PROPOSED OPENING OF QUARRY ON PORTION 100 ON THE FARM STRATHMORE NO 214 JU

BIODIVERSITY ASSESSMENT

Terrestrial Ecological Assessment (Fauna and Flora) and Aquatic Ecological Assessment for the Proposed Quarry on Portion 100 on the Farm Strathmore No. 214 JU, Nkomazi Local Municipality, Ehlanzeni District Municipality, Mpumalanga Province

Compiled by

FLORI SCIENTIFIC SERVICES

NOVEMBER 2021

PROJECT TITLE: Proposed Opening of Quarry on Portion 100 on the Farm Strathmore No. 214 JU

STUDY NAME: Biodiversity Impact Assessment

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EXECUTIVE SUMMARY

Background

The proposed opening of a new quarry on Portion 100 on the Farm Strathmore No. 214 JU, along the N4 National Route is busy being proposed. The excavated materials are essential and needed by South African National Roads Agency (SOC) Limited (SANRAL) for the upgrade, maintenance and/or construction of roads in the area, in particular the N4 National Route. The proposed quarry site is immediately north of the N4 National Route in the Nkomazi Local Municipality of the Ehlanzeni District Municipality, Mpumalanga Province.

Chameleon Environmental was appointed to undertake the environmental studies and EIA / BA process. Flori Scientific Services cc was appointed as the independent consultancy to conduct a biodiversity assessment.

Site visits were conducted on 12 November 2021.

Location of the Study Site

The study site is situated on tribal land near Strathmore. The site is immediately north of the N4 National Route, west of Malelane and east of Kaapmuiden, within the Nkomazi Local Municipality of the Mpumalanga Province. The study site is approximately 19,9ha in size.

TERRESTRIAL ECOLOGY

Vegetation

The study site is situated within the original extent of the veldtype known as Granite Lowveld. The veldtype is within the Lowveld Bioregion of the Savanna Biome of South Africa.

The vegetation of the study site characterised by moderately degraded lowveld granite bushveld. Some areas in the north and northwest of the site are heavily degraded. The small seasonal drainage lines along the eastern and western boundaries of the site are in moderate to fair condition. There are a number of fringe impacts arising from farming related activities in surrounding farmlands. There is a 33 / 22kV power line that runs through the site from west to east. The bush in the power line servitude is regularly cleared as is necessary. There are a number of scattered protected trees through the site, namely, marula (*Sclerocarya birrea*) and leadwood (*Combretum imberbe*).

There are a number of scattered marlotti and Transvaal / Zebra aloes on the site. These will be very easy to relocate to unused areas of the site. There are also a number of cluster fig trees and other common lowveld trees in the riparian zones of the small drainage lines, which although not protected are recommended to not be disturbed.

No Red Data Listed (RDL) species were observed. That is, critically endangered, endangered or vulnerable species.

Hierarchy of the vegetation on site

Category Description	Classification
Biome	Savanna
Bioregion	Lowveld
Veldtype	Granite Bushveld
Status of veldytpe (Ecosystem)	Not threatened (Least Threatened / Least Concern)

Fauna

During field investigations no faunal species of conservation concern were encountered. This can also be due to the limited time available for site investigations. There are some ideal habitats for some priority faunal species, but mainly outside of the limits of the study area, which are mainly in the undeveloped rocky granite outcrops (koppies) and hills to the north and south. The table below highlights some of the priority species and their likelihood to occur in the study area.

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	Unlikely. Study site not within main distribution of frog
Mammals					
Atelerix frontalis	SA hedgehog	Near threatened	Most, broad	Broad	Possible
Manis temmincki	Pangolin (Scaly anteater)	Vulnerable	Grassland, savanna	Woody savanna, ants, termites	Unlikely, but within distribution range
Mellivora capensis	Honey badger (Ratel)	Near threatened	Most, broad	Broad	Unlikely, but within distribution range
Cloeotis percivali	Short-eared trident bat	Critically endangered	Savanna	Caves and subterranean habitat	No
Pipistrellus rusticus	Rusty bat	Near threatened	Most, broad	Woody savanna, large trees	No
Snakes					
Python natalensis	Southern African python	Vulnerable	Ridges, wetlands	Rocky areas; open water	No

AQUATIC ECOLOGY

Watercourses in the study area

There are no major watercourses in the study site, such as perennial rivers, semi-perennial streams, seasonal streams and large wetlands. The closest river to the study site is the perennial Crocodile River, which is approximately 700m north of the outer boundary of the study site.

Two small, seasonal drainage lines are present along the eastern and western boundaries of the study site and both flow in a northerly direction and eventually into the Crocodile River, which in turn flows in an easterly direction. The drainage lines are defined by denser thicket / bush along their courses. The proposed quarry will have no impact on the Crocodile River, but the tow small drainage lines along the eastern and western boundaries of the site will need to be buffered and protected.

Drainage areas

The table below is a summary of the drainage areas / catchment areas of the study site.

Level	Category
Primary Drainage Area (PDA)	X
Quaternary Drainage Area (QDA)	X24D
Water Management Area (WMA) – Previous / Old	Inkomati
Water Management Area (WMA) – New	Inkomati-Usuthu (WMA 3)
Sub-Water Management Area	Crocodile
Catchment Management Agency (CMA)	Inkomati-Usuthu (CMA 3)
Wetland Vegetation Ecoregion	Lowveld (Group 3)
River FEPA	Not on site, but Crocodile River is
Fish FEPA	No
Fish FSA	Not on site, but Crocodile River is
Fish Corridor	No
Fish Migratory	No
Priority Quaternary Catchment	No
SWSA (National importance)	No
WSA (Sub-national, provincial importance)	No

Priority Areas

The study site is not situated within any priority areas. Priority areas include formal and informal protected areas (nature reserves); important bird areas (IBAs); RAMSAR sites; national fresh water ecosystem priority areas (NFEPA) and national protected areas expansion strategy (NPAES) focus areas.

Critical Biodiversity Areas and Ecological Support Areas

The site is not within a critical biodiversity area (CBA), but is within an ecological support area (ESA) buffer for the Kruger National Park.

National Desktop Screening Tool

According to the national desktop screening tool the sensitivities of the various themes of the study area are as follows:

- Terrestrial Biodiversity Combined Theme: Low.
- Aquatic Biodiversity Combined Theme: Low.
- Plant Species Theme: Medium (in the south) and Low (in the north).
- Animal Species Theme: Medium.

During site investigations the sensitivities as shown in the above screening tool results were assessed and verified. From the site investigations and specialist studies it is reasonable to accept that the desktop screening tool assessments are accurate.

The overall biodiversity and aquatic sensitivities are 'Low'.

Ecological 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, whether it is floristic or faunal in nature.

Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Bushveld	Medium/Low	Medium	**Medium**
Drainage Line	Medium	Medium	**Medium**

According to the analyses there are no high sensitivity areas or habitats. However, regardless of the actual ratings, watercourses are, by default, viewed as sensitive (ie – High Sensitivity). There are a few protected trees within the study area, especially along the small drainage line, but this in itself does not make the overall ecoogical sensitivity of the site 'High'.

Sensitivity Map

During site investigations the only sensitive habitat encountered was the small, seasonal drainage line along the eastern boundary of the study site. The rest of the site is not sensitive, but along with the potential of free-roaming wildlife as the main factor, and some characteristic lowveld bushveld, the sensitivity rating of the site is a mix of 'Medium' and 'Low'. The area on the west and northwest is rated as 'Low' due to higher levels of degradation of the bushveld, including high levels of encroachment of sicklebush in this area.

The sensitivity map for the site is shown below, along with the recommended 50m buffer zone around the drainage line.

Sensitivity map

Buffer Zones

The small, seasonal drainage line along the eastern boundary of the study site needs to be protected. A 50m buffer zone from the middle of the narrow channel has been recommended. This buffer zone will be sufficient to protect the main channel, riparian zone and overall integrity of the watercourse's ecosystem. The bufferzone can only be established on the western side of the drainage line and not on the eastern side, which is bounded by a gravel farm road and sugarcane plantation.

Fatal flaws

There are no obvious environmental fatal flaws.

Conclusions

- The study site is situated within Lowveld Granite, which is within the Lowveld Bioregion of the Savanna Biome.
- The site is not within a threatened veldtype (ecosystem).

- The site is not within any priority areas, which include protected areas (nature reserves), important bird areas (IBAs) and national protected area expansion strategy (NPAES) focus areas.
- The only watercourse is a small, seasonal drainage line along the eastern boundary of the study site. There are no other watercourses, including wetlands.
- During field investigations no Red Data Listed (RDL) plants were found. Protected trees (marula and leadwood) are present on site.
- The study site is not situated within a Critical Biodiversity Area (CBA), but is within an Ecological Support Area (ESA Kruger Park Buffer Zone).
- There are no 'high' sensitive habitats present on site, except for the small drainage lines and associated riparian zones.
- No red data listed (RDL) fauna or flora species were observed within the study area boundaries.
- Site investigations were conducted during the wet (summer) season and the findings and availability of field data is sufficient to reach acceptable conclusions 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.
- A 50m buffer zone (no-go zone) is recommended from the main channel of the drainage line. The buffer zone will include the riparian zone as well.
- Mitigating measures have been recommended for implementation to help reduce the potential negative impact the project will have on the natural environment. These mitigating measures include the following:
    - **Construction Phase / Setup Phase:**
    - The initial Construction Phase (or establishment of the site) will be 'Moderate'
    - These impacts will include the initial need to clear bushveld and remove topsoils.
    - During the construction phase all temporary laydown areas, ablution facilities; site offices, etc. must only be within the larger demarcated study area.
    - During the initial Construction Phase / site establishment phase existing access roads must be used as far as possible. These roads need to be continually maintained during the construction phase. Keeping in mind that other landowners and inhabitants of the area use some of these roads.
    - Ensure small footprint during construction phase.

- There are two demarcated 50m buffer zones (no-go zones). One along the eastern boundary of the study site, and one along the western boundary, which are necessary to protect the integrity of the drainage lines and riparian zones. No construction, or temporary activities may take place in these buffer zones. Under no circumstances may any water or wood be removed from the drainage lines and riparian zones. No thoroughfares (roads, walk paths) are allowed through the buffer zones. Except in the extreme south, where there is an existing road.
- **Note: The establishment of a road from off the existing gravel road on the eastern boundary and around the north will trigger the need for a crossing over the drainage line in the northeast corner of the site. This will trigger the need for a Water Use Licence Application (WULA). Therefore, preferably no crossing should be planned and access to the site from the south is preferred.**
- All excess materials brought onto site for construction to be removed after construction.
- **Operational Phase:**
- No site offices, parking areas, ablution facilities, etc. may be set up outside of the demarcated study area.
- All access roads to the site must be maintained at all times. Many of these roads are gravel / sand public roads used by surrounding farmers and landowners. During the entire operational phase / life of the quarry these roads must be maintained and dust-suppression must be used.
- Perimeter fences to be routinely monitored and maintained. Assurances need to be in place that local livestock as well as wild animals will not be able to enter the mining site.
- An Erosion Plan to be implemented and monitored during construction phase and operational phases of the project. Even though the erosion potential is low.
- All hazardous materials must be stored appropriately to prevent these contaminants from entering the soils and natural environment.
- Under no circumstances may farm livestock as well as wild animals be interfered with.
- **Mine Closure (Rehabilitation)**
- All standard quarry mining operation procedures and regulations to be implemented. Rehabilitation plan for the quarry and general study area must be compiled prior to mine closure and assurances must be given that it will be implemented.
- The rehabilitation will have a positive impact on the site and area, although it will not be able to restore the area back to its original state

EXPERTISE AND EXPERIENCE OF SPECIALIST

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

21 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 speciaist 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.

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ACRONYMS

BA	Basic Assessment
CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DEA	Department of Environmental Affairs (Old name for DFFE)
DFFE	Department of Forestry, Fisheries 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
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
PES	Present Ecological State
PDA	Primary Drainage Area
QDA	Quaternary Drainage Area
REC	Recommended Ecological Category (or Class)
REMC	Recommended Ecological Management Category (or Class)
RVI	Riparian Vegetation Index
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency (SOC) Limited
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 proposed opening of a new quarry on Portion 100 on the Farm Strathmore No. 214 JU, along the N4 National Route is busy being proposed. The excavated materials are essential and needed by South African National Roads Agency (SOC) Limited (SANRAL) for the upgrade, maintenance and/or construction of roads in the area, in particular the N4 National Route. The proposed quarry site is immediately north of the N4 National Route in the Nkomazi Local Municipality of the Ehlanzeni District Municipality, Mpumalanga Province.

Chameleon Environmental was appointed to undertake the environmental studies and EIA / BA process. Flori Scientific Services cc was appointed as the independent consultancy to conduct a biodiversity assessment, which includes terrestrial ecology (fauna and flora) aquatic ecology assessments, for the study site.

Site visits were conducted on 12 November 2021.

Previously Flori Scientific Services conducted a desktop screening assessment for the site in April 2021. The screening information has also been used for this study and report.

1.2 Scope of work

The scope of work was understood to be as follows:

- Conduct a biodiversity impact assessment for the study site, which includes fauna & flora as well as watercourses (aquatic);
- 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 latest data sets were used for the report in terms of background information. The data used and websites accessed are routinely used and approved by most consultants and specialists.

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

- Screening Tool: DFFE – (www.screening.environment.gov.za).
- Threatened ecosystems: South African National Biodiversity Institute - (www.bgis.sanbi.org).
- Protected areas: Protected Areas Register (PAR): DEFF – (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).
- Mpumalanga Biodiversity Sector Plan: 2014.

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 on 12 November 2021. The site visits fall within the wet 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 was obtained prior to visits.
- The study site is small with easy access and limited variation in biodiversity. The field investigations conducted are therefore sufficient to make informed conclusions and recommendations for the study and necessary investigations.
- The site investigations and study are deemed adequate for the project and no further specialist environmental studies are 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;
- The latest data sets were used as background information and desktop review for the project. The data sets were verified and refined during field investigations (ground-truthing). These include inaccurate Wetland Map 5 delineations for the area.
- Equipment used: Standard soil augers; hand-held Garmin GPS instrument; EC & pH hand-held meters; IPhone 7 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 directly to arrange access to area for site investigations.

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 Field Investigations

Site investigations of the study site and surrounding areas were conducted on 12 November 2021, which is during the wet (summer) season for the area.

During field 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 fauna and flora species;
- Watercourses.

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 Present Ecological State

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.

2.6 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

Wetland 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

2.7 Impact Assessment

2.7.1 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

2.7.2 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 situated on tribal land near Strathmore. The site is immediately north of the N4 National Route, west of Malelane and east of Kaapmuiden, within the Nkomazi Local Municipality of the Mpumalanga Province (Figure 1, Figure 2, Figure 3). The study site is approximately 19,9ha in size.

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

- Approximate centre of Study Site: 25°30'53.01"S; 31°26'45.22"E.
- Malelane: 25°29'41.62"S; 31°30'31.86"E.
- Quarter Degree Square (QDS): 2531CB.
- Quaternary Drainage Area (QDA): X24D.

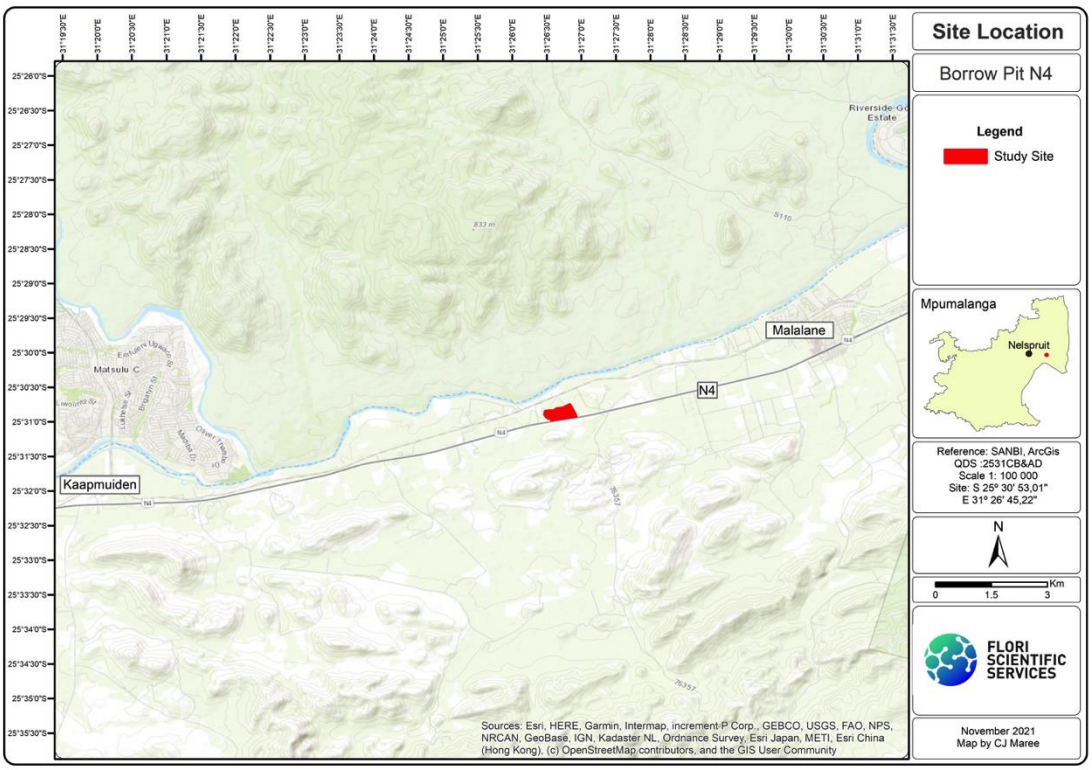


Figure 1: Site Location

Figure 2: Site location (Google Earth)

Figure 3: Site location (Close Up)

3.2 Topography

The topography of the region is that of rocky hills and low mountains with a broad, shallow valley in between. The study site is situated within the flat, valley on open plains and lowlands. The average height above sea level for the study site is approximately 326m, with maximum and minimum elevations of 330m and 325m, respectively. The general downward slope (gradient) of the site is from south to north, towards the lowest point, which is the Crocodile River.

3.3 Climate

The site is situated within the high (801 mm to 1 000 mm) summer rainfall region of South Africa, and receives on average about 663 mm per annum (en-climate-data.org). The site is in the Hot Interior Climatic Zone, where the summers are general warm to hot and the winters cool to mild. Frost during winter is not common. The climate of the site is similar to that of Nelspruit, where the average annual rainfall is approximately 934 mm (www.en.climate-data.org).

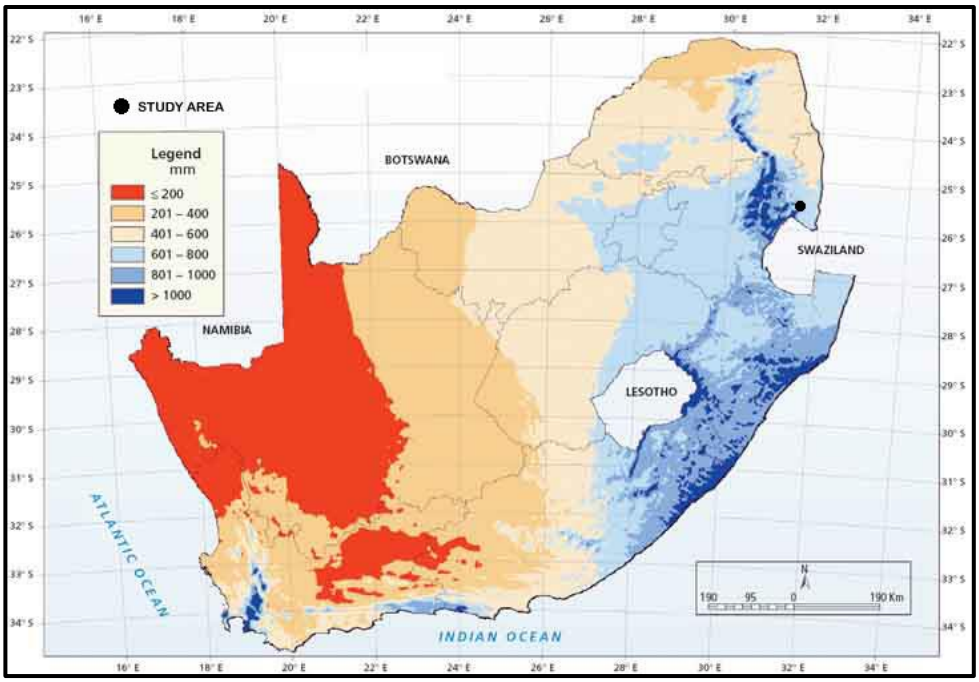


Figure 4: Rainfall Regions of South Africa

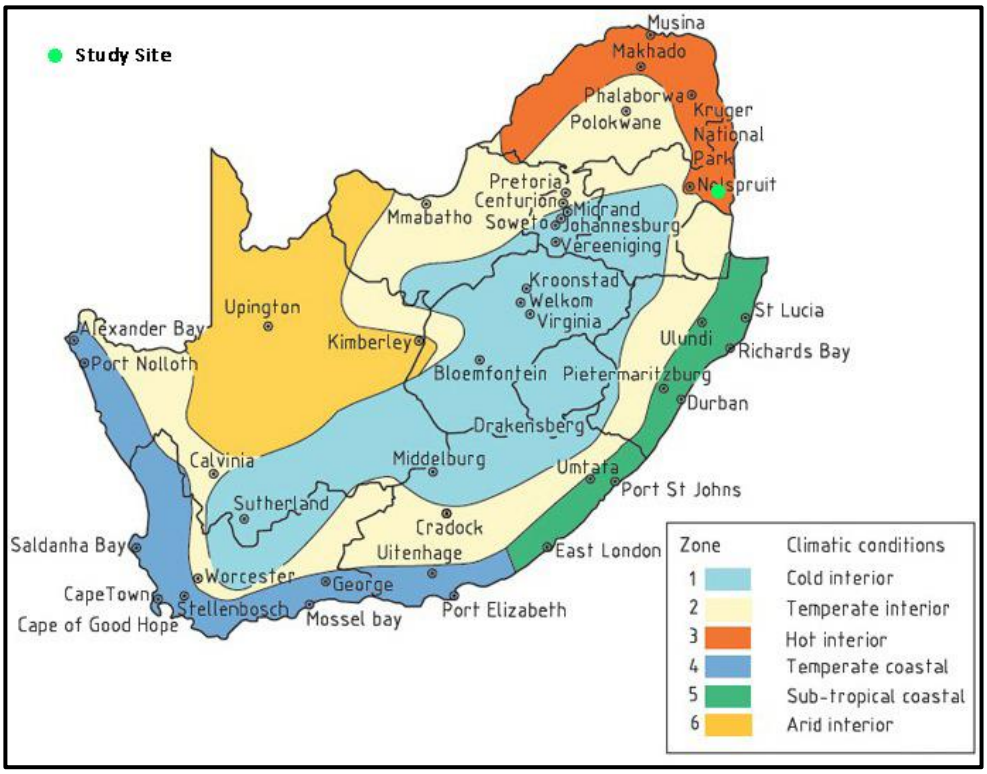


Figure 5: Broad Climatic Zones of South Africa

3.4 Landuse

The current land use / landcover of the site is that of open bushveld, surrounded by active, commercial cultivated farmlands. There is some open bushveld to the south of the site, with the Kruger National Park further north of the site.

Figure 6, below, highlights the current landuse of the study site and surrounding areas.

Figure 6: Environmental & Current Landuse Map

4 TERRESTRIAL ECOLOGY

4.1 Vegetation

The study site is situated within Lowveld Bioregion of the Savanna Biome of South Africa (Figure 7).

The Savanna or Bushveld Biome is typically characterised by dominant upper layer of trees, middle layer of shrubs and a lower layer of grasses and herbs. The ratio and presence of the different layers various from region to region. The Savanna Biome is subdivided into six bioregions. These are: Central Bushveld; Mopane; Lowveld; Sub-Escarpment Savanna; Eastern Kalahari Bushveld; and Kalahari Duneveld.

The Savanna or Bushveld vegetation of South Africa and Swaziland constitutes the southernmost extension of the most widespread biome in Africa. It represents 32.8% of South Africa. It extends beyond the tropics to meet the Nama-Karoo Biome on the central plateau, the Grassland Biome at higher altitudes towards the east and extends down the eastern seaboard interior and valleys where it grades into Albany Thicket in the Eastern Cape (Mucina & Rutherford, 2006) (Figure 7).

The study site is situated within the original extent of the veldtype known as **Granite Lowveld** (Figure 8).

The veldtype is not a threatened ecosystem / veld type. Table 6, below, shows the hierarchy of the vegetation of the site.

Granite Lowveld is characterised by tall shrubland with few trees to moderately dense low woodland on the deep sandy uplands with *Terminalia sericea*, *Combretum zeyheri* and *Combretum apiculatum* and ground layer including *Pogonarthria squarrosa*, *Tricholaena monachne* and *Eragrostis rigidior*. Dense thicket to open savanna in the bottomlands with *Vachellia (Acacia) nigrescens*, *Dichrostachys cinerea*, *Grewia bicolor* in the woody layer. The dense herbaceous layer contains the dominant *Digitaria eriantha*, *Panicum maximum* and *Aristida congesta* on fine-textured soils, while brackish bottomlands support *Sporobolus nitens*, *Urochloa mosambicensis* and *Chloris virgata* (Mucina & Rutherford, 2006).

From statellite images the vegetation of the site appears to be moderately degraded. Although it does not appear to have been previously ploughed and cultivated, it is mostly surrounded by active large, commercial cultivated farmlands, which can lead to fringe impacts and degradation.

Table 6: Vegetation hierarchy of the study area

Category Description	Classification
Biome	Savanna (Bushveld)
Bioregion	Lowveld
Veldtype	Granite Lowveld
Status	Not threatened (Least Concern)

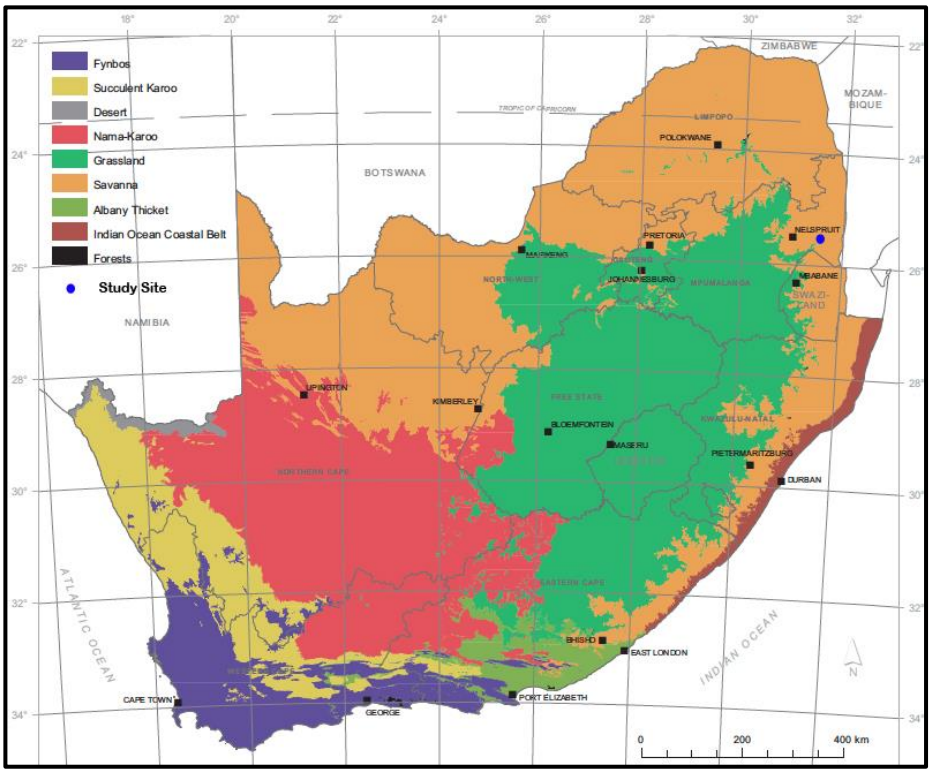


Figure 7: Biomes of South Africa

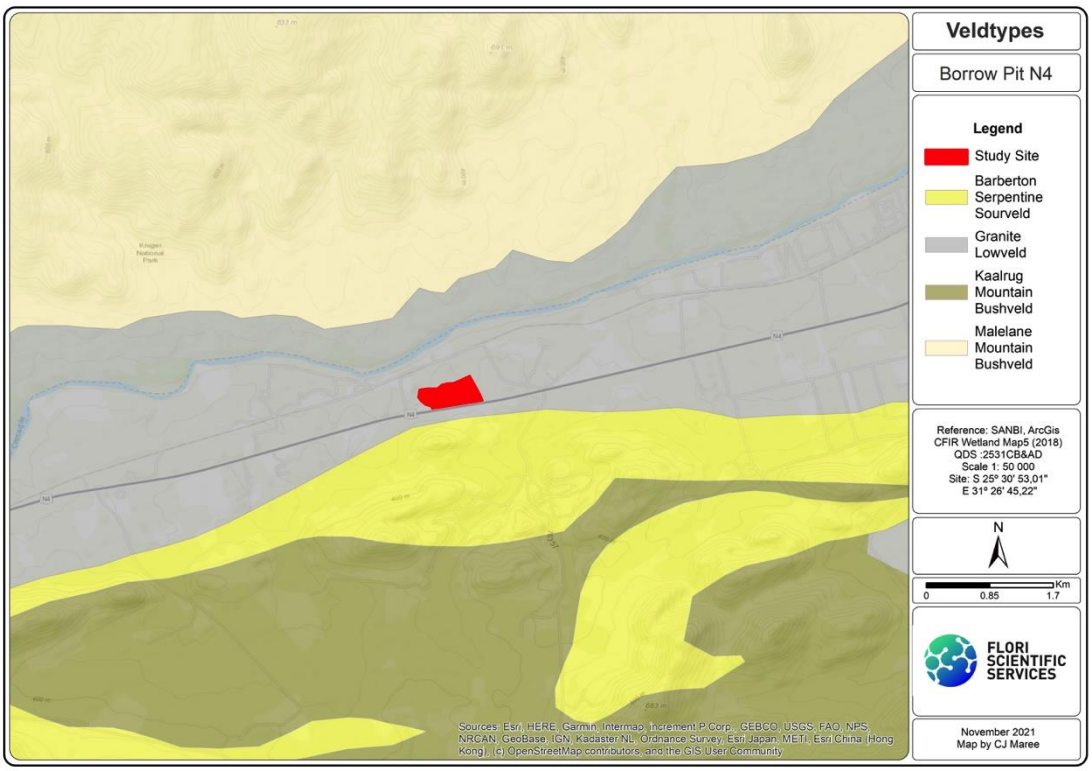


Figure 8: Veldtypes

The vegetation of the study site characterised by moderately degraded lowveld granite bushveld. Some areas in the north and northwest of the site are heavily degraded. The two small seasonal drainage lines along the eastern and western boundaries of the site are in moderate to fair condition. There are a number of fringe impacts arising from farming related activities in surrounding farmlands, which is to be expected There is a 33 / 22kV wooden poles power line that runs through the site from west to east, approximately 90m north of the N4 and parallel to the N4. The bush in the power line servitude is regularly cleared as is necessary. There are a number of scattered protected trees through the site. Mainly marula trees and a few leadwood trees. The leadwoods are mostly restricted to the riparian area of the drainage lines along the study site / property boundary.

There are a number of scattered marlotti and Transvaal / Zebra aloes on the site. These will be very easy to relocate to unused areas of the site. There are also a number of cluster fig trees and other common lowveld trees in and along the riparian zone, which although not protected are recommended to not be disturbed.

No Red Data Listed (RDL) species were observed. That is, critically endangered, endangered or vulnerable species.

The vegetation on site can best be described as *Senegalia (Acacia) burkei - Dichrostachys cinerea* bushveld. The dominance of Black monkey thorn (burkei) and Sicklebush (cinerea) is due to bush encroachment resulting in disturbances on site such as harvesting of wood, etc.

The list of dominant and other species observed on site are listed in the Appendices.

Photo 1: Photo of study site showing typical Lowveld Granite veldtype

Photo 2: Vegetation can be described as Senegalia (Acacia) nigrescens - Dichrostachys cinerea bushveld

4.2 Priority Floral Species

No Red Data Listed (RDL) species (endangered, threatened or vulnerable) were observed during field investigations. None are expected to occur. No Orange Data Listed (ODL) species were observed either with none expected to occur.

Some protected trees are present in the study area, namely marula and leadwood.

4.3 Threat Status

Granite Lowveld is not a threatened veldtype (ecosystem) and has a threat status / conservation status of 'Least Threatened' (LT) (Table 7).

In the National Biodiversity Assessment (NBA, 2011) the ecosystem threat status indicator for terrestrial ecosystems was linked to the National List of Threatened Terrestrial Ecosystems, which appeared in the government gazette in 2011. Since 2011 there have been significant changes to both the national vegetation map (which includes a wide range of refinements) and the land cover data (which now includes land cover change between 1990 and 2014).

However, there has been no change is status of the veldtype (Granite Lowveld) from the 2011 assessment (NEMBA list) until the 2018 assessment (NBA Red List of Ecosystems) (Skowno, 2019).

Table 7: Veldtype status

Veldtype	Status	Description
Granite Lowveld	Least Threatened (LT) / Least Concern (LC)	Approximately 17% of the veldtype is statutorily conserved in the Kruger National Park. About the same amount conserved in private reserves mainly the Selati, Klaserie, Timbavati, Mala Mala, Sabi Sand and Manyeleti Reserves. More than 20% already transformed, mainly by cultivation and by settlement development (Mucina & Rutherford, 2006, 2010)

Table 8 below gives a basic description of each of the status categories, while Figure 9 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 8: 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.

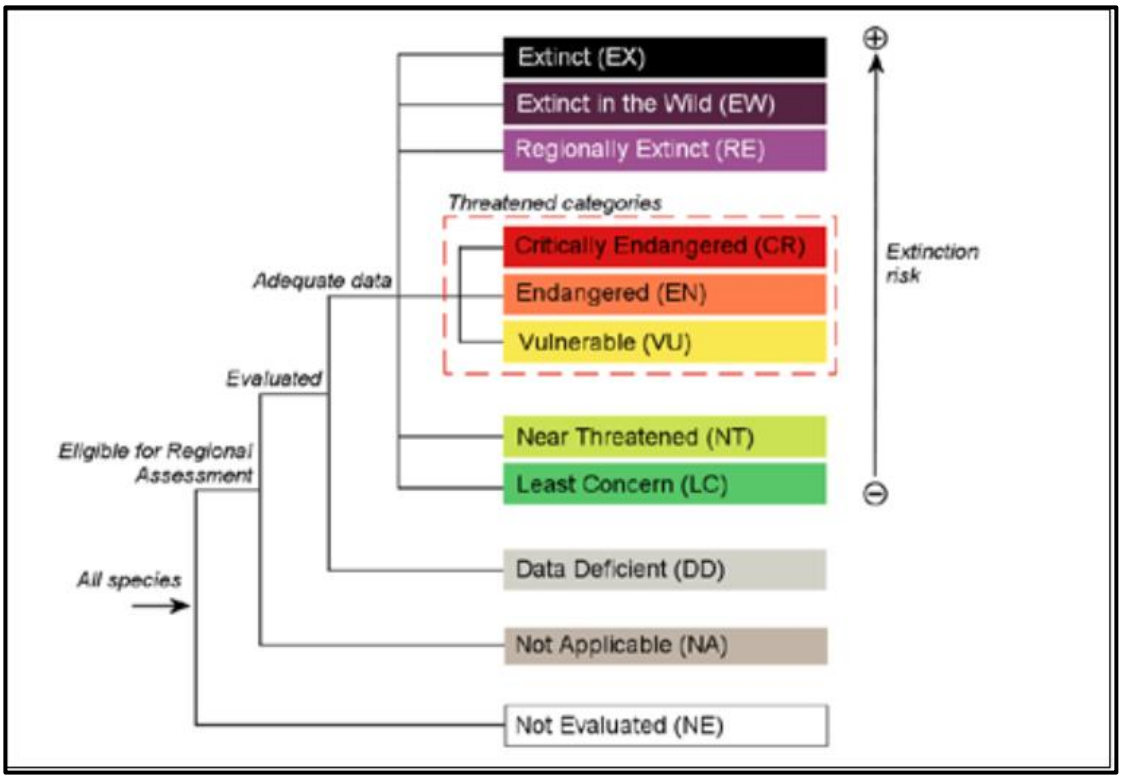


Figure 9: Structure of categories used at the regional level

4.4 Fauna

There are potentially a number of different wild, free roaming faunal species present in the study area and surrounding areas. There are some ideal habitats, especially north of the site in the area of the Kruger National Park and Crocodile River. The main ideal habitat on the study site is the small drainage line and riparian zone on the eastern boundary. Some faunal species are highly mobile and can also traverse the study area from time to time. For this to happen more easily ideal and sufficient green corridors are required between open areas. The area is a well-established farming region with high-intensity commercial farming enterprises such as sugarcane. There are a few bushveld corridors within the cultivated farmlands. Furthermore, farmlands do attract certain wild fauna, which adapts well to the environment. For example, cane rats in terms of the sugarcane plantations.

4.4.1 Mammals

No large- or medium-sized mammals were observed during field investigations. A few small burrows were seen, which appear to be used by small field mice, and possibly some mongooses.

It is impossible to conduct an accurate survey of faunal species 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.

A total of 12 red data listed (RDL) mammal species' range of distribution falls within the study area of which three can possibly utilise the available habitats on site. Of these, only the honey badger (*Mellivora capensis*) is possibly actively present and will use all the natural habitats on site (Wandima Report, 2010). It is also possible that occasional other priority wild species will break out of the Kruger National Park and into the study area, and these might include species such as leopard, cheetah, etc. However, the Crocodile River will also create a natural barrier for the frequent movement of many wild species from the north.

4.4.2 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 IUCN Red List of Threatened Species was also consulted via the official website (www.iucnredlist.org). The Probability of Occurrence (POC) is the probability of the faunal species 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 9).

Table 9: Probability of Occurrence (POC): Mammals

Scientific Name	Common Name	SA Status	POC (%)	POC Value
Atelerix frontalis	Hedgehog	NT	67	Medium/High
Crocidura cyanea	Reddish-grey musk shrew	DD	60	Medium
Cloeotis percivali	Short-eared trident bat	CR	40	Low/Medium
Crocidura flavescens	Greater red musk shrew	DD	63	Medium/High
Crocidura fuscomurina	Tiny musk shrew	DD	67	Medium/High
Crocidura hirta	Lesser red musk shrew	DD	43	Medium
Crocidura marquensis	Swamp musk shrew	DD	40	Medium
Crocidura silacea	Lesser grey-brown musk shrew	DD	40	Medium
Dasymys incomtus	Water rat	NT	30	Low/Medium
Elephantulus brachyrhynchus	Short-snouted elephant shrew	DD	30	Low/Medium
Epomophorus gambianus	Gambian fruit bat	DD	47	Medium
Graphiurus platyops	Rock dormouse	DD	47	Medium
Hippsideros caffer	Sundevall's leaf- nosed bat	DD	37	Low/Medium
Lemniscomys rosalia	Singel stripped mouse	DD	40	Medium
Leptailurus serval	Serval	NT	33	Low/Medium
Lutra macuicollis	Spotted-necked otter	NT	33	Low/Medium
Manis temminckii	Pangolin	VU	43	Medium
Mellivora capensis	Honey badger	NT	60	Medium
Miniopteris schreibersi	Schreibers's long-fingered bat	NT	33	Low/Medium

Myotis tricolor	Temminck's hairy bat	NT	33	Low/Medium
Paracynictis selousi	Selous mongoose	DD	33	Low/Medium
Pipistrellus rusticus	Rusty bat	NT	33	Low/Medium
Poecilogale albiucha	African weasel	DD	33	Low/Medium
Rhinolophus blasii	Peak-Saddle Horseshoe Bat	VU	33	Low/Medium
Rhinolophus clivosus	Geoffroy's Horseshoe bat	NT	60	Medium
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	33	Low/Medium
Suncus infinitesimus	Least dwarf shrew	DD	33	Low/Medium
Suncus lixus	Lesser dwarf shrew	DD	33	Low/Medium
Tatera leucogaster	Bushveld gerbil	DD	33	Low/Medium

The Red Data Sensitivity Index Score (RDSIS) for the study area's potential Red Data Listed (RDL) mammals yielded an average score of **27,9%**, indicating a '**Low/Medium**' index score of importance or potential occurrence with regards to RDL 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 10, 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 above in the chapter on Methodology.

Table 10: RDSIS for Mammals for the study area

RED DATA SENSITIVITY INDEX SCORE (RDSIS)	
Average Total Species Score	42,0%
Average Threatened Taxa Score	28,15%
Average of the combined Total Species and Threatened Taxa Scores	35,10%
% of Species with a Probability of Occurrence of >60%	20,7%
RDSIS for the Study Site	**27,9%**
RDSIS Category for Study Site	**LOW / MEDIUM**

Low: 0-20%; Low/Medium: 21-40%; Medium: 41-60%; Medium/High: 61-80%; High: 81-100%

4.4.3 Avifuana

No priority birds were observed during site investigations. Although the study site is not within an Important Bird Area (IBA), the Kruger National Park IBA, is very close to the north of the site. Many priority birds, such as raptors (eagles, hawks, vultures), storks and cranes will be found flying over the area from time to time. These large, mobile birds can easily fly over the site between various IBAs and other ideal habitats as well. No new or old nest for priority birds such as raptors were observed during site investigations.

Common birds seen during site visits included laughing dove (*Streptopelia senegalensis*), cape turtle dove (*Streptopelia capicola*), hadeda ibis (*Bostrychia hagedash*), southern masked weaver (*Ploceus velatus*), fiscal shrike (common fiscal) (*Lanius collaris*), yellow-fronted canary (*Crithagra mozambica*), white-bellied sunbird (*Cinnyris talatala*), and dark-capped bulbul (*Pycnonotus tricolor*). The purple-crested turaco (loerie) (*Tauraco porphyreolopha*) was spotted in the trees in the riparian vegetation of the drainage line on the eastern boundary of the site.

No waterbirds were observed in the area and none are expected to occur or breed on the site due to lack of permanent bodies of open water or wetlands. Such birds will be more attracted to the Crocodile River, north of the site.

4.4.4 Reptiles and Amphibians

The study site falls within the distribution range of about thirty (30) frog species, but none of these are official RDL species and none are expected to occur on the actual study site. Only one species, the yellow-striped reed frog (*Hyperolius semidiscus*), is regarded as endemic to the immediate region (Wandima, 2010). However, it is not anticipated that the frog species will be present on site due to the lack of streams, wetlands and other ideal habitat.

There are a few ideal habitats in the surrounding areas for a diverse group of reptiles, especially north along the Crocodile River and rocky hills. The rocky hills are particularly ideal for numerous snake and lizard species. According to Branch (1998), 98 species of reptiles can potentially occur in the greater Nelspruit area. The only Red Data / priority species expected to occur are the African rock python (*Python natalensis*) and the variegated wolf snake (*Lycophidion variegatum*). Three Endemic species are expected in the greater region, namely, the Haacke's Flat Gecko (*Afroedura (multiporis) haackei*) (provincial Endangered status); Barberton Girdled Lizard (*Cordylus warreni barbertonensis*); and Wilhelm's Flat Lizard (*Platysaurus wilhelmi*) (Wandima Report, 2010). All of these have a limited range of distribution roughly covering the area between Nelspruit, Barberton, Malelane and the southerly Kruger National Park. Several important lizard species are potentially present on the rocky hills and outcrops. However, it is not anticipated that these species will be negatively impacted or even encountered.

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. However, care should still be taken to avoid interacting with snakes should any be encountered. It is more than likely that there are snakes and lizards in the general area.

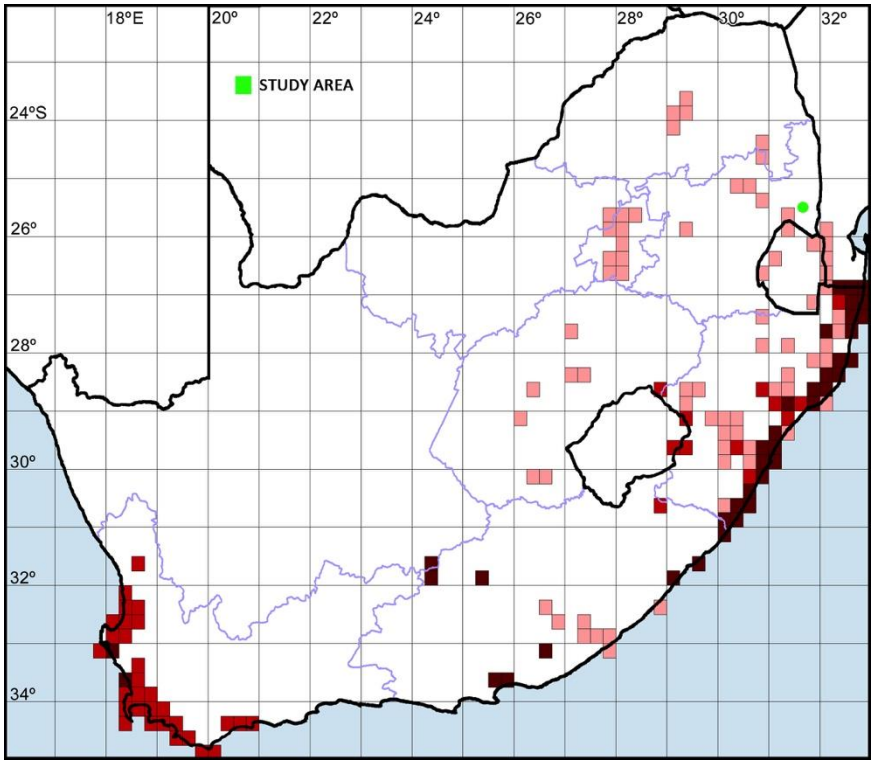


Figure 10: Snake hotspots

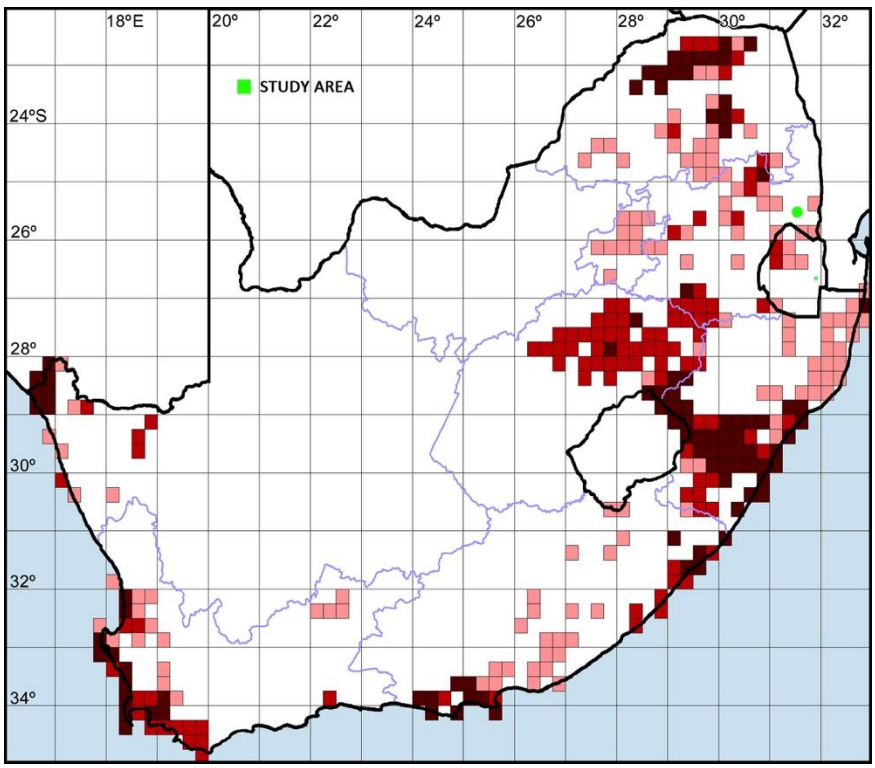


Figure 11: Lizard hotspots

4.4.5 Invertebrates

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.

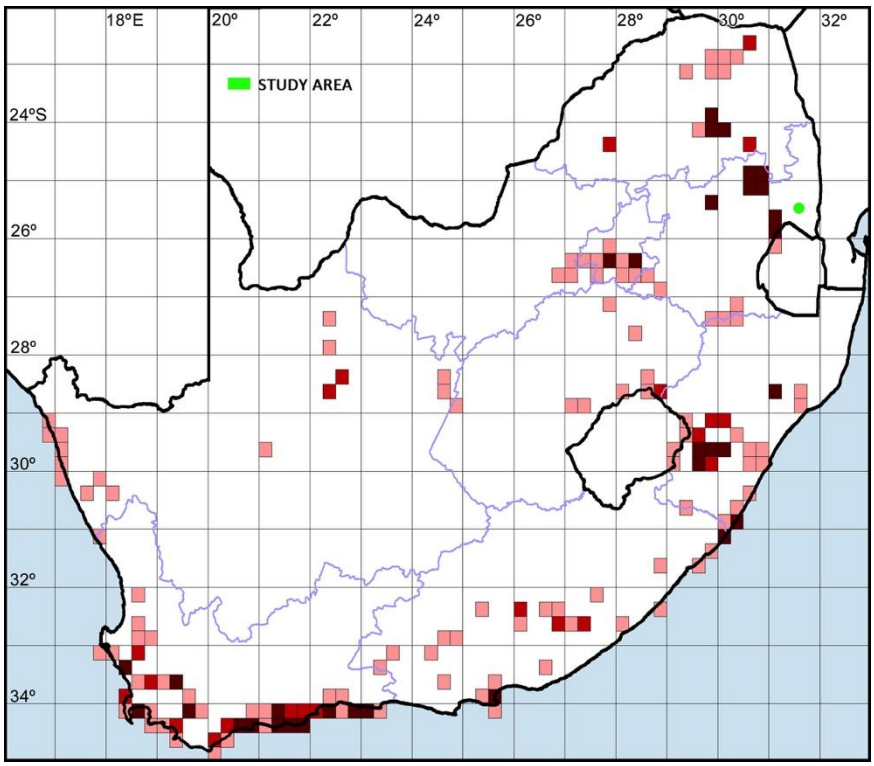


Figure 12: Butterfly hotspots

4.4.6 Faunal species of conservation concern

During field investigations no faunal species of conservation concern were encountered. This can also be due to the limited time available for site investigations. There are some ideal habitats for some priority faunal species, but mainly outside of the limits of the study area, which are mainly in the undeveloped rocky granite outcrops (koppies) and hills. Table 11, below, highlights some of the priority species and their likelihood to occur in the study area.

Table 11: 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	Unlikely. Study site not within main distribution of frog
Mammals					

Atelerix frontalis	SA hedgehog	Near threatened	Most, broad	Broad	Possible
Manis temmincki	Pangolin (Scaly anteater)	Vulnerable	Grassland, savanna	Woody savanna, ants, termites	Unlikely, but within distribution range
Mellivora capensis	Honey badger (Ratel)	Near threatened	Most, broad	Broad	Unlikely, but within distribution range
Cloeotis percivali	Short-eared trident bat	Critically endangered	Savanna	Caves and subterranean habitat	No
Pipistrellus rusticus	Rusty bat	Near threatened	Most, broad	Woody savanna, large trees	No
Snakes					
Python natalensis	Southern African python	Vulnerable	Ridges, wetlands	Rocky areas; open water	No

5 AQUATIC ECOLOGY

The aquatic ecology focuses on surface water in the environment and looks at all watercourses and other open waterbodies within the study area. These watercourses include rivers, streams and wetlands. Wetlands include marshes, seeps and pans (freshwater and saltwater). Manmade systems such as farm dams 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, its beds and banks.

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 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.

5.1 Watercourses in the study area

There are no distinctive or major watercourses in the study site, such as perennial rivers, semi-perennial streams, seasonal streams and large wetlands. The closest river to the study site is the

perennial Crocodile River, which is approximately 700m north of the outer boundary of the study site (Figure 13).

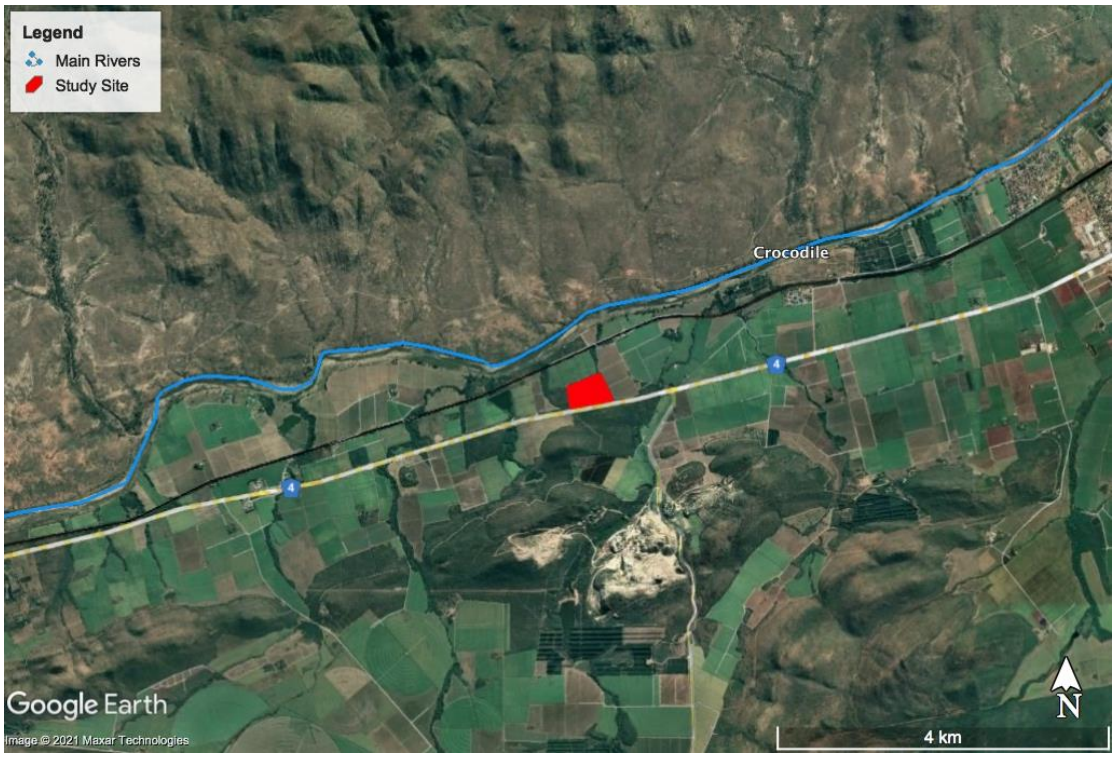


Figure 13: Main Watercourses in the Region

Two small, seasonal drainage lines are present along the eastern and western boundaries of the study site and both flow in a northerly direction and eventually into the Crocodile River, which in turn flows in an easterly direction. The drainage lines are defined by denser thicket / bush along their courses (Figure 14).

The proposed quarry will have no impact on the Crocodile River. However, the two small seasonal drainage lines will need to be buffered and protected.

According to the latest wetland map data (National Wetland Map 5, 2018) there are no demarcated wetlands or other watercourses in the study area (Figure 15).

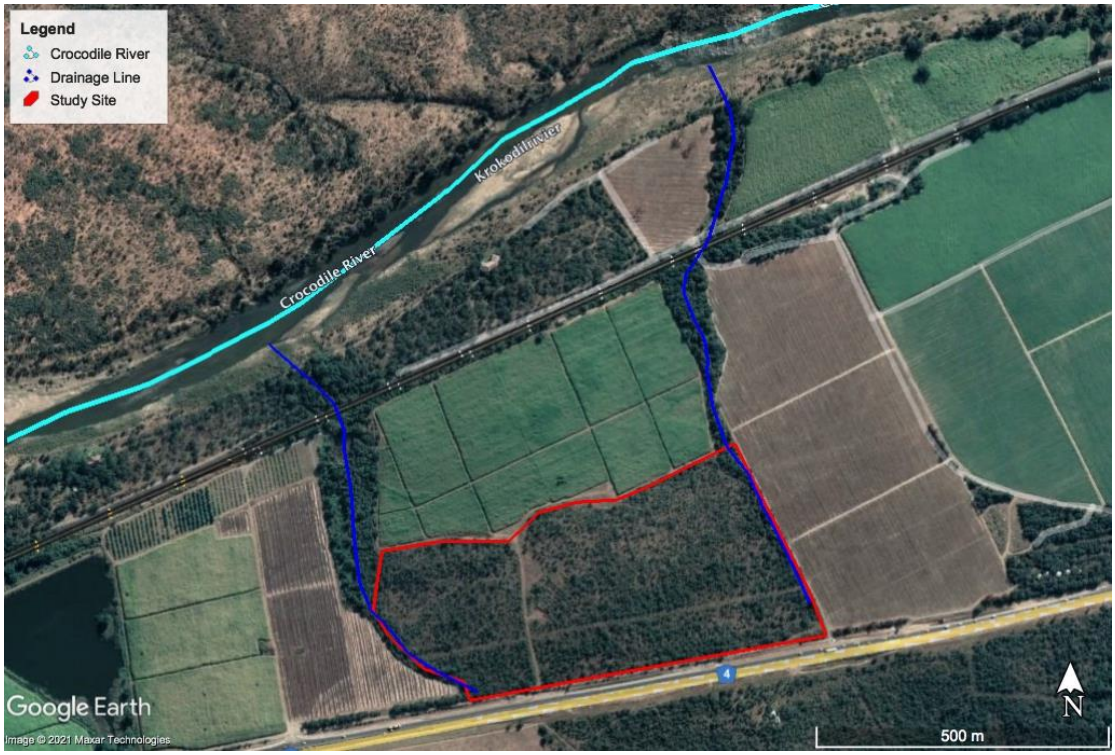


Figure 14: Watercourses in or close to the Study Area

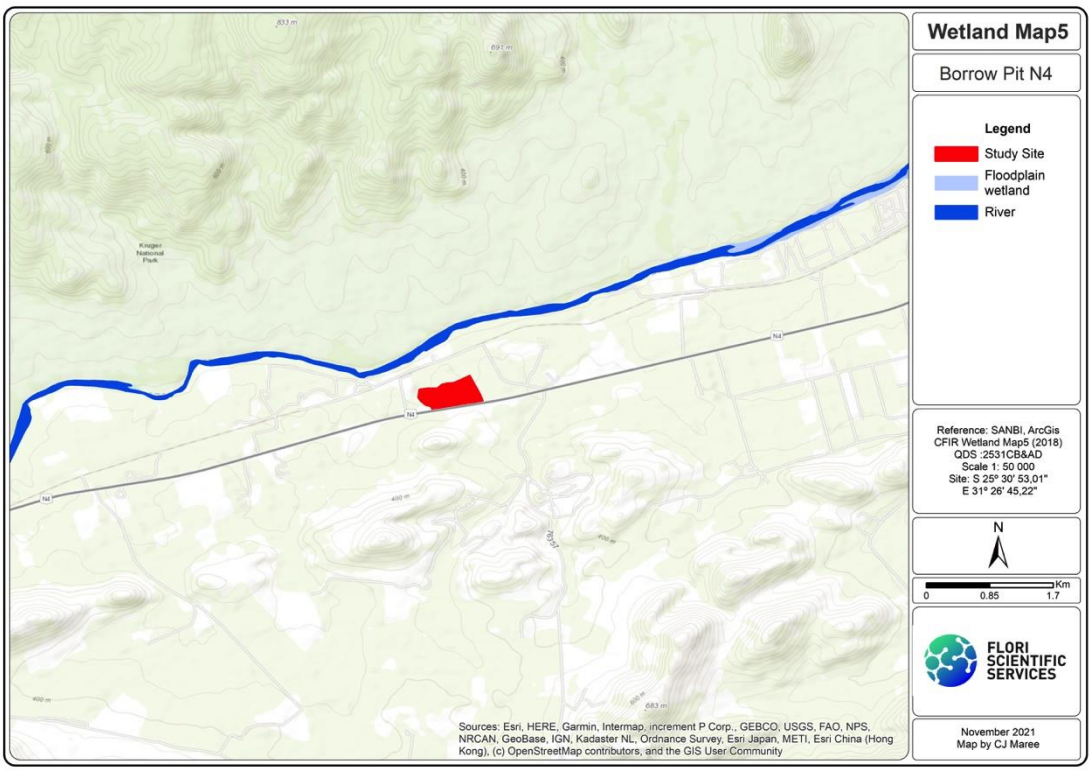


Figure 15: National Wetland Map 5

The study area is situated along the N4 National Road. The general downward gradient (slope) is from south to north. The large, N4 has a number of stormwater culverts that go under the road in the area of the study site. There is also a stormwater culvert along the northern side of the N4 road which channels stormwater run-off on the road down and into the study area. Much of this surface stromwater run-off eventually flows into the drainage line along the eastern boundary of the site. The two drainage lines on the boundaries of the study site have been altered over the years by road works as well as landowners and farming practices to assist waterflow and reduce erosion, etc. The three main stormwater concrete culverts are shown in the maps and photographs below, along with general surface stormwater run-off (Figure 16).

The stormwater run-off does not constitute a watercourse, and will change depending on where stormwater culverts are inserted in the road, etc.

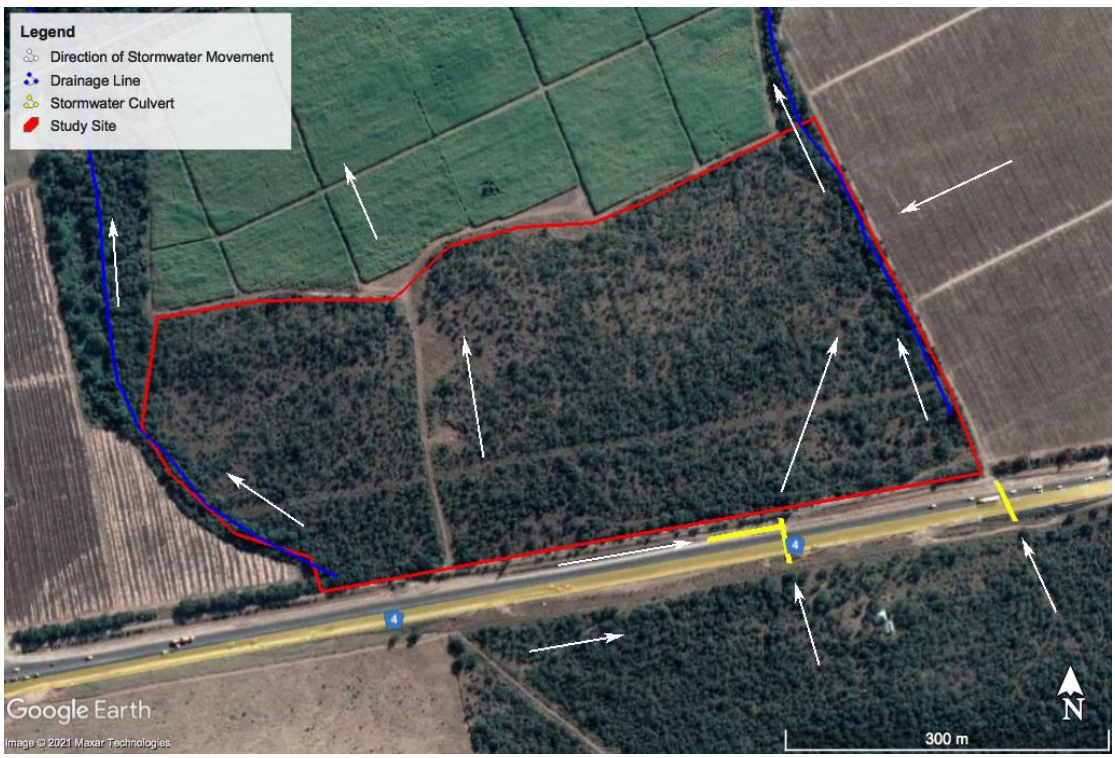


Figure 16: Stormwater Culverts and general movement of surface stormwater run-off

Photo 3: Small seasonal drainage line. Dry during site visit. Width less than 5m

Photo 4: Seasonal drainage line on eastern boundary of site. Dry during site visit

Photo 5: Stormwater culvert under N4 in area of southeast corner of site

Photo 6: Smaller stormwater culvert under N4 in approximate middle of study site

5.2 Classification of watercourses

Watercourses identified are classified along different hydrogeomorphic (HGM) types or 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). See tables below (Table 12).

Watercourses found on site, or within a 500m radius if a wetland, are assessed in terms of their Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS).

Table 12: 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
			Channeled 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 13: Classification of watercourses in the study area

Delineated systems	Level 1 System	Level 2 Regional Setting (Ecoregion)	Level 3 Landscape Unit	Level 4 HGM Unit
Crocodile River	Inland	Lowveld (Group 3)	Valley floor / Plain	River (Lower foothills)
Drainage lines	Inland	Lowveld (Group 3)	Valley floor / Plain	River (Lower foothills)

5.3 Drainage areas

South Africa can be naturally divided up into a number of geographically occurring Primary Drainage Areas (PDAs) (Figure 17). 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 18).

The study area is situated within the Primary Drainage Area (PDA) of **D** and in the Quaternary Drainage Area (QDA) of **D53F** (Figure 19). A summary of the catchment and management areas is shown in Table 14, below. It is important to note that the proposed quarry site is not within an Important Water Source Area on a national or provincial level. This has relevance because the proposed project is a quarry, which potentially could impact on surface as well as ground water reserves.

Table 14: Summary of Catchment Areas

Level	Category
Primary Drainage Area (PDA)	X
Quaternary Drainage Area (QDA)	X24D
Water Management Area (WMA) – Previous / Old	Inkomati
Water Management Area (WMA) – New	Inkomati-Usuthu (WMA 3)
Sub-Water Management Area	Crocodile
Catchment Management Agency (CMA)	Inkomati-Usuthu (CMA 3)
Wetland Vegetation Ecoregion	Lowveld (Group 3)
River FEPA	Not on site, but Crocodile River is
Fish FEPA	No
Fish FSA	Not on site, but Crocodile River is
Fish Corridor	No
Fish Migratory	No
Priority Quaternary Catchment	No
SWSA (National importance)	No
WSA (Sub-national, provincial importance)	No

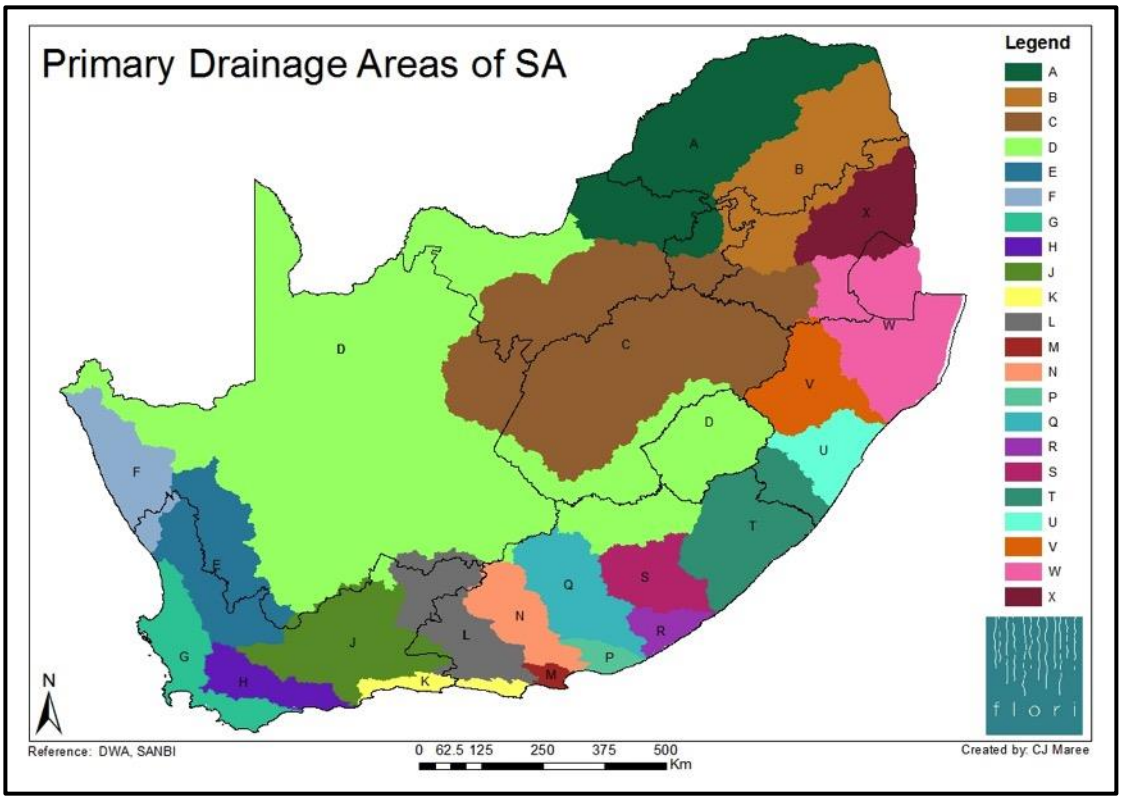


Figure 17: Primary drainage areas of South Africa

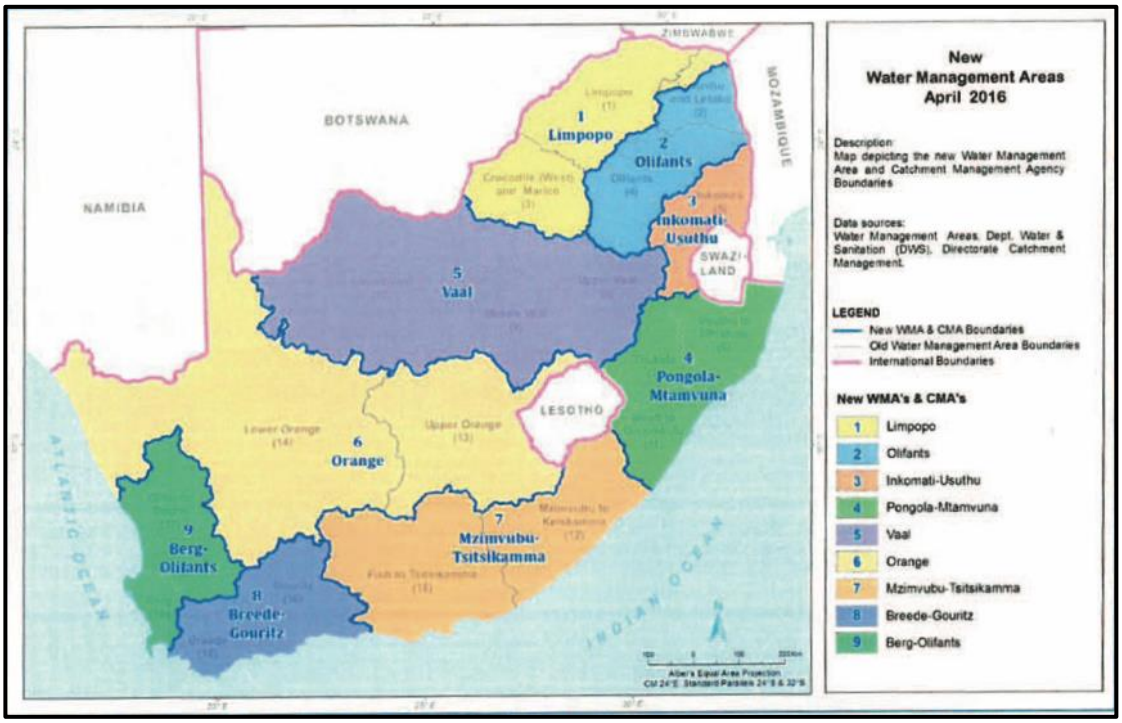


Figure 18: WMAs and CMAs of South Africa

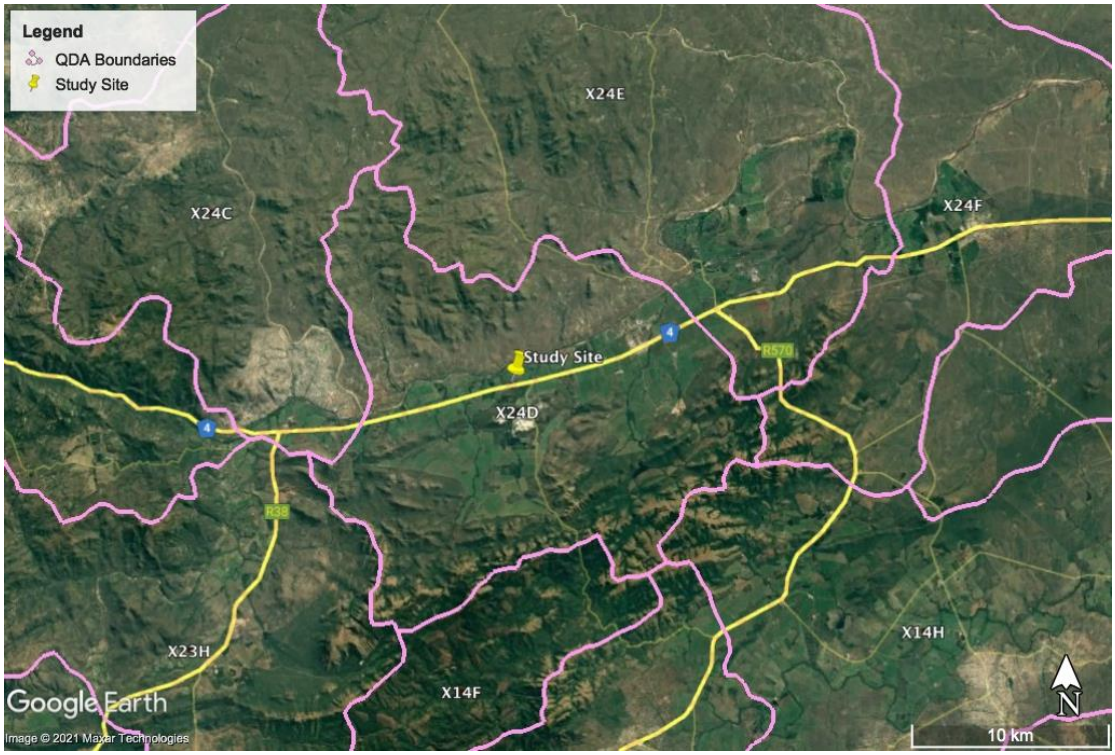


Figure 19: Quaternary Drainage Areas (QDAs)

5.4 Strategic Water Source Areas

The study site is not situated within a Strategic Water Source Area (SWSA).

A SWSA of South Africa are those areas that supply a disproportionate amount of mean annual runoff in relation to the size of the geographical region. These areas are important because they have the potential to contribute significantly to overall water quality and supply, 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 (SANBI). A SWSA can be strategic (important) in terms of surface water run-off, or ground water.

A Water Source Area (WSA) is a water catchment or aquifer system that either supplies a relatively large volume of water for its size, or is the primary source of water for a town, city or industrial activity. Strategic Water Source Areas (SWSAs) are defined as areas of land that either: (a) supply a disproportionate (i.e. relatively large) volume of mean annual surface water runoff (i.e. water in streams, rivers and wetlands) in relation to their size and so are considered nationally important; or (b) have relatively high groundwater recharge and groundwater forms a nationally important resource (has high levels of use or settlements depend on it); or (c) areas that meet both criteria (a) and (b). A SWSA is one where the water that is supplied is considered to be of national importance for water security, but there are others, which are considered to be sub-nationally important (WRC, 2019).

5.5 Present Ecological State of Watercourses

All watercourses identified within the study area and surrounding areas were assessed to determine their Present Ecological State (PES) (Table 15). 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 15). The PES ratings of the two small unnamed seasonal drainage lines are the same, also with very little difference in physical features. The Crocodile River will not be impacted at all by the proposed project. However, because of the national importance and relative closeness of the river the PES was also determined (Table 15).

Table 15: PES of Watercourses in the study area

Criteria	Identified Watercourses	
	Crocodile River	Drainage Lines
HYDROLOGY		
Flow modification	3	3
Permanent inundation	2	3
WATER QUALITY		
Water Quality Modification	2	2
Sediment Load Modification	2	3
GEOMORPHOLOGY		
Canalisation	3	4
Topographic Alteration	3	3
BIOTA		
Terrestrial Encroachment	2	2
Indigenous Vegetation Removal	2	3
Invasive Plant Encroachment	2	3
Alien Fauna	4	4
Over utilisation of Biota	2	3
Total:	27	33
Average:	2,5	3,0
Category:	**C**	**C**
Description	**Moderately Modified**	**Moderately Modified**
Recommended EMC	**C**	**C**

5.6 Ecological Importance & Sensitivity of Watercourses in the Study Area

The Ecological Importance and Sensitivity (EIS) ratings of the watercourses were determined as shown in the table below (Table 16). The Crocodile River has a EIS rating of 'High' (Category B), while the two small seasonal drainage lines are both 'Low" (Category D). The drainage lines are not Ecological Important (EI) due mainly to their small size, volumes of water and therefore lack of significant inflow / supply into the larger river of the Crocodile River. This is not to say that the small streams and drainage lines are not sensitive in terms of habitat and aquatic ecology.

Table 16: EIS of watercourses in the study area

Determinants	Crocodile River	Drainage Lines	Confidence
PRIMARY DETERMINANTS			
1. Rare & Endangered Species	2	0	4
2. Populations of Unique Species	2	1	4
3. Species/taxon Richness	3	1	4
4. Diversity of Habitat Types or Features	3	0,5	4
5 Migration route/breeding and feeding site for wetland species	3	0	3
6. Sensitivity to Changes in the Natural Hydrological Regime	2	0	3
7. Sensitivity to Water Quality Changes	2	1	3
8. Flood Storage, Energy Dissipation & Particulate / Element Removal	3	1	3
MODIFYING DETERMINANTS			
9. Protected Status	1	0	4
10. Ecological Integrity	1	1	4
TOTAL	22	5,5	-
AVERAGE	2,2	0,55	-
EIS Category	**B**	**D**	**-**
Description	**High**	**Low**	**-**

6 SENSITIVITY ASSESSMENT

6.1 National Screening Tool Assessment

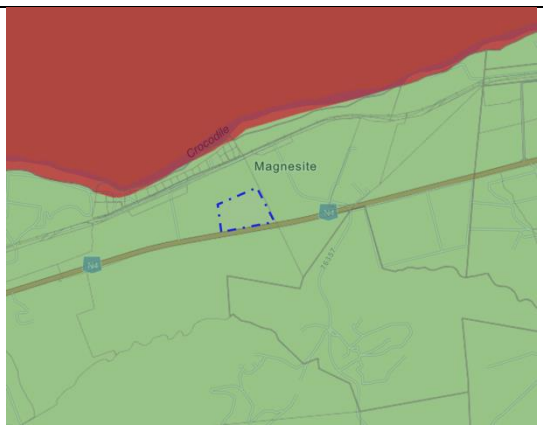
The Department of Forestry, Fisheries and the Environment (DFFE) (Previously DEA) has development a desktop screening tool that is to be used as a guideline in an initial desktop assessment of a project site (www.screening.environment.gov.za). The screening tool incorporates most datasets produced by DWS, DEA (DEFF), SANBI and Provincial Conservation Plans. The screening tool is a desktop guideline 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. can be required by government authorities. According to the screening tool the various sensitivities for the study site and immediate surroundings are as follows:

- Terrestrial Biodiversity Combined Theme: Low.
- Aquatic Biodiversity Combined Theme: Low.
- Plant Species Theme: Medium and Low.
- Animal Species Theme: Medium.

During site investigations the sensitivities as shown in the above screening tool results were assessed and verified. From the site investigations and specialist studies it is reasonable to accept that the desktop screening tool assessments are accurate.

The overall biodiversity and aquatic sensitivities are 'Low'.

Table 17: Maps from DEA Screening Tool

	
Combined Biodiversity Sensitivity	Aquatic Sensitivity

Plant Species

Animal Species

Blue Dotted Line: Study Site. Red: High Sensitivity Orange: 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 badly 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 natural environment within the study area is homogenous and consists of one distinctive habitat type, namely, bushveld. Other habitats within the larger bushveld habitat include the small, seasonal drainage lines along the eastern and western boundaries of the study site. The sensitivities of the habitats are first assessed separately in terms of fauna and flora (Table 18 & Table 19) and then combined into a combined ecological sensitivity analysis (Table 20).

Table 18: Floristic sensitivity analysis

Criteria	Distinctive habitats in the study area	
	Bushveld	Drainage Lines
Red Data Species	2	3
Habitat Sensitivity	4	5
Floristic Status	5	5
Floristic Diversity	4	5
Ecological Fragmentation	4	4
Sensitivity Index	38%	44%

Sensitivity Level	**Medium/Low**	**Medium**

Low: 0-20%; Medium/Low: 20-40%; Medium: 40-60%; Medium/High: 60-80%; High: 80-100%

Table 19: Faunal sensitivity analysis

Criteria	Distinctive habitats in the study area	
	Bushveld	Drainage Lines
Red Data Species	3	5
Habitat Sensitivity	5	5
Faunal Status	5	5
Faunal Diversity	5	5
Ecological Fragmentation	4	5
Sensitivity Index	44%	50%
Sensitivity Level	**Medium**	**Medium**

Low: 0-20%; Medium/Low: 20-40%; Medium: 40-60%; Medium/High: 60-80%; High: 80-100%

The ecological sensitivity of the study site 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 20).

Table 20: Ecological sensitivity analysis

Ecological community	Floristic sensitivity	Faunal sensitivity	Ecological sensitivity
Bushveld	Medium/Low	Medium	**Medium**
Drainage Lines	Medium	Medium	**Medium**

According to the analyses there are no high sensitivity areas or habitats. However, regardless of the actual ratings, watercourses are, by default, viewed as sensitive (ie – High Sensitivity). There are a few protected trees within the study area, especially along the small drainage lines, but this in itself does not make the overall ecoogical sensitivity of the site 'High'.

6.3 Priority Areas

The study area is not situated within any priority areas (Figure 20).

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.

The study site is within the 10km buffer zone of the Kruger National Park (KNP). The KNP is approximately 700m north of the study area and the Dumaneni Private Nature Reserve is situated approximately 9km southeast. This is according to the official Protected Areas Register (PAR)

(www.portal.environment.gov.za). The Crocodile River forms the boundary of the Kruger National Park in the area of the study site.

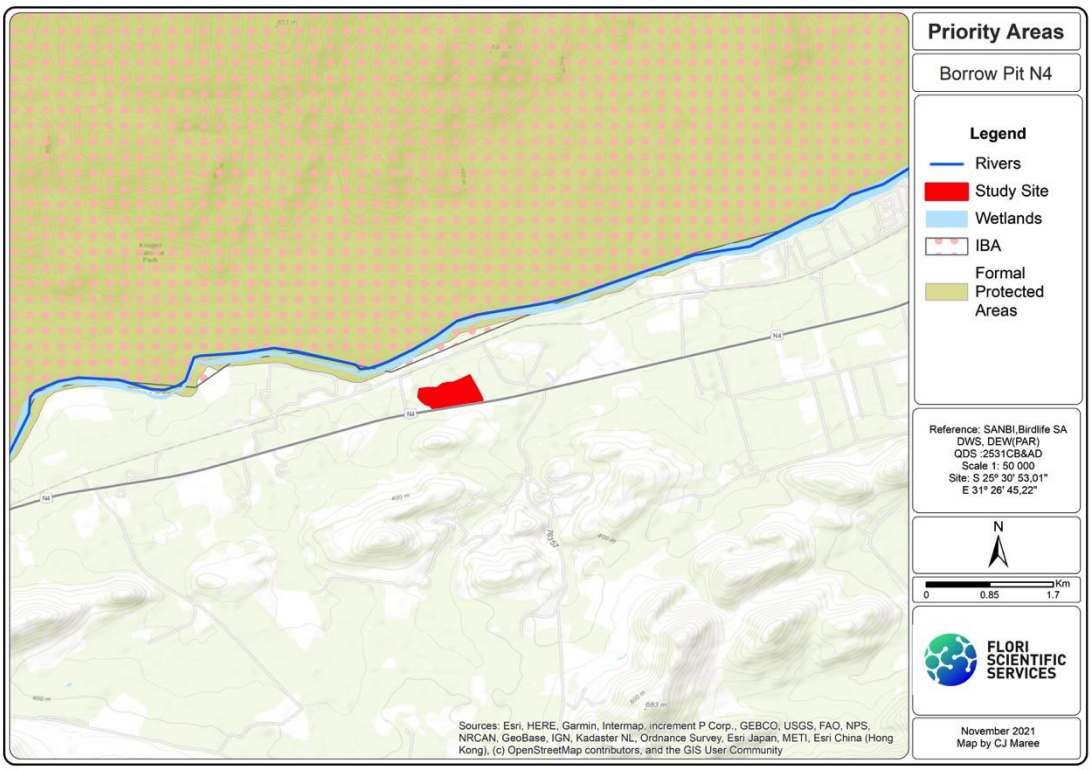


Figure 20: Priority Areas

6.4 Critical Biodiversity Areas and Ecological Support Areas

According to the Mpumalanga Biodiversity Sector Plan (2014) the study site is situated within an Ecological Support Area (ESA), which is also demarcated as the 10km Buffer Zone of the Kruger National Park (Figure 21). The protected area buffer does not mean that no development may take place within the buffer. That is, it is not a 'no-go' zone, which is very clear when looking at all the developments within the buffer zone, including major settlement developments. However, it is imperative that specialist studies, such as these, are conducted to determine the actual sensitivities, potential buffer areas, give recommendations, and highlight any potential 'fatal flaws'. The study and report does give a 'go; no-go' recommendation in the findings and recommendations of the study.

Critical biodiversity areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services (SANBI, 2007). These form the key outputs of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision-making tools. CBAs are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services (SANBI).

Ecological Support Areas (ESAs) are areas that are often seen as buffer areas for CBAs as well as corridors and connective areas between CBAs and/or other priority areas. ESAs are also often designated buffer and support areas along rivers and streams.

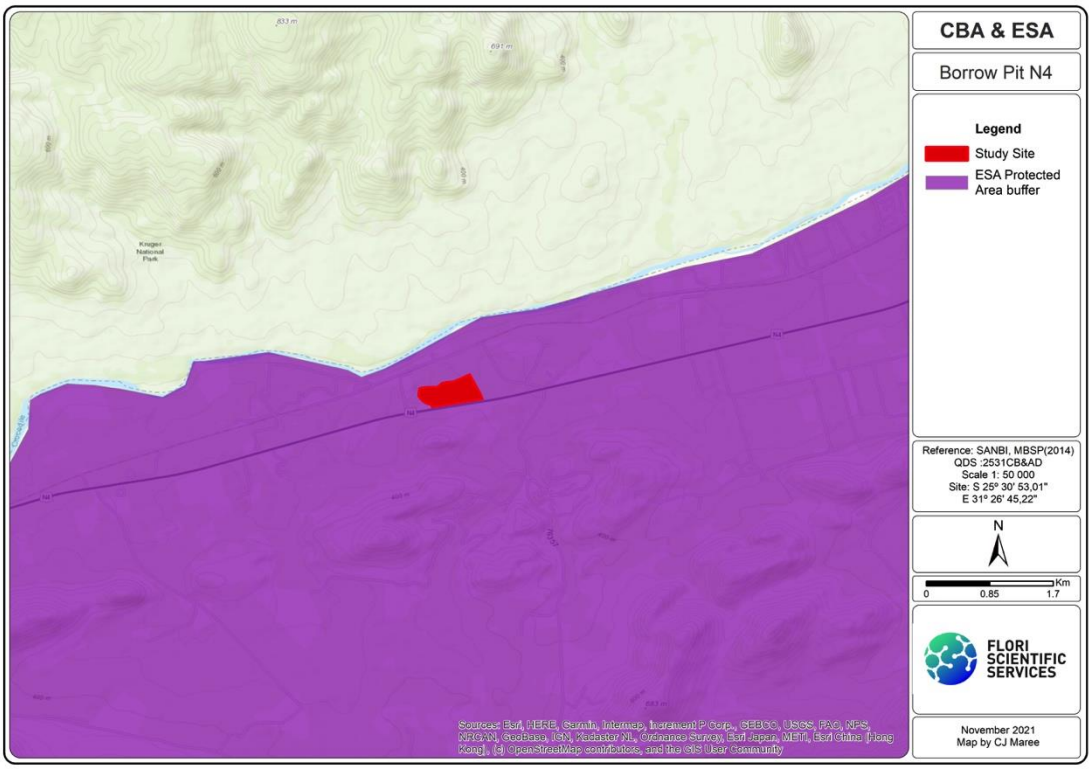


Figure 21: CBAs and ESAs

6.5 Buffer Zones

Determining appropriate management measures for aquatic impact buffer zones is largely dependent on the threats associated with the proposed activity adjacent to the water resource (WRC, 2017). These threats include:

- Increases in sedimentation and turbidity.
- Increased nutrient inputs.
- Increased inputs of toxic organic and heavy metal contaminants.
- Pathogen inputs.
- Loss of riparian zone.
- Loss of floodplain.
- Loss of water from catchment area.

The two small, seasonal drainage lines along the eastern and western boundaries of the study site need to be protected. A 50m buffer zone from the middle of the narrow channel has been recommended for each drainage line. These buffer zones will be sufficient to protect the main channel, riparian zone and

overall integrity of each of the watercourse's ecosystems. The bufferzones can only be established within the property (study site). The eastern boundary of the site is impeded by a gravel farm road and sugarcane plantation, while the western boundary is impeded by sugarcane plantations. The extent of the buffer zone is shown in the map below (Figure 22).

The gravel farm road forms the eastern boundary of the buffer zone and may still be used as per normal. There is also a gravel road on the southern boundary of the buffer zone, which may also still be used. However, the existing stormwater culvert under the N4 releases directly into this area, onto the road and will most likely need to be addressed in terms of stormwater management (see Figure 16).

Figure 22: Recommended 50m buffer zones

6.6 Sensitive areas identified during field investigations

During site investigations the only sensitive habitats encountered were the two small, seasonal drainage lines along the eastern and western boundaries of the study site. The rest of the site is not sensitive, but along with the potential of free-roaming wildlife as the main factor, and some characteristic lowveld bushveld, the sensitivity rating of the site is a mix of 'Medium' and 'Low'. The area on the west and northwest is rated as 'Low' due to higher levels of degradation of the bushveld, including high levels of encroachment of sicklebush in this area.

The sensitivity map for the site is shown below (Figure 23). It is important to protect the integrity of the small drainage lines and therefore buffer zones (no-go zones) of 50m each have been recommended. It

is also recommended that stormwater run-off, where possible, be directed into the drainage areas to maintain their integrity and riparian zones.

Figure 23: Sensitivity map

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 quarries, there are no obvious environmental fatal flaws and the project may proceed to the next phase. However, recommendations must be implemented, which include buffer zones.

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, 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 dominant existing negative impact on the study area and surrounding natural environment is cultivated farmlands, mostly in the form of sugarcane production. Other lesser negative impacts include low-levels of urbanisation (farmhouses and other farming related infrastructure); and local amenities such as power lines, roads railway lines, etc. The study area is a open area of lowveld bushveld with low to medium levels of negative impacts. The largest existing impacts on the actual site include encroachment of sicklebush, which is due to clearing of wood/trees and other activities; power line running through the site and fringe impacts arising from the surrounding farming activities, such as roads, movement of people and vehicles through the area, etc.

8.2 Potential Impacts

The project and related activities do have high potential negative impacts on the natural environment due to the nature of the project. The impacts will however, be at a very localised level (site). With the implementation of mitigating measures and general standards and procedures, the potential impacts can be reduced and contained to the specific quarry / mining site, which includes related machinery and infrastructure such as a small site office and processing plant / area. There are close by existing farm

roads / gravel roads, but these will need to be maintained in the immediate area of the quarry site. The impacts will be medium-term to long-term and rehabilitation of the site is essential.

In terms of the natural environment there are no positive impacts arising from the proposed project.

8.3 Assessment of potential impacts

The calculated potential impacts on the natural environment, along with required and necessary mitigating measures are found in the table below (Table 21).

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 (total) is 100 significance points (SP). Environmental impacts will be rated as either that of High, Moderate or Low significance as follows:

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

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 are the sum of the overall impacts arising from the project (under the control of the developer), 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.

The cumulative impacts on the study site are:

- Loss of natural bushveld / vegetation for the long-term.
- Low levels of loss of habitat and ecosystem functions in the area.

The cumulative negative impact on the study site itself is 'high'. However, the cumulative negative impact on the larger area is 'low'.

8.5 Levels of acceptable change

The cumulative negative impacts will increase in the localised area of the study area, with some measurable increase in negative impacts outside of the study area, in the form of loss of some surface water run-off and fringe impacts arising from the operational phase of the quarry. 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 'fatal flaws'.

The negative impact on the actual study site (site) will be 'High', but very localised. However, the negative impacts on a local level will be 'Low'.

Table 21: Assessment of Potential Impacts

Potential Impacts arising from Project	Phase of Project	Impact Rating (Significance: (Total) <30 (Low); 31-59 (Moderate); >60 (High)					
Total Impact of Proposed Project							
		Extent	Duration	Magnitude	Probability	Total	Significance
	Construction Phase: Pre-mitigation	**Local (2)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**30**	**Moderate**
	Construction Phase: Post mitigation	**Site (1)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Operational Phase Pre-mitigation	**Local (2)**	**Long-term (4)**	**High (8)**	**Definite (5)**	**70**	**High**
	Operational Phase Post mitigation	**Site (1)**	**Long-term (4)**	**High (8)**	**Probable (4)**	**52**	**Moderate**
Cumulative Effect of Project on the local Ecology		**Local (2)**	**Long-term (4)**	**Minor (2)**	**Medium (3)**	**24**	**Low**
Mitigating Measures	**Construction Phase (Site Establishment)** 1. The initial Construction Phase (or establishment of the site) will be 'Moderate' 2. These impacts will include the initial need to clear bushveld and remove topsoils. 3. During the construction phase all temporary laydown areas, ablution facilities; site offices, etc. must only be within the larger demarcated study area. 4. During the initial Construction Phase / site establishment phase existing access roads must be used as far as possible. These roads need to be continually maintained during the construction phase. Keeping in mind that other landowners and inhabitants of the area use some of these roads. 5. Ensure small footprint during construction phase. 6. There are two demarcated 50m buffer zones (no-go zones). One along the eastern boundary of the study site, and one along the western boundary, which are necessary to protect the integrity of the drainage lines and riparian zones. No construction, or temporary activities may take place in these buffer zones. Under no circumstances may any water or wood be removed from the drainage lines and riparian zones. No thoroughfares (roads, walk paths) are allowed through the buffer zones. Except in the extreme south, where there is an existing road. **7. <u>Note: The establishment of a road from off the existing gravel road on the eastern boundary and around the north will trigger the need for a crossing over the drainage line in the northeast corner of the site. This will trigger the need for a Water Use Licence Application (WULA). Therefore, preferably no crossing should be planned and access to the site from the south is preferred.</u>** 8. All excess materials brought onto site for construction to be removed after construction. **Operational Phase** 9. No site offices, parking areas, ablution facilities, etc. may be set up outside of the demarcated study area. 10. All access roads to the site must be maintained at all times. Many of these roads are gravel / sand public roads used by surrounding farmers and landowners. During the entire operational phase / life of the quarry these roads must be maintained and dust-suppression must be used. 11. Perimeter fences to be routinely monitored and maintained. Assurances need to be in place that local livestock as well as wild animals will not be able to enter the mining site. 12. An Erosion Plan to be implemented and monitored during construction phase and operational phases of the project. Even though the erosion potential is low. 13. All hazardous materials must be stored appropriately to prevent these contaminants from entering the soils and natural environment. 14. Under no circumstances may farm livestock as well as wild animals be interfered with. 15. All standard quarry mining operation procedures and regulations to be implemented. The						

	mitigating measures recommended here are additional and do not replace any others. **Mine Closure (Rehabilitation)** 16. Rehabilitation plan for the quarry and general study area must be compiled prior to mine closure and assurances must be given that it will be implemented. 17. The rehabilitation will have a positive impact on the site and area, although it will not be able to restore the area back to its original state.						
Individual Impacts							
Potential Impacts arising from Project	**Phase of Project**	**Impact Rating (Significance: (Total) <30 (Low); 31-59 (Moderate); >60 (High)**					
		Extent	Duration	Magnitude	Probability	Total	Significance
1. Loss of natural vegetation	**Construction Phase: Pre-mitigation**	**Local (2)**	**Long-term (4)**	**High (8)**	**Medium (3)**	**30**	**Moderate**
	Construction Phase: Post mitigation	**Site (1)**	**Short-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Operational Phase	**Site (1)**	**Long-term (4)**	**High (8)**	**Definite (5)**	**65**	**High**
Mitigating Measures	1. There are protected trees within the study site. Therefore a final walkdown / layout plan is required to determine if a tree permit is required. 2. There are no RDL or ODL (Priority) species on site. However, it is recommended that all of the Aloes be lifted and replanted somewhere on the fringes of the site, or in the immediate bushveld area. 3. The drainage lines and riparian zones are the only habitats with 'High' sensitivity. 4. Most of the vegetation (which is sparse grassland) will be lost during the operational phase. 5. Any vegetation areas damaged outside of the site during the construction phase (establishment phase) must be rehabilitated during the operational or construction phases. It may not be left until mine closure. 6. A site-specific detailed rehabilitation plan, aimed at mine closure, must be compiled and assurances given that it will be implemented at mine closure. 7. There are some invasive alien weeds on site. A weed control programme must be compiled and implemented during the entire lifespan of the mining operations. The plan can be basic. All weeds must found on site must be routinely removed to avoid any spread or plants going to seed. A record of weeds found on site and treatment used to control them must be kept in the on-site records of the mine.						
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)**	**Long-term (4)**	**Moderate (6)**	**Low (2)**	**22**	**Low**
Mitigating Measures	1. Care must be taken not to interact directly with any wild life encountered. 2. The site must be well fenced to ensure that free-roaming wildlife (and surrounding livestock) do not wander into the mine site. 3. Under no circumstances may any wildlife be interfered with, hunted, disturbed. Relevant specialists must first be contacted to consult on how to approach and deal with any dangerous animals found on site (such as snakes) 4. Litter (especially food waste) must be properly dealt with to avoid attracting wild animals such as snakes, rats, mice, jackals, etc. Keeping the mine site clean will help to avoid encounters with wild animals. 5. No pets such as cats and dogs may be kept on site.						
3. Siltation and	**Construction**	**Local**	**Short-term**	**Moderate**	**Low (2)**	**20**	**Low**

erosion	**Phase: Pre-mitigation**	**(2)**	**(2)**	**(6)**			
	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. All mitigating measures as per Items 1 & 2 have reference to siltation and erosion. 2. Careful monitoring of construction and operations 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 from escalating and siltation of drainage lines occurring. 3. Proper systems must be put in place to deal with sewerage, grey water and drinking water. These systems must be routinely inspected and maintained to avoid leakage, seepage, etc. which can lead to erosion and other problems. 4. A detailed stormwater systems plan is required.						
4. Fringe impacts arising from construction phase	**Construction Phase: Pre-mitigation**	**Site (1)**	**Shot-term (2)**	**Moderate (6)**	**Medium (3)**	**27**	**Low**
	Construction Phase: Post mitigation	**Site (1)**	**Shot-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 benefits can and will exist. Management must ensure that all fringe impacts are recorded, discussed and dealt with on a regular basis. These may include potential problems such as rubbish, movement of workers into private lands, illegal harvesting of wood out of buffer zone area, illegal dumping, etc. 2. Care must be taken with heavy machinery used on the project. All access roads and farm roads used must be monitored and maintained. 3. Any overburden stockpiles must be routinely inspected and maintained.						

9 CONCLUSIONS & RECOMMENDATIONS

The following are the conclusions of the study, along with recommendations.

Conclusions

- The study site is situated within Lowveld Granite, which is within the Lowveld Bioregion of the Savanna Biome.
- The site is not within a threatened veldtype (ecosystem).
- The site is not within any priority areas, which include protected areas (nature reserves), important bird areas (IBAs) and national protected area expansion strategy (NPAES) focus areas.
- The only watercourses are two small, seasonal drainage lines along the eastern and western boundaries of the study site. There are no other watercourses, including wetlands.
- During field investigations no Red Data Listed (RDL) plants were found. Protected trees (marula and leadwood) are present on site.

- The study site is not situated within a Critical Biodiversity Area (CBA), but is within an Ecological Support Area (ESA Kruger Park Buffer Zone).
- There are no 'high' sensitive habitats present on site, except for the small drainage lines and associated riparian zones.
- No red data listed (RDL) fauna or flora species were observed within the study area boundaries.
- Site investigations were conducted during the wet (summer) season and the findings and availability of field data is sufficient to reach acceptable conclusions 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

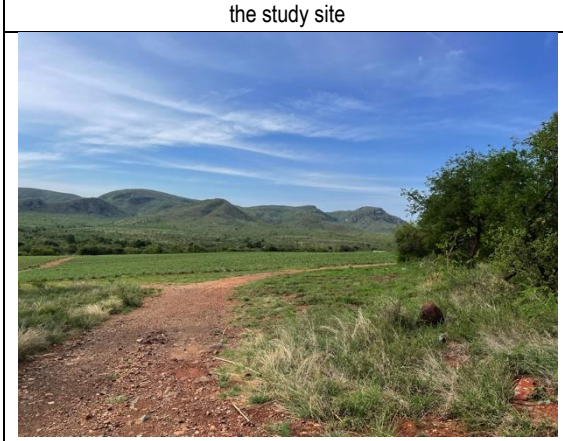
- Recommended mitigating measures as proposed in this study and report should be implemented if the findings of this report are to remain pertinent.
- A 50m buffer zone (no-go zone) is recommended from the main channel of each of the drainage lines. The two buffer zones will include the riparian zones as well.
- Mitigating measures have been recommended for implementation to help reduce the potential negative impact the project will have on the natural environment. These mitigating measures include the following:
    - **Construction Phase / Setup Phase:**
    - The initial Construction Phase (or establishment of the site) will be 'Moderate'
    - These impacts will include the initial need to clear bushveld and remove topsoils.
    - During the construction phase all temporary laydown areas, ablution facilities; site offices, etc. must only be within the larger demarcated study area.
    - During the initial Construction Phase / site establishment phase existing access roads must be used as far as possible. These roads need to be continually maintained during the construction phase. Keeping in mind that other landowners and inhabitants of the area use some of these roads.
    - Ensure small footprint during construction phase.
    - There are two demarcated 50m buffer zones (no-go zones). One along the eastern boundary of the study site, and one along the western boundary, which are necessary to protect the integrity of the drainage lines and riparian zones. No construction, or temporary activities may take place in these buffer zones. Under no circumstances may any water or wood be removed from the drainage lines and riparian zones. No thoroughfares (roads, walk paths) are allowed through the buffer zones. Except in the extreme south, where there is an existing road.
    - **Note: The establishment of a road from off the existing gravel road on the eastern boundary and around the north will trigger the need for a crossing over**

the drainage line in the northeast corner of the site. This will trigger the need for a Water Use Licence Application (WULA). Therefore, preferably no crossing should be planned and access to the site from the south is preferred.

- All excess materials brought onto site for construction to be removed after construction.
- **Operational Phase:**
- No site offices, parking areas, ablution facilities, etc. may be set up outside of the demarcated study area.
- All access roads to the site must be maintained at all times. Many of these roads are gravel / sand public roads used by surrounding farmers and landowners. During the entire operational phase / life of the quarry these roads must be maintained and dust-suppression must be used.
- Perimeter fences to be routinely monitored and maintained. Assurances need to be in place that local livestock as well as wild animals will not be able to enter the mining site.
- An Erosion Plan to be implemented and monitored during construction phase and operational phases of the project. Even though the erosion potential is low.
- All hazardous materials must be stored appropriately to prevent these contaminants from entering the soils and natural environment.
- Under no circumstances may farm livestock as well as wild animals be interfered with.
- **Mine Closure (Rehabilitation)**
- All standard quarry mining operation procedures and regulations to be implemented. Rehabilitation plan for the quarry and general study area must be compiled prior to mine closure and assurances must be given that it will be implemented.
- The rehabilitation will have a positive impact on the site and area, although it will not be able to restore the area back to its original state.

10 APPENDICES

10.1 Photographs

	
Power line running through study site from west to east	Power line and servitude in another area of the study site
	
Mountains in background are in the Kruger National Park. Cultivated farmlands in foreground are on the north side of the study site	Gravel road (farm road) that forms the eastern boundary of the study site. Right is a sugarcane plantation. Left is the riparian vegetation of the small seasonal drainage line
	
Road the runs along the western boundary of the study site. Cultivated farmlands in the mid ground with the mountains and Kruger National Park in the background	

10.2 List of floral species

Trees & Shrubs

Vachellia (Acacia) nigrescens, Sclerocarya birrea subsp. caffra, Vachellia (Acacia) nilotica, Albizia harveyi, Combretum apiculatum, Combretum imberbe, Combretum zeyheri, Ficus stuhlmannii, Peltophorum africanum, Pterocarpus rotundifolius, Terminalia sericea, Vachellia (Acacia) exuvialis, Vachellia (Acacia) gerrardii, Cassia abbreviata, Combretum collinum, Gymnosporia glaucophylla, Pavetta schumanniana, Terminalia prunioides. Combretum hereroense, Dichrostachys cinerea, Euclea divinorum, Hibiscus micranthus, Abutilon austro-africanum, Sphedamnocarpus pruriens subsp. pruriens. Rhynchosia totta.

Herbaceous and other plants

Achyranthes aspera, Aspilia mossambicensis, Becium filamentosum, Chamaecrista absus, Commelina benghalensis, Evolvulus alsinoides, Heliotropium strigosum, Hibiscus praeteritus, Indigofera filipes, Ocimum gratissimum, Phyllanthus maderaspatensis, Pupalia lappacea.

Graminoids (Grasses)

Graminoids: Brachiaria nigropedata, Digitaria eriantha, Eragrostis rigidior, Melinis repens, Panicum maximum, Pogonarthria squarrosa, Aristida congesta, Chloris mossambicensis, Enneapogon cenchroides, Heteropogon contortus,

Aquatic plants

None

10.3 Alien plants identified in the Study Area

A number of common alien plant species are present in the study area and surrounding areas. The alien species encountered in the study area are recorded, along with their category rating below, in Table 22. The categories are as set out in the Conservation Act of Agricultural Resources Act, 1983 (CARA) (Act 43 of 1983).

Table 22: Alien plants

Botanical Name	Common Name	Category
Argemone ochroleuca	White-flowered Mexican poppy	1
Bidens pilosa	Blackjacks	-
Cardiospernum grandiflorum	Ballon vine	-
Eucalyptus sp	Gum trees	2
Jacaranda mimosifolia	Jacaranda	1b
Lantana camara	Lantana	1
Melia azedarach	Syringa	3 (proposed 1b)
Morus alba	Mulberry	-
Psidium guajava	Guava	-
Tecoma stans	Yellow elder	3
Ricinus communis	Castor oil plant	2
Sesbania punicea	Sesbania	1b
Solanum mauritanum	Bugweed	1
Tagetes minuta	Khakibos, kahki weed	-

Verbena bonariensis	Vervain	-
Xanthium strumarium	Large cocklebur	-

10.4 Granite Lowveld

Below is the list of the dominant plant species found in Granite Lowveld, as taken from Mucina & Rutherford (2006, 2010).

Important Taxa *Tall Trees: Vachellia (Acacia) nigrescens (d), Sclerocarya birrea subsp. caffra (d). Small Trees: Vachellia (Acacia) nilotica (d), Albizia harveyi (d), Combretum apiculatum (d), Combretum imberbe (d), Combretum zeyheri (d), Ficus stuhlmannii (d), Peltophorum africanum (d), Pterocarpus rotundifolius (d), Terminalia sericea (d), Vachellia (Acacia) exuvialis, Vachellia (Acacia) gerrardii, Bolusanthus speciosus, Cassia abbreviata subsp. beareana, Combretum collinum subsp. suluense, Dalbergia melanoxylon, Gymnosporia glaucophylla, Lannea schweinfurthii var. stuhlmannii, Pavetta schumanniana, Plectroniella armata, Terminalia prunioides. Tall Shrubs: Combretum hereroense (d), Dichrostachys cinerea (d), Euclea divinorum (d), Strychnos madagascariensis (d), Gardenia volkensii, Hibiscus micranthus, Tephrosia polystachya. Low Shrubs: Abutilon austro-africanum, Agathisanthemum bojeri, Aptosimum lineare, Barleria elegans, Clerodendrum ternatum, Commiphora africana, Gossypium herbaceum subsp. africanum, Pavonia burchellii. Woody Climber: Sphedamnocarpus pruriens subsp. pruriens. Herbaceous Climber: Rhynchosia totta. Graminoids: Brachiaria nigropedata (d), Digitaria eriantha subsp. eriantha (d), Eragrostis rigidior (d), Melinis repens (d), Panicum maximum (d), Pogonarthria squarrosa (d), Aristida congesta, Bulbostylis hispidula, Chloris mossambicensis, Enneapogon cenchroides, Heteropogon contortus, Leptochloa eleusine, Perotis patens, Schmidtia pappophoroides, Sehima galpinii, Tricholaena monachne, Urochloa mosambicensis. Herbs: Achyranthes aspera, Aspilia mossambicensis, Becium filamentosum, Chamaecrista absus, Commelina benghalensis, C. erecta, Cucumis africanus, Evolvulus alsinoides, Heliotropium strigosum, Hermbstaedtia odorata, Hibiscus praeteritus, Indigofera filipes, I. sanguinea, Kohautia virgata, Kyphocarpa angustifolia, Leucas glabrata, Ocimum gratissimum, Phyllanthus maderaspatensis, Pupalia lappacea, Vahlia capensis subsp. vulgaris, Waltheria indica. Succulent Herbs: Orbea rogersii, Stapelia leendertziae.*

(d) = Dominant.

10.5 Ecosystems of the Local Municipality

Below is a summary of the main ecosystems of the Local Municipality in which the study area is situated, as taken from SANBI website (www.bgis.sanbi.org.za)

Biomes

Biomes		
Name	**Size (ha)**	**Size (%)**
Grassland Biome	18390,1 ha	5,68%
Savanna Biome	305635,9 ha	94,32%
2 biomes in the municipality covering 324026 ha (100 %)		

Veldtypes

Vegetation Types		
Name	**Size (ha)**	**Size (%)**
Barberton Montane Grassland	18070,3 ha	5,58%
Barberton Serpentine Sourveld	2664,6 ha	0,82%
Delagoa Lowveld	21300,3 ha	6,57%
Granite Lowveld	133839,8 ha	41,3%
Kaalrug Mountain Bushveld	31878,6 ha	9,84%
Lebombo Summit Sourveld	942,2 ha	0,29%
Malelane Mountain Bushveld	1123,5 ha	0,35%
Northern Lebombo Bushveld	174,4 ha	0,05%
Northern Mistbelt Forest	8,4 ha	0%
Scarp Forest	1381,5 ha	0,43%
Southern Lebombo Bushveld	13673,9 ha	4,22%
Swaziland Sour Bushveld	293,5 ha	0,09%
Tshokwane-Hlane Basalt Lowveld	60123,9 ha	18,56%
Zululand Lowveld	38544,6 ha	11,9%
14 vegetation types in the municipality covering 324019,4 ha (100 %)		

Threatened Veldtypes (Ecosystems)

Threatened EcoSystems (Critically Endangered)
There are no Critically Endangered Threatened EcoSystems in the municipality.

Threatened EcoSystems (Endangered)		
Name	**Size (ha)**	**Size (%)**
Mananga-Lebombo Thornveld	29542,5 ha	9,12%
1 Endangered Threatened EcoSystems in the municipality covering 29542,5 ha (9,12 %)		

Threatened EcoSystems (Vulnerable)		
Name	**Size (ha)**	**Size (%)**
Barberton Mountainlands	489,8 ha	0,15%
Croc Gorge Granite Mountainlands	18,1 ha	0,01%
Eastern Scarp Forest	211 ha	0,07%
Kaalrug Mountainlands	21758,3 ha	6,71%
Lebombo Summit Sourveld	8,1 ha	0%
5 Vulnerable Threatened EcoSystems in the municipality covering 22485,3 ha (6,94 %)		

10.6 RDSIS Calculations for Mammals

RED DATA SENSITIVITY INDEX SCORE (RDSIS): MAMMALS
PROJECT: BORROW PIT ALONG N4 NAITONAL ROUTE

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

Scientific Name	Common Name	SA Status	Distribution Range (D)	Habitat (H)	Availability of Food (F)	POC (%)	POC Value
Atelerix frontalis	Hedgehog	NT	100	50	50	67	Medium/High
Crocidura cyanea	Reddish-grey musk shrew	DD	80	50	50	60	Medium
Cloeotis percivali	Short-eared trident bat	CR	50	20	50	40	Low/Medium
Crocidura flavescens	Greater red musk shrew	DD	80	50	60	63	Medium/High
Crocidura fuscomurina	Tiny musk shrew	DD	80	60	60	67	Medium/High
Crocidura hirta	Lesser red musk shrew	DD	70	20	40	43	Medium
Crocidura marquensis	Swamp musk shrew	DD	70	10	40	40	Medium
Crocidura silacea	Lesser grey-brown musk shrew	DD	50	20	50	40	Medium
Dasymys incomtus	Water rat	NT	50	10	30	30	Low/Medium
Elephantulus brachyrhynchus	Short-snouted elephant shrew	DD	50	10	30	30	Low/Medium
Epomophorus gambianus	Gambian fruit bat	DD	50	40	50	47	Medium
Graphiurus platyops	Rock dormouse	DD	50	40	50	47	Medium
Hippsideros caffer	Sundevall's leaf- nosed bat	DD	50	10	50	37	Low/Medium
Lemniscomys rosalia	Singel stripped mouse	DD	30	40	50	40	Medium
Leptailurus serval	Serval	NT	30	40	30	33	Low/Medium
Lutra macuicollis	Spotted-necked otter	NT	30	40	30	33	Low/Medium
Manis temminckii	Pangolin	VU	50	30	50	43	Medium
Mellivora capensis	Honey badger	NT	80	50	50	60	Medium
Miniopteris schreibersi	Schreibers's long-fingered bat	NT	30	40	30	33	Low/Medium
Myotis tricolor	Temminck's hairy bat	NT	30	40	30	33	Low/Medium
Paracynictis selousi	Selous mongoose	DD	30	40	30	33	Low/Medium
Pipistrellus rusticus	Rusty bat	NT	30	40	30	33	Low/Medium
Poecilogale albiucha	African weasel	DD	30	40	30	33	Low/Medium
Rhinolophus blasii	Peak-Saddle Horseshoe Bat	VU	30	40	30	33	Low/Medium
Rhinolophus clivosus	Geoffroy's Horseshoe bat	NT	70	40	70	60	Medium
Rhinolophus darlingi	Darling's Horseshoe Bat	NT	30	40	30	33	Low/Medium
Suncus infinitesimus	Least dwarf shrew	DD	30	40	30	33	Low/Medium
Suncus lixus	Lesser dwarf shrew	DD	30	40	30	33	Low/Medium
Tatera leucogaster	Bushveld gerbil	DD	30	40	30	33	Low/Medium
					Average TSS	**42,0**	

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

Scientific Name	Common Name	SA Status	POC	TSS
Atelerix frontalis	Hedgehog	NT	67	46,9
Crocidura cyanea	Reddish-grey musk shrew	DD	60	12
Crocidura flavescens	Greater red musk shrew	DD	63	12,6
Crocidura fuscomurina	Tiny musk shrew	DD	67	13,4
Mellivora capensis	Honey badger	NT	60	42
Rhinolophus clivosus	Geoffroy's Horseshoe bat	NT	60	42
			Average TT Score	**28,15**

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

Average Total Species Score

Average TSS	42,0
Average TT Score	28,15
Average Score	35,1

RED DATA SENSITIVITY INDEX SCORE (RDSIS)

Average Total Species Score		42,0%	
Average Threatened Taxa Score		28,15%	
Average (TSS + TT)		35,10%	
% Speices >60% POC		20,7%	
RDSIS for Study area		**27,9**	**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 24).

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  Wetland

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

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

Figure 24: 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 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.

Special attention must be given to the demarcated buffer zone. Monitoring must ensure that the buffer zone is enforced. If not the infringement must be reported to relevant authorities and correct immediately.

No other special or specific monitoring requirements are required or recommended.

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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