UNIVERSITY OF MPUMALANGA

FINAL BASIC ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE DEVELOPMENT OF 3000 BEDS

Date: 10 June 2021

PREPARED FOR: GRANTON MERIWEL & KHENKANE TRADING JV		**PREPARED BY: Minenviro (Pty) Ltd**	
GRANTON MERIWEL & KHENKANE TRADING JV		**MINENVIRO CONSULTING**	
Your Ref.:		**Our Ref.:**	MIN-BAR-10/2020
Address:	Suite 4 Roycol Building, Elmadre Centre, Ferreira St. Nelspruit	**Address:**	31 Newquay Road, New Redruth Alberton 1450
Client Contact Person:	Professor Hove	**Consultant Contact Person:**	Charles Chigurah
Tel No:	013 744 0637	**Tel No:**	087 822 2319
Mobile No:	063 539 8952	**Mobile No:**	071 887 1394
Fax No:	013 744 0637	**Fax No:**	

DOCUMENT CONTROL

Document Information

Description	Information
Document ID:	PS-UMP 08/2020: R0
Document Name:	UMP Bulk services report
Document Revision:	000
Issue Date:	Tuesday, 24 November 2020
Electronic File Name:	Bulk Services report.docx

Document Revision History

Date	Rev.	Prepared by	Changes
10 January 2021	01	Charles Chigurah	Project Description
10 June 2021	02	Charles Chigurah	

Internal Document Approvals

	Role	Name	Signature	Date
Compiled by:	Snr Environmental Consultant	Charles Chigurah		18 December 2020
Checked by:	Snr Environmental Consultant	Charles Chigurah		10 January 2021
Approved by:	Project Manager			
Authorized by:	N/A			

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

Minenviro was appointed by AES Consulting Engineers to provide professional environmental services for the proposed establishment of student accommodation on Bee Eaters Farm, in the Mpumalanga Province. This report forms part of an application for an environmental authorisation for the proposed student housing accommodation.

The application process is undertaken on behalf of the applicant, by Minenviro Consulting. Minenviro Consulting was appointed, as independent environmental practitioner, to assist the applicant in complying with the 2014 EIA Regulations in terms of the National Environmental Management Act (Act 107 of 1998

2 DETAILS OF PROJECT TEAM

2.1 Project Applicant

Table 1~~Table 1~~ below sets out information of the Project Applicant

Formatted: Font: 11 pt

Table 1: Project Applicant Information

Company/Entity Name	Granton Meriwell (Pty) Ltd & Khenkane Trading JV
Physical Address	Portion 33 of Farm 13 Fredenheim Road, City of Mbombela
Contact Person	Prof Peter Hove
Contact Number	013 744 0637
Email Address	eaglesuccess.research@gmail.com

2.2 Details of Environmental Assessment Practitioner (EAP)

Company/Entity Name	Minenviro Pty Ltd
Physical Address	31 Newquay Road, Alberton, 1450
Contact Person	Charles Gumisai Chigurah
Designation	Environmental Scientist
Contact Number	071 887 1394
Email Address	charles@minenviro.com
Qualifications	B.Sc. Hon Health and Environmental Sciences

Professional Registration	SACNASP

3 DESCRIPTION OF THE PROPOSED ACTIVITY

3.1 General Description

The development will comprise of the construction of 3000 beds for the University of Mpumalanga, which will be developed in three (3) phases. The first phase will involve the construction of fifteen (15) U-shaped blocks with each block comprising of three (3) floors. An access road from Koedoe Street and Rietbok Street will be surfaced.

3.2 Wastewater Treatment

3.2.1 Existing Services

Information provided by The City of Mbombela engineering services department has shown that there is an existing concession sewer pipeline which is passing through the proposed site on the Agricultural College Road. The said pipeline could not be identified visually during the site assessment. Also, information gathered is that there is a municipal bulk sewer pipeline that end at the University of Mpumalanga where the University is currently connected.

3.2.2 Design Philosophy

The design standards to be employed shall be in accordance with CSIR Guidelines for Human Settlement Planning and Design, DWA standards and requirements, SANS.10252.2.1, together with guidelines and requirements provided by The City of Mbombela.

3.2.3 Demand Calculations / Projections

Sewer flow is usually based on historical flow data. This information will be requested from the City of Mbombela. For purposes of this report, 600 litres per day for every 100 m^2 of erf size has been used as indicated in the Guidelines for Human settlement Planning and Design Volume 2 (CSIR).

A preliminary sewer flow analysis has been carried out to determine the expected sewage flow from the development. Table 2 below is a summary of the anticipated sewer flow for the development.

Table 2: Wastewater projections for the development

Stand	Projected No of beds	Unit Estimated Occupancy	Flow (l/c/d) (80 % of Water Demand)	Average Dry Weather Flow (l/d)	Peak Factor	Average Wet Weather Flow (AWWF - l/day)
BEE EATERS FARM	3000	4	80	960000	2,5	2400000
TOTAL (litres/day)						**2400000**
TOTAL (Mega Litres/day)						**2,400**
TOTAL (m^3/s)						**0,0278**

3.2.4 Existing Infrastructure vs Required Infrastructure

A true indicator of the of the adequacy of the existing infrastructure will be to have historical flow data. It will also be critical to conduct flow logging at the inlet and outlet points on the pump station as this will give a more realistic indication on the need and level of upgrade.

In this absence of flow data, an assumption has been made that the gravity line is flowing at full bore and that inflow is lower than the outflow

3.2.5 Conclusion & Recommendations

It is recommended that flow logging is conducted on the main discharge pipe leading to the existing pump station so that realistic sewer flows can be used during the design process.

3.3 Roads Access & Stormwater

3.3.1 Overview

Access to the new development will be obtained from the existing access on Koedoe street and Rietbok street. Appropriate traffic management will be required at existing entrance. The street fall within the jurisdiction of The City of Mbombela, who shall be the relevant authority regarding necessary access wayleaves and traffic management for the new development. Traffic management requirements and conditions will be prescribed by The City of Mbombela.

3.3.2 Existing Services

The site currently has informal access roads and no defined stormwater management systems. Since the site is having a mono slope, it is assumed that stormwater is following the natural slope of the catchment.

3.3.3 Design Philosophy

The following design codes and standards will be considered during the design stage:

- The Standard Specifications for Road and Bridge Works for State Road Authorities, COLTO, 1998 Edition
- Roads Drainage Manual, National Department of Transport, 1997
- TRH3. 2007. Design and Construction of Surfacing Seals. Technical Recommendations for Highways. ISBN 0 7988 2272 4. CSRA.
- TRH4. 1996. Structural Design of Flexible Pavements for Interurban and Rural Roads. Technical Recommendations for Highways. DRAFT. Pretoria
- TRH12. 1997. Flexible Pavement Rehabilitation Investigation and Design. Technical Recommendations for Highways. DRAFT. Pretoria
- TRH14.1985. Guidelines for Road Construction Materials. Technical Recommendations for Highways.
- TG 2. Technical Guideline: Bitumen Stabilised Materials. A Guideline for the design and construction of Bitumen Emulsion and Foamed Bitumen Stabilised Materials. Second Edition, May 2009, Asphalt Academy

All low points will be identified and provision of concrete pipe culverts, v-drains etc. will be made for stormwater control. The proposed stormwater design will connect with the existing stormwater drainage. The approach that will be followed in designing a drainage system for each road is as follows:

- Determine a storm recurrence interval for minor drainage systems.
- Define the minor drainage system as the road surface drainage capacity (80% of roadway under water) in combination with an underground pipe drainage system where roads have insufficient drainage capacity to drain peak runoff from the catchment.
- Design the road geometry and determine low points requiring drainage via pipe system.
- Identify an appropriate connection point to the existing stormwater drainage system.
- Determine locations along the project roads where surface drainage capacity is insufficient to drain the peak runoff and propose kerb inlet structures at these points if possible. This step involves an iterative process of hydrology calculations and road surface flow capacity calculations (defined below).
- Calculate the required kerb inlet structure lengths using The City of Mbombela's method or using orifice capacity calculation formula, depending on whether the kerb inlet is situated along a sloped section of road (CoT) or at a low point on the road (orifice).
- Create longitudinal sections for the pipe systems.

- Determine the required pipe sizes to drain the peak runoff at design longitudinal slopes.

3.4 Solid Waste

3.4.1 Overview

The method of waste disposal in dependant on the type of waste anticipated to be generated by the new development. The main types of waste are:

Hazardous Waste: Is waste which on account of its toxicity, corrosivity, ignitability and carcinogenicity has the potential to harm people or the environment even in small quantities. General Waste: Is municipal solid waste consisting of domestic, commercial, institutional, garden, rubble and dry industrial waste. It may contain small quantities of hazardous substances within it such as domestic medical waste, batteries, fluorescent tubes, weed killer etc

The new development is anticipated to generate mainly domestic waste. Domestic and household waste comes mainly from residential areas and may include foodstuffs, garden waste, old clothing, packaging materials such as glass, paper and cardboard, plastics, and, in certain cases, ash.

For any collection service to be truly effective all waste must be removed completely from all storage and collection points.

3.4.2 Existing Services

There are currently no formal waste disposal mechanisms within the project area

3.4.3 Demand Calculations / Projections

Solid waste quantities are usually best based on historical data. For purposes of this report, 0,12 m^3/unit/week has been used as indicated in the Guidelines for Human settlement Planning and Design Volume 2 (CSIR).

A preliminary waste generation analysis has been carried out to determine the expected solid waste generated from the development. Table below is a summary of the anticipated solid waste generated.

Table 3: Project waste generation for the proposed development

Stand	Projected No of Beds	Waste Generation Rate (m^3/unit/week) - 5 litres/person/day	Waste Generated (m^3/week)	Peak Factor	Peak Quantity
BEE EATERS FARM	3000	0,21	630	1,50	945
TOTAL (m^3/week)					**945**

3.5 Water

3.5.1 Overview

The proposed site is bordered by developed areas which currently have access to portable water. There are existing farms, and these are also currently receiving water through a bulk pipeline. It therefore means there are higher chances of connecting the new development to the existing bulk supply line.

3.5.2 Existing Services

Information provided by The City of Mbombela engineering services department has shown that there is an existing concession water pipeline which is passing through the proposed site on the Agricultural College Road. The said pipeline could not be identified visually during the site assessment.

3.5.3 Design Philosophy

The design standards to be employed shall be in accordance with CSIR Guidelines for Human Settlement Planning and Design, SABS 1200, SABS 241, DWA standards and requirements, SANS.10252.1, together with guidelines and requirements provided by Mbombela Municipality.

3.5.4 Demand Calculations/Projections

Water demand is usually based on historical consumption data. This information will be requested from the City of Mbombela. For purposes of this report, consumption figures have been based on values provided in the table below of the Guidelines for Human settlement Planning and Design Volume 2 (CSIR).

A preliminary water demand analysis has been carried out to determine the amount of water the development will require at present. Table below is a summary of the population demographics and the water demand.

Table 4: Water projections for the development

Stand	Projected No of Beds	Unit Estimated Occupancy	Consumption (l/c/d)	Average Annual Daily Demand (l/d)	Peak Factor	Instantaneous Peak Flow
BEE EATERS FARM	3000	1	280	840000	2,5	2100000
TOTAL (litres/day)						**2100000**
TOTAL (Mega Litres/day)						**2,100**
TOTAL (m^3/s)						**0,0243**

3.5.5 Existing Infrastructure vs Required Infrastructure

A true indicator of the of the adequacy of the existing infrastructure will be to have the design capacity of the water source and its historical supply performance. It will also be critical to conduct flow and pressure logging at the actual tap-off point where the new development will connect to the existing bulk water supply line.

In this absence of this information (pressure and flow), an assumption has been made that the bulk line is flowing at full bore and that there is adequate residual head in the system which will meet the entire development's residual head requirements.

The current flow rate was estimated and calculated by fixing the velocity within the acceptable limits of 0.6m/sec and 1.2m/sec as stated in the Guidelines for Human settlement Planning and Design Volume 2 (CSIR). The continuity equation was then used to calculate the flow in the bulk line. The results are shown in

Formatted: Font: 11 pt

Table 5~~Table 5~~ below.

Continuity equation: Q = AV Where:

- Q = flow rate in cubic meters per second
- A = Cross sectional area of the pipe in square meters
- Velocity of the water in m/sec

Table 5:Bulk line flow calculations

Pipe Diameter (m)	Pipe Cross-Sectional Area (m^2)	Velocity Lower Limit (m/s)	Velocity Upper Limit (m/s)	Flow (Q) 1 (m^3/s)	Flow (Q) 2 (m^3/s)
0,16	0,0201	0,6	1,2	0,0121	0,0241

When flowing at maximum acceptable velocity (1,2 m/s), the bulk system's flow rate (0,0241 m^3/s) will meet the development's flow requirements (0,0243 m^3/s)

3.5.6 Required Infrastructure

A valve chamber complete with all ancillaries (Gate valve, nonreturn valve and water meter) will be introduced at a tap-off point, which will be determined during the detailed design stage, along the bulk line where the residual head will have the minimum need for boosting to meet the development's residual head requirements.

3.5.7 Conclusion & Recommendations

The City of Mbombela has confirmed that there is a concession current water source. It is recommended that flow and pressure logging be conducted along the bulk line at the chosen point of tap-off meant to supply the development.

3.6 Stormwater Management

The development will be served by a conventional stormwater drainage system consisting of surfaced driveways, open channels, and pipe culverts. The applicable design criteria are shown below in

Formatted: Font: 11 pt

Table 6. These have been extracted and adapted from the **"Red Book"**.

Table 6: Stormwater design criteria

Classification	**Internal Roads**
Recurrence Interval: Major	1:50 years
Recurrence Interval: Minor	1:5 years
Encroachment: Major	150mm above the crown of the road
Encroachment: Minor	No kerb overtopping
Roadside Channels	Min. gradient 0.5%
	Max. velocity 3 m/s
Channel Lining	Channels to preferably be grassed where possible. Concrete lined channels to be used where required.
Low points	1:25 years

Pipes: Minimum Diameter – 450mm diameter

Minimum 0.7 m/s self-cleansing velocity

Minimum Slope of 0.5%

Class 100D and 50D

Minimum Pipe Cover – 600mm under roads

450mm elsewhere in the road reserve

Trenches: Widths to SABS 1200, Class B bedding, backfilling to 90% Mod AASHTO or 93% Mod AASHTO in road reserves.

3.6.1 Catchment Hydrologic Modelling

The SCS Hydrology Method was used for the runoff calculations, as it is widely accepted both internationally and locally for the estimation of storm runoff peak flows and volumes. The model was developed by the United States Department of Agriculture's Soil Conservation Service (SCS). The model has been adapted for South African use, originally by Schulze and Arnold in 1979, and most recently in Water Research Commission Report Nos. TT31/87, TT32/87 and TT33/87, titled "Flood Volume and Peak Discharge from Small Catchments in South Africa based on the SCS Technique" by J C Smithers and R E Schulze, Department of Agricultural Engineering, University of Natal, Pietermaritzburg, dated 1987.

3.6.2 Storm Duration

The design storm duration is selected to exceed the catchment's time of concentration, which is the time required for a water particle to travel from the farthest point of the catchment to the outlet.

The time of concentration was determined using the method prescribed by the Rational method. The time of concentration is derived from the length of the longest watercourse, slope and nature of drainage (Sheet flow vs. Channel flow).

3.6.3 Rainfall Depth

The computer programme "Design Rainfall Estimation in South Africa" which accompanies the Water Research Commission Report titled "Design Rainfall and Flood Estimation in South Africa" by JC Smithers and RE Schulze, School of Bioresources Engineering and Environmental Hydrology, University of Natal, Pietermaritzburg, WRC Project No. K5/1060, dated December 2002 was used to complete a rainfall station locality search and to obtain storm rainfall depth data from the surrounding rainfall stations. The applicable rainfall data is determined by means of weighted average rainfall data from the surrounding rainfall stations. The weighting is based on the distance from the specified locality to the specific rainfall station.

A summary of the rainfall station searches, and related data is summarised in Table 7 on the next page.

Table 7: Rainfall stations data

Station Name	SAWS Number	Distance from Proposed Dev	Length of Record (Yrs)	Coordinates	Mean Annual Precipitation , MAP (mm)	Altitude (mams)
MAYFERN	0556088_W	4.0 km	69	Lat = 25° 28′ Long = 31° 2′	725	655
NELSPRUIT RES	0555837_A	5.7 km	87	Lat = 25° 27′ Long = 30° 58′	750	648
NELSPRUIT	0555837_W	5.7 km	87	Lat = 25° 27′ Long = 30° 58′	750	648
THE KNOLL	0556143_W	9.0 km	53	Lat = 25° 22′ Long = 31° 4′	772	771
KARINO	0556178_W	9.7 km	39	Lat = 25° 28′ Long = 31° 6′	745	520
UMGENYANA	0556141_W	11.5 km	36	Lat = 25° 21′ Long = 31° 5′	870	860

The table below summarises the design rainfall depths obtained from the Rainfall Station Data mentioned in the page before.

Table 8: Design rainfall depth

Storm Recurrence	5 year	10 year	20 year	50 year	100 year
24-hour Storm Duration Rainfall Depth	113.3mm	137.6mm	163.6mm	201.7mm	233.9mm

3.6.4 Stormwater Drainage System

The minor stormwater system will consist of a network of pipe culverts sized to accommodate the minor storm event runoff. Runoff from major storm events (flows larger than 1 in 5-year runoff) will be accommodated by a combination of the network of pipe culverts and surface flow in the car park area. The combined stormwater system will be designed to ensure that no flooding of properties occurs in the major flood event (1 in 50-year storm).

3.6.5 Stormwater Detention Pond Design Criteria

The detention ponds have been sized and designed based on the following criteria:

Table 9: Detention Pond design

Classification	Criteria
Maximum storage time	24 hrs
Side slopes	1:2
Pond Depth	Average Depth 1.5m
Attenuated Capacity	up to 1:25 year
Emergency Overflow	1:50 year and above

The detention ponds will incorporate energy dissipation devices and silt removal traps downstream of the inlets. The primary outlet (1:5yr discharge) and secondary outlet details are shown on the engineering drawings. The discharge of flows greater than the 1 in 25-year event

up to the 50-year event will flow over the emergency spillway. The emergency spillways will discharge into the public open space areas provided.

Figure 1: Stormwater layout plan

3.7 Listed Activities

Activities applied for to be authorised are indicated in Table 10~~Table 10~~.

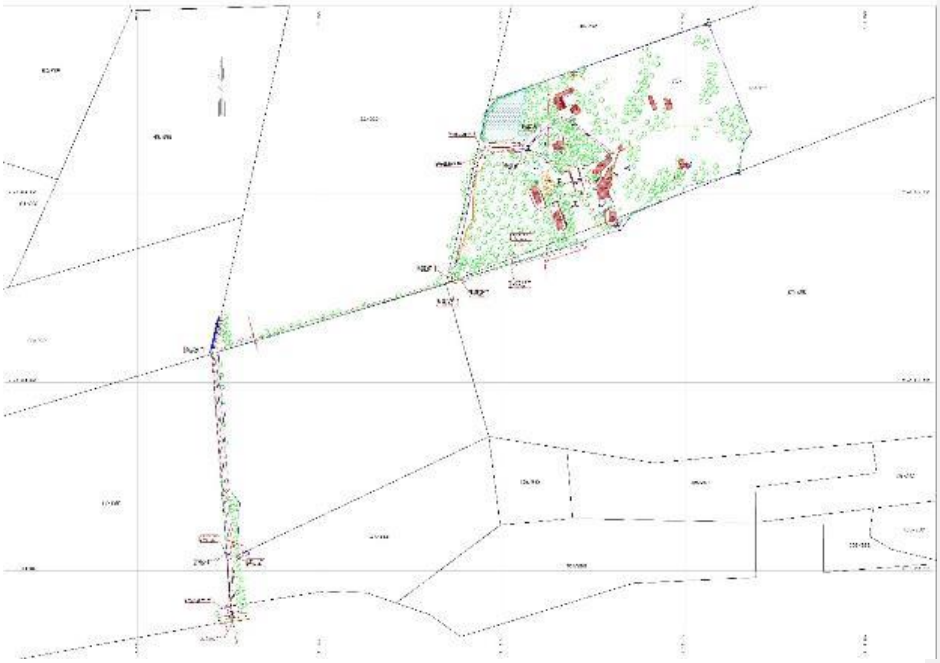
Formatted: Font: 11 pt

Table 10: Listed activities

Government Notice R983 (as amended) Activity No.	Describe the relevant Basic Assessment Activity in writing as per Listing Notice 1 (GN No. R983, as amended)	Describe the portion of the development as per the project description that relates to the applicable listed activity
19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;	The construction of river crossing
27	The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	The construction of student accommodation and associated infrastructure

4 PROJECT LOCATION

The project area is located on Portion 33 of Farm Friedenheim 282JT in Mbombela within the jurisdiction of Mbombela Local Municipality in Mpumalanga Province.




Project Location
Legend
Google Earth
N

Figure 2: Study area

Table 11: Property details

No	Farm Name	Farm/Erf No	Portion	Latitude	Longitude	Property Type
1	Friedenheim	282JT	33	25°26'2.34"	31°0'57.96"	Farm Portion

SG 21 Digit Code:

T	0	J	T	0	0	0	0	0	0	0	0	0	2	8	2	0	0	0	3	3

5 SURROPUNDING LANDUSES

The site is surrounded by agricultural properties and the Friedenheim dam which is North-West of the property as indicated in Figure 3~~Figure 3~~:

SURROUNDING LANDUSES

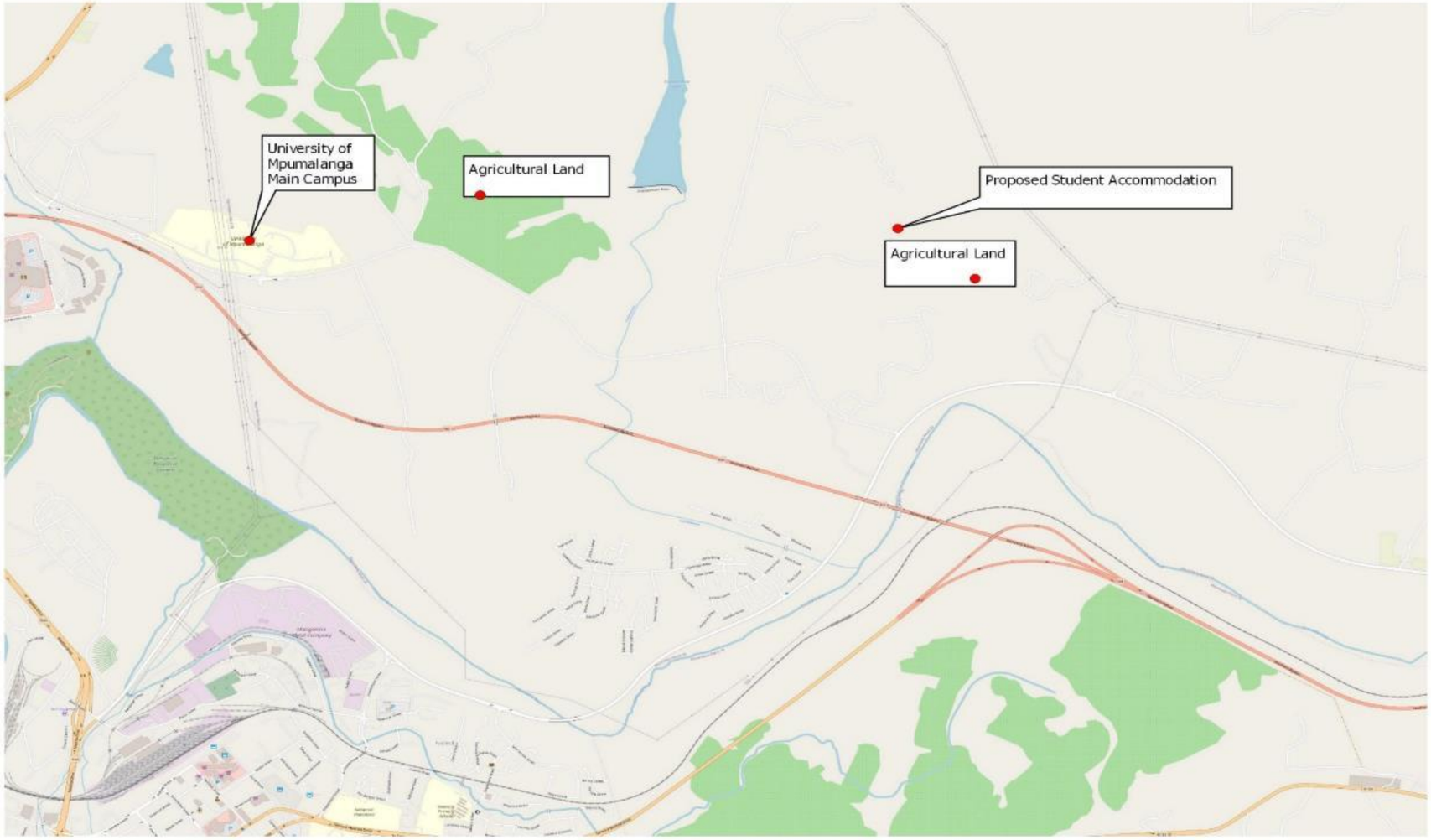


Figure 3: Landuses surrounding the project site

6 NEED AND DESIRABILITY

The requirement to consider and assess the need and desirability of a proposed project stems from the principle of sustainability as set out in both the Constitution and the NEMA. The Environmental Right enshrined in the Bill of Rights provides that:

"*Everyone has the right...to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that...secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*".

Addressing the need and desirability of a proposed project is therefore intended as a method of ensuring sustainable development, i.e., that a development is ecologically sustainable and socially and economically justifiable.

The Department of Environmental Affairs (DEA) has published a guideline document for consideration of the need and desirability of proposed developments. This guideline sets out a list of questions which should be addressed, divided into questions relating to ecological sustainability and justifiable economic and social development. The questions that relate to ecological sustainability include how the development may impact ecosystems and biological diversity; Pollution; and renewable and non-renewable resources. When considering how the development may affect or promote justifiable economic and social development, the relevant spatial plans must be considered, including Municipal Integrated Development Plans (IDP), Spatial Development Frameworks (SDF) and Environmental Management Frameworks (EMF), which have been compiled through participatory process and therefore reflect the broader community's needs and interests. Environmental Impact Assessment Reports need to provide information as to how the development will address the socioeconomic impacts of the development, and whether any socio-economic impact resulting from the development will impact on people's environmental rights. Considering the need and desirability of a development entails the balancing of these factors.

For the purposes of discussing the need and desirability of the proposed development, the EAP has adopted the understanding that the **NEED** for the proposed development can be interpreted as the *demand for the activity,* whilst the **DESIRABILITY** of the proposed development can be understood as the *suitability of the placement of the activity*.

The need and desirability of the proposed project is discussed in two sections, split into a consideration of the ecological sustainability of the development, followed by a consideration of the socio-economic justification of the project in each section, the questions included in the Guideline Document have been listed and answered.

Development pressure over the years Mbombela has grown considerably due to its status as provincial capital seat, with Nelspruit as a regional service centre, growing tourism and major new infrastructural developments (i.e., Mbombela Stadium, N4 Northern Bypass, KMIA, R40 upgrade, improvements to the Lowveld Botanical Gardens etc.). This resulted in a demand for urban land around the main economic centres i.e., White River, Nelspruit and Hazyview with resultant higher land prizes. Development pressures characterising the Nelspruit-White River Development Corridor involve:

a) Business and commercial development along the R40,
b) The provision of affordable housing nearer to places of employment,
c) The provision of roads and engineering infrastructure.

Table 12: An assessment of the needs and desirability for the development.

How will this development (and its separate elements / aspects) impact on the ecological integrity of the area?
It is anticipated that the impact of the proposed development of ecological integrity will be low. It is recommended that, prior to the commencement of construction activities, all protected plant and tree species be removed from site and relocated to a Protected Area (providing all necessary permits are in place). The loss of the indigenous vegetation occurring on the site is anticipated, following implementation of the recommended mitigation measures, to have **LOW** significance.
How were the following ecological integrity considerations considered? 1. Threatened ecosystems. 2. Sensitive, vulnerable, highly dynamic or stressed ecosystems such as coastal shores, estuaries, wetlands, and similar systems that require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure. 3. Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). 4. Conservation targets. 5. Ecological drivers of the ecosystem.

6. Environmental Management Framework (EMF); and
7. Global and international responsibilities relating to the environment (e.g., RAMSAR, climate change, etc.).

No sensitive, vulnerable, highly dynamic, or stressed ecosystems have been identified as occurring on the site. The phrase "*Ecological drivers of an ecosystem*" is understood to include those processes, parameters or pathways that have the potential to cause ecosystem changes. Drivers considered in the identification and assessment of impacts on ecological integrity, arising because of the proposed development, and reported on in this document, include:

a) Impacts arising from clearance of indigenous vegetation:
   - Possible disturbance / destruction of protected plant and tree species.
   - Invasion of the site by alien vegetation; and
   - General reduction in floral biodiversity

b) Impacts on fauna:
   - Habitat destruction, loss of foraging / hunting, nesting and movement areas.
   - Loss / displacement of fauna; and
   - General reduction in faunal biodiversity

c) Impacts on surface water features:
   - Contamination of groundwater.
   - Reduced infiltration (because of vegetation clearing) and increased overland flow (because of compaction and construction of hardened surfaces) resulting in an altered hydrological regime; and
   - Increased erosion risks.

d) Impacts on soil quality:
   - Compaction.
   - Erosion / loss; and
   - Contamination

Measures for the avoidance, minimisation and mitigation of these impacts have been recommended. Should these measures be effectively implemented, it is anticipated that these impacts will have low significance on ecological integrity.

The international environmental agreements to which South Africa is currently party are summarised in the table below, together with their applicability in the context of the proposed development:

Name of Agreement	Description	Relevance to the Development
Convention on Biological Diversity	• To develop national strategies for the conservation and sustainable use of biological diversity; and • To address the fair and equitable sharing of benefits arising out of the utilization of genetic resources	• The NSBA, 2004 was undertaken to meet the obligations imposed by this Convention. • The results and recommendations of the NSBA, in particular regarding ecosystem threat status and ecosystem protection level, have been considered in the compilation of this document.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	• To reduce transboundary movements of wastes subject to the Convention to a minimum consistent with the environmentally sound and efficient management of such wastes; • To minimize the amount and toxicity of wastes generated and ensure their environmentally sound management as closely as possible to the source of generation; and • To assist LDCs in environmentally sound management of the hazardous and other wastes they generate	• Measures aimed at the minimisation of wastes generated by the construction and operation of the proposed development has been recommended in this report. • Measures to ensure environmentally sound management of wastes generated by the construction and operation of the proposed development have been recommended in this report

How will this development disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?
The proposed development will disturb ecosystems and result in the loss of biological diversity due to the clearance of indigenous vegetation from the site. Such clearance may give rise to additional, related, adverse impacts on biological diversity, including: • The potential invasion of the site by alien vegetation. • Habitat destruction, loss of foraging / hunting, nesting, and movement areas; and • The loss / displacement of fauna. In terms of avoiding these negative impacts, the no-go alternative was explored. This alternative would, however, result in the loss of significant social and economic benefits / opportunities, and the avoidance of environmental impacts that have MEDIUM significance (pre-mitigation) and LOW significance (post-mitigation). Based on this, therefore, the no-go alternative is not the preferred alternative. In terms of minimising the identified impacts, the following mitigation measures have been recommended: a) Vegetation clearance and disturbances associated with the construction of each individual phase of the proposed development must be limited to the footprint of that relevant phase b) Vegetation occurring in the area designated as open space should not be cleared (apart from aliens). c) All protected plant and tree species must be identified, removed from the site, and relocated either to the Open Space area or offsite to a suitable area (which is formally protected), as far as possible. Such search and rescue exercise must be undertaken prior to the commencement of each individual phase, and by an appropriately qualified Botanical Specialist d) Prior to the removal of any protected plant or tree species, it will be necessary to apply for the relevant permits from the relevant authorities: protected plants require a permit from DAFF.
How will this development pollute and / or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?

The biophysical environment is understood to comprise of the water and soil elements of the natural environment. It is anticipated that the biophysical environment might be degraded or polluted in the following ways:

- It is unlikely that the proposed development will have any impact on surface water resources.
- Contamination of soil and groundwater because of poor control of hazardous materials (improper storage, spills, leaks, and poor clean-up).
- Increased demand for water.
- Altered hydrological regime because of artificial hardening of the soil surface and compaction of soils on the site.
- Soil compaction and physical removal.
- Erosion and / or damage of neighbouring properties.

In terms of avoiding these negative impacts, the no-go alternative was explored. This alternative would, however, result in the loss of significant social and economic benefits / opportunities, and the avoidance of biophysical impacts that have LOW significance, both pre-and post-mitigation. Based on this, therefore, the no-go alternative is not the preferred alternative. In terms of minimising the identified impacts, the following mitigation measures have been recommended:

- Vehicles and construction equipment should not undergo maintenance procedures on site. Maintenance procedures should only take place at a Workshop.
- A Method Statement (MS) for the handling, storage, and management of hazardous substances during the construction phase must be drawn up by the appointed Contractor, and reviewed by the ECO, prior to the commencement of construction.
- As far as possible, water for construction purposes must be non-potable and sourced from legal supplies. Potable municipal water may not be used for construction purposes.
- A construction-phase stormwater management plan must be implemented across the entire development site to prevent and control potential stormwater impacts (flooding, erosion) on neighbouring properties.
- Baseline sampling of groundwater quality should be undertaken prior to the commencement of construction activities, to provide a point of comparison for groundwater sampling recommended to be undertaken during the operational phase.
- All potential soil and water contaminants (including oil, fuel, and cement) must be stored and handled in such a way so as to minimise the potential for spillage or leakage and contamination.

What waste will be generated by this development? What measures were explored to firstly avoid waste and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat

and / or recycle the waste? What measures have been explored to safely treat and / or dispose of unavoidable waste?
Wastes generated during the construction phase are anticipated to include: • Excavated material from the levelling of the site. • Plant waste from the clearance of vegetation from the site. • Domestic waste from construction workers using the site. • Waste from equipment, packaging, materials, and vehicles. • Hazardous wastes; and • Sewage waste. Wastes generated during the operational phase are anticipated to include: • Solid, general waste will be generated by the residential use. This waste will comprise predominantly domestic waste, garden waste and non-hazardous waste; • Liquid waste (sewage) will be generated by development. In terms of avoiding waste, the no-go alternative was explored. This alternative would, however, result in the loss of significant social and economic benefits / opportunities. Based on this, therefore, the no-go alternative is not the preferred alternative. In terms of minimising, re-using, or recycling wastes, the following mitigation measures have been recommended: • The Contractor must, during the construction phase, investigate ways in which to implement the waste hierarchy on site by: i. Identifying ways to avoid and reduce waste generation. ii. Re-use waste materials. iii. Recycle waste. iv. Recover waste; and v. As a last resort, treat and dispose of wastes. This must be done by way of the preparation of a Waste Management Method Statement. • To reduce pressure on general waste landfill sites, it is recommended that, as far as possible, general solid wastes be separated and sorted into its recyclable components (glass, plastic, metal, paper). This will require the provision of separate waste bins within the site camp, and the removal of these wastes to appropriate recycling facilities. • The requirement to separate and sort general wastes should be included as part of the environmental induction and awareness programme.

How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?
Renewable resources include, for example: Water; Air; Soil; and Animals, etc. Of these, water is likely to be the most significantly impacted upon, especially in the context of the current drought conditions being experienced within the country. To mitigate the impact on water resources, the following is recommended: • As far as possible, water for construction purposes must be non-potable and sourced from legal supplies. Potable municipal water may not be used for construction purposes. • It is recommended that the Applicant and his Civil Engineers investigate feasible engineering interventions to design water-conservation measures into the design of the proposed development.
Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)
The proposed development will result in increased dependency on the increased use of natural resources to maintain economic growth. However, should the recommendations for water and energy use efficiency and waste recycling be implemented, the ecological footprint of the proposed development can be reduced.
Do the proposed location, type and scale of development promote a reduced dependency on resources?
If the recommended water and energy conservation measures are implemented, then the proposed development will contribute to enhanced water use efficiency and sustainability of the resource.
How will the ecological impacts resulting from this development impact on people's environmental right in terms following: 1. Negative impacts: e.g., access to resources, opportunity costs, loss of amenity (e.g., open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What

measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts? 2. Positive impacts: e.g., improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	
1. The following negative impacts on human health and well-being were identified: • Dust impacts; and • Noise impacts. Measures for the mitigation of these impacts have been recommended, and include: **DUST:** • Dust minimisation and control measures should be implemented on the construction site at regular intervals. This could include irrigation (utilising legal, non-potable water) by water tankers. • The frequency of implementation of dust suppression measures should be increased when it is expected that high wind conditions will develop. • Vegetation clearing for each phase of development should only take place immediately prior to the commencement of construction activities for the relevant phase (i.e. immediately prior to the construction of each Phase), in order to minimise the amount of exposed soil on the site. • A Complaints Register must be made available on the site for the duration of construction. Any dust-related complaints must be efficiently and effectively dealt with. **NOISE:** • Construction activities should be limited to normal working hours (08:00 – 17:00) during the week and 08:00 – 13:00 on Saturdays. No work should occur on Sundays or Public Holidays. • All machinery and equipment to be utilised on the site should be fitted with mufflers and must be maintained in good working order to minimise noise levels. • The Contractor should encourage construction workers to minimise shouting and hooting on the site. • The Contractor shall warn any local communities and/or residents that could be disturbed by particularly noisy activities well in advance and shall keep such activities to a minimum. • The Contractor shall be responsible for compliance with the relevant legislation with the respect to noise. It must be ensured that all potential noise sources conform to the South African Bureau of Standards recommended code of practice, SANS Code 0103:1983, so that it will not produce excessive or undesirable noise.	

• Construction work should be completed in as short a time frame as possible in order to limit the longevity of these impacts.
Based on all the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?
Based on the preliminary specialist input, as well as the impact identification and significance rating exercise undertaken in the compilation of this document, it is expected that the proposed development will have limited negative impact on the ecological integrity of the area. The proposed development will not contribute positively to the ecological integrity of the area.
Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of ecological considerations?
The Best Practicable Environmental Option (BPEO) is defined in the NEMA as the *option that provides the most benefit or causes the least damage to the environment, at a cost acceptable to society, in the long term, as well as in the short term*. As described above, the proposed development will have socio-economic benefits of **MEDIUM** significance and detrimental ecological impacts of **LOW** significance (provided the recommended mitigation measures are implemented). The development will also not impact significantly on non-renewable resources, and the effect on renewable resources (such as water) can be minimised through the implementation of the recommended water conservation interventions, to enhance sustainable resource use. Based on information available at this time, therefore, the Preferred Alternative is deemed to be the BPEO.
Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?
Cumulative impacts identified include: • General reduction in floral biodiversity in the area. • Reduction in predator populations resulting in increased pest (e.g., rats) populations. • General reduction in faunal biodiversity in the area.

From the perspective of the site location, existing and future developments in the area, it is not anticipated that the identified cumulative impacts will have unacceptable consequences, especially when weighed against the socio-economic benefits that will be gained should development proceed.
What is the socio-economic context of the area, based on, amongst other considerations, the following considerations? 1. The IDP (and its sector plans' vision, objectives, strategies, indicators, and targets) and any other strategic plans, frameworks of policies applicable to the area. 2. Spatial priorities and desired spatial patterns (e.g., need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.). 3. Spatial characteristics (e.g., existing land uses, planned land uses, cultural landscapes, etc.);
Based on the SDP the following areas are reserved for future housing development and integrated human settlements to accommodate a variety of residential densities and provide for different income categories: • The area north of Riverside node (proposed Boschrand Heights). • The area east of the University of Mpumalanga (Friedenheim area).
Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?
The proposed development will be comprised of the following elements, which may have socioeconomic impacts: • Student accommodation

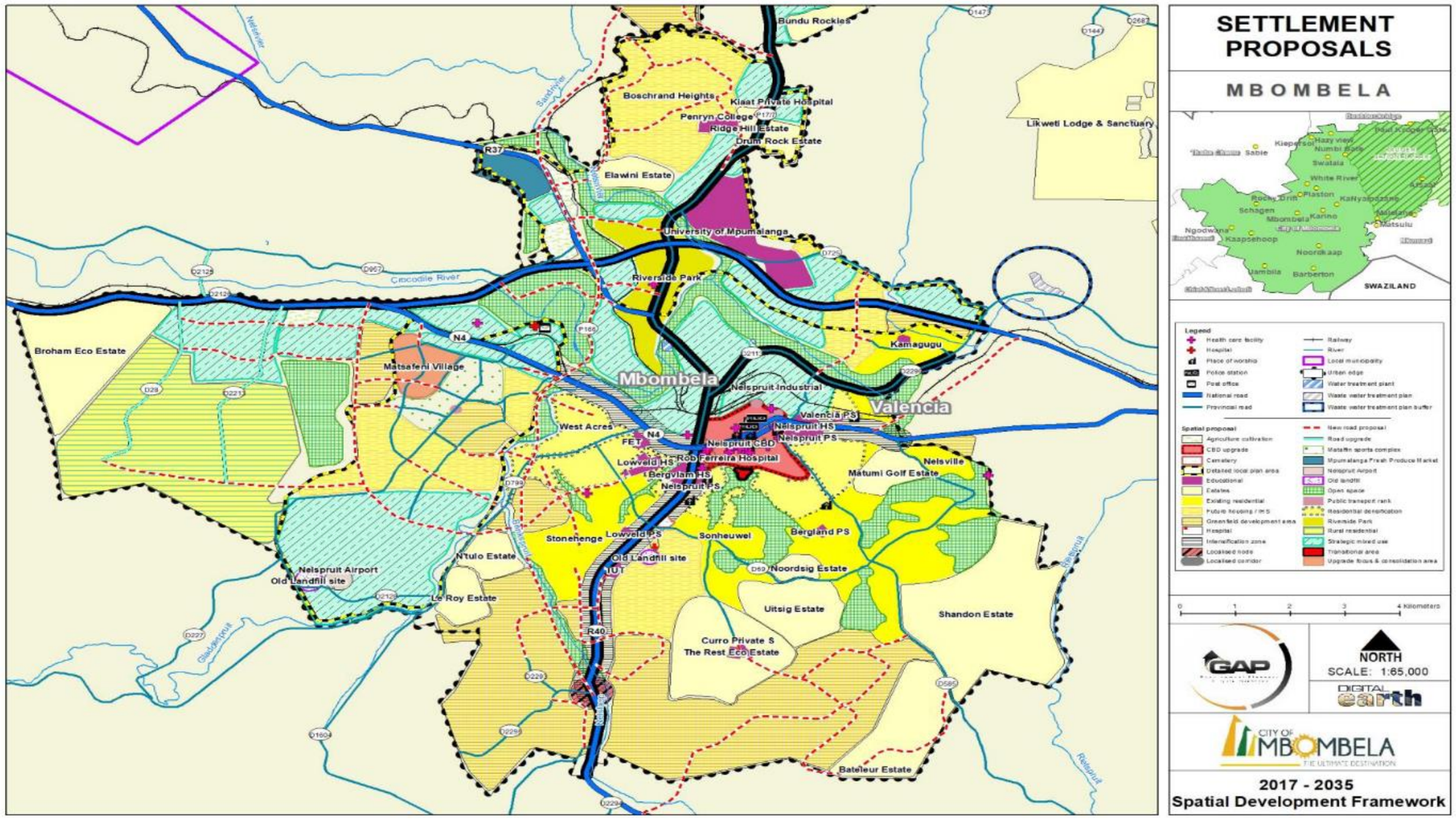


Figure 4: Proposed settlements (Source: Mbombela SDF)

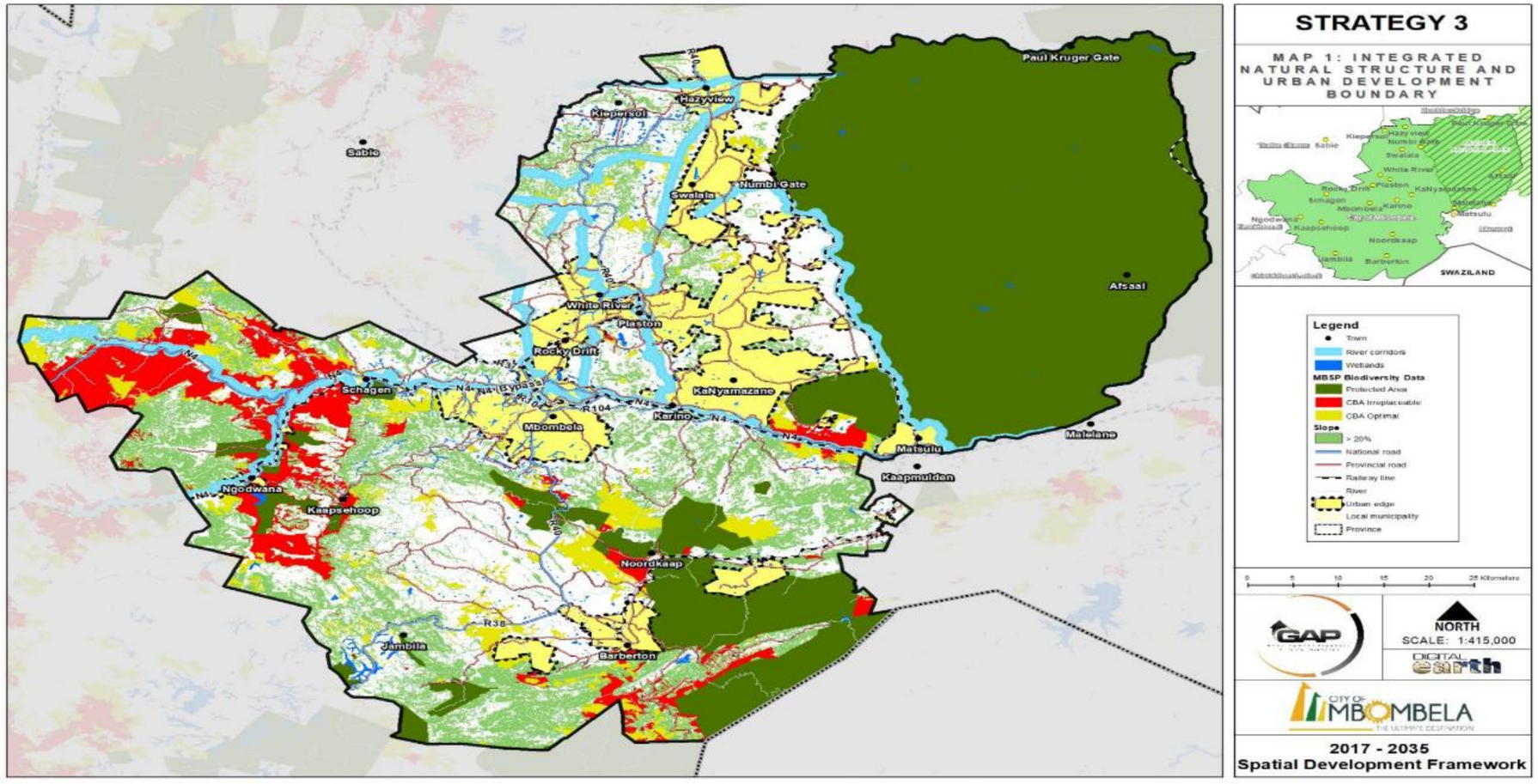


Figure 5: Integrated natural structure & urban development boundary

7 LEGISLATION, POLICIES AND GUIDELINES

This section serves to highlight key legislation and policy framework that has implications on the proposed activity. It must be noted that this list is not exhaustive but notes, at high level, the critical laws and policies that have been considered.

7.1 The Constitution of the Republic of South Africa, Act No. 108 of 1996

All environmental aspects should be interpreted within the context of the Constitution. The Constitution has enhanced the status of the environment by virtue of the fact that environmental rights have been established (Section 24) and because other rights created in the Bill of Rights may impact on environmental management. An objective of local government is to provide a safe and healthy environment (Section 152) and public administration must be accountable, transparent and encourage participation (Section 195(1)(e) to (g)).

Implications for the proposed development:

- Obligation to ensure that proposed activity will not result in pollution and/or ecological degradation;
- Obligation to ensure that where possible conservation is promoted; and
- Obligation to ensure that the proposed activity is ecologically sustainable, while demonstrating economic and social benefits.

7.2 The National Environmental Management Act No.107 of 1998

The National Environmental Management Act (Act No. 107 of 1998) (NEMA) is South Africa's overarching legislative framework for environmental management. Act establishes the principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance, and procedures for co-ordinating environmental functions exercised by organs of state.

It sets out a number of principles that aim to give effect to the environmental policy of South Africa. These principles are designed to, amongst others, serve as a general framework for environmental planning, as guidelines by reference to which organs of state must exercise their functions and guide other laws concerned with the protection or management of the environment.

Chapter 5 of NEMA serves to promote integrated environmental management which must place people and their needs at the forefront of its concerns, and serve their physical, psychological, developmental, cultural and social interests equitably. Development must be socially, environmentally and economically sustainable. Sustainable development therefore requires the consideration of all relevant factors.

In terms of the NEMA and the EIA Regulations, 2014, an application for environmental authorisation for certain listed activities must be submitted to either the provincial environmental authority, or the national authority, depending on the types of activities being applied for. The current EIA regulations, GN R.982, GN R.983, GN R.984 and GN R.985, promulgated in terms of Sections 24(5), 24M and 44 of the NEMA commenced on 08 December 2014. GN R.983 lists those activities for which a Basic Assessment is required, GN R.984 lists the activities requiring a full EIA (Scoping and Impact Assessment phases) and GN R.985 lists certain activities and competent authorities in specific identified geographical areas. GN R.982 defines the EIA processes that must be undertaken to apply for Environmental Authorisation. The listed activities that are applicable to this project are identified in Section 2 above.

Implications for the proposed development

- The principles espoused in NEMA serve as guidelines for relevant decision makers in ensuring the protection of the environment. Therefore, the proposed development must be consistent with these principles.
- Where this is not possible, deviation from these principles would have to be very strongly motivated;
- The activity may not take place without the required authorization; and
- The EIA process will have to be informed by these principles and include public participation, the outcomes of these are to be incorporated into the final reports.

7.3 National Environmental Management: Waste Act, Act No 59 of 2008

One of the main objectives of the NEMWA is to provide for the regulation of waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development. The Act provides:

- National norms and standards for regulating the management of waste by all spheres of government;
- Specific waste management measures including:
  - The licensing and control of waste management activities;
  - The remediation of contaminated land;
  - to provide for the national waste information system; and
  - Compliance and enforcement mechanisms.

In terms of the NEMWA, certain waste management activities must be licensed and in terms of Section 44 of the Act, the licensing procedure must be integrated with an environmental impact assessment process in accordance with the EIA Regulations promulgated in terms of the NEMA. Government Notice 921, which was published in Government Gazette No.37083, on 29 November 2013 and implemented with immediate effect, lists the waste management activities that require licensing. A distinction is made between Category A waste management activities, which require a Basic Assessment, and Category B activities, which require a full EIA (Scoping followed by Impact Assessment)

Implications for the development:

- Waste generated by the activity must be managed in accordance with the provisions of the Act.

7.4 The National Environmental Management: Biodiversity Act, Act 10 of 2004

The Act provides for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This Act allows for the protection of species and ecosystems that warrant national protection, the sustainable use of indigenous biological resources, the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources and the establishment and functions of the South African National Biodiversity Institute. Key elements of the Act are:

- The identification, protection and management of species of high conservation value;
- The identification, protection and management of ecosystems and areas of high biodiversity value;

- Biodiversity Initiatives such as the STEP (Subtropical Thicket Ecosystem Plan) and CAPE (Cape Action Plan for People and Environment) may become accepted as bioregional plans and are thus implemented as legislation;
- Alien invasive species control of which the management responsibility is directed to the landowner; and
- Section 53 of the Act identifies that any process or activity that is regarded as a threatening process in terms of a threatened ecosystem, requires environmental authorization via a full Environmental Impact Assessment (Government Notice No. 387).

Implications for the current development:

There were no ecologically endangered species encountered on the site. The freshwater habitat unit of the site does however provide suitable habitat, however the likelihood for any individuals to utilise the freshwater habitat unit is low due to severe habitat degradation.

7.5 Spatial Planning and Land Use Management Act (SPLUMA)

The Spatial Planning and Land Use Management Act "SPLUMA", 2013 (Act 16 of 2013) intends to provide a uniform framework for spatial planning and land use management in the republic. It seeks to promote consistency and uniformity in procedures and decision-making in spatial planning. The objective of the Act are as follows:

- Provide for a uniform, effective and comprehensive system of spatial planning and land use management for the Republic;
- Ensure that the system of spatial planning and land use management promotes social and economic inclusion;
- Provide for development principles and norms and standards;
- Provide for sustainable and efficient use of land;
- Provide for cooperative government and intergovernmental relations amongst the national, provincial and local spheres of government; and
- Redress the imbalances of the past and to ensure that there is equity in the application of spatial development planning and land use management systems.

Implications for the proposed development:

- The principles espoused in SPLUMA apply to all organs of state and other authorities responsible for the implementation of legislation regulating the use and development of land. Therefore, decisions on the proposed development must be consistent with these principles.
- Where this is not possible, deviation from these principles would have to be very strongly motivated.

7.6 The National Water Act, 1998 (Act No.36 of 1998)

The National Water Act (The Act) provides for the management of South Africa's water resources. The purpose of the Act is to ensure that the Republic's water resources are protected, used, developed, conserved and controlled. It is concerned with the allocation of equitable access and the conservation of water resources within South Africa. The National Water Act of 1998 repealed many of the powers and functions of the Water Act of 1956. Key provisions include the following:

- Catchment Areas - Any disturbance to a watercourse such as the construction of a dam or weir type facility requires authorization from the Department of Water and Sanitation.
- Water Supply - Under the Act, a developer is required to obtain the necessary permits for water usage and the disposal of wastewater from the authority responsible for the administration of the Act.
- Any private well or borehole sunk for the abstraction of groundwater has to be reported and registered with the regulatory authority.
- Wastewater - The National Water Act is the principal piece of South African legislation governing wastewater management.

Implications for the proposed development:

- Any proposed water uses must be specified and registered and/or licensed;
- Any modifications to drainage lines on site must be investigated in terms of water use requirements;
- The developers are responsible for taking reasonable measures to prevent pollution of water resources that it owns, controls, occupy or uses on the land in question;

- The developers are required to remedy a situation where pollution of a water resource occurs following an emergency incident and where it is responsible for the incident or owns or is in control of the substance involved;
- The applicant must take all reasonable measures to minimise the impacts of the incident, undertake clean-up procedures, remedy the effects of the incident and implement measures as directed; and
- Waste created during construction needs to be controlled adequately to negate the impacts on ground and surface water.

7.7 The National Heritage Resources Act, 1999 (Act 25 of 1999)

The Act aims to promote the good management of the national estate of South Africa which can include:

- Places, buildings, structures and equipment of cultural significance;
- Places to which oral traditions are attached or that are associated with living heritage;
- Historical settlements and townscapes;
- Geological sites of scientific or cultural importance;
- Archaeological and palaeontological sites;
- Graves and burial grounds, including:
    - Ancestral graves
    - Royal graves and graves of traditional leaders
    - Graves of victims of conflict
    - Graves of individuals designated by the Minister by notice in the Gazette
    - Historical graves and cemeteries
- Other human remains covered by the Human Tissue Act, 1983 (Act No 65 of 1983).
- Sites of significance relating to the history of slavery in South Africa.

In terms of Section 38 of the Act, the South African Heritage Resources Agency (SAHRA) must be notified during the early planning phases of a project for any development that includes the following activities:

- The construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent
    - involving three or more existing erven or subdivisions thereof
    - involving three or more erven or divisions thereof which have been consolidated within the past five years
    - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- The re-zoning of a site exceeding 10 000 m^2 in extent, or
- Any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

Implications for the proposed development:

- Any artefacts uncovered during the construction phase must be reported to SAHRA;
- Development may not alter or demolish any structure or part of a structure, which is older than 60 years or disturb any archaeological or palaeontological site or grave older than 60 years without a permit issued by the relevant provincial heritage resources authority; and
- SAHRA must be informed of the proposed development and provided an opportunity to comment. This may result in the need for a basic heritage assessment.

8 FEASIBLE AND REASONABLE ALTERNATIVES

According to Chapter 1 of the EIA Regulations 2014 (as amended), *"Alternatives"*, in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

*a) The **property** on which or **location** where it is proposed to undertake the activity;*
*b) The **type** of activity to be undertaken;*

*c) The **design** or **layout** of the activity;*

*d) The **technology** to be used in the activity;*

*e) The **operational** aspects of the activity; and*

*f) The option of **not implementing** the activity.*

The EIA Regulations 2014 (as amended), recognise that details on alternatives need to include a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity.

The consideration of alternatives is therefore a key component of an EIA process. While an EIA process should investigate and comparatively consider all alternatives that have been identified, only those found to be feasible and reasonable must be comparatively ***assessed***, in terms of the advantages and disadvantages that the proposed activity and alternatives will have on the environment and on the socio-economic aspects of communities that may be affected by the activity. The feasibility and reasonability of an alternative are measured by:

a) The general purpose and requirements of the activity;
b) The need and desirability of the activity;
c) Opportunity costs;
d) The need to avoid and/or minimise negative impacts;
e) The need to maximise benefits; and
f) How it impacts on the community that may be affected by the activity (DEA&DP, 2013b).

8.1 Site/Location alternatives

No alternative sites have been considered by the proponent, as this site is owned by the proponent and is contiguous to areas/sites that have been developed by the applicant. Preliminary investigations concluded that the proposed site is the most suitable due to its ideal location in terms of the requirements for residential development.

8.1.1 Site layout alternatives

Site layout alternatives permit consideration of different spatial configurations of an activity on a particular site. This may include specific components of a proposed development or the entire activity. For example, siting of a particular structure either prominently to attract attention or screened from view to minimize aesthetic impacts.

Furthermore, the site is surrounded by vacant land and is bordered by a river and wetland. As a result, the design of the layout had to incorporate environmentally sensitive portions of the site into an open pace system while ensuring that efficiency in circulation and linkages within the study area are not adversely compromised.

Figure 6: Layout alternative

8.2 Energy Alternative

The use of solar power

To curb the ever-growing need of burning of fossils polluting the atmosphere the use of solar energy is a more environmentally friendly consideration. There is a global need to save energy and ensure that sustainable practises are in place to protect and prevent loss of natural resources. Therefore, a reasonable and feasible alternative for the development is the use of renewable energy in the form of solar systems for the whole development or only for water heating.

Solar energy facilities operate by converting solar energy into a useful form such as electricity. Solar technologies can be divided into two categories, namely those that harness solar energy from the sun and those that use the light energy. The former uses sun (i.e., solar thermal) while the second does not (i.e., photovoltaic technology).

The use of solar energy for electricity generation is a non-consumptive use of a natural resource and consumes no fuel for continuing operation. Renewable energy is considered a clean source of energy with the potential to contribute greatly to a more ecologically, socially, and economically sustainable future. Alternative and renewable energy generation is becoming a necessary substitute for the replacement of fossil-fuel powered energy sources because they reduce the emissions of the greenhouse gases which will lead to sustainable development.

Apart from the use of solar systems to heat water, complex parking lots can be roofed with solar panels as illustrated in the picture below. The basic idea behind a solar parking lot is simply to incorporate solar panels into a carport, which is basically an open-sided shed with a roof. Solar carports can be small enough to fit a single car at a residence. The main benefit, of course, is to generate renewable energy that can be used to lower utility costs on site. Depending on the scale, the installation could also yield excess energy in the form of electricity for sale. A solar carport can also help reduce the "heat island" effect of parking lots and contribute to a cooler community, and by providing protection from the elements it can help enhance vehicle lifespan

Figure 7: Illustration of solar panels installed over parking bays.

Advantages of using Solar Power (Energy) in the proposed development.

Drawing from the ever growing need to extract coal from the earth surface to power electricity in South Africa is exhausting the availability and quality of Coal as a mineral. Solar power generation is sustainable practice and renewable means of energy (Using solar rays/ radiant energy from the sun), furthermore such practices reduce excessive carbon emissions into the atmosphere. Although Solar power generators are expensive to install however it offers a much affordable service to the user therefore such a system can ease the burden triggered by high expensive electricity tariffs.

8.2.1 Preferred Alternative

The development will be connected to the Eskom grid for electricity supply. The area's electrical services are provided by Eskom which supplies the areas around the proposed development via over headlines. There are MV over headlines within the site location and there was an existing pole mounted transformer which has been removed, hence a bulk power connection will be feasible within a reasonable distance. Confirmation of bulk power application with Eskom will be made following necessary approvals.

8.3 Wastewater Treatment Alternatives

8.3.1 Biorock Waste Treatment Process Technology

8.3.1.1 The Biorock Non-Electric Treatment Process. How Biorock Plants Work?

a) Step 1: Primary Tank

The Primary Tank clarifies the raw sewage by dividing fats, oils, greases and organic solids. The sewage then passes through an effluent filter, before discharging into the BIOROCK reactor.

b) Step 2: Bioreactor

The Bioreactor purifies further the pre-treated wastewater with a biological process. To naturally treat the wastewater, our systems use our unique BIOROCK Media, an exclusive and very efficient carrier material for bacteria.

c) Step 3: Discharge

Depending on the ground type, effluent will be discharged by gravity, or by a pump.

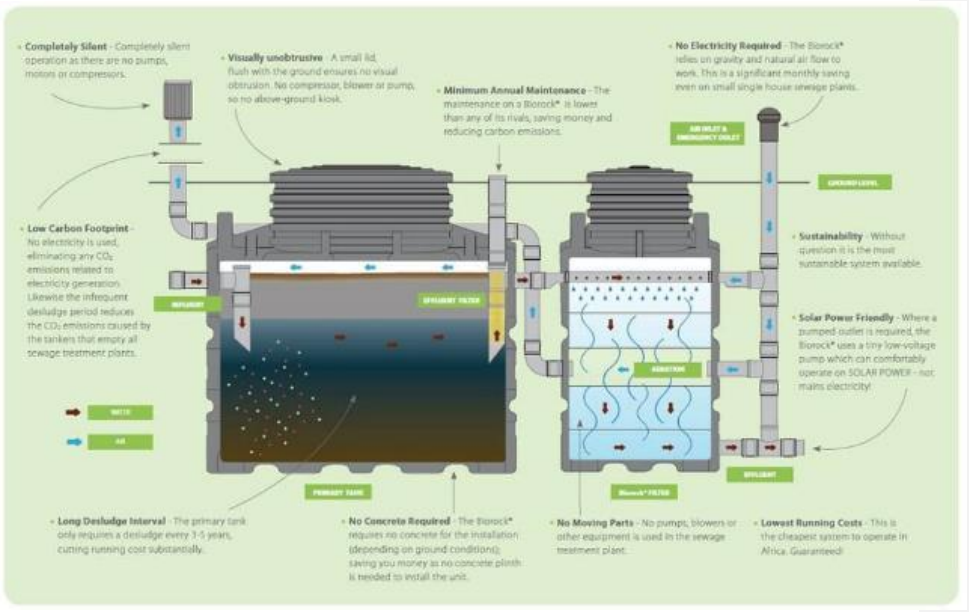


Figure 8: An illustration of how the Biorock system works.

Disadvantages of the Biorock System

- The system is not prevalent in South Africa at a commercial level
- It is expensive to install and to maintain.
- Municipality advised that they need to have conventional sewer

8.4 Preferred Alternative for Wastewater Treatment Technology

8.4.1 Convectional Method of Wastewater Treatment

Information provided by The City of Mbombela engineering services department has shown that there is an existing concession sewer pipeline which is passing through the proposed site on the Agricultural College Road. Information gathered is that there is a municipal bulk sewer pipeline that end at the University of Mpumalanga where the University is currently connected.

8.5 No-Go Alternative

The No Go alternative is the option of not developing the proposed development and associated service infrastructure. The no-development option would result in a lost opportunity in terms of the employment opportunities associated with the construction and operational phases as well as the benefits associated with the provision of student accommodation. A high negative socio-economic impact significance would occur if the proposed development were not constructed.

The socio-economic benefits of this project largely outweigh the environmental biophysical impacts in an area which is partly degraded, fragmented from any other natural areas, is completely enclosed by development, and which supports vegetation with a low conservation threat status. The No-Go Alternative is therefore not recommended

9 DESCRIPTION OF THE RECEIVING BIOPHYSICAL ENVIRONMENT

9.1 Topography

CoM lies on the eastern edge of the Drakensberg Mountain range. The area can be divided into three distinct physiographic regions based on the north-south orientation of the Drakensburg Mountain range, namely:

- Highveld,
- Escarpment and
- Lowveld.

The topography ranges from mountainous areas in the western & southern parts to gently sloping areas in the eastern parts and some parts of the south. The area falls from a height of

approximately 1200m above sea level in the southern-western part to 350m in the north-eastern parts.

A slope analysis, based on slope data received from the National Department of Agriculture, Forestry and Fisheries, presents areas with slopes that vary between 2% (level to very gently slope) and 23% (steep slopes). Accordingly, most of the municipality consists of steep slopes.

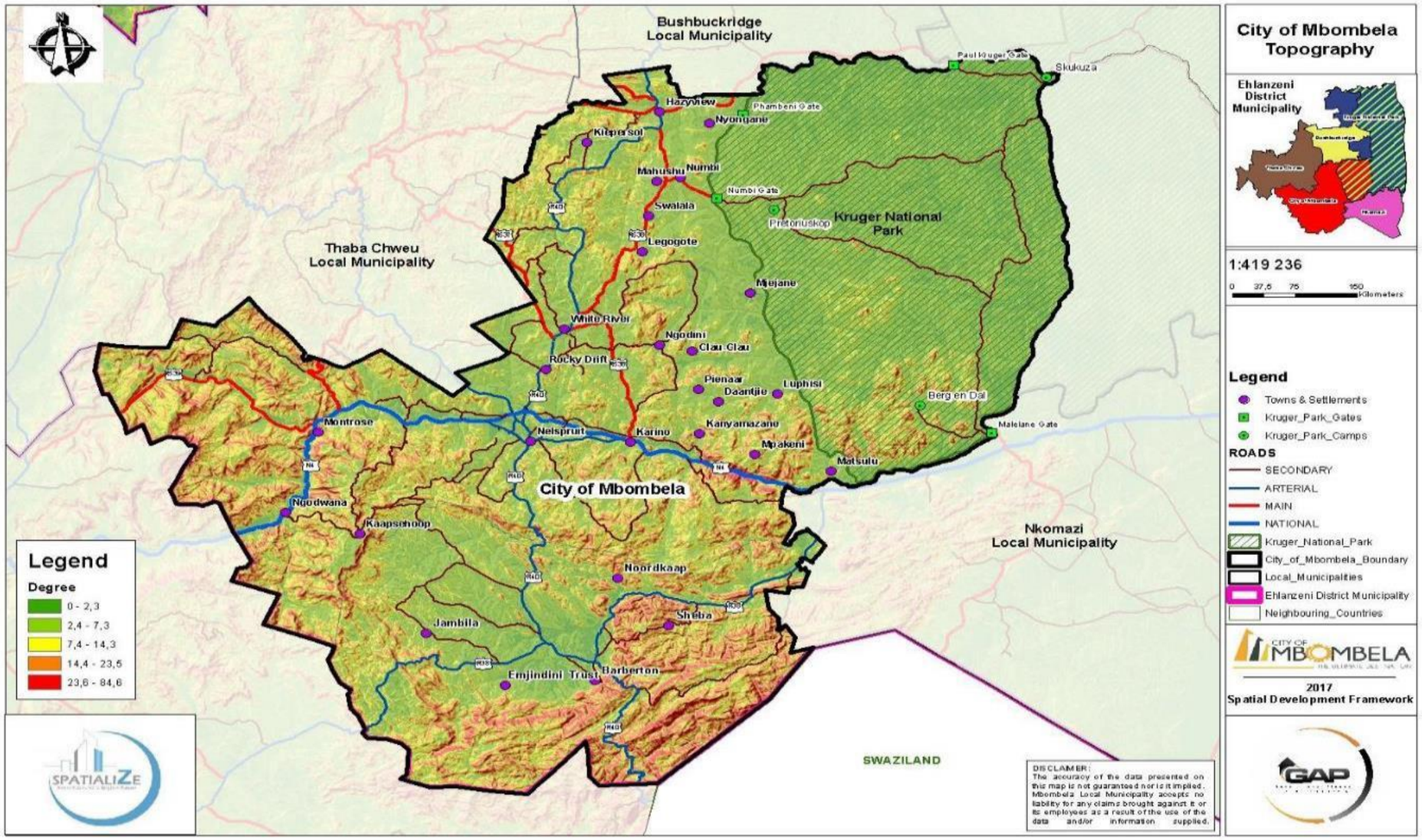


Figure 9: Slope analysis (Source: CoM SDF)

9.2 Geology

The geology types occurring in the City of Mbombela municipal area can be summarised as follows:

- A large portion of the municipality is underlined with the Granite Group which covers most of the central, eastern and northern regions.
- The southern region (former Umjindi) is mostly covered with the Gabbro Group, coupled with the Shale & Quartzite, Sandstone, Greywacke and Mafic Groups.
- Highly permeable and erodible, colluvial sands and residual soils overlay the granitic bedrock (Potassic Gneiss and Migmatite) in the Kanyamazane area.
- The western part has a variety of geology groups including Shale,
- Dolomite, Quartzite, Andesite, Ultramafic rocks and Gneiss. Dolomite rocks give rise to caustic features, the most notable in Mbombela is the 1.8km long Sudwala Caves. Hazyview is underlain by Granodiorite and Matsulu is underlain by Gneiss.

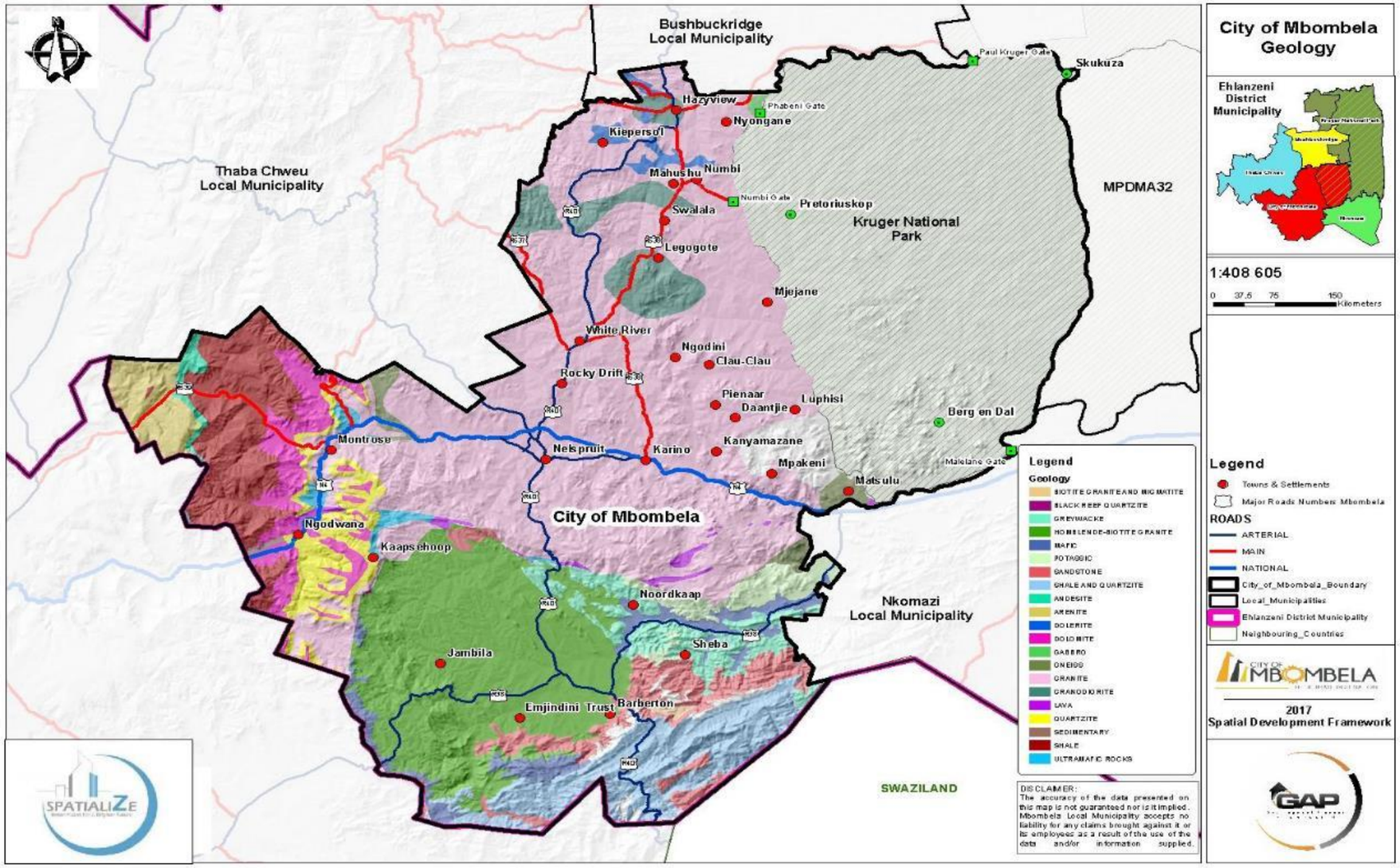


Figure 10: Geological map for CoM. (Source: CoM SDF)

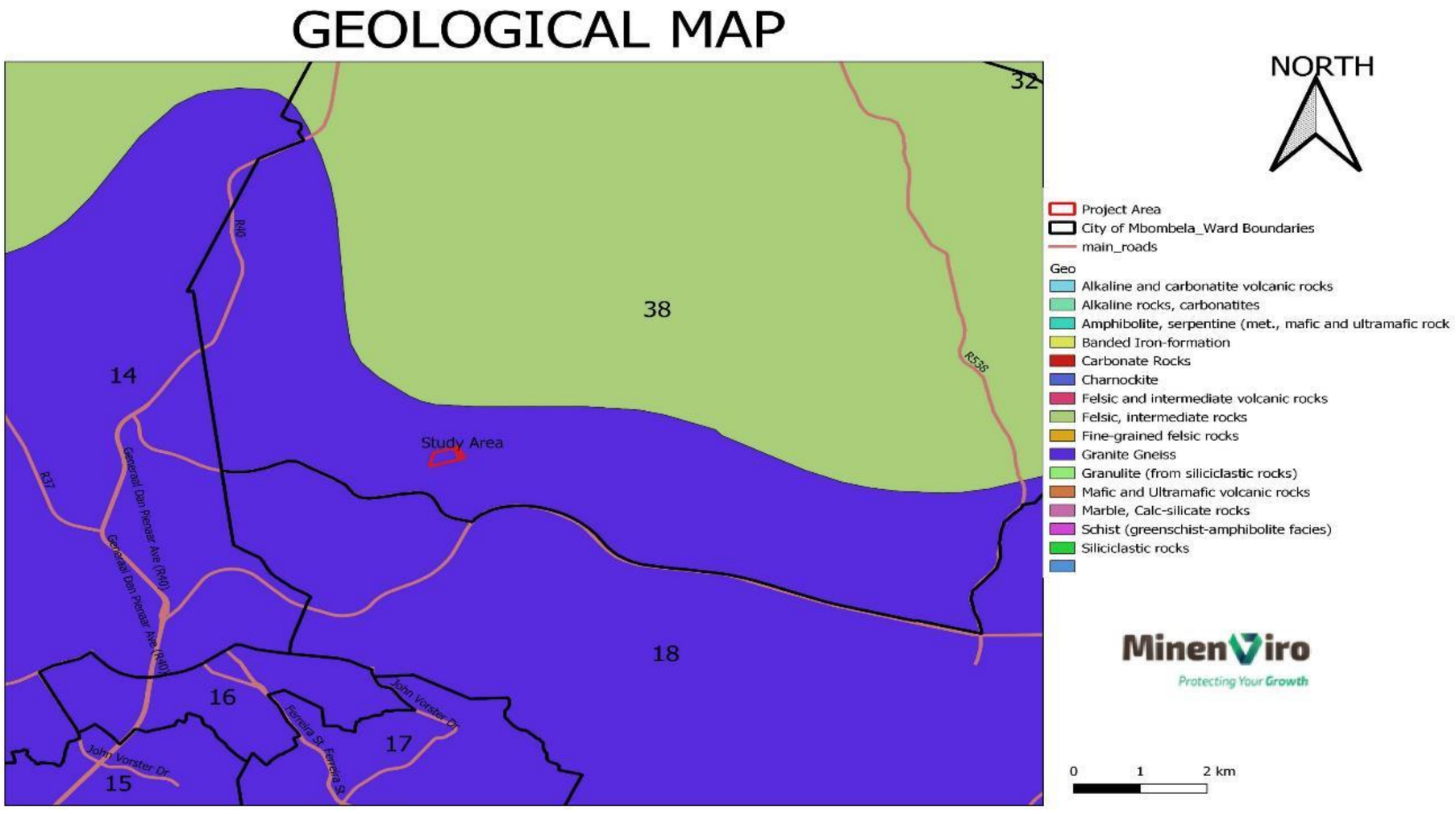


Figure 11: Site geology

9.2.1 Geological Specialist Input

9.2.1.1 Field Work

9.2.1.1.1 Trial Pits

The site investigation was carried on the 13th of January 2021 and lasted for a day. Fourteen trial pits were excavated using a TLB machine. Trial pits were excavated within the proposed school and the maximum depth reached was 1,6m below the surface. The soil profiles were described according to the standard method proposed by Jennings, Brink and Williams (1973).

Disturbed samples of the most prominent soil horizons were taken and submitted to a SANAS accredited soil laboratory for CBR and foundation indicators tests. The trial pits were loosely backfilled after profiling.

The position of the trial pits was determined with the aid of a hand-held GPS, the test holes profile is presented in Appendix A of the Geotechnical Report and its approximate location is indicated on a trial pits locality plan attached in Appendix C of the Geotechnical Report.

Table 13: Investigated area site photo logs

Photo Logs: UMP Student Accommodations	
	
	

9.2.1.2 Local geology

As shown in (Figure 12) the study area is entirely underlain by Znm (potassic gneiss and migmatite with some phenocrysts; strongly porphyroblastic; veined by granodiorite) belong to the Nelspruit suite.

Granite is a coarse-grained igneous rock composed mostly of quartz, alkali feldspar, and plagioclase. It forms from magma with a high content of silica and alkali metal oxides that slowly solidifies underground.

The soils are predominately sandy in the uplands with a low clay content, with clay soils in the bottom lands (Mucina and Rutherford, 2006). The main underlying rock formation is Quartz-feldspar rocks of the Makhutswi Gneiss (Swazian) domain.

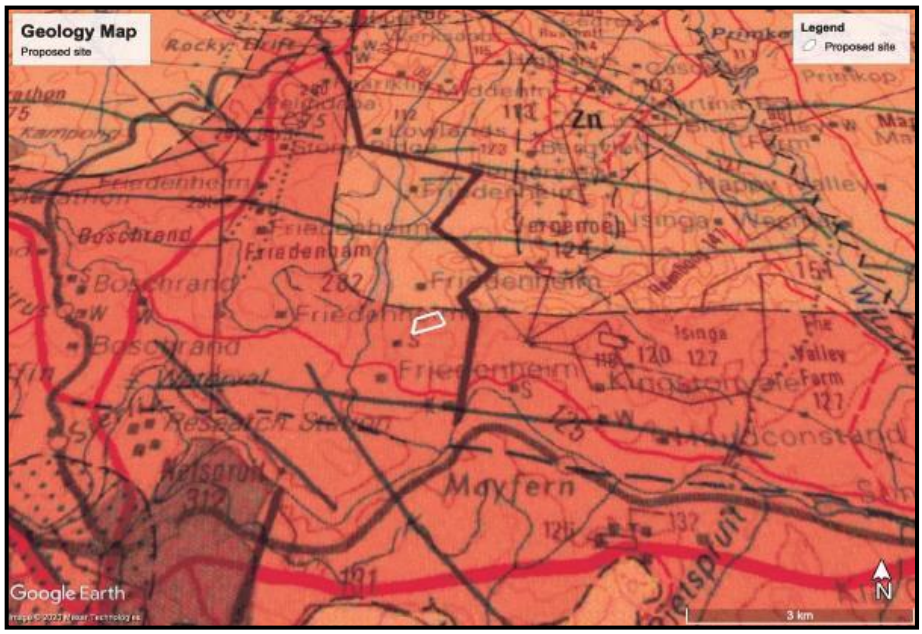


Figure 12: Site geological map.

9.2.2 Soil profile

Our interpretation of soil and groundwater conditions at the project site is based on information obtained at the test pits location only. This information has been used as the basis for our conclusions.

Descriptions of the various soil horizon as encountered in the test pits are given in the sub-sections below.

9.2.3 Colluvium

The colluvium horizon forms the most upper layers of the site. This horizon is characterised by slightly moist, dark reddish brown to grey, loose to medium in consistency and with intact structure, soil type was sandy gravel and gravelly sand with plants roots at some place. Material found here are loose, unconsolidated sediments that have been deposited either by gravity or downslope creep, or a variable combination of these processes.

9.2.4 Residual granite

The residual granite horizon was found just below the colluvium horizon. It is characterised by slightly moist, dark reddish brown to yellowish, medium dense to dense in consistency, intact, gravelly sand to sandy gravels with roots.

9.2.5 Weathered granite

The weathered granite was only encountered on trial pit (UM11) and is characterised by light grey weathered granite rock with coarse grained and medium hardness.

9.2.6 Granite bedrock

All trial pits end of hole was due to refusal on granite bedrock. It was described as light greyish, coarse grained and medium to hard granite.

8.1 Outcrops

The south eastern part of the site and few patches within the investigated site is covered by boulders and outcrops of granite. The granite found on site was described to be light greyish, coarse grained and very hard granite.

Figure 13: A photographs showing outcrops.

9.2.7 WATER LEVEL MEASUREMENTS

Groundwater was not encountered during test pits excavation or profiling. Maximum depth reached was at 1.6.m depth below ground level. It should be noted that groundwater levels determined during excavation may not accurately reflect the true groundwater conditions, and therefore should only be considered as approximate.

9.3 Agricultural Land Capability

Increased pressure on agricultural land for use other than agriculture makes it very important to protect especially high potential agricultural land for the exclusive use by agriculture. This is especially important if one takes into consideration the harsh environmental conditions of the country and the fact that only about 4 % of the country's land is regarded as high potential agricultural land.

The National Department of Agriculture, Forestry and Fisheries developed an Agricultural Land Capability system for the whole of South Africa. The agricultural land capability system and applicability thereof to CoM is briefly discussed below.

9.3.1 Agricultural Land Capability

Spatial economic planning, from a dry-land agricultural production perspective, is subjected to the capability and suitability of the natural environment to sustain adapted production systems. Land capability provides a framework that combines soil, terrain and climate factors to assess the most intensive long-term use of land for rain-fed agriculture and at the same time indicate the permanent limitations associated with the different land-use classes.

Agricultural land capability is the total suitability for use, in an ecologically sustainable way, for crops, for grazing, for woodland and for wildlife. The land capability groups, and applicable land use options are indicated in the table below:

Table 14: Land use options per capability group

Land Capability Group	Land Use Options
Arable	Wildlife, forestry, light grazing, moderate grazing, intensive grazing, poorly adapted cultivation, moderately adapted cultivation, intensive well adapted cultivation, very intensive, well adapted cultivation
Grazing	Wildlife, forestry, light grazing, moderate grazing
Wildlife	Wildlife

Accordingly, the following agricultural land capability categories in CoM are noted:

a) Approximately half of the municipal area consists of arable land which occurs in most parts of the southern region, along the escapement in the western parts of the municipality. Within the eastern settlement, arable land underlies in areas around Legogote, stretching down to areas around Mpakeni and Matsulu.
b) Approximately half of the municipal area consist of grazing land which stretches across the areas around Nelspruit, Karino, White River, Hazyview and Mjejane down to Luphisi.

c) Agricultural land capability is also categorised into high, medium, low, and very low. Accordingly, the following is noted:

- **High**: Land with a high agricultural capability is located at Kiepersol to the north, along the Crocodile River and its tributary to the west and in the areas around Kiepersol.
- **Medium**: The larger extent of the municipality contains land with a medium agricultural capability.
- **Low**: Land with a low agricultural capability is located in the Kruger National Park, Schoemanskloof, Ngodwana, at Pienaar, Matsulu, Daantjie, north-east of Legogote, Hilltop areas along the R40, and the western & southern escarpments of the municipality.
- **Very Low**: The land with a very low agricultural capability coincides with the mountainous areas.

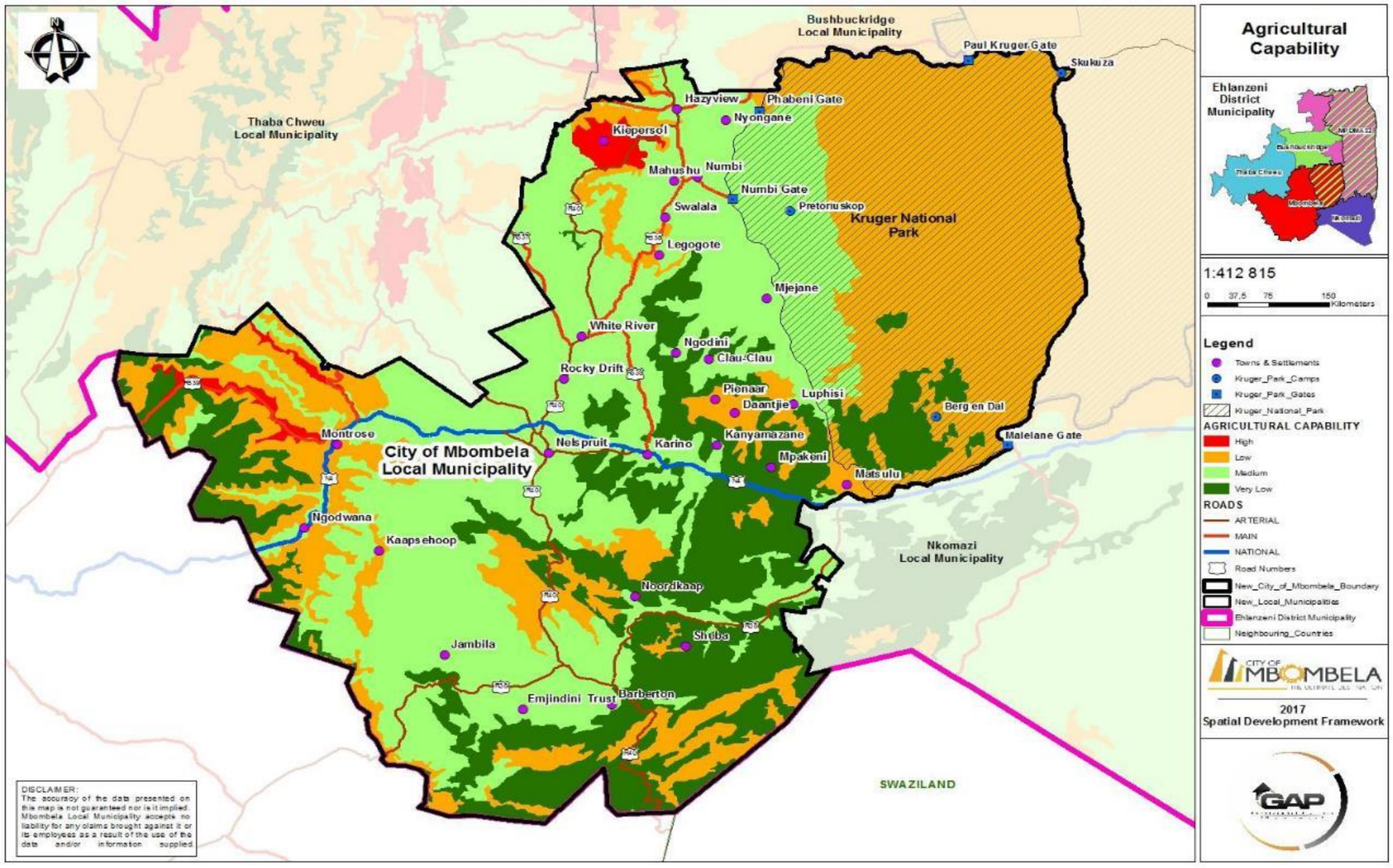


Figure 14: Agricultural land capability map (Source: CoM SDF)

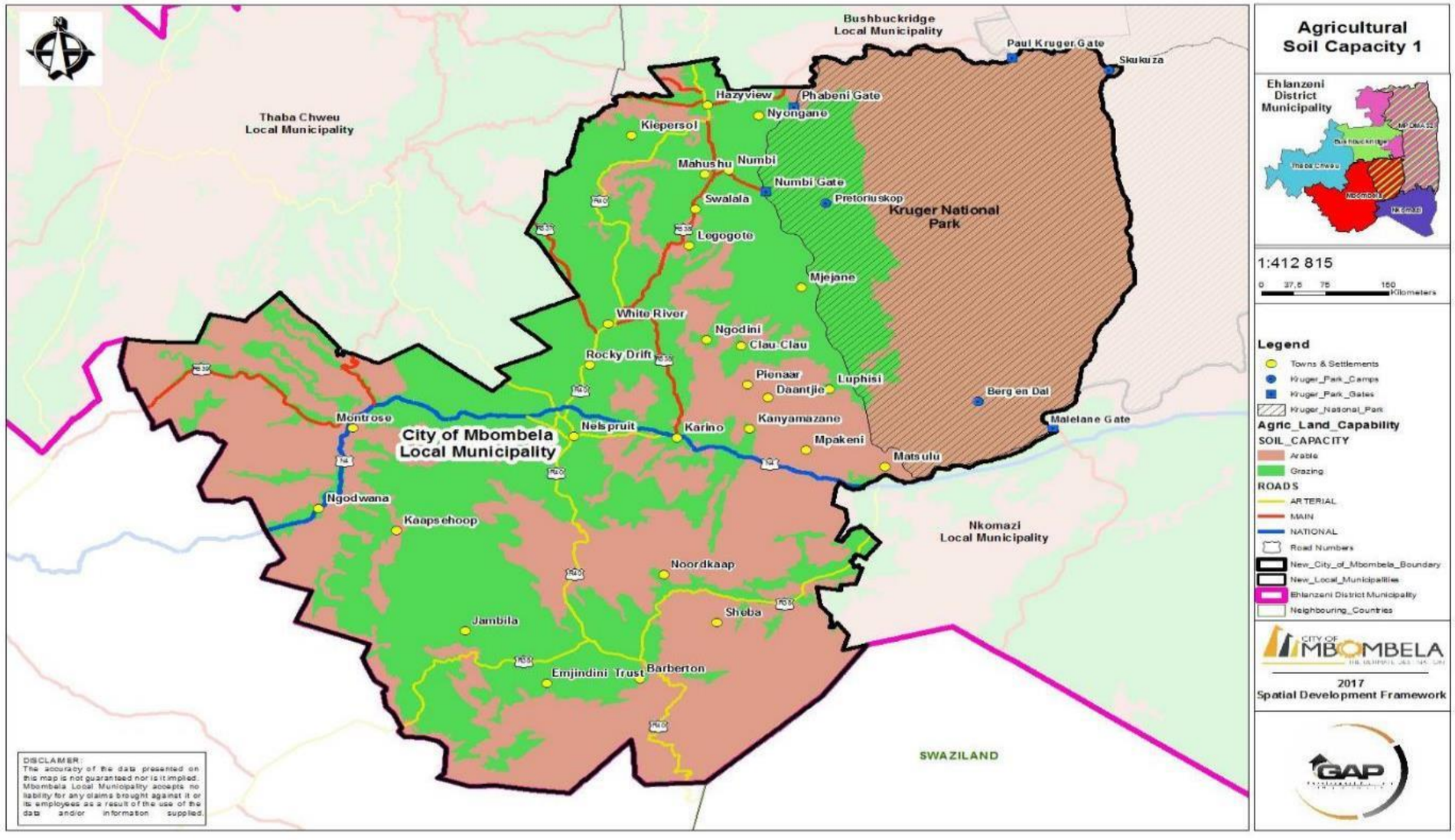


Figure 15: Agricultural soil capability (Source: CoM SDF)

9.4 Hydrology

The City of Mbombela is situated within four sub-catchments that's constitutes the main Nkomati River catchment area. The four major sub-catchments are the following:

a) Crocodile River catchment area
b) Sabie-Sand catchment area
c) Noordkaap River catchment area and the
d) Suidkaap River catchment area

The Crocodile River runs in a west-east direction across the middle of the municipality and the Sabie River runs in a west-east direction along the northern boundary of the municipality.

The Elands River, running south-east to north-west, is the main tributary flowing into the Crocodile River. The North Sand River, running north-south, is the main tributary flowing into the Sabie River.

The southern region of CoM disposes of the Noordkaap River, the Suidkaap River, Queen's and Fig Tree Creek feeding the Kaap River, the Mtsoli River and Mlumati River, flowing towards the Indian Ocean. The catchments of the rivers determine the respective landscapes for tourism, timber growing and agriculture.

The main dams in CoM include: Longmere; Ngodwana; Da Gama; Klipkopje; Primkop and Shiylongubo Dam

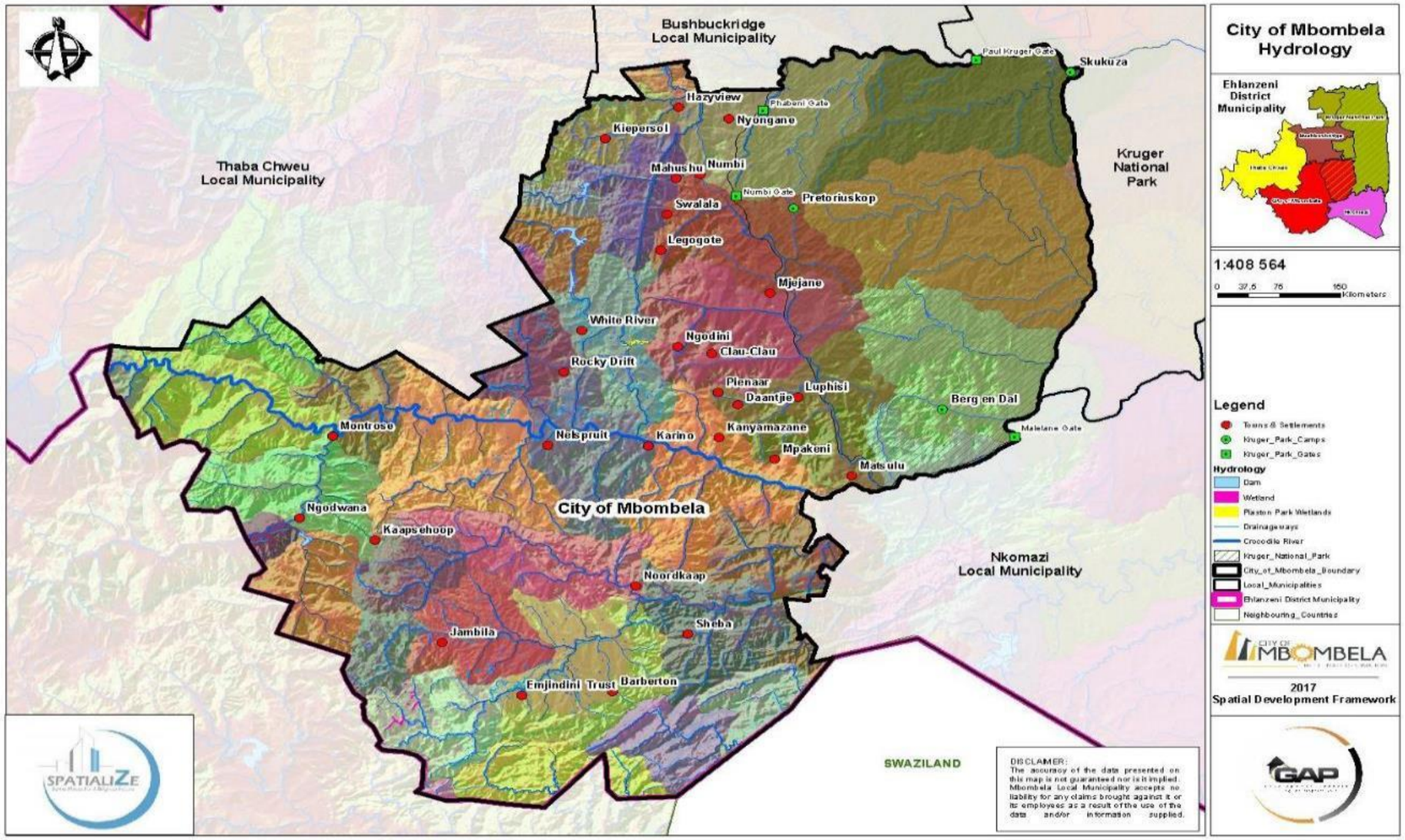


Figure 16: Open water bodies and hydrology (Source: CoM SDF)

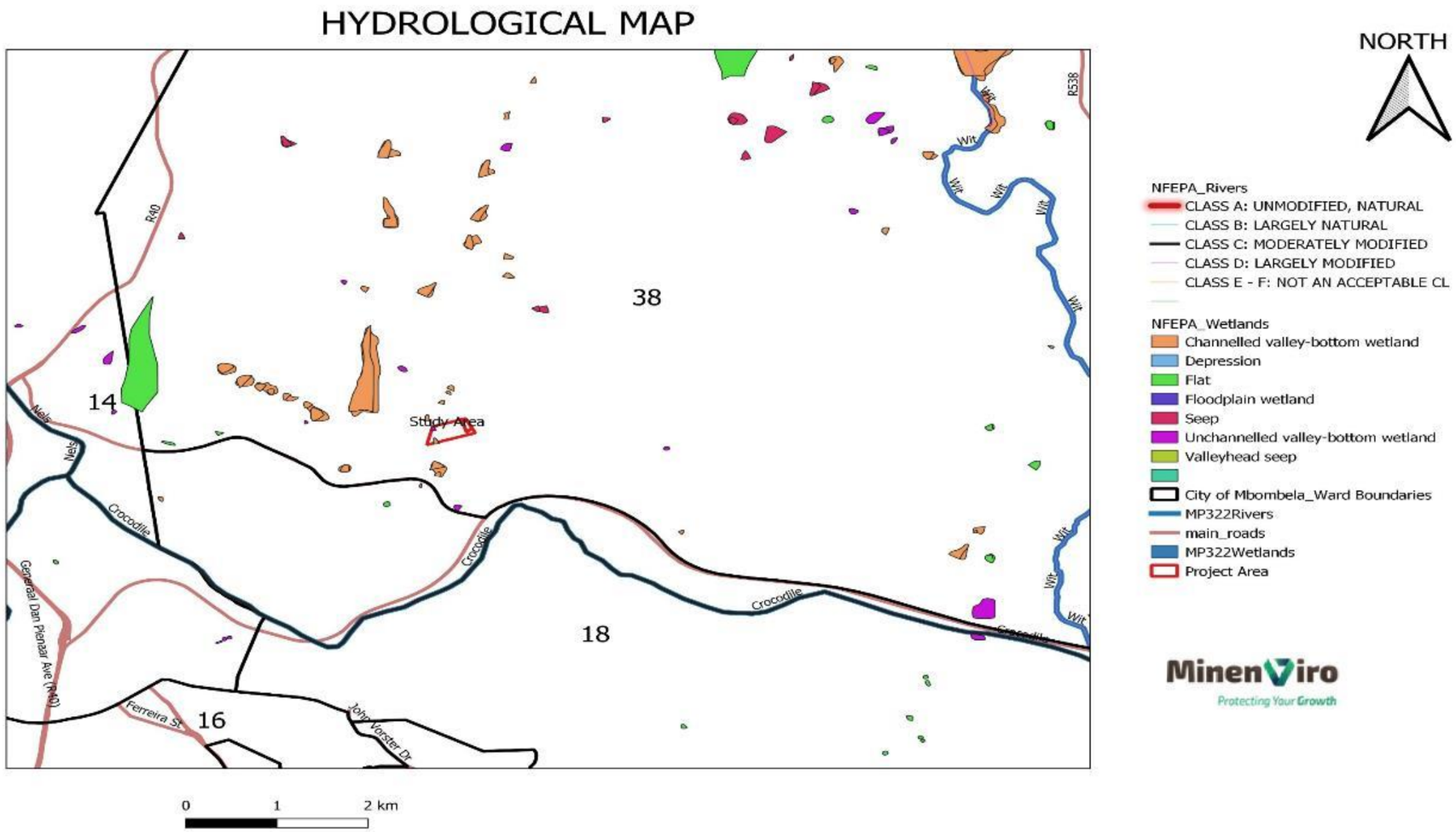


Figure 17: NFEPA wetlands and rivers

9.4.1 Regional Hydrology

The project site is located almost at the centre of the secondary catchment X2 more specifically within the X22J quaternary catchment drained by the identified small tributaries which will eventually drain in the Crocodile River. The project is located in the Crocodile River drainage system. The surface water attributes of the X22J quaternary catchment are summarised in **Error! Reference source not found.**~~Table 3-3-4~~. This includes the Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), and Mean Annual Evaporation (MAE) as obtained from the Water Resources of South Africa 2012 Study (WR2012).

Table 15: Summary of the Surface Water Attributes of the X22J Quaternary Catchment

Quaternary Catchment	Catchment Area km²	MAE (mm)	Evaporation Zone	Rainfall Zone	MAP (mm)	MAR (Mm³)*
X22J	174,2	1800-2000	5A	W	761	69.4

9.4.2 Local Hydrology

The project site is within the Crocodile River catchment and close to the National Freshwater Ecosystem Priority Areas (NFEP) wetland of the Crocodile wetland. Crocodile is a perennial river system.

The proposed site is encroaches an unnamed dam or wetland comprised of both unchanneled and channelled valley bottom which is NFEPA demarcated wetland (SANBI, 2011) which is natural and artificial (due to modified surface).

From the Local hydrology map, it is evidenced that the proposed site is close to the dam/wetland which runs on the south western edge of the proposed site. The section in close proximity of the proposed site encroaches this dam and small tributary section that has been demarcated as the National Freshwater Ecosystem Priority Areas NFEPA) wetlands.

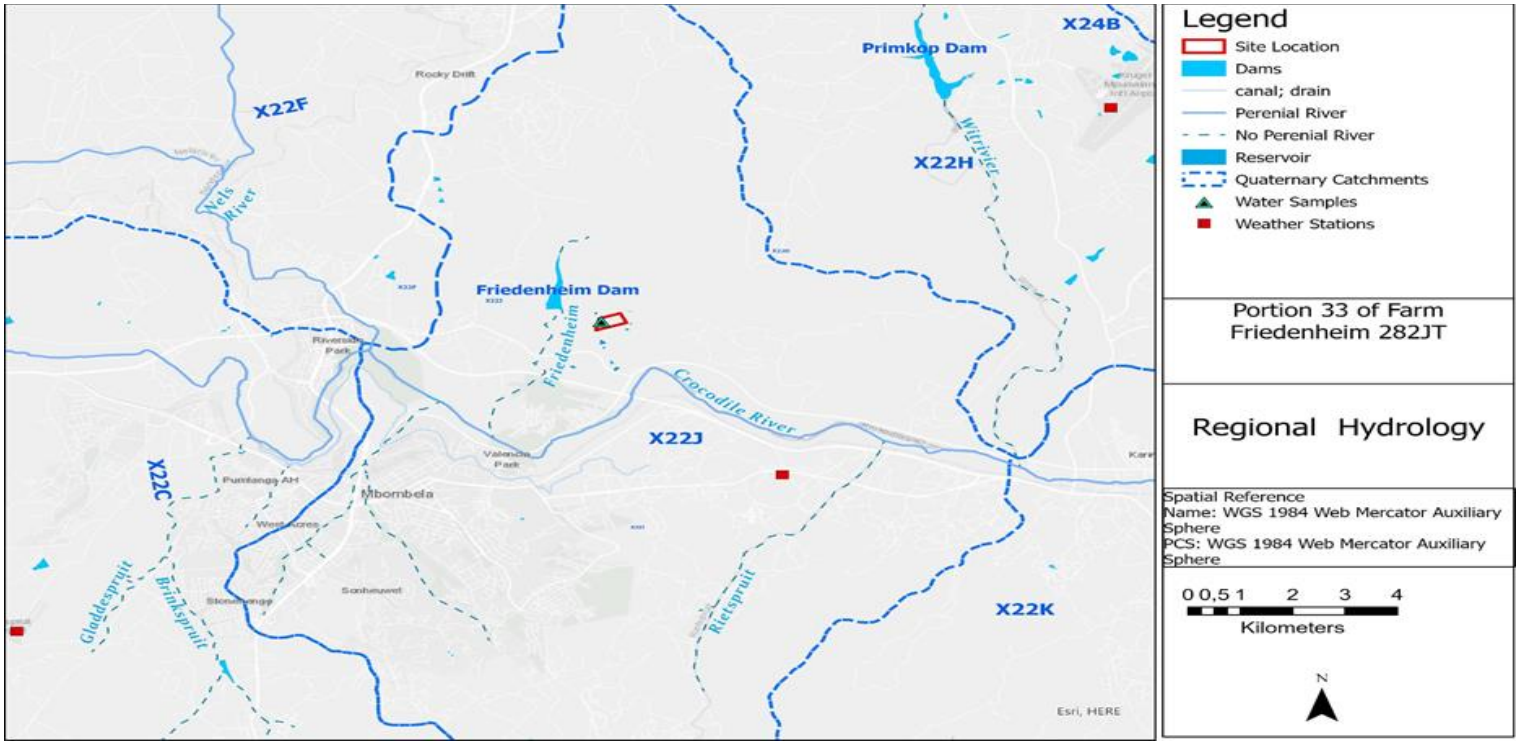


Figure 18: Regional hydrology

Figure 19: Local hydrology

9.4.3 Floodline Results

The site is prone to floods on the areas close to the small tributary as can be depicted on Figure 20~~Figure 20~~. Steady state flood modelling was undertaken which is a conservative approach as it ignores the effect of storage within the system and therefore produces higher flood levels than would be expected to occur in reality. A steady state modelling will result in worst case (conservative) estimates of flooding, and resultant flood levels and floodplain extents would decrease if unsteady state modelling were undertaken using an inflow hydrograph as opposed to continuous peak flow.

Formatted: Font: 11 pt

Despite the above mentioned, the manning coefficient being large due to heavy presence of weeds in the channels, and the low resolution topographic data, the flood risk to the surface infrastructure has been adequately assessed on the Project Stream tributary, therefore; given that the flooding extent will mostly be utilised as green areas/parks in the site plan, and houses should be ensured that they are all outside the conservative estimate of flood-lines and the 100 m buffer, no further flood modelling work is considered necessary. It would only be considered necessary when more detailed topographical data is available and there is need to increase the area available for use for housing as well as development of flood control measures / embankments.

It is recommended that detailed design studies be undertaken in more detail for design purposes of road and that any supporting structures located within the flood-lines are designed to withstand the flow velocities. This will necessitate more detailed elevation data to a good resolution even up to 0.5 / 1m.

Figure 20: 1:100 Year Floodlines

9.5 Climatic Conditions

Most parts of the municipality have an average summer temperature of 23.60°C and this includes places such as Nelspruit, White River, Hazyview, Barberton and other areas in the eastern parts of the municipality. Matsulu, Luphisis and Lowsckereek & surroundings are the paces with high summer temperatures averaging at 260 Lower summer's temperatures are evident in the western and southern escarpments of the municipality in places such as Kaapsehoop, Ngodwana, Baberton, and Jambila. Most parts of the municipality have winter temperatures averaging between 140 – 170.

9.5.1 Annual Rainfall

The geographic distribution of rainfall in CoM is depicted in the map below and the following is noted:

- The highest rainfall (1104-1400>mm) is recorded in the areas surrounding Ngodwana, Kaapsehoop, Elandshoek to the west, some parts of the southern escarpment and north-west of White River town.
- The eastern areas receive the lowest annual rainfall between 400–600mm

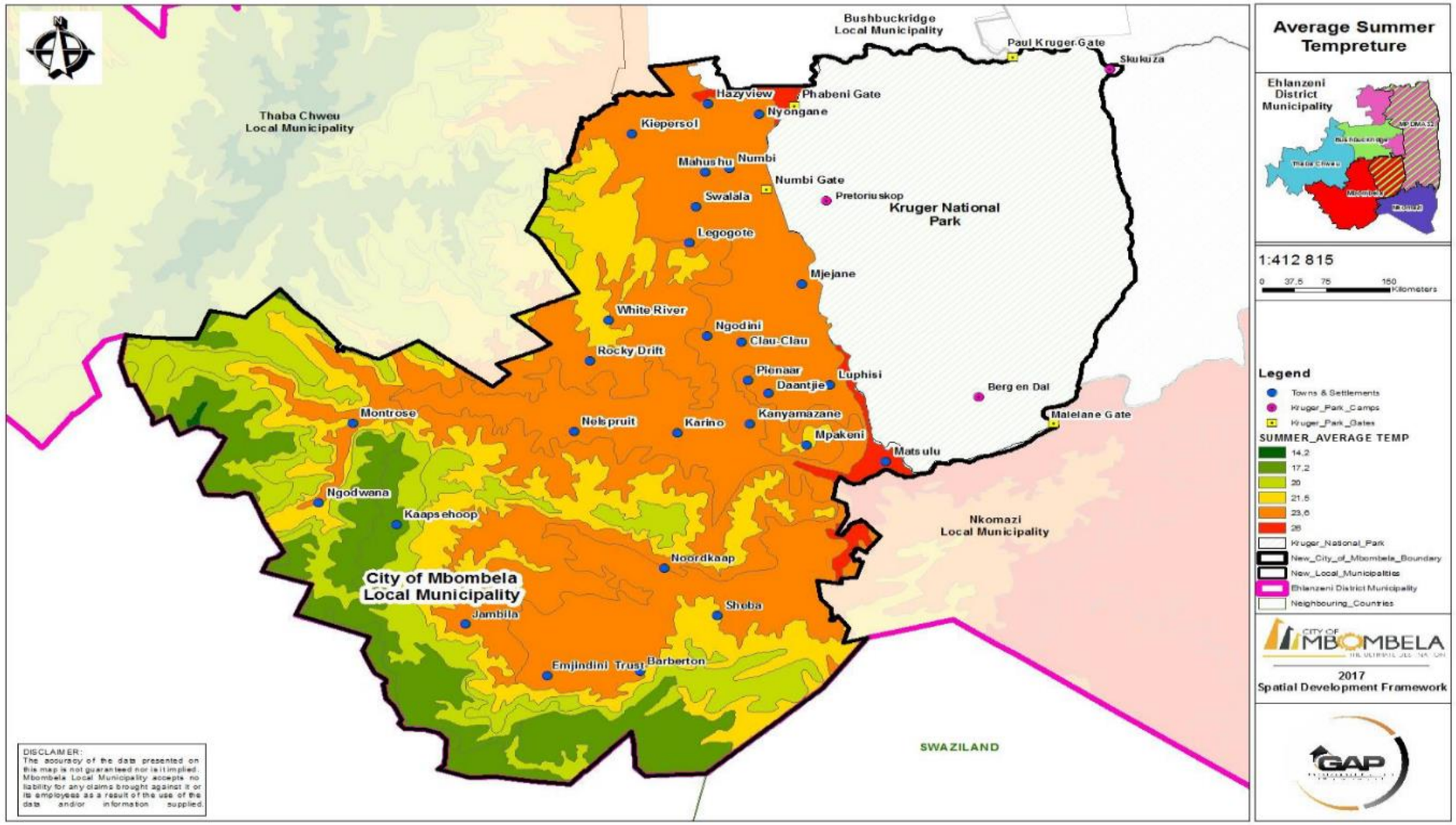


Figure 21: Average summer temperatures (Source: CoM SDF).

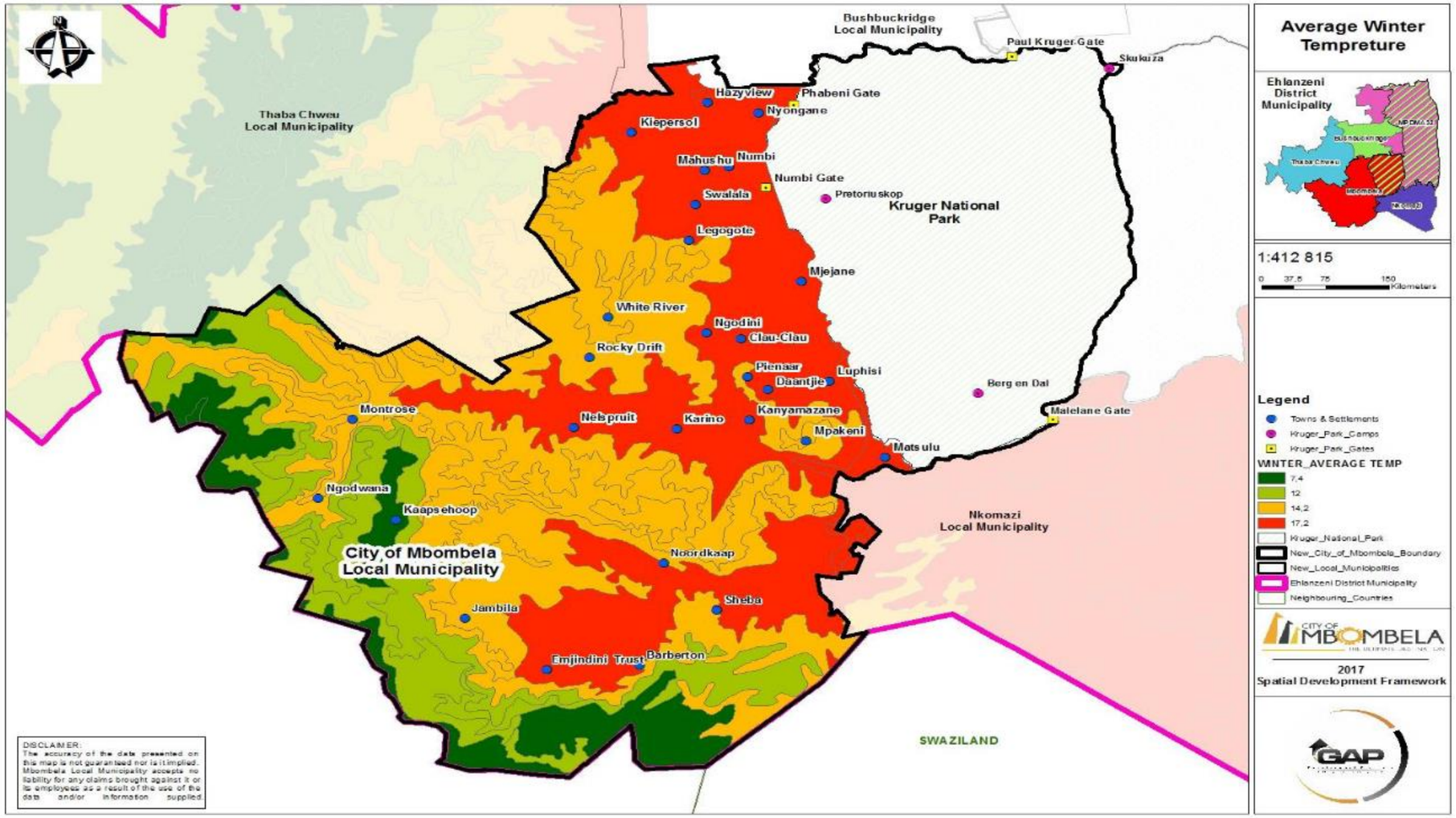


Figure 22: Average winter temperatures (Source: CoM SDF)

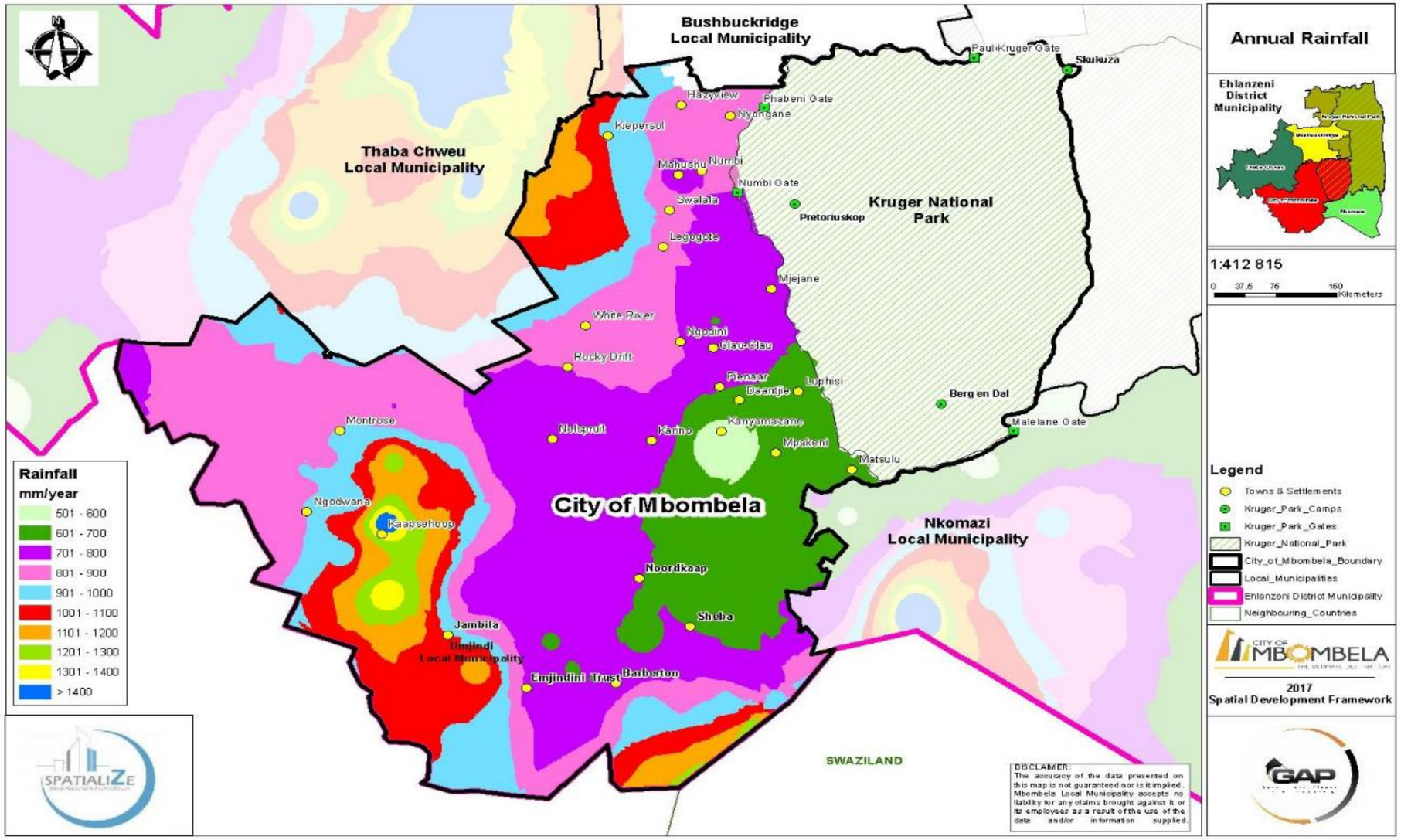


Figure 23: Annual rainfall (Source: CoM SDF)

9.6 Biodiversity and Ecosystems

The Critical Biodiversity Areas (CBAs) map for the City of Mbombela was produced using the Mpumalanga Biodiversity Conservation Plan (MBCP), a spatial plan that groups the province's biodiversity assets into six conservation categories based on the measured distribution of hundreds of biodiversity and ecological features throughout the province. Evident from the biodiversity as illustrated on the map below are the following revelations:

a) Irreplaceable areas mainly include the Crocodile Gorge and western escarpment areas stretching from Elandshoek to Kaapsehoop, with a few patches scattered in Schoemanskloof and Mpakeni. In the southern region irreplaceable areas stretches across the songimvelo-mountainlands-barberton nature reserves.
b) CBA optimal areas are predominantly found in Mpakeni, Noordkaap and Umjindini Trust with patches scattered around the entire municipal area.
c) Landscape and local corridors are predominant in the area between Mpakeni and Noordkaap and Sheba

9.6.1 Specialist Findings

9.6.1.1 Floral Species

The table below shows the kind of plants observed as well as those expected to be seen, during the walk through the investigation site and note that some of the plants observed are classified as alien or invasive plant species and are therefore categorized accordingly. The table below was generated after taking into consideration the Mpumalanga vegetation map for the expected versus the observed. Please note that some plant species can be recorded as not observed while they are grown within the tree thicket and dominance affected, therefore all-season's observation might be required to fully exhaust the list of plants or even animals likely to be seen on site.

Table 16: List of Plant Species Observed and Expected on Site.

Common name	RSA Tree Number	Scientific name	Conservation status (RED List)	Observed or Not (O/N)
Paper bark acacia	187	*Vachellia siebriana*	Least concern & indigenous	O
Cycad		*Dioon spinulosii*	Endangered	O
Giant reeds	Grass	*Arundo donax*	Least Concern	O
Bulrush	Grass	*Typhae capensis*	LC	O
Mace Sedges	Grass	*Currex greyii sedges*	LC	O

White flowered wild banana	32	*Strelitzia alba*	LC	O
Scented Thorn	179	*Acacia nilotica*	LC	N
Splendid Acacia	183	*Acacia robusta*	LC	N
Fever Tree	189	*Acacia xanthophloea*	LC	N
Baobab	467	*Adansonia digitata*	Protected	N
Jacaranda tree		*Jacaranda mimosifolia*	Vulnerable	O
Tree Wisteria	222	*Bolusanthus speciosus*	LC	N
Shepherd's Tree	122	*Boscia albitrunca*	Protected	N
African Teak	684	*Breonadia salicina*	LC	N
Agave or fox tailed agave		*Agave attenuatta*	LC	O
Wild Syringa	197	*Burkea africana*	Not listed	N
White Cat's Whiskers	667	*Clerodendron glabrum*	LC	N
Mopane	198	*Colophospermum mopane*	LC	N
River Bushwillow	536	*Combretum erythrophyllum*	LC	N
Leadwood	539	*Combretum imberbe*	Protected	N
Velvet Bushwillow	537	*Combretum molle*	LC	N
Large-fruited Bushwillow	546	*Combretum zeyheri*	Least threatened	O
Wild Mango	216	*Cordyla africana*	LC	N
Lavender Feverberry	328	*Croton gratissimus*	Least threatened	N
Jackal-berry	606	*Diospyros mespiliformis*	Not specifically protected	N
Wild Pear	471	*Dombeya rotundifolia*	Least Threatened	N
Transvaal Milkplum	581	*Englerophytum magalismontanum*	LC	N
Wooden Banana	293	*Entandrophragma caudatum*	LC	N
Coral Tree	245	*Erythrina lysistemon*	LC	N
Ana Tree	159	*Faidherbia albida*	Protected	N

Large-leaved Rock Fig	63	*Ficus abutilifolia*	LC	N
Sycamore Fig	66	*Ficus sycomorus*	LC	N
African Rock Fig	64	*Ficus glumosa*	LC	N
Red-leaved Rock Fig	55	*Ficus ingens*	LC	N
Lavender Tree	455	*Heteropyxis natalensis*	LC	N
Wild Pride-of-India	523	*Galpinia transvaalica*	LC	N
Sausage Tree	678	*Kigelia africana*	LC	N
Mountain Syringa	269	*Kirkia wilmsii*	LC	O
Apple-leaf	238	*Lonchocarpus capassa*	Protected	N
Transvaal Red Milkwood	585	*Mimusops zeyheri*	LC	N
Weeping Wattle	215	*Peltophorum africanum*	Not threatened	N
Kiaat	236	*Pterocarpus angolensis*	LC	N
Quinine Tree	647	*Rauvolfia caffra*	Protected	N
Weeping Boer-bean	202	*Schotia brachypetala*	LC	N
Marula	360	*Sclerocarya birrea*	Protected	N
Lowveld Chestnut	475	*Sterculia murex*	LC	N
Water Berry	555	*Syzygium cordatum*	LC	N
Toad Tree	644	*Tabernaemontana elegans*	LC	N
Transvaal Silverleaf	551	*Terminalia sericea*	Not Listed as threatened	N
Buffalo Thorn	447	*Ziziphus mucronata*	LC	N
Date Palm tree		*Phoenix rupicola*	LC	O

Adopted from DAFF

Plants Found on Site in pictures

Figure 24: Date Palm Tree behind the buildings

Figure 25: Setaria sphacelate grass observed on site

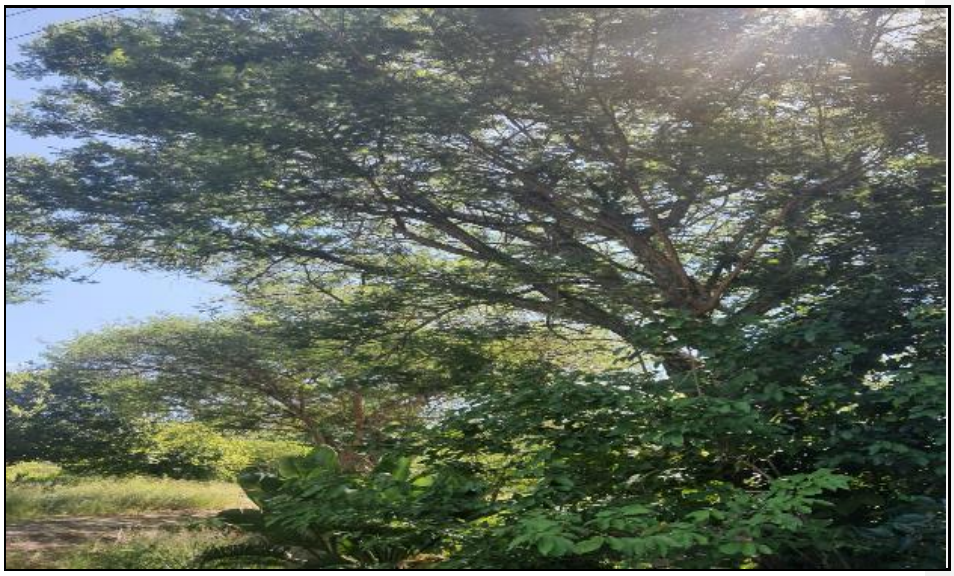


Figure 26: Mature Paper bark acacia trees with wild banana and common guava trees as undergrowth

Figure 27: Wild Banana Plant (Strelitzia spp)

Figure 28: Lower portion close to the watercourse where grass dominates the open spaces

Figure 29: Typhae and sedges growing on wet soils of the water-course margins

Figure 30: Eragrotis grass spp

Figure 31: Sporobolus fimbriatus grass spp

Figure 32: Dioon spinulosii and agave attenuate (marked with arrows)

Figure 33: Elephant grass (Pennisetum purpureum napiergrass)

Figure 34: Litchi tree (Litchi chinensis)

Figure 35: Giant aloe (Aloe bainesii)

Figure 36: Guinea grass (Megathyrsus maximus)

9.6.1.2 Conservation status

The status of all veld-types in the greater study area is least threatened (LT) or classified from the Mpumalanga Biodiversity and Conservation Plan (MBCP) as endangered from the ecosystem status map. There are riparian belts and aquatic habitats in the vicinity (www.bgis.sanbi.org/LUDS). The table below gives a basic description of the status categories. 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).

The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process. This includes the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011) (SANBI).

Table 17: Ecosystem Status: Simplified Explanation of Categories used

Status	**Percentage 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 veld-type	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 veld-type. In other words, because the composition, recovery rate, etc. differs for each veld-type 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 veld-type is critically endangered.

The major plant species identified during field investigations are listed in the photographs that follow. During field investigations no red data listed (RDL) species where observed. A final and comprehensive walk through will be required prior to commencement with the Student Accommodation development project construction activities to conduct a search and rescue operation.

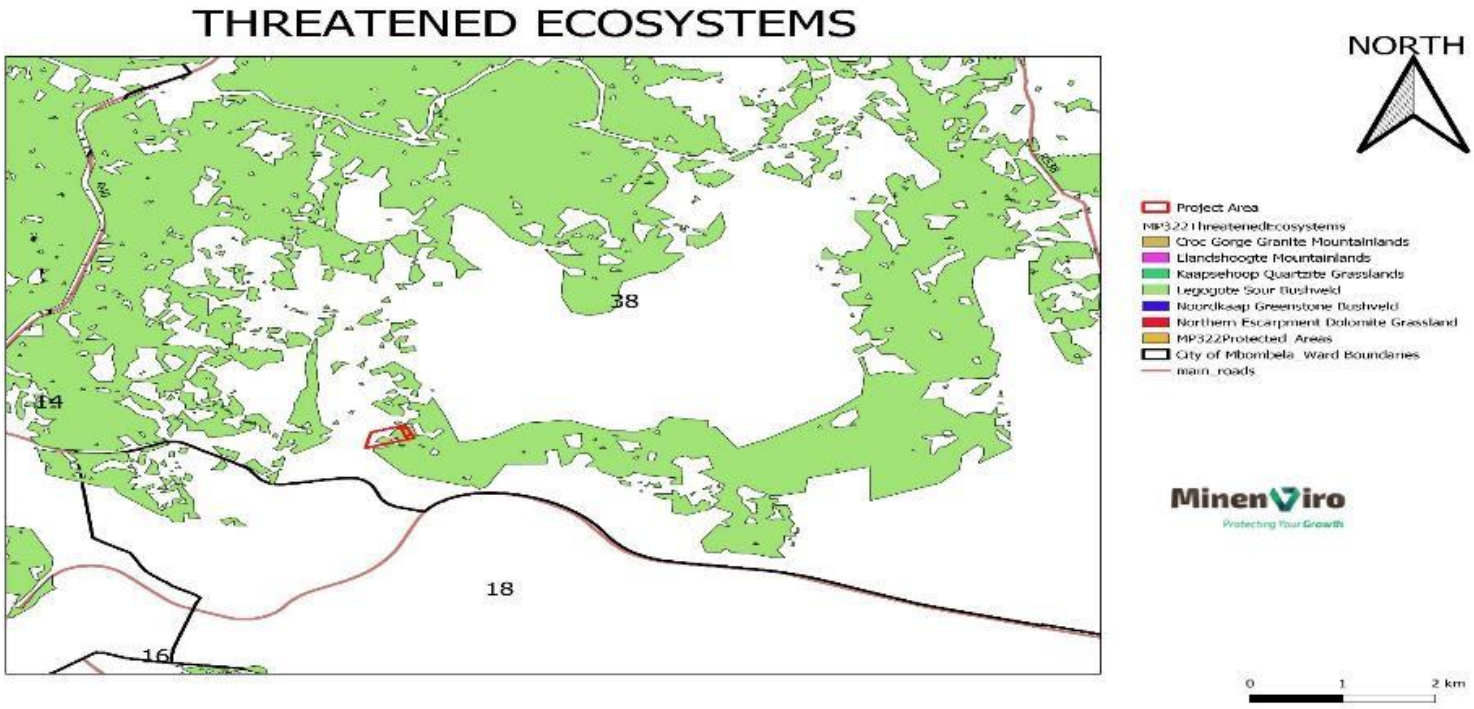


Figure 37: Threatened ecosystems within the study area

9.6.2 Alien plants identified in the Study Area.

The Department of Environmental Affairs defines invasive alien plants as plant species that are exotic, non-indigenous or non-native to an ecosystem. Due to the lack of natural enemies and the resistance to local diseases, these plants tend to spread aggressively, which then threatens biodiversity, reduce water availability, and increase the risk and intensity of wildfires. The Alien and Invasive Species Regulations of the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) regulates all invasive organisms in South Africa and categorizes invasive plant species into four different categories: Category 1a & 1b, Category 2 and Category 3. These categories of IAP's need to be controlled or removed from areas where they may cause harm to the environment or where they are prohibited. In South Africa there is a total of 383 invasive plant species that must be controlled, and these species are listed in the NEMBA Alien and Invasive Species list of 2016.

A few alien invasive plant species common to the area and province are present in the study area. The alien plant species encountered in the study area are recorded, along with their category rating, in table below. Although there are invasive alien species present there are not many areas of significant encroachment or serious infestation. Most invasive species are within disturbed areas. A specific invasive species monitoring, and management programme should be designed and followed to enable the management of these plants especially during construction and operation of the student accommodation area.

Table 18: Alien Plant Species Observed on Site

Botanical Name	**Common Name**	**Category**
Arundo donax	Giant reeds	1b
Mexican merigold	Marigold	1b
Bidens pilosa	Blackjack	1b
Psidium guajava	Common guava	1b

Figure 38: Giant Reeds- Arundo Donax

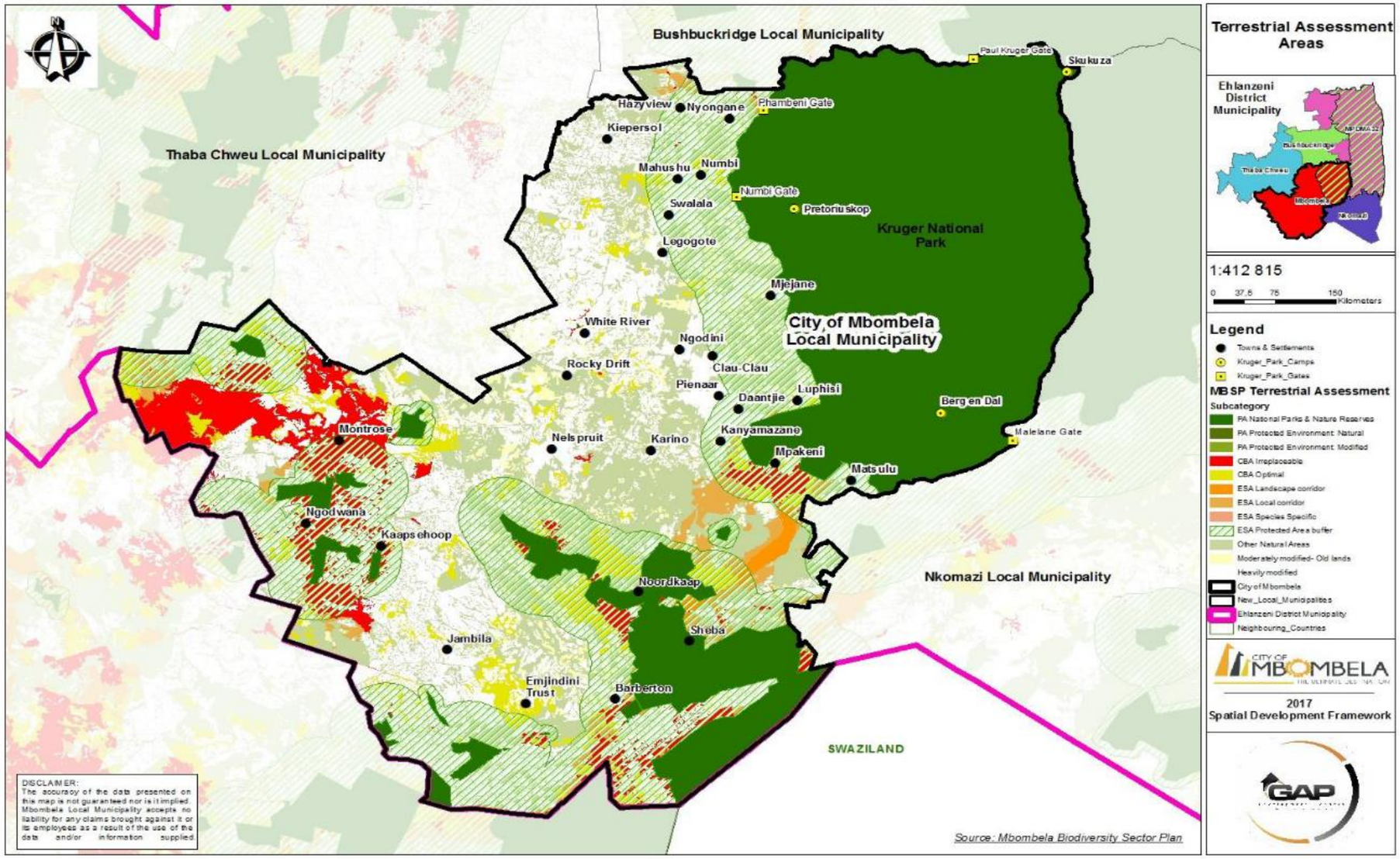


Figure 39: Terrestrial biodiversity assessment (Source: CoM SDF)

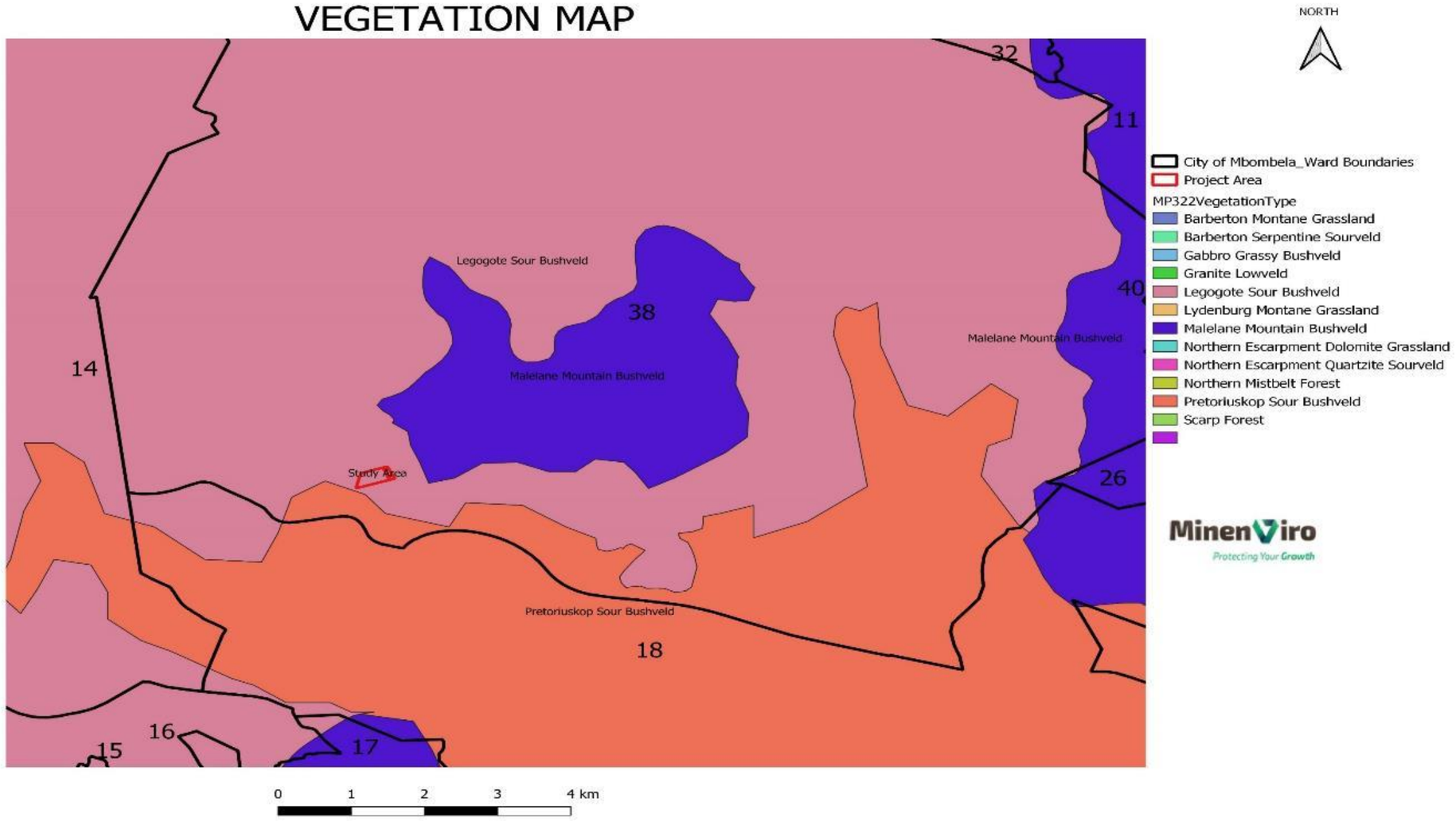


Figure 40: Vegetation in the study area

9.7 Fauna

During field investigations only a few birds were observed, small mammals' holes and droppings were seen on site. The table below indicates the animals seen on site and those expected to be seen.

Table 19: Fauna Observed on Site

Biological Name	Common Name	Red Data Status	Habitat Type	Habitat Restrictions
Mammals				
Bos taurus	Cattle	Least concern	Not specific (domesticated)	None
Rodentia rattus	Rats	Pests	Not specific (organic waste areas)	None
Avifauna				
Streptopelia roseogrisea	*African* Collared-*Dove*	Least concern	Tree branches	On Mature vascular trees found on dry landscape
Red-billed weaver	Quillea birds	Least concern	Grass seed producing plants	None

9.8 Sensitivity Mapping

The sensitivity mapping system is used to mark areas which are perceived to be sensitive around or in the vicinity of the project development area. These zones which are deemed sensitive should be avoided when project implementation and operation occur, or some precautionary measures need to be partaken to minimise the impacts of the project development (Construction and operation). Some of the mitigation measures are therefore highlighted in this report as well as the Environmental Management Programme (EMPr). Some of the areas to be avoided or treated with care are watercourses, wetlands, riparian belts, granite rock outcrops and buffer zones as they are classified and/ or deemed sensitive. These are areas with sensitive species (biodiversity),

sensitive habitats and their disturbance or human interference can destabilise the natural ecological recovery patterns or its natural system of operation

The following is the unedited sensitivity map for the Mpumalanga University Student Accommodation Project in Mbombela without buffer zones for the riparian area as well as the granite rock outcrop which are all included in the figure that follows. The construction of the proposed student accommodation should avoid the two buffer zones as well as concentrating on minimising vegetation clearance on unauthorised areas (only on marked footprint area). Mature vascular trees should also be spared unless they are within the footprint area.

Figure 41: University of Mpumalanga Student Accommodation Sensitivity Map

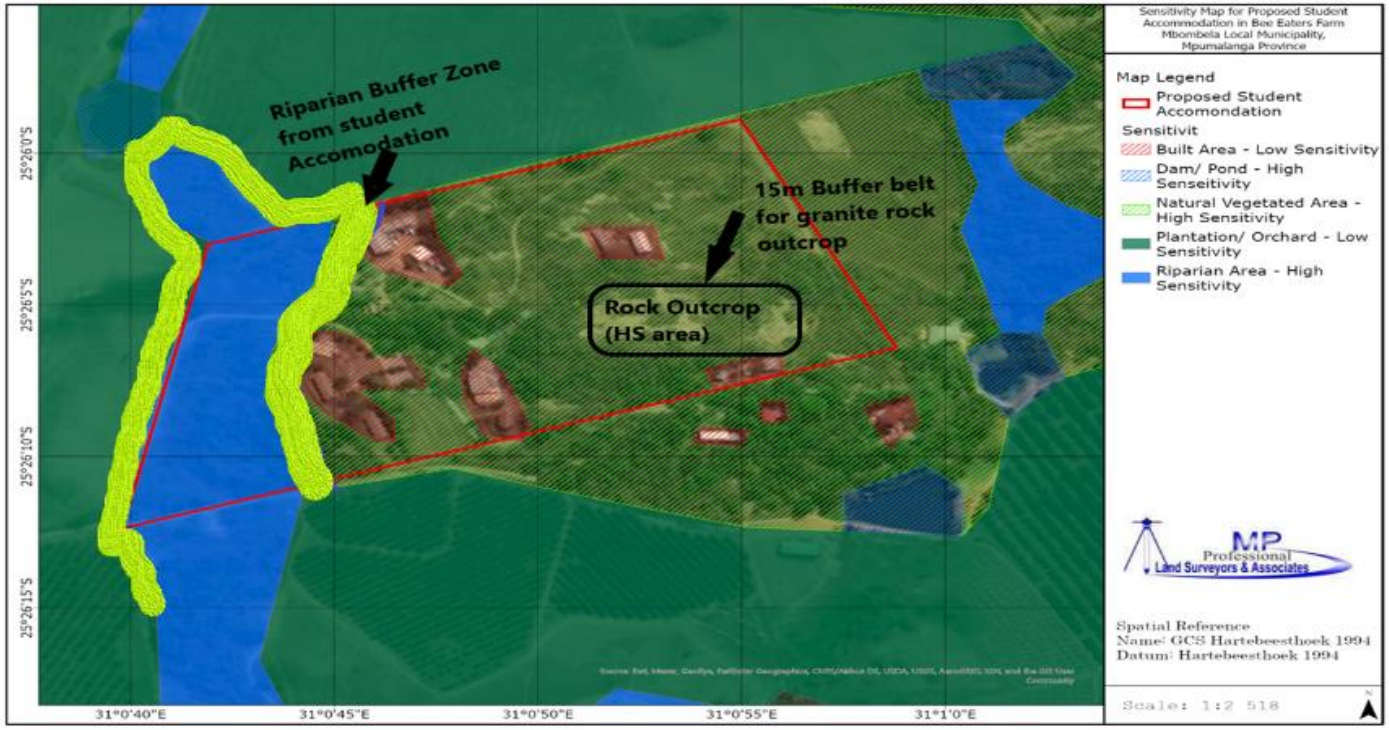


Figure 42: Sensitivity map with highlighted buffer zones (yellow and Black)

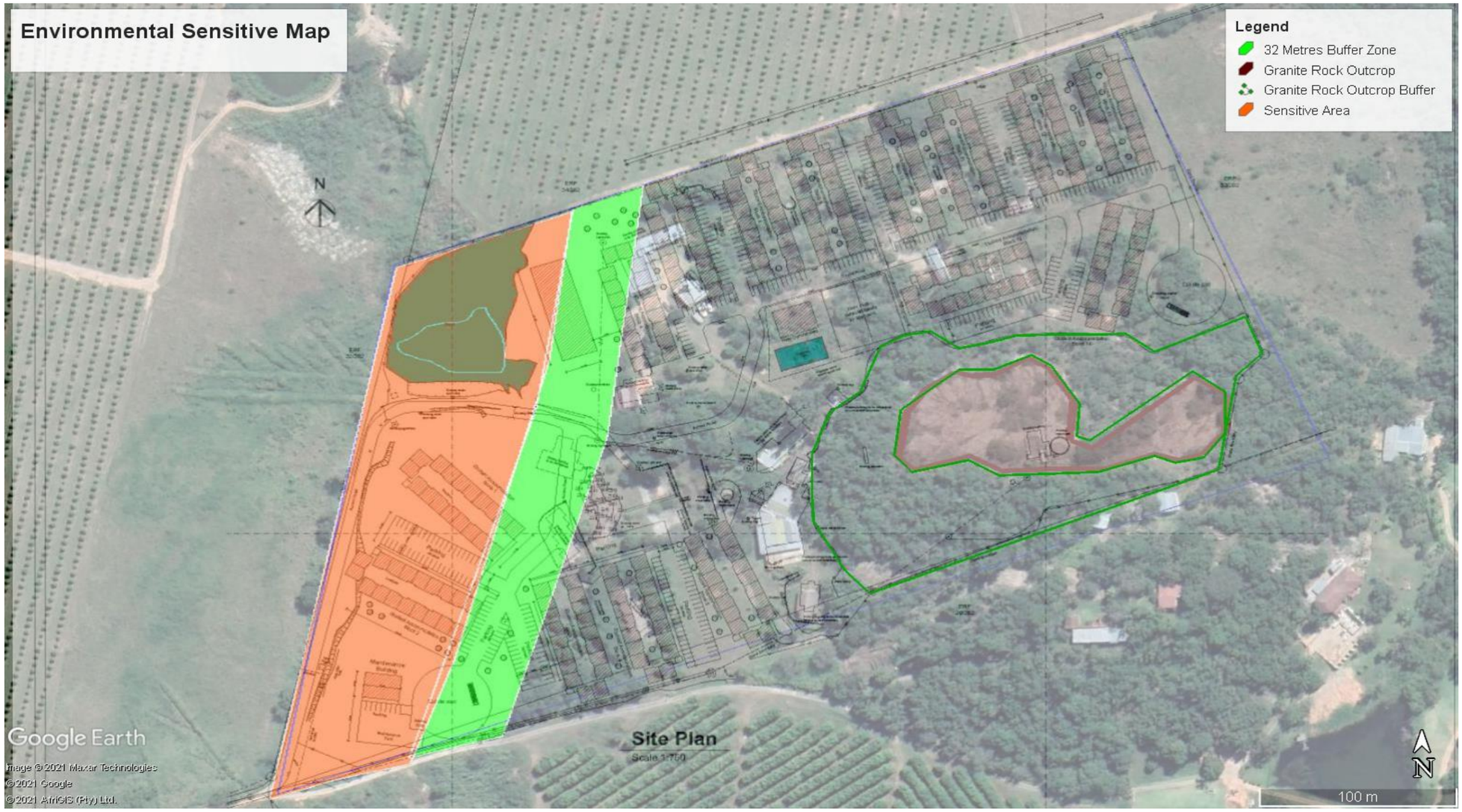


Figure 43: Superimposed environmental sensitivity map

9.9 Socio-Economic Environment

The socio-economic environment reflects the relationship between population requirements and the natural resource base. In other words, the distribution of the population is directly influenced by the bio-physical environment

9.9.1 Population Size & Growth

According to the Community Survey 2016 conducted by STATSSA the current population of the City of Mbombela is estimated to be **695 913.** This population constitutes 39.6% of the entire population of Ehlanzeni District.

Table 20: Total population

	2011	**2016**	**2030**	**Growth Rate**
Total Population	655 950	695 913	965 877	2.4%

The City of Mbombela has recorded an annual population growth rate of 2.3% per annum between 2001 and 2011 (Stats SA, 2011). However, between 2011 and 2016 an annual population growth rate of 1.2% was observed. The projected population of the City of Mbombela for the year 2030 is estimated to be **956 877**.

9.9.2 Population Distribution

The larger portion of Mbombela's population live in peri-urban and rural areas. About 75% of the people live within communal areas on the eastern axis of the City of Mbombela which is far from the economic centres.

9.9.3 Age and Gender Composition

Table 21~~Table 21~~ below illustrate the age and gender composition of the City of Mbombela

Formatted: Font: 11 pt

Table 21: Age and gender composition (Source: StatsSA)

Description		**2011**	**%**	**2016**	**%**
Age Composition	0-4	73227	11.16	85580	12.34
	5-9	59700	9.10	72570	10.47
	10-14	61143	9.32	64958	9.37
	15-19	66603	10.15	61567	8.88
	20-24	73182	11.16	66692	9.62
	25-29	70578	10.76	70971	10.24
	30-34	52383	7.99	59663	8.60
	35-39	45831	6.99	50329	7.26

Description		2011	%	2016	%
	40-44	36840	5.62	40935	5.90
	45-49	31968	4.87	34118	4.92
	50-54	23577	3.59	24703	3.56
	55-59	19578	2.98	18416	2.66
	60-64	13710	2.09	15646	2.26
	65-69	8997	1.37	10351	1.49
	70-74	7686	1.17	7739	1.12
	75-79	4560	0.70	4309	0.62
	80-84	3444	0.53	2476	0.36
	85+	2943	0.45	2344	0.34
Gender Composition	Total	655 950	100	693 367	100
	Female				51
	Male				49

According to the above table it's evident that the City of Mbombela has a fairly young population, with 61% of the population being 29 years and below as per the 2016 Community Survey data. The age group between 15-64 years is classified as predominantly economic active and represents 64% of the total population. With regard to sex composition, the Mbombela municipal had seen females being in majority since Census 1996 to the most recent Community Survey conducted in 2016. This has also been quantified by the sex ratios. There have been fluctuations in sex ration between the three Censuses. In 2001, the sex ratio was 93 males for every 100 females. This increased to 96 in 2011 and then further up to 98 males per 100 females in 2016.

9.9.4 Income Profile

Household income is used as one of the main poverty indicators in South Africa. Social support and subsidy systems are often based on household income parameters. When comparing household income, it is important to discount the impact of inflation. The figures in the table below were adjusted to 2011 Rand values.

Table 22: Income profile

Income Group (Rands)	2001	%	2011	%
<1200	45 957	33	62 167	34
1 200-2 000	37 574	27	28 503	16
2 000-5 000	18 356	13	34 379	19
5 000-10 000	17 104	12	25 674	14

Income Group (Rands)	2001	%	2011	%
10 000-20 000	9 198	7	16 898	9
20 000-50 000	9 380	7	10 516	6
>50 000	1 553	1	3 591	2
Total	**139 102**	**100**	**181 782**	**100**

a) An increase from 33% in 2001 to 34% in 2011 in the number of households with no income.
b) 50% of the total population earned below the poverty line in 2011, which decreased from 60% in 2001.

Although there is some evidence across the census and some surveys that quality of life is improving across the city region, the fact that the wealthy have got richer at a faster rate than lower income groups, has driven inequality.

10 DETAILS OF THE PUBLIC PARTICIPATION PROCESS

The principles of the National Environmental Management Act, 1998 (Act No 107 of 1998) and the Environmental Impact Assessment Regulations, April 2006 govern many aspects of Environmental Impact Assessments, including Public Participation. These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment and ensuring the participation of previously disadvantaged people, women, and youth. Effective public involvement is an essential component of many decision-making structures, and effective community involvement is the only way in which the power given to communities can be used efficiently. The Public Participation Process is designed to provide sufficient and accessible information to interested and affected parties (I&AP's) in an objective manner to assist them to:

a) Raise issues of concern and suggestions for enhanced benefits.
b) Verify that their issues have been captured.
c) Verify that their issues have been considered by the technical investigations; and
d) Comment on the findings of the Basic Assessment Report.

In terms of the Guideline Document for Environmental Impact Assessment (EIA) Regulations promulgated in terms NEMA, stakeholders (I&AP's) were notified of the Environmental Evaluation Process through:

a) A site notice that was erected (at prominent points on and around the study area)

b) A public notice was distributed in a 100m radius around the proposed site to all parties concerned.

c) An advertisement was placed in the …….. (**refer to Appendix 6B**).

d) A list of all persons, organisations and organs of state that were registered as interested and affected parties in relation to the application are included in the final report (**refer to Appendix 6D)**

e) A public participation meeting with I&APs was done on the …….. **(refer to Appendix 6C)**.

f) The draft reports were circulated to I&APs and State Organs as per the EIA regulations (**refer to Appendix 6F)**

Commented [CC1]: To complete

Table 23: Site Notice Locations

Location	Coordinates

10.1 Public Review

The draft BAR was distributed to the interested and affected parties and local municipality for access to the public. Soft copies were also shared with affected government organs (**refer to Appendix 6F)**.

10.2 Assumptions and Limitations

General assumptions and limitations relating to the BA process are listed below:

a) The EAP hereby confirms that they have undertaken to obtain project information from the client that is deemed to be accurate and representative of the project.

b) Site visits have been undertaken to better understand the project and ensure that the information provided by the client is correct, based on site conditions observed.

c) The EAP hereby confirms their independence and understands the responsibility they hold in ensuring all comments received are accurately replicated and responded to within the assessment documentation.

d) The comments received in response to the public participation process, are representative of comments from the broader community; and

e) The competent authority would not require additional specialist input, as per the proposals made in this report, to make a decision regarding the application.

Notwithstanding these assumptions, it is the view of Minenviro Consulting that this BA report provides a sound description of the issues associated with the project and the resultant impacts.

11 ENVIRONMENTAL IMPACT ASSESSMENT

11.1 Introduction

The EIA of the project activities is determined by identifying the environmental aspects and then undertaking an environmental risk assessment to determine the significant environmental aspects. The environmental impact assessment has included all phases of the project namely:

a) Construction Phase; and
b) Operational Phase.

NB: due to the nature of the development it is anticipated that the infrastructure would be permanent, thus not requiring decommissioning or rehabilitation. Maintenance of infrastructure will be addressed under the operational phase.

11.2 Methodology

The potential environmental impacts associated with the project will be evaluated according to it nature, extent, duration, intensity, probability, and significance of the impacts, whereby:

a) **Nature**: A brief written statement of the environmental aspect being impacted upon by a particular action or activity.
b) **Extent:** 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. For example, high at a local scale, but low at a regional scale.
c) **Duration:** Indicates what the lifetime of the impact will be.
d) **Intensity:** Describes whether an impact is destructive or benign.
e) **Probability:** Describes the likelihood of an impact occurring; and
f) **Cumulative:** In relation to an activity, means the impact of an activity that may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

The identification of potential impacts should include impacts that may occur during the construction, operational and decommissioning phases of the development. The assessment of impacts is to include direct, indirect as well as cumulative impacts. In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed projects is well understood so that the impacts associated with the projects can be assessed. The process of identification and assessment of impacts will include:

a) Determining the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured.
b) Determining future changes to the environment that will occur if the activity does not proceed.
c) Develop an understanding of the activity in sufficient detail to understand its consequences; and
d) The identification of significant impacts which are likely to occur if the activity is undertaken.

As per the DEAT Guideline 5: Assessment of Alternatives and Impacts the following methodology is to be applied to the predication and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

a) **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
b) **Indirect impacts** of an activity are indirect or induced changes that may occur because of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place because of the activity.
c) **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. The cumulative impacts will be assessed by identifying other project proposals and other applicable projects,
d) **Spatial extent** – The size of the area that will be affected by the impact:
- Site specific **(1)**.
- Local **(2):** (<2 km from site).
- Regional **(3):** (within 30 km of site).

- National **(4)**; or

e) Intensity – The anticipated severity of the impact:

- Very High (**4):** (Natural, cultural, and social functions and processes are altered to extent that they permanently cease)
- High **(3)**: (severe alteration of natural systems, patterns, or processes).
- Medium **(2)**: (notable alteration of natural systems, patterns, or processes); or
- Low **(1)**: (negligible alteration of natural systems, patterns, or processes).

f) Duration – The timeframe during which the impact will be experienced:

- Short term **(1)**: (1 to 6 years).
- Medium term **(2)**: (6 to 15 years).
- Long term **(3)**: (the impact will cease after the operational life of the activity); or
- Permanent **(4)**: (mitigation will not occur in such a way or in such a time span that the impact can be considered transient).

g) Reversibility of the Impacts - the extent to which the impacts are reversible assuming that the project has reached the end of its life cycle (decommissioning phase) will be

- High reversibility of impacts (impact is highly reversible at end of project life);
- Moderate reversibility of impacts.
- Low reversibility of impacts; or
- Impacts are non-reversible (impact is permanent).

h) Irreplaceability of Resource Loss caused by impacts – the degree to which the impact causes irreplaceable loss of resources if the project has reached the end of its life cycle (decommissioning phase) will be:

- High irreplaceability of resources (project will destroy unique resources that cannot be replaced).
- Moderate irreplaceability of resources.
- Low irreplaceability of resources; or
- Resources are replaceable (the affected resource is easy to replace/rehabilitate).

Using the criteria above, the impacts will further be assessed in terms of the following:

a) Probability –The probability of the impact occurring:

- Improbable **(1)**: (little or no chance of occurring).
- Probable **(2)**: (<50% chance of occurring).
- Highly probable **(3)**: (50 – 90% chance of occurring); or

- Definite **(4)**: (>90% chance of occurring).

b) Significance – Will the impact cause a notable alteration of the environment?

- Low to very low (the impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures and will not have an influence on decision-making).
- Medium (the impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated); or
- High (the impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision making).

Table 24: Criteria for the rating of classified impacts

Low impact (4 -6 points)	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
Medium impact (7 -9 points)	Mitigation is possible with additional design and construction inputs.
High impact (10 -12 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
Very high impact (13 - 20 points)	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the status quo – i.e. should the project not proceed. Therefore not all negative impacts are equally significant.	

11.3 Construction Phase

The potential direct, indirect, and cumulative environmental impacts associated with the construction / development phase of the Preferred Alternative are set out in Table 25 hereunder, together with recommended mitigation measures.

Table 25: Potential Construction Phase Impacts of the Preferred Alternative

POTENTIAL ENVIRONMENTAL IMPACT	**RECOMMENDED MITIGATION MEASURES**
VEGETATION	
Direct Impacts: A direct, negative impact on indigenous vegetation will arise because of the clearance of vegetation for the purposes of development. **Indirect impacts** • Disturbance of the indigenous vegetation and the topsoil, because of clearing, will increase the risk of invasion of the remainder of the site and neighbouring properties by opportunistic alien invasive plant species. **Cumulative Impacts:** • General reduction in floral biodiversity in the area.	• It is recommended that vegetation clearance and disturbances associated with the construction of each individual phase be limited to the footprint of that relevant phase. • Vegetation occurring in the area designated as open space should not be cleared (apart from aliens). • All protected plant and tree species must be identified, removed from the site, and relocated either to the Open Space area or offsite to a suitable area (which is formally protected), as far as possible. • An alien invasive plant management programme must be compiled and implemented as part of the EMPr for the construction phase. This plan must require that alien plants be continuously monitored and controlled throughout all phases of the construction, and not left until the post construction / rehabilitation phase
IMPACT SIGNIFICANCE RATING	

Before Mitigation	**E**	**D**	**I**	**P**	**Significance**	**After Mitigation**	**E**	**D**	**I**	**P**	**Significance**
	3	4	4	4	-15 (Negative Very High)		1	4	3	3	-12 (Negative Very high)

FAUNAL IMPACTS	
Direct Impacts:	All fauna captured must be relocated to a formally protected area.

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
• Vegetation clearance of the site will result in habitat destruction and loss, as well as displacement of fauna currently living on the site. **Indirect Impacts:** • Loss of foraging / hunting, nesting, and movement areas. • Increased faunal mortality. **Cumulative Impacts:** • Reduction in predator populations resulting in increased pest (e.g., rats) populations. • General reduction in faunal biodiversity in the area.	

IMPACT SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	3	4	4	4	-15 (Negative Very High)	Impact Assessment	1	2	2	2	-7 (Negative Medium)

WATER RESOURCES IMPACTS

Direct Impacts: • Due to the distance between the proposed development site and any surface water features, as well as the presence of physical barriers, such as roads and buildings, between the site and	To prevent contamination of surface water resources due to oil and fuel leakages and accidental spillages, vehicles and construction equipment should not undergo maintenance procedures on site. • Maintenance procedures should only take place at a Workshop. • A Method Statement (MS) for the handling, storage and management of hazardous substances during the construction phase must be drawn up by the appointed Contractor, and reviewed

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
the surface water features, it is unlikely that the proposed development will have any impact on surface water resources. • Poor control of hazardous materials (improper storage, spills, leaks and poor clean-up) could cause contamination of groundwater. **Indirect Impacts:** • Construction activities will require significant volumes of water. The significance of this impact is increased by the current drought conditions being experienced in the region. • Altered hydrological regime as a result of artificial hardening of the soil surface and compaction of soils on the site. The significance of this impact is reduced, however by the fact that the site is almost entirely surrounded by previously transformed / artificially hardened surfaces, and the fact that the stormwater runoff regime of the area is artificially managed through a series of municipal drains, channels and subsurface pipelines. The proposed development will	by the ECO, prior to the commencement of construction. This MS must, as a minimum, include the following: a) Potentially hazardous materials used during the construction phase (including cement and solvents) must be housed under cover (where practical) and utilising bunded areas, where necessary. b) All reasonable efforts must be made to prevent potential spills of these substances. c) Accidental spillages of hazardous materials to be cleaned up immediately by the Contractor, placed in sealed containers and disposed of at a licensed hazardous waste disposal site. d) Spill kits must be made available and the correct procedures followed during the clean-up of spills. • A construction-phase stormwater management plan must be implemented across the entire development site to prevent and control potential stormwater impacts (flooding, erosion) on neighbouring properties. • Baseline sampling of groundwater quality should be undertaken prior to the commencement of construction activities, to provide a point of comparison for groundwater sampling recommended to be undertaken during the operational phase

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
merely feed into this existing, managed system, and will not contribute to the alteration of natural hydrological regimes.	

IMPACTS SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	1	2	2	2	-7 (Negative Medium)	Impact Assessment	1	2	1	2	-6 (Negative Low)

SOIL IMPACTS

Direct Impacts: • Potential disturbances on the soil include compaction, physical removal and potential pollution by hydrocarbons (diesel and oil), pain, solvents, cleaners and other harmful chemicals. **Indirect Impacts:** • If standard stormwater control measures are not implemented during the construction phase, contamination and / or damage of neighbouring properties may arise	• A stormwater management plan must be implemented across the entire development site to prevent and control potential stormwater impacts (flooding, erosion) on neighbouring properties. • All potential soil and water contaminants (including oil, fuel and cement) must be stored and handled in such a way so as to minimise the potential for spillage or leakage and contamination.

IMPACTS SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance

POTENTIAL ENVIRONMENTAL IMPACT						RECOMMENDED MITIGATION MEASURES					
Impact Assessment	1	3	3	2	-9 (Negative Medium)	Impact Assessment	1	2	1	1	-5 (Negative Low)

DUST IMPACTS

Direct Impacts:

- Clearance of vegetation, grading and levelling, excavation activities and increased traffic volumes will result in increased dust generation and impact on the local community residing in the area.
- This impact will be limited to the construction phase.

Indirect Impacts:

- Potential health impacts for construction workers and neighbours (allergies / asthma, etc).
- Alteration of the aesthetics / sense of place of the area, although this will be temporary, limited to the Construction Phase.

Cumulative Impacts:

- Potential decline in well-being of neighbours as a result of perceived nuisance and actual health impacts.

- Dust minimisation and control measures should be implemented on the construction site at regular intervals. This could include irrigation (utilising legal, non-potable water) by water tankers.
- The frequency of implementation of dust suppression measures should be increased when it is expected that high wind conditions will develop.
- Vegetation clearing for each phase of development should only take place immediately prior to the commencement of construction activities for the relevant phase (i.e. immediately prior to the construction of each Phase), in order to minimise the amount of exposed soil on the site.
- A Complaints Register must be made available on the site for the duration of construction. Any dust-related complaints must be efficiently and effectively dealt with

IMPACT SIGNIFICANCE RATING

POTENTIAL ENVIRONMENTAL IMPACT						RECOMMENDED MITIGATION MEASURES					
Before Mitigation	**E**	**D**	**I**	**P**	**Significance**	**After Mitigation**	**E**	**D**	**I**	**P**	**Significance**
Impact Assessment	1	3	3	2	-9 (Negative Medium)	Impact Assessment	1	2	1	1	-5 (Negative Low)

NOISE AND VIBRATION IMPACTS

Direct Impacts: • Construction vehicles, including delivery trucks and excavation equipment will produce an increase in noise and vibration disturbance. • Construction activities on the site, such as excavation, earthworks and the use of machinery will generate noise impacts which will affect the local community residing in close proximity to the construction site. • It must be noted that these impacts will be limited to the construction phase. **Indirect Impacts:** • Alteration of the aesthetics / sense of place of the area, although this will be temporary, limited to the Construction Phase. **Cumulative Impacts:**	• Construction activities should be limited to normal working hours (08:00 – 17:00) during the week and 08:00 – 13:00 on Saturdays. No work should occur on Sundays or Public Holidays. • All machinery and equipment to be utilised on the site should be fitted with mufflers and must be maintained in good working order to minimise noise levels. • The Contractor should encourage construction workers to minimise shouting and hooting on the site. • The Contractor shall warn any local communities and/or residents that could be disturbed by particularly noisy activities well in advance and shall keep such activities to a minimum. • The Contractor shall be responsible for compliance with the relevant legislation with the respect to noise. It must be ensured that all potential noise sources conform to the South African Bureau of Standards recommended code of practice, SANS Code 0103:1983, so that it will not produce excessive or undesirable noise. • Construction work should be completed in as short a time frame as possible in order to limit the longevity of these impacts.

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
• Potential decline in well-being of neighbours as a result of perceived nuisance impacts.	

IMPACTS SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	1	3	3	2	-9 (Negative Medium)	Impact Assessment	1	2	1	1	-5 (Negative Low)

WASTE MANAGEMENT IMPACTS

Direct Impacts: Wastes from construction activities may arise from a range of sources including excavated material from the levelling of the site, waste from construction workers using the site, and waste from equipment, packaging, materials, and vehicles. • Increase in volumes of general solid waste generated, resulting in increased pressure on licensed general waste disposal facilities. • Increase in volumes of hazardous waste generated, resulting in increased pressure on licensed hazardous waste disposal facilities. • Increase in volumes of sewage waste generated, resulting in increased pressure on licensed	• The Contractor must investigate ways in which to implement the waste hierarchy on site by: a) Identifying ways to avoid and reduce waste generation; b) Re-use waste materials; c) Recycle waste; d) Recover waste; and e) As a last resort, treat and dispose of wastes. This must be done by way of the preparation of a Waste Management Method Statement. • In order to reduce pressure on general waste landfill sites, it is recommended that, as far as possible, general solid wastes be separated and sorted into its recyclable components (glass, plastic, metal, paper). This will require the provision of separate waste bins within the site camp, and the removal of these wastes to appropriate recycling facilities • The requirement to separate and sort general wastes should be included as part of the environmental induction and awareness programme. • All general waste bins on the site must be weather- and scavenger-proof. • Litter must be cleared from the site daily.

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
wastewater treatment and disposal facilities. • Improper storage and handling of wastes on site, and insufficient waste collection / removal may result in windblown litter, the attraction of pests (rats, flies, etc), water and soil contamination or bad odours (in particular from chemical ablution facilities). • Insufficient waste collection / removal may result in soil contamination (in particular if chemical toilets should overflow). **Indirect Impacts:** • Windblown litter and bad odours may result in an altered sense of place. • Increased pest populations and bad odours may create a nuisance and / or have health impacts for surrounding neighbours.	• Hazardous wastes must be stored on an impermeable surface, in a bunded area. Such storage area must be clearly demarcated. • Wastes must be collected / removed from site regularly to ensure that no overflow occurs. It is recommended that chemical ablution facilities be serviced once a week, by an authorised service provider. • Safe disposal slips must be maintained for all waste types generated on site and disposed of off-site.

IMPACT SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	1	2	2	2	-8 (Negative Medium)	Impact Assessment	1	2	1	2	-6 (Negative Low)

TRAFFIC IMPACT ASSESSMENT

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
Direct Impacts: • The construction phase will result in additional traffic volumes on the local roads. • This traffic will be large and slow moving, in general. This may result in congestion. • Increased volumes and congestion may cause safety risks. • Large, heavy traffic, may cause deterioration of the road surfaces	• A detailed Traffic Management Plan should be compiled by the Contractor to ensure that traffic on the local roads is disrupted as little as possible. • This plan should include measures for the optimization of the amount of travel on the local roads, thereby reducing impact. • The delivery of construction equipment and material should be limited to hours outside peak traffic times (including weekends).

IMPACT SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	1	2	2	2	-8 (Negative Medium)	Impact Assessment	1	2	1	2	-6 (Negative Low)

CULTURAL AND HERITAGE IMPACTS

Direct Impacts: • There is a risk of sub-surface archaeological and/or paleontological resources being impacted upon and damaged during excavation activities associated with construction activities	• A Phase 1 Heritage Assessment (including paleontological assessment) should be undertaken during the EIA Phase. The recommendations arising from this specialist assessment must be included into the EMPr. • Should sub-surface archaeological resources or artefacts be uncovered during construction, activity must be halted and the relevant Heritage Authority informed / permit application made

IMPACT SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance

POTENTIAL ENVIRONMENTAL IMPACT						RECOMMENDED MITIGATION MEASURES					
Impact Assessment	1	1	1	1	-4 (Negative Medium)	Impact Assessment	1	1	1	1	-4 (Negative Low)

SOCIO-ECONOMIC IMPACTS

Construction will result in the creation of skilled, semi-skilled and unskilled jobs. Skills transfer will be promoted.	• All labour (skilled and unskilled) and contractors should be sourced locally where possible. • A labour and recruitment policy must be developed, displayed and implemented by the contractor. • Recruitment at the construction site will not be allowed. • Where possible, labour intensive practices (as opposed to mechanised) should be practiced. • The principles of equality, BEE, gender equality and non-discrimination will be implemented.

IMPACT SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	1	3	3	3	+10 (Positive High)	Impact Assessment	2	4	4	4	+14 (Positive Very High)

Potential influx of workers to the area may result in increased expenditure, for food, accommodation and entertainment, within the local economy, generating economic growth in the region.	• If possible, all labour should be sourced locally. • Contractors and their families may not stay on site. • No informal settlements will be allowed.

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
An influx of job seekers may also have negative impacts including potential increases in sexually transmitted diseases, prostitution, alcohol and drug abuse, crime and creation of conflict in local communities).	• The developers need to be actively involved in the prevention of social ills associated with contractors. • If possible, all labour should be sourced locally. • Contractors and their families may not stay on site. • No informal settlements will be allowed. • Contractors must be educated about the risk of prostitution and spread of HIV and AIDS.

IMPACTS SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	2	2	2	2	-8 (Negative Medium)	Impact Assessment	2	1	1	1	-5 (Negative Low)

11.4 Operational Phase

The potential direct, indirect and cumulative environmental impacts associated with the operational phase of the Preferred Alternative are set out in ~~Table 26~~Table 26 hereunder, together with recommended mitigation measures

Formatted: Font: 11 pt

Table 26: Potential Operational Phase Impacts of the Preferred Alternative

POTENTIAL ENVIRONMENTAL IMPACT	RECOMMENDED MITIGATION MEASURES
GROUNDWATER AND SOIL IMPACTS	
Direct Impacts: Contamination may arise as a result of the spillage of hazardous substances, inappropriate responses to hazardous spills, improper waste handling, storage and disposal, and the failure of the effluent	The following is recommended for the effluent management system: • The sewer management system must be inspected regularly for leaks and to ensure structural integrity. • Any leaks must be immediately identified, contained and fixed.

management system or stormwater management system.	• Contaminated soil arising from such leaks must be excavated and appropriately disposed of. Clean material will need to be imported to the site to replace this.

IMPACTS SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	2	4	3	2	-11 (Negative Medium)	Impact Assessment	2	1	1	1	-5 (Negative Low)

WASTE MANAGEMENT IMPACTS

• Liquid waste (sewage) will be generated by all elements of the proposed development. all such waste will be directed into the municipal sewer system • Solid, general waste will be generated during the operational phase by the residential, shopping centre, school and office land uses. These wastes will comprise predominantly domestic wastes, garden wastes and non-hazardous business wastes.	It is recommended that, as far as possible, residents and businesses be encouraged to separate and sort general solid wastes into its recyclable components, and then to send it to appropriate recycling companies. This will reduce the volume of waste being directed to landfill.

IMPACTS SIGNIFICANCE RATING

Before Mitigation	E	D	I	P	Significance	After Mitigation	E	D	I	P	Significance
Impact Assessment	2	4	3	2	-11 (Negative Medium)	Impact Assessment	2	1	1	1	-5 (Negative Low)

INCREASED WATER DEMAND

Direct Impacts: • The proposed operational development will result in the consumption of natural	• It is recommended that the Applicant and his Civil Engineers investigate feasible engineering interventions to design water-conservation measures into the design of the proposed development.

resources, in particular water resources for the supply of domestic demand	• It is recommended that all structures be equipped with rainwater harvesting and storage structures, that all bathrooms and kitchens be fitted with water conservation devices (e.g. aerators in taps; low flow showerheads; lowflush toilets, etc) and that all landscaped areas be planted with locally-indigenous vegetation only.

IMPACTS SIGNIFICANCE RATING

Before Mitigation	**E**	**D**	**I**	**P**	**Significance**	**After Mitigation**	**E**	**D**	**I**	**P**	**Significance**
Impact Assessment	2	4	3	2	-11 (Negative Medium)	Impact Assessment	2	1	1	1	-5 (Negative Low)

12 ENVIRONMENTAL IMPACT STATEMENT

12.1 Summary of Key Findings

During the EIA, the impact of the development on the biophysical and social environments was assessed. From the assessment, it was determined which parts of the two environments will be more significantly affected as compared to others. Below is a summary of the main findings of the EIA:

12.1.1 Vegetation Findings

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study site since the proposed development is largely destructive, involving the alteration of natural habitat or degradation of habitat that is currently in a climax status.

12.1.2 Waste Management

The potential waste streams for the project were identified as domestic, hazardous, building and sewerage waste. The impact of the waste streams would be minimised by the rigorous mitigation measures that have been developed.

Waste collection will be undertaken by local municipality and sent through to a licensed waste disposal facility. All sewerage waste will be sent through to a licensed treatment facility.

12.1.3 Dust

During construction and decommissioning, the pollutants likely to be emitted are particulate matter generated by vehicle movement and exposed soil to wind erosion. This is most likely to be a nuisance.

Dust suppression activities (e.g., wet suppression with water) must be implemented during construction and decommissioning activities

12.1.4 Noise

The construction and decommissioning phases will see an increase in noise in the study area. Impacts relating to noise can be effectively managed with the implementation of the EMPr

13 ASSUMPTIONS AND LIMITATIONS

The process of investigation which has led to the identification and recommended mitigation of impacts, the assessment of impacts and the production of this report, harbours several assumptions, which include the following:

- All information provided by the Applicant, his Project Manager and the Project Team to the EAP was correct and valid at the time that it was provided;
- The public received a fair and sufficient opportunity to participate in the EIA process, through the provision of adequate public participation timeframes stipulated in the Regulations;
- The need and desirability was based on strategic national, provincial and local plans and policies which reflect the interests of both statutory and public viewpoints;
- The information provided by specialists is accurate and unbiased;
- The EIA process is a project-level framework and is limited to assessing the anticipated environmental impacts associated with the construction and operational phases of the preferred alternative for the proposed facility; and
- Strategic level decision making is conducted through cooperative governance principles with the consideration of sustainable and responsible development principles underpinning all decision making.

Given that an EIA involves prediction, **uncertainty** forms an integral part of the process. Two types of uncertainty are associated with the EIA process, namely process-related and prediction-related.

- Uncertainty of prediction is critical at the data collection phase as final certainty will only be obtained upon implementation of the proposed development. Adequate research, experience and expertise may minimise this uncertainty;
- Uncertainty of values depicts the approach assumed during the EIA process, while final certainty will be determined at the time of decision making. Enhanced communication and widespread/comprehensive coordination can lower uncertainty;
- Uncertainty of related decision relates to the interpretation and decision-making aspect of the EIA process, which shall be appeased once monitoring of the project phases is undertaken.

14 CONCLUSION

The Environmental Impact Assessment (EIA) process for the development has been undertaken in accordance with the EIA Regulations In order to protect the environment and ensure that the development is constructed and operate in an environmentally responsible manner, there are several significant pieces of environmental legislation that have been taken into account during this study. This relevant legislation has informed the identification and development of appropriate management and mitigation measures that should be implemented in order to minimise potentially significant impacts associated with the project.