the study area or using the study area as a corridor for movement between habitats and areas. The species with a POC of 100% are those species that were observed during field investigations. Table 12, below, is a summary of the main calculated indices for the RDSIS for the study area in terms of Red Data Listed Mammal Species. The spreadsheet showing the more detailed calculations in determining the RDSIS can be found in the appendices. The rating levels and descriptions are found in the chapter on Methodology and in the table below (Table 13).

Table 12: RDSIS for Mammals for the study area

RED DATA SENSITIVITY INDEX SCORE (RDSIS)	
Average Total Species Score	29,3%
Average Threatened Taxa Score	84,5%
Average of the combined Total Species and Threatened Taxa Scores	56,9%
% of Species with a Probability of Occurrence of >60%	16%
RDSIS for the Study Site	**36,5&**
RDSIS Category for Study Site	**LOW / MEDIUM**

Table 13: RDSIS Rating & Description (Mammals)

RDSIS Rating	Description
0-20	Low
21-40	Low/Medium
41-60	Medium
61-80	Medium/High
81-100	High

4.6.3 Avifuana

The study area is not situated within an Important Bird Area (IBA). The closest IBAs are the Loskop Dam Nature Reserve IBA (about 27 km southwest of the KM 0,0) and Steenkampsberg IBA (approximately 38 km southeast of KM 38,8) (Figure 9). The open veld and especially the hilly and mountainous terrain where there are low densities of urban development and activities will be rich with typical bushveld birds. However, the project is of such a nature that it will have no additional impact on birds. Keeping in mind that roads are an ongoing hazard to many faunal species, including owls and nightjars that hunt at night and are often blinded by the lights of oncoming vehicles when sitting in the road.

Another potential negative impact on birds is where migratory swallows nest under the roads on the ceilings of culverts and bridges. Care should be taken not to disturb active nests during the construction

phase. If active nests / nest with chicks are encountered a specialist must first be contacted to determine how to proceed.

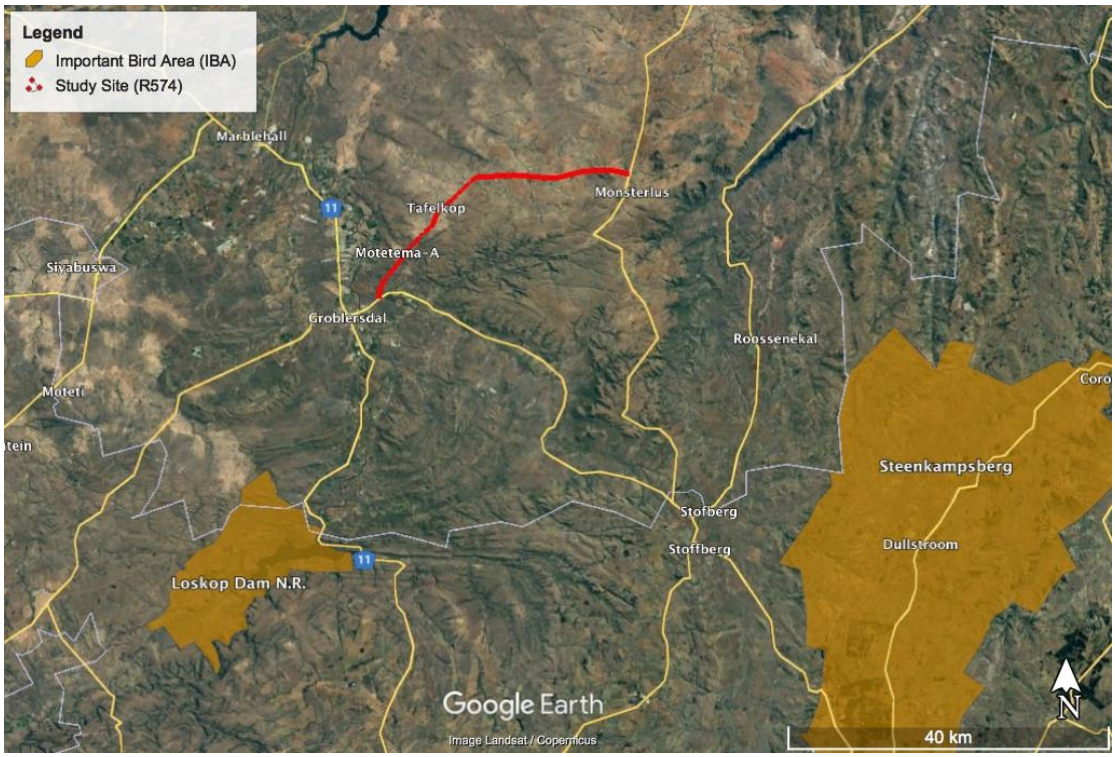


Figure 9: Important Bird Areas (IBAs)

Table 14, below, lists the priority bird species for Limpopo Province and the likelihood of any of these species been regularly present in and around the study area.

Table 14: Priority Bird species for Limpopo Province

Scientific Name	Common Name	Local Status	Distribution range within Study Site
Anthropoides paradiseus	Blue crane	NT	Unlikely
Areotis kori	Kori bustard	NT	No
Aquila rapax	Tawny eagle	EN	Yes
Bucorvus leadbeateri	Southern ground hornbill	EN	No
Buphagus africanus	Yellow-billed oxpecker	LT	No
Buphagus erythrorhynchus	Red-billed oxpecker	NT	Unlikely
Certhilauda chuana	Short-clawed lark	NT	No
Cinonia nigra	Black stork	VU	Yes
Falco naumanni	Lesser kestrel	LC	Yes
Gyps africanus	White-backed vulture	CR	Unlikely
Gyps coprotheres	Cape vulture	EN	Yes
Polemaetus bellicosus	Martial eagle	EN	Yes
Pterocles gutturalis	Yellow throated sandgrouse	NT	No
Scotopelia peli	Pel's fishing-owl	EN	No
Stephanoaetus coronatus	Crowned eagle	VU	No
Terathopius ecaudatus	Bateleur eagle	EN	Unlikely
Torgos tracheliotos	Lappet-faced vulture	EN	No

Trigonoceps occipitalis	White-headed vulture	CR	No

(References: Redlist checklist for birds in SA, 2020, BirdLife SA & Sasol eBirds)

4.6.4 Reptiles

The maps below show the hotspots for priority snake and lizard species for South Africa (Figure 10 & Figure 11). The study area is not within a snake or lizard hotspot.

The only reptiles observed during field investigations were a few common plated lizards and common dwarf geckos. Lizards tend to prefer rocky habitats. The likelihood is very low that priority lizard species will be present in the actual study area.

Snakes tend to be more mobile and adaptable to various and altered environments. A number of common snake species will be found in the general area and some are likely to wander into the study area. Examples of common species potentially found in the area are common brown house (*Lamprophis capensis*), red-lipped herald (*Crotaphopeltis hotamboeia*) and rinkhals (*Hemachatus haemachatus*). It is unlikely that the Rock Python (*Python natalensis*), which is a priority species / species of conservation concern is present in the study area, even though the study area is within the snake's distribution range. A possible exception might be in the area of the Mahtrombi Nature Reserve.

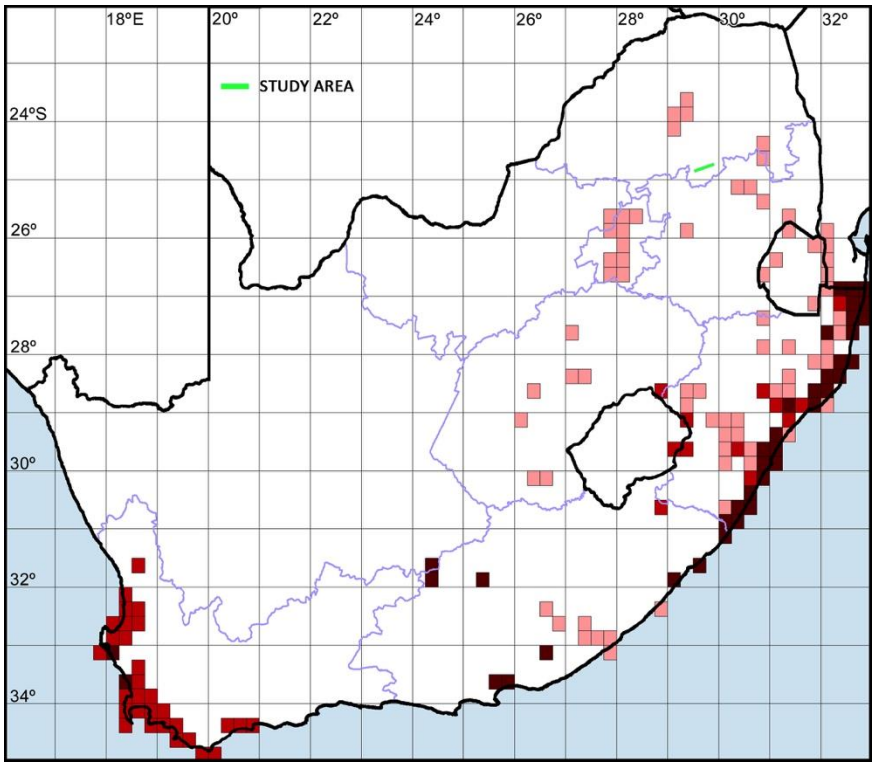


Figure 10: Snake hotspots

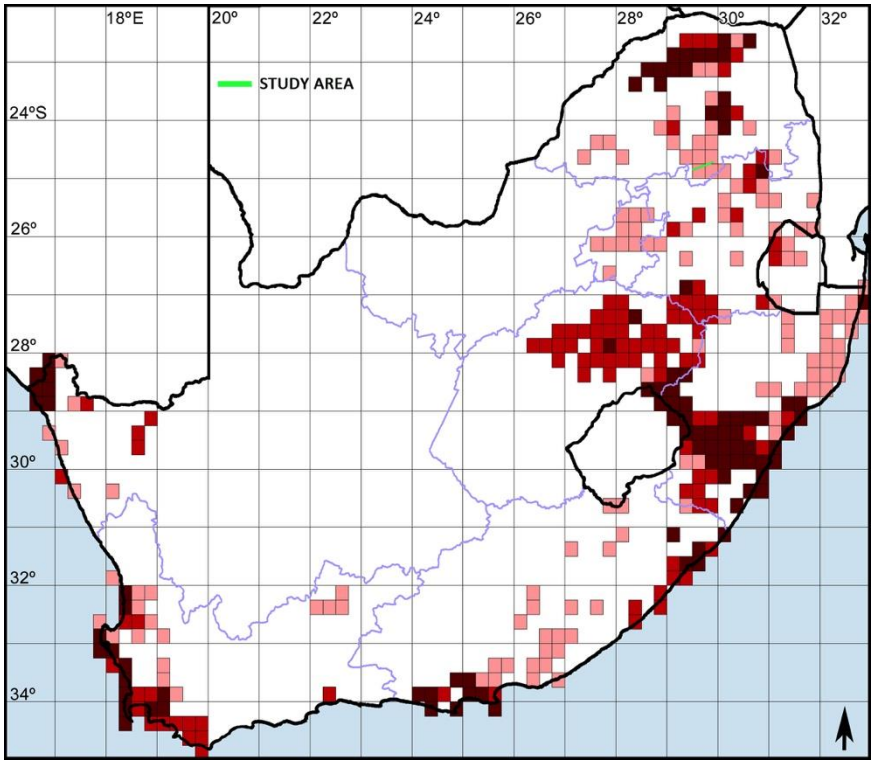


Figure 11: Lizard hotspots

4.6.5 Amphibians

Most of the study site is within dry, rocky or sandy soils, with a few watercourses present. There are a number of common frog species that will be found in the general area of the larger and less disturbed watercourses such as the Bloed and Gemsbokspruit. Amphibians are sensitive to polluted waters. The priority species of the Giant Bulfrog (*Pyxicephalus adspersus*) is unlikely to occur within the confines of the study area.

4.6.6 Invertebrates

Invertebrates such as spiders, scorpions and butterflies are important faunal groups, but are difficult to fully assess in a short time period. During field investigations specific attention was given to priority species such as Mygalomorphae arachnids (Trapdoor and Baboon spiders) and red data butterflies. Fortunately, the nature and scope of the project is such that it will have little to no measurable negative impact on these species. No priority species were observed. Spiders and scorpions are problematic due to the lack and paucity of data on spiders and the wide distribution of scorpions. Conservation efforts are now more focused on specific species, as opposed to faunal groups.

Recorded butterfly fauna for Limpopo Provinces falls into: 5 families, 17 subfamilies, 127 genera, 361 species and 8 additional subspecies (369 taxa). Shared endemic genera: 8. Exclusive endemism: 10

species and 8 subspecies (18 taxa). Shared endemism: 31 species and 7 subspecies (38 taxa). Proposed Red List taxa: 9 (all endemic to LP) (SA Red Data Book: Butterflies, SANBI Series 13).

The species of conservation concern for Limpopo are:

Nymphalidae: *Telchinia induna salmontana, Dingana clara, Dingana jerinae, Pseudonympha swanepoeli.*

Lycaenidae: *Alaena margaritacea, Aloeides stevensoni, Anthene juanitae, Erikssonia acraeina, Lepidochrysops lotana*

The Wolkberg mountain range is the main hotspot in the Province for butterflies and include priority species such as: *Aloeides stevensoni Dingana clara Lepidochrysops lotana.* The likelihood for RDL butterfly species to occur in the study area is shown in Table 15, below.

Table 15: RDL butterfly species for the Limpopo Province

Scientific Name	Common name	Local Status	Present in study area
Alaena margaritacea	Wolkberg zulu	CR	No
Aloeides stevensoni	Stevenson's copper	VU	No
Anthene juanitae	Juanita's hairtail	VU	No
Dingana clara	Wolkberg widow	Vu	No
Dingana jerinae	Jerine's widow	VU	No
Erikssonia acraeina	Erikson's copper	CR	No
Lepidochrysops lotana	Lotana blue	CR	No
Pseudonympha swanepoeli.	Swanepoel's brown	CR	No
Telchinia induna salmontana	Induna acraea	VU	No

CR= Critically Endangered**, EN=** Endangered**, NT =** Near Threatened**, VU=** Vulnerable**.**

The map below shows the hotspots for priority butterflies and species-rich areas for South Africa (Figure 12). The study area is not within any of these known hotspots. A number of common butterfly species will be present in the study area, especially in the hills and northern sections where there is a greater variety of trees and shrubs.

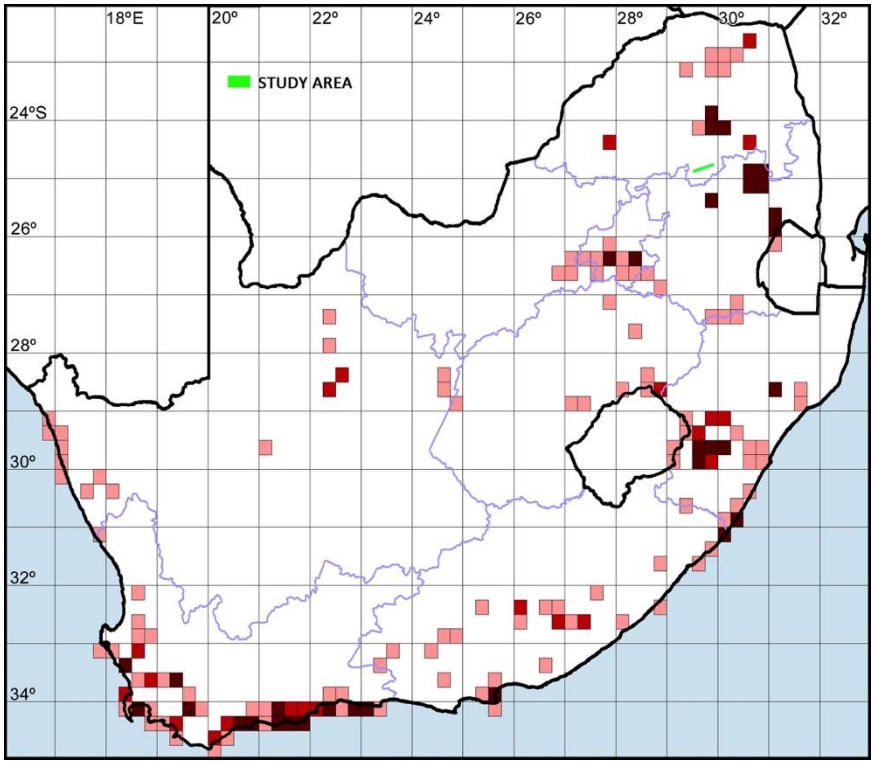


Figure 12: Butterfly hotspots

4.7 Priority Faunal Species

No priority faunal species or species of conservation concern (SCC) are present in the study area and none are expected to occur permanently. It is however not unlikely that species may wonder through the study area on occasion, as the traverse from one area to another or move around in search of food or water. However, due to the transformed and altered environment, with no ideal habitats and high levels of urbanisation along the route, it is extremely unlikely that any will nest, breed or remain within the actual study area. The most likely area for faunal SCC to be encountered along the route or during construction phase is in the area of the Mahtrombi Nature Reserve.

Table 16, below, lists some of the wild, free-roaming priority species found in the region and their likelihood to be present in the study area.

Table 16: Priority Faunal Species likely to occur in the area

Species	Common Name	Red Data Status	Preferred Habitat	Habitat Restrictions	Present in Study area
Frogs					
Pyxicephalus adspersus	Giant bullfrog	Threatened	Grassland; savanna	Temporary floodplains, pans	No
Mammals					
Atelerix frontalis	SA hedgehog	Near threatened	Most, broad	Broad	Possible
Manis	Pangolin (Scaly	Vulnerable	Grassland,	Woody	Possible, but

temmincki	anteater)		savanna	savanna, ants, termites	unlikely
Mellivora capensis	Honey badger (Ratel)	Near threatened	Most, broad	Broad	Possible
Cloeotis percivali	Short-eared trident bat	Critically endangered	Savanna	Caves and subterranean habitat	Unlikely
Pipistrellus rusticus	Rusty bat	Near threatened	Most, broad	Woody savanna, large trees	Unlikely
Snakes					
Python natalensis	Southern African python	Vulnerable	Ridges, wetlands	Rocky areas; open water	Unlikely. Found in rocky areas and close to water sources

5 AQUATIC ECOLOGY

The aquatic ecology focuses on surface water in the environment and looks at all watercourses. These watercourses include rivers, streams, drainage lines and wetlands. Wetlands include marshes, seeps and pans (freshwater and saltwater). Manmade systems (artificial systems) such as farm dams, canals and artificial wetlands are also investigated and discussed in the aquatic ecology. Although rivers, streams and wetlands are all watercourses, the legal implications differ in terms of development, buffer zones, etc.

According to the National Water Act (36 of 1998) a 'watercourse' means:

a. A river or spring;
b. A natural channel in which water flows regularly or intermittently;
c. A wetland, lake or dam into which or from which water flows; and
d. Any collection of water, which the Minister may, by notice in the Gazette declare to be a watercourse.

The reference to a watercourse includes, where relevant, beds, banks, floodlines, floodplains and riparian zones. The official definitions of the different watercourses, including that of a riparian zone can be found in the Appendices.

During site investigations the following indicators are used to determine whether an area needs to be defined as a wetland or not, namely: Terrain unit indicator; Soil form indicator; Soil wetness indicator; and Vegetation indicator.

5.1 Drainage Areas

South Africa can be naturally divided up into a number of geographically occurring Primary Drainage Areas (PDAs) (Figure 13). The PDAs can be further divided into a number of Quaternary Drainage Areas (QDAs). The different areas are demarcated into Water Management Areas (WMAs) and

Catchment Management Agencies (CMAs). Previously there were 19 WMAs and 9 CMAs. As of September 2016, the WMAs were revised and there are now officially only 9 WMAs, which correspond directly in demarcation and area to the 9 CMAs (Government Gazette, 16 September 2016. No.1056, pg.169-172) (Figure 14).

The study area is situated within the Primary Drainage Area (PDA) of **B** and in the Quaternary Drainage Areas (QDAs) of **B32F, B32J, B51A & B51B** (Figure 15). A summary of the catchment areas is shown in Table 17, below.

Table 17: Summary of Catchment Areas

Level	Category
Primary Drainage Area (PDA)	B
Quaternary Drainage Area (QDA)	B32F, B32J, B51A, B51B
Water Management Area (WMA) – Old	Olifants
Water Management Area (WMA) – New	Olifants (WMA 2)
Sub-Water Management Area	Middle Olifants
Catchment Management Agency (CMA)	Olifants (CMA 2)
Wetland Vegetation Ecoregion	Central Bushveld & Mesic Highveld Grassland
RAMSAR Site	No
River FEPA	Yes (Bloed, Puleng, Gemsbok)
Wetland FEPA	No
Fish FEPA	No
Fish FSA	No
Fish Corridor	No
Fish Migratory	No
National Strategic Water Source Area (SWSA)	No
Provincial Important Water Source Area (WSA)	No

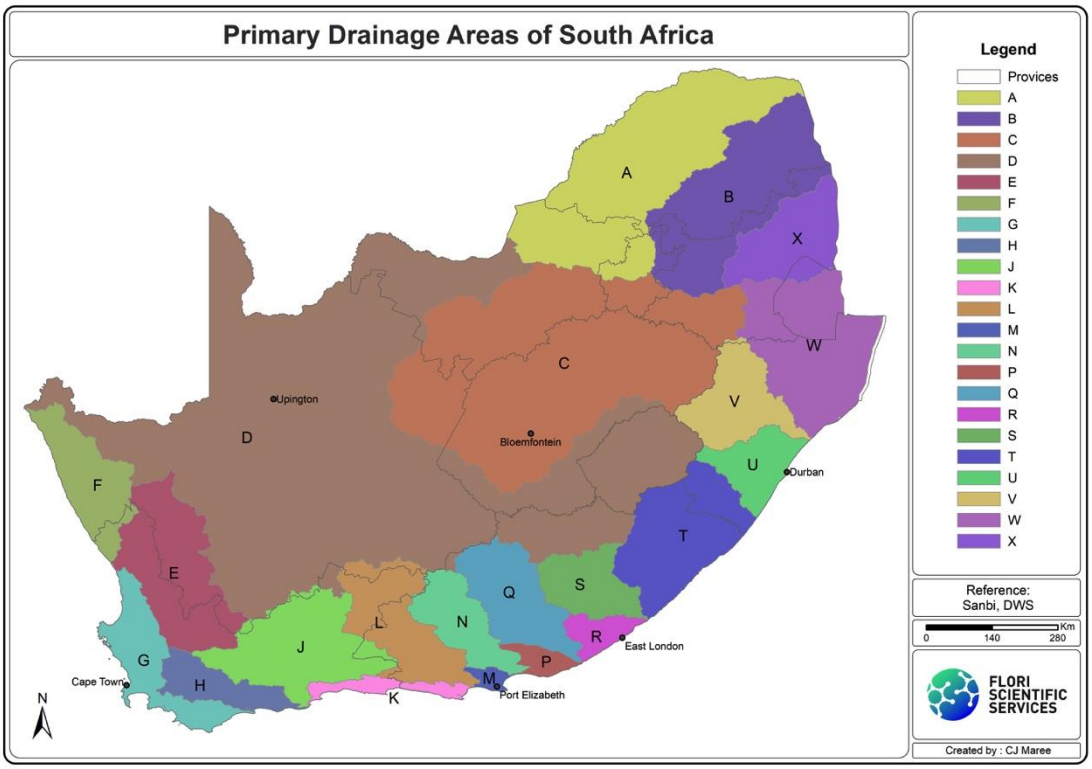


Figure 13: Primary Drainage Areas of South Africa

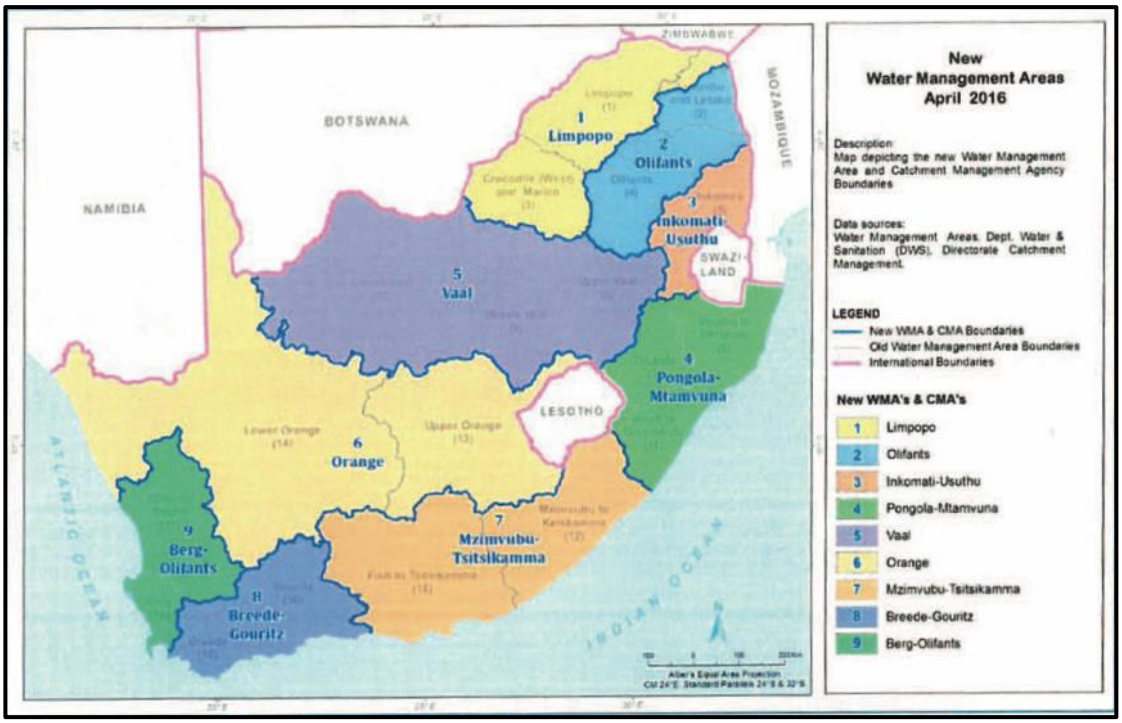


Figure 14: WMAs and CMAs of South Africa

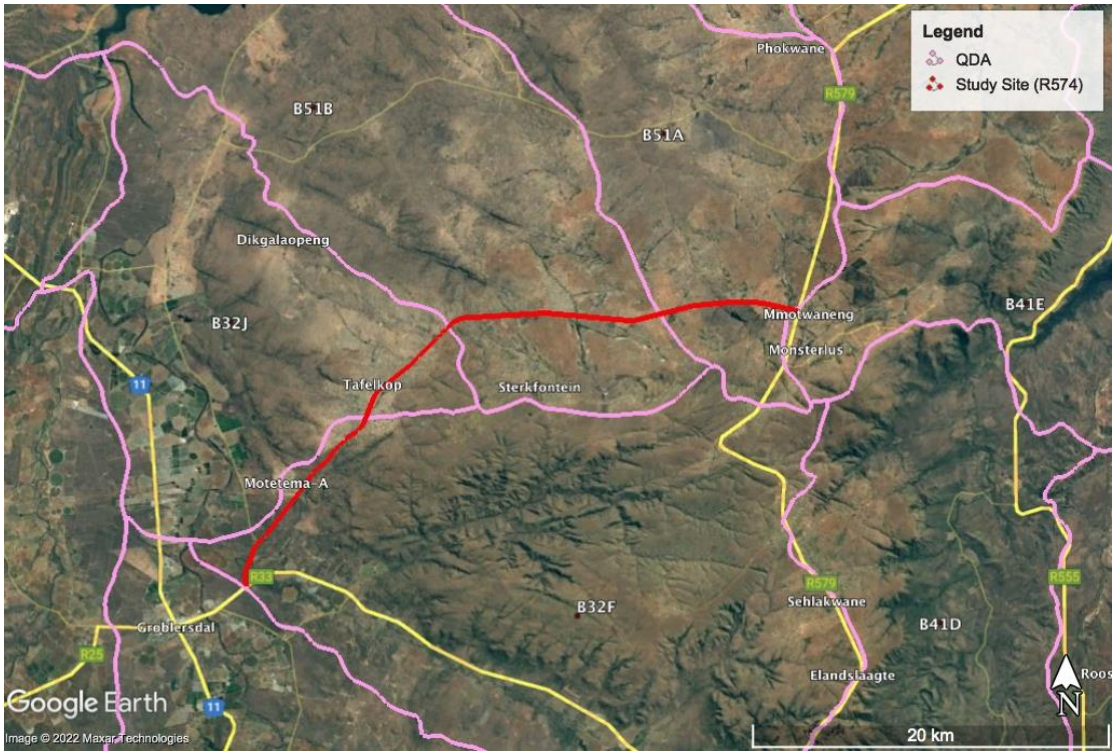


Figure 15: Quaternary Drainage Areas (QDAs)

5.2 Strategic Water Source Areas of South Africa

The study site is not situated within any provincial or national strategic water source area (SWSA) of South Africa (Figure 16).

The Strategic Water Source Areas of South Africa (SWSA) are those areas that supply a disproportionate amount of mean annual runoff compared to the actual size of the geographical area. These areas are important because they have the potential to contribute significantly to the overall water quality and supply of the country, supporting growth and development needs that are often a far distance away. These areas make up 8% of the land area across South Africa, Lesotho and Swaziland but provide 50% of the water in these countries.

Strategic Water Source Areas (SWSA) are of national or provincial importance and can be either strategic in terms of surface water supply or groundwater supply.

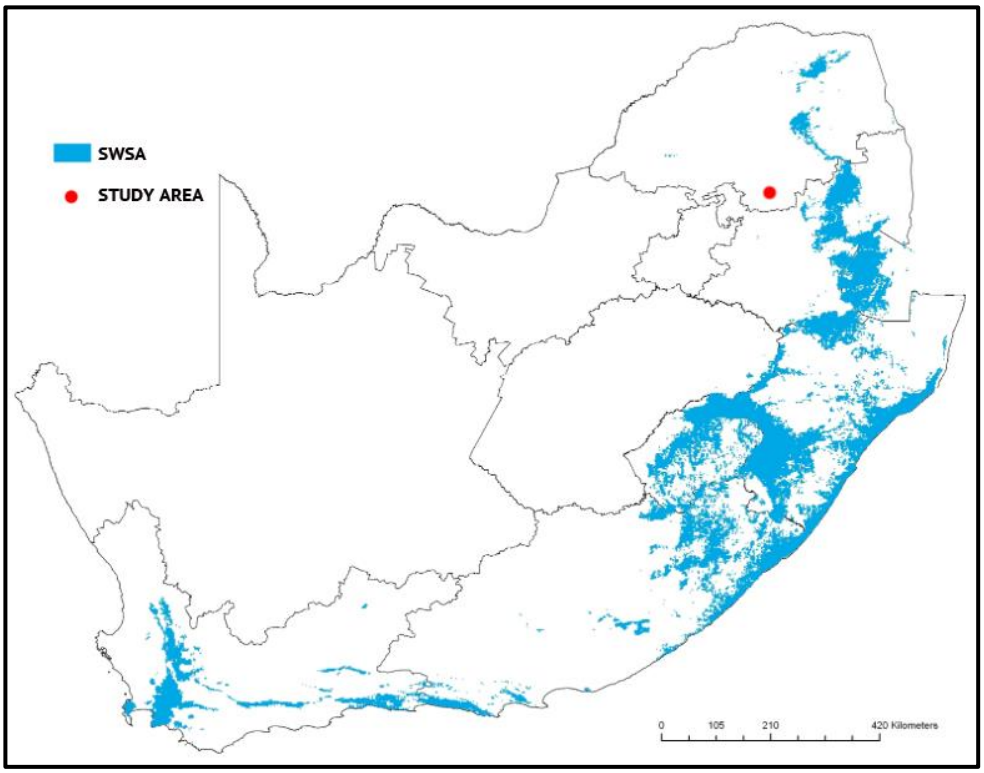


Figure 16: SWSA of South Africa

5.3 Watercourses in the study area

There are eight main watercourses (rivers or streams) that the study site (R574) crosses over. Starting from KM 0,0, near Groblersdal these are: Bloed, Rulokwane, Puleng, Puleng tributary, Ga-Makatle, Gemsbokspruit tributary, Gemsbokspruit and Malekani (Figure 17). The positions of these watercourse crossings are shown below in Table 18 and Figure 17.

Table 18: Coordinates of Watercourse Crossings

No	River / Stream	GPS Location	Present Structures
1	Bloed	25°8'17.60"S; 29°26'15.96"E	Bridge
2	Rulokwane	25°3'29.81"S; 29°30'20.35"E	Box Culverts
3	Puleng	25°0'44.63"S; 29°33'38.96"E	Box Culverts
4	Puleng Tributary	25°0'39.50"S; 29°35'11.60"E	Box Culverts
5	Ga-Makatle	25°0'41.76"S; 29°37'14.07"E	Bridge
6	Gemsbokspruit Tributary	25°0'31.63"S; 29°40'30.79"E	Box Culverts
7	Gemsbokspruit	25°0'18.76"S; 29°41'58.95"E	Pipe Culverts
8	Malekani	25°0'28.75"S; 29°44'17.42"E	Box Culvert

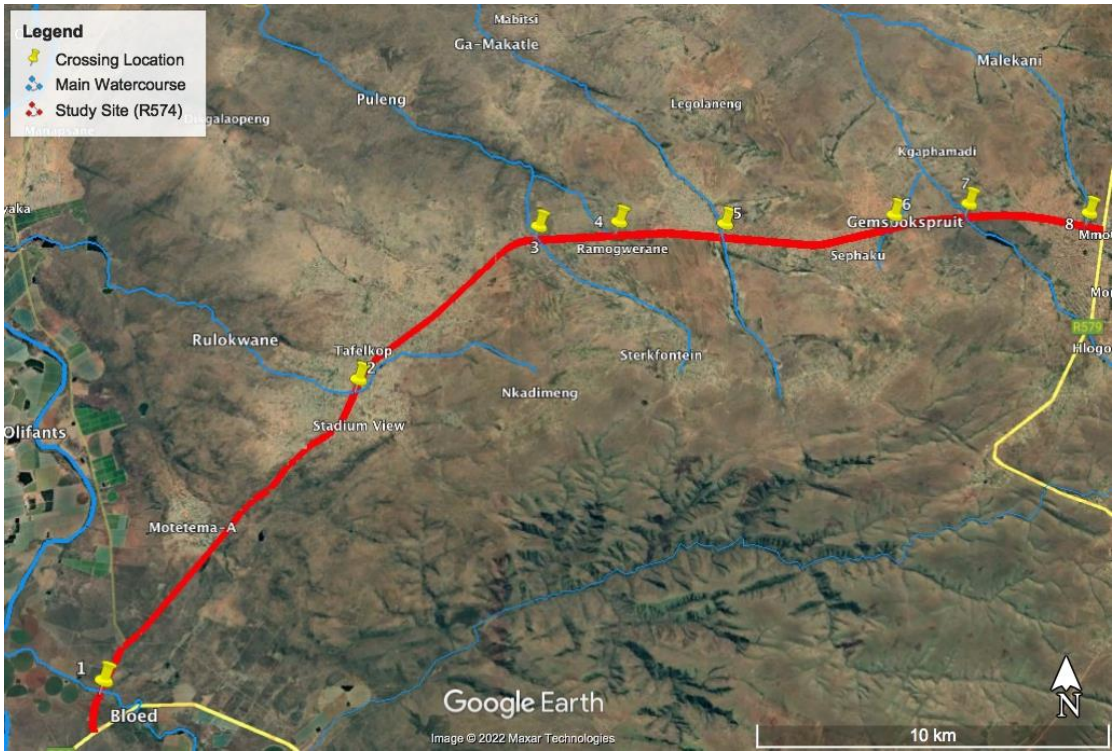


Figure 17: Main Watercourses

In general the watercourses in the study area (those that are crossed) are all small, mostly semi-perennial / intermittent streams and seasonal drainage lines. The crossings are also small and narrow with only two actual bridges crossings over the Bloed River and Ga-Makatle River. The streams have no distinctive riparian zones or vegetation, except for the Bloed River, which only has a narrow zone of a few metres wide. Table 19, below, shows the existing watercourse crossings in the study site (R574).

The only wetlands present in the study site are valley bottom or floodplain wetlands associated with the eight small rivers and streams already mentioned. There are no large or distinctive 'stand alone' wetlands in the study area such as pans, valley bottom wetlands without mainstream channels, etc. The national wetland map (Map 5, 2018) only shows one valley bottom wetland associated with the Gemsbokspruit (Figure 18).

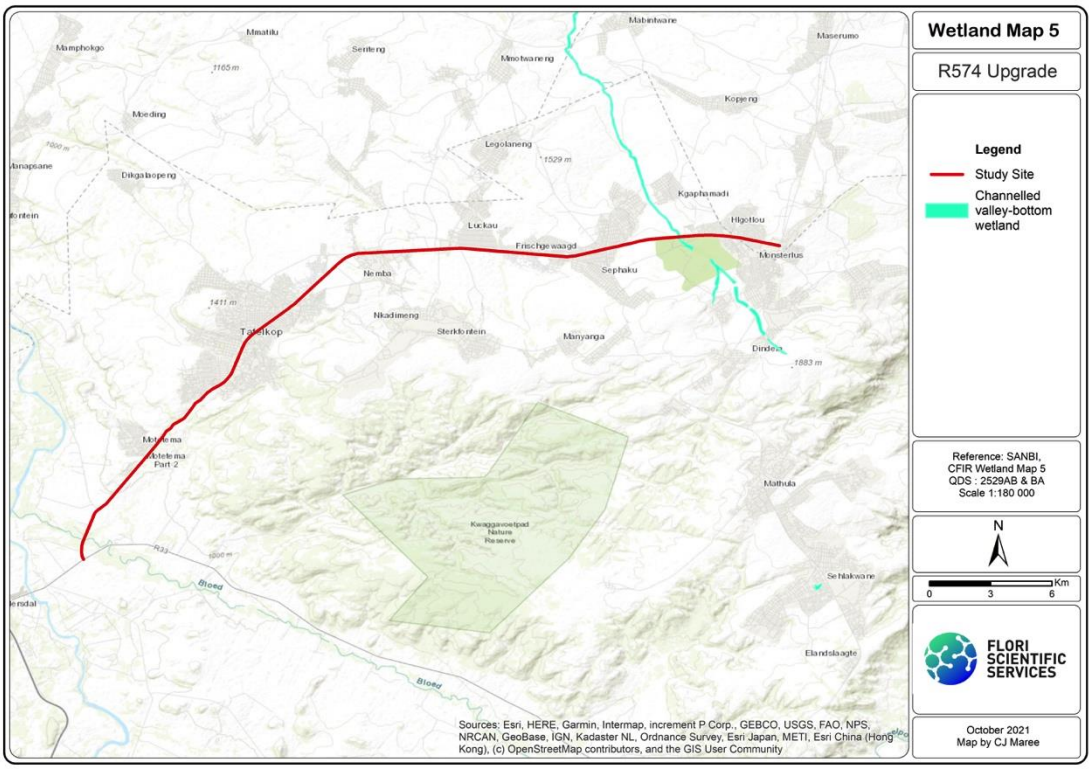


Figure 18: National Wetland Map 5

Table 19: Photos of watercourse crossings

	Bridge crossing over the **Bloed River**. Tall trees can be seen upstream (left) in the river and along the banks. This is the only watercourse crossing with any riparian zone and large trees present.

	Crossing at the **Rulokwane**. The watercourse is small with pipe culverts under the road.
	**Puleng** with small side barriers and no bridge, only cement box culverts under the road. A few thorn trees can be seen on the edge of the stream near the road, but no riparian zone is present.
	The **Puleng tributary** is a small drainage line that flows into the Puleng Stream. The crossing is very small and narrow with box culverts

	**Ga-Makatle River** is a larger crossing with a bridge. The main channel is still small and narrow, but there is a larger, broader floodplain area.
	**Gemsbokspruit tributary**. Small narrow crossing in a steep narrow valley. Concrete box culverts have been used at this watercourse crossing.
	**Gemsbokspruit** with low, stone / concrete side barriers and a number of concrete pipe culverts.

	**Malekani Stream**. There is literally just a stormwater culvert under the road. The stream starts basically just north of the road, with some stormwater run-off channelled under the road the the culvert.

5.4 Classification of watercourses

Watercourses identified are classified along different hydrogeomorphic (HGM) units, up to Level 4, in terms of various levels as refined for South Africa by Kleynhans, *et. al*. (2005) and used in the Classification System for Wetlands user manual – SANBI Series 22 (Ollis *et. al.* 2013) (Table 20).

Table 20: Classification levels 1 - 4

LEVEL 1 System	LEVEL 2 Regional setting (Ecoregion)	LEVEL 3 Landscape Unit	LEVEL 4 HGM Unit	
			HGM Type	Landform
Inland	SA Ecoregions according to DWS and/or NFEPA	• Valley floor • Slope • Plain • Bench	River	• Mountain headwater stream • Mountain stream • Transitional stream • Upper foothill • Lower foothill • Lowland • Rejuvenated foothill • Upland floodplain
			Channelled valley bottom wetland	
			Unchannelled valley bottom wetland	
			Floodplain Wetland	
			Depression	• Exorheic • Endorheic • Dammed
			Seep	• With channel outflow (connected) • Without channel outflow

				(disconnected)
			Wetland flat	

Table 21: Classification of watercourses

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit
Bloed	Inland	Central Bushveld (Group 3)	Plain / Valley bottom	River (Lowland)
Rulokwane	Inland	Central Bushveld (Group 3)	Plain	River (Lowland)
Puleng	Inland	Central Bushveld (Group 3)	Plain	River (Lowland)
Puleng Tributary	Inland	Central Bushveld (Group 3)	Plain / Valley bottom	River (Lowland)
Ga-Makatle	Inland	Central Bushveld (Group 2)	Plain / Valley bottom	River (Lowland)
Gemsbokspruit Tributary	Inland	Central Bushveld (Group 2)	Plain	River (Lowland)
Gemsbokspruit	Inland	Central Bushveld (Group 2)	Plain / Valley bottom	River (Lowland)
Malekani	Inland	Central Bushveld (Group 2)	Plain	River (Lowland)

5.5 Present Ecological State of Watercourses

All watercourses identified and delineated within the study area were assessed to determine their Present Ecological State (PES) (Table 22, Table 23). The assessment criteria and structure are based on the modified Habitat Integrity approach of Kleynhans (1996, 1999). The PES is calculated by looking at the hydrology, geomorphology, water quality and biota of each watercourse. Of importance is the overall PES of the system (Table 22).

In general the conditions (present ecological state) of the watercourses are poor. Most of the watercourses have PES ratings of Category D (Largely Modified) or Category E (Seriously Modified).

The Bloed River is rated as Category C (Moderately Modified) and the Gemsbokspruit is rated at Category B (Largely Natural). The rating of the Gemsbokspruit at the road crossing is largely due to the fact that upstream the river is within a protected, fairly natural area.

In general, the watercourses do not have high levels of invasive weeds present, although they are present everywhere, but scattered.

Note that the PES ratings of a river or stream can vary across the length of their course. The PES ratings are calculated at the R547 road crossing and within an area of about 100m upstream and 100m downstream of the crossing.

Table 22: PES of Watercourses in the study area (1-4)

CRITERIA	IDENTIFIED WATERCOURSES			
	Bloed	Rulokwane	Puleng	Puleng Tributary
HYDROLOGY				
Flow modification	3	2	2	2
Permanent inundation	2	2	2	2
WATER QUALITY				

Water Quality Modification	3	2	2	1
Sediment Load Modification	3	2	2	2
GEOMORPHOLOGY				
Canalisation	3	3	3	1
Topographic Alteration	3	2	2	1
BIOTA				
Terrestrial Encroachment	2	2	2	1
Indigenous Vegetation Removal	3	2	2	2
Invasive Plant Encroachment	3	3	3	3
Alien Fauna	3	3	3	3
Over utilisation of Biota	2	2	2	1
Total:	30	25	25	19
Average:	2,7	2,3	2,3	1,7
Category:	**C**	**D**	**D**	**E**
Description	**Moderately modified**	**Largely modified**	**Largely modified**	**Seriously modified**
Recommended EMC	**C**	**C**	**C**	**D**

Table 23: PES of Watercourses in the study area (5-8)

CRITERIA	IDENTIFIED WATERCOURSES			
	Ga-Makatle	Gemsbok Tributary	Gemsbok	Malekani
HYDROLOGY				
Flow modification	2	1	3	1
Permanent inundation	2	2	3	2
WATER QUALITY				
Water Quality Modification	2	2	4	2
Sediment Load Modification	2	2	3	2
GEOMORPHOLOGY				
Canalisation	3	2	4	1
Topographic Alteration	2	2	4	2
BIOTA				
Terrestrial Encroachment	2	1	3	1
Indigenous Vegetation Removal	2	1	3	1
Invasive Plant Encroachment	3	3	3	3
Alien Fauna	3	3	3	3
Over utilisation of Biota	2	2	3	2
Total:	25	21	36	20
Average:	2.3	1,9	3,3	1,8
Category:	**D**	**E**	**B**	**E**

Recommended EMC	**C**	**D**	**B**	**D**

5.6 Ecological Importance & Sensitivity of Watercourses

The Ecological Importance and Sensitivity (EIS) ratings of the watercourses were determined as shown in the table below (Table 24).

None of the watercourses in the study site have high EIS ratings of Category A or B. Three of the watercourses (Bloed, Ga-Makatle and Gemsbok) have EIS ratings of Category C (Moderate), while the rest have EIS ratings of Category D (Low).

In other words, three of the rivers / streams are important on a provincial scale, while the rest of small insignificant watercourses that are only important on a local scale.

Table 24: EIS of watercourses in the study area

Determinants	Bloed, Ga-Makatle, Gemsbok	Rulokwane, Puleng, Tributaries	Confidence
PRIMARY DETERMINANTS			
1. Rare & Endangered Species	1	0	4
2. Populations of Unique Species	1	1	4
3. Species/taxon Richness	1	1	4
4. Diversity of Habitat Types or Features	1	1	4
5 Migration route/breeding and feeding site for wetland species	1	0	3
6. Sensitivity to Changes in the Natural Hydrological Regime	1	1	3
7. Sensitivity to Water Quality Changes	1	1	3
8. Flood Storage, Energy Dissipation & Particulate / Element Removal	1,5	1	3
MODIFYING DETERMINANTS			
9. Protected Status	1	1	4
10. Ecological Integrity	1	1	4
TOTAL	10,5	8	-
AVERAGE	1,1	0,8	-
EIS Category	**C**	**D**	**-**
Description	**Moderate**	**Low**	**-**
Description of EIS Category	Ecologically important and sensitive on a **provincial or local** scale. They play a small role in moderating the quantity and quality	Not ecologically important and sensitive on any scale. They play an insignificant role in moderating the quantity and quality of water of	

	of water of major rivers.	major rivers.	

6 SENSITIVITY ASSESSMENT

6.1 DEA Screening Tool Assessment

The Department of Forestry, Fisheries and Environment (DFFE) (Previously DEA) has development a desktop screening tool that is to be used as a guideline in an initial desktop assessment of a project site (www.screening.environment.gov.za). The screening tool is a guideline tool that needs to be verified during site investigations (ground truthing). Depending on the levels of sensitivity shown in the screening assessment certain criteria in terms of assessments, studies, etc. may be required by the competent authorities. According to the screening tool (accessed January 2022) the various sensitivities for the study site and immediate surroundings are as follows:

- Terrestrial biodiversity combined theme sensitivity: Very High & Low.
- Aquatic biodiversity combined theme sensitivity: Low.
- Plant species theme sensitivity: Mostly Low with a few patches of Medium.
- Animal species theme sensitivity: Medium & Low.

Screenshots of the maps taken from the screening tool assessment are shown below in Table 25.

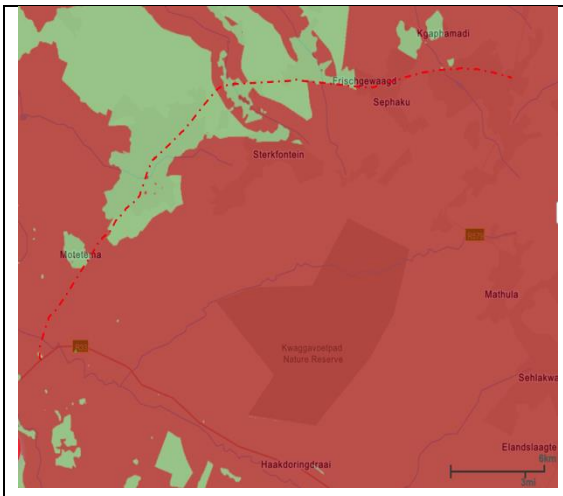
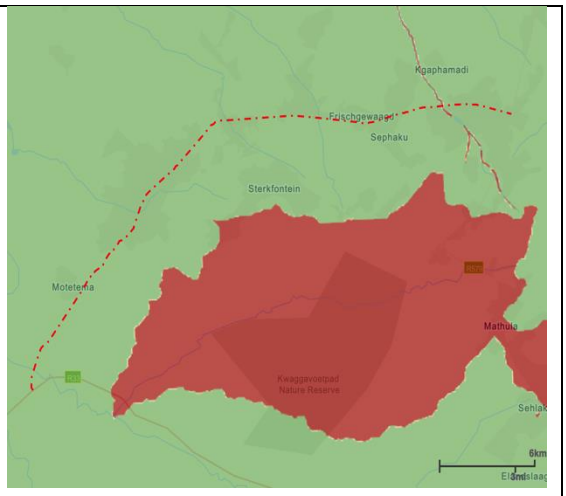
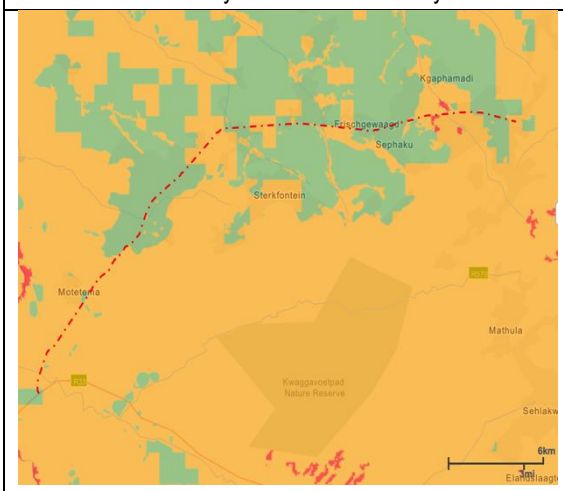
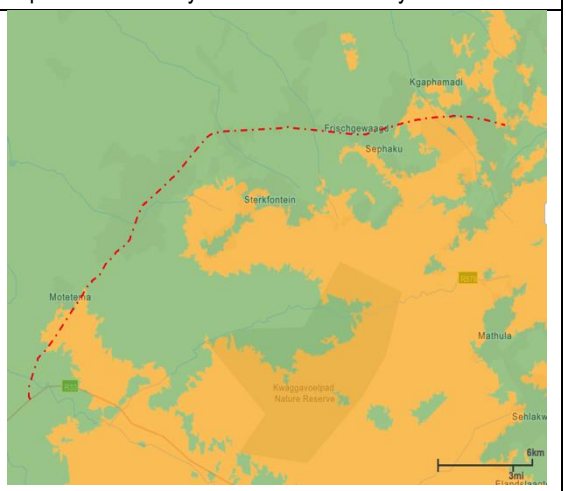
During site investigations the sensitivities, as shown in the screening tool results (Table 25) were assessed and verified. The site investigations affirmed most of the sensitivity ratings as shown in the screening tool assessment.

It must be kept in mind that although the existing study site passes through some 'high' sensitive areas, that the study site consists entirely of a transformed and degraded environment within these larger sensitive patches.

The only biodiversity areas of 'high' sensitivity encountered within the study site are the larger watercourse crossings and a section near Motetema where the road goes up a slight rise and onto higher lying ground / plateau. This is in the area where the 'cutting' for widening of the road will need to take place. The area of the Gemsbokspruit (stream) and Mahtrombi Nature Reserve are shown as having animal and plant sensitivities of 'Medium'. This was verified as such during site investigations (ground-truthing).

There are no 'no-go zones' along the study site that might trigger a 'fatal flaw' in terms of the project brief and scope.

Table 25: Maps from Screening Tool Assessment

	
Terrestrial Biodiversity Combined Sensitivity	Aquatic Biodiversity Combined Sensitivity
	
Animal Species Theme	Plant Species Theme
Red Dotted Line - Study Site; Red – Very High Sensitivity; Yellow – Medium Sensitivity; Green – Low Sensitivity	

6.2 Ecological Sensitivity Assessment

The sensitivity assessment identifies those areas and habitats within the study site that have a high conservation value and that may be sensitive to disturbance. All watercourses, including seasonal streams and drainage lines are, by default, viewed as sensitive, even if they are degraded. Areas or habitats have a higher conservation value (or sensitivity) based on their threatened ecosystem / veldtype status; ideal habitat for priority species (including Red Data species); species-richness; distinctive habitats; etc. Demarcated priority areas such as nature reserves also have a higher ecological sensitivity, even if not within a threatened ecosystem.

The sensitivities of the habitats are first assessed separately in terms of fauna and flora (Table 26 & Table 27) and then combined into an overall ecological sensitivity analysis (Table 28).

6.3 Floristic Sensitivity Analysis

Table 26: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area			
	Thornveld	Bushveld	Hills	Watercourses
Red Data Species	3	3	4	4
Habitat Sensitivity	3	3	4	4
Floristic Status	3	3	5	5
Floristic Diversity	4	5	5	5
Ecological Fragmentation	4	5	5	5
Sensitivity Index	34%	38%	46%	46%
Sensitivity Level	Medium/Low	Medium/Low	Medium	Medium

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

6.4 Faunal Sensitivity Analysis

Table 27: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area			
	Thornveld	Bushveld	Hills	Watercourses
Red Data Species	2	2	4	4
Habitat Sensitivity	3	3	4	4
Faunal Status	3	3	5	4
Faunal Diversity	3	3	4	5
Ecological Fragmentation	4	5	5	5
Sensitivity Index	30%	32%	44%	44%
Sensitivity Level	Medium/Low	Medium/Low	Medium	Medium

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

6.5 Ecological Sensitivity Analysis

The ecological sensitivity of the study area is determined by combining the sensitivity analyses of both the floral and faunal components. The highest calculated sensitivity unit of the two categories is taken to represent the sensitivity of that ecological unit, whether it is floristic or faunal in nature (Table 28).

Table 28: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Thornveld	Medium / Low	Medium / Low	Medium / Low
Bushveld	Medium / Low	Medium / Low	Medium / Low
Hills	Medium	Medium	Medium
Watercourses	Medium	Medium	Medium

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

6.6 Priority Areas

The study site (R574) runs along the northern boundary of the Mahtrombi Nature Reserve in the east near Morwaneng (Figure 19). The site does not infringe on any other priority areas. The Kwaggavoetpad Nature Reserve and the Mesic Grasslands NPAES are both south of the study site (Figure 19).

Priority areas include formal and informal protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; national fresh water ecosystem priority areas (NFEPAs) and national protected areas expansion strategy (NPAES) focus areas.

According to the National Environmental Management: Protected Areas Act (Act 57 of 2003), The Minister must maintain an official register of protected areas. A Protected Areas Register (PAR) was therefore developed for reporting and mapping purposes of protected areas and conservation areas in South Africa (www.portal.environment.gov.za). The PAR confirms the areas as shown in Figure 19 below.

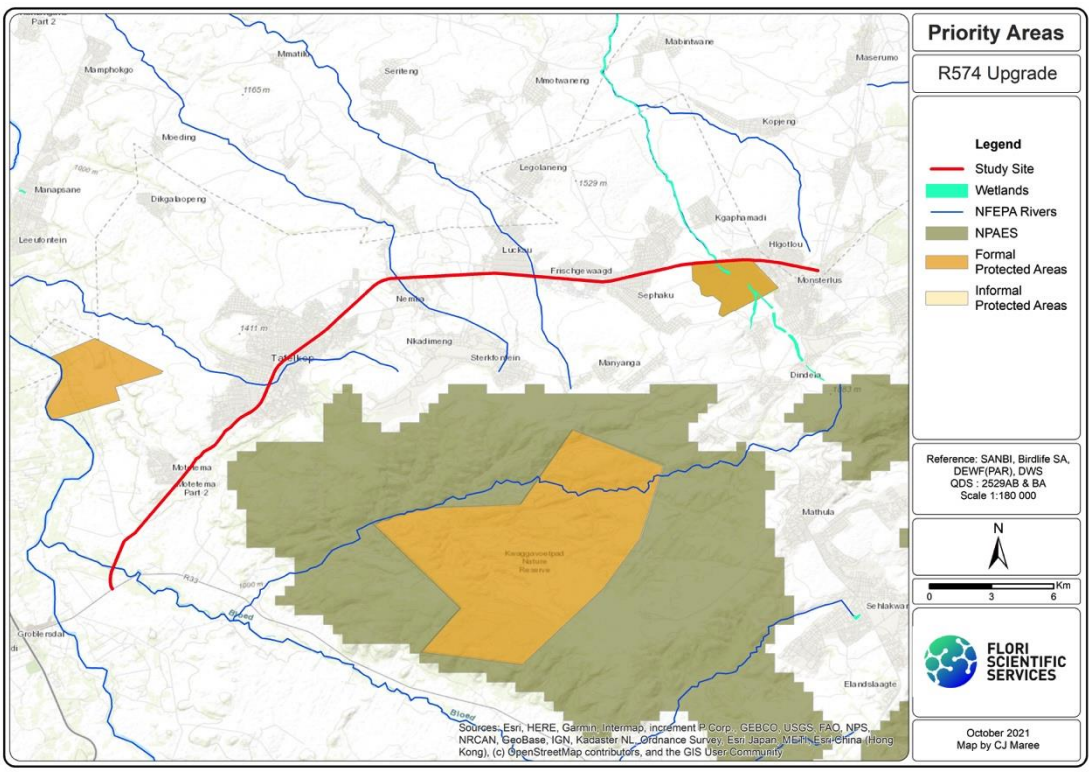


Figure 19: Priority Areas

6.7 Critical Biodiversity Areas and Ecological Support Areas

According to the Limpopo Conservation Plan Version 2 (2015) some of the study site crosses through some Critical Biodiversity Areas (CBAs) and some Ecological Support Areas (ESAs) (Figure 20). The ESAs are basically along the small rivers and streams. The CBAs are in two areas. The one area in the east is in the area of the Mahtrombi Nature Reserve and is well founded. The CBA2 area on the western section is completely within existing and old cultivated and grazing farmlands and seems that it should rather be designated as an ESA. The only area of any concern in terms of CBAs, ESAs and sensitive areas that may be impacted on, is the CBA1 area in the vicinity of the proposed 'cutting' which is just east of Motetema.

Table 29 gives a brief description of the different CBA and ESA categories as per the Limpopo Conservation Plan (V2) and Sekhukhune District Bioregional Plan (2018).

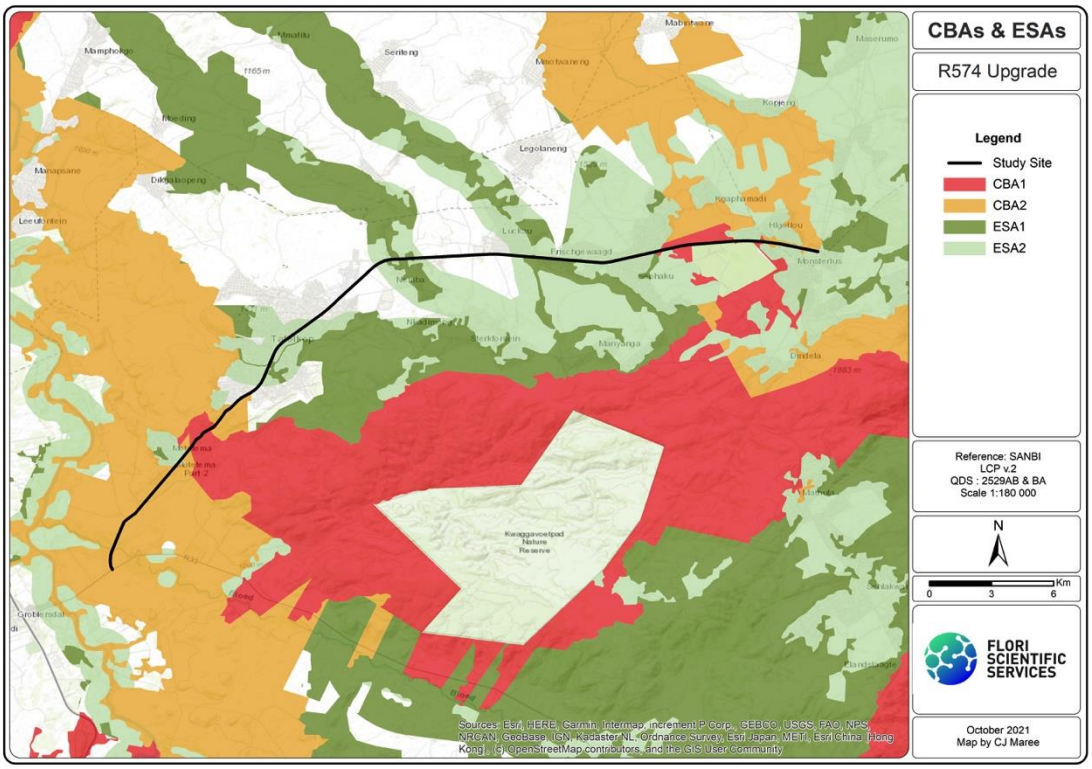


Figure 20: CBAs and ESAs

Table 29: CBA & ESA Category Descriptions

Category	Definition	Land Management Objective	Land Management Recommendations
CBA 1	Irreplaceable sites. Areas that is essential for meeting biodiversity targets. No alternative sites are available to meet targets.	Maintain in a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state, and manage for no further degradation.	Obtain formal conservation protection where possible. Implement appropriate zoning to avoid loss of intact habitat or intensification of land use.

CBA 2	Areas selected to meet biodiversity targets. Alternative sites may be available to meet targets, but these are the optimal sites based on complementarity, connectivity and avoidance of conflict with other land uses.	Maintain in a natural state with limited or no biodiversity loss. Rehabilitate degraded areas to a natural or near natural state, and manage for no further degradation.	Obtain formal conservation protection where possible. Implement appropriate zoning to avoid loss of intact habitat or intensification of land use.
ESA 1	Natural, near natural and degraded areas that support the ecological functioning of CBAs and protected areas and maintain ecological processes.	Maintain ecosystem function and connectivity allowing for limited loss of biodiversity pattern.	Implement appropriate zoning and land management guidelines to avoid impacting of ecological processes. Avoid intensification of land use. Avoid fragmentation of natural landscape.
ESA 2	Areas with no natural habitat that are nevertheless important for supporting ecological processes.	Avoid additional / new impacts on ecological processes. Ensure that land use is not intensified and that activities are managed to minimise impact on threatened species.	Avoid intensification of land use, which may result in additional impact on ecological processes. Avoid conversion of agricultural land to more intensive land uses, which may have a negative impact on threatened species or ecological processes.

6.8 Sensitive areas identified during field investigations

The study site is an existing transformed and highly degraded environment. Most of the study site (R574) also runs through built up villages and townships with high levels of transformed, altered and degraded natural environments. In reality there are no sensitive areas within the study site itself. That is, the existing asphalt / hard-surfaced road and road reserve.

The only sensitive areas along the study site route, which can be negatively impacted on during, in particular, the construction phase are the watercourse crossings and the 'cutting' area.

Most of the watercourses are small and badly degraded by are all, by default, viewed and approached as 'sensitive'. The cutting is within a CBA area and there are some protected trees on the cliff top that might be impacted.

However, although there are some 'sensitive' areas there are no areas that need to be completely avoided. In other words, there are no 'no-go' zones in the study area.

Figure 21, below, shows the nine (9) areas of 'High Sensitivity'. The rest of the route has a sensitivity rating of 'Low'.

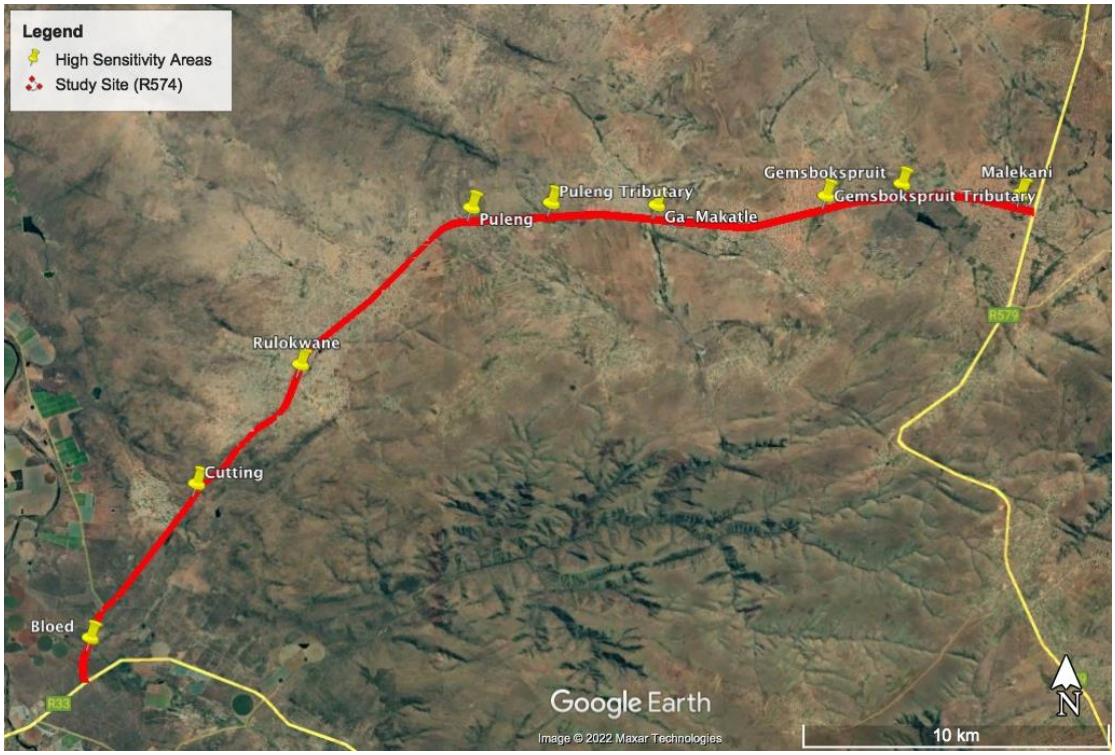


Figure 21: Sensitivity Map: Areas of High Sensitivity

7 THE GO, NO-GO OPTION

7.1 Potential Fatal Flaws

Taking all aspects and investigations into consideration, as well as mitigating measures and existing procedures for roads and road upgrades, there are no obvious environmental fatal flaws and the project should be allowed to proceed.

7.2 Classification criteria

The term 'fatal flaw' is used in the pre-application planning and screening phases of a project to evaluate whether or not an impact would have a 'no-go' implication for the project. In the scoping and impact assessment stages, this term is not used. Rather impacts are described in terms of their potential significance.

A potential fatal flaw (or flaws) from a biodiversity perspective is seen as an impact that could have a "no-go" implication for the project. A 'no-go' situation could arise if residual negative impacts (i.e. those impacts that still remain after implementation of all practical mitigatory procedures/actions) associated with the proposed project were to:

a) Conflict with international conventions, treaties or protocols (e.g. irreversible impact on a World Heritage Site or Ramsar Site);

b) Conflict with relevant laws (e.g. clearly inconsistent with NEMA principles, or regulations in terms of the Biodiversity Act, etc.);

c) Make it impossible to meet national or regional biodiversity conservation objectives or targets in terms of the National Biodiversity Strategy and Action Plan (BSAP) or other relevant plans and strategies (e.g. transformation of a 'critically endangered' ecosystem);

d) Lead to loss of areas protected for biodiversity conservation;

e) Lead to the loss of fixed, or the sole option for flexible, national or regional corridors for persistence of ecological or evolutionary processes;

f) Result in loss of ecosystem services that would have a significant negative effect on lives (e.g. loss of a wetland on which local communities rely for water);

g) Exceed legislated standards (e.g. water quality), resulting in the necessary licences/approvals not being issued by the authorities (eg. WULA);

h) Be considered by the majority of key stakeholders to be unacceptable in terms of biodiversity value or cultural ecosystem services.

8 IMPACT ASSESSMENT

8.1 Existing Impacts

The largest existing impacts on the area are high levels of urbanisation found in villages and townships all along the route. Continual human settlement and population growth in the region is noted as a threat to the natural environment of the Sekhukhune District in the Sekhukhune District Bioregional Plan (Draft, 2018). Within the study site the existing impacts include the transformed road, road shoulder and road reserve.

8.2 Potential Impacts

The project and related activities have low potential negative impacts on the natural environment due to the nature of the project, where most of the footprint will be within the transformed areas of the road and road reserve. The impacts will, however, be at a very localised level. With the implementation of mitigating measures and general standards and procedures for roads, the potential impacts can be reduced and confined to the specific road servitude with low levels of fringe impacts. Most impacts, such as loss of vegetation, erosion, siltation of watercourses will be short-term for the most part.

The upgrade and cleaning of stormwater culverts will have a positive impact by helping to improve water flow and reduce impeding and impounding of water flow.

8.3 Assessment of potential impacts

The assessment of potential impacts on the natural environment arising from the project and related activities is shown below in Table 30.

The scoring method used in the impact assessment is as follows:

Significance (SP) = [extent (E) + duration (D) + magnitude (M)] x probability (P).

The maximum value is 100 significance points (SP). Environmental impacts will be rated as either that of High, Moderate or Low significance on the following basis:

SP ≥60: **High**; SP 31 ≥ 59: M**oderate**; SP ≤ 30: **Low**.

Further explanation of the assessment methodology is found in the section on methodology

8.4 Cumulative Impacts

Cumulative impacts can be defined as impacts or effects on the environment which are caused by the combined effects of past, current and future activities. Cumulative impacts (or the cumulative effect) are the sum of the overall impacts arising from the project (under the control of the developer / contractor), other activities (that may be under the control of others, including other developers, local communities, government and landowners) and other background pressures and trends which may be unregulated, including existing impacts.

The cumulative impacts on the study site are:

- Very low levels of loss of natural vegetation.
- No increase in levels of loss of habitat and ecosystem functions in the area.

The cumulative negative impact on the study site itself is 'Very Low' to non-measurable. There will be no loss of any unique habitats, fauna or flora.

8.5 Levels of acceptable change

The cumulative negative impacts will increase very slightly to negligible in the localised area of the study site, with no measurable increase in negative impacts outside of the study site. The levels of change (increase in negative cumulative impacts) due to the activities of the proposed project are at acceptably low levels for the area and for the project to proceed and not trigger any environmental 'fatal flaws'.

The project will have positive impacts by upgrading, rehabilitating and cleaning out of blocked and broken culverts. This will improve water flow during high rainfall periods and reduce negative impeding and impounding of watercourses.

Table 30: Assessment of Potential Impacts

Potential Impacts arising from Project	Phase of Project	Impact Rating (Low: <30; Moderate: 31-59; High: >60)					
		Extent	Duration	Magnitude	Probability	Total	Significance
Total Impact of Proposed Project	**Construction Phase: Pre-mitigation**	**Local (2)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**30**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**

	Operational Phase	**Site (1)**	**Permanent (5)**	**Minor (2)**	**Medium (3)**	**21**	**Low**
Mitigating Measures	1. Impacts on the existing natural environment related to the project are '**LOW**' 2. Any temporary storage, lay-down areas or accommodation facilities to be setup in existing disturbed areas only. 3. Ensure small footprint during construction phase. 4. 32m Buffer zones, from the edge of the banks of all watercourses need to be implemented. These are 'No-Go' zones in terms movement of vehicles and contractors. The only areas of exception are the work areas and footprints at the road crossings of watercourses. 5. No temporary site offices or lay-down areas are allowed within 50m of the edge of any watercourses. 6. No temporary site offices or lay-down areas are allowed on top of any rocky hills or along any steep hill slopes. All laydown areas must be on flat, plains / surfaces and must be within disturbed areas as far as possible. No areas of trees may be specifically cleared for a laydown area or temporary office site. 7. All hazardous materials must be stored appropriately to prevent these contaminants from entering the water environment; 8. All excess materials brought onto site for construction must be removed after construction. 9. No open trenches or mounds of soils to be left. 10. A rehabilitation plan for disturbed areas to be compiled and implemented as part of the construction phase of the project. This includes access roads and temporary laydown / site office areas. 11. There are a few marula trees within the road reserve. These are protected trees and a permit will be required if any need to be removed. However, it seems unlikely that any will need to be removed. 12. A General Authorisation (GA) process will be required for work on the stream crossings.						
Cumulative Effect of Project on Terrestrial Ecology	After construction and during operational phase	Site (1)	Short-term (2)	Moderate (6)	Medium (3)	27	**Low**
Cumulative Effect of Project on Aquatic ecology	After construction and during operational phase	Site (1)	Short-term (2)	Moderate (6)	Medium (3)	27	**Low**
Individual Impacts							
		Extent	Duration	Magnitude	Probability	Total	Significance
1. Loss of natural vegetation	Construction Phase: Pre-mitigation	Local (2)	Short-term (2)	Low (4)	Medium (3)	24	**Low**
	Construction Phase: Post mitigation	Site (1)	Short-term (2)	Minor (2)	Medium (3)	15	**Low**
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Medium (3)	15	**Low**
Mitigating Measures	1. There are a few protected trees (Marulas) within the study area. All efforts must be made to avoid these trees, along with other any other large, well-established trees. 2. The study site is within a transformed and degraded environment and therefore impact on natural vegetation will be low. 3. Any priority species encountered must be identified and rescue prior to any excavation or construction activities. However, it is unlikely that any are present within the study site or the road and road reserve. 4. A weed control programme should be implemented. This can form part of the routine maintenance programme for the road. 5. A site-specific rehabilitation plan is required for the project.						
2. Loss or impact on wildlife	Construction Phase: Pre-mitigation	Site (1)	Short-term (2)	Moderate (6)	Medium (3)	27	**Low**
	Construction Phase: Post mitigation	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
	Operational Phase	Site (1)	Immediate	Minor (2)	Improbable	4	**Low**

			(1)		(1)		
Mitigating Measures	1. Care must be taken not to interact directly with any wild life encountered. 2. Any bird nests encountered in the grass, trees or on the ceilings of culverts must not be interfered with. If encountered must first be discussed with specialist as how best to proceed. This also applies to any active animal burrows encountered.						
3. Impeding & Impounding waterflow	Construction Phase: Pre-mitigation	Local (2)	Short-term (2)	Low (4)	Low (2)	16	**Low**
	Construction Phase: Post mitigation	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
Mitigating Measures	1. 32m buffer zones (no-go) zones must be implemented around all watercourses. 2. No watercourses (streams, drainage lines, rivers) may be impeded or impounded during the construction phase or at any stage of the project. 3. Work at watercourse crossings and on stormwater culverts should preferably be carried out during the dry, winter season when water flow is at its lowest or non-existent. 4. Erosion and potential siltation of watercourses must be monitored at all times during the construction phase of the project.						
4. Altering flow of a watercourse	Construction Phase: Pre-mitigation	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
	Construction Phase: Post mitigation	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
	Operational Phase	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
Mitigating Measures	1. The main flow of watercourses at crossings must not be altered or rerouted during the construction phase. 2. Preferably any major upgrades and construction of water crossings, and stormwater culverts should be done during the dry, winter period when water flow is at its' lowest.						
5. Siltation and erosion	Construction Phase: Pre-mitigation	Local (2)	Short-term (2)	Moderate (6)	Medium (3)	30	**Low**
	Construction Phase: Post mitigation	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
	Operational Phase	Site (1)	Immediate (1)	Minor (2)	Improbable (1)	4	**Low**
Mitigating Measures	1. All mitigating measures above have reference to siltation and erosion. 2. Careful monitoring during the construction phase is essential to locate and mitigate any erosion observed. Investigations must be conducted after every rain downpour. Any problems need to be rectified immediately to avoid the problem escalating. 3. All work areas must be monitored at all times and maintained.						
6. Fringe impacts arising from construction phase	Construction Phase: Pre-mitigation	Site (1)	Short-term (2)	Moderate (6)	Medium (3)	27	**Low**
	Construction Phase: Post mitigation	Site (1)	Short-term (2)	Minor (2)	Low (2)	10	**Low**
	Operational Phase	Site (1)	Immediate (1)	Minor (2)	Improbable (1)	4	**Low**
Mitigating Measures	1. Due to the nature of the project the potential for any significant fringe impacts is low. 2. Care must be taken with heavy machinery used on the project. All access roads used during construction must be monitored and maintained. 3. Soils and stones excavated may be used on site as backfill, fixing of roads, filling of dongas, etc.						

	4. Excavated soils and rocks may not be simply dumped in any open veld or even on site. 5. All temporary access roads, laydown areas, temporary camps, site offices, etc. must be fully rehabilitated by the contractors prior to final signing off of the construction phase of the project.

8.6 Construction & Operation Phase

- No temporary accommodation, temporary storage sites, or portable toilets to be erected within 50m of the any river, stream, drainage line, wetland or farm dam.
- Only existing roads to be used by vehicles during construction as far as possible. Especially in terms of crossing over watercourses.
- Erosion is a concern along steeper gradients in the study area. All precautions must be taken to avoid increasing erosion, especially in areas where dongas / gullies already exist. Weekly monitoring of erosion gullies and open, bare soil work areas to be inspected. Any signs of erosion to be rectified immediately. This is especially important during the rainy season.
- Upgrade activities close to watercourses to be carefully monitored in terms of erosion and possible resulting siltation of watercourses. Weekly inspection of work areas around watercourses to be conducted. Any signs of new erosion and siltation to be rectified immediately.
- Areas disturbed during the construction phase to be rehabilitated. No open trenches to be left. No mounds of soils created during construction to be left. Soils around erected poles to be levelled and sculptured to the original contours of the surrounding soils.
- All construction material, equipment and any foreign objects brought into the area by contractors to be removed immediately after completion of construction.
- Proper rubbish/waste bins to be provided. These to be emptied weekly and the waste to be removed to an official waste disposal site.
- Ensure as small as possible footprint during construction phase.

8.7 Maintenance phase (to be implemented in defect liability period for 1 year)

- Mechanical control of alien plants around disturbed areas to be implemented within three months of completion of construction. Thereafter every six months. Mechanical control to be of such a nature as to allow local, indigenous grasses and other pioneers to colonise the previously disturbed areas, thereby keeping out alien invasives.
- No chemical control (herbicides) of alien plants to be used within 100m of any watercourses.
- Areas around foundations, culverts, gabions, etc. need to be check before and after the summer rainy season for signs of soil erosion due to stormwater run-off. Such sites need to be

modified and rehabilitated to prevent ongoing erosion. These sites need to be monitored more closely than other sites which show no or minimal signs of erosion.

- Inspection of road shoulders in areas of steep topography to be inspected after the summer rainy season for signs of erosion and rehabilitated and rectified as required.

8.8 Buffer Zones

The only bufferzones required for the project are along the watercourses. Obviously work on crossings has to be done and this acceptable. However, a 32m buffer zone (no-go zone) form the edge of the stream banks should be implemented along all watercourses (upstream and downstream). No movement of vehicles and contractors is allowed in this 32m buffer zone, including the setup of temporary laydown areas, portable toilets, site offices, parking of vehicles, etc. The only exception is when actual work is done on the road, bridges and/or culverts, crossing over that watercourse. Even then the footprint and movement of vehicles, equipment and people must be limited and kept within the work zone only.

There are no buffer zones for normal stormwater culverts and pipes under the road. This is in areas where culverts and pipes are simply used to prevent the road from impeded and impounding general surface flow of stormwater / rainfall.

9 CONCLUSIONS & RECOMMENDATIONS

The following are the conclusions and recommendations of the study.

9.1 Conclusions

- The only biodiversity areas of 'high' sensitivity encountered within the study site are the larger watercourse crossings and a section near Motetema where the road goes up a slight rise and onto higher lying ground / plateau. This is in the area where the 'cutting' for widening of the road will need to take place. The area of the Gemsbokspruit (stream) and Mahtrombi Nature Reserve are shown as having animal and plant sensitivities of 'Medium'. This was verified as such during site investigations (ground-truthing).
- There are no 'no-go zones' along the study site that might trigger a 'fatal flaw' in terms of the project brief and scope.
- There are no 'high' sensitive habitats present on site.
- No red data listed (RDL) fauna species were found to be present and / or breeding with the study area boundaries., but it is likely that a few might occasional move through the area.

- Site investigations were conducted during the summer (wet) season of the region and the findings and availability of field data is sufficient to reached acceptable findings and outcomes from the assessment.
- There are no obvious fatal flaws in terms of the natural environment.
- Taking all findings and recommendations into account it is the reasonable opinion of the author / specialist that the activity may be authorised. The project and related activities may proceed to the next phase.

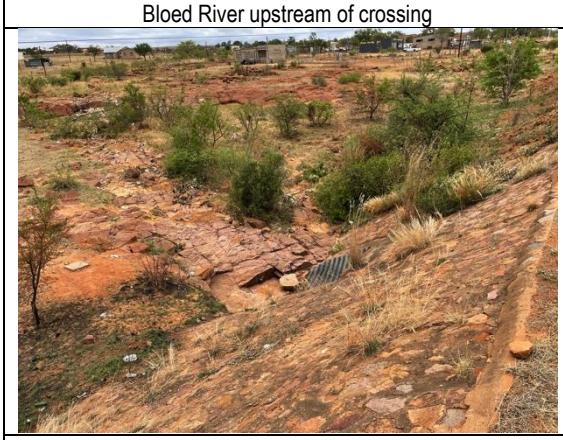
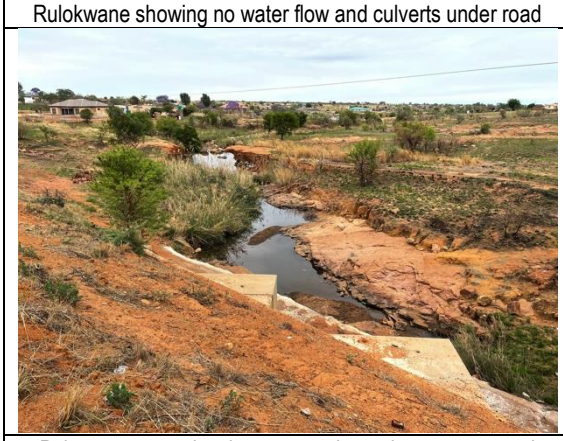
9.2 Recommendations

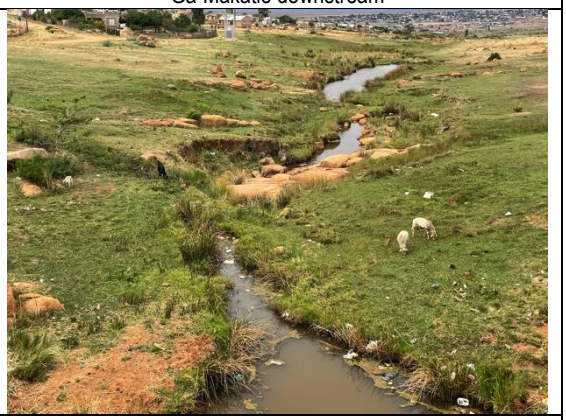
- Recommended mitigating measures as proposed in this study and report should be implemented if the findings of this report are to remain pertinent.
- The only bufferzones required for the project are along the watercourses. Obviously work on crossings has to take place and this acceptable. However, a 32m buffer zone, from the edge of the stream banks should be implemented along all watercourses (upstream and downstream). No buffer zones are necessary in areas of normal stormwater culverts and pipes that are simply installed to prevent impeding and impounding general surface flow of rainfall.
- A final walkdown is recommended in the area of the cutting to determine how many protected trees will be impacted. Thereafter a tree permit / plant permit application will be required to obtain permission.

10 APPENDICES

10.1 Photographs

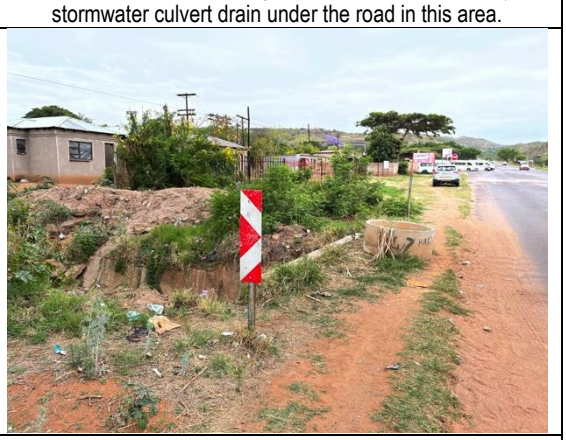
Table 31: Photographs of the watercourses

	
Bloed River upstream of crossing	Bloed River downstream of crossing
	
Rulokwane showing no water flow and culverts under road	Rulokwane downstream
	
Puleng upstram showing narrow channel some scattered shrubs along the streambanks and box culverts under the road. Erosion is also fairly evident along the stream banks	Puleng downstream showing no distinctive riparian zone except for a few small shrubs along the narrow stream channel

	
Puleng Tributary upstream showing that it is a small seasonal and ephemeral drainge line.	Puleng Tributary downstream showing the narrow drainage line. The tree in the background is an alien gum tree.
	
Ga-Makatle upstream	Ga-Makatle downstream
	
Gemsbokspruit Tributary upstream is a narrow and small drainge line / small stream with no riparian vegetation	Gemsbokspruit Tributary downstream
	
Gemsbokspruit upstream. The area is picture is part of the Mahtrombi Nature Reserve	Gemsbokspruit downstream

	
Malekani downstream. The stream originates in the area of the road crossing and there is no upstream channel or watercourse. There is only a stormwater culvert under the road for channelled surface run-off from various directions and areas.	

Table 32: Photographs of some of the culvert crossings

	
Box culvert at the Puleng Tributary	Culvert at Malekani showing that in this area it is literally a stormwater culvert drain under the road in this area.
	
Small wall / barrier on box culvert at Gemsbokspruit Tributary crossing	Stormwater open drain in village area of R574.

	
Open concrete stormwater drain common in the villages along the route of the study site. Many of these stormwate drains are crossed by the road with pipe culverts.s	Swallow nests on the ceilings of box culverts. These box culverts make ideal nesting sites for migratory swallows. Care must be tken not to disturb any active nests encountered.

10.2 List of floral species

Trees

Vachellia (Acacia) karoo; Vachellia (Acacia) caffra; Vachellia (Acacia) mellifera; Vachellia (Acacia) nilotica; Vachellia (Acacia) tortillis; Burkea africana, Celtis africana; Combretum apiculatum; Combretum molle; Englerophytum magalismontanum, Eucalyptus spp & cultivars*, Euclea crispa, Faurea saligna, Melia azedarach*; Ochna pretoriensis, Ochna pulchra*, *Protea caffra, Peltophorum africanum, Sersia (=Searsia) lancea; Sersia (=Searsia) leptodictya, Strychnos pungens, Terminalia sericea, Vangueria infausta, Ziziphus macronata, Vachellia (Acacia) burkei*, *Vachellia (Acacia) robusta*, *Sclerocarya birrea* subsp. *caffra*, *Burkea africana*, *Combretum apiculatum*, *Combretum zeyheri*, *Terminalia sericea*, *Ochna pulchra*, *Peltophorum africanum*, *Searsia leptodictya*

* = Alien

Shrubs & Herbaceous Plants

Acalypha indica, Adenia digitata, Aloe greatheadii, Aloe transvaalensis, Antericum sp., Anthospernum hispidulum, Asparagus africanus, Barleria sp., Becia obovatum, Berkheya seminivea, Boophane disticha, Bulbostylus burchellii, Cassia mimosoides, Chelanthes hirta, Chenopodium album, Cleome maculata, Crabbea augustifolia, Diospyros lycioides, Grewia flava, Grewia occidentalis, Gymnosporia buxifolia, Mystroxylon aethiopicum, Boophone distichia, Helichrysum nudifolium. Helichrysum acutatum, Helichrusum rugulosum Hypoxis hemerocallidea, Hypoxis rigidula, Xerophyta retinervis. Pellaea calomelanos, Pentanisia angustifolia, Senecio venosus, Xerophyta retinervis

Graminoids (Grasses)

Aristida congesta, Aristida diffusa, Cynodon incompletus, Eragrostis bergiana, Eragrostis bicolor, Eragrostis lehmanniana, Eragrostis obtusa, Sporobolus fimbriatus, Stipagrostis ciliata.

Aquatic plants

Phragmites australis,

Alien plants

Acacia mearnsii, Argemone ochroleuca, Bidens pilosa, Cereus jamacaru, Conyza canadensis, Datura ferox, Eucalyptus spp, Melia azedarach, Opuntia ficus-indica, Populus x canescens, Sesbania punicea, Solanum elaeagnifolium, Tagetes minuta, Verbena bonariensis.

10.3 Central Sandy Bushveld

Below is the list of the dominant plant species found in the veldtype of Central Sandy Bushveld, as taken from Mucina & Rutherford (2006, 2010).

Trees: *Vachellia (Acacia) burkei* (d), *Vachellia (Acacia) robusta*, *Sclerocarya birrea* subsp. *caffra*, *Burkea africana* (d), *Combretum apiculatum* (d), *Combretum zeyheri* (d), *Terminalia sericea* (d), *Ochna pulchra*, *Peltophorum africanum*, *Searsia leptodictya*. Tall Shrubs: *Combretum hereroense*, *Grewia bicolor*, *Grewia monticola*, *Strychnos pungens*. Low Shrubs: *Agathisanthemum bojeri* (d), *Indigofera filipes* (d), *Felicia fascicularis*, *Gnidia sericocephala*. Geoxylic Suffrutex: *Dichapetalum cymosum* (d). Woody Climber: *Asparagus buchananii*. Graminoids: *Brachiaria nigropedata* (d), *Eragrostis pallens* (d), *Eragrostis rigidior* (d), *Hyperthelia dissoluta* (d), *Panicum maximum* (d), *Perotis patens* (d), *Anthephora pubescens*, *Aristida scabrivalvis* subsp. *scabrivalvis*, *Brachiaria serrata*, *Elionurus muticus*, *Eragrostis nindensis*, *Loudetia simplex*, *Schmidtia pappophoroides*, *Themeda triandra*, *Trachypogon spicatus*. Herbs: *Dicerocaryum senecioides* (d), *Barleria macrostegia*, *Blepharis integrifolia*, *Crabbea angustifolia*, *Evolvulus alsinoides*, *Geigeria burkei*, *Hermannia lancifolia*, *Indigofera daleoides*, *Justicia anagalloides*, *Kyphocarpa angustifolia*, *Lophiocarpus tenuissimus*, *Waltheria indica*, *Xerophyta humilis*. Geophytic Herb: *Hypoxis hemerocallidea*. Succulent Herb: *Aloe greatheadii* var. *davyana*.

(d) = Dominant species.

10.4 Loskop Thornveld

Below is the list of the dominant plant species found in the veldtype of Marikana Thornveld, as taken from Mucina & Rutherford (2010).

Tall Trees: *Vachellia (Acacia) burkei*, *Sclerocarya birrea* subsp. *caffra*. Small Trees: *Vachellia (Acacia) gerrardii* (d), *Vachellia (Acacia) sieberiana* var. *woodii* (d), *Vachellia (Acacia) nilotica*, *Vachellia (Acacia) tortilis* subsp. *heteracantha*, *Berchemia zeyheri*, *Combretum zeyheri*, *Pappea capensis*, *Peltophorum africanum*, *Rhus leptodictya*. Tall Shrubs: *Euclea crispa* subsp. *crispa* (d), *Searsia (Rhus) pyroides* var. *pyroides* (d), *Dichrostachys cinearea*, *Euclea undulata*, *Grewia flava*, *Olea europaea* subsp. *africana*. Low Shrubs: *Asparagus suaveolens*, *Leonotis ocymifolia*, *Orthosiphon fruticosus*, *Vernonia poskeana* subsp. *botswanica*. Succulent Shrub: *Kalanchoe paniculata*. Woody Climber: *Clematis brachiata* (d). Woody Succulent Climber: *Senecio pleistocephalus*. Herbaceous Climber: *Rhynchosia minima* (d). Graminoids: *Bothriochloa insculpta* (d), *Digitaria argyrograpta* (d), *Themeda triandra* (d), *Aristida congesta*, *Bulbostylis humilis*, *Cenchrus ciliaris*, *Cymbopogon nardus*, *Enneapogon scoparius*, *Eragrostis trichophora*, *Eustachys paspaloides*, *Setaria verticillata*. Herb: *Kyphocarpa angustifolia*.

(d) = Dominant species.

10.5 Rand Highveld Grassland

Below is the list of the dominant plant species found in the veldtype of Gold Reef Mountain Bushveld, as taken from Mucina & Rutherford (2010).

Graminoids: *Ctenium concinnum* (d), *Cynodon dactylon* (d), *Digitaria monodactyla* (d), *Diheteropogon amplectens* (d), *Eragrostis chloromelas* (d), *Heteropogon contortus* (d), *Loudetia simplex* (d), *Monocymbium ceresiiforme* (d), *Panicum natalense* (d), *Schizachyrium sanguineum* (d), *Setaria sphacelata* (d), *Themeda triandra* (d), *Trachypogon spicatus* (d), *Tristachya biseriata* (d), *T. rehmannii* (d), *Andropogon schirensis*, *Aristida aequiglumis*, *A. congesta*, *A. junciformis* subsp. *galpinii*, *Bewsia biflora*, *Brachiaria nigropedata*, *B. serrata*, *Bulbostylis burchellii*, *Cymbopogon caesius*, *Digitaria tricholaenoides*, *Elionurus muticus*, *Eragrostis capensis*, *E. curvula*, *E. gummiflua*, *E. plana*, *E. racemosa*, *Hyparrhenia hirta*, *Melinis nerviglumis*, *M. repens* subsp. *repens*, *Microchloa caffra*, *Setaria nigrirostris*, *Sporobolus pectinatus*, *Trichoneura grandiglumis*, *Urelytrum agropyroides*. Herbs: *Acanthospermum australe* (d), *Justicia anagalloides* (d), *Pollichia campestris* (d), *Acalypha angustata*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Helichrysum caespititium*, *H. nudifolium* var. *nudifolium*, *H. rugulosum*, *Ipomoea crassipes*, *Kohautia amatymbica*, *Lactuca inermis*, *Macledium zeyheri* subsp. *argyrophylum*, *Nidorella hottentotica*, *Oldenlandia herbacea*, *Rotheca hirsuta*, *Selago densiflora*, *Senecio coronatus*, *Sonchus dregeanus*, *Vernonia oligocephala*, *Xerophyta retinervis*. Geophytic Herbs: *Boophone disticha*, *Cheilanthes hirta*, *Haemanthus humilis* subsp. *humilis*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*, *Oxalis corniculata*. Succulent Herb: *Aloe greatheadii* var. *davyana*. Low Shrubs: *Anthospermum rigidum* subsp. *pumilum*, *Indigofera comosa*, *Rhus magalismontana, Stoebe plumosa*. Succulent Shrub: *Lopholaena coriifolia* (d). Geoxylic Suffrutex: *Elephantorrhiza elephantina*.

(d) = Dominant species.

10.6 RDSIS Calculations for Mammals

RED DATA SENSITIVITY INDEX SCORE (RDSIS): MAMMALS
Project: R574 UPGRADE

1. Red Data Listed Species potentially occuring in the study area

Scientific Name	Common Name	IUCN Status	Distribution Range (D)	Habitat (H)	Availability of Food (F)	POC (%)	POC Value
Acinonyx jubatus	Cheetah	VU	20	20	20	20	Low
Amblysomus gunningi	Gunning's Golden mole	VU	0	-	-	0	Low
Atelerix frontalis	Hedgehog	NT	100	50	60	70	Medium/High
Ceratotherium simum	White rhinoceros	NT	0	-	-	0	Low
Cloeotis percivali	Short-eared trident bat	CR	100	10	50	53	Medium
Diceros bicornis	Black rhinoceros	CR	0	-	-	0	Low
Felis lybica	African wild cat	VU	100	80	70	83	Medium/High
Loxodonta africana	African elephant	VU	0	-	-	0	Low
Lutra macuicollis	Spotted-necked otter	NT	50	80	50	60	Medium/High
Lycaon pictus	African wild dog	EN	0	-	-	0	Low
Miniopteris schreibersi	Schreibers's long-fingered bat	NT	100	20	50	57	Medium
Myotis tricolor	Temminck's hairy bat	LC	50	40	60	50	Medium
Mystomys albicaudatus	White tailed mouse	EN	0	-	-	0	Low
Neamblysomus julianae	Juliana's Golden Mole	EN	0	-	-	0	Low
Panthera leo	Lion	VU	0	-	-	0	Low
Rhinolophus blasii	Blasius's/Peak-Saddle Horseshoe Bat	LC	10	10	50	23	Low/Medium
Rhinolophus clivosus	Geoffroy's Horseshoe bat	NT	100	20	50	57	Medium
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	30	10	50	30	Low/Medium
Rhinolophus hildebrandtii	Hildebrandt's Horseshoe Bat	LC	80	30	50	53	Medium
					Average TSS	**29,3**	

Total Species Score (Only use species with a POC >60%)

Scientific Name	Common Name	IUCN Status	POC	TSS
Atelerix frontalis	Hedgehog	EN	70	119
Felis lybica	African wild cat	VU	83	99,6
Lutra macuicollis	Spotted-necked otter	NT	50	35
			Average TT Score	**84,5**

Status Category	TSS Weighting
DDT	0,2
R	0,5
NT	0,7
VU	1,2
EN	1,7
CR	2

Average Total Species Score

Average TSS Score	29,3
Average TT Score	84,5
Average Score	56,9

RED DATA SENSITIVITY INDEX SCORE (RDSIS)

Average Total Species Score		59,90%	
Average Threatened Taxa Score		84,50%	
Average (TSS + TT)		56,90%	
% Speices >60% POC		16%	
RDSIS for Study area		**36,5**	**LOW/MEDIUM**

POC range	Description
0-20	Low
21-40	Low/Medium
41-60	Medium
61-80	Medium/High
81-100	High

RDSIS Rating	Description
0-20	Low
21-40	Low/Medium
41-60	Medium
61-80	Medium/High
81-100	High

Status Category	Abbreviation	Weighting
Data deficient	DDT	0,2
Rare	R	0,5
Near Threatened	NT	0,7
Vulnerable	VU	1,2
Endangered	EN	1,7
Critically Endangered	CR	2

10.7 Definitions

10.7.1 Rivers and Streams

A river or stream is a watercourse that is characterised by a very distinct channel. Most, but not all rivers and streams have an associated floodplain and / or riparian zone. Although rivers, streams and wetlands are all watercourses, the legal implications differ in terms of development, buffer zones, etc.

10.7.2 Wetlands

'Wetland' is a broad term and for the purposes of this study it is defined according to the parameters as set out by the Department of Water & Sanitation (DWS) in their guideline (A practical field procedure for identification and delineation of wetlands and riparian areas, 2005). The classification of wetlands (which is a type of watercourse) is summarised below (Figure 22).

According to the DWS document and the National Water Act (NWA) a wetland is defined as, "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

Furthermore, the guidelines stipulate that wetlands must have one or more of the following defining attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes); and
- A high water table that results in saturation at or near surface, leading to anaerobic conditions developing in the top 50cm of the soil.

During site investigations the following indicators are typically used to determine whether an area needed to be defined as a wetland or not, namely: Terrain unit indicator; Soil form indicator; Soil wetness indicator; and Vegetation indicator.

Hydrogeomorphic types		Description	Source of water maintaining the wetland[1]	
			Surface	Sub-surface
Floodplain		Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel		Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel		Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hillslope seepage		Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans)		A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important output in all of the above settings

Water source: * Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on the local circumstances

*/ *** Contribution may be small or important depending on the local circumstances.

 Wetland

Figure 22: Classification of wetlands

10.7.3 Riparian zones

Riparian vegetation is typically zonal vegetation closely associated with the course of a river or stream and found in the alluvial soils of the floodplain. According to the National Water Act (NWA) riparian habitat is defined as including "*The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.*"

It is important to note that the NWA states that the riparian zone has a floral composition distinct from those of adjacent areas. The NWA also defines riparian zones as areas that "c*ommonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments*."

10.8 Conditions for inclusion in the Environmental Authorisation (EA)

The mitigation measures in the report are to be included in the Environmentl Authorisation and EMPr for the project that will be approved together with the BAR. The EMPr for the project must therefore be strictly implemented by the applicant. There are no additional or special conditions required.

10.9 Monitoring requirements

Environmental monitoring by an ECO, as required by law, industry standards, etc. should still take place. Part of the monitoring must include the mitigating measures as per this report as well as the conditions of the EMPr.

No special or specific monitoring requirements are required or recommended outside of those recommended in the mitigating measures of the report.

10.10 Short CV of Specialist

Name: Johannes Oren Maree

Qualifications

2000 MBA, Oxford Brookes University (England)

1998 Diploma in Small Business Management (Damelin College)

1988 MSc (Rand Afrikaans University)

1987 BSc (Hons.) (Rand Afrikaans University)

1986 BSc (Rand Afrikaans University)

Further training and development

- Diploma in Public Speaking & Communications Ambassador College (USA)
- SAQA Accreditation and Qualifications in Training, Assessing & Service Provision (AgriSeta)
- SASS 5 Training Course

Publications

- Co-Authored Book: Cut Flowers of the World. 2010. Briza, Pretoria.
- Co-Authored Book: Cut Flowers of the World, 2ed. 2020. Briza, Pretoria.
- 100s of articles for popular magazines such as Farmer's Weekly & SA Landscape

Professional memberships

- SA Council of Natural Scientific Professions (SACNASP)
    - Reg. No. 400077/91

- South African Wetland Society
    - Reg. No: 998061
- Society of Wetland Scientists

Professional career

Position: Director / Owner

Employer: Flori Scientific Services

Period: 2000 to current

Scope of Work Done:

- Conduct specialist studies and reasearch for EIA projects.
- Specialist studies and consultancy includes
- Ecological studies
- Aquatic and Wetland assessments
- Avifaunal impact assessments
- Risk Matrices for water use licences
- Specialist Environmental Consultant
- Environmental Control Officer (ECO) work
- Specialist work involves field investigations and report writing.

Position: Technical Manager

Employer: Sunbird Flowers (Pty) Ltd

Period: 1997 - 2000

Scope of Work Done:

- Consulted on and managed projects in the agricultural & floricultural industries.
- Managed existing and new projects.
- Involved in all aspects of project management from managing, planning; costing; marketing; budgeting, technical and training.
- Assisted emerging rural farmers in most aspects of agriculture

(i.e. Cut flower and vegetable production) including setting up of business plans, marketing, training and costings.

- Conducted “turn-key” projects in most agriculture related fields. This included – Tunnel and greenhouse production; Hydroponics; vegetables, cut flowers; field crops.

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