4a Old Main Road, Judges Walk, Kloof, Kwazulu-Natal, South Africa, 3610

PO Box 819, Gillitts, 3603, South Africa

Tel: +27 (0) 31 764 7130 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

Draft Basic Assessment Report

Application for a Prospecting Right at Fuleni in the Empangeni Magesterial District, KwaZulu-Natal

Version – **Draft for Public Comment**

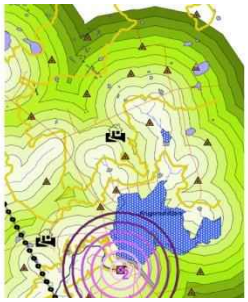
March 2022

Imvukuzane Resources (Pty) Ltd

GCS Project Number: 22-0082

DMRE Ref No: KZN 30/5/1/1/2/10747 PR




GCS (Pty) Ltd. **Reg No:** 2004/000765/07 Est. 1987
Offices: **Johannesburg** (Head Office) | Durban | Gaborone | Lusaka | Maseru | Windhoek | Ostrava
Directors: AC Johnstone (CEO) | A Wilke | M Van Rooyen | W Sherriff (Financial) | N Marday (HR)
Non-Executive Director: B Wilson-Jones

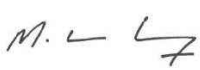
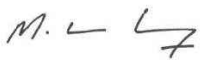
Draft Basic Assessment Report:

Application for a Prospecting Right for the Prospecting of Coal in the Amajuba District, KwaZulu-Natal

March 2022

22-0064

DOCUMENT ISSUE STATUS

Issue	**Draft for Public Comment**		
GCS Reference Number	22-0082		
DMRE Reference	KZN 30/5/1/1/2/10747 PR		
Title	Draft Basic Assessment Report: Application for a Prospecting Right at Fuleni in the Empangeni Magesterial District, KwaZulu-Natal		
	Name	**Signature**	**Date**
Author	Janice Callaghan		**March 2022**
Document Reviewer	Magnus van Rooyen		**April 2022**
Director Sign Off	Magnus van Rooyen		**April 2022**

Disclaimer

Information contained in this report relating to the project description is based on information supplied by the client and other client-appointed sources. It is assumed that the information provided to GCS is correct.

Environmental and social data, as well as Environmental Impact Assessment, provided in this report is based on information supplied by specialists in their respective fields, as well as existing information pertaining to the area in question (including previous site investigation data and information from the Department of Environmental Affairs' Online Screening Tool). It has been assumed that the information provided to GCS to perform the outcomes of this report is correct.

No responsibility is accepted by GCS for incomplete or inaccurate data supplied by others (the client and external sources). Where gaps have been identified these are listed for consideration by the responsible decision-makers.

GCS's opinions, conclusions and recommendations are based upon information that existed at the time of the start of the production of this document.

EXECUTIVE SUMMARY

GCS Water and Environmental Consultants (Pty) Ltd (GCS) was appointed by Imvukuzane Resources (Pty) Ltd (Imvukuzane Resources) to conduct the application for a prospecting right on located on Portion 0 of Fuleni Reserve 14375 GU in the Empangeni Magesterial District. This application is being undertaken on behalf of Imvukuzane Resources, the applicant, and will be submitted to the Department of Mineral Resources and Energy (DMRE) as the competent authority. The resources being applied for are coal, pseudocoal, torbanite, clay and aggregate.

NEED AND DESIRABILITY

The aim of prospecting activities is to confirm the presence of a resource through both non-invasive methods such as desktop studies, and invasive methods i.e. drilling activities, and to evaluate the quality thereof. The prospecting right area was identified using existing geological information. An exploration programme is required to determine the extent of the resource and its quality.

SITE DESCRIPTION

The site is currently used for agriculture and grazing. It is located approximately 23km north of Empangeni and 30km northwest of Richard's Bay, and is adjacent to the Hluhluwe-iMfolozi Reserve. The total area to be included in the application is 14 717 ha. The project falls within quaternary catchment W23A (90% of the total prospecting right area) and W21L (10%) of the Mtamvuna Water Management Area (WMA).

LISTED ACTIVITIES

Listed activities in terms of the 2014 NEMA EIA regulations, as amended:

Notice	Activity	Description of related activity
1	20	Any activity including the operation of that activity which requires a prospecting right in terms of section 16 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including— (a) associated infrastructure, structures and earthworks, directly related to prospecting of a mineral resource[,] ; or [including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)] (b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining,

		calcining or gasification of the mineral resource in which case activity 6 in Listing Notice 2 applies.
3	12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.

SPECIALIST STUDIES

The following specialist studies were identified as required based on the Department of Forestry, Fisheries and Environment Screening Tool:

Theme	Sensitivity	Study Undertaken	Reason
Agriculture	Very High	No	A small area will be disturbed for each borehole. An Agricultural Assessment will not be conducted as the impact will be limited.
Animal Species	High	No	A small area will be disturbed for each borehole. A faunal impact assessment will not be conducted as the impact will be limited.
Aquatic	Very High	Yes	-
Heritage	Very High	Yes	-
Civil Aviation	High	No	The majority of the site falls within a low sensitivity classification. Only one small section falls within high classification. No specialist investigations will be required.
Defence	Low	No	Not required
Paleontology	Very High	No	Based on the South African Heritage Resources Agency (SAHRA) paleontological sensitivity map, the area is classed as being of low sensitivity.
Plant Species	Medium	No	A small area will be disturbed for each borehole.
Terrestrial Biodiversity	Very High	Yes	-

PUBLIC PARTICIPATION PROCESS

The comment period will be run from 13 April 2022 to 16 May 2022. Site notices detailing information about the project and the BA Process, as well as invitation to register as I&APs, were placed at various locations, in both English and isiZulu. Newspaper advertisements for the registration and participation of I&APs was placed in the Isolezwe on 14 April 2022 in isiZulu and the Zululand Observer on 11 April 2022 in English.

ENVIRONMENTAL IMPACT STATEMENT

All negative Medium significant impacts can be mitigated to Low significance. The following

impacts associated with the proposed project are considered of **Positive** significance:

- Employment opportunities for local communities; and
- Determination of the potential and extent of the reserve.

In the decommissioning phase, the receiving environment will be rehabilitated as closely as possible to the pre-disturbed conditions.

ENVIRONMENTAL MANAGEMENT PROGRAMME

An Environmental Management Programme (EMPr) related to the prospecting activities is included as Appendix E.

CONCLUSIONS

The EAP is confident that all major impacts associated with the proposed prospecting right application have been adequately described and mitigated. Given the generally medium-low impacts associated with the activities and the implementation of the proposed mitigation measures including those in the detailed EMPr (Appendix E), the EAP is confident that the project can proceed without significant impact on the receiving environment.

YOUR OPPORTUNITY TO PARTICIPATE

This Draft Basic Assessment Report will be made available to all registered I&APs for public review and comment from **13 April 2022** (comment period ending **16 May 2022**). I&AP's will be notified of the availability and will be sent an electronic copy on request. Copies will also be available for download from the GCS website: www.gcs-sa.biz.

Any comments on the Draft Basic Assessment Report must be submitted in writing or email (including any additional supporting material) on or before **16 May 2022** directly to Janice Callaghan, Junior Environmental Assessment Practitioner, by means of the following:

Tel: 031 764 7130
Fax: 011 803 5232
E-mail: janicec@gcs-sa.biz

PO Box 819
Gillitts
Durban
3603

CONTENTS PAGE

List of Figures

List of Tables

List of Appendices

ACRONYMS AND ABBREVIATIONS

BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CR	Critically Endangered
CRR	Comments and Responses Report
CV	Curriculum Vitae
DBAR	Draft Basic Assessment Report
DFFE	Department of Forestry, Fisheries and Environment
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act, 1989 (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
GCS	GCS Water and Environmental Consultants (Pty) Ltd
GDP	Gross Domestic Product
GNR	Government Notice Regulation
GPS	Global Positioning System
ha	Hectares
HCAC	Heritage Contracts and Archaeological Consulting
HiP	Hluhluwe-iMfolozi Park
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IGRD	Intermediate groundwater Reserve Determination
Imvukuzane Resources	Imvukuzane Resources (Pty) Ltd
ITB	Ingonyama Trust Board
KCDM	King Cetshwayo District Municipality
km	Kilometres
KZN	KwaZulu-Natal
L	Litres
m	Metres
m^3	Cubic metres
MAE	Mean Annual Evaporation
mamsl	Metres above mean sea level

MAP	Mean Annual Precipitation
MAR	Mean annual Runoff
MLM	Mtubatuba Local Municipality
mm	Millimetres
Mm/yr	Millimeters per year
MPRDA	Mineral and Petroleum Resources Development Act
NEMA	National Environmental Management Act
NEM: BA	National Environmental Management: Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Area
NGO	Non-Governmental Organisations
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID	Notice of Intent to Develop
NMAR	natural mean annual runoff
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PM	Project Manager
POPIA	Protection of Personal Information Act, 2013 (Act No 4 of 2013)
PPP	Public Participation Process
PR	Prospecting Right
SAHRA	South African Heritage Resources Agency
SAPS	South African Police Services
SDF	Spatial Development Framework
SEIA	Scoping and Environmental Impact Assessment
SS	Site Supervisor
SWMP	Stormwater Management Plan
TOP/TOPS	Threatened or Protected / Species
ULM	Umfolozi Local Municipality
VEGRAI	Riparian Vegetation Response Index
VU	Vulnerable
WMA	Water Management Area

1 INTRODUCTION

1.1 Background and Overview

GCS Water and Environmental Consultants (Pty) Ltd (GCS) was appointed by Imvukuzane Resources (Pty) Ltd (Imvukuzane Resources) to conduct the application for a prospecting right (PR), located on Portion 0 of Fuleni Reserve 14375 GU in the Empangeni Magisterial District. This application is undertaken on behalf of Imvukuzane Resources (the applicant) and, as such, will be submitted to the Department of Mineral Resources and Energy (DMRE) as the competent authority. Prospecting activities for coal, pseudocoal, torbanite, clay and aggregate will take place by means of desktop studies and borehole drilling to retrieve geological core samples.

Applications for an Environmental Authorisation (EA) and Prospecting Right (PR) have been undertaken in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Mineral and Petroleum Resources Development Act, 2002 (MPRDA), and were submitted in April 2018, however, no Basic Assessment was undertaken. Imvukuzane Resources' application was automatically placed on hold on 9 August 2018, due to an appeal lodged by Ibutho Coal (Pty) Ltd in 2018 against the rejection of their mining right application (KZN 30/5/1/2/2/10060 MR) over the farm Fuleni Reserve 14375 for coal. Imvukuzane Resources requested to stay their prospecting right application (KZN 30/5/1/1/2/10747 PR), pending the outcome of the appeal, as the appeal had the potential to hamper Imvukuzane's prospecting right application process in terms of set timeframes, as well as negative financial implications, should the appeal be granted. The outcome of the appeal was supplied to Imvukuzane Resources in June 2021, when they reinitiated the enviro-legal processes required for their application for a prospecting right.

This report serves to fulfil the requirements for the application, and has been prepared per the 2014 Environmental Impact Assessment (EIA) Regulations, as amended.

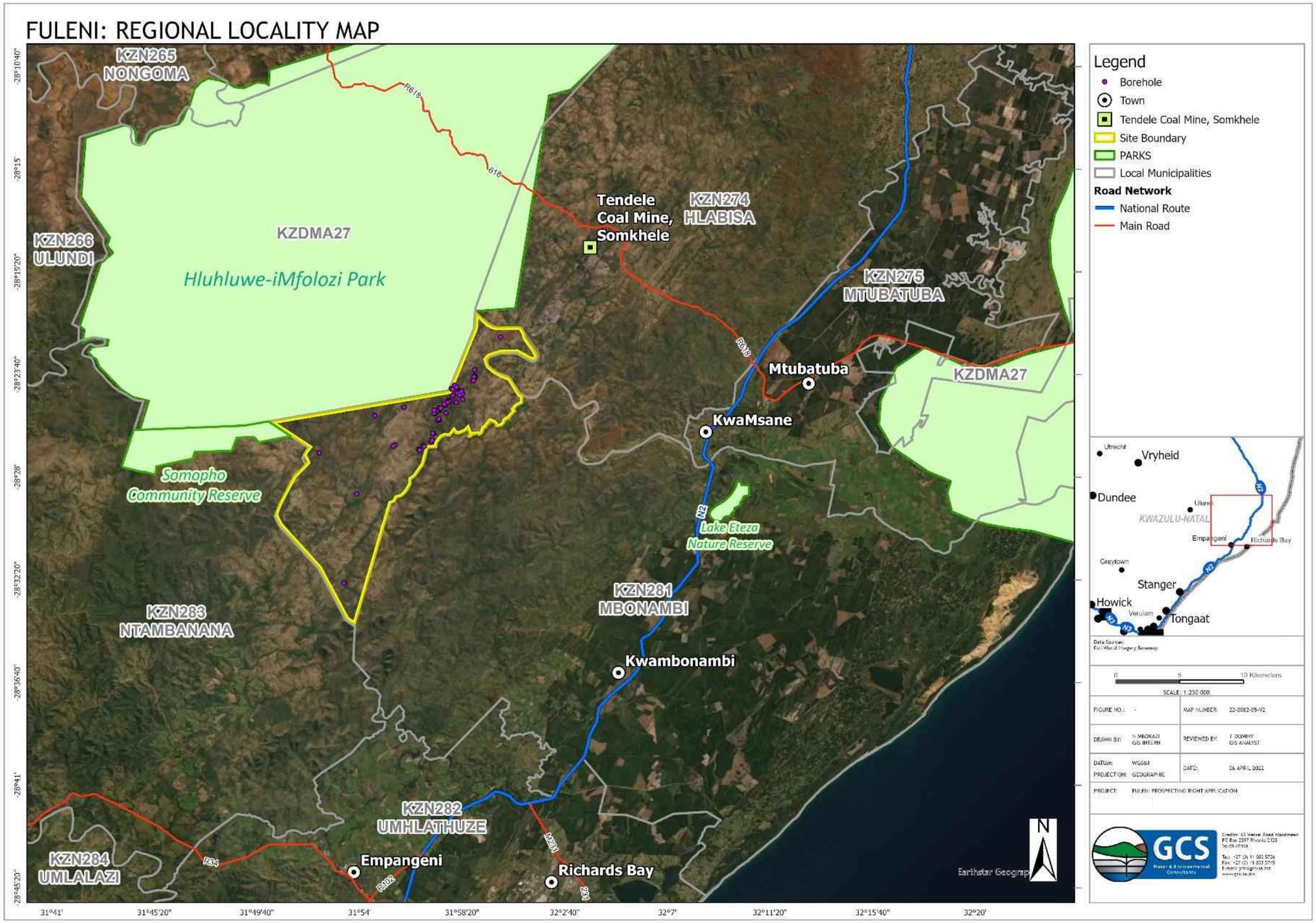
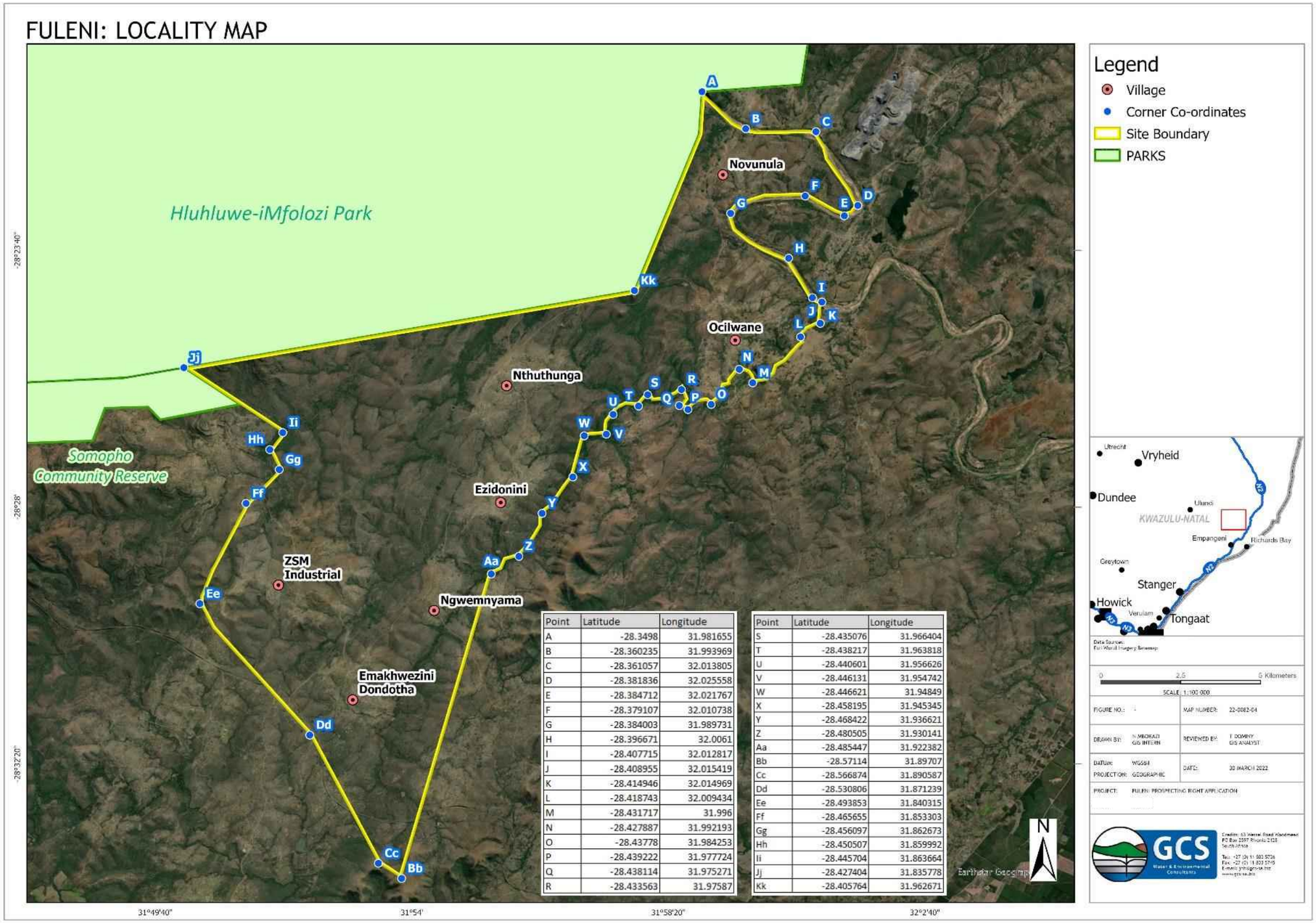


Figure 1-1: Regional Locality Map



Point	Latitude	Longitude
A	-28.3498	31.981655
B	-28.360235	31.993969
C	-28.361057	32.013805
D	-28.381836	32.025558
E	-28.384712	32.021767
F	-28.379107	32.010738
G	-28.384003	31.989731
H	-28.396671	32.0061
I	-28.407715	32.012817
J	-28.408955	32.015419
K	-28.414946	32.014969
L	-28.418743	32.009434
M	-28.431717	31.996
N	-28.427887	31.992193
O	-28.43778	31.984253
P	-28.439222	31.977724
Q	-28.438114	31.975271
R	-28.433563	31.97587

Point	Latitude	Longitude
S	-28.435076	31.966404
T	-28.438217	31.963818
U	-28.440601	31.956626
V	-28.446131	31.954742
W	-28.446621	31.94849
X	-28.458195	31.945345
Y	-28.468422	31.936621
Z	-28.480505	31.930141
Aa	-28.485447	31.922382
Bb	-28.57114	31.89707
Cc	-28.566874	31.890587
Dd	-28.530806	31.871239
Ee	-28.493853	31.840315
Ff	-28.465655	31.853303
Gg	-28.456097	31.862673
Hh	-28.450507	31.859992
Ii	-28.445704	31.863664
Jj	-28.427404	31.835778
Kk	-28.405764	31.962671

Figure 1-2: Site Locality

1.2 Details of Applicant and Environmental Assessment Practitioner (EAP)

The details of the applicant are provided in Table 1-1.

Table 1-1: Contact details for applicant

ITEM	DETAILS		
Project Applicant	Imvukuzane Resources (Pty) Ltd		
Registration Number:	2018/228661/07		
Responsible Person:	Melissa Pillay		
Contact Persons	Sarah Wanless		
Postal Address	13 Fredman Drive, Fredman Towers, 7th Floor, Sandown,		
Postal Code:	2196	Cell:	
Telephone:	011 783 7996	Fax:	011 783 0816
E-mail:	sw@menar.com		

The contact details of the EAP are provided in Table 1-2 and thes EAP's CV is attached as Appendix A.

Table 1-2: Contact details for EAP

ITEM	DETAILS
Company Name	GCS Water and Environmental Consultants (Pty) Ltd
Company Representative	Magnus van Rooyen
Telephone No.	+27 (0)31 764 7430
Facsimile No.	+27 (0)11 803 5745
E-mail Address	magnusvr@gcs-sa.biz
Postal Address	PO Box 819, Gillitts, 3603

2 Project Description

2.1 Site description

2.1.1 Existing and Adjacent Land Uses

The current land uses are grazing and agriculture, with large areas of natural grassland. The proposed Fuleni PR area is situated to the south of the existing Somkhele Anthracite mine, which is situated on the north-eastern side of the Umfolozi River. The proposed PR area is also situated to the south-east of Hluhluwe-iMfolozi Park (HiP) and adjacent to the Somopho Community Reserve. Refer to Figure 2-1 for further detail. The following communities are located within the PR area:

- Novunula;
- Ocilwane;
- Nthuthunga;
- Ezidonini;
- ZSM Industrial;
- Ngwemnyama; and
- Emakhwezini Dondotha.

2.1.2 GPS Coordinates

The Global Positioning System (GPS) coordinates for the corners of the PR Area are indicated in Figure 1-2. The coordinates of the proposed prospecting holes are provided in Table 2-1.

Table 2-1: GPS Co-ordinates of the boreholes

Point	Latitude	Longitude
1	28°26'37.86"S	31°55'29.77"E
2	28°26'41.06"S	31°55'24.62"E
3	28°26'29.38"S	31°57'1.60"E
4	28°26'58.60"S	31°52'17.94"E
5	28°28'42.24"S	31°53'52.98"E
6	28°32'28.58"S	31°53'19.97"E
7	28°22'4.50"S	31°59'57.02"E
8	28°23'28.00"S	31°58'51.67"E
9	28°24'6.94"S	31°58'0.78"E
10	28°24'11.69"S	31°58'6.44"E
11	28°24'15.15"S	31°57'52.83"E
12	28°24'17.77"S	31°57'55.31"E
13	28°23'43.26"S	31°58'51.33"E
14	28°23'45.76"S	31°58'52.17"E
15	28°23'51.90"S	31°58'49.11"E
16	28°23'49.03"S	31°58'50.36"E
17	28°23'45.96"S	31°58'49.71"E
18	28°23'55.33"S	31°58'48.67"E
19	28°24'24.31"S	31°58'11.75"E
20	28°24'28.12"S	31°58'21.01"E
21	28°24'22.41"S	31°58'14.74"E

22	28°24'22.54"S	31°58'18.48"E
23	28°24'26.78"S	31°58'8.26"E
24	28°24'31.50"S	31°58'13.87"E
25	28°24'43.02"S	31°58'21.14"E
26	28°24'33.48"S	31°57'55.73"E
27	28°24'50.36"S	31°58'5.16"E
28	28°24'45.47"S	31°57'45.18"E
29	28°24'48.20"S	31°57'47.48"E
30	28°24'51.01"S	31°57'42.80"E
31	28°25'17.12"S	31°57'39.30"E
32	28°24'57.24"S	31°57'36.97"E
33	28°24'54.18"S	31°57'34.27"E
34	28°25'4.12"S	31°57'21.31"E
35	28°26'9.88"S	31°57'7.17"E
36	28°26'25.25"S	31°57'4.41"E
37	28°26'26.27"S	31°57'3.71"E
38	28°26'39.98"S	31°56'42.05"E
39	28°26'42.14"S	31°56'44.00"E
40	28°26'49.49"S	31°56'29.61"E
41	28°26'51.47"S	31°56'32.28"E
42	28°25'23.92"S	31°54'38.56"E
43	28°26'8.73"S	31°57'5.12"E
44	28°25'35.29"S	31°57'17.18"E
45	28°25'35.11"S	31°57'22.48"E
46	28°25'32.27"S	31°57'20.96"E
47	28°25'2.57"S	31°55'52.57"E
48	28°25'10.56"S	31°57'22.40"E
49	28°25'10.09"S	31°57'19.34"E
50	28°25'13.73"S	31°57'15.12"E
51	28°25'7.68"S	31°57'24.66"E
52	28°25'19.29"S	31°57'10.99"E
53	28°25'17.92"S	31°57'9.65"E
54	28°25'5.16"S	31°57'26.03"E
55	28°25'10.24"S	31°57'8.46"E

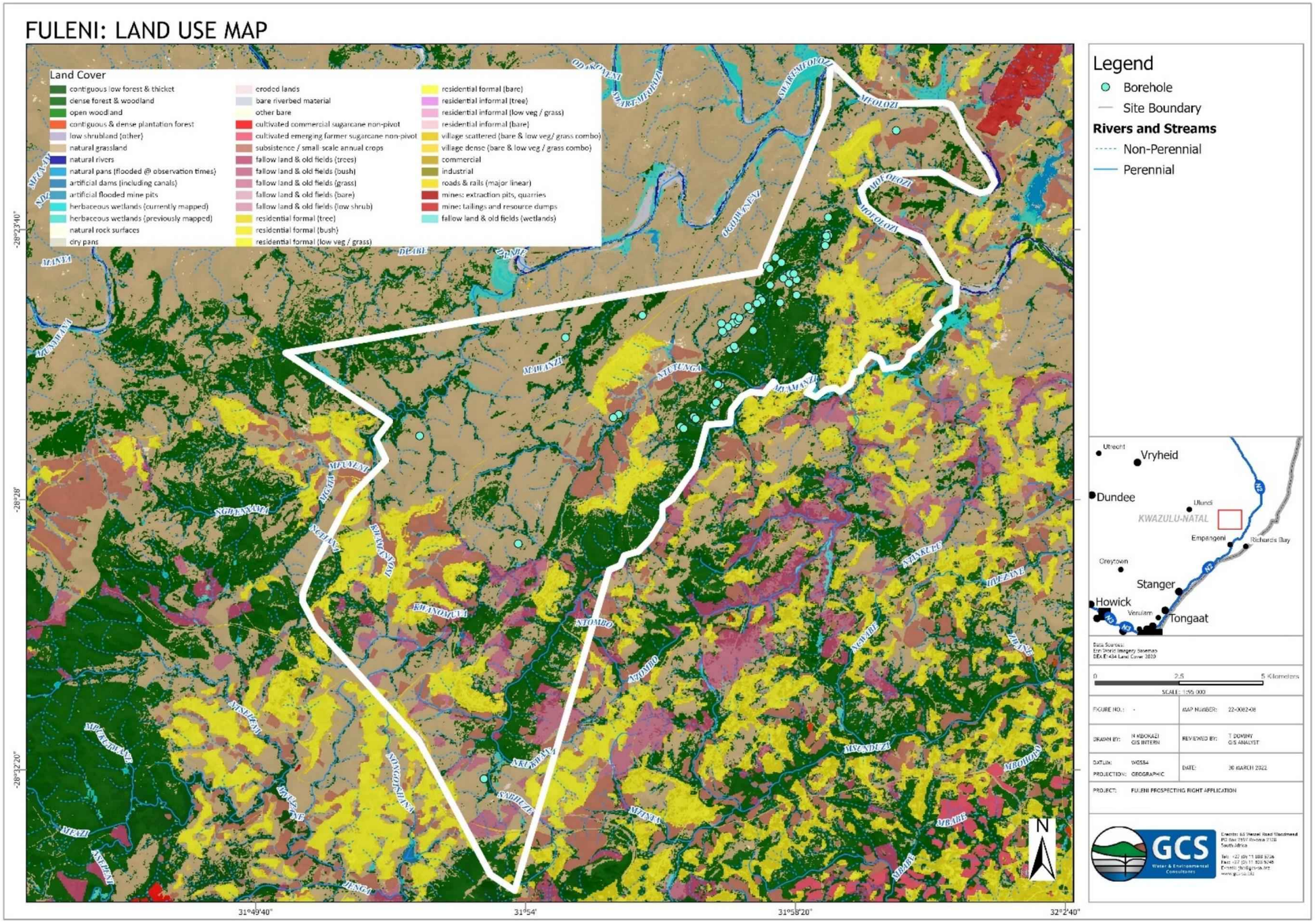


Figure 2-1: Land use of the proposed prospecting right area and surrounds

2.2 Land Ownership

The property is owned by the Ingonyama Trust Board (ITB). Refer to Table 2-2 for the affected property details. The total PR area being applied for is 14 717 ha.

Table 2-2: Affected property details

Property Description	SG Code	Property size (ha)
Portion 0 of Fuleni Reserve 14375 GU	N0GU00000001437500000	22039.1996H

2.3 Description of Proposed Activity

The proposed activities on site will be associated with prospecting and exploration, to obtain core samples by means of drilling sampling holes. A phased approached will be used for the drilling of boreholes. A maximum of four boreholes or less will be drilled at any given time.

2.3.1 Site infrastructure

The following infrastructure is required for the drilling of a borehole:

- Drill equipment;
- Sump;
- Waste storage;
- Laydown area; and
- Chemical toilets.

No additional roads are foreseen to be required, existing tracks wil be used as far as possible.

2.3.2 Non-invasive Methods

Ground magnetic survey, geophysical survey and field reconnaissance will be undertaken initially. This will assist with the identification of sites within the boundary of the PR area, and obtaining detailed data for mapping of the ore body to be prospected. It is assumed that information from previous prospecting in the area (should it be available) will be incorporated.

2.3.3 Invasive Methods

Diamond drilling will be undertaken to determine the stratigraphy and horizons of the ore body and confirm the information collected during the non-invasive investigations.

A maximum amount of 55 holes will be drilled. Please note these holes were plotted on a grid and basic consideration has been made with regards to environmental sensitivities for the purposes of this report. All drill holes will, however, be approved by the team's environmental manager prior to approval thereof. The environmental management plan related to this project will consider environmental sensitivities and approve or reject holes in Table 2-1. Clearly

defined targets will warrant testing by diamond, reverse circulation or percussions drilling. It is envisaged that a combination of HQ (63.5mm) and NQ (47.63mm) drilling will be used to drill targets. The borehole depths are expected to vary between 25m and 125m with an average of approximately 70m. The core will be logged, cut and sampled at a core yard to be located near the prospecting site. The samples will be crushed and milled and then analysed at an accredited laboratory to determine quality.

A rigorous quality control and assurance program (insertion of reference standards, duplicates and blanks into each batch) will be used to monitor the analyses and make sure that valid results are achieved. An area of approximately 500m^2 will be cleared by means of a TLB around each borehole site. The area will be fenced off to prevent unauthorised access by people or animals. The recovered Cores will be constructed in core trays and stored for analysis. When completed, all boreholes will be cemented, sealed and capped, and the sites will be fully rehabilitated.

3 LEGAL FRAMEWORK

This chapter details applicable legal provisions and aims to provide a review of relevant national and provincial legislation and regulations, and policy documents, which apply to, or have implications for, the proposed prospecting activities.

3.1 The Constitution of South Africa, 1996

The legal reference source for environmental law in South Africa is found in the Constitution of the Republic of South Africa, 1996 (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 since environmental rights have been established (Section 24) and other rights created in the Bill of Rights which impact on environmental management.

3.2 NEMA EIA regulations (2014) as amended

The NEMA, 1998 (Act No. 107 of 1998) is South Africa's overarching framework for environmental legislation. Of particular importance is the requirement of 'duty of care' with regards to environmental remediation stipulated in Section 28 of NEMA:

Duty of care and remediation of environmental damage: "(1) Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be

reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment."

Regulations promulgated under NEMA include the EIA Regulations (2014) published under Government Notice Regulation (GNR) 982, as amended 4 April 2017, and the associated Listing Notices Listing Notice 1, 2 and 3. Section 24(5) of NEMA stipulates that certain "listed activities" require environmental authorisation by way of either a Basic Assessment (BA) or a full Scoping and Environmental Impact Assessment (SEIA) as defined in the Listing Notices. Activities listed under Listing Notice 1 and 3 require a BA process to be undertaken while those listed under Listing Notice 2 require a full Scoping and SEIA process. Table 3-2 provides an assessment of the applicable listed activities.

3.2.1 Screening and Initial Site Sensitivity Verification

Based on the Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA, when applying for EA (GN R320 of 20 March 2020) (the Protocols), the required level of assessment must be based on the findings of the Initial Site Sensitivity Verification and must comply with Appendix 6 of the EIA Regulations promulgated under sections 24(5) and 44 of the NEMA, where a specialist assessment is required.

An Initial Site Sensitivity Verification must be undertaken by an EAP or a registered specialist with expertise in the relevant environmental theme being considered. The Initial Site Sensitivity Verification must be undertaken through the use of:

- A desktop analysis, using satellite imagery; and
- A preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web-based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.

The outcome of the Initial Site Sensitivity Verification must be recorded in the form of a report that-

- Confirms or disputes the current use of the land and environmental sensitivity as identified by the national web-based environmental screening tool;
- Contains motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
- Is submitted together with the relevant assessment report prepared following the requirements of the EIA Regulations.

The site has several sensitivities and associated reporting requirements, as shown in Table 3-1. The assessment was based on the property description, using the from Department of Forestry, Fisheries and Environment (DFFE) online screening tool (29 March 2022) (Appendix C).

Table 3-1: Site Sensitivities (based on the property description) from Department of Forestry, Fisheries and Environment (DFFE) online screening tool

THEME	VERY HIGH	HIGH	MEDIUM	LOW
Agriculture	X			
Animal Species		X		
Aquatic Biodiversity	X			
Archaeological and Cultural Heritage	X			
Civil Aviation		X		
Defence				X
Paleontology	X			
Plant Species			X	
Terrestrial Biodiversity	X			

3.2.2 Applicable Listed Activities

The proposed project will require an EA and Prospecting Right through a BA process, due to the following listed activities being triggered (Table 3-2).

Table 3-2: Listed activities in terms of the 2014 NEMA EIA regulations, as amended

Notice	Activity	Description of related activity	Applicability
1	20	Any activity including the operation of that activity which requires a prospecting right in terms of section 16 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including— (a) associated infrastructure, structures and earthworks, directly related to prospecting of a mineral resource[,] ; or [including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)] (b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in Listing Notice 2 applies.	Prospecting activities

Notice	Activity	Description of related activity	Applicability
3	12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. d. KwaZulu-Natal v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	Areas of 100m^2 will be cleared around each of the 55 boreholes. According to the DFFE Screening Tool, the area is classified as a CBA 1 and 2, Ecological Support Area, Protected Areas Expansion Strategy, vulnerable ecosystem and falls within an aquatic CBA and NFEPA quaternary catchments. It is also adjacent to the HiP and Somopho Community Reserve.

As such, a BA process is deemed applicable for the proposed project.

3.3 National Environmental Management: Biodiversity Act, 2004

The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM: BA) 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 (SANBI).

The national list of ecosystems that are threatened or in need of protection was published in GN 1002 of 9 December 2011. Ecosystems are classified as critically endangered (CR), endangered (EN), vulnerable (VU), or protected. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value. **According to the DFFE Screening Tool, the area is classified as a CBA 1 and 2, Ecological Support Area (ESA), Protected Areas Expansion Strategy, vulnerable ecosystem and falls within an aquatic CBA and NFEPA quaternary catchments. It is also adjacent to the HiP and Somopho Community Reserve.**

In accordance with Section 57(1) of the NEMBA, a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species (TOPS) without a permit.

3.4 National Water Act, 1998

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) is the fundamental law for managing South Africa's water resources. The NWA provides the legal basis upon which to develop tools such as the authorisation of water uses as defined in Chapter 4 of the NWA. Section 21 of the NWA lists water uses which can only be legitimately undertaken through the water use authorisation issued by the regional Department of Water and Sanitation (DWS). There are various wetlands and watercourses across the site, as well as dams, presumably used for the agricultural activities.

The prospecting activities for the proposed project will not require a water use license as it does not trigger any Section 21 water uses.

3.5 National Heritage Resources Act, 1999

The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. In terms of Section 38 (1) of the NHRA, subject to the provisions of subsections (7), (8) and (9), the following activities trigger the need for a Heritage Impact Assessment (HIA):

- Any development or other activity which will change the character of a site (applicable to this application);
- The re-zoning of a site exceeding 10 000 m^2 in extent; or
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA) or a Provincial Heritage Resources Agency (PHRA).

As such, a Notice of Intent to Develop (NID) was prepared and is included as Appendix B.

4 PROJECT MOTIVATION AND NEED & DESIRABILITY

The prospecting right area was identified using existing geological information. The aim of prospecting activities is to confirm the presence, quality and economic viability of a resource through both non-invasive methods such as desktop studies, and invasive methods i.e. drilling activities, and to evaluate the quality thereof.

5 DEVELOPMENT ALTERNATIVES

Development alternatives are defined in relation to a proposed activity as different means of meeting the general purposes and requirements of the activity, which may include alternatives to –

- The property on which, or location where it is proposed to undertake the activity;
- The type of activity to be undertaken;
- The design or layout of the activity;
- The technology to be used in the activity;
- The operational aspects of the activity; and
- The option of not implementing the activity.

5.1 Potential Alternatives

Due to the geology of the area and the potential for coal, no other sites or methods of exploration/prospecting are applicable. It is assumed that the points chosen were determined in conjunction with a geologist as per the prospecting programme.

5.2 No Go Alternative

Should the prospecting activities not go-ahead, the confirmation of the resource and resource determination will not be realised.

6 ENVIRONMENTAL ATTRIBUTES

This section outlines the biophysical and cultural heritage attributes of the study area, and indicates any environmental sensitivities that must be considered in planning and design, and in the impact assessment process.

6.1 Topography

The study area is characterized by gentle to steep slopes, with prominent topographical depressions along the drainage lines in the area. Elevations range from 50 to 250 meters above mean sea level (mamsl).

6.2 Geology

The regional geological map (DMEA, 1998) indicates that most of the PR area is underlain by sediments of the Emakwezeni Formation (lower Beaufort Group) and sediments of the Volksrust Formation of the Karoo Supergroup. Occurrences of younger sedimentary rock of the Ntabene, Clarens, Nyoka and Letaba formations (still part of the Karoo Supergroup) are also known to occur in the project area. Dolerite sill and dyke structures, fault zones and metamorphic contact zones are known to be associated with the area.

The Emakwezini Formation comprises mainly of grey, greenish-grey and brown mudstones with interbedded coal seams, medium to coarse-grained sandstones and may contain plant fossils and lenses of limestone. The site is characterised by steeply dipping strata and the block faulting which disrupts the continuity of the coal zone. The Emakwezini Formation is overlain by the Late Triassic Molteno Formation, which comprises alternating medium to coarse-grained sandstone with secondary quartz overgrowths and thin grey mudrocks, and the Elliot Formation, which predominantly consists of red and purple mudstone, medium-grained sandstone with calcareous concretions, shale and siltstone. The Late Triassic–Early Jurassic Clarens Formation consists of yellowish-grey, pale orange or pink, very fine-grained aeolian sandstone that represents the final phase of Karoo basin sedimentation (GCS, 2022).

6.3 Climate

6.3.1 Temperature

The average yearly temperature (refer to Figure 6-1) for the project area ranges from 25 to 39 C (high) and 5 to 19 °C (Low). The study area is situated in a sub-tropical climate area, as per the Köppen Climate Classification (Kottek, et al., 2006). Hence, the area received summer rainfall.

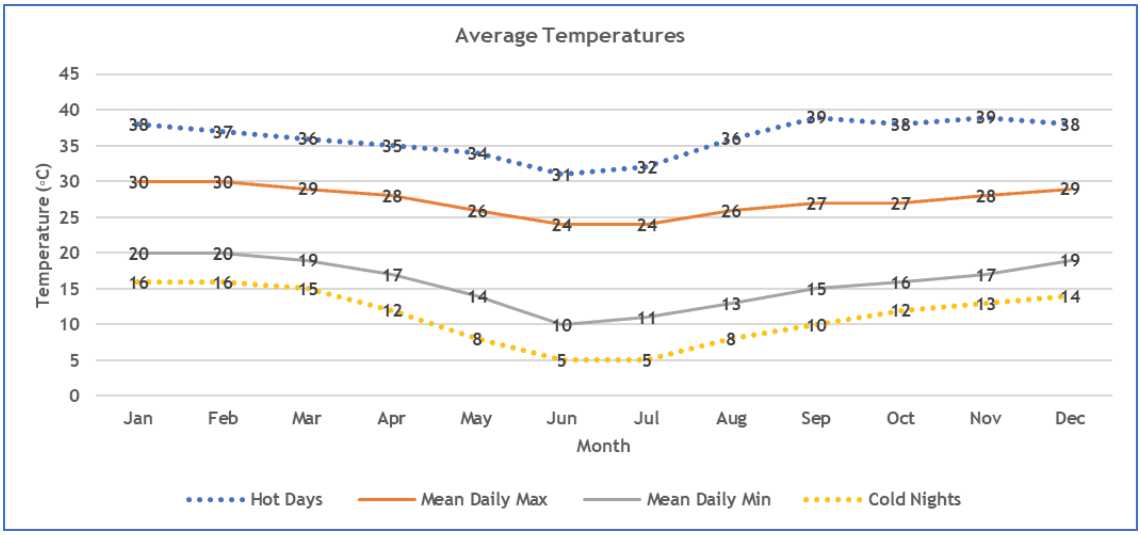


Figure 6-1: Average yearly temperatures (Meteoblue, 2022)

6.3.2 Wind speed and direction

Figure 6-2 shows the wind rose for the project area (Ezidonini used as reference as it is the nearest available weather station with wind data) and presents the number of hours per year the wind blows from the indicated direction. Wind generally blows from N, NNE and S at velocities >19 km/h, with less frequent and lower wind velocity from other directions. Precipitation intensity during wind will likely cause intensity changes on slopes perpendicular to the wind direction, throughout the year.

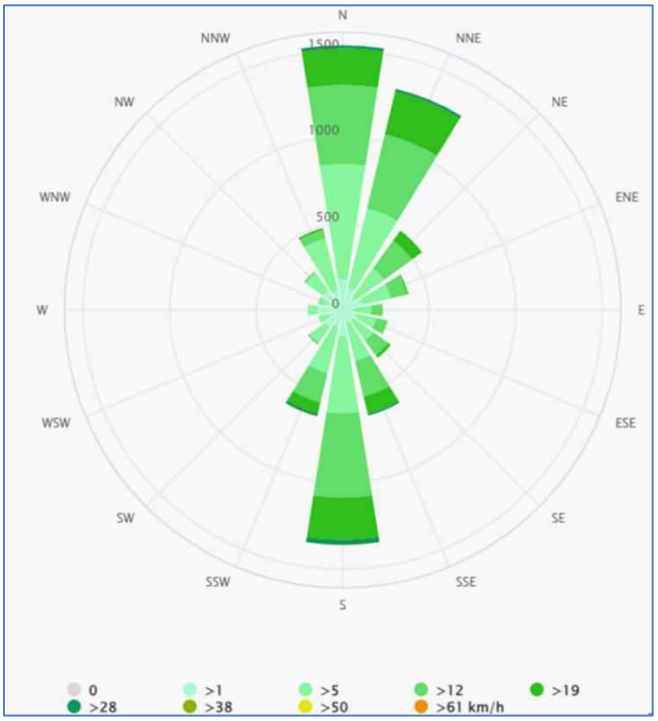


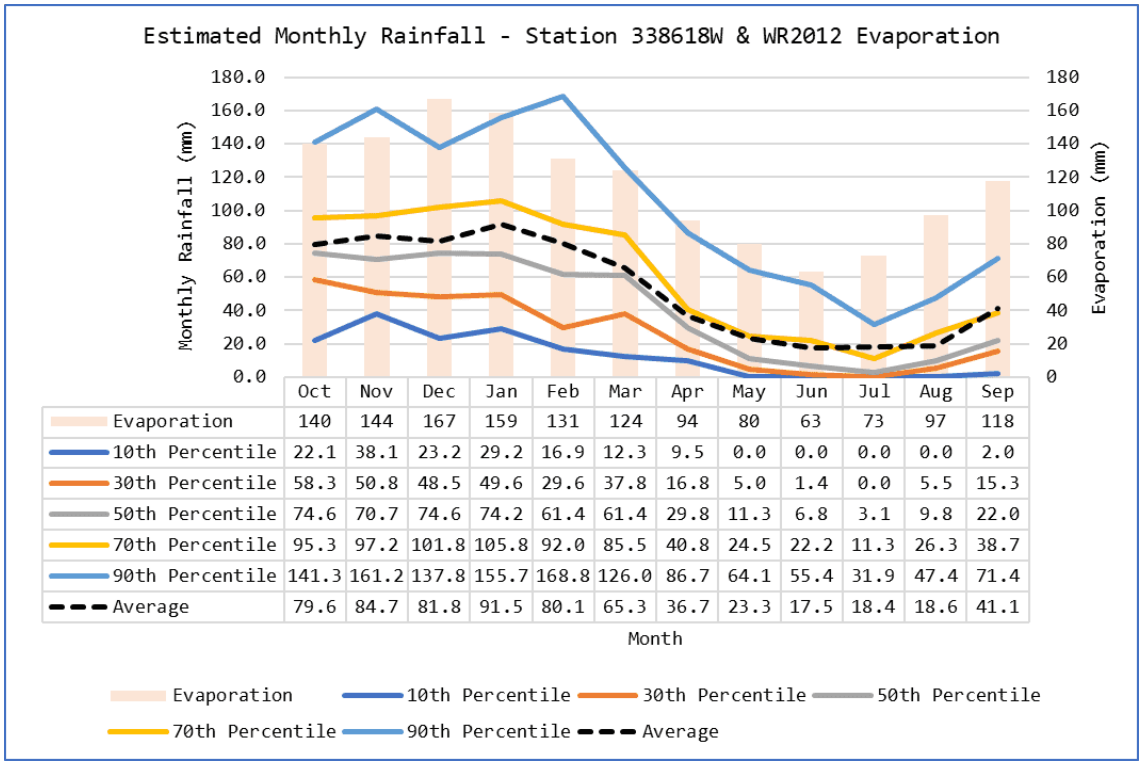
Figure 6-2: Wind rose (Meteoblue, 2022)

6.3.3 Rainfall and evaporation

The project area is situated in rainfall zone W2C and W2F. The monthly rainfall data used to calculate Mean Annual Precipitation (MAP) was obtained from WR2012 rainfall station 0338618 W (situated 11km north). The rainfall record is for the period 1958 to 2009 (51 years). Monthly rainfall for the site is likely to be distributed as shown in Figure 6-3, below.

Available rainfall data suggest a MAP ranging from 318.5 (30th percentile) to 1247 (90th percentile) mm/yr. The average rainfall is in the order of 638 mm/yr.

The project area falls within evaporation zone 22B & 22C, of which Mean Annual Evaporation (MAE) ranges from 1 300 to 1 400 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Monthly evapotranspiration for the site is likely to be distributed as shown in Figure 6-3, below.



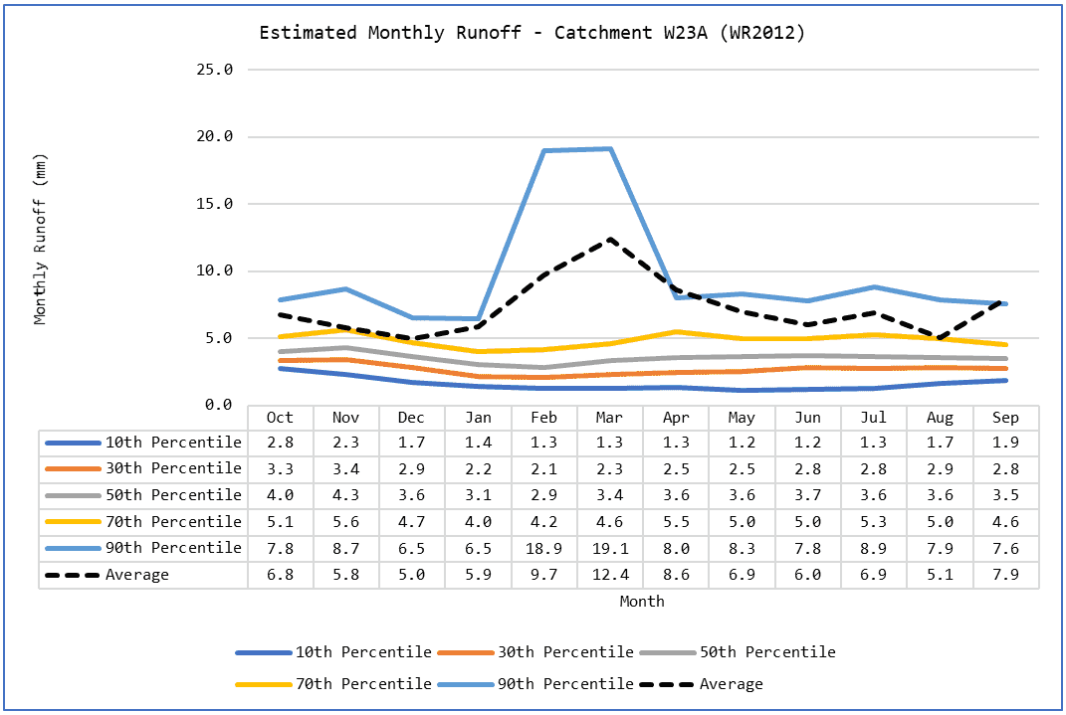
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation	140	144	167	159	131	124	94	80	63	73	97	118
10th Percentile	22.1	38.1	23.2	29.2	16.9	12.3	9.5	0.0	0.0	0.0	0.0	2.0
30th Percentile	58.3	50.8	48.5	49.6	29.6	37.8	16.8	5.0	1.4	0.0	5.5	15.3
50th Percentile	74.6	70.7	74.6	74.2	61.4	61.4	29.8	11.3	6.8	3.1	9.8	22.0
70th Percentile	95.3	97.2	101.8	105.8	92.0	85.5	40.8	24.5	22.2	11.3	26.3	38.7
90th Percentile	141.3	161.2	137.8	155.7	168.8	126.0	86.7	64.1	55.4	31.9	47.4	71.4
Average	79.6	84.7	81.8	91.5	80.1	65.3	36.7	23.3	17.5	18.4	18.6	41.1

Figure 6-3: Average rainfall for Station 0338618W & WR2012 evaporation

6.3.4 Runoff

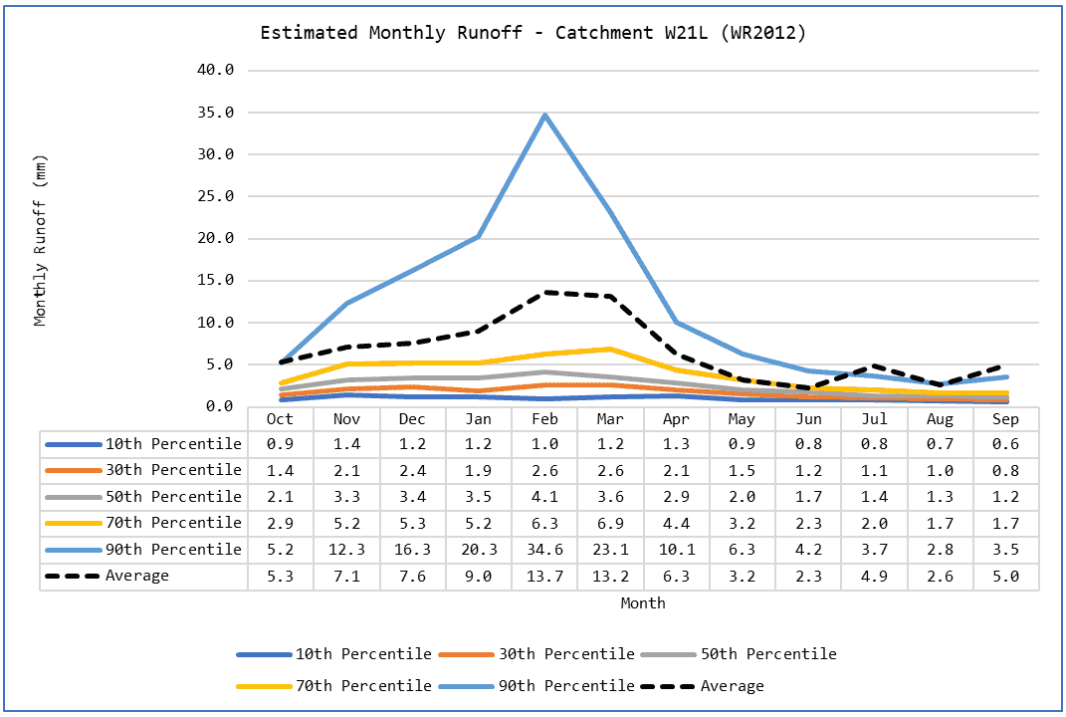
Runoff from natural (unmodified) catchments in Catchment U30E is simulated in WR2012 (WRC, 2015) as being equivalent to:

- W23A: This is equal to approximately 14% of the MAP.
  - The natural mean annual runoff (NMAR) is calculated to be in the order of 35 988 888.89 m^3/year (35.98 Mm^3/yr).
  - Monthly runoff is distributed as shown in Figure 6-4.
- W21L: This is equal to approximately 13% of the MAP.
  - The NMAR is calculated to be in the order of 42 695 000 m^3/year (42.69 Mm^3/yr).
  - Monthly runoff is distributed as shown in Figure 6-5.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	2.8	2.3	1.7	1.4	1.3	1.3	1.3	1.2	1.2	1.3	1.7	1.9
30th Percentile	3.3	3.4	2.9	2.2	2.1	2.3	2.5	2.5	2.8	2.8	2.9	2.8
50th Percentile	4.0	4.3	3.6	3.1	2.9	3.4	3.6	3.6	3.7	3.6	3.6	3.5
70th Percentile	5.1	5.6	4.7	4.0	4.2	4.6	5.5	5.0	5.0	5.3	5.0	4.6
90th Percentile	7.8	8.7	6.5	6.5	18.9	19.1	8.0	8.3	7.8	8.9	7.9	7.6
Average	6.8	5.8	5.0	5.9	9.7	12.4	8.6	6.9	6.0	6.9	5.1	7.9

Figure 6-4: Simulated runoff for quaternary catchment W23A (WRC, 2015)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	0.9	1.4	1.2	1.2	1.0	1.2	1.3	0.9	0.8	0.8	0.7	0.6
30th Percentile	1.4	2.1	2.4	1.9	2.6	2.6	2.1	1.5	1.2	1.1	1.0	0.8
50th Percentile	2.1	3.3	3.4	3.5	4.1	3.6	2.9	2.0	1.7	1.4	1.3	1.2
70th Percentile	2.9	5.2	5.3	5.2	6.3	6.9	4.4	3.2	2.3	2.0	1.7	1.7
90th Percentile	5.2	12.3	16.3	20.3	34.6	23.1	10.1	6.3	4.2	3.7	2.8	3.5
Average	5.3	7.1	7.6	9.0	13.7	13.2	6.3	3.2	2.3	4.9	2.6	5.0

Figure 6-5: Simulated runoff for quaternary catchment W21L (WRC, 2015)

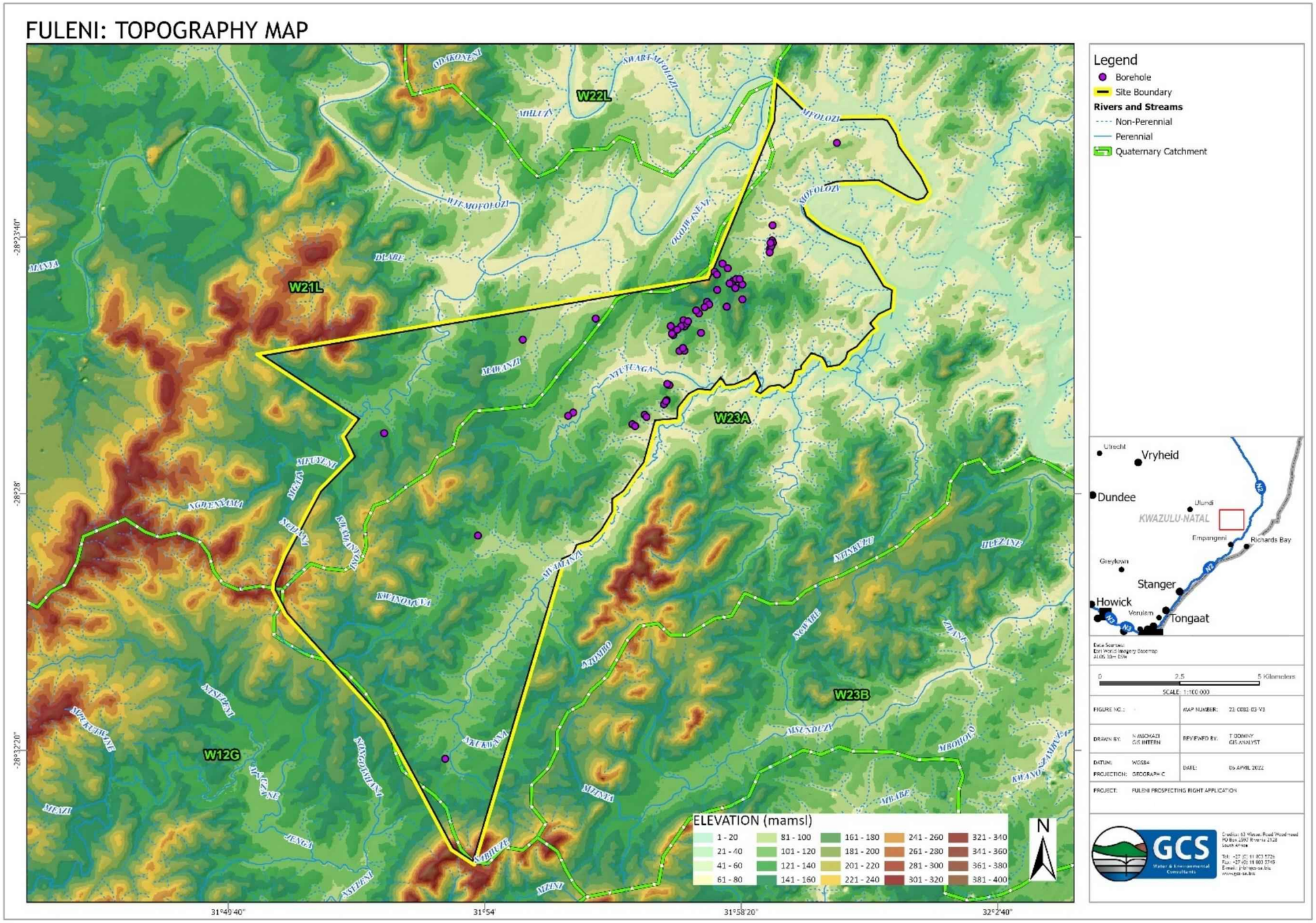


Figure 6-6: Topography of the area

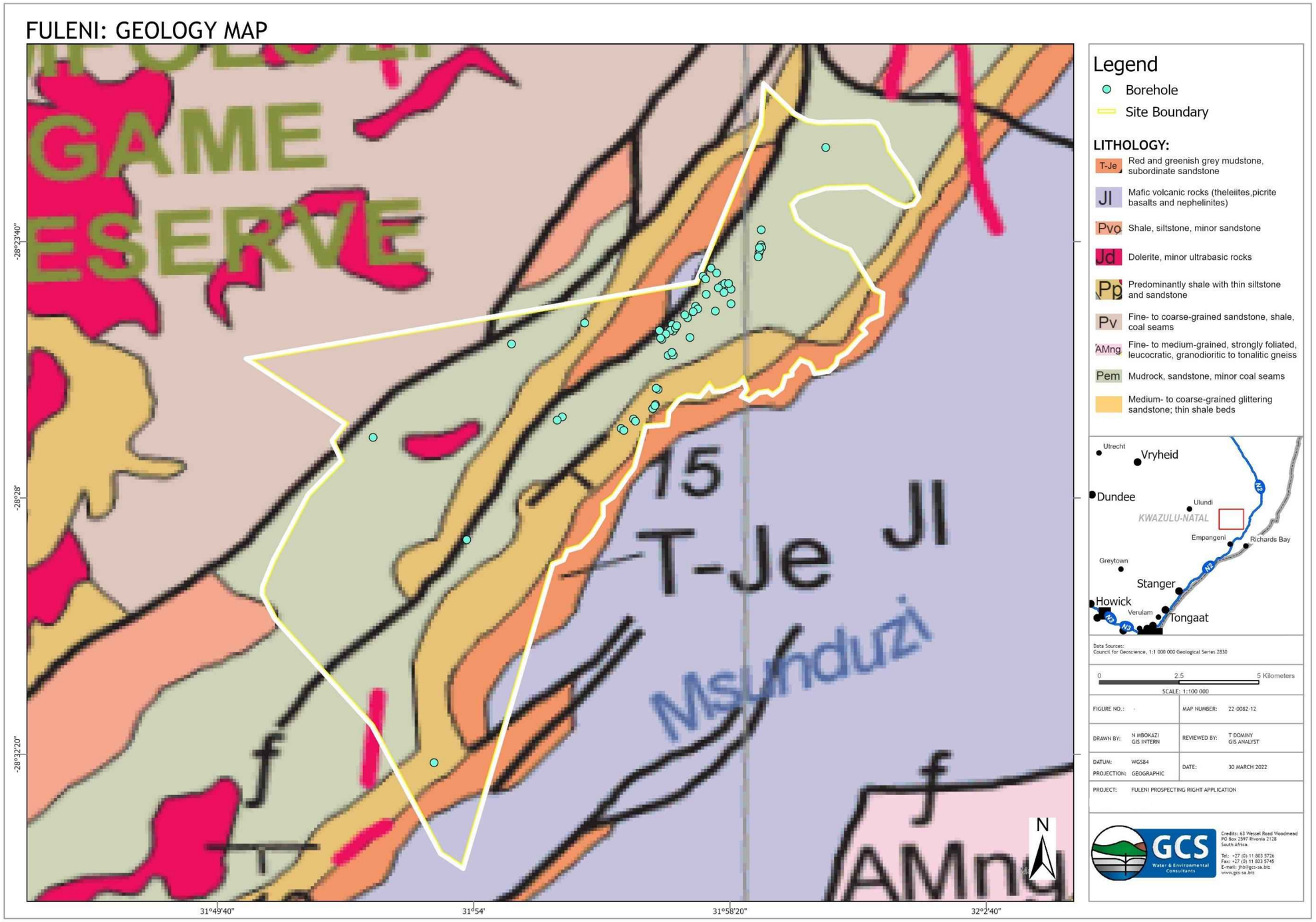


Figure 6-7: Geology of the area

6.4 Terrestrial Biodiversity

A field investigation undertaken by Enviro-Niche in 2018 identified vegetation types on site to be Zululand Lowveld (SVl 23), Northern Zululand Sourveld (SVl 22) and Zululand Coastal Thornveld (SVl 24) (Appendix B). Isolated pockets of Eastern Escarp Forests (FOz 5) was observed on the eastern slopes of the Mduba Peak, boardering the HiP, and just outside the project site in the Somopho Community Reserve. Table 6-1 indicates the conservation status of the vegetation types in the project area.

Table 6-1: Conservation status of vegetation types (Mucina and Rutherford, 2006)

Vegetation Type	Conservation Status
Northern Zululand Sourveld (SVl 22)	Vulnerable
Zululand Lowveld (SVl 23)	Vulnerable
Zululand Coastal Thornveld (SVl 24)	Endangered
Eastern Escarp Forests (FOz 5)	Vulnerable

The site was also noted to fall within the North Eastern Uplands Ecoregion. According to the KwaZulu-Natal Biodiversity Plan (EKZNW, 2015), the project area is not situated within a formal or informal protected area. It does boarder the HiP and Somopho Community Nature Reserve.

The vegetation in and around the communities was noted to be highly degraded, due to communal grazing activities and subsistence farming, while some small areas away from the communities and along the non-perennial drainage lines are in relatively good condition.

Extensive alien invasive plants were observed, including Black Wattle (*Acacia mearnsii*), *Melia azedarach, Ricinus communis, Senna didymobotrya, Cereus jamacaru, Ipomoea carnea, Xanthium strumarium, Tagetes minuta, Bidens bipinnata, Flaveria bidentis, Gomphrena celosioides, Chromolaena odorata,* and *Psidium guajava*. Famine weed (*Parthenium hysterophorus*), a Category 1b weed, was also observed to be widespread in the proposed project area.

The natural ecosystem around the communities was observed to be in a low-moderate condition, while further away from the communities were observed to be in a moderate-good condition. *Sclerocarya birrea* and *Sideroxylon inerme* were noted in the project areas, which is a protected species in terms of the Forest Act (Act 84 of 1998).

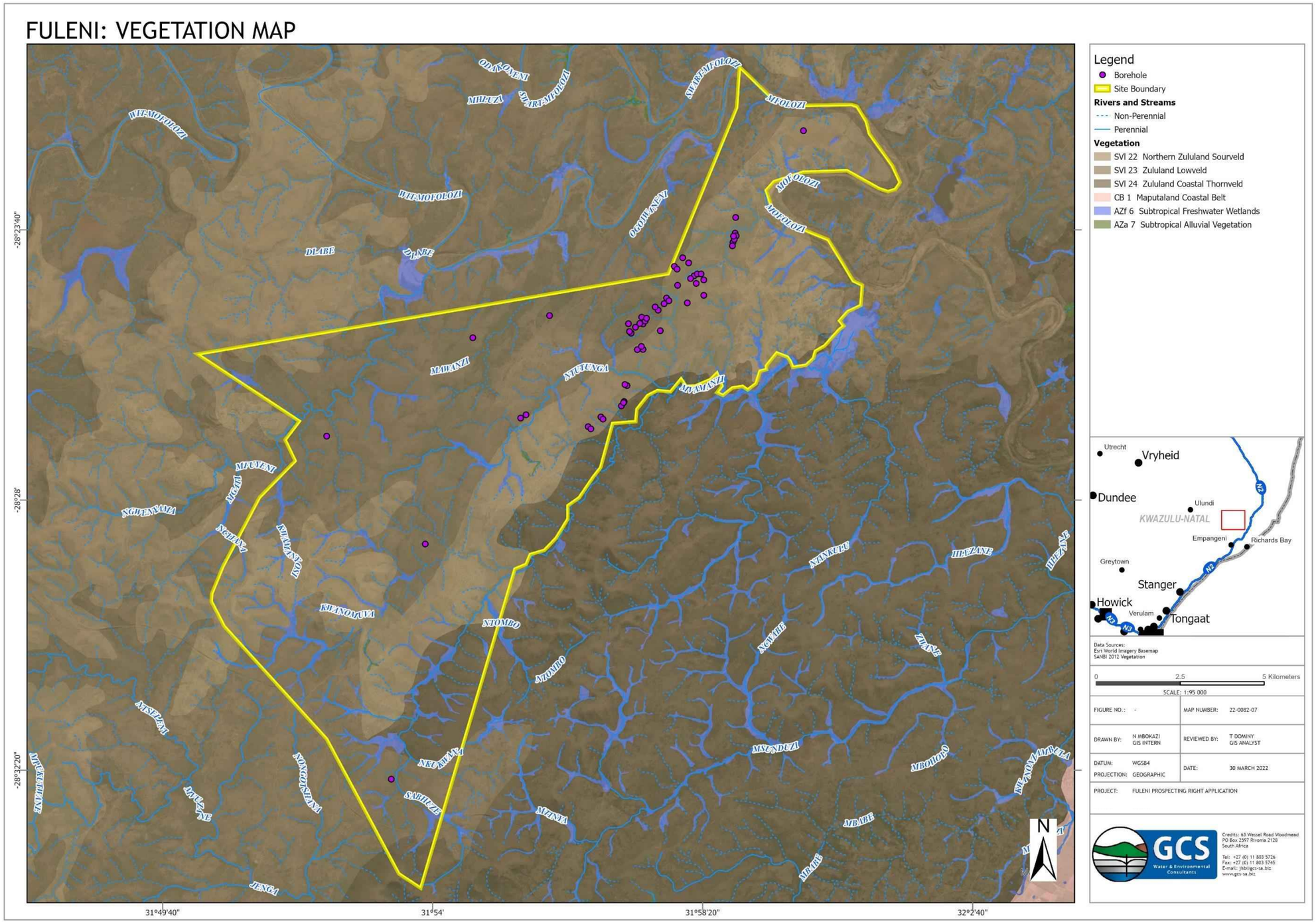


Figure 6-8: Vegetation of the proposed prospecting area and surrounds

6.5 Hydrology

The PR area falls within the W23A and W21L quaternary catchments which is within the uSuthu to Mhlatuze Water Management Area (WMA). It is downstream of the confluence of the Black Mfolozi with the White Mfolozi in the Mfolozi River Catchment. These rivers rise on the eastern escarpment of the Drakensburg Mountain range and flow eastward across the Zululand coastal plain. The two tributaries eventually confluence in the southeastern boundary of the Hluhluwe-Umfolozi Game Reserve to form the Mflozi River which discharges into the Indian Ocean. The mean annual runoff (MAR) from the Mfolozi River is estimated to be 962 million m^3/annum. The runoff ranges from 226 mm/annum in W23D on the cost to 41 mm/annum in W21D inland along the Drakensberg mountains.

Agriculture is the largest water user in this catchment, predominantly for sugarcane and forestry. The main threats to the water quality of the uMfolozi River are land degradation due to land use practices and coal mining. The uMfolozi River carries over a million tonnes of suspended sediment annually to the ocean.

Floodlines were developed as part of the surface hydrology study for the Fuleni PR as part of their application for an EA.The backwater modelling program, HEC-RAS, was used to calculate the floodlines for the 1 in 50 and 1 in 100 peak flows resulting from the respective 24-hour storm events (Figure 6-10 and Figure 6-11). The results provided indicate that given the gentle channel shape of the Mfolozi in this area, the extent of the flood is not excessive. No stormwater management plan (SWMP) is required.

6.6 Wetlands

The site is noted to have NFEPA floodplain wetlands and valley-bottom wetlands (Enviro-Niche, 2018).

The Riparian Vegetation Response Index (VEGRAI) was applied to assess the impacts of modifications to the system on the riparian vegetation of the rivers and drainage channels. The VEGRAI Ecological Category of the riparian features of the Umfolozi and Mvamanzi Rivers falls within Category D (40%), indicating largely modified, while that of the riparian features of the non-perennial drainage lines is a Category C (55%), indicating moderately modified ecostatus. It was observed that much of the functionality of the wetland and riparian features have been altered due to human influences such as abstraction and sand mining, agricultural activities such as crop and livestock production, and excessive alien vegetation due to activities such as the clearing of indigenous vegetation for access to the rivers and grazing by livestock. Water is currently used by communities for domestic and agricultural purposes, resulting in a decrease in downstream slow and increase in water pollution (Enviro-Niche, 2018).

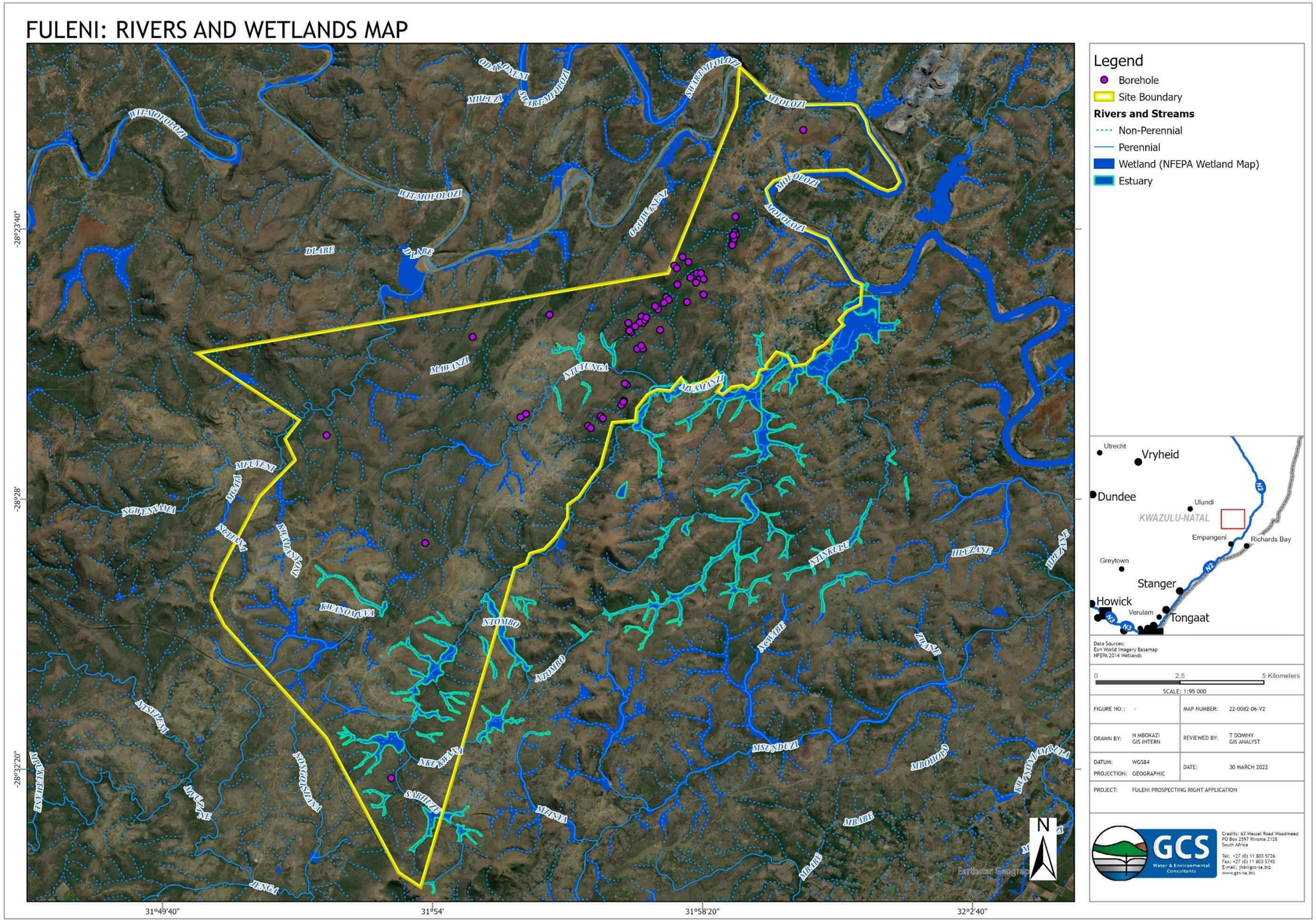


Figure 6-9: Rivers and wetlands of the proposed prospecting area and surrounds

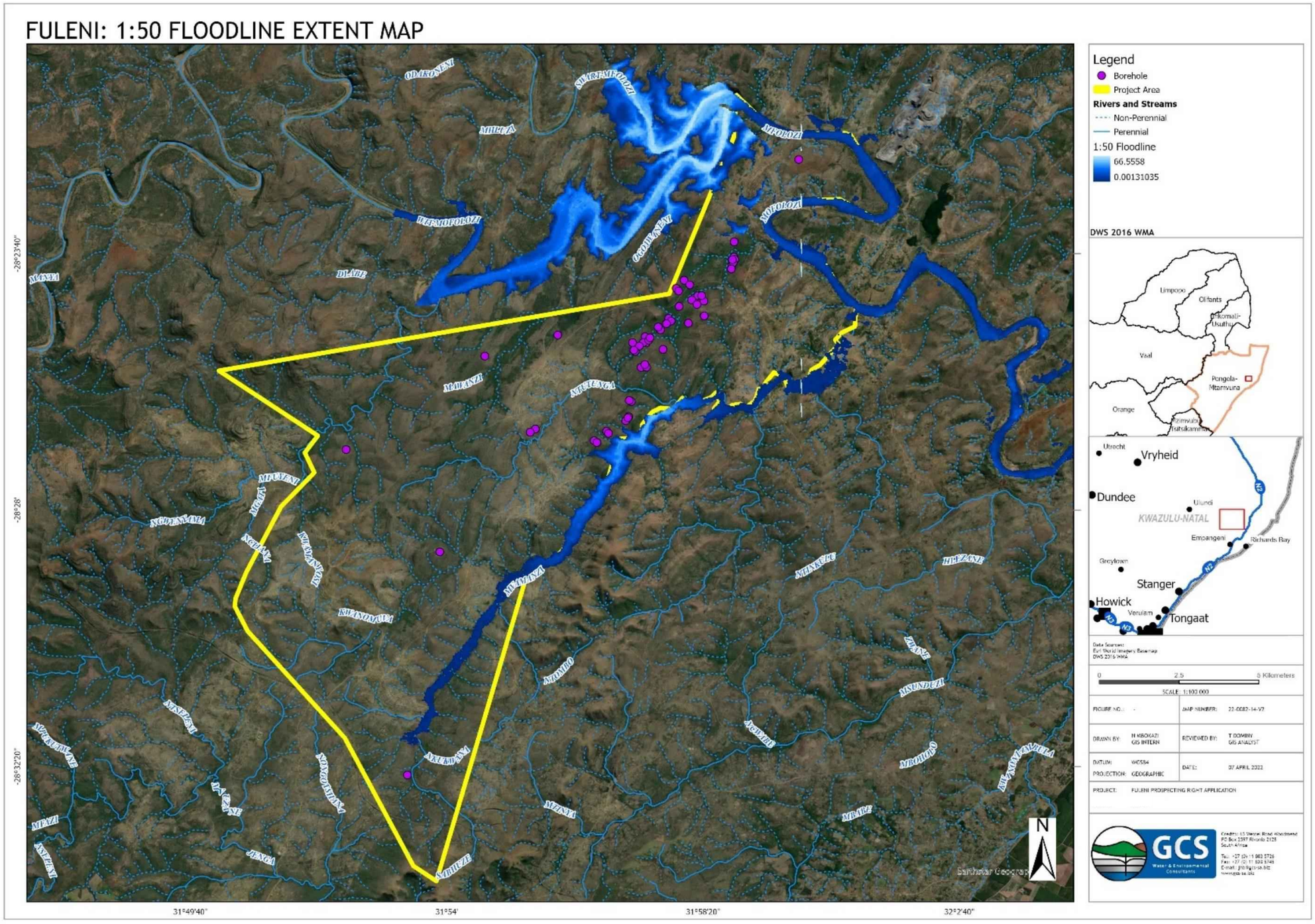


Figure 6-10: 1 in 50 year floodlines

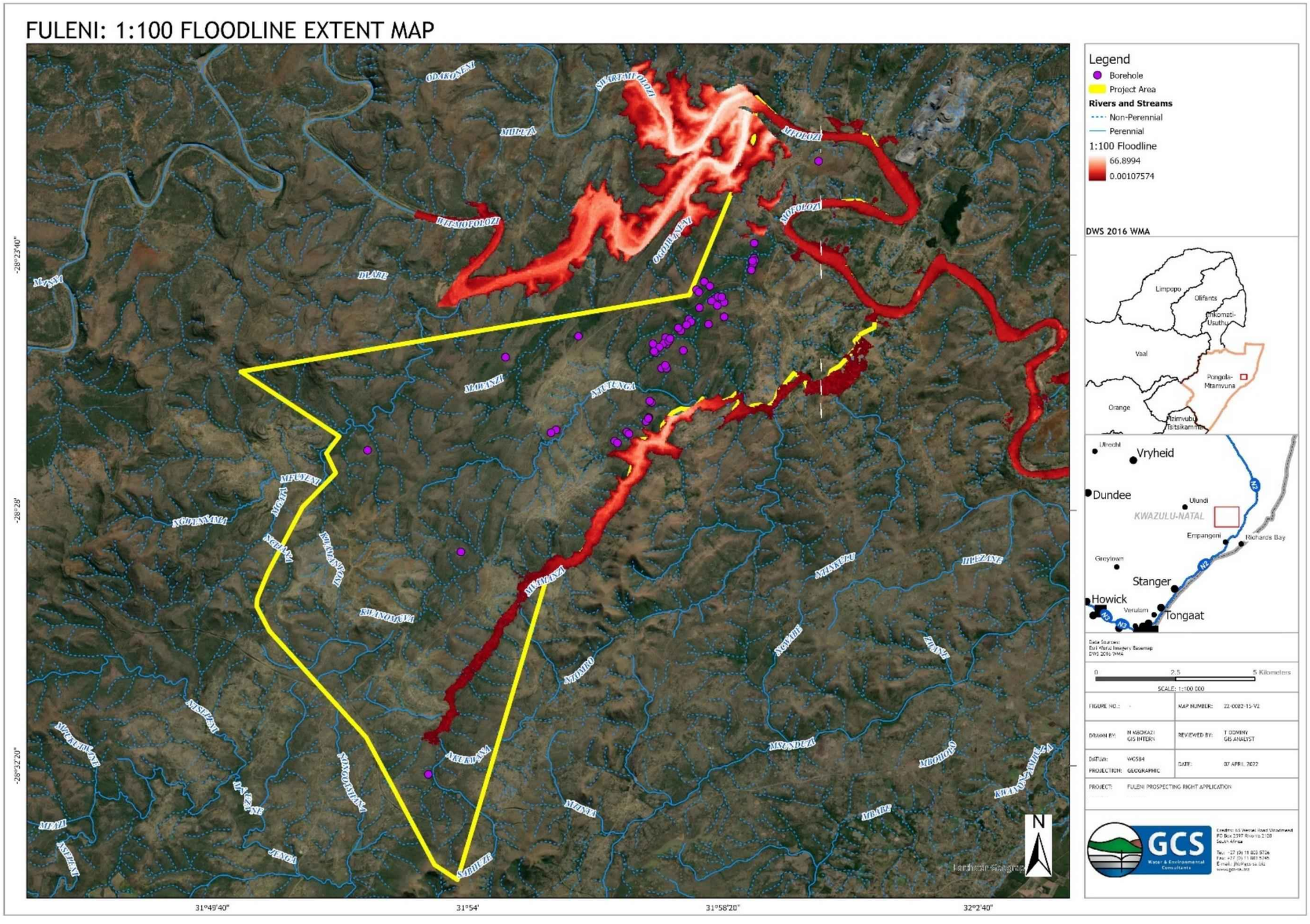


Figure 6-11: 1 in 100 year floodlines

6.7 Geohydrology

A desktop study undertaken by GCS (2022) indicates that the groundwater quality for the region will be variable and will depend on the underlying geology and hydrogeology characteristics associated with groundwater recharge (i.e., older rock and aquifers with ion exchange will have higher EC, and recently recharged more permeable younger rocks will have lower EC). Literature and available hydrogeology maps for the area suggests that the electrical conductivity (EC) for the underlying aquifers generally ranges from 70 to 300 mS/m (milli Siemens/metre) which translates into groundwater that may have a high total dissolved solids (TDS) or be of better quality depending on the underlying geological formation. It is known from other work undertaken in the project area, that groundwater associated with the Volksrust, Emakwezini, Ntabene, Nyoka, Clarens and Letaba Formation Formations is generally high in Ca, Mg, Na, K, and Cl. The pH for the region ranges from 6 to 8.

Intermediate groundwater Reserve Determination (IGRD) was conducted for the study area to establish the groundwater reserve. The IGRD aims to quantify the likely impact of the site on the groundwater reserve. The groundwater balance indicates a surplus value of approx. +30 533.50 m^3/day is available for abstraction on a sub-catchment scale.

The groundwater level for the project area is expected to range from 2.37 to 63.9 mbgl, depending on the aquifer intercepted and the position of the borehole on the landscape. Available data suggest that the groundwater table mimics the topography.

6.8 Socio-Economic Context

The site is located in ward 12 and 13 of the Umfolozi Local Municipality (ULM), within the King Cetshwayo District Municipality (KCDM) (ULM, 2021). The ULM is noted to be largely rural, as it comprises mostly of subsistence farmers. There are significant cultural and heritage sites in the municipality, resulting in tourism being one of the more significant economic sectors, contributing to the Gross Domestic Product (GDP).

More than 90% of the population in the ULM are dependent on subsistence farming, with the average household size being 5. The population growth rate from 2001 to 2016 is 14.9%. The community survey undertaken in 2016 indicated that the population is concentrated between the 15-19 and 25-29 years age groups. There are noted to be more females than males in the municipality, likely due to males being migrant workers.

The number of school-going individuals increased slightly between 2011 and 2016, however there is still a generally low level of education in the municipality, with only 2% of the population under 21 years old that have attended higher education.

The majority of households in the ULM earn between R4 800 and R9 600 per month. This leads to financial constraints for the municipality, due to a low number of tax payers.

Approximately 368 households access water through boreholes and water schemes, while 378 use rivers or streams as a source of water. Pit latrines are the most common form of sanitation, with a low number of households using septic tanks and water borne sewerage, and some homes not having access to sanitation facilities at all.

6.9 Cultural Heritage Resources

A NID was undertaken by Heritage Contracts and Archaeological Consulting (HCAC) in 2022. During the site visit, the project area was observed to be mostly undeveloped and rural with low-density, dispersed settlements and subsistence agriculture. Dwellings are grouped as small homesteads. Based on the South African Heritage Resources Agency (SAHRA) paleontological sensitivity map, the area is classed as being of low sensitivity. As a result, no paleontological studies are required, however a protocol for finds is required.

One area of significance was noted to be the HiP. The HiP is located adjacent to the PR. HiP is the oldest proclaimed natural park in Africa, known for its diverse wildlife and conservation efforts. There are many Stone Age archeological sites noted throughout the park. According to the NID, it is expected that a high frequency of sites similar to finds in the greater area can be found in the prospecting area, including heritage resources such as:

- Middle and Late Stone Age sites;
- Rock art sites
- Iron Age stone walled sites related to the rich Zulu heritage of the area
- Cultural landscapes and also natural heritage of the area;
- Places associated with oral traditions and living heritage; and
- Numerous Grave sites.

The KZN Database has indicated five (5) known sites in the prospecting area.

7 PUBLIC PARTICIPATION PROCESS

The Public Participation Process (PPP) is a legislated requirement environmental authorisation procedure. Refer to Appendix D for a copy of the advertisement adn documentation.

7.1 Objectives of Public Participation

The procedures followed during the undertaking of the PPP for the proposed Application for EA must adhere to the NEMA principle whereby the participation of all Interested and Affected Parties (I&APs) in environmental governance must be promoted, and all people must have

adequate opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and involvement by vulnerable and disadvantaged individuals must be ensured [NEMA, Section 2(1)(f).

The primary objectives of the PPP are to:

- Identify key stakeholders (i.e. Non-Governmental Organisations [NGOs], municipalities, government departments, traditional authorities) and I&APs (i.e. surrounding businesses, residents, landowners, interested members of the public);
- Inform I&APs about the proposed Application for an EA;
- Establish lines of communication between I&APs and the project team to deal with concerns;
- Provide ample opportunity to all parties to exchange information and express their views and raise issues and concerns; and
- Obtain contributions of I&APs and ensure that all issues, concerns and questions raised are fully documented and assessed as part of the BA process.

7.2 Public Participation Process

The public participation process will include the following activities (refer to Appendix D for reference documents):

- An electronic I&AP database was developed, which is maintained and updated throughout the project. The public consultation process will be conducted in accordance with the Protection of Personal Information Act, 2013 (Act No 4 of 2013) (POPIA).
- An advertisement for the registration and participation of I&APs was placed in the Isolezwe on 14 April 2022 (isiZulu) and the Zululand Observer on 11 April 2022 (English).
- English and isiZulu notice boards detailing information about the project and the BA Process, as well as invitation to register as I&APs, were placed at strategic points around the PR area. All notice boards were designed to the specification of Section 54 (3) of the NEMA EIA Regulations.
- Email notifications will be circulated to all I&APs on the database (as applicable) inviting comments until 16 May 2022.

7.3 Public Review of Draft BAR

The Draft Basic Assessment Report (DBAR) will be made available for public comment for 30 days. The DBAR will be submitted for public review from 13 April 2022 until 16 May 2022 (30 days). The report is available electronically via the GCS Website (www.gcs-sa.biz) or a CD can

be made available upon request. A hard copy of the report will be available for viewing at the following locations:

- Mhlana Traditional Offices, Fuleni Area;
- Empangeni Library, Corner of Union and Commercial Streets; and
- Kwambonami Library, 25 Bredilia Street, Kwa-Mbonambi.

7.4 Comments and Responses

All comments received during the application process will be captured in a Comments and Responses Report (CRR). This CRR will be updated on a continuous basis and will be presented to the authorities and other I&APs together with the consultation and final reports as a full record of issues raised, including responses on how the issues were considered during the application process.

8 IMPACT ASSESSMENT

This section outlines the anticipated environmental impacts associated with each phase of the proposed prospecting application. These impacts are later rated in terms of significance.

8.1 Methodology

The assessment of potential impacts was addressed in a standard manner to ensure that a wide range of impacts were comparable. The ranking criteria and rating scales were applied to all potential impacts identified by the EMPr. The following methodology was used to rank these impacts. Clearly defined rating and rankings scales (**Table 8-1 -**Table 8-4) were used to assess the impacts associated with the proposed activities. The impacts identified by each specialist study and through public participation were combined into a single impact rating table for ease of assessment.

Table 8-1: Severity or magnitude of impact.

Not applicable/none/negligible	0
Minor	2
Low	4
Moderate	6
High	8
Very high/extreme	10

Table 8-2: Spatial Scale – extent of area being impacting upon.

Not applicable/none/negligible	0
Site only	1
Local (within 5km)	2
Regional/neighbouring areas (5 km to 50 km)	3
National	4
International	5

Table 8-3: Duration of activity

Not applicable/none/negligible	0
Immediate	1
Short term (reversible, 0-5 years)	2
Medium term (difficult to reverse with effort, 5-15 years)	3
Life of the activity (long term – very difficult to reverse with extensive effort)	4
Beyond life of the activity (permanent – not reversible)	5

Table 8-4: Probability

Not applicable/none/negligible	0
Improbable / almost never / Annually or less	1
Low probability / Very seldom / 6 monthly	2
Medium probability / Infrequent / Temporary / Monthly	3
Highly probable / Often / semi-permanent / Weekly	4
Definite / Always / permanent / Daily	5

Each identified impact was assessed in terms of severity, spatial scale and duration (temporal scale). Significance was then determined as follows:

Significance = (Magnitude + Duration + Scale) x Probability

Impacts were rated as either of high, moderate or low significance on the basis provided in **Table 8-5**.

Table 8-5: Impact significance ratings (maximum of 100).

Significance	Environmental Significance Points	Colour Code
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	<30	L
Neutral	0	N
Low (negative)	>-30	L
Medium (negative)	-30 to -60	M
High (negative)	<-60	H

8.2 Site Establishment Phase

The construction phase impact assessment refers to the individial areas where each borehole will be drilled and not the entire prospecting right area.

8.2.1 Surface Water

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Site establishment	• Clearing of vegetation. • Pollution of surface water resources from hydrocarbons.	
Vehicle movements	• Pollution of surface water resources from hydrocarbons. • Compaction of soil leading to increased runoff velocity and erosion.	
Significance	**Before mitigation**	Low - 28
	After mitigation	Low - 8
Mitigation Measures	• Measures should be put in place to prevent and contain spills and facilitate the safe collection and disposal of waste. • Restrict vehicle movement to designated access roads. No vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. • Restrict vegetation clearing to specific footprints. • Minimise areas where spills might occur. • Capture and contain runoff from these areas. • Safely dispose of captured pollutants immediately upon detection.	

8.2.2 Groundwater

According to the Groundwater Study (GCS, 2022), no impacts are foreseen.

8.2.3 Fauna

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Site Establishment: Clearing of vegetation	• Disturbance of habitats. • Increase in human activity. • Disturbance or possible mortality incidents of terrestrian fauna.	
Significance	**Before mitigation**	Medium - 36
	After mitigation	Low - 12
Mitigation Measures	• All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised personnel and maintenance vehicles. • Restrict all movement of vehicles and heavy machinery to permissible, designated areas. No off-road driving beyond designated areas may be allowed.	

Activity	Impact
	• Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. • Strict speed limits must be set and adhered to. • Driving between dusk and dawn should be permissible to emergency situations only. • Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution. • All spills, should they occur, should be immediately cleaned up and treated accordingly.

8.2.4 Flora

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Site establishment: clearing of vegetation	• Vegetation removal. • Disturbance of ecosystems. • Establishment of alien invasive vegetation.	
Significance	**Before mitigation**	Medium - 44
	After mitigation	Low - 12
Mitigation Measures	• All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised vehicles as well as personnel. • Restrict all movement of vehicles and heavy machinery to permissible, designated areas. No off-road driving beyond designated areas may be allowed. • Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. • Disturbed areas must be rehabilitated and reseeded with indigenous grasses. • Monitor its establishment and growth. • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment. • Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used. • Herbicide to be applied by a qualified pest control officer only. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.	

8.2.5 Rivers and Wetlands

The table below indicates the potential impacts based on activities and the proposed mitigation measures, based on the specialist report (Appendix B) undertaken for the entire area.

Activity	Impact	
Site Establishment: clearing of vegetation	• Loss of ecosystem functioning. • Increase in runoff and erosion. • Loss off the ability of these systems to assimilate toxins. • Trap sediments and help with flood control during periods of high flow.	
Significance	**Before Mitigation**	High - 85
	After Mitigation	Medium - 36
Mitigation Measures	• Limit the footprint area of the prospecting activities to what is absolutely essential in order to minimise environmental damage. • During the prospecting phase, no vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. • Implement effective waste management in order to prevent construction related waste from entering the drainage line and riparian environments. • Plant soil stabilizing species such as grasses. • Plant indigenous trees common to the habitat to replace riparian vegetation. • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.	

Based on the EAP's recommendations and that the boreholes have been placed outside of the 500m buffer of wetlands and 100m buffer of watercourses, which further reduces the significance before mitigation from high to medium, and after mitigation from medium to low.

8.2.6 Geology and Topography

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Levelling of drill site	• Small change in topography at sites where clearing and flattening takes place.	
Significance	**Before mitigation**	Medium – 36
	After mitigation	Low - 12

Mitigation Measures	• Restrict disturbance to designated footprint.
	• Strict adhereance to the EMPr.
	• Ensure proper access control to the development area
	  ○ Fencing.
	  ○ Security.
	  ○ Barriers.
	• Ensure warning signs are erected on the perimeter of these areas.
	• Structural safety to be ensured according to engineering standards.	

8.2.7 Soil

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Clearing of vegetation	• Soil disturbance. • Potential for soil erosion . • Decrease in soil fertility/nutrient content. • Increase in alien invasive vegetation.	
Construction of site infrastructure	• Soil disturbance.	
Vehicle movements	• Soil disturbance. • Soil pollution.	
Significance	**Before mitigation**	Medium - 40
	After mitigation	Low - 8
Mitigation Measures	• All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak. • Discontinue use of all faulty machinery / equipment on site until properly repaired. • Regular vehicle and equipment inspections. • All hazardous substances including hydrocarbons must be correctly stored. • Ensure vehicles are in good condition and not leaking fuel or oil. • All hydrocarbons spills on bare ground to be cleared immediately. • Restrict movement of employees outside of prospecting areas. • Vegetation stripping must be restricted to a minimum. • Erosion control measures must be implemented in areas sensitive to erosion. These measures include but are not limited to - the use of sandbags, geotextiles such as soil cells which are used in the protection of slopes, silt fences and retention or replacement of vegetation. • All soils compacted as a result of prospecting activities should be ripped and profiled. • Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat. • Sheet runoff from access roads should be slowed down by the strategic placement of berms or/and sandbags, although anticipated to be insignificant. • Cover disturbed areas with soil-binding plants such as grasses.	

8.2.8 Land Use

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Site establishment	• Temporary change in land use on borehole sites for the duration of the prospecting phase.	
Significance	**Before mitigation**	Low - 12
	After mitigation	Low - 4
Mitigation Measures	• Restrict disturbance to designated footprint. • Restrict vehicle movement to designated access roads. • Strict adherence to the EMPr. • All areas disturbed by activities must be subject to rehabilitation.	

8.2.9 Traffic

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Site establishment	• Slight increase in traffic.	
Significance	**Before mitigation**	Low - 5
	After mitigation	Low - 5
Mitigation Measures	• None required – very minimal impact.	

8.2.10 Cultural and Heritage Resources

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Clearing of vegetation Site establishment Vehicle movements	• Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to sense of place. • Damage to and/or destruction of non-renewable archaeological resources. • Damage to and/or destruction of burial grounds. • Unmarked graves can be accidentally exposed.	
Significance	**Before mitigation**	Low - 24
	After mitigation	Low - 4
Mitigation Measures	• Adhere to footprint areas. • Adhere to 50m buffer around all resources identified. The buffer material (danger tape, fencing, etc.) must be highly visible to crews. • The local community should be engaged when identfying graves as well as places of social and spiritual significance. • A Chance find procedure should be implemented for the duration of the prospecting with inputs from stakeholders and the local community, should there be a heritage resource identified. • For any chance finds of heritage resources, such as graves, all work must cease in the affected area and the Contractor must immediately inform the Project Manager/Developer. A heritage specialist must be called to site for inspection. The relevant heritage resource agency (SAHRA) must also be informed about the finding. • Should any recent remains be found on site that could potentially be human remains, the South African Police Service (SAPS) as well as SAHRA and AMAFA must be informed. No SAPS official may remove remains until the correct permit/s have been obtained.	

8.2.11 Socio-Economic

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Site establishment: Clearing of vegetation	• Potential employment opportunities for local communities. • Potential economic growth for the area if the resource is feasible.	
Significance	**Before mitigation**	Low - 16
	After mitigation	Low - 16
Mitigation Measures	• Positive impact, so no mitigation measures required.	

8.2.12 Noise

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Clearing of vegetation Vehicle movements	• Increase in ambient noise levels.	
Significance	**Before mitigation**	Low - 20
	After mitigation	Low - 8
Mitigation Measures	• The Contractor must keep noise level within acceptable limits. • Comply with the Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) (GN R154 of 10 January 1992) and all local noise bylaws. • Restrict the use of sound amplification equipment for communication and emergency only. • Any complaints received by the Contractor regarding noise must be recorded and communicated to the Site Supervisor (SS) and Project Manager (PM). • Develop a Code of Conduct for the site establishment phase in terms of the behaviour of construction staff.	

8.2.13 Visual

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Clearing of vegetation Site establishment Vehicle movements	• Visual intrusion.	
Significance	**Before mitigation**	Low – 27
	After mitigation	Low - 12
Mitigation Measures	• Limit the site footprint to the designated works area. • Limit the site establishment duration. • Reinstating and rehabilitating disturbed areas as soon as possible. • Limiting site establishment activities to working hours. • Ensure that the site is in a visually acceptable state at all times. • Ensure a complaints register is in place to record and address complaints.	

Activity	Impact
	• Undertake rehabilitation efforts as soon as feasibly possible

8.2.14 Air Quality

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Clearing of vegetation Vehicle movements	• Generation of dust. • Air pollution from equipment.	
Significance	**Before mitigation**	Low – 20
	After mitigation	Low - 6
Mitigation Measures	• Implement dust suppression measures if dust becomes a problem. • Ensure a complaints register is in place to record and address complaints. • Fuel-saving through optimal vehicle and equipment use scheduling. • Servicing and maintenance of vehicles, and machinery. • Use of fuel-saving technology. • Use of low carbon and sulphur fuels. • Restricting vehicle speeds on access routes and other unsurfaced areas of the work site. • Restrict vehicle access to defined areas to avoid unnecessary off-road vehicle movements outside of the active work sites.	

8.3 Prospecting Phase

The prospecting phase impact assessment refers to the individual areas where each borehole will be drilled and not the entire prospecting right area.

8.3.1 Surface Water

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Vehicle movements Drill maintenance and refuelling	• Increase in runoff velocity. • Pollution of surface water resources from hydrocarbons.	
Significance	**Before mitigation**	Low - 28
	After mitigation	Low - 8

Activity	Impact
Mitigation Measures	• Measures should be put in place to prevent and contain spills and enable safe collection and disposal of waste. • Restrict vehicle movement to designated access roads. No vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. • Restrict vegetation clearing to specific footprints. • Minimise areas where spills might occur. • Capture and contain runoff from these areas. • Safely dispose of captured pollutants immediately upon detection.

8.3.2 Groundwater

According to the Groundwater Study (GCS, 2022), no impacts are foreseen.

8.3.3 Fauna

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Vehicle movements Exploration drilling Drill maintenance and refuelling	• Disturbance of habitats • Disturbance of fauna • Disturbance or possible mortality incidents of terrestrial fauna	
Significance	**Before mitigation**	Medium – 36
	After mitigation	Low - 12
Mitigation Measures	• All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised vehicles as well as personnel; • Restrict all movement of vehicles and heavy machinery to permissible areas. • Parking areas and vehicles should be regularly inspected for oil spills. • Re-fuelling must take place on a sealed surface or drip trays should be used to prevent infiltration of hydrocarbons into topsoil. • Strict speed limits must be set and adhered to. • Driving between dusk and dawn should be permissible to emergency situations only. • Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution. • All spills, should they occur, should be immediately cleaned up and treated accordingly. • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.	

8.3.4 Flora

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Clearing of vegetation	• Increase in alien invasive vegetation on cleared sites	
Significance	**Before mitigation**	Medium - 36
	After mitigation	Low - 12
Mitigation Measures	• All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel. • Restrict all movement of vehicles and heavy machinery to permissible areas. No off-road driving beyond designated areas may be allowed. • Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. • Re-fuelling must take place on a sealed surface or drip trays should be used to prevent infiltration of hydrocarbons into topsoil. • Disturbed areas must be rehabilitated and reseeded with indigenous grasses. • Monitor its establishment and growth. • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment. • Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used. • Herbicide to be applied by a qualified pest control officer only. • Footprint areas should be kept as small as possible when removing alien plant species. • No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.	

8.3.5 Rivers and Wetlands

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Site establishment: Clearing of vegetation	• Loss of ecosystem functioning • Increase in runoff and erosion • Loss off the ability of these systems to assimilate toxins • Trap sediments and help with flood control during periods of high flow	
Significance	**Before mitigation**	High - 85
	After mitigation	Medium - 36
Mitigation Measures	• Limit the footprint area of the prospecting activities to what is absolutely essential in order to minimise environmental damage. • During the prospecting phase, no vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. • Implement effective waste management in order to prevent waste from entering the drainage line and riparian environments. • Plant soil stabilizing species such as grasses. • Plant indigenous trees common to the habitat to replace riparian vegetation. • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.	

Based on the EAP's recommendations and that the boreholes have been placed outside of the 500m buffer of wetlands and 100m buffer of watercourses, which further reduces the significance before mitigation from high to medium, and after mitigation from medium to low.

8.3.6 Geology and Topography

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Exploration drilling	• Removal of soil core and a portion of coal resource.	
Significance	**Before mitigation**	Medium – 36
	After mitigation	Low - 12
Mitigation Measures	• Restrict disturbance to designated footprint. • Strict adhereance to the EMPr.	

8.3.7 Soil

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Vehicle movements	• Soil disturbance and compaction. • Potential for soil erosion. • Decrease in soil fertility/nutrient content. • Soil pollution. • Establishment of alien invasive vegetation on stockpiles.	
Exploration drilling Drill maintenance and refuelling	• Decrease in soil fertility/nutrient content. • Soil pollution.	
Significance	**Before mitigation**	Medium – 40
	After mitigation	Low - 8

Activity	Impact
Mitigation Measures	• All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak. • Discontinue use of all faulty machinery / equipment on site until properly repaired. • Regular vehicle and equipment inspections. • All hazardous substances including hydrocarbons must be correctly stored. • Ensure vehicles are in good condition and not leaking fuel or oil. • All hydrocarbons spills on bare ground to be cleared immediately. • Restrict movement of employees outside of prospecting areas. • Vegetation stripping must be restricted to a minimum. . • Erosion control measures must be implemented in areas sensitive to erosion. These measures include but are not limited to - the use of sandbags, geotextiles such as soil cells which are used in the protection of slopes, silt fences and retention or replacement of vegetation. • All soils compacted as a result of prospecting activities should be ripped and profiled. • Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat. • Topsoil must be removed and stockpiled before major excavations is taking place. • Sheet runoff from access roads should be slowed down by the strategic placement of berms and sandbags, although anticipated to be insignificant. • Cover disturbed areas with soil-binding plants such as grasses.

8.3.8 Land Use

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Exploration drilling	• Temporary change in land use on borehole sites for the duration of the prospecting phase.	
Significance	**Before mitigation**	Low - 12
	After mitigation	Low - 4
Mitigation Measures	• Restrict disturbance to designated footprint. • Restrict vehicle movement to designated access roads. • Strict adherence to the EMPr. • All areas disturbed by prospecting activities must be subject to landscaping and rehabilitation.	

8.3.9 Traffic

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact
Exploration drilling	• Slight increase in traffic.

Activity	Impact	
Significance	Before mitigation	Low – 5
	After mitigation	Low - 5
Mitigation Measures	• None required – very minimal impact.	

8.3.10 Cultural and Heritage Resources

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Exploration drilling	• Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to sense of place. • Damage to and/or destruction of non-renewable archaeological resources. • Damage to and/or destruction of burial grounds. • Unmarked graves can be accidentally exposed.	
Significance	Before mitigation	Low – 24
	After mitigation	Low - 4
Mitigation Measures	• Adhere to footprint areas. • Adhere to 50m buffer around all resources identified. The buffer material (danger tape, fencing, etc.) must be highly visible to construction crews. • For any chance finds of heritage resources, such as graves, all work must cease in the affected area and the Contractor must immediately inform the Project Manager/Developer. A heritage specialist must be called to site for inspection. The relevant heritage resource agency (the Institute) must also be informed about the finding. • The heritage specialist will assess the significance of the resource and guide the way forward. • A heritage management plan should be compiled that indicates buffer zones and management actions for known and unknown heritage sites and sites of social importance in the prospecting area.Under no circumstances may any heritage material be destroyed or removed from the site unless under the direction of a heritage specialist. • Should any recent remains be found on site that could potentially be human remains, the SAPS as well as the Institute must be informed. No SAPS official may remove remains until the correct permit/s have been obtained. • The local community should be engaged when identfying graves as well as places of social and spiritual significance.	

8.3.11 Socio-Economic

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact
Vehicle movements Exploration drilling	• Potential employment opportunities for local communities. • Potential economic growth for the area if the resource is feasible.

Activity	Impact	
Drill maintenance and refuelling		
Significance	**Before mitigation**	Low – 16
	After mitigation	Low - 16
Mitigation Measures	• Positive impact, so no mitigation measures required.	

8.3.12 Noise

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Vehicle movements	• Increase in ambient noise levels.	
Exploration drilling		
Drill maintenance and refuelling		
Significance	**Before mitigation**	Low – 20
	After mitigation	Low - 8
Mitigation Measures	• The Contractor must keep noise level within acceptable limits. • Comply with the Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) (GN R154 of 10 January 1992) and all local noise bylaws. • Restrict the use of sound amplification equipment for communication and emergency only. • Any complaints received by the Contractor regarding noise must be recorded and communicated to the Site Supervisor (SS) and Project Manager (PM).	

8.3.13 Visual

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Vehicle movements	• Visual intrusion	
Exploration drilling		
Drill maintenance and refuelling		
Significance	**Before mitigation**	Low – 27
	After mitigation	Low - 12
Mitigation Measures	• Limit the prospecting footprint to the designated works area. • Limit the duration of prospecting activities • Reinstating and rehabilitating disturbed areas as soon as possible. • Limiting prospecting to working hours. • Ensure that the site is in a visually acceptable state at all times. • Ensure a complaints register is in place to record and address complaints.	

8.3.14 Air Quality

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Vehicle Movements Exploration drilling Drill maintenance and refuelling	• Generation of dust. • Air pollution from equipment.	
Significance	**Before mitigation**	Low – 20
	After mitigation	Low - 6
Mitigation Measures	• Implement dust suppression measures if dust becomes a problem. • Ensure a complaints register is in place to record and address complaints. • Fuel-saving through optimal vehicle and equipment use scheduling. • Servicing and maintenance of vehicles, and machinery. • Use of fuel-saving technology. • Use of low carbon and sulphur fuels. • Restricting vehicle speeds on access routes and other unsurfaced areas of the work site. • Restrict vehicle access to defined areas to avoid unnecessary off-road vehicle movements outside of the active work sites.	

8.4 Decommissioning Phase

The decommissioning phase impact assessment refers to the prospecting area where each borehole will be drilled and not the entire prospecting right area.

8.4.1 Surface Water

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Removal of drill rig and associated equipment Rehabilitation of prospecting area	• Compaction of soil leading to increased runoff velocity and erosion. • Pollution of surface water resources from hydrocarbons.	
Significance	**Before mitigation**	Low – 28
	After mitigation	Low - 8
Mitigation Measures	• Measures should be put in place to prevent and contain spills and enable safe collection and disposal of waste. • Restrict vehicle movement to designated access roads. • Minimise areas where spills might occur. • Capture and contain runoff from these areas. • Safely dispose of captured pollutants immediately upon detection.	

It should be noted that after the rehabilitation of the site has been completed, these impacts will no longer be applicable.

8.4.2 Groundwater

According to the Groundwater Study (GCS, 2022), no impacts are foreseen.

8.4.3 Fauna

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Rehabilitation of prospecting area	• Restoration of habitats will lead to fauna returning to the area.	
Significance	**Before mitigation**	Low – 28
	After mitigation	Low - 28
Mitigation Measures	• None required – positive impact.	

8.4.4 Flora

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Removal of alien vegetation Rehabilitation of prospecting area	• Restoration of prospecting area as closely as possible to the pre-disturbed state. • Improvement in biodiversity of the areas.	
Significance	**Before mitigation**	Low - 28
	After mitigation	Low - 28
Mitigation Measures	• None required – positive impact.	

8.4.5 Rivers and Wetlands

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact
Removal of alien vegetation Rehabilitation of prospecting area	• Restoration of prospecting area as closely as possible to the pre-disturbed state. • Improvement in biodiversity of the areas.

Activity	Impact	
Significance	**Before mitigation**	Low – 28
	After mitigation	Low - 28
Mitigation Measures	• None required – positive impact.	

8.4.6 Geology and Topography

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Rehabilitation of prospecting area	• Disturbed areas returning to as closely as possible to the pre-disturbance state.	
Significance	**Before mitigation**	Low – 28
	After mitigation	Low - 28
Mitigation Measures	• None required – positive impact.	

It is important to note that, while the landscape and topography will be restored to its pre-prospecting state, there will be a permanent loss of resource (prospecting materials) as this will have been extracted. This is the target resource and this impact cannot be mitigated.

8.4.7 Soil

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Removal of drill rig and associated equipment Rehabilitation of prospecting area	• Restoration of soil as closely as possible to the pre-disturbed state.	
Significance	**Before mitigation**	Low – 28
	After mitigation	Low - 28
Mitigation Measures	• All hydrocarbons spills on bare ground to be cleared immediately. • All soils compacted as a result of prospecting activities should be ripped and profiled. • Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat.	

8.4.8 Land Use

The table below indicates the potential impacts based on activities and the proposed mitigation

measures.

Activity	Impact	
Rehabilitation of prospecting area	• Restoration of disturbed areas as closely as possible to the previous land use.	
Significance	**Before mitigation**	Low – 12
	After mitigation	Low - 12
Mitigation Measures	• None required – positive impact.	

8.4.9 Traffic

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Rehabilitation of prospecting area	• Decrease in exploration related traffic.	
Significance	**Before mitigation**	Low – 5
	After mitigation	Low - 5
Mitigation Measures	• None required – very minimal impact.	

8.4.10 Cultural and Heritage Resources

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Removal of drill rig and associated equipment Rehabilitation of prospecting area	• Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to sense of place • Damage to and/or destruction of non-renewable archaeological resources • Damage to and/or destruction of burial grounds • Unmarked graves can be accidentally exposed	
Significance	**Before mitigation**	Low – 18
	After mitigation	Low - 4

Activity	Impact
Mitigation Measures	• Adhere to footprint areas. • Adhere to 50m buffer around all resources identified. The buffer material (danger tape, fencing, etc.) must be highly visible to construction crews. • For any chance finds of heritage resources, such as graves, all work must cease in the affected area and the Contractor must immediately inform the Project Manager/Developer. A heritage specialist must be called to site for inspection. The relevant heritage resource agency (the Institute) must also be informed about the finding. • The heritage specialist will assess the significance of the resource and guide the way forward. • A heritage management plan should be compiled that indicates buffer zones and management actions for known and unknown heritage sites and sites of social importance in the prospecting area.Under no circumstances may any heritage material be destroyed or removed from the site unless under the direction of a heritage specialist. • Should any recent remains be found on site that could potentially be human remains, the SAPS as well as the Institute must be informed. No SAPS official may remove remains until the correct permit/s have been obtained. • A stakeholder engagement process should be conducted (where the local community should indicate graves as well as places of social and spiritual significance)

8.4.11 Socio-Economic

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Removal of drill rig and associated equipment	• Limited employment opportunities for local communities.	
Rehabilitation of prospecting area		
Significance	**Before mitigation**	Low – 16
	After mitigation	Low - 16
Mitigation Measures	• Positive impact, so no mitigation measures required.	

It is important to note that, although employment opportunities will be available during the decommissioning phase, these opportunities will cease once the drilling programme is complete.

8.4.12 Noise

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Removal of drill rig and associated equipment Rehabilitation of prospecting area	• Noise associated with rehabilitation activities (temporary).	
Significance	**Before mitigation**	Low – 20
	After mitigation	Low - 8
Mitigation Measures	• The Contractor must keep noise level within acceptable limits. • Comply with the Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) (GN R154 of 10 January 1992) and all local noise bylaws. • Restrict the use of sound amplification equipment for communication and emergency only. • Any complaints received by the Contractor regarding noise must be recorded and communicated to the Environmental Control Officer (ECO) and Project Manager (PM). • Develop a Code of Conduct for the construction phase in terms of the behaviour of construction staff.	

It is important to note that, although the impacts have been rated negatively, these will cease once the drilling programme is complete , resulting in the pre-drilling noise levels again.

8.4.13 Visual

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact	
Removal of drill rig and associated equipment Rehabilitation of prospecting area	• Improvement in visual aspect of the site due to rehabilitation activities.	
Significance	**Before mitigation**	Low – 28
	After mitigation	Low - 28
Mitigation Measures	• Positive impact, so no mitigation measures required.	

8.4.14 Air Quality

The table below indicates the potential impacts based on activities and the proposed mitigation measures.

Activity	Impact
Removal of drill rig and associated equipment	• Generation of dust fall during rehabilitation activities (temporary)

Activity	Impact	
Rehabilitation of prospecting area		
Significance	**Before mitigation**	Low – 20
	After mitigation	Low - 6
Mitigation Measures	• Implement dust suppression measures if dust becomes a problem. • Ensure a complaints register is in place to record and address complaints. • Fuel-saving through optimal vehicle and equipment use scheduling. • Servicing and maintenance of vehicles, plant and machinery. • Use of fuel-saving technology. • Use of low carbon and sulphur fuels. • Restricting vehicle speeds on access routes and other unsurfaced areas of the work site. • Restrict vehicle access to defined areas to avoid unnecessary off-road vehicle movements outside of the active work sites.	

It is important to note that, although the impacts have been rated negatively, these will cease once the drilling programme is complete, resulting in the pre-drilling visual aesthetic.

8.5 Cumulative Impacts

Section 2 of the NEMA requires the consideration of cumulative impacts as part of the environmental assessment process. Assessments have traditionally, however, failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires co-ordinated institutional arrangements; and
- Assessments are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

Cumulative impacts associated with this type of application could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the soil and land use within the available habitat. Pollution of these elements might not always be immediately evident, but incremental increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and are dispersed or diluted over an area that is much larger than the actual footprint of the causal factor. These impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

However in this instance, this is not envisaged.

One of the key cumulative impacts relates to the cumulative loss of the vegetation in the area, due to the vegetation types being vulnerable. Any further cumulative loss of this type is likely to reduce the capacity to meet provincial and national conservation targets. Loss of grassland

in this area (given the status of the vegetation type) **may** be considered significant. There could also be an increase in alien invasive vegetation due to vegetation disturbance, and an increase in soil erosion if no mitigation measures are implemented.

However, the size of the sites to be cleared is relatively small (25m x 25m), and they will be rehabilitated to their former state. There is also a significant level of degradation in the area, and so the site is not considered to be pristine. As such, the loss of the vegetation on site is not considered significant. There will be an alien invasive management plan implemented in order to minimize the proliferation of alien invasive species. Measures to mitigate and minimize soil erosion will be implemented.

Another consideration is the cumulative impact on the soil ecosystem services and soil fertility. Further cumulative loss due to other mining activities in the area could lead to the progressive loss of soil ecosystem services due to in the progressive degradation of soil quality and the services provided such as water and nutrient cycling.

However, due to the nature and magnitude of the proposed activities, it is envisaged that the mitigation measures described in this report and in the EMPr will be suitable to minimize these impacts.

9 ASSUMPTIONS, UNCERTAINTIES, AND GAPS IN KNOWLEDGE

Information in this report has been obtained from various sources. The following gaps, uncertainties or assumptions have been identified:

- It is assumed that no more than 2 to 4 holes will be actively drilled at any given time.
- It is assumed that the existing farm roads will be used, and no additional roads are foreseen to be constructed.
- A field survey was not undertaken for the NID, and it is assumed that information obtained for the wider area is applicable to the study area.

The impact descriptions and assessment are based on the author's understanding of the proposed development based on the information provided.

10 ENVIRONMENTAL IMPACT STATEMENT

10.1 Negative Impacts

The following impacts associated with the proposed project are considered Medium (Negative) significance (pre-mitigation):

- Disturbance of habitats.

- Increase in human activity.
- Disturbance or possible mortality incidents of terrestrian fauna.
- Increase in alien invasive vegetation on cleared sites.
- Loss of ecosystem functioning.
- Increase in runoff and erosion.
- Loss off the ability of these systems to assimilate toxins.
- Trap sediments and help with flood control during periods of high flow.
- Small change in topography at sites where clearing and flattening takes place.
- Soil disturbance.
- Potential for soil erosion .
- Decrease in soil fertility/nutrient content.
- Removal of soil core and a portion of coal resource.
- Establishment of alien invasive vegetation on stockpiles.

All impacts can be mitigated to Low significance.

10.2 Positive Impacts

The following impacts associated with the proposed project are considered of **Positive** significance:

- Employment opportunities for local communities; and
- Determination of the potential and extent of the reserve.

In the decommissioning phase, the receiving environment will be rehabilitated as closely as possible to the pre-disturbed conditions.

10.3 Site sensitivity

The sensitivity of the receiving environment is depicted in Figure 10-1 to Figure 10-3. The correct implementation of the mitigation measures outlined in the EMPr will ensure that all impacts are managed, mitigated or avoided as far as practicably possible.

Figure 10-1: Environmental Sensitivity - Watercourses (100m buffer)

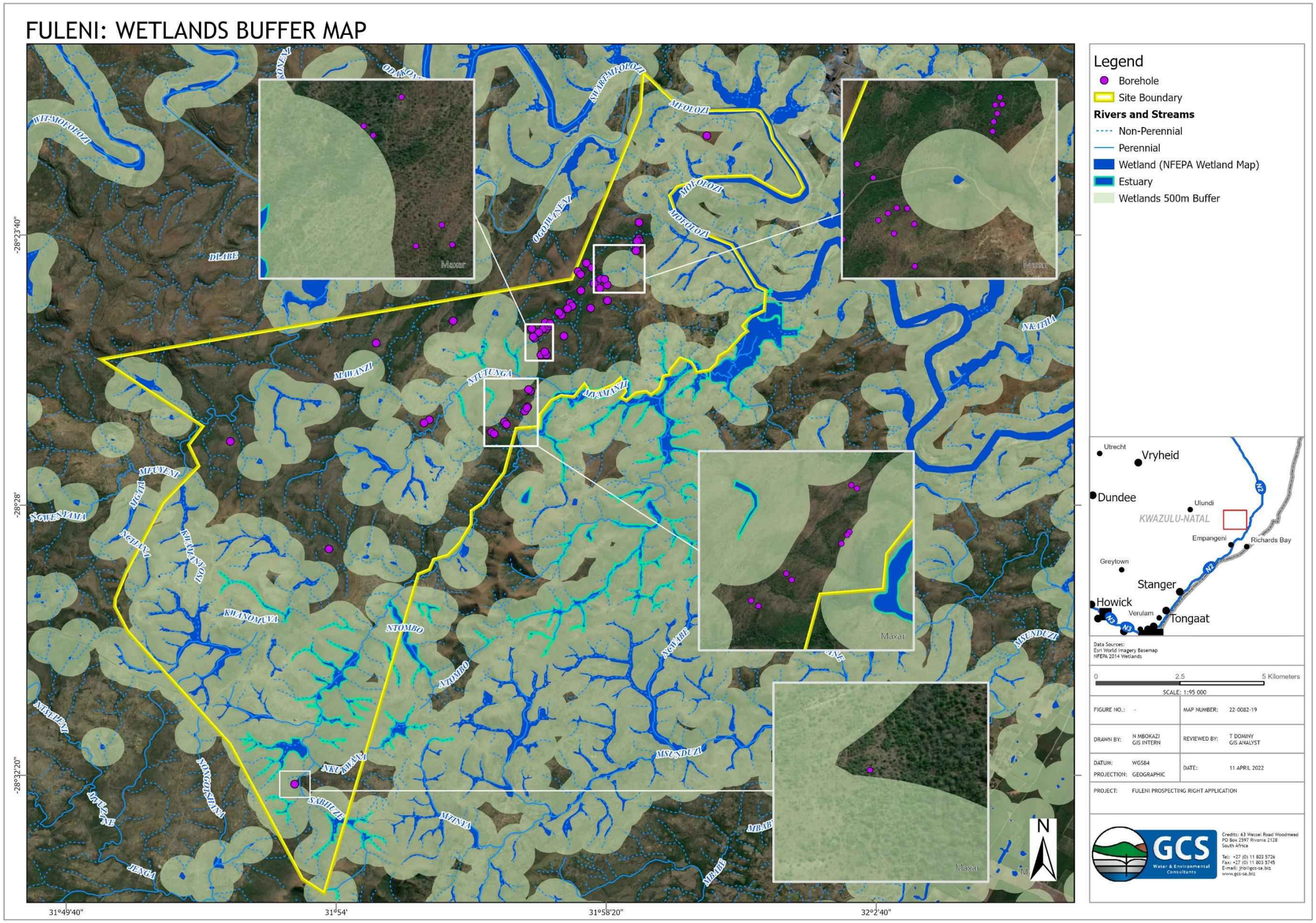


Figure 10-2: Environmental Sensitivity - Wetlands (500m buffer)

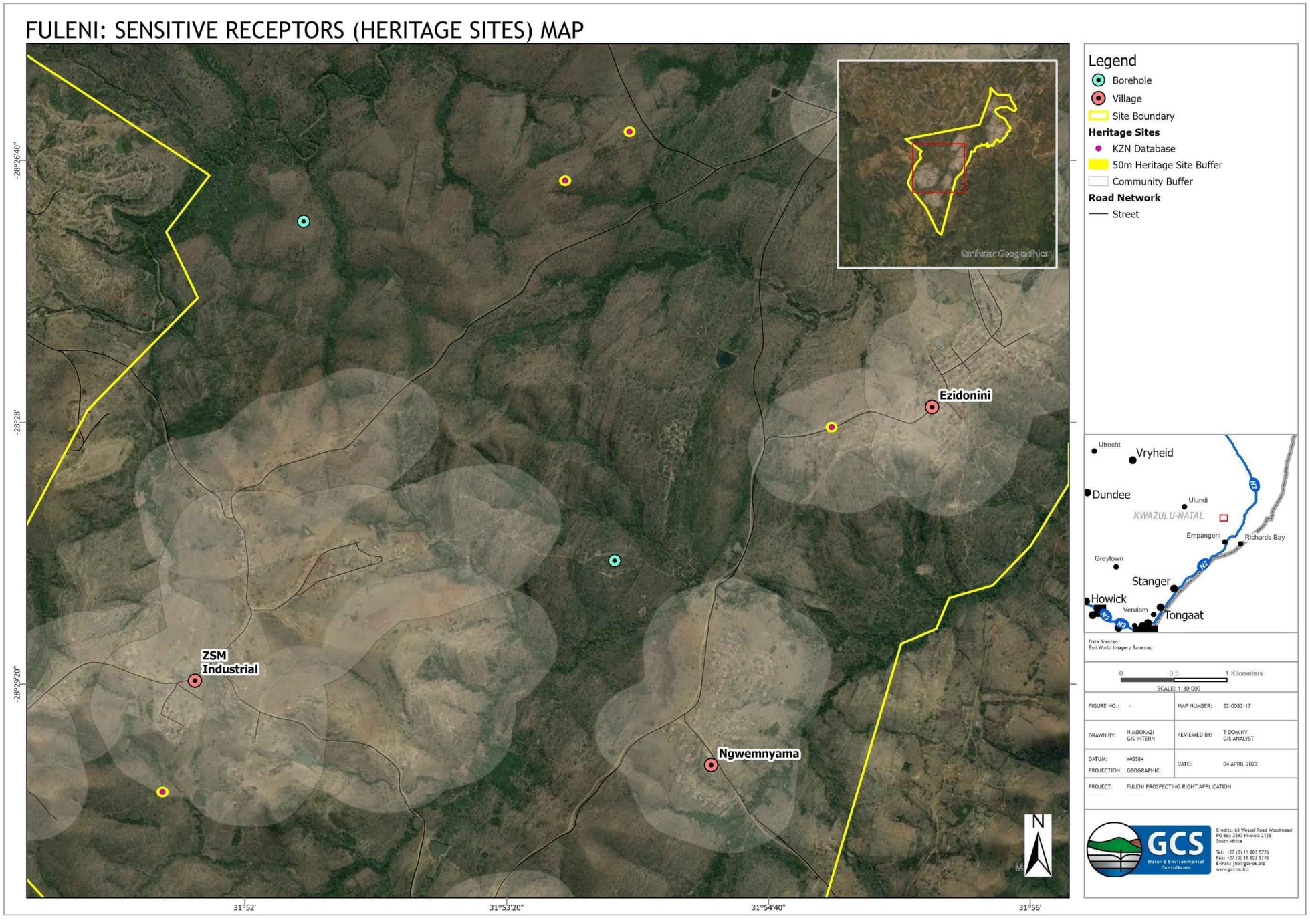


Figure 10-3: Environmental Sensitivity - Heritage sites (50m buffer)

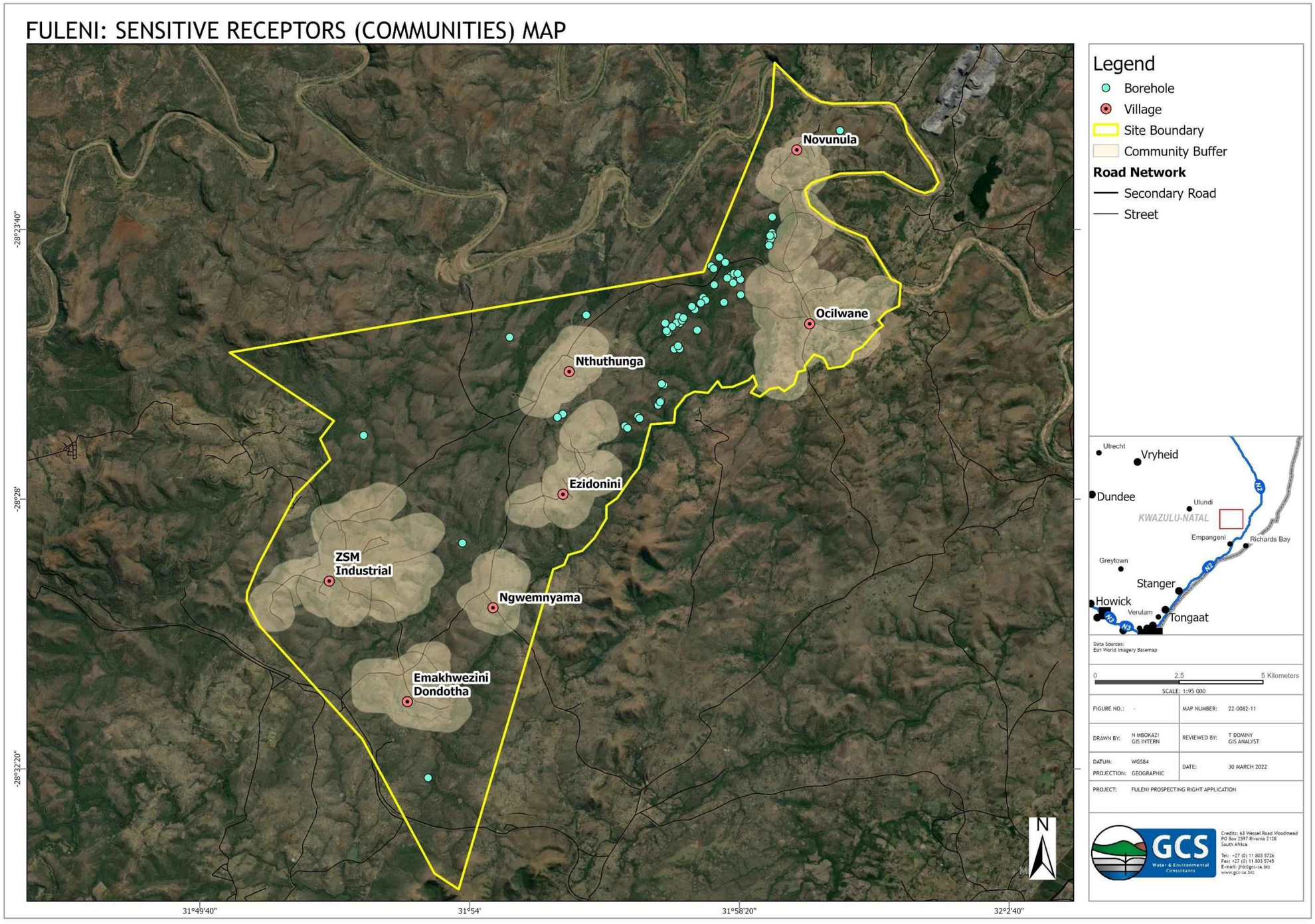


Figure 10-4: Environmental Sensitivity – Community buffer

11 SPECIALIST RECOMMENDATIONS

Based on the Desktop Geohydological Report, there is no predicted impact on groundwater by the prospecting activities. As a result, there are no applicable recommendations.

Recommendations from the NID are as follows:

- A stakeholder engagement process should be conducted prior to drilling (where the local community should indicate graves as well as places of social and spiritual significance);
- A Chance find procedure should be implemented for the duration of the prospecting; and
- A heritage management plan should be compiled that indicates buffer zones and management actions for known and unknown heritage sites and sites of social importance in the prospecting area.

12 MOTIVATION OF THE EAP

The EAP is confident that all major impacts associated with the proposed prospecting activities have been adequately described and mitigated. Given the generally medium-low impacts associated with the activities and the implementation of the proposed mitigation measures including those in the detailed EMPr (Appendix E), the EAP is confident that the project can proceed without significant impact on the receiving environment.

13 REFERENCES

Beyond Heritage. 2022. *Notification of Intent to Develop for a Prospecting Right for coal, pseudocoal, torbanite, clay and aggregate on on the Farm Fuleni Reserve 14375 GU, Magisterial District Empangeni, KwaZulu-Natal Province*. Project Reference: 2247.

DFFE. 2022. *Screening report for an Environmental Authorization as required by the 2014 EIA Regulations – proposed site Environmental sensitivity*.

DMEA, 1998. *1:250 000 Geological Series – 27 ½ 32 St Lucia*, s.l.: s.n.

Enviro-Niche. 2018. *Proposed coal prospecting application on the Fuleni reserve 14375 UG, Mtubatuba area, KwaZulu-Natal Province: Ecological Impact Assessment and Wetland Report*.

Ezemvelo KZN Wildlife. 2015. *Zululand District Municipality: Biodiversity Sector Plan*.

GCS. 2022. *Desktop Geohydrological Screening for the Fuleni Prospecting Right Application Report*. Reference 22-0082.

GCS. 2022a. *Fuleni Prospecting Right Application Hydrological Assessment Report*. Reference 22-0082.

Kottek, M. et al., 2006. *World Map of the Köppen-Geiger climate classification updated. Meteorol. Z.15, 259-263. doi:10.1127/0941-2948/2006/0130.* s.l.:s.n.

Meteoblue, 2022. *Climate Data*. s.l.:https://www.meteoblue.com

Mucina and Rutherford. 2006. *The vegetation of South Africa, Lesotho and Swaziland*. South African National Biodiversity Institute, Pretoria.

Umfolozi Local Municipality. 2021. *2021/22 Umfolozi Integrated Development Plan (IDP)-Draft*.

WRC, 2015. *http://www.waterresourceswr2012.co.za/resource-centre/*. [Online].

APPENDICES

APPENDIX A: QUALIFICATIONS AND DECLARATION OF EAP

MAGNUS VAN ROOYEN
Technical Director

CORE SKILLS

- Environmental Impact Assessments
- Scoping Reports
- Preliminary Environmental Assessment
- Mining Right and Applications
- Environmental Management Programmes
- Strategic Environmental Assessments
- Wildlife Management Plans

DETAILS

Qualifications

- BSc – Botany & Zoology
- B.SC Honours - Botany
- Specialist Student
- Post Graduate Diploma in Teaching
- Masters Degree: Environmental Management

Memberships

- SACNASP
- International Association of Impact Assessors

Languages

- English - fluent
- Afrikaans- fluent
- German – fair
- Dutch – fair
- Zulu - adequate

PROFILE

In addition to holding a Masters Degree: Environmental Management, Magnus also holds a BSc degree in Botany and Zoology, an Honours Degree in Botany and a Post Graduate Certificate in Education.

Magnus has 13 years' experience in projects involving Environmental Impact Assessments in various developmental sectors (Mining and Agricultural Sector, National Roads, Pipelines, Dams, and Residential Developments), conducting of Specialist Biodiversity Assessments associated with Environmental Impact Assessments and Project Feasibility Studies. He has experience in the compilation of Resettlement Policy Framework Plans associated with infrastructure development projects.
Magnus has experience in working on various private and public sectors as well as rural and urban environments in various countries.
His expertise lies within the mining sector where he has gained extensive exposure to all the aspects of mining projects from the pre-feasibility, prospecting, environmental impact assessment

Magnus has experience in the following areas:

- Environmental Impact Assessments
- Scoping Reports
- Preliminary Environmental Assessment
- Mining Right and Permit Applications
- Environmental Management Programmes
- Strategic Environmental Assessments
- Wildlife Management Plans

WORK EXPERIENCE

Year	Employer	Position	Role and Responsibility
2007 – 2020	JG Afrika (Pty) Ltd	Executive Associate	Project Management of an environmental contingent of 4 people and conducting Environmental Impact Assessments
2006 – 2007	JG Afrika (Pty) Ltd	Environmental Scientist	Conducted a wide range of infrastructure related Environmental Impact Assessments
2002 – 2005	Department of Conservation Ecology, University of Stellenbosch	Biodiversity Researcher	Conducted field work, sampling, laboratory work and logistics associated with two projects within the Conservation Ecology Department
2002 – 2005	Department of Botany and Zoology, University of Stellenbosch	Junior Lecturer in Botany	Lectured Botany practical component of the first-year Natural Science Degree
2001 – 2002	Paul Roos Gymnasium	Biology Teacher	Teaching the South African Biology curriculum to high school students

Biodiversity Assessment Projects	**Biodiversity Assessment Projects** **Mamatwan Tailings Facility** Biodiversity and Wetland Assessment for the site to be used for the establishment of the new tailings facility on the South32 Mamatwan Manganese Mine near Hotazel. **Hillside Aluminum Desalination Plant** Biodiversity Screening Assessment for the infrastructure network associated with the South32 Hillside Aluminum Desalination Plant in Richards Bay. **Lichtenburg Siding Expansion** Biodiversity Assessment for the proposed expansion of the Lichtenburg Cement Siding, North West Province. **Nacala Dam Project** Riparian Vegetation Study for the Ecological Reserve Determination Specialist Study for the Environmental Impact Assessment for the Nacala Dam Project in Mozambique. **National Route N8** Vegetation Specialist Study for the Environmental Impact Assessment for the National Route N8. National Route N2 uMgeni Interchange ImprovementsEnvironmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process within the city of Durban, KwaZulu-Natal during the process. **Qudeni Link Road** Vegetation Specialist Study for the Environmental Impact Assessment for the Qudeni Rural Link Road. **Municipal Landfill Site Identification** Negative mapping and ground truthing for the options analysis for the identification of a District Municipality Landfill Site.
Port Related Projects	**Pier 1 Phase 2 expansion** Environmental Impact Assessment for proposed expansions to Pier 1 within the Durban Harbour. Locomotive Turning Table in the Port of Richards Bay Environmental Impact Assessment for proposed Locomotive Turn Table in within the Port of Richards Bay. **Rail line construction in the Port of Richards Bay** Environmental Impact Assessment for proposed additional rail line into the Richards Bay Coal Terminal in the Port of Richards Bay.

	Environmental Monitoring – RME Projects Durban Harbour Environmental Monitoring Duties for all the RME construction projects within the Durban harbour. **Ore Loading Facility at Kalia in Guinea** Environmental Impact Assessment for the proposed Ore Loading Facility in Kalia in Guinea, West.
Roads Projects	**National Route N2 uMgeni Interchange Improvements** Environmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process with a range of public and private sector stakeholders. **National Route N11 upgrade** Environmental Impact Assessment for proposed upgrade of the National Route N11. The project included a public participation process with a range of public and private sector stakeholders as well as specialist studies associated with the river crossings. **National Route N2 improvement and upgrade** Environmental Impact Assessment for proposed upgrade of the National Route N2. The project included a public participation process with a range of public and private sector stakeholders as well as specialist studies associated with the river crossings. **National Route N3 Chota Motala Interchange Environmental Audits** Environmental Monitoring for the construction of the Chota Motala Interchange on the National Route N3. N**ational Route R30 Environmental Audits** Environmental Monitoring for the construction of the National Route R30.
Agricultural Projects	**uMngano Community Dairy Development Project** Environmental and Social Impact Assessment for the Development of a 200ha dairy for the uMngano Community in KwaZulu-Natal, South Africa. **uMngano Community Vegetable Project** Environmental and Social Impact Assessment for the Development of a 180ha vegetable growing project for the uMngano Community in KwaZulu-Natal, South Africa. **Sundays River Citrus Project** Environmental and Social Impact Assessment for the Development of a 100ha citrus project in the Sundays River Valley in the Eastern Cape, South Africa.
Water Projects	**Nacala Dam project in Mozambique for the Millennium Challenge Corporation** Environmental and Social Impact Assessment for the Nacala Dam project in Nacala, Mozambique. The study included the management of a range of specialist studies which included; biodiversity (fauna and flora) assessments, health impact assessments, social impact assessments, a hydrocensus, geotechnical investigation and an ecological flow requirement assessment. The project was conducted under the auspices

	of the Millennium Challenge Corporation. **Mpofana Bulk Water Supply Scheme Environmental Impact Assessment for the Bulk Water Supply Scheme** which included an extensive public facilitation process with affected landowners and other specialist studies. **KwaHlokohloko Rural Water Supply Scheme Environmental Impact Assessment for the Rural Water Supply** Scheme which included an extensive public facilitation process with the rural landowners and tribal leaders. **Conservation Management Plans** **Ndumo Game Reserve Management Plan** Compilation of the Management Plan for the KwaZulu-Natal Wildlife Ndumo Game Reserve in northern KwaZulu-Natal. The compilation was conducted in accordance to the National Environmental Management: Protected Areas Act (No 57 of 2003).
Mining Projects	Uithoek Colliery for Miranda Mineral Holdings Environmental Impact Assessment for the establishment of the Uithoek Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Burnside Colliery for Miranda Mineral Holdings** Environmental Impact Assessment for the establishment of the Burnside Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Ultimate Goal Colliery for Corobrik (Pty) Ltd** Environmental Impact Assessment for the establishment of the Ultimate Goal Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Klipwaal Gold Mine for Miranda Mineral Holdings** Environmental Due Diligence assessment on the Klipwaal Gold Mine which included an assessment of completed and required rehabilitation, a contaminated land liability assessment and an evaluation of the structure and the possible impact of the slurry dams. **Afrimat Quarries Compliance Audits** Compliance audits and Due Diligence assessments of the Afrimat Quarry operations in South Africa. These audits are conducted on a two yearly basis. **Private and Public Sector Development Projects** Provincial Legislature Precinct Environmental and Social Impact Assessment for the proposed Provincial Legislature Precinct. This study consisted of a large public facilitation component and extensive engagement with private and public sector stakeholders.

	Camps Drift Canal Mixed Use Development Environmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process within the city of Durban, KwaZulu-Natal during the process. **Tiger Lodge Development** Environmental Impact Assessment for the proposed Tiger Lodge Tourism Development. **Paradise Lodge Development** Environmental Impact Assessment for the proposed Paradise Lodge Tourism Development.

DECLARATION

I, Magnus Van Rooyen hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.

Signature: **Date: 27/02/2021**

THE SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Magnus van Rooyen
Registration number: 400335/11

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice
(Schedule I of the Act)

Environmental Science	**31 August 2011**

31 August 2011
Pretoria

President

Chief Executive Officer

0058905

UNIVERSITY OF STELLENBOSCH

This is to certify that whereas

MAGNUS VAN ROOYEN

had complied with all the conditions prescribed in the Act, Statute and Rules of the University, the degree

MASTER OF PHILOSOPHY

(MPhil)

(Environmental Management)

with all the rights and privileges pertaining thereto was conferred on him at a congregation of the University in December 2004.

RECTOR AND VICE CHANCELLOR

DEAN

Endorsement: This is a duplicate of the original certificate, which was lost or destroyed as far as can be determined by the University.

REGISTRAR

21 November 2006

This certificate was issued in both Afrikaans and English. In the unlikely event of an inconsistency in the wording, the Afrikaans text shall have precedence.

This certificate is not authentic, unless printed on US watermark paper.

APPENDIX B: SPECIALIST STUDIES

63 Wessel Road, Rivonia, 2128 PO Box 2597, Rivonia, 2128 South Africa
Tel: +27 (0) 11 803 5726 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

Fuleni Prospecting Right Application Hydrological Assessment

Report

Version 0

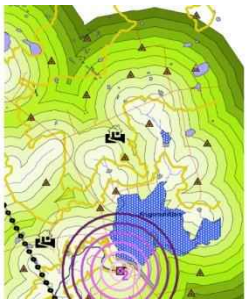
31 March 2022

Imvukuzane Resources (Pty) Ltd

GCS Project Number: 22-0082

Client Reference: Fuleni Prospecting Right Application - Hydrological Assessment




GCS (Pty) Ltd. **Reg No:** 2004/000765/07 Est. 1987
Offices: **Johannesburg** (Head Office) | Durban | Gaborone | Lusaka | Maseru | Windhoek | Ostrava
Directors: AC Johnstone (CEO) | A Wilke | M Van Rooyen | W Sherriff (Financial) | N Marday (HR)
Non-Executive Director: B Wilson-Jones

Fuleni Prospecting Right Application - Hydrological Assessment

Report
Version – 0

Imvukuzane Resources (Pty) Ltd

31 March 2022

DOCUMENT ISSUE STATUS

Report Issue	Version 0 - Issue to Client		
GCS Reference Number	GCS Ref – 22-0082		
Client Reference	Fuleni Prospecting Right Application - Hydrological Assessment		
Title	Fuleni Prospecting Right Application Hydrological Assessment		
	Name	**Signature**	**Date**
Author	Zinhle Sithole		March 2022
Document Reviewer	Jennifer Meneghelli		March 2022
Director	Magnus van Rooyen		March 2022

EXECUTIVE SUMMARY

The proposed Fuleni Prospecting Right area is located in the province of Kwazulu-Natal approximately 34km to the northeast of the city of Richards Bay. Imvukuzane Resources (Pty) Ltd is in the process of applying for an Environmental Authorisation in accordance with the National Environmental Management Act (Act No. 107 of 1998): Environmental Impact Assessment Regulations (2014), as amended, associated with the Prospecting Right Application in the Fuleni area.

A hydrological assessment was carried out, including floodline delineation and a storm water assessment. This assessment will be submitted with the Basic Assessment Report required to for the Application for Environmental Authorisation.

The Fuleni Prospecting Right area falls within the W23A and W21L quaternary catchments which is within the uSuthu to Mhlatuze Water Management Area. It is downstream of the confluence of the Black Mfolozi with the White Mfolozi in the Mfolozi River Catchment. The Mfolozi River runs along the north-eastern border of the site and the Mvanmanzi River (a tributary of the Mfolozi River) runs along the site boundary to the south.

Rainfall gauging station 0305037 W (Fairview) was used in the hydrological analysis of the site, the station has a rainfall record of 80 years (1920 – 2000). The mean annual precipitation of the site is 1 007 mm/yr. (higher than the mean annual precipitation of the W23A and W21L of 833 mm/yr. and 733 mm/yr respectively) and mean annual evaporation of 1 586 mm/yr. The region experiences its rainy season in summer and its dry season in winter, typical of the interior of South Africa. Streamflow analysis indicates a response to tropical cyclones which result in extreme, high flows in the Mfolozi River. The largest of these cycles was Tropical Storm Domoina in 1984. The ensuing floods washed away stream gauging equipment, so the exact measurement of this storm's streamflow was not recorded. From an analysis of the streamflow, estimations of streamflow associated with recurrence intervals was estimated.

A floodline analysis was conducted for the Prospecting Right area. Peak flow was determined using the Rational Method Alternative 3, Standard Design Flood (SDF) and the Regional Maximum floods (RMF) methods for the 1 in 50-year and 1 in 100-year flood recurrence intervals. The peak flow estimates were in line with the estimation made by Kovacs (et.al, 1984) for the 1984 Domoina Floods and well as for the events Kovacs (1988) determined for the 50-year recurrence interval event which occurred between 1956 and 1988.

A stormwater assessment was conducted for the boreholes to be drilled for the site. The water used for drilling will contain hydrocarbons and therefore should not be released into the environment. It is recommended that the standard practice of collecting all drilling fluid in an in-ground sump or above ground storage tanks must be followed. From these storage areas, the fluid can be reused and contained to prevent contact with the environment. As the drilling site footprint is small, and the drilling is a short-term activity, hydrological impacts may be reduced to negligible if the proposed stormwater management method mentioned above is adhered to.

CONTENTS PAGE

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

GCS (Pty) Ltd was appointed by Imvukuzane Resources (Pty) Ltd to conduct an Application for Environmental Authorisation associated with the Prospecting Right Application for Fuleni Prospecting Right KwaZulu-Natal. In support of the application, a hydrological assessment is required for the proposed prospecting activities. The hydrological assessment includes a floodline delineation and a stormwater assessment to inform the management of possible stormwater around the drilling sites.

1.1 Project background

The proposed Fuleni Prospecting Right Area is situated in the KwaZulu-Natal Province approximately 35 km to the northeast of the city of Richards Bay. The Fuleni Prospecting Right Area is located in the Mhlana Traditional Area with the main communities being the Novunula, Ocilwane, Ntuthunga, Ezidonini, ZSM Industrial and Ngwemnyama.

The Hluhluwe-iMfolozi Park is located to the north of the application area, with the northern border of the Prospecting Right area forming the southern border of the park. See the Locality Map in Figure 1-1, below. The proposed borehole locations, site boundary and villages are shown in the map. The Mfolozi River runs along the north-eastern boundary of the site and the Mvanmanzi River (a tributary of the Mfolozi River) runs along the southern border of the site.

2 METHODOLOGY

The objective of the hydrological assessment includes the following:

- Analyse climate and rainfall data and produce 24-hour rainfall depths for different recurrence intervals for use in floodline assessment and development of a stormwater management plan (if applicable);
- Describe baseline information to characterise the flow in streams crossing or adjacent to the project area;
- Produce the 50-year and 100-year return intervals flood line for the rivers crossing or adjacent proposed mining site and the surrounds;
- Delineate clean and dirty areas associated with the prospecting activities (where applicable);
- Recommend a stormwater management around the proposed prospecting boreholes to be established on site; and
- Produce a final report that incorporates findings and recommendations of the study.

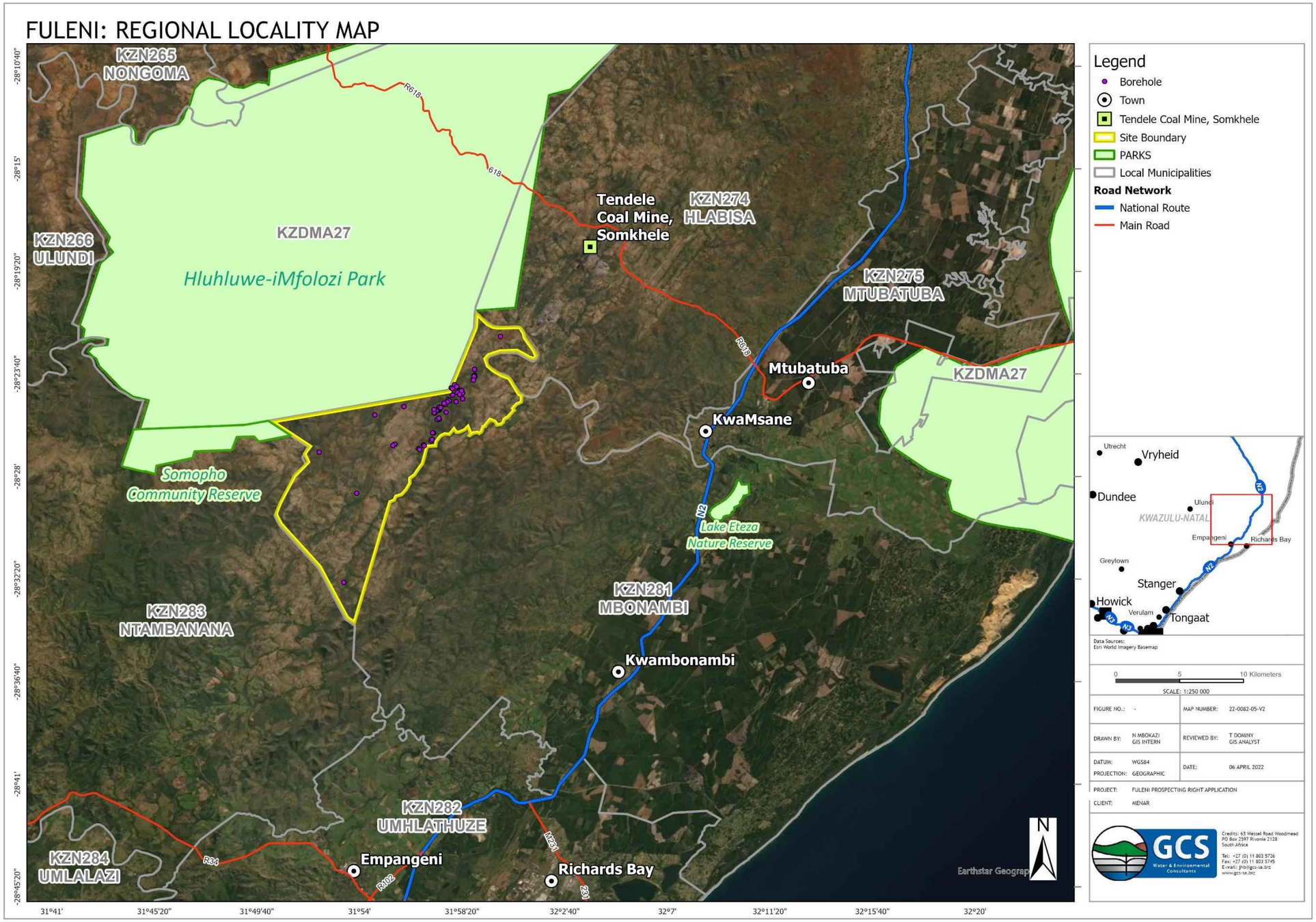


Figure 2-1 Site Locality Map

3 BASELINE HYDROLOGY

The baseline describes the catchment and project area in respect of surface water resources and hydrological data for the current situation. It informs the floodline assessment and stormwater management plan components that support the various legislative requirements for the Application for Environmental Authorisation associated with the Prospecting Right Application.

3.1 General climate

The average Mean Annual Precipitation (MAP) for the Mfolozi River catchment is 803 mm/annum with a maximum depth of 1 150 mm/annum occurring along the eastern seaboard and a minimum of about 700 mm/annum which occurs inland. The general trend is that the rainfall decreases moving inland.

3.2 Water Management Area

The Usuthu to Mhlathuze Water Management Area (WMA) is situated in the northern KwaZulu-Natal province but also occupies the south-eastern corner of the Mpumalanga province, west of Swaziland. The WMA borders on Mozambique and Swaziland and two of its major rivers, the Usuthu and the Pongola are shared with these countries. Refer to Figure 3-1 for the drainage map.

The WMA is bordered by the Indian Ocean in the east and the Drakensberg Mountain range in the north-west. Altitudes ranges from over 2 000 mamsl to sea level. Rainfall varies from almost 1 500 mm/annum in the mountainous areas in the west and to low as 600 mm/annum in the vicinity of the Ponoglapoort Dam where the Lebombo mountains create a rain shadow.

The WMA consists of a number of catchments which are mostly independent of each other. These are Mhlatuze, Mfolozi, Mkuze, Pongola, Usuthu and Lake Sibaya catchments. The Fuleni Prospecting Right Area falls within the Mfolozi River catchment, specifically quaternary catchments W23A and W21L.

3.2.1 Mflolozi catchment (W20)

The Mfolozi River catchment has a land area of 10 008 km^2. The main tributaries, the Black Mfolozi and White Mfolozi, rise on the eastern escarpment of the Drakensberg Mountain range and flow eastward across the Zululand coastal plain. The two tributaries eventually confluence in the south-eastern boundary of the Hluhluwe-Umfolozi Park to form the Mfolozi River which discharges into the Indian Ocean.

The mean annual runoff (MAR) from the Mfolozi River is estimated to be 962 million m^3/annum. The runoff ranges from 226 mm/annum in W23D on the coast to 41 mm/annum in W21D inland along the Drakensberg Mountain range. Figure 3-2 shows the quaternary catchments that make up the Mfolozi catchment.

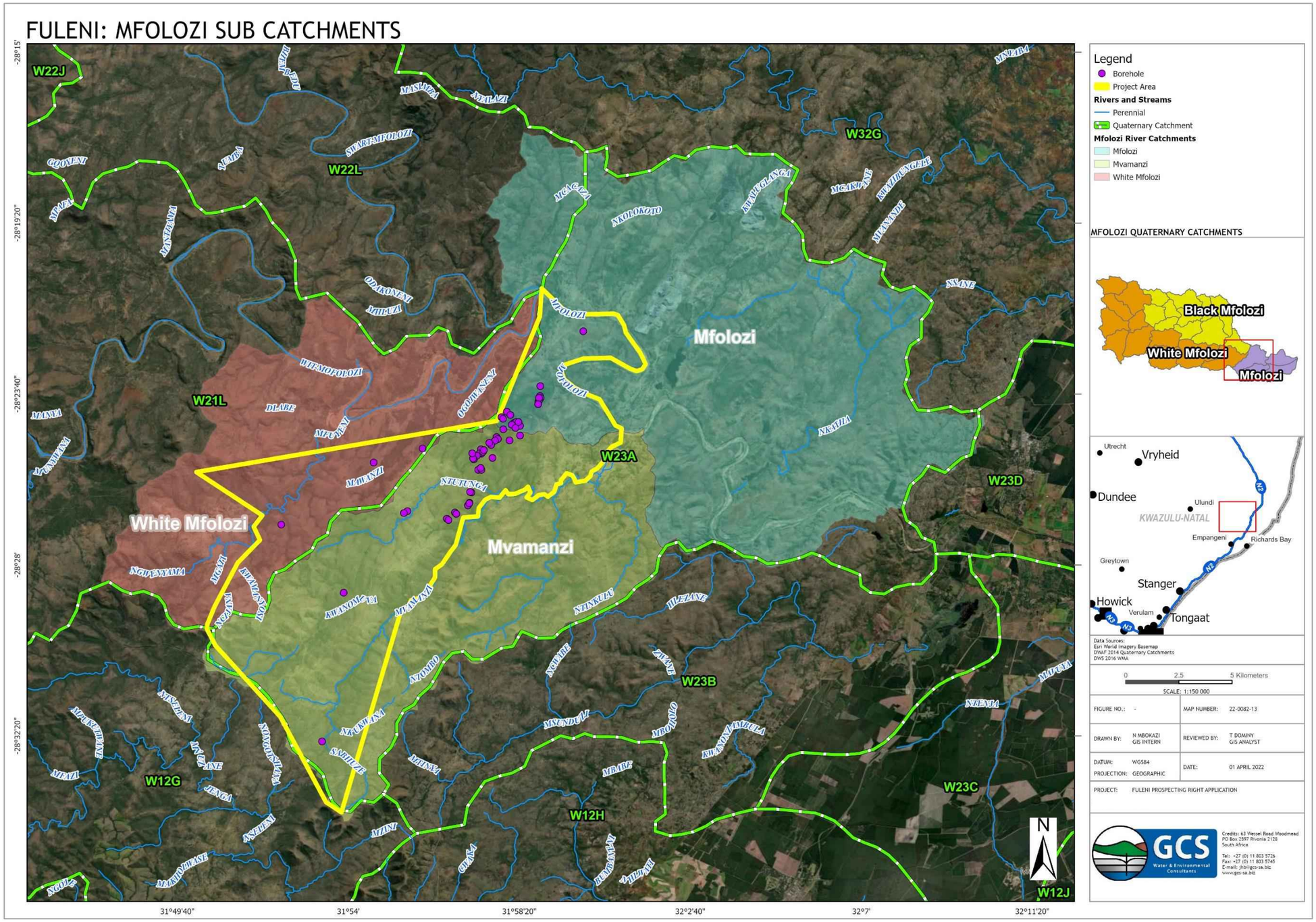


Figure 3-1 Site Drainage Map – Catchments and sub-catchments

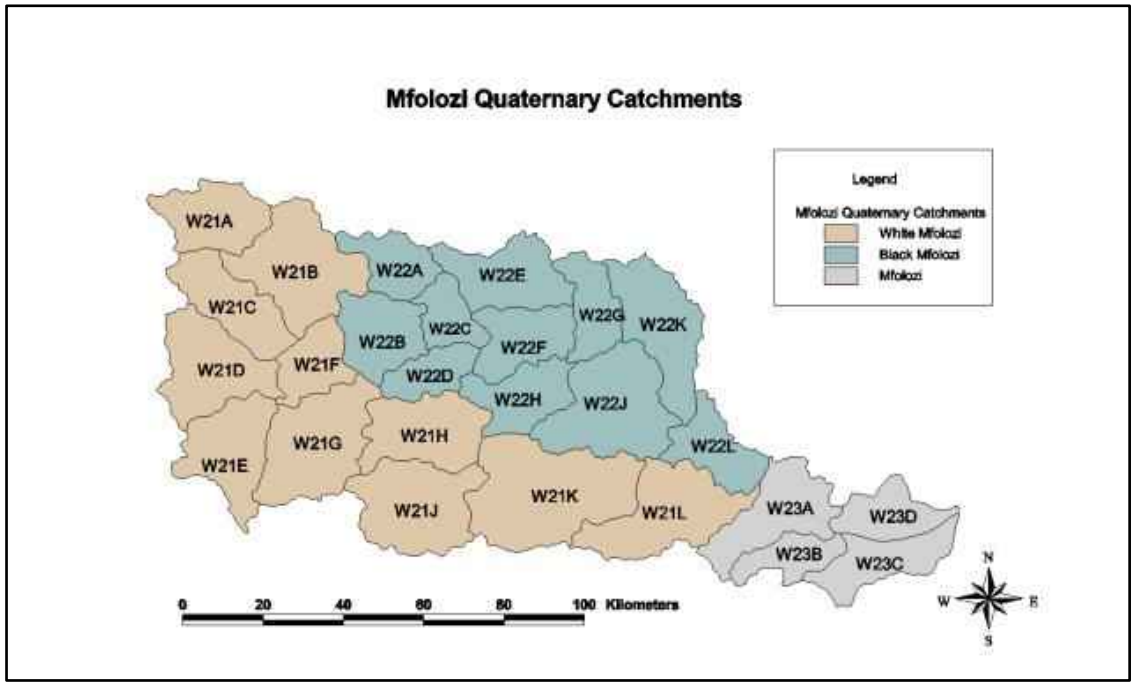


Figure 3-2 Mfolozi Quaternary Catchments

The Mfolozi River catchment consists mostly of tribal authority land, with the main activity being communal and commercial livestock farming. There is a limited amount of afforestation in the catchment compared to the total area of the catchment (approximately 434 km^2 ~ 4 % afforestation). This is situated in the upper reaches of the catchment near Vryheid, in the vicinity of Nongoma and near the coast. Dryland sugarcane is also grown in the coastal area where the rainfall is high.

There is a significant area under irrigation in the Mfolozi River catchment, estimated at about 72 km^2 (~1%). The majority of this is found near the coast where there is about 50 km^2 of irrigated sugar cane.

The Hluhluwe-Mfolozi Park lies in the central part of the catchment. Significant towns in the catchment are Vryheid, Ulundi, Babanango, Nongoma and Mtubatuba.

The water resources of the Mfolozi River catchment are mostly undeveloped. The most significant development is the Klipfontein Dam, which is situated in the upper reaches of the White Mfolozi River. There is an allocation to irrigators downstream of the dam, but very little of this allocation is currently utilized (Department of Watter Affairs and Forestry, 2004).

The Klipfontein Dam, with a capacity of 19 million m^3, is situated in the upper reaches of the White Mfolozi catchment. The dam was constructed primarily to supply water to the town of Vryheid but is also used to supplement supplies to Ulundi when necessary. The natural MAR into the dam is 47 million m^3/annum.

3.2.2 Water quality

According to (Umgeni Water Amanzi, 2020) the water quality of Mfolozi headwaters is affected by coal fields in and around Vryheid and as result places considerable pressure on the ecological and hydrological functioning of this water source. Agriculture is the largest water user in this catchment, predominantly for sugarcane and forestry. The main threats to the water quality of the Mfolozi River are land degradation due to land use practices and coal mining. The Mfolozi River carries over a million tonnes of suspended sediment annually to the ocean and this has led to costly dredging operations in the estuary mouth which have proved ineffective.

3.2.3 Reserve

The impact of the Ecological Reserve of the White Mfolozi River on the yield of these catchments is considered significant. The relative impact is large at the Klipfontein Dam while the impact on the run-of river yields in the rest of the catchments is also considered significant. The winter and summer low flow Ecological Reserve (based on the desktop method) is 4 million m^3 for the four driest months and 30 million m^3 for the eight wettest months (Umgeni Water Amanzi, 2020).

The impact of the Ecological Reserve of the Black Mfolozi River on the yield of this catchment is considered significant. The winter and summer low flow ecological reserve, based on the desktop method, is 4 million m^3 for the four driest months and 26 million m^3 for the eight wettest months (Umgeni Water Amanzi, 2020).

The Present Ecological State (PES) of the Black Mfolozi River is generally a Class C. The recommended ecological category is a Class C and this means the current river ecological status must be maintained. The PES of the White Mfolozi River is generally a Class B/C. The recommended ecological category is a Class B/C and this means that the current river ecological status must be maintained (Department of Water and Sanitation, 2014).

3.3 Regional Rainfall

The site falls within quaternary catchments W21L and W23A, in the W2F and W2C rainfall zones and has a high MAP of between 733 mm/annual and 833 mm/annual characteristic of humid subtropical areas. The MAP for quaternary catchments W21L and W23A has a percentage difference of 58 % and 80 % when compared to the MAP of the country.

Three stations were identified in the vicinity of the site and their rainfall records were obtained from the Daily Rainfall Extraction Utility (Kunz,2004) and the Department of Water Affairs Hydrological Services – Surface Water website. The metadata for the stations considered for the regional rainfall analysis is provided in Table 3-1. The metadata is sourced from the Daily Rainfall Extraction Utility.

Table 3-1 Rainfall Station metadata

Station Name	Station ID	Reliability (%)	Record Length (yr.)	Years	MAP (mm)	Altitude (mamsl)	Distance from site (km)
Fairview	0305037W	61	80	1920 - 2000	1 007	70	0
River View	0339357W	46.1	80	1920 - 2000	860	30	19
Farm 3/7638 Hluhluwe	0339355W	100	58	1963 - 2021	729	118	32

The regional rainfall records were compared. Figure 3-3 illustrates the cumulative plots of the rainfall stations. The plots are used to check for any anomalies and irregularities that may occur in the rainfall record. The cumulative stations for the three stations with 58 – 80 years of record highlight the following:

- The plots for the stations show a similar trend. On the mass plots oscillations are visible, this indicates the seasonality of the data.
- A linear regression trendline was added for the mass plot representing station 0305037 W. The trendline has a R^2 of 0.993, this indicates that this trend line is a good fit for the data and there are no large deviations between the observed data and the trendline. The slope of the plot indicates that a change over a day results in a 2.75 mm change in the accumulated rainfall depth.
- A linear regression trendline was added for the mass plot representing station 03005037 W. The trendline has a R^2 of 0.992, this indicates that this trend line is a good fit for the data and there are no large deviations between the observed data and the trendline. The slope of the plot indicates that a change over a day result in a 2.36 mm change in the accumulated rainfall depth.
- A linear regression trendline was added for the mass plot representing station W3E003. The trendline has a R^2 of 0.9966, this indicates that this trend line is a good fit for the data and there are no large deviations between the observed data and the trendline. The slope of the plot indicates that a change over a day result in a 2.15 mm change in the accumulated rainfall depth.
- The plot for station 0305037 W is consistently higher than the other two rainfall stations even though the trends and slopes are similar.

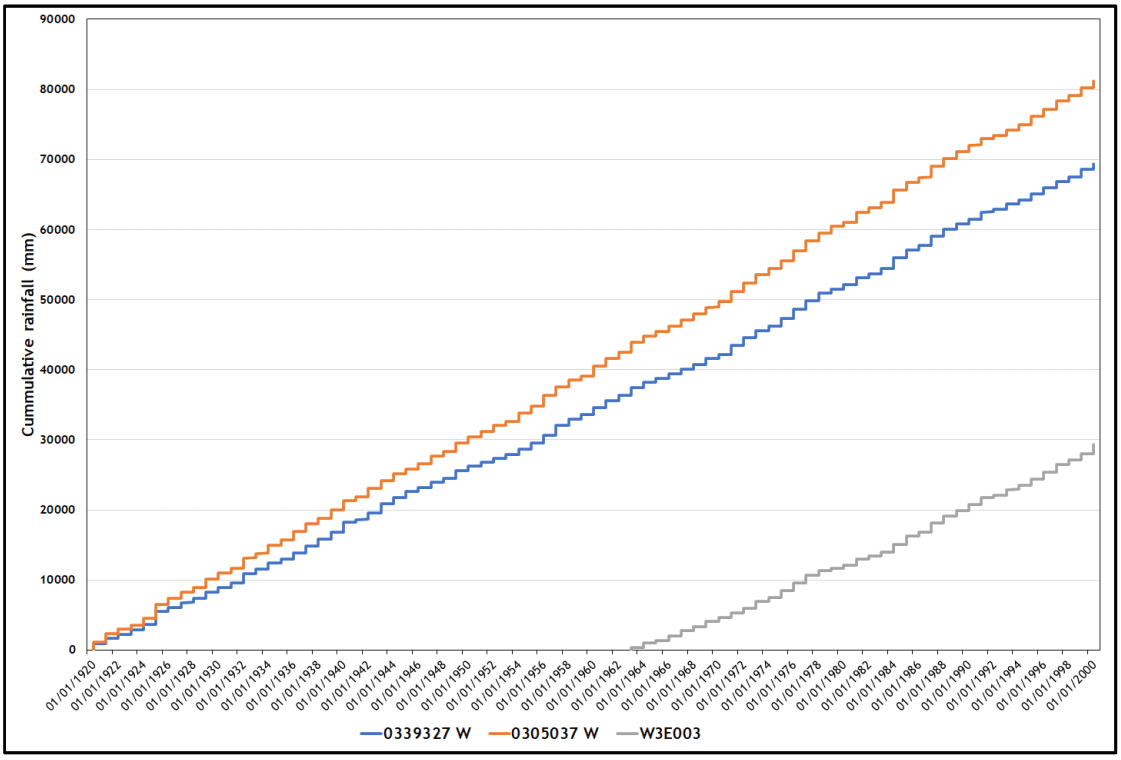
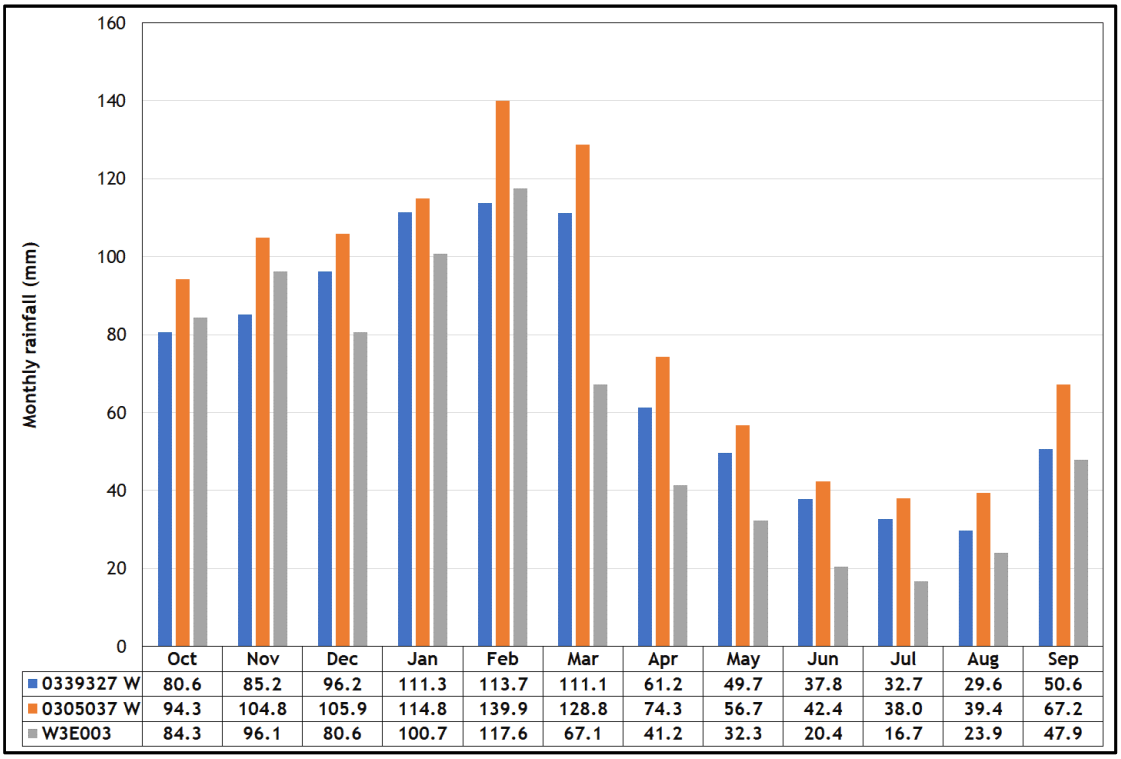


Figure 3-3 Cumulative rainfall depths for the stations near the proposed Fuleni Prospecting Right area

Figure 3-4 shows the average monthly rainfall distribution for the five rainfall stations near the Fuleni Prospecting Right area. The following observations were made:

- The rainfall stations show similar seasonal patterns and values with the 0305037 W gauge being significantly higher than the other stations during the dry and wet seasons.
- Rain gauge 0305037 W has the highest MAP of 1 007 mm.
- February is the wettest month with the averages of the rainfall stations being 123.7 mm. July is the driest month with averages of the month being 29.2 mm.
- The Fairview, Riverview and farm 3/7638 Hluhluwe Dam stations monthly distribution display similar seasonal trends. The farm 3/7638 Hluhluwe Dam station is consistently lower than the other two stations even though there are similar trends.

The Fairview (0305037W) rainfall station was chosen to represent the rainfall within Fuleni Prospecting Right area and is used in the hydrological investigation. The station has good reliability of 61 % and record length (80 years, from 1920 – 2000). The rainfall station also has a higher MAP than the other four stations, making it a more conservative option.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
0339327 W	80.6	85.2	96.2	111.3	113.7	111.1	61.2	49.7	37.8	32.7	29.6	50.6
0305037 W	94.3	104.8	105.9	114.8	139.9	128.8	74.3	56.7	42.4	38.0	39.4	67.2
W3E003	84.3	96.1	80.6	100.7	117.6	67.1	41.2	32.3	20.4	16.7	23.9	47.9

Figure 3-4 Average monthly rainfall

3.4 Design rainfall depth

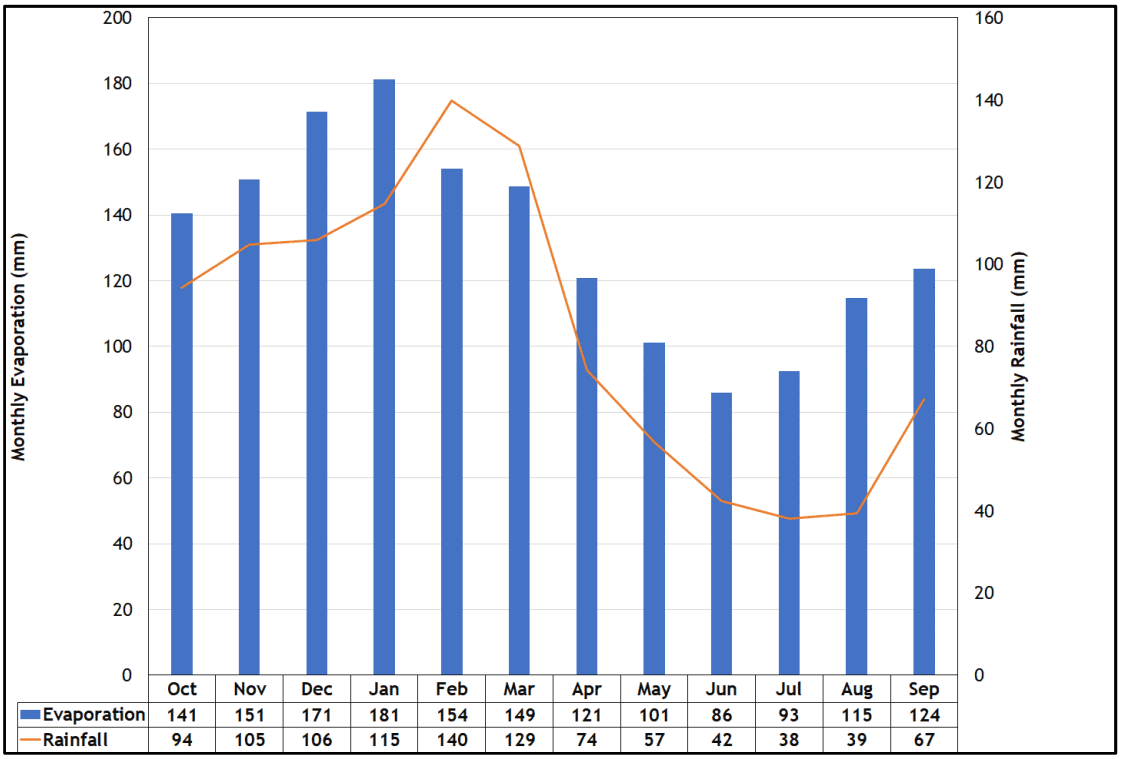
Design rainfall depths for the site were estimated using the Design Rainfall software for South Africa (Smithers and Schulze, 2000). The design rainfall depths (rainfall station 0305037 W) for the 1:2-year to 1:200-year return periods can be seen in Table 3-2. Table 3-2 indicates that there is a 1 in 50 chance that 301 mm of rainfall will fall in the study area in a 24-hour period during any given year (a flood of this magnitude has a 2% chance of occurring at any given year).

Table 3-2 Design rainfall depth for Fairview station 0305037 W

	Return period (years)						
Duration:	**2**	**5**	**10**	**20**	**50**	**100**	**200**
24-hour	85.7	133.7	174.7	222.8	301.0	373.9	461.9
2-day	114.3	179.3	233.2	295.2	393.4	483.1	588.9
3-day	125.8	197.5	256.5	323.3	428.1	522.8	633.4
4-day	133.5	208.2	268.5	335.9	440.0	532.7	639.5
6-day	150.6	215.4	276.3	344.1	448.3	540.4	646.3

3.5 Evaporation

The Mean Annual Evaporation (MAE) for quaternary catchments W21L and W23A is 1 400 mm/yr and the quaternary catchments lie in 22B and 22C evaporation zones. Evaporation from nearby SAWS station 3/7638 Hluhluwe Dam W3E003 is calculated to be 1 586 mm/yr. with highest evaporation occurring between December and January. The average monthly evaporation values are shown in Figure 3-5. It can be seen from the graph that evaporation is high throughout the year, and several times higher than rainfall. Evaporation is at its highest during the summer months.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation	141	151	171	181	154	149	121	101	86	93	115	124
Rainfall	94	105	106	115	140	129	74	57	42	38	39	67

Figure 3-5 Average monthly evaporation for station W3E003

3.6 Tropical Cyclones

Tropical cyclones/storms have also been a contributor to heavy rainfall events in the past (Dyson & van Heerden, 2009). According to Kovacs (et.al., 1985) 10 tropical cyclones have affected the study area (1956 to 1985). During the 1893 – 2000 period, Tropical Storm Domoina (1984) had the highest rainfall associated with a tropical cyclone (Kovács et al. 1985). A storm in March of 1925 (not confirmed), thought to be a tropical cyclone, produced flooding greater than that attributed to Tropical Storm Domoina (van Heerden & Swart 1986).

Table 3-3 lists the tropical cyclones/storms that have affected rainfall in South Africa. From this list only five tropical cyclones/storms have had a trajectory along a path sufficiently southerly to have affected the study area during the 1956 – 1984 period. Extreme storm events in January 1909, February 1937 and February 1967 identified as a possible tropical cyclone/storm is not listed in Table 3-3 but fits all the other characteristics of the tropical cyclone/storm regional storm events. The extreme events are not listed because there is no concrete information available to confirm that these extreme events were indeed cyclones.

Table 3-3 List of tropical cyclones/storms that have affected South Africa (After Darlow 1990)

Tropical Cyclone Name	Dates	Impact on KZN
A?	11 February 1956-16 February 1956	No
Astrid	December 1957 – January 1958	No
Brigette	24 December 1957 – 2 January 1958	No
Claude	30 January 196 - 1 February 1960	No
Caroline	30 December 1965 – 5 January 1966	Yes
Eugenie	4 February 1972 – 13 February 1972	No
Danae	5 February 1972 – 22 February 1972	No
Emilie	30 January 1976 – 31 January 1984	Yes
Domoina	26 January 1984 – 1 February 1984	Yes
Imboa	17 February 1984 – 19 February 1984	Yes
Unknown	28 September 1987 – 30 September 1987	Yes
Favio	19 March 2007 – 20 March 2007	Yes

3.7 Streamflow analysis

The Mfolozi River, confluence of the Black and White Mfolozi Rivers is the closest major watercourse to the prospecting right area. The flow regime of the Black and White Mfolozi was assessed. Two streamflow gauging stations were identified in the vicinity of the site and their streamflow records were obtained from the Department of Water Affairs Hydrological Services – Surface Water website.

3.7.1 White Mfolozi River at Overvloed

Flow measured in the White Mfolozi River at Overvloed located near the town Ulundi (gauging station W2H005, has a contributing catchment area of 3 939 km^2. The average flow data recorded between 1960 – 2021 indicate a mean annual flow of 2 965 cubic metres per second/year ($m^3/s/yr.$) with average daily flows varying between 1.3 m^3/s. in August to 19.7 m^3/s in December. A maximum recorded monthly total flow of 5 481 m^3/s was observed in July 1936 as shown in Figure 3-6. The data however does not have the peaks recorded of the 1984 Demoina flood.

Discharge peaks for this period was determined by Kovacs (et al., 1985) in a detailed study commissioned by the then Department of Water Affairs. The data provided by Kovacs (Figure 3-7) showed a peak discharge of 1 100 m^3/s during the Demoina floods.

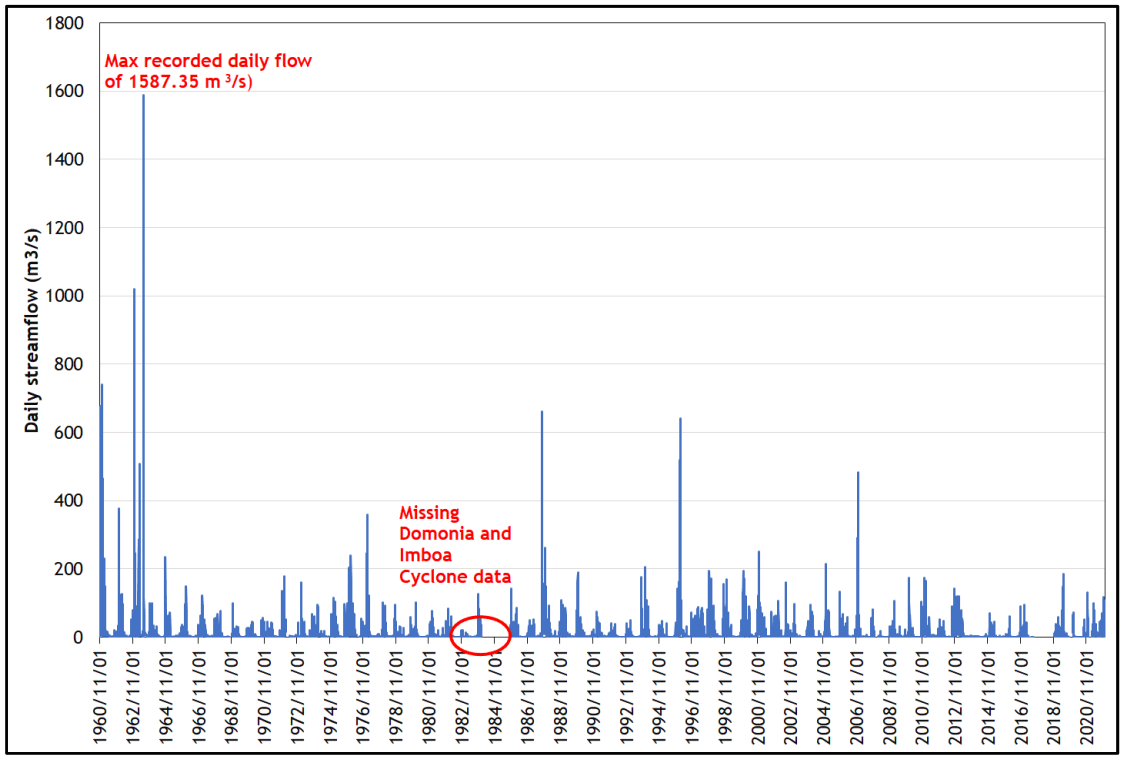


Figure 3-6 Daily streamflow recorded at gauging station W2H005

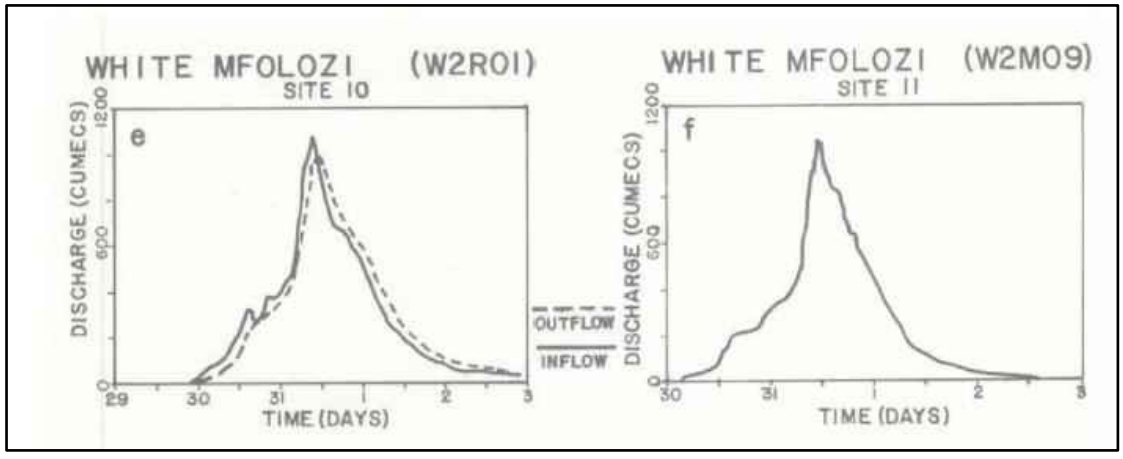


Figure 3-7 Peak hydrograph at two locations along the White Mfolozi (Kovacs *et al.*,1985)

3.7.2 Black Mfolozi River at Native Res 1

Flow measured in the Black Mfolozi River at Native Res located near the town KwaNstele (gauging station W2H006), has a contributing catchment area of 1 648 km^2. The average flow data recorded between 1963 – 2021 indicate a mean annual flow of 2 760 m^3/s/yr. with average daily flows varying between 1.2 m^3/s. in August to 26.6 m^3/s in September. A maximum recorded monthly total flow of 5 813 m^3/s was observed in November 2016 as shown in Figure 3-8. The data however does not have the peaks recorded of the 1984 Demoina flood.

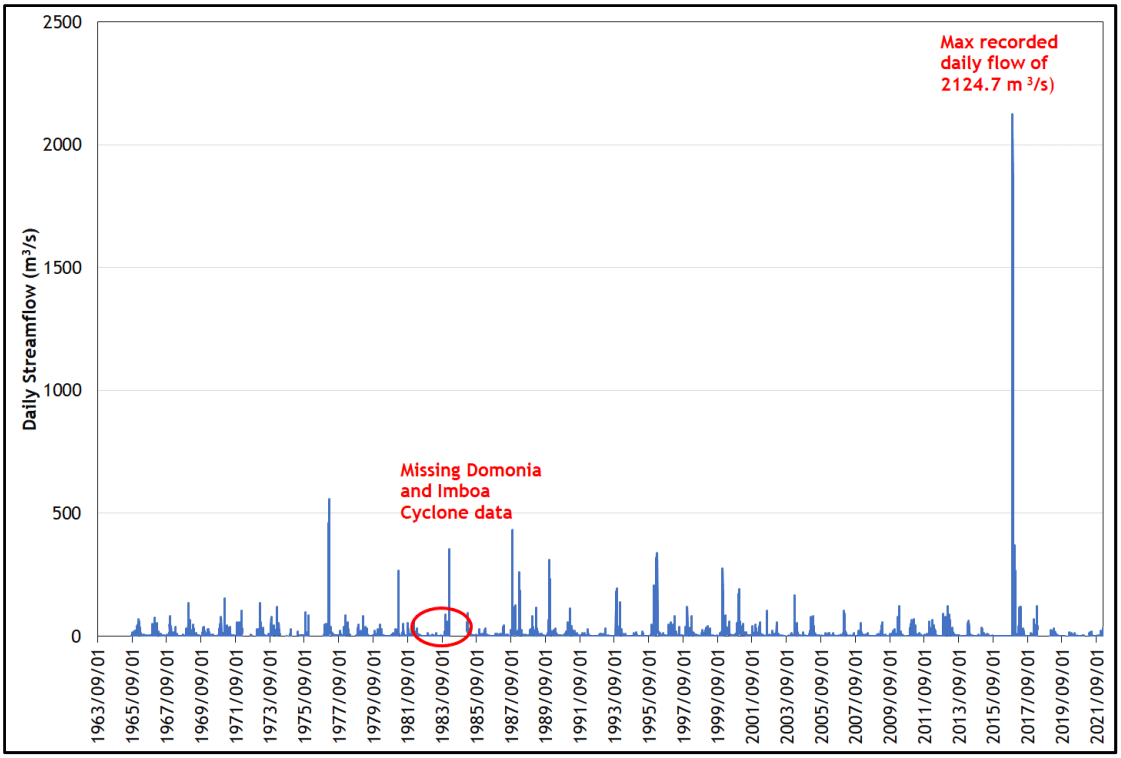


Figure 3-8 Daily streamflow recorded at gauging station W2H006

4 FLOODLINE ASSESSMENT

Floodlines on river sections are analysed to evaluate risks associated with potential flooding of infrastructure and protection of natural water resources. Legislation guides with regards to minimum requirements of placement of infrastructure in relation to a natural watercourse. The approach adopted in the study can be summarized as follows:

- The catchment areas of the Mfolozi River were delineated based on 30 m contours.
- A flood peak analysis was undertaken to determine the different recurrence interval flood peaks for the Mfolozi, White Mfolozi and Mvamanzi Rivers using the Alternative Rational, Standard Design Flood (SDF) and Regional Maximum Flood (RMF) methods.
- The flood peaks and a Digital Elevation Model (DEM) of the study area were used as inputs to the HEC-RAS backwater program to determine the surface water elevations for the 1:50 and 1:100-year flood peaks.

4.1.1 Sub Catchments

The total drainage area of the Mfolozi River that flows adjacent the proposed Fuleni Prospecting Right boundary was divided into sub-catchments based on the topography of the area. The sub-catchments were found to be predominantly grassland. Figure 3-2 show the 26 quaternary catchments that make up the Mflolozi River catchment. This is to give an idea of the river system and inter-catchment flow paths of the Mfolozi River. Figure 4-1 shows the catchments adjacent to the site boundary that will have runoff directly into the surrounding rivers.

4.1.2 Peak Flow Determination

Three methods were applied to determine the peak storm water discharge values for the study area.

4.1.2.1 Alternative Rational Method

The alternative rational method is based on the rational method with the point precipitation being adjusted to consider local South African conditions.

The rational method considers the entire drainage area as a single unit and estimates the peak discharge at the most downstream point of that drainage area. The sub catchment area analysed based on the length of the watercourse running through it, as well as the lengths at 10% and 85% of the full length and the corresponding elevations. The time of concentration of a catchment is often defined to be the time required for a parcel of runoff to travel the most hydraulically distant part of a watershed to the outlet. Time of concentration represents the time at which all areas of the catchment will contribute runoff to the outlet. The characteristics used in applying the Alternative Rational Method are shown in Table 4-1.

Table 4-1 Sub catchment characteristics used in the Rational Method

Catchment Name	Catchment Area (km^2)	Longest Watercourse (km)	Average Slope (m/m)	Time of concentration (hr)
Mfolozi	251.8	37.5	0.1229	2.423
White Mfolozi	130.2	20.6	0.1102	1.593
Mvamanzi	169.2	23.4	0.1272	1.633

4.1.2.2 Standard Design Flood (SDF)

The Standard Design Flood (SDF) method was developed specifically to address the uncertainty in flood prediction under South African conditions (Alexander, 2002). The runoff coefficient (C) is replaced by a calibrated value based on the subdivision of the country into 26 regions or Water Management Areas (WMA). The design methodology is slightly different and looks at the probability of a peak flood event occurring at any one of a series of similarly sized catchments in a wider region, while others focus on point probabilities. The characteristics used in applying the SDF are shown in Table 4-2.

Table 4-2 Sub catchment characteristic used in the SDF Method

SDF Basin	Mean Annual daily maxima (mm)	Days of thunder per year
28	75	54

4.1.2.3 Regional Maximum Flood

The Regional Maximum Flood (RMF) (Kovacs,1988) method is a regional empirical approach to calculating the upper limit of the flood peak that can be expected in the area.

Kovács (1988) applied the Francou-Rodier (1967) methodology to Southern Africa where he delineated nine homogeneous hydrographic regions (K envelopes) for Southern Africa based on maximum three-day storm rainfall depths, catchment orientation with respect to the dominant storm generating weather systems, topography, soil permeability, main drainage systems and the location of major dams. By plotting the peak discharges, against catchment size for the individual homogenous hydrographic regions (Table 4-3) Kovács determined the regional envelope coefficients (K_e) of 519 flood peaks (354 from South Africa and 165 from neighbouring countries) for events which occurred between 1856 and 1988. Kovács termed this method the Regional Maximum Flood (RMF) peak.

Of the eight RMF regions, only 5.6 and 5.4 overlie the proposed Fuleni Prospecting Right area. The characteristics used in applying the RMF are shown in Table 4-3.

Table 4-3 Hydrological characteristics of the eight RMF regions in South Africa, Lesotho and Swaziland

RMF Region (R_e)	Mean annual rainfall (mm)	Dominant relief
5.6	600 – 1 000	Hilly to mountainous
5.4	Generally >1 000	Hilly
5.2	Generally >900	Mountainous
5	200 – 1 500	Mountainous to hilly
4.6	Southwest: 200 – 500 Northeast: 500 - 800	Undulating to flat with mountainous patches
4	100 - 500	Flat to undulating with pans
3.4	South and west: ≤200 North: 150 - 500	South and west: flat North: flat to undulating
≤2.8	150 - 400	Flat to undulating

A comparison of the 1 in 50 and 1 in 100 flood peaks for the rivers are presented in Table 4-4.

Table 4-4 Comparison of calculated peak flows

Method ($m^3.s^{-1}$)						
River ID	**Alternative Rational Method**		**SDF**		**RMF**	
	1:50 yr	**1:100 yr**	**1:50 yr**	**1:100 yr**	**1:50 yr**	**1:100 yr**
Mfolozi	2 138	3 217	1 591	2 001	1 329	1 528
White Mfolozi	1 681	2 530	1 165	1 465	981	1 128
Mvamanzi	2 094	3 151	1441	1 813	1 107	1 273

Of the methods used here, the results obtained from the SDF method were chosen to represent the peak flows. This is because the SDF method is:

- The most conservative of these methods; and
- Specifically set out for South African conditions.

4.1.3 Floodline Modelling

The Manning's roughness coefficients for the channel and the banks of the drainage line were estimated by comparing the vegetation and nature of the channel surface with published data (Hicks and Mason, 1991). The Manning's n coefficients of 0.035 and 0.04 were estimated for the bed and banks respectively of the Mfolozi and White Mfolozi Rivers within the area. A Manning's coefficient of 0.03 and 0.035 were estimated for the bed and banks of the Mvamanzi River.

HEC-RAS 6.0 was used for the purposes of modelling the flooding resulting from a 1:50 and 1:100-year rainfall event. Hec-Ras is designed to perform one- and two-dimensional hydraulic calculations. This was further used to define the channel and banks within the model. No site visit was undertaken to confirm the data used in the hydraulic analysis and this was considered to be the best available contour data at the time of the study. Peak flows and inflow boundaries have been calculated based upon an understanding of the catchment, the delineation of the respective catchment.

4.2 Results

4.2.1 Mfolozi River

The 1:50 and 1:100 flood levels are depicted in Figure 4-1 and 4-2. No flood encroachment is indicated except at the two communities of Novunula and Ocilwane. No boreholes will be located within the 1 in 100 year floodline of the Mfolozi River. The Froude number along the riverbed is less than one, demonstrating subcritical flow regime. However, some sections along the river have a Froude of less than 0.5; indicating some wave action on the water surface. The water surface elevation ranges between 21.21 masl and 75.57 masl. The top width of the

active flow area varies between 197.6 m and 916.87 m. The river velocity increases as with river depth.

4.2.2 White Mfolozi River

The 1:50 and 1:100 flood levels are depicted in Figure 4-1 and 4-2. No flood encroachment is indicated except at the two villages Novunula and Nthuthinga. No boreholes will be located within the 1 in 100 year floodline of the White Mfolozi River. These boreholes will be relocated to outside of the floodline boundary. The Froude number along the riverbed is less than one, demonstrating subcritical flow regime. The water surface elevation and velocity of the river ranges between 74.28 m - 75.57 m and 0.03 m/s - 1.78. m/s. The river velocity increases as with river depth. The top width of the active flow area varies between 228.92 m and 4373.84 m.

4.2.3 Mvamanzi River

The 1:50 and 1:100 flood levels are depicted in Fig.4-2 and 4-3 No flood encroachment is indicated except at the three villages Ngwemnyama, Ezidonini and Ocilwane. Borehole F054 is affected by the flood events. This borehole will be relocated outside of the floodline. The Froude number along the riverbed is greater than one, demonstrating supercritical flow regime. The water surface elevation of the river ranges between 36.27 m - 106.0 m . The top width of the active flow area varies between 152.3 m and 489.59 m.

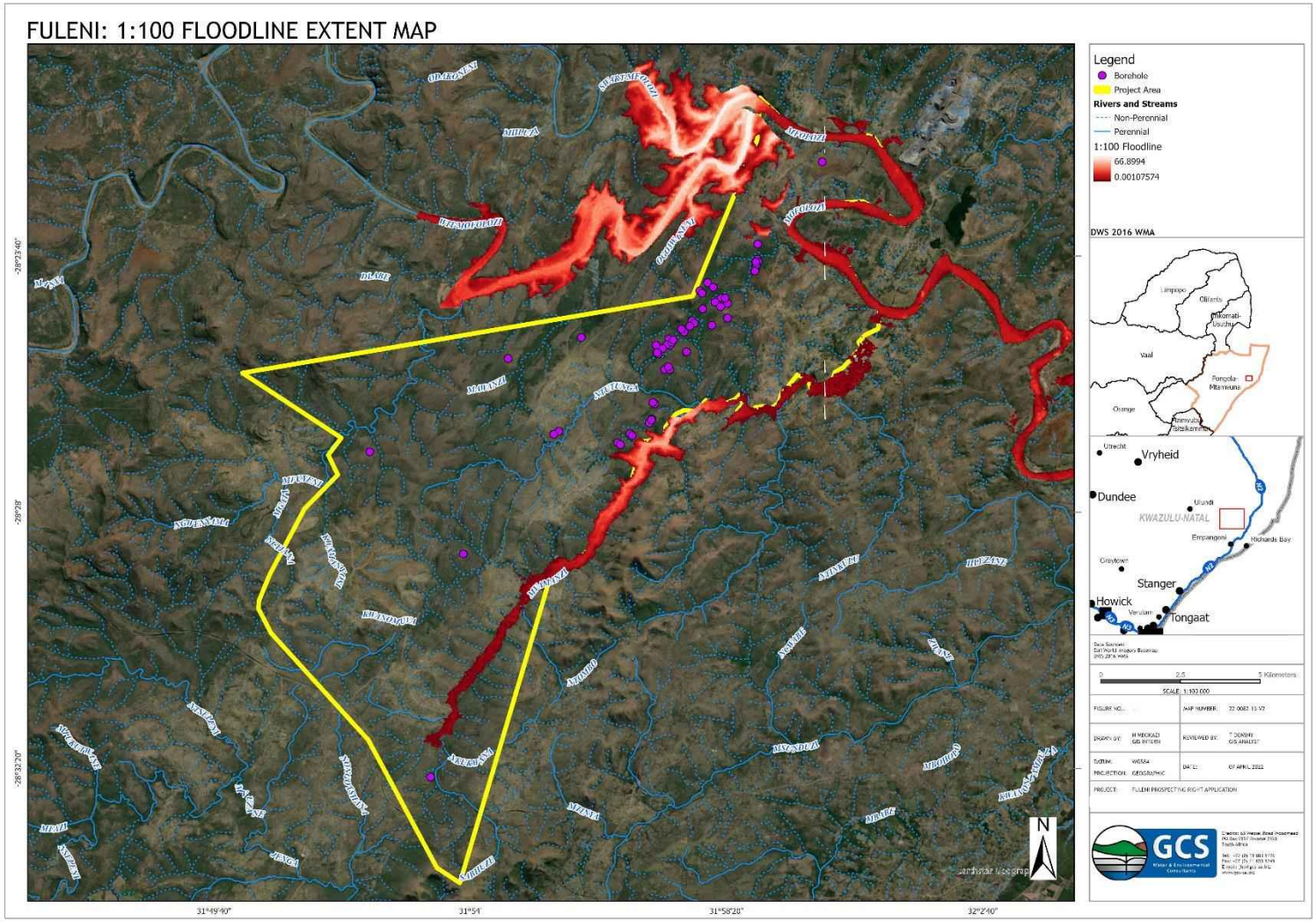


Figure 4-1: 1 in 100 year floodline map

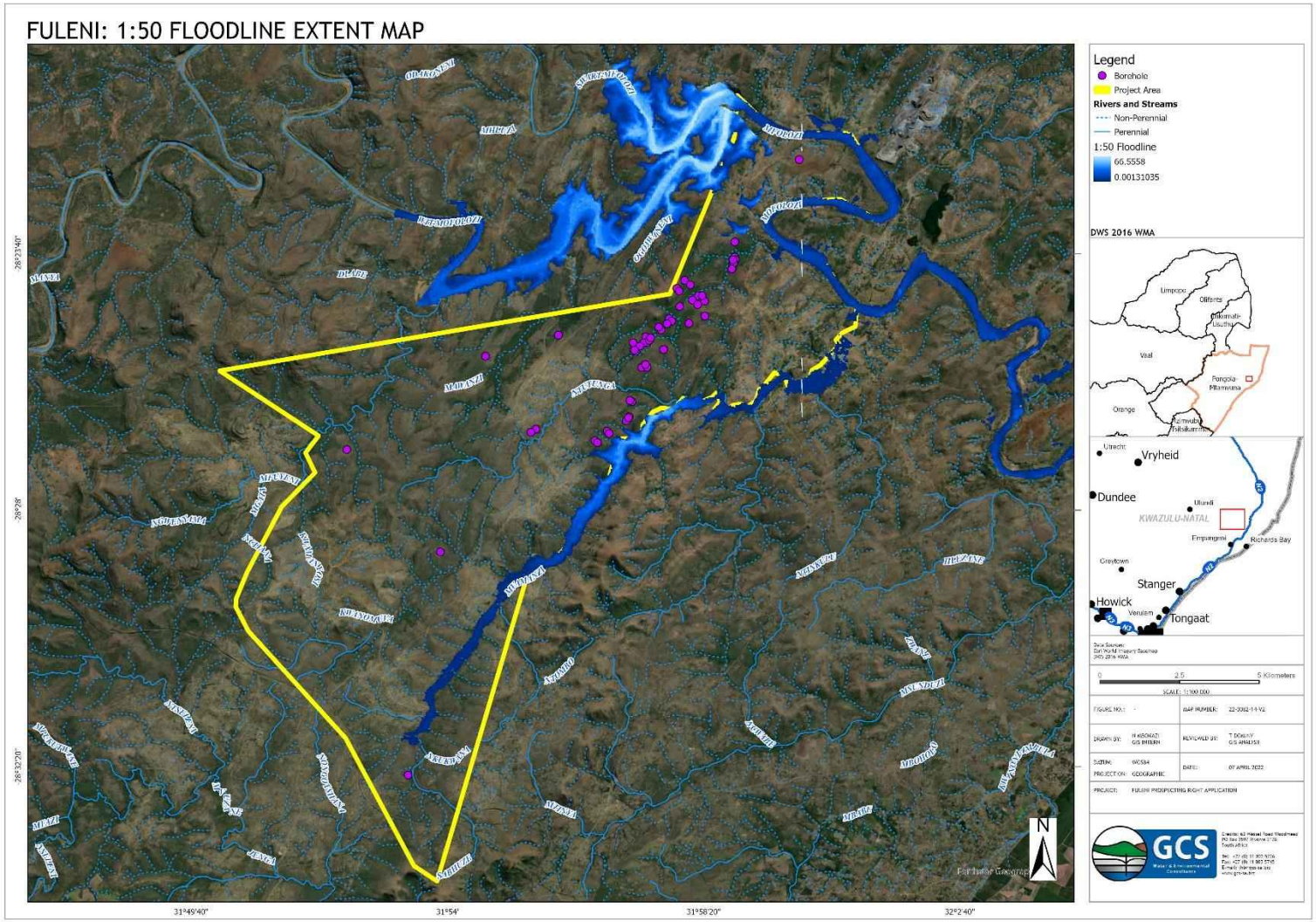


Figure 4-2: 1 in 50 year floodlines map

5 STORMWATER MANAGEMENT PLAN

Even though minimal, prospecting activities have the potential to impact upon the baseline water quality of an area. The aim of stormwater management measures is to mitigate these impacts by fulfilling the requirements of the National Water Act (Act 36 of 1998).

The following definitions are appropriate to the classification of catchments and design of stormwater management measures at the Fuleni Prospecting Right Area:

- Dirty area: means any area or activity which causes, has caused or is likely to cause pollution of a water resource; and
- Dirty water system: This includes any dirty water diversion bunds, channels, pipelines, dirty water dams or other forms of impoundment, and any other structure or facility constructed for the retention or conveyance of water containing waste (i.e. dirty water).

Based on the principles stated above, the proposed boreholes associated with the Fuleni Prospecting Activities do not pose any significant risk of flooding. The area is undeveloped meaning high rates of infiltration then runoff generation. There is no surface infrastructure associated with the borehole installation that will interrupt surface flows. However, the drilling fluid contains hydrocarbons and therefore may potentially cause pollution of the downstream receiving watercourses. Refer to Figure 5-1 for a typical drill rig set up.

It is recommended that the standard practice of collecting all drilling fluid in an in-ground sump or above ground storage tanks must be followed. From these storage areas, the fluid can be reused and contained to prevent contact with the environment. As the drilling site footprint is small, and the drilling is a short-term activity, hydrological impacts may be reduced to negligible if the proposed stormwater management method mentioned above is adhered to.

Figure 5-1 Typical drill rig set up

6 CONCLUSION

The floodlines presented in this report were developed as part of the surface hydrology study for the Fuleni Prospecting Right as part of their application for Environmental Authorisation. The backwater modelling program, HEC-RAS, was used to calculate the floodlines for the 1 in 50 and 1 in 100 peak flows resulting from the respective 24-hour storm events.

The results provided indicate that given the gentle channel shape of the Mfolozi in this area, the extent of the flood is not excessive. As the location of the prospecting boreholes were selected in such a manner to be located outside of the 1 in 100 year floodline, none of the boreholes will be affected by the floodlines.

7 REFERENCES

Department of Water and Sanitation. (2014). *A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa*. Pretoria.

Department of Watter Affairs and Forestry. (2004). *Internal Strategic Persepctive: Usuthu to Mahlathuse Water Management Area*. Pretoria: Report No. P WMA 06/000/00/0304.

Dyson, J., & van Heerden, J. (2009). *Heavy daily-rainfall characteristics over the Gauteng Province*. Pretoria: WaterSA.

Kovacs, Z., du Plessis, D., Bracher, P., Dunn, P., & GCL, M. (1985). *Documentation of the 1984 Domoina Floods*. Pretoria: Department of Water and Sanitation.

Smithers and Schulze. (2000). *Design Rainfall Estimation for South Africa*. Pretoria: Water Research Commission.

T, D. (1990). *The effects of sea surface temperature on tropical cyclones in the South West Indian Ocean*. Port Elizabeth: In Student Geography Conference, University of Port Elizabeth.

Umgeni Water Amanzi. (2020). *Infrastructure Master Plan 2020 2020/2021 – 2050/2051 Volume 9:uMfolozi System and uMkuze-uPhongolo-Lake Sibiya System*. Pietermaritzburg.

van Heerden, I., & D, S. (1986). *Fluvial processes in the Mfolozi Flats and the consequences for St Lucia Estuary*. Pietermaritburg: Proceedings, 2nd South African National Hydrology.

APPENDIX A: PEAK FLOW CALCULATION – RATIONAL METHOD 3

RATIONAL METHOD 3

Description of catchment	A1						
River detail	Mfolozi @ Fuleni						
Calculated by	Zinhle Sithole			Date	25/03/2022		
Physical characteristics							
Size of catchment (A)	251.8	km^2		Rainfall region	W2C		
Longest watercourse (L)	37.500	km		**Area distribution factors**			
Average slope (S_{av})	0.1229	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual precipitation (MAP)	1007	mm					
Rural				**URBAN**			
Surface slope	**%**	**Factor**	**C_s**	**Description**	**%**	**Factor**	**C2**
Vleis and pans (<3%)	0.00	0.05	0.00	**Lawns**			
Flat areas (3 - 10%)	10.00	0.11	1.10	Sandy,flat<2%	0	0	0
Hilly (10 - 30%)	90.00	0.20	18.00	Sandy,steep>7 %	0	0	0
Steep Areas (>30%)	0.00	0.30	0.00	Heavy s,flat<2%	0	0	0
Total	100.00	0.66	19.10	Heavy s,steep>7%	0	0.35	0
Permeability	**%**	**Factor**	**C_p**	**Residential Areas**			
Very permeable	0	0.05	0.00	Houses	0	0	0
Permeable	100	0.1	10.00	Flats	0	0	0
Semi-permeable	0	0.2	0.00	Industry			
Impermeable	0	0.3	0.00	Light industry	0	0	0
Total	100	0.65	10.00	Heavy industry	0	0	0
Vegetation	**%**	**Factor**	**C_v**	**Business**			
Thick bush & plantation	0	0.05	0.00	City centre	0	0	0
Light bush & farm-lands	0	0.15	0.00	Suburban	0	0	0
Grasslands	100	0.25	25.00	Streets	0	0	0
No vegatation	0	0.3	0.00	Max flood	0	1	0
Total	100	0.75	25.00	Total (C2)	0		0
Time of concentration (TC)							
Overland flow	Defined watercourse						
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$			Use definded watercourse. R value not required for Tc calculation (however the area has medium grass cover)			
3.052 hours	2.423 hours						

Run-off coefficient							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Run-off coefficient, C_1	0.541	0.541	0.541	0.541	0.541	0.541	
Adjusted for dolomitic areas, C_{1D}	0.541	0.541	0.541	0.541	0.541	0.541	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.271	0.298	0.325	0.362	0.449	0.541	
Combined run - off coefficient, C_T	0.271	0.298	0.325	0.362	0.449	0.541	
Rainfall							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Point rainfall (mm), P_T	52.30	75.90	96.90	122.20	164.90	206.00	
Point Intensity (mm/h), P_{it}	21.59	31.33	40.00	50.44	68.07	85.04	
Area reduction factor (%),ARF_T	1.000	1.000	1.000	1.000	1.000	1.000	
Average intensity (mm/hour),I_T	21.589	31.331	40.000	50.443	68.069	85.035	
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Peak flow (m3/s)	408.431	652.006	908.076	1278.772	2137.696	3217.47	

RATIONAL METHOD 3

Description of catchment	A2						
River detail	White Mfolozi @ Fuleni						
Calculated by	Zinhle Sithole			Date	25/03/2022		
Physical characteristics							
Size of catchment (A)	130.2	km^2		Rainfall region		W2F	
Longest watercourse (L)	20.600	km		**Area distribution factors**			
Average slope (S_{av})	0.1102	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual precipitation (MAP)	1007	mm					
Rural				**URBAN**			
Surface slope	**%**	**Factor**	**C_s**	**Description**	**%**	**Factor**	**C2**
Vleis and pans (<3%)	0.00	0.05	0.00	**Lawns**			
Flat areas (3 - 10%)	10.00	0.11	1.10	Sandy,flat<2%	0	0	0
Hilly (10 - 30%)	90.00	0.20	18.00	Sandy,steep>7 %	0	0	0
Steep Areas (>30%)	0.00	0.30	0.00	Heavy s,flat<2%	0	0	0
Total	100.00	0.66	19.10	Heavy s,steep>7%	0	0.35	0
Permeability	**%**	**Factor**	**C_p**	**Residential Areas**			
Very permeable	0	0.05	0.00	Houses	0	0	0
Permeable	100	0.1	10.00	Flats	0	0	0
Semi-permeable	0	0.2	0.00	Industry			
Impermeable	0	0.3	0.00	Light industry	0	0	0
Total	100	0.65	10.00	Heavy industry	0	0	0
Vegetation	**%**	**Factor**	**C_v**	**Business**			
Thick bush & plantation	0	0.05	0.00	City centre	0	0	0
Light bush & farm-lands	0	0.15	0.00	Suburban	0	0	0
Grasslands	100	0.25	25.00	Streets	0	0	0
No vegatation	0	0.3	0.00	Max flood	0	1	0
Total	100	0.75	25.00	Total (C2)	0		0
Time of concentration (TC)							
Overland flow	Defined watercourse						
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$	$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AV}}\right]^{0.385}$			Use definded watercourse. R value not required for Tc calculation (however the area has medium grass cover)			
2.367 hours	1.593 hours						
Run-off coefficient							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Run-off coefficient, C_1	0.541	0.541	0.541	0.541	0.541	0.541	
Adjusted for dolomitic areas, C_{1D}	0.541	0.541	0.541	0.541	0.541	0.541	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.271	0.298	0.325	0.362	0.449	0.541	
Combined run - off coefficient, C_T	0.271	0.298	0.325	0.362	0.449	0.541	
Rainfall							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Point rainfall (mm), P_T	52.30	75.90	96.90	122.20	164.90	206.00	
Point Intensity (mm/h), P_{it}	32.83	47.65	60.83	76.71	103.52	129.32	
Area reduction factor (%),ARF_T	1.000	1.000	1.000	1.000	1.000	1.000	
Average intensity (mm/hour),I_T	32.831	47.646	60.829	76.711	103.516	129.316	
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Peak flow (m3/s)	321.216	512.779	714.168	1005.707	1681.219	2530.42	

RATIONAL METHOD 3

Description of catchment		A3					
River detail		Mvamanzi @ Fuleni					
Calculated by		Zinhle Sithole			Date	25/03/2022	
Physical characteristics							
Size of catchment (A)	169.2	km^2		Rainfall region		W2F	
Longest watercourse (L)	23.400	km		**Area distribution factors**			
Average slope (S_{av})	0.1272	m/m		Rural (α)	Urban (β)	Lakes (γ)	
Dolomite area (D%)	0	%		1	0	0	
Mean annual precipitation (MAP)	1007	mm					
Rural				**URBAN**			
Surface slope	**%**	**Factor**	**C_s**	**Description**	**%**	**Factor**	**C2**
Vleis and pans (<3%)	0.00	0.05	0.00	**Lawns**			
Flat areas (3 - 10%)	10.00	0.11	1.10	Sandy,flat<2%	0	0	0
Hilly (10 - 30%)	90.00	0.20	18.00	Sandy,steep>7 %	0	0	0
Steep Areas (>30%)	0.00	0.30	0.00	Heavy s,flat<2%	0	0	0
Total	100.00	0.66	19.10	Heavy s,steep>7%	0	0.35	0
Permeability	**%**	**Factor**	**C_p**	**Residential Areas**			
Very permeable	0	0.05	0.00	Houses	0	0	0
Permeable	100	0.1	10.00	Flats	0	0	0
Semi-permeable	0	0.2	0.00	Industry			
Impermeable	0	0.3	0.00	Light industry	0	0	0
Total	100	0.65	10.00	Heavy industry	0	0	0
Vegetation	**%**	**Factor**	**C_v**	**Business**			
Thick bush & plantation	0	0.05	0.00	City centre	0	0	0
Light bush & farm-lands	0	0.15	0.00	Suburban	0	0	0
Grasslands	100	0.25	25.00	Streets	0	0	0
No vegatation	0	0.3	0.00	Max flood	0	1	0
Total	100	0.75	25.00	Total (C2)	0		0
Time of concentration (TC)							
Overland flow		Defined watercourse					
$T_C = 0.604\left(\frac{rL}{\sqrt{S_{av}}}\right)^{0.467}$		$T_c = \left[\frac{0.87\,L^2}{1000\,S_{AT}}\right]^{0.385}$		Use definded watercourse. R value not required for Tc calculation (however the area has medium grass cover)			
2.429	hours	1.663	hours				

Run-off coefficient							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Run-off coefficient, C_1	0.541	0.541	0.541	0.541	0.541	0.541	
Adjusted for dolomitic areas, C_{1D}	0.541	0.541	0.541	0.541	0.541	0.541	
Adj factor for initial saturation, F_t	0.5	0.55	0.6	0.67	0.83	1	
Adjusted run - off coefficient, C_{1T}	0.271	0.298	0.325	0.362	0.449	0.541	
Combined run - off coefficient, C_T	0.271	0.298	0.325	0.362	0.449	0.541	
Rainfall							
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Point rainfall (mm), P_T	52.30	75.90	96.90	122.20	164.90	206.00	
Point Intensity (mm/h), P_{it}	31.46	45.65	58.28	73.50	99.18	123.90	
Area reduction factor (%),ARF_T	1.000	1.000	1.000	1.000	1.000	1.000	
Average intensity (mm/hour),I_T	31.456	45.650	58.281	73.498	99.180	123.900	
Return Period (years)	**2**	**5**	**10**	**20**	**50**	**100**	**PMF**
Peak flow (m3/s)	399.988	638.528	889.304	1252.338	2093.506	3150.96	

APPENDIX B: PEAK FLOW CALCULATION – STANDARD DESIGN FLOOD

STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment			A1				
River detail			Mfolozi @ Fuleni				
Calculated by			Zinhle Sithole		Date	25/03/2022	
Physical characteristics							
Size of catchment (A)	251.780	km^2		Days of thunder per year (R)		54	days
Longest watercourse (L)	37.500	km		Time of concentration, t		145.352	minutes
Average slope (S_{av})	0.1229	m/m		Time of concentration , T_c	$Tc = \left[\frac{0.87L^2}{1000S_{av}}\right]^{0.385}$		
SDF Basin	28						
Mean of annual daily maxima (M)	75	mm					2.4225
TR102 n-day rainfall data							
Weather Service Station	Fairview			MAP		1007	mm
Weather Service Station no.	0305037_W			Coordinates		Lat: -28°22'12.00"S Long: 32°1'12.00"E	
Duration	**Return Period (years)**						
	2	**5**	**10**	**20**	**50**	**100**	**200**
	85.7	133.7	174.7	222.8	301	373.9	
Rainfall							
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Point precipitation depth (mm) $P_{t,T}$	41.1	69.3	90.7	112.0	140.2	161.6	
Area reduction factor (%),ARF_T	0.858	0.858	0.858	0.858	0.858	0.858	
Average intensity (mm/hour),I_T	14.6	24.5	32.1	39.7	49.7	57.2	
Run-off coefficient							
Calibration factors C_2 (%)	15		C_{100} (%)		50		
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	
Run-off coefficient, C_T	0.150	0.276	0.342	0.396	0.458	0.500	
Peak flow (m3/s)	152.65	474.13	768.62	1099.67	1590.70	2001.22	

STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment			A2				
River detail			White Mfolozi @ Fuleni				
Calculated by			Zinhle Sithole		Date	25/03/2022	
Physical characteristics							
Size of catchment (A)	130.210	km^2		Days of thunder per year (R)		54	days
Longest watercourse (L)	20.600	km		Time of concentration, t		95.579	minutes
Average slope (S_{av})	0.1102	m/m		Time of concentration , T_c	$Tc = \left[\frac{0.87L^2}{1000S_{av}}\right]^{0.385}$		
SDF Basin	28						
Mean of annual daily maxima (M)	75	mm					1.5930
TR102 n-day rainfall data							
Weather Service Station	Fairview			MAP		1007	mm
Weather Service Station no.	0305037_W			Coordinates		Lat: -28°22'12.00"S Long: 32°1'12.00"E	
Duration	**Return Period (years)**						
	2	**5**	**10**	**20**	**50**	**100**	**200**
	85.7	133.7	174.7	222.8	301	373.9	
Rainfall							
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Point precipitation depth (mm) $P_{t,T}$	37.3	63.0	82.3	101.7	127.4	146.8	
Area reduction factor (%),ARF_T	0.879	0.879	0.879	0.879	0.879	0.879	
Average intensity (mm/hour),I_T	20.6	34.7	45.5	56.2	70.3	81.0	
Run-off coefficient							
Calibration factors C_2 (%)	15		C_{100} (%)		50		
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	
Run-off coefficient, C_T	0.150	0.276	0.342	0.396	0.458	0.500	
Peak flow (m3/s)	111.76	347.12	562.72	805.09	1164.58	1465.14	

STANDARD DESIGN FLOOD (SDF) METHOD							
Description of catchment		A3					
River detail		Mvamanzi @ Fuleni					
Calculated by		Zinhle Sithole			Date	25/03/2022	
Physical characteristics							
Size of catchment (A)	169.230	km^2		Days of thunder per year (R)		54	days
Longest watercourse (L)	23.400	km		Time of concentration, t		99.758	minutes
Average slope (S_{av})	0.1272	m/m		Time of concentration , T_c	$Tc = \left[\frac{0.87L^2}{1000S_{av}}\right]^{0.385}$		1.6626
SDF Basin	28						
Mean of annual daily maxima (M)	75	mm					
TR102 n-day rainfall data							
Weather Service Station	Fairview			MAP		1007	mm
Weather Service Station no.	0305037_W			Coordinates		Lat: -28°22'12.00"S Long: 32°1' 12.00"E	
Duration	**Return Period (years)**						
	2	**5**	**10**	**20**	**50**	**100**	**200**
	85.7	133.7	174.7	222.8	301	373.9	
Rainfall							
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Point precipitation depth (mm) $P_{t,T}$	37.7	63.6	83.2	102.8	128.7	148.3	
Area reduction factor (%),ARF_T	0.865	0.865	0.865	0.865	0.865	0.865	
Average intensity (mm/hour),I_T	19.6	33.1	43.3	53.5	66.9	77.1	
Run-off coefficient							
Calibration factors C_2 (%)	15		C_{100} (%)		50		
Return Period (years), T	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Return period factors (Y_T)	0	0.84	1.28	1.64	2.05	2.33	
Run-off coefficient, C_T	0.150	0.276	0.342	0.396	0.458	0.500	
Peak flow (m3/s)	138.29	429.55	696.33	996.25	1441.10	1813.02	

APPENDIX C: PEAK FLOW CALCULATION – REGIONAL MAXIMUM FLOOD

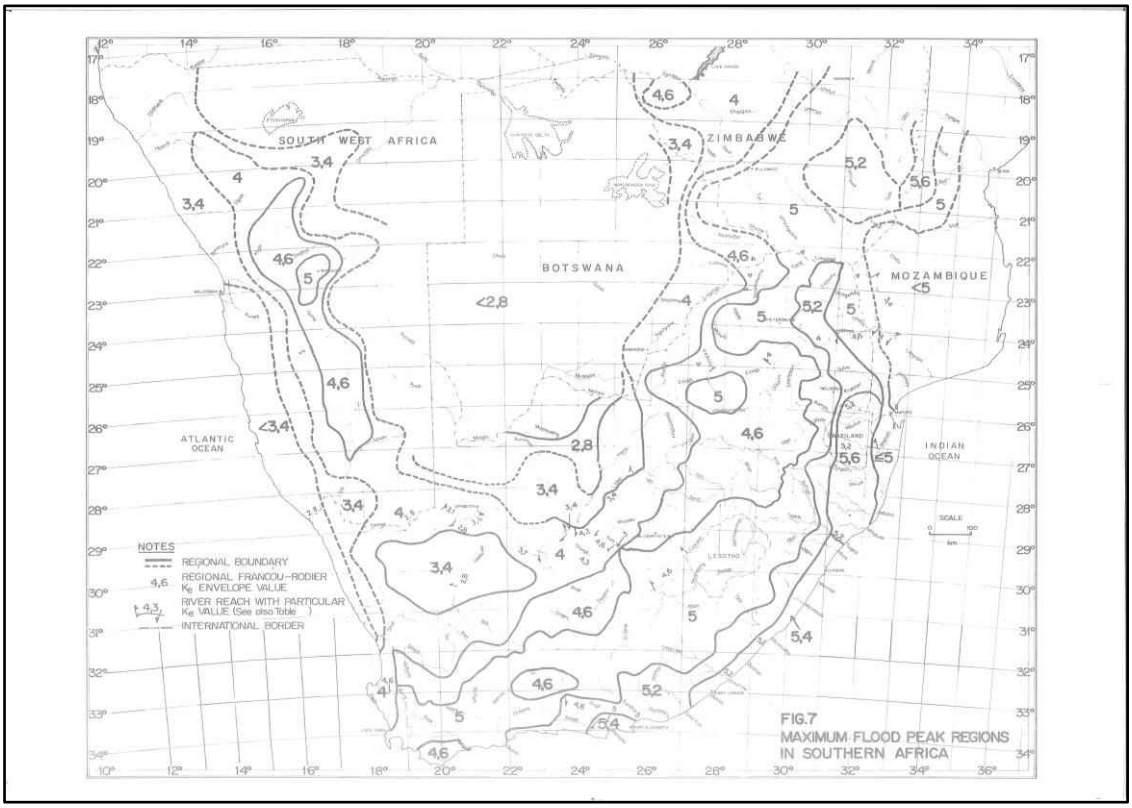


Figure C1: Maximum flood peak regions in Southern Africa

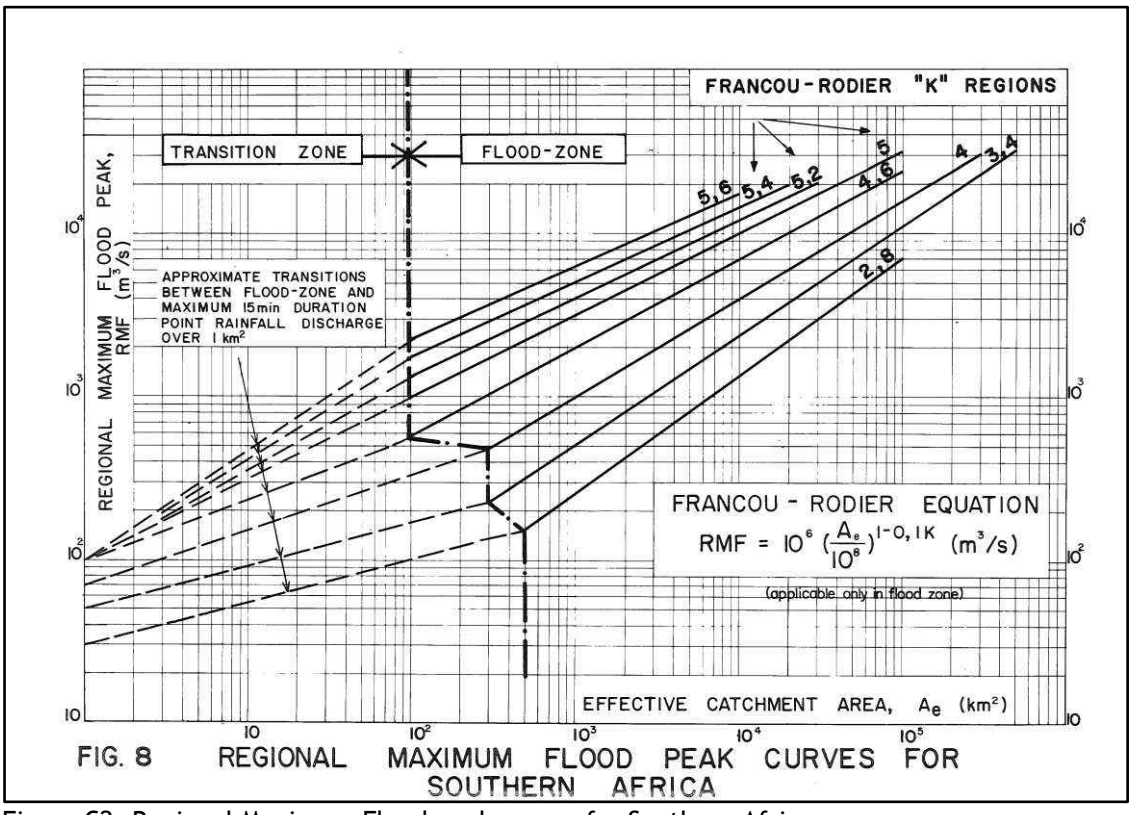


Figure C2: Regional Maximum Flood peak curves for Southern Africa

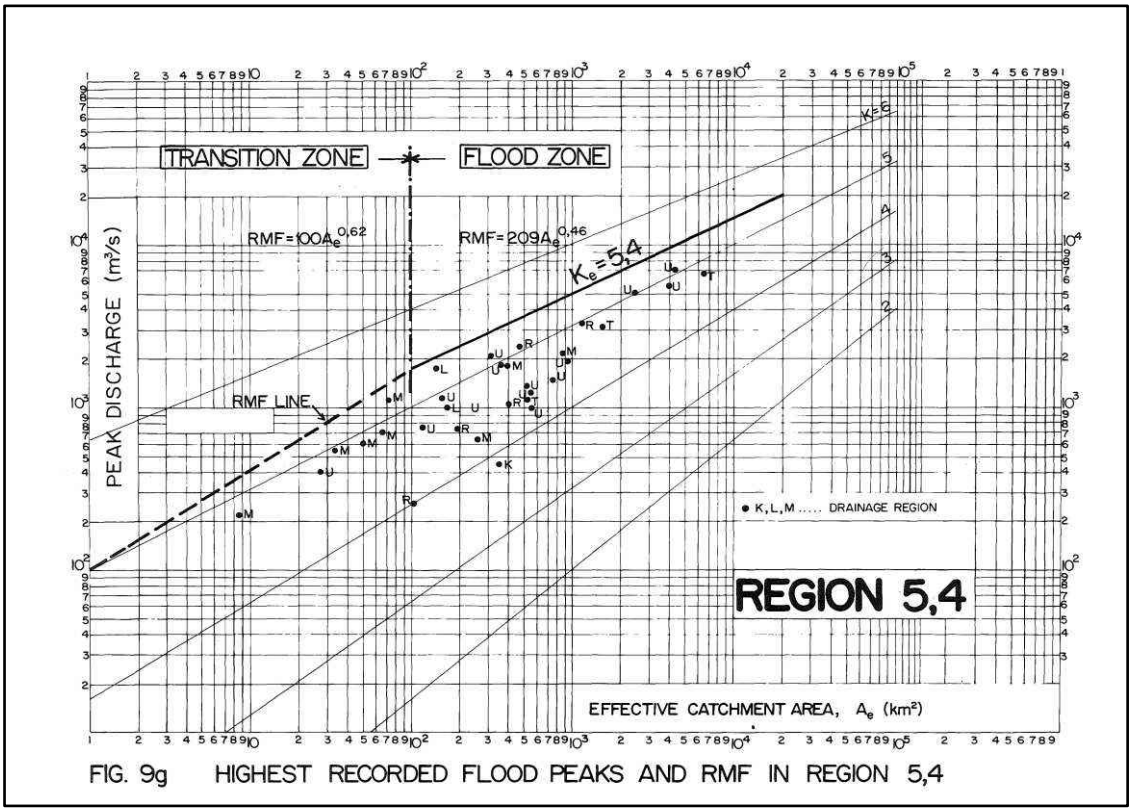


Figure C3: Highest recorded flood peaks and RMF in Region 5.4

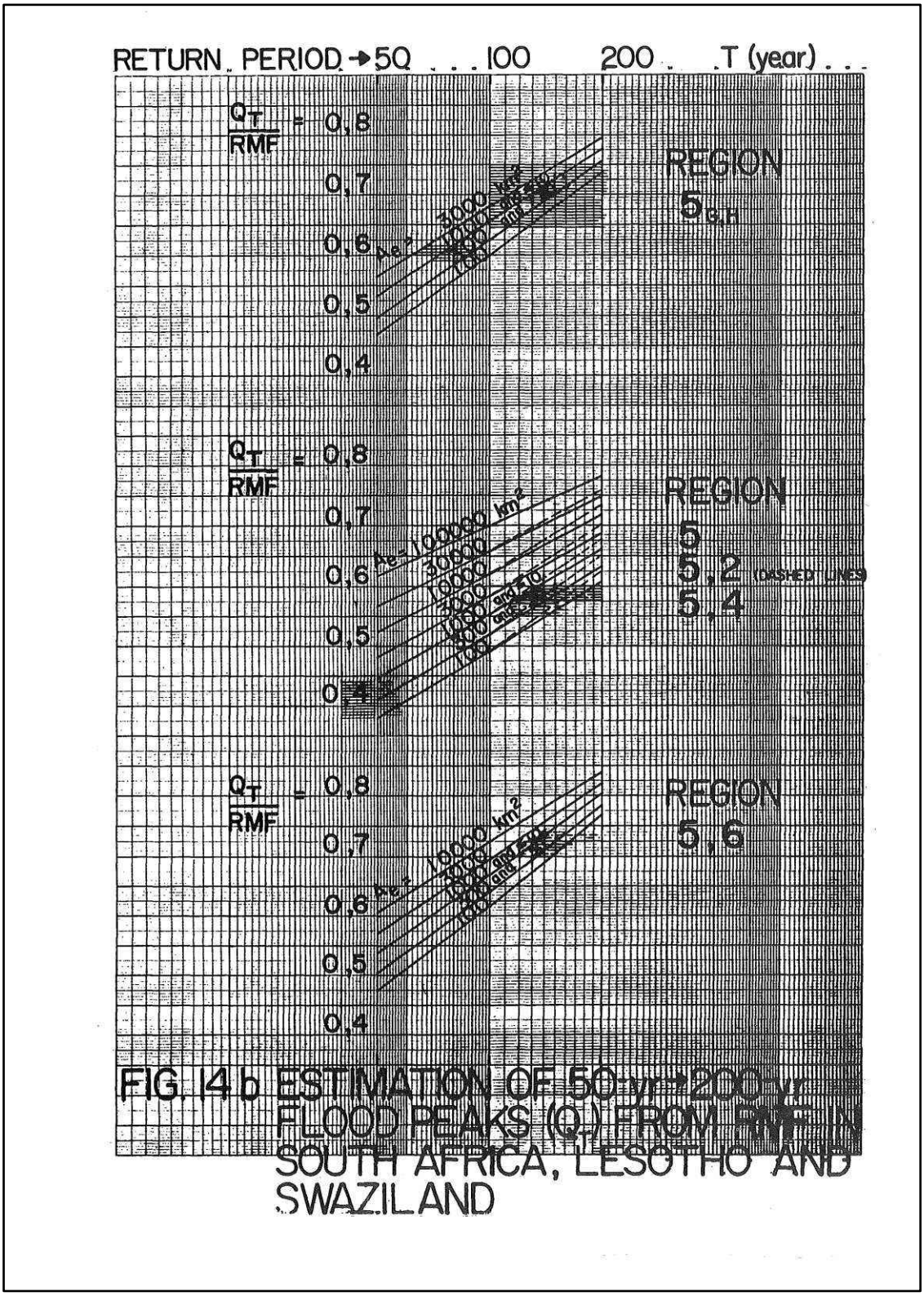


Figure C4: Estimation of 50-yr – 200 yr. flood peaks from RMF in South Africa, Lesotho and Swaziland.

APPENDIX D: SPECIALIST CVS

JENNIFER MENEGHELLI

Water Resource Engineer

CORE SKILLS

- Water Resource planning, management and optimisation
- Hydrological modelling and analysis
- Hydraulic engineering of water management systems
- Stormwater Management Plans
- Surface flood risk assessment
- Dam Break Analysis
- Floodline Determination
- Modelling of water systems

DETAILS

Qualifications

- B.Sc. – Civil Engineering
- Post Graduate Course Work – Civil Engineering
- M.Sc – Civil Engineering

Memberships

ECSA – Professional Engineer

SAICE – Associate Member

WISA – Associate Member

Languages

- English – fluent
- Afrikaans- fluent

PROFILE

Jennifer is a Professional Engineer committed to protecting and conserving freshwater systems by implementing sustainable surface water management practices. She applies water resource management principles to strategize optimal operation and site development of mining and industrial facilities. She effectively solves complex problems by proposing innovative, holistic solutions that come from a desire to learn. She is client focused and strives for technical excellence. She works independently and collaborates well with others.

Jennifer has experience in the following areas:

- Water resource planning, management, and optimisation from concept to detailed design
- Hydrological modelling and analysis
- Rainfall calculation
- Runoff modelling of sub catchments
- Peak flow analysis of rivers
- Floodline determination and flood mapping
- Hydraulic engineering of water management systems
- Stormwater Management Plans
- Surface flood risk assessment
- Dam break analyses
- Floodline determination
- Water balances
- River impact assessment
- Structural analysis and engineering
- Structural steel and concrete design
- Application of codes and specifications
- Site inspections and investigations
- Engineering coordination and technical direction
- Dam break analyses
- Environmental compliance and permitting
- River impact assessment
- Static and dynamic water balances

WORK EXPERIENCE

Year	Employer	Position	Role and Responsibility
2015 – 2018	**Jones & Wagener**	**Hydrological Engineer**	**Provided Surface water management consultancy to coal, diamond and gold mines, hazardous waste storage facilities and ash disposal facilities at power stations** • Multidisciplinary team in partnership with Specialists • Feasibility stage to construction, including tender phase • Site inspections • Preparation of proposals • Environmental compliance and permitting in accordance with national environmental and water bodies • Technical report writing • Holistic solution formulation and risk assessment of alternatives • Management of draughting services • Numerical modelling of surface water studies
2014	**Jacobs Engineering Group**	**Civil Structural Engineer**	**Civil and Structural resident engineer in the Front-End Loading (FEL) team at Sasol Synfeuls, as part of the alliance with Jacobs** • Multidisciplinary Front End Loading engineering team • Project scope definition • Problem identification and conceptual design • Tender evaluation • Consultant and contractor appointment • Liaison with the Department of Water and Sanitation and Environmental Affairs • Site supervision and quality management
2012 – 2013	**SNC-Lavalin Engineering Company**	**Civil and Structural Engineer**	**Complex structural engineering problems for large structures at gold and copper mine process plants and for the fertilizer industry.** • Multi-disciplinary team • BOQ development • Tender evaluation and ajudication • Dynamic structures • Composite concrete and steel structures • Foundations • Mining infrastructure civil design
2011 – 2012	**Roman Rock Consulting Engineers**	**Junior Civil and Structural Engineer**	**Static, dynamic and seismic structural analysis of heavy industrial steel and reinforced concrete structures. Designed light steel structures and mining civil infrastructure works.**

Eskom South Africa	**Medupi Ash Disposal Facility Stormwater Management Plan**	• Detailed dynamic water balance modelled in GoldSim. • Detailed stormwater management plans for all phases of the project from construction, to operational, to rehabilitated.
Sasol South Africa	**Consolidated Black Products Site Remediation Programme**	• Stormwater management plan to construction level of detail, including contractor management • Hydrologic assessment of the site • Dynamic SWMP that adapts to each phase of the project from construction to operation to rehabilitation
De Beers South Africa	**Venetia Stormwater Management Plan Feasibility Study**	• Stormwater infrastructure specification for various storm events • Mitigation measures • Dam break analyses
De Beers South Africa	**Venetia Surface Flood Risk Management Plan**	• Subcatchment delineation • Rainfall-runoff of subcatchments • Pit flooding and pumping strategy • 2D modelling of flooding of the site • Floodline determination
Newmont Ghana	**Ahafo Tailings Storage Facility Dam Breach Analysis**	• Modelling of alternative TSF locations • Modelling of displacement of inland lake by tailings • Dam break analysis in Flo2D
Debswana Botswana	**Jwaneng Slimes Dams Breach Analysis**	• Modeling of multiple dam breaches • Assessment of impacts • Emergency planning and preparedness plan
Sasol South Africa	**Sasolberg Water Dam Breach Analysis**	• Dam breach modelling • River flooding • Floodline modelling
AngloGold Ashanti Guinea	**Siguiri Gold Mine RWD Breach Analysis**	• Dam breach modelling • River flooding • Floodline modelling
EnviroServ South Africa	**Holfontein IWWMP Site Water Balance**	• Dynamic water balance, both operational and forecasting, in GoldSim
EnviroServ South Africa	**Shongweni IWWMP Site Water Balance**	• Dynamic water balance, both operational and forecasting, in GoldSim • Specification of dam management
AngloGold Ashanti South Africa	**Welverdiend Sinkhole Diversion**	• Detailed engineering design of stormwater management infrastructure
Rosema South Africa	**Era Stene Specialist Surface Water Study for EIA**	• Era Stene Specialist Surface Water Study for EIA
South 32 South Africa	**Middelburg Coal Mine Floodlines**	• Floodlines for EIA

DECLARATION

I, JENNIFER MENEGHELLI hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.

Signature:  **Date: 2021/01/21**

MAGNUS VAN ROOYEN
Technical Director

CORE SKILLS

- Environmental Impact Assessments
- Scoping Reports
- Preliminary Environmental Assessment
- Mining Right and Applications
- Environmental Management Programmes
- Strategic Environmental Assessments
- Wildlife Management Plans

DETAILS

Qualifications

- BSc – Botany & Zoology
- B.SC Honours - Botany
- Specialist Student
- Post Graduate Diploma in Teaching
- Masters Degree: Environmental Management

Memberships

- SACNASP
- International Association of Impact Assessors

Languages

- English - fluent
- Afrikaans- fluent
- German – fair
- Dutch – fair
- Zulu - adequate

PROFILE

In addition to holding a Masters Degree: Environmental Management, Magnus also holds a BSc degree in Botany and Zoology, an Honours Degree in Botany and a Post Graduate Certificate in Education.

Magnus has 13 years' experience in projects involving Environmental Impact Assessments in various developmental sectors (Mining and Agricultural Sector, National Roads, Pipelines, Dams, and Residential Developments), conducting of Specialist Biodiversity Assessments associated with Environmental Impact Assessments and Project Feasibility Studies. He has experience in the compilation of Resettlement Policy Framework Plans associated with infrastructure development projects.
Magnus has experience in working on various private and public sectors as well as rural and urban environments in various countries.
His expertise lies within the mining sector where he has gained extensive exposure to all the aspects of mining projects from the pre-feasibility, prospecting, environmental impact assessment

Magnus has experience in the following areas:

- Environmental Impact Assessments
- Scoping Reports
- Preliminary Environmental Assessment
- Mining Right and Permit Applications
- Environmental Management Programmes
- Strategic Environmental Assessments
- Wildlife Management Plans

WORK EXPERIENCE

Year	Employer	Position	Role and Responsibility
2007 – 2020	JG Afrika (Pty) Ltd	Executive Associate	Project Management of an environmental contingent of 4 people and conducting Environmental Impact Assessments
2006 – 2007	JG Afrika (Pty) Ltd	Environmental Scientist	Conducted a wide range of infrastructure related Environmental Impact Assessments
2002 – 2005	Department of Conservation Ecology, University of Stellenbosch	Biodiversity Researcher	Conducted field work, sampling, laboratory work and logistics associated with two projects within the Conservation Ecology Department
2002 – 2005	Department of Botany and Zoology, University of Stellenbosch	Junior Lecturer in Botany	Lectured Botany practical component of the first-year Natural Science Degree
2001 – 2002	Paul Roos Gymnasium	Biology Teacher	Teaching the South African Biology curriculum to high school students

Biodiversity Assessment Projects	**Biodiversity Assessment Projects** **Mamatwan Tailings Facility** Biodiversity and Wetland Assessment for the site to be used for the establishment of the new tailings facility on the South32 Mamatwan Manganese Mine near Hotazel. **Hillside Aluminum Desalination Plant** Biodiversity Screening Assessment for the infrastructure network associated with the South32 Hillside Aluminum Desalination Plant in Richards Bay. **Lichtenburg Siding Expansion** Biodiversity Assessment for the proposed expansion of the Lichtenburg Cement Siding, North West Province. **Nacala Dam Project** Riparian Vegetation Study for the Ecological Reserve Determination Specialist Study for the Environmental Impact Assessment for the Nacala Dam Project in Mozambique. **National Route N8** Vegetation Specialist Study for the Environmental Impact Assessment for the National Route N8. National Route N2 uMgeni Interchange ImprovementsEnvironmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process within the city of Durban, KwaZulu-Natal during the process. **Qudeni Link Road** Vegetation Specialist Study for the Environmental Impact Assessment for the Qudeni Rural Link Road. **Municipal Landfill Site Identification** Negative mapping and ground truthing for the options analysis for the identification of a District Municipality Landfill Site.
Port Related Projects	**Pier 1 Phase 2 expansion** Environmental Impact Assessment for proposed expansions to Pier 1 within the Durban Harbour. Locomotive Turning Table in the Port of Richards Bay Environmental Impact Assessment for proposed Locomotive Turn Table in within the Port of Richards Bay. **Rail line construction in the Port of Richards Bay** Environmental Impact Assessment for proposed additional rail line into the Richards Bay Coal Terminal in the Port of Richards Bay.

	Environmental Monitoring – RME Projects Durban Harbour Environmental Monitoring Duties for all the RME construction projects within the Durban harbour. **Ore Loading Facility at Kalia in Guinea** Environmental Impact Assessment for the proposed Ore Loading Facility in Kalia in Guinea, West.
Roads Projects	**National Route N2 uMgeni Interchange Improvements** Environmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process with a range of public and private sector stakeholders. **National Route N11 upgrade** Environmental Impact Assessment for proposed upgrade of the National Route N11. The project included a public participation process with a range of public and private sector stakeholders as well as specialist studies associated with the river crossings. **National Route N2 improvement and upgrade** Environmental Impact Assessment for proposed upgrade of the National Route N2. The project included a public participation process with a range of public and private sector stakeholders as well as specialist studies associated with the river crossings. **National Route N3 Chota Motala Interchange Environmental Audits** Environmental Monitoring for the construction of the Chota Motala Interchange on the National Route N3. N**ational Route R30 Environmental Audits** Environmental Monitoring for the construction of the National Route R30.
Agricultural Projects	**uMngano Community Dairy Development Project** Environmental and Social Impact Assessment for the Development of a 200ha dairy for the uMngano Community in KwaZulu-Natal, South Africa. **uMngano Community Vegetable Project** Environmental and Social Impact Assessment for the Development of a 180ha vegetable growing project for the uMngano Community in KwaZulu-Natal, South Africa. **Sundays River Citrus Project** Environmental and Social Impact Assessment for the Development of a 100ha citrus project in the Sundays River Valley in the Eastern Cape, South Africa.
Water Projects	**Nacala Dam project in Mozambique for the Millennium Challenge Corporation** Environmental and Social Impact Assessment for the Nacala Dam project in Nacala, Mozambique. The study included the management of a range of specialist studies which included; biodiversity (fauna and flora) assessments, health impact assessments, social impact assessments, a hydrocensus, geotechnical investigation and an ecological flow requirement assessment. The project was conducted under the auspices

	of the Millennium Challenge Corporation. **Mpofana Bulk Water Supply Scheme Environmental Impact Assessment for the Bulk Water Supply Scheme** which included an extensive public facilitation process with affected landowners and other specialist studies. **KwaHlokohloko Rural Water Supply Scheme Environmental Impact Assessment for the Rural Water Supply** Scheme which included an extensive public facilitation process with the rural landowners and tribal leaders. **Conservation Management Plans** **Ndumo Game Reserve Management Plan** Compilation of the Management Plan for the KwaZulu-Natal Wildlife Ndumo Game Reserve in northern KwaZulu-Natal. The compilation was conducted in accordance to the National Environmental Management: Protected Areas Act (No 57 of 2003).
Mining Projects	Uithoek Colliery for Miranda Mineral Holdings Environmental Impact Assessment for the establishment of the Uithoek Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Burnside Colliery for Miranda Mineral Holdings** Environmental Impact Assessment for the establishment of the Burnside Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Ultimate Goal Colliery for Corobrik (Pty) Ltd** Environmental Impact Assessment for the establishment of the Ultimate Goal Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Klipwaal Gold Mine for Miranda Mineral Holdings** Environmental Due Diligence assessment on the Klipwaal Gold Mine which included an assessment of completed and required rehabilitation, a contaminated land liability assessment and an evaluation of the structure and the possible impact of the slurry dams. **Afrimat Quarries Compliance Audits** Compliance audits and Due Diligence assessments of the Afrimat Quarry operations in South Africa. These audits are conducted on a two yearly basis. **Private and Public Sector Development Projects** Provincial Legislature Precinct Environmental and Social Impact Assessment for the proposed Provincial Legislature Precinct. This study consisted of a large public facilitation component and extensive engagement with private and public sector stakeholders.

	Camps Drift Canal Mixed Use Development Environmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process within the city of Durban, KwaZulu-Natal during the process. **Tiger Lodge Development** Environmental Impact Assessment for the proposed Tiger Lodge Tourism Development. **Paradise Lodge Development** Environmental Impact Assessment for the proposed Paradise Lodge Tourism Development.

DECLARATION

I, Magnus Van Rooyen hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.

Signature: **Date: 27/02/2021**

Zinhle Sithole

HYDROLOGIST

CORE SKILLS

- Hydrologic and hydraulic modelling
- Flood risk management
- Mine water management
- Land development
- Environmental assessment
- Report Writing
- Onsite data measurement
- Project management and client liaison

DETAILS

Qualifications
MSc Civil Engineering, Ongoing

Advance Diploma in Financial Markets, 2021

G.D.E Civil Engineering, 2020

BSc (Hons) Hydrology, 2011

BSc Water Resources Management, 2009

Membership
Water Institute South Africa (WISA) No:26195

South African Council of Natural Scientific Professions (SACNASP) No: 123215

Languages
English – Fluent
IsiZulu - Fluent
SeSotho – Basic

Countries Worked In

South Africa

PROFILE

Zinhle Sithole has 7 years of experience in the field of hydrology. Her experience includes baseline monitoring, water quality and catchment analysis, flood and flow determination, stormwater management plans and water balances. She has worked on projects ranging from water management planning and flow monitoring investigations, flood assessments and demand analysis.

Professional Affiliations:
SACNASP Candidate Natural Scientist (123215)

Areas of Expertise:
Development of Water Conservation (WC)/Water Demand Management (WDM) plans for the mining sector;
Development of storm water management plans for urban, mine and industrial complexes;
Development of integrated water resource management plans for catchments;
Flow and flood line determinations;
Water balances on pollution control dams, mines and pans;
Environmental impact assessments
Hydrological, water quality and water resource systems analysis;
Basic Assessments;
Environmental Management Plans;
Environmental Scoping Reports;
Surface water monitoring programmes for flow and water quality;
Mine water management;
Technical report writing;
Project management

Work Experience

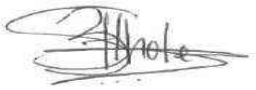
Period	Employer	Position	Role/ Responsibility
2013-2014	Ikwezi Mining	Control Environmental Officer	Facilitate and coordinate environmental planning/management on the mine.
2014-2020	Golder	Hydrologist	Data analysis and water calculations
Current	GCS (Pty)Ltd	Hydrologist	Data analysis and water calculations

Year	Client	Project Description	Role/Responsibility
2020	Richards Bay Coal Terminal Proprietary Limited	Site wide dynamic water balance	Development of Basis of design, setting up of Goldsim model.
2020	Anglo American Thermal Coal (AATC) Zibulo Colliery	Update of the Surface Water Flood Risk Management Plan and Stormwater management Plan	Update the SWMP for Zibulo Colliery to ensure compliance with Regulation 704 of the National Water Act (1999), meet the Department of Water and Sanitation (DWS) Best Practice guidelines as well as the Anglo's Environmental Way guidelines and Group Technical Standards.
2019	Black Rock Mine Operations (BRMO) Assmang Propriety Limited	Development of water conservation water demand management plans	Determine current water use efficiency (WUE) indicators and compile a 5- year WC/WDM plan for the mine.
2019	Exxaro Resources Limited	Stormwater management plan	Determination of a stormwater management plan as part of IWUL application for the proposed Turfvlakte pits.
2019	Anglo Gold Ashanti, Ghana	Obuasi Kokotesusa Spillway sizing	Development of IDF curves and hyetographs, sizing of spillways using runoff models and freeboard recommendations.
2018	Gold Fields Ghana	Rainfall analysis	Development of IDF curves for Tarkwa.
2018	Twinsaver Group (Pty) Ltd	Floodline determination	Revise and update the existing floodline determination for the Klip river and Kok channel.
2018	Dolphin Coast Landfill Management (DCLM) KwaDukuza. Operated by Veolia	Stormwater management plan	Perform a due diligence of the current storm water management plan and pollutant load analysis.
2018	Hiilside Aluminium (Pty)Ltd	Surface water impact assessment and floodline assessment	Describe site baseline assessment, determine a site wide water management plan covering all areas of the smelter and assess compliance with regards to regulations GN704
2018	Newmont, Ghana	Akyem and Ahafo watershed strategies	Development of regional water management strategies and site water management plans for Akyem and Ahafo
2017	Tres-Jolie Agricultural Holding	Floodline Determination	1:100-year floodline analysis for the Nicolas Plant@ Holding 7 Tres-Jolie Agricultural holding
2017	Department of Water and Sanitation	Development of an integrated water quality management plan for the Oliphants River system	Water resources monitoring, data analysis, waste-load allocation, salinity balances
2016	Eurasian Resources Group (ERG) Africa	Revision and Update of the Frontier Environmental Impact	Review of the existing flow and water quality sampling programme, characterise the flow and water quality profiles

		Study (EIS) to International Standards	
2015-2017	Exxaro Coal Mpumalanga (Pty)Ltd	Belfast Implementation Project: Surface water and Groundwater	To assess, on a monthly basis, the quality of the surface and groundwater resources in and around the Belfast study area in accordance with the mine's approved IWUL, identify potential impacts of the mining operations on the receiving water resources and provide suitable mitigation measures for adaptive management.

DECLARATION

I, _Zinhle Sithole____ hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.



Signature:_ Date: 13/09/2021

APPENDIX E: SPECIALIST DECLARATION

I, Magnus van Rooyen, declare that:

- I act as an independent specialist;
- Results will be interpreted in an objective manner, even if the viewpoints are not favourable to the applicant;
- I have the relevant expertise to conduct a report of this nature, including knowledge of the National Environmental Management Act (Act 107 of 1998) and the National Water Act (Act 36 of 1998);
- I will comply with the act(s) and other relevant legislation; and
- I understand that any false information published in this document is an offense in terms of regulation 71 and is punishable in terms of Section 24 (f) of the Act.

_____
Magnus van Rooyen
Environmental Specialist (Pr.Sci.Nat. 400355/11)

I, Jennifer Meneghelli, declare that:

- I act as an independent specialist;
- Results will be interpreted in an objective manner, even if the viewpoints are not favourable to the applicant;
- I have the relevant expertise to conduct a report of this nature, including knowledge of the National Environmental Management Act (Act 107 of 1998) and the National Water Act (Act 36 of 1998);
- I will comply with the act(s) and other relevant legislation; and
- I understand that any false information published in this document is an offense in terms of regulation 71 and is punishable in terms of Section 24 (f) of the Act.

_____
Jennifer Meneghelli
Water Resources Engineer (Pr.Eng. 2018332)

GCS Newcastle Office
1 Karbochem Rd, Newcastle, 2940
Cell: +27 (0) 71 102 3819 **Fax:** +27 (0) 31 764 7140 **Web:** www.gcs-sa.biz

Desktop Geohydrological Screening for the Fuleni Prospecting Right Application

Report

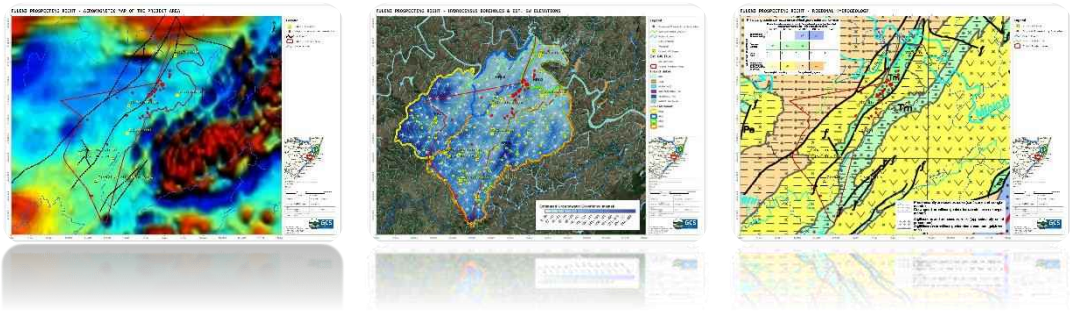
Version – Final 1

12 April 2022

Imvukuzane Resources (Pty) Ltd

GCS Project Number: 22-0082

Client Reference: Fuleni Desk GW



DESKTOP GEOHYDROLOGICAL SCREENING FOR THE FULENI PROSPECTING RIGHT APPLICATION

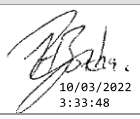
Report
Version – Final 1

12 April 2022

Imvukuzane Resources (Pty) Ltd

22-0082

DOCUMENT ISSUE STATUS

Report Issue	Final 1		
GCS Reference Number	GCS Ref - 22-0082		
Client Reference	Fuleni Desk GW		
Title	Desktop Geohydrological Screening for the Fuleni Prospecting Right Application		
	Name	**Signature**	**Date**
Author (Principal Hydrogeologist / Modeller)	Hendrik Botha (MSc, PriSciNat)	 10/03/2022 3:33:48	12 April 2022

LEGAL NOTICE

DECLARATION OF INDEPENDENCE

GCS (Pty) Ltd was appointed to conduct this specialist groundwater study and to act as the independent hydrological specialist. GCS objectively performed the work, even if this results in views and findings that are not favourable. GCS has the expertise in conducting the specialist investigation and does not have a conflict of interest in the undertaking of this study. This report presents the findings of the investigations which include the activities set out in the scope of work.

CONTENTS PAGE

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

GCS Water and Environment (Pty) Ltd (GCS) was appointed by Imvukuzane Resources (Pty) Ltd to undertake a desktop geohydrological assessment for the proposed Fuleni Mine, stretching from Emakwezini Dondotha to Novunula, south-west of the Umfolozi River, in the KwaZulu-Natal Province (refer to Figure 1-1). The project falls within quaternary catchment W23A (90% of the total prospecting right area) and W21L (10%) of the Mtamvuna Water Management Area (WMA) (DWS, 2016).

1.1 Project background

Imvukuzane Resources (Pty) Ltd proposes to undertake prospecting activities in the Fuleni area. As such, they intend to apply for prospecting right (reference KZN 30/5/1/3/2/0311PR) for an area of approximately 14 720 Ha. The prospecting right area stretches from Emakwezini Dondotha to Novunula and includes villages like Ocilwane, Nthuthunga, Ezidonini, Ngwemnyama and ZSM Industrial. Imvukuzane Resources (Pty) Ltd proposes to drill no more than 54 boreholes within the prospecting right area, to establish the coal resource quantities likely to be found in the area.

This desktop-level geohydrological assessment was requested to evaluate the geohydrological occurrences in the general area, for the prospecting right application.

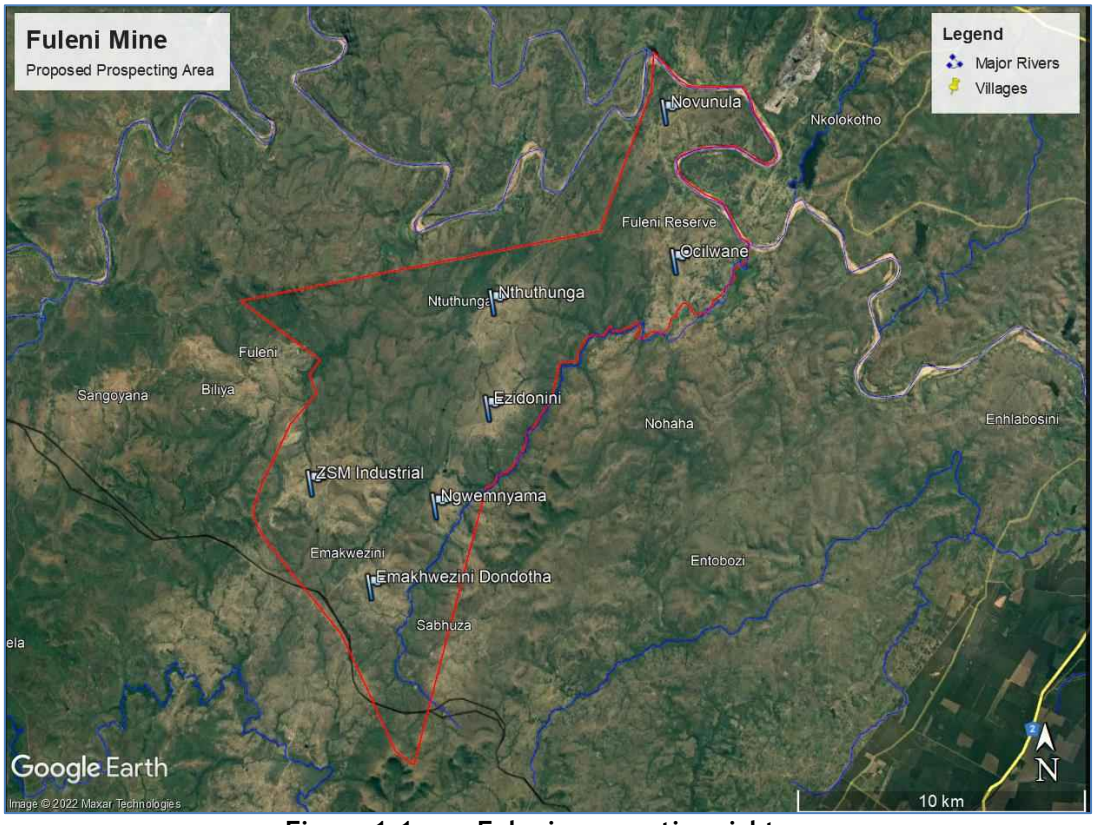


Figure 1-1: Fuleni prospecting right area

1.2 Study relevance to the season in which it was undertaken

This study was undertaken as a once-off study and relies on historical hydrological and climate data for the site; as well as recognized hydrological, geohydrological and water resource databases for South Africa. Data generated during the time of this study is not seasonally bound as average yearly data was applied where required and as scientifically acceptable.

1.3 Objectives of this geohydrological study

The geohydrological study aimed to achieve the following objectives:

- Characterize the geohydrological setting, to set a basis for evaluating potential impacts relating to the existing and proposed activities.
- Produce a desktop level geohydrological report which can be used for decision-making purposes and input for the prospecting right.

1.4 The layout of this report

The report has been structured, as far as possible, as per *Annexure D of the Government Gazette (GN267 of 24 March 2017)* applicable to geohydrological studies for environmental impacts assessment/water use license applications.

1.5 Gaps and study limitations

The following gaps and study limitations are recognized:

- No intrusive fieldwork (drilling, geophysics, etc.) was undertaken as part of this study, to supplement the desktop gathered geohydrological data or to confirm/dispute the desktop findings.
- As the study is conducted for the prospecting activities only, no geohydrological risk assessment could be undertaken.
- No numerical groundwater flow and transport model was construed for the prospecting activities.

2 SCOPE OF WORK

The scope of work included:

1. Desktop Assessment:
    a. All available reports relating to the site were assessed, including a review of all geohydrology, publicly available geophysical information, hydrology, hydrochemistry, and geology literature data.

b. A desktop-level hydrocensus was conducted. National Groundwater Archive (NGA, 2019), SADAC GIP boreholes (SADAC GIP, 2022) and the Groundwater Resource Information Project (GRIP, 2016) databases were assessed to identify existing groundwater users in the area.

c. A desktop-level reserve determination was conducted, to establish the groundwater reserve for the sub-catchments associated with the proposed prospecting right area (on a preliminary level).

2. Hydrogeological and Geological Conceptual model:

   a. A hydrogeological and geological site conceptual model was developed with data obtained for the study area.

3. Preliminary risk assessment:

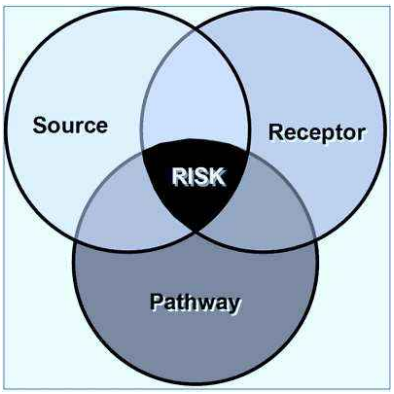
   a. The likely impact on the hydrogeological environment for the drilling of the 55 prospecting boreholes was evaluated, on a preliminary level.

4. Reporting:

   a. This hydrogeological report encompassing desktop findings was compiled.

3 METHODOLOGY

A logical and holistic approach was adopted to assess the study area. The Best Practice Guidelines for Impact Prediction (G4) (Department of Water Affairs and Forestry [DWAF], 2008), was considered to define and understand the three basic components of the hydrogeological risk associated with the site activities:



- **Source term** - The source of the risk.
- **Pathway** - The pathway along which the risk propagates; and
- **Receptor** - The target that experiences the risk.

The approach was used to assess:

1. How the existing/proposed site activities could impact groundwater *Quality*; and
2. How the existing/proposed site activities could affect the groundwater *Quantity*.

3.1 Literature & desktop information sources

The following sources supply an overview of the hydrogeological conditions of the project area, as per the desktop information reviewed for this assessment:

- Groundwater Resource Information Project (GRIP, 2016)), Groundwater information portal boreholes (SADAC GIP, 2022) and National Groundwater Database Archives (NGA, 2019) borehole data.
- 2730 Vryheid – 1:500 000 Hydrogeological map series (King, et al., 1998).
- 2732 St. Lucia – 1:250 000 Geological map series (CGS, 2011)
- 2830 Dundee – 1:250 000 Geological map series (DMEA, 1998a)
- Literature on similar geology and hydrogeology:
    - A South African Aquifer System Management Classification (Parsons, 1995);
    - Aquifer Classification of South Africa (DWA, 2012);
    - Karoo Aquifers: Their Geology, Geometry and Physical Properties. Water Research Council (WRC) Report No: 457/1/98 (Botha, et al., 1998);
    - Karoo Groundwater Atlas Volume 2 (Woodford, 2013);
    - The relationship between South African geology and geohydrology (Lourens, 2013).

3.2 Hydrological overview

Hydrometeorological data for the study area were obtained from various sources including the South African Water Resources Study WR2012 database (Bailey & Pitman, 2015), South African Atlas of Agrohydrology, and Climatology (Schulze, 1997), and the Daily Rainfall Data Extraction Utility (Lynch, 2004). Moreover, sources such as the Köppen Climate Classification (Kottek, et al., 2006), World Climate Data CMIP6 V2.1 (Eyring, 2016), and Meteoblue (Meteoblue, 2022) were used to refine hydrological data.

These sources provided means of determining the Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR), and Mean Annual Evaporation (MAE) of the study site as well as the design rainfall data. Data was applied to the site water balance calculations, runoff peak flow estimates for flood line modelling and stormwater runoff peak flow estimates for stormwater system sizing (where applicable to this study).

3.2.1 Catchment description and delineation

A 30 m Digital Terrain Model (DTM) data from the Advanced Land Observing Satellite (ALOS) (JAXA, 2022) were used to delineate the area draining to the streams relevant to this study, sub-catchment flow path as well as to derive river geometry characteristics. These characteristics (area, slopes, and hydraulic parameters) are used to parameterize the site hydraulic model for flood line modelling, water balance modelling or stormwater modelling.

2019 South African (SA) National Land Cover data (DEA, 2019) was used to characterize the sub-catchment vegetation and derive manning surface roughness (n-values) coefficients.

3.3 Hydrochemistry

Hydrochemistry data for the study area was derived from available geohydrological map sets as well as desktop identified boreholes that fall in the project area.

3.4 Groundwater reserve determination

Intermediate groundwater Reserve Determination (IGRD) was conducted for the study area to establish the groundwater reserve. The IGRD aims to quantify the likely impact of the site on the groundwater reserve.

It is necessary, from a groundwater point of view, to quantify the groundwater reserve in terms of potential impacts associated with the development (i.e., areas that may become impermeable or increased runoff will reduce groundwater recharge).

The IGRD considers the following parameters:

- Effective recharge from rainfall and specific geological conditions.
- Basic human needs for the sub-catchment.
- GW contribution to surface water (baseflow).
- Existing and proposed abstraction; and
- Surplus reserve.

The data used for the calculation was derived from the WRC 90 Water Resources of South Africa 2012 Study (WR2012) and GW Resource Assessment Ver. 2 (GRAII) datasets.

4 GEOGRAPHICAL SETTING

As stated previously, the project falls within quaternary catchment W23A (90% of the total prospecting right area) and W21L (10%) of the Mtamvuna Water Management Area (WMA) (DWS, 2016) – refer to Figure 4-6.

The prospecting right area stretches from Emakhwezini, Dondotha to Novunula and includes villages like Ocilwane, Nthuthunga, Ezidonini, Ngwemnyama and ZSM Industrial. The proposed Fuleni mine would be situated near the existing Somkhele Anthracite mine, which is situated on the north-eastern side of the Umfolozi River. The study area is characterized by gentle to steep slopes, with prominent topographical depressions along the drainage lines in the area. Elevations typically range from 50 to 250 meters above mean sea level (mamsl).

Four (4) hydrological response units (HRU) (1:50 000 stream count, 30mDTM fill) were delineated for the project area – refer to Figure 4-6. HRU1 and HRU2 describe drainage within the greater quaternary catchment W21L (approximately 10% of the protesting right area), and HRU3 and HRU4 describe the drainage of the majority (90%) of the proposed prospecting right area.

Drainage is in the form of several non-perennial (ephemeral) streams that drain to perennial streams and larger rivers such as the Mgati, Mgwenyama, and Mfuyeni rivers (situated in HRU1 and HRU2); and the Sabhuze, Mvamanzi and Ntutunga rivers (HRU4). The end receiver of surface water drainage is the White Umfolozi reach (in HRU2) and Umfolozi Rivers (in HRU3).

4.1 Land cover

Dense woodland forest, low forest, natural grassland, cultivated and bare land types dominate the sub-catchments (DEA, 2019) – refer to Table 4-1 and Figure 4-7.

Table 4-1: Summary of sub-catchments characteristics

Sub-Catchment		HRU1	HRU2	HRU3	HRU4
Area (km²)		72.180	36.741	21.511	168.94
Longest Drainage Line (km)		8.10	17.43	14.68	16.33
Average Slope (%)		0.53%	0.13%	0.06	0.29%
Land Cover	Thick bush & plantation	62%	25%	0%	13%
	Light bush & farmlands	40%	45%	2%	13%
	Grasslands	53%	30%	3%	14%
	No Vegetation	51%	31%	1%	17%

4.2 Climate

Climate, amongst other factors, influences soil-water processes, runoff, peak flows and groundwater recharge. The most influential climatic parameter is rainfall. Rainfall intensity, duration, evaporative demand, and runoff were considered in this study to indicate rainfall partitioning within the project area.

4.2.1 Temperature

The average yearly temperature (refer to Figure 4-1) for the project area ranges from 25 to 39 C (high) and 5 to 19 °C (Low). The study area is situated in a sub-tropical climate area, as per the Köppen Climate Classification (Kottek, et al., 2006). Hence, the area received summer rainfall.

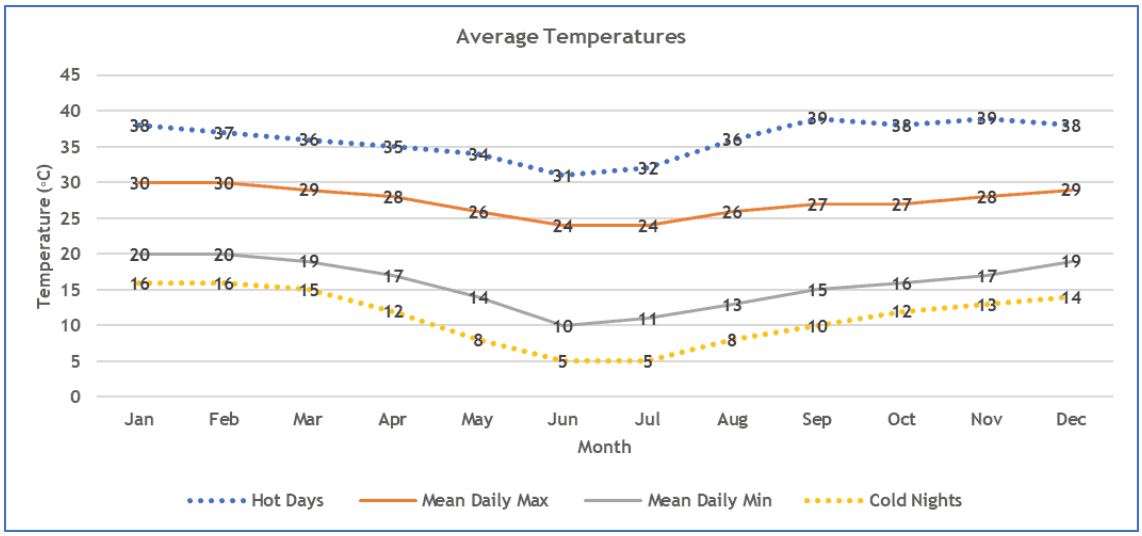


Figure 4-1: Average yearly temperatures (Meteoblue, 2022)

4.2.2 Wind speed and direction

Figure 4-2 shows the wind rose for the project area (Ezidonini used as reference) and presents the number of hours per year the wind blows from the indicated direction. Wind generally blows from N, NNE and S at velocities >19 km/h, with less frequent and lower wind velocity from other directions. Precipitation intensity during wind will likely cause intensity changes on slopes perpendicular to the wind direction, throughout the year.

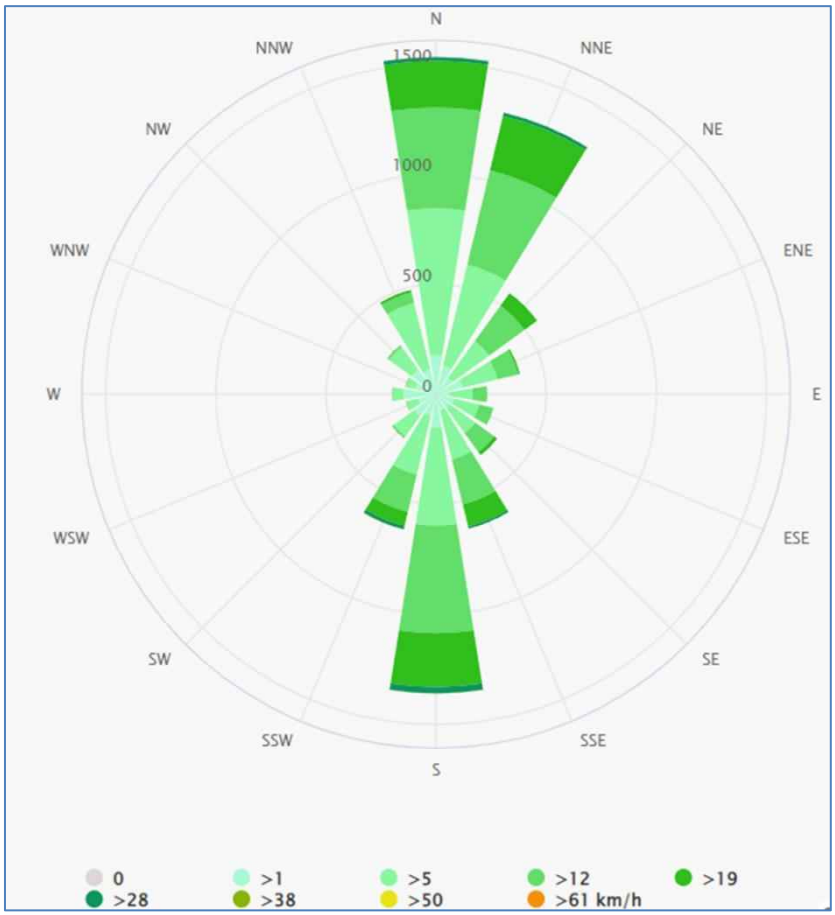


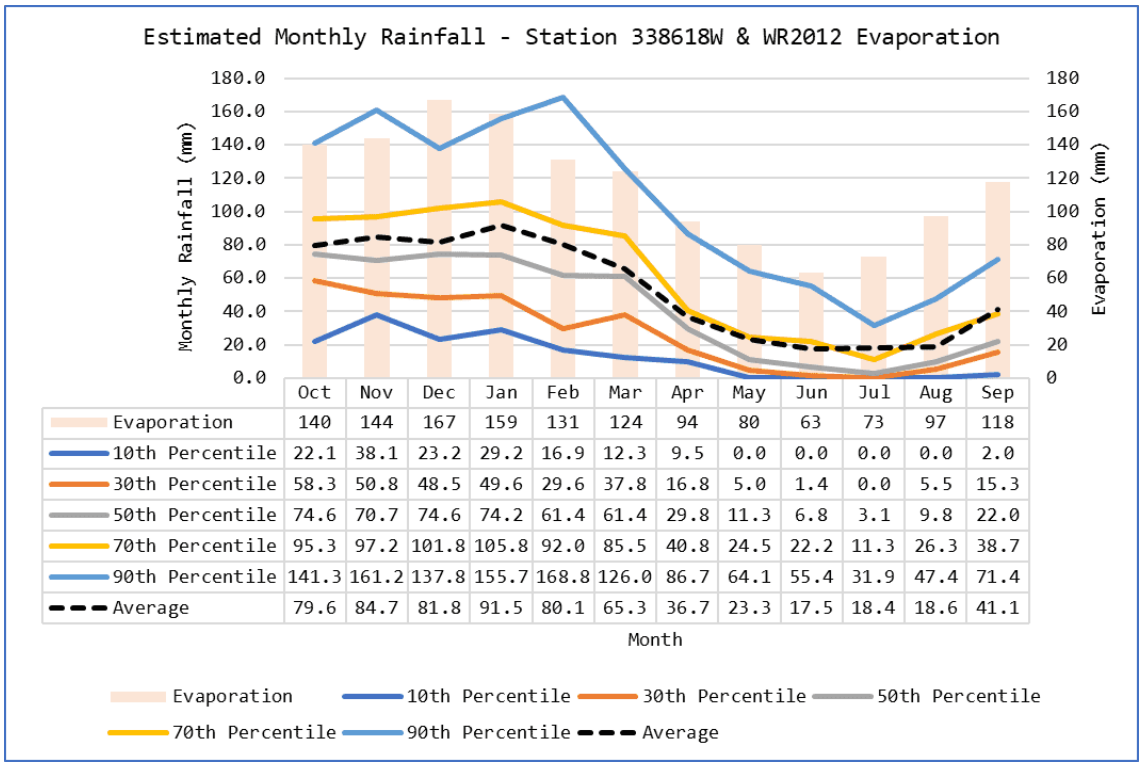
Figure 4-2: Wind rose (Meteoblue, 2022)

4.2.3 Rainfall and evaporation

The project area is situated in rainfall zone W2C and W2F. The monthly rainfall data used to calculate Mean Annual Precipitation (MAP) was obtained from WR2012 rainfall station 0338618 W (situated 11km north). The rainfall record is for the period 1958 to 2009 (51 years). Monthly rainfall for the site is likely to be distributed as shown in Figure 4-3, below.

Available rainfall data suggest a MAP ranging from 318.5 (30th percentile) to 1247 (90th percentile) mm/yr. The average rainfall is in the order of 638 mm/yr.

The project area falls within evaporation zone 22B and 22C, of which Mean Annual Evaporation (MAE) ranges from 1 300 to 1 400 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Monthly evapotranspiration for the site is likely to be distributed as shown in Figure 4-3, below.



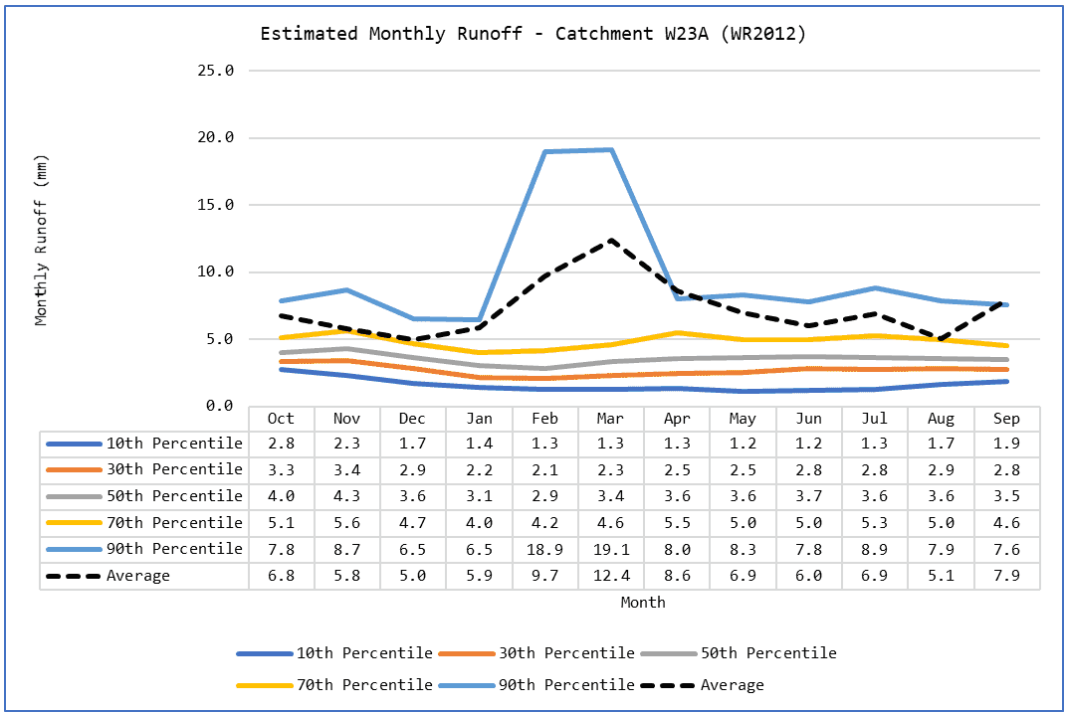
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation	140	144	167	159	131	124	94	80	63	73	97	118
10th Percentile	22.1	38.1	23.2	29.2	16.9	12.3	9.5	0.0	0.0	0.0	0.0	2.0
30th Percentile	58.3	50.8	48.5	49.6	29.6	37.8	16.8	5.0	1.4	0.0	5.5	15.3
50th Percentile	74.6	70.7	74.6	74.2	61.4	61.4	29.8	11.3	6.8	3.1	9.8	22.0
70th Percentile	95.3	97.2	101.8	105.8	92.0	85.5	40.8	24.5	22.2	11.3	26.3	38.7
90th Percentile	141.3	161.2	137.8	155.7	168.8	126.0	86.7	64.1	55.4	31.9	47.4	71.4
Average	79.6	84.7	81.8	91.5	80.1	65.3	36.7	23.3	17.5	18.4	18.6	41.1

Figure 4-3: Average rainfall for Station 0338618W & WR2012 evaporation

4.2.4 Runoff

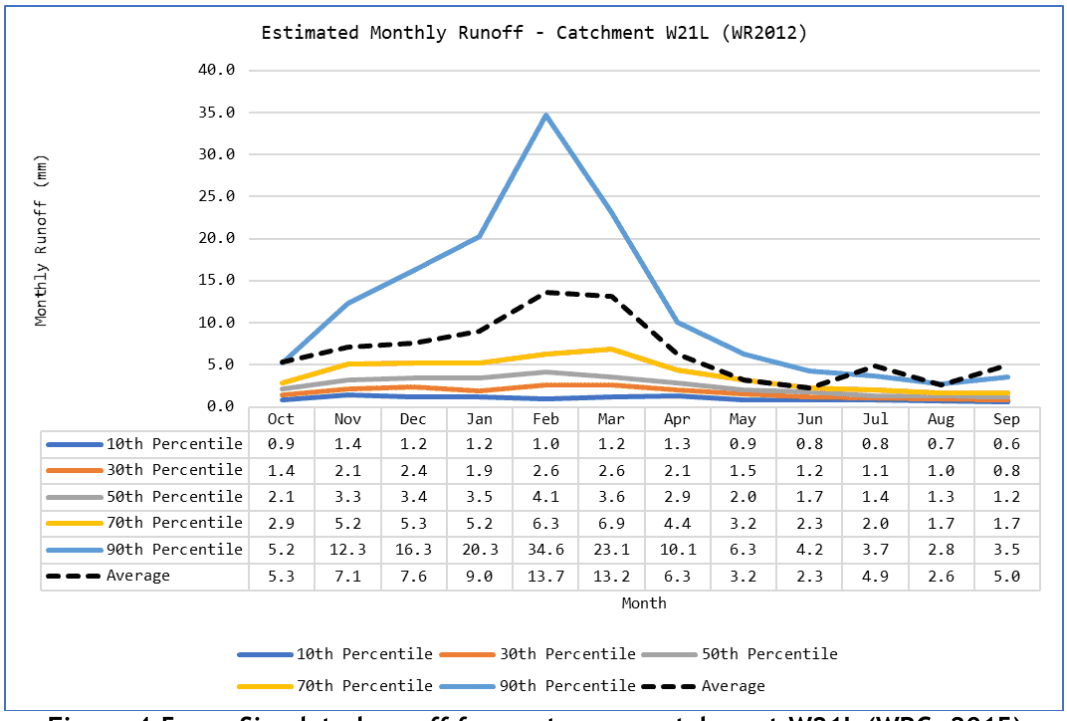
Runoff from natural (unmodified) catchments in Catchment U30E is simulated in WR2012 (WRC, 2015) as being equivalent to:

- W23A: This is equal to approximately 14% of the MAP.
  - The natural mean annual runoff (NMAR) is calculated to be in the order of 35 988 888.89 m^3/year (35.98 Mm^3/yr).
  - Monthly runoff is distributed as shown in Figure 4-4.
- W21L: This is equal to approximately 13% of the MAP.
  - The natural mean annual runoff (NMAR) is calculated to be in the order of 42 695 000 m^3/year (42.69 Mm^3/yr).
  - Monthly runoff is distributed as shown in Figure 4-5.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	2.8	2.3	1.7	1.4	1.3	1.3	1.3	1.2	1.2	1.3	1.7	1.9
30th Percentile	3.3	3.4	2.9	2.2	2.1	2.3	2.5	2.5	2.8	2.8	2.9	2.8
50th Percentile	4.0	4.3	3.6	3.1	2.9	3.4	3.6	3.6	3.7	3.6	3.6	3.5
70th Percentile	5.1	5.6	4.7	4.0	4.2	4.6	5.5	5.0	5.0	5.3	5.0	4.6
90th Percentile	7.8	8.7	6.5	6.5	18.9	19.1	8.0	8.3	7.8	8.9	7.9	7.6
Average	6.8	5.8	5.0	5.9	9.7	12.4	8.6	6.9	6.0	6.9	5.1	7.9

Figure 4-4: Simulated runoff for quaternary catchment W23A (WRC, 2015)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10th Percentile	0.9	1.4	1.2	1.2	1.0	1.2	1.3	0.9	0.8	0.8	0.7	0.6
30th Percentile	1.4	2.1	2.4	1.9	2.6	2.6	2.1	1.5	1.2	1.1	1.0	0.8
50th Percentile	2.1	3.3	3.4	3.5	4.1	3.6	2.9	2.0	1.7	1.4	1.3	1.2
70th Percentile	2.9	5.2	5.3	5.2	6.3	6.9	4.4	3.2	2.3	2.0	1.7	1.7
90th Percentile	5.2	12.3	16.3	20.3	34.6	23.1	10.1	6.3	4.2	3.7	2.8	3.5
Average	5.3	7.1	7.6	9.0	13.7	13.2	6.3	3.2	2.3	4.9	2.6	5.0

Figure 4-5: Simulated runoff for quaternary catchment W21L (WRC, 2015)

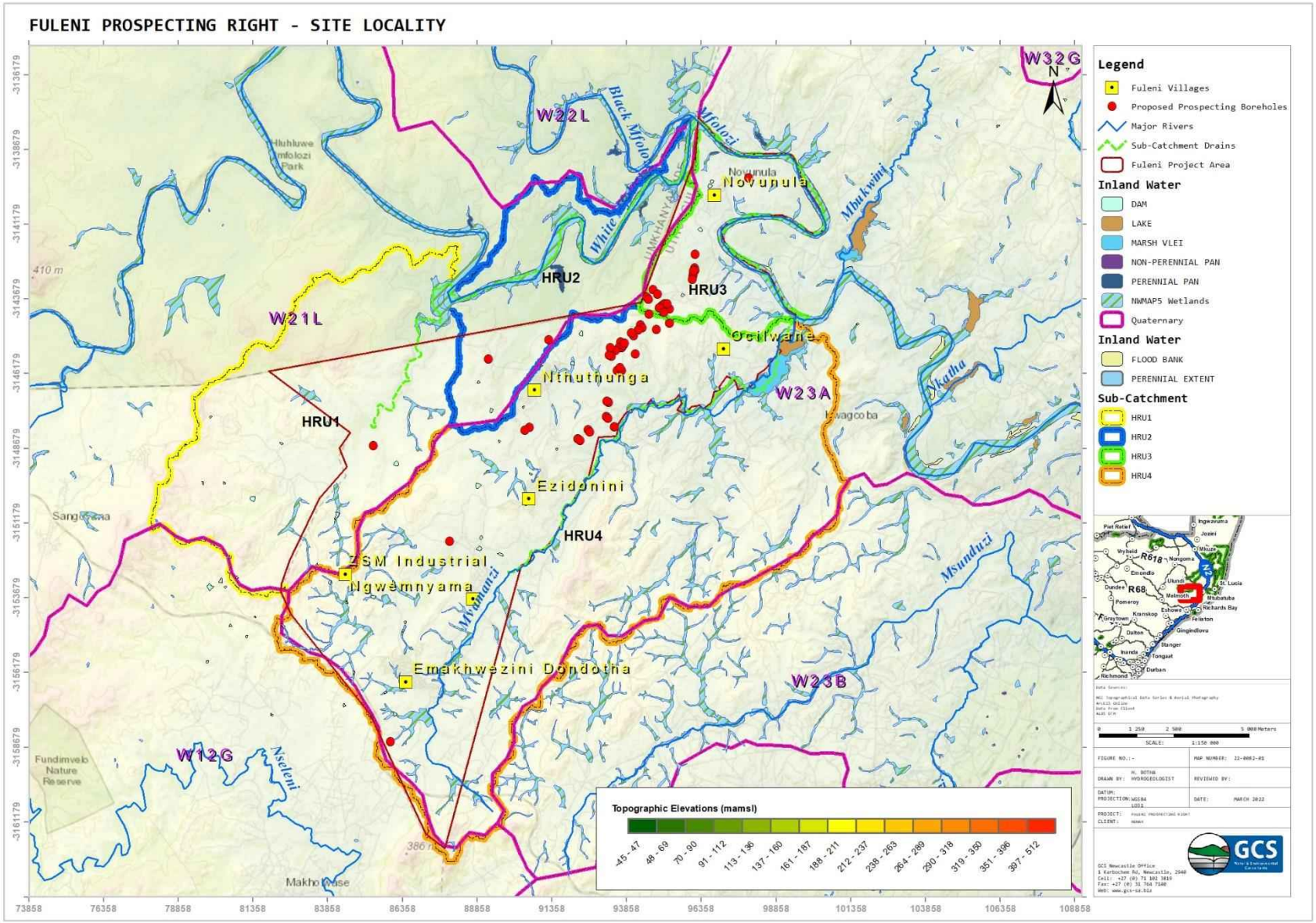


Figure 4-6: Site locality and drainage

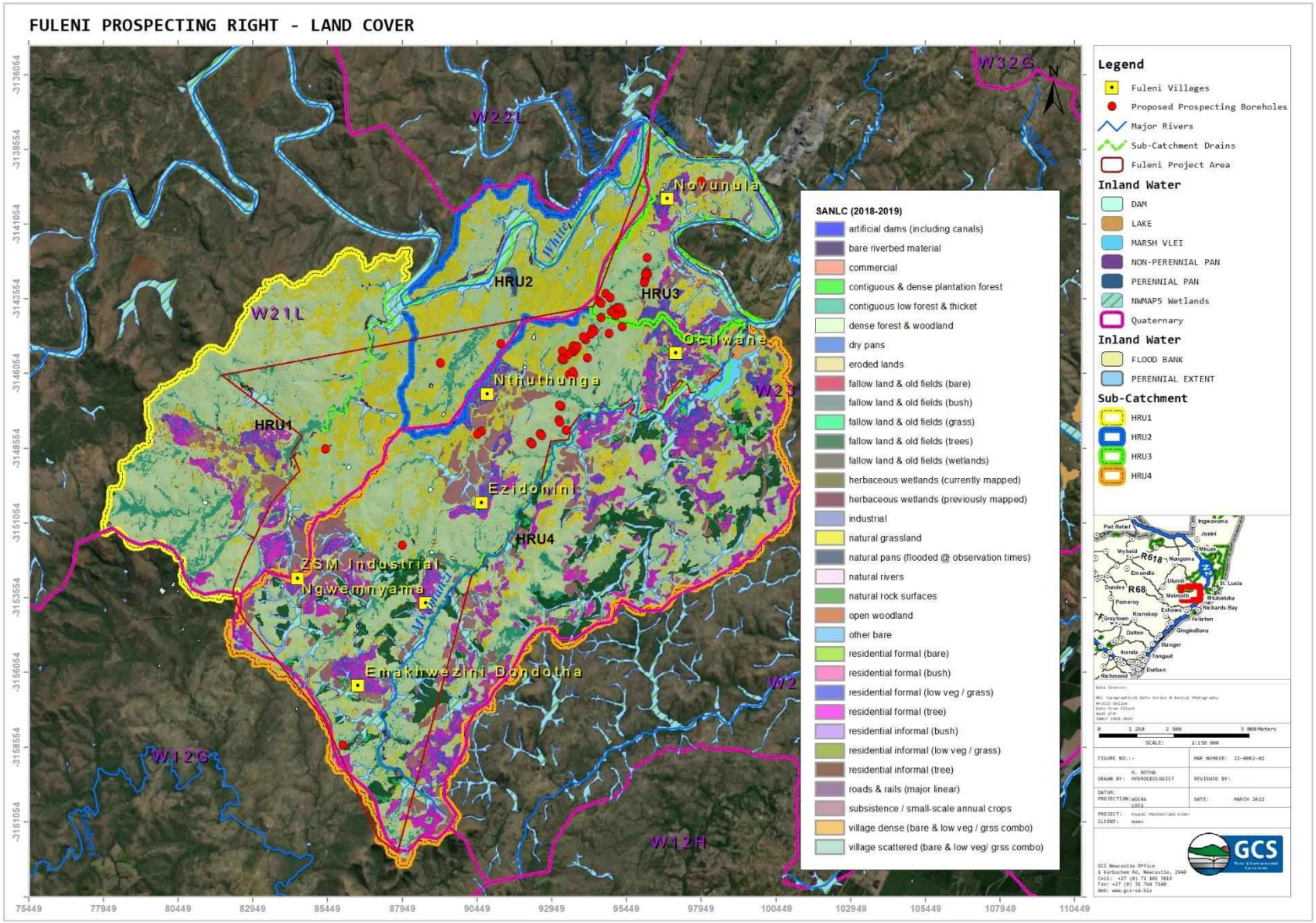


Figure 4-7: Landcover (SANLC, 2019)

5 PREVAILING GROUNDWATER CONDITIONS

The following section supplies an overview of the prevailing geohydrological conditions encountered at the Fuleni prospecting right area. The data were derived from available literature sources.

5.1 Local Geology

The regional geological map (DMEA, 1998) indicates that most of the Fuleni prospecting right is underlain by sediments of the Emakwezeni Formation (lower Beaufort Group) and sediments of the Volksrust Formation of the Karoo Supergroup. Occurrences of younger sedimentary rock of the Ntabene, Clarens, Nyoka and Letaba formations (stull part of the Karoo Supergroup) are also known to occur in the project area. Dolerite sill and dyke structures, fault zones and metamorphic contact zones are known to be associated with the area (refer to Figure 5-1).

The Karoo Supergroup comprises the Dwyka, Ecca, Beaufort and Stormberg Groups. The Ecca Group comprises the Pietermaritzburg, Vryheid and Volksrust Formations, of which the Vryheid and Volksrust Formations hosts most of South Africa's coal deposits. The Vryheid Formation comprises both coarsening-upward deltaic cycles and fining-upward fluvial cycles, with the latter occurring largely in the middle part of the formation. The regressive Vryheid Formation is sandwiched between the mudrocks of the Pietermaritzburg and Volksrust Formations and is the most widespread lithology in the Hluhluwe-iMfolozi Park where it is downthrown against the older Natal- and Dwyka Group rocks (Johnson et al. 1996). This formation has been subdivided into the lower sandstones, coal zone and upper sandstone and comprises medium- to coarse-grained sandstone, grey micaceous shale and coal. These sediments were deposited in meandering to braided stream environments and host the seams of the Natal Coalfield in the Natal Midlands. Around Somkhele however, these coal seams occur as occasional, thin and continuous bands and beds less than a meter in thickness. The Volksrust Formation overlies the Vryheid Formation and consists of a monotonous, occasionally bluish mudstone and shale. The Volksrust Formation immediately underlies the Emakwezini Formation of the Beaufort Group that hosts the coal in the Somkhele Coalfield (Botha and Singh, 2012; Schluter, 2008).

The Emakwezini Formation comprises mainly of grey, greenish-grey and brown mudstones with interbedded coal seams, medium to coarse-grained sandstones and may contain plant fossils and lenses of limestone. The mining of coal within this succession is complicated by the steeply dipping strata and the block faulting which disrupts the continuity of the coal zone. The Emakwezini Formation is conformably overlain by the Late Triassic Molteno Formation, which comprises alternating medium to coarse-grained sandstone with secondary quartz overgrowths and thin grey mudrocks. It is then conformably overlain by the Elliot Formation, which predominantly consists of red and purple mudstone, medium-grained sandstone with calcareous concretions, shale and siltstone. The Late Triassic–Early Jurassic Clarens Formation consists of yellowish-grey, pale orange or pink, very fine-grained aeolian sandstone that represents the final phase of Karoo basin sedimentation (Botha and Singh, 2012).

Table 5-1: Stratigraphy of the study area

	Group	Formation	Rock Type	Thickness
Karoo Supergroup	Stormberg Group	Drakensberg Volcanics	Lava (Amygdaloidal)	+ 2000m
		Clarens Formation	Aeolian Sandstone	< 40m
		Elliot Formation / Nyoka	Mudstone	±250m
		Molteno Formation / Ntabene	Sandstone	±100m
	Beaufort Group	Emakwezini Formation	Sandstone, Siltstone, Mudstone, Coal	500-600m
	Ecca Group	Volksrust Formation	Shale	±140m
		Fryheid Formation	Sandstone, Carbonaceous Shale, Coal, Gritstone	±500m
		Pietermaritzburg Formation	Shale and Sandstone	±200m
	Dwyka Group	Dwyka Formation	Glacial Tillite	±1000m

* Table compiled from various sources.

5.2 Structural geology

The sills and dykes that intrude the Emakwezini Formation and locally affect the coal quality preserve the intricate magma feeder systems to the Drakensberg Volcanic Groups. Later normal faulting associated with rifting on a geocline introduced the moderate easterly dip to the strata and created a succession of fault-bounded blocks in which the coal-bearing strata are repeated. The repetitions create multiple exploration and open-pit mining opportunities.

The aerial magnetic map (refer to Figure 5-2) of the study area suggest several fault NE-SW striking faults traversing the study area, which forms compartments and contact zones between the different rock strata of older and younger Karoo sediments.

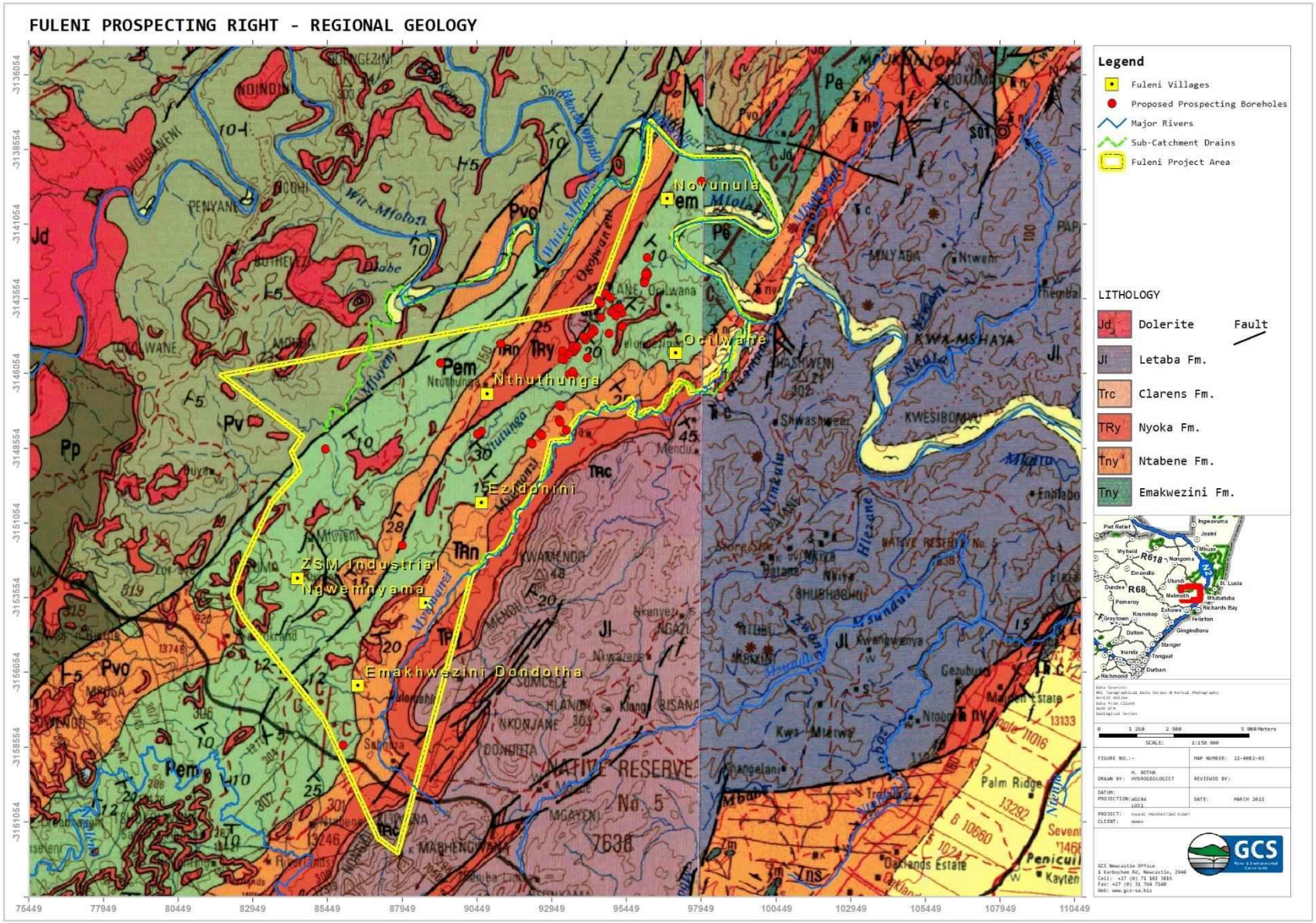


Figure 5-1: Regional geology

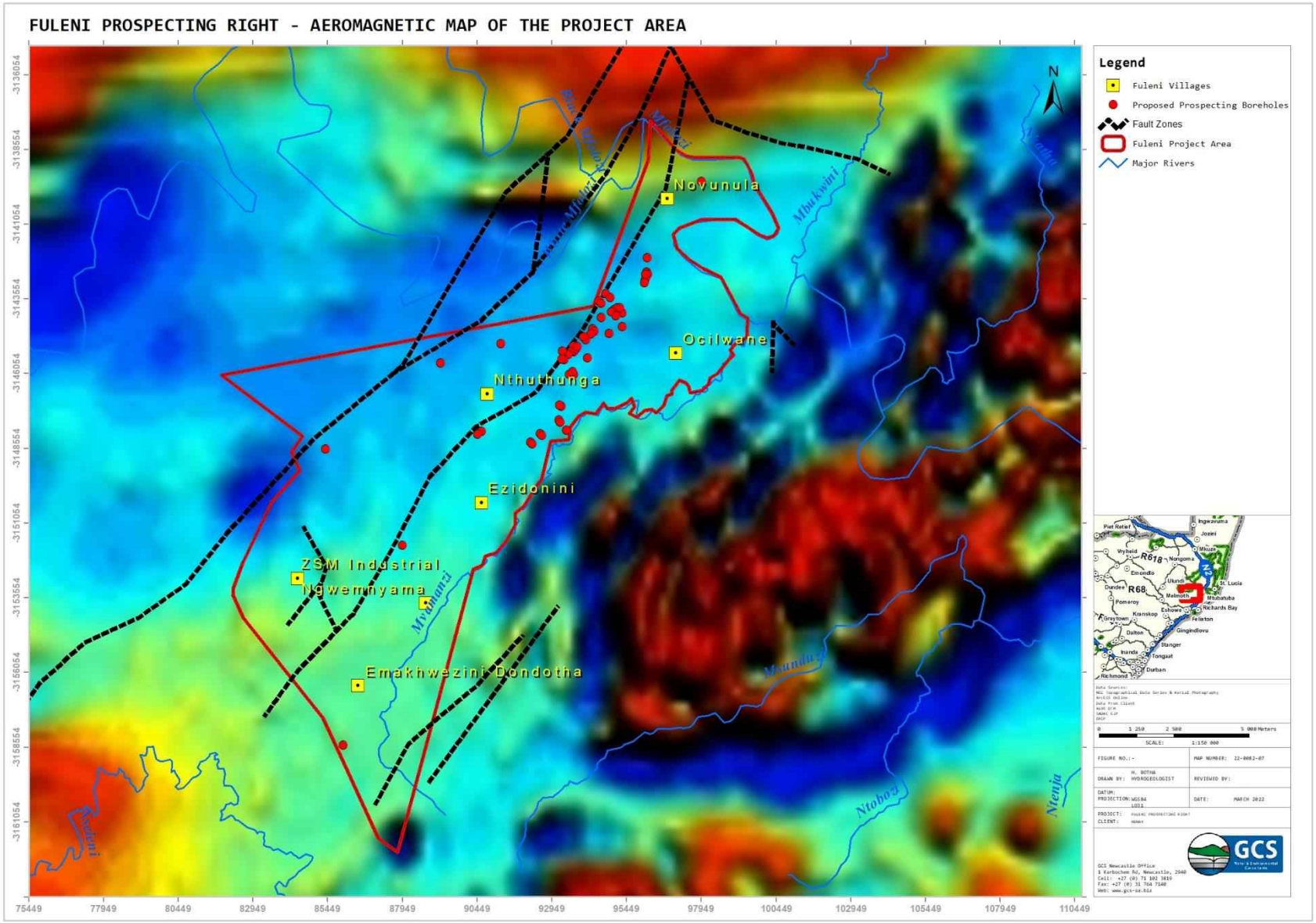


Figure 5-2: Aeromagnetic map of the project area

5.3 Hydrocensus / groundwater users in the area

A desktop-level screening of database boreholes for the proposed prospecting right area revealed at least 141 boreholes within the Fuleni prospecting right area. However, of the 141 boreholes, only 49 (30%) have groundwater level data available. Table 5-2 lists the boreholes identified in the study area (with data), and all desktop identified borehole positions are shown in Figure 5-5.

Table 5-2: Boreholes identified in the study area

ID	Source	Latitude (WGS84) Decimal Degrees	Longitude (WGS84) Decimal Degrees	Elevation (mamsl)	Water Level (mbgl)
2831BD00109	GRIP	-28.436819	31.992558	59.097	19.5
2831BD00111	GRIP	-28.487927	31.989216	162.036	31.6
2831BD00112	GRIP	-28.464595	31.973112	125.867	20
2831BD00113	GRIP	-28.479314	31.990055	152.719	63
2831BDG1974	GRIP	-28.493204	31.907272	119.035	13.51
2831BDG2011	GRIP	-28.483760	31.929773	91.626	46.4
2831BDV0669	GRIP	-28.446383	32.004764	78.082	7.3
2831BDV0704	GRIP	-28.459596	31.998110	124.365	60
2831BDV0730	GRIP	-28.481539	31.934495	91.951	21.3
2831BDV0731	GRIP	-28.464321	31.946717	103.013	15.8
2831BDV0734	GRIP	-28.467928	31.961166	145.042	32
2831BDV0735	GRIP	-28.476815	31.970049	183.617	42
2831BDV0740	GRIP	-28.498757	31.924770	135.252	29.9
2831BDV0744	GRIP	-28.496540	31.904213	118.339	16.1
2831BDV0748	GRIP	-28.455981	31.966438	139.603	63.9
2831BDV0749	GRIP	-28.446263	31.963941	88.997	16.3
2831BDV0750	GRIP	-28.451821	31.980335	125.373	13.8
2831BDV0751	GRIP	-28.486540	31.885603	155.97	39.4
2831BDV0753	GRIP	-28.489869	31.881433	181.993	26
2831BDV0756	GRIP	-28.469595	31.874495	203.626	18.8
2831BDV0758	GRIP	-28.462927	31.930329	166.317	31.2
2831BDV0760	GRIP	-28.429319	31.923666	149.329	36.4
2831BDV0765	GRIP	-28.371270	31.988948	98.954	32.6
2831BDV0766	GRIP	-28.367098	31.989501	75.352	18.4
2831BDV0767	GRIP	-28.432096	31.983114	72.86	13.9
2831BDV0768	GRIP	-28.422651	31.995334	89.021	45.7
2831BDV1630	GRIP	-28.452890	31.970750	94.833	11
2831BDV1632	GRIP	-28.440417	31.968167	87.308	14.06
2831DB00201	GRIP	-28.534034	31.916706	159.237	27
2831DB00314	GRIP	-28.502368	31.956995	168.367	2.37
2831DB00363	GRIP	-28.545979	31.877271	157.998	15.4
2831DB00370	GRIP	-28.508755	31.845604	200.031	14.43
2831DBG1973	GRIP	-28.539312	31.908383	123.678	15
2831DBG1996	GRIP	-28.544034	31.909772	131.579	12
2831DBG1997	GRIP	-28.523757	31.923384	181.472	53.8
2831DBG2023	GRIP	-28.521535	31.912828	171.158	58.7
2831DBV0553	GRIP	-28.508755	31.845605	200.031	14.43
2831DBV0666	GRIP	-28.436819	31.992558	59.088	19.5
2831DBV0686	GRIP	-28.571809	31.898100	291.935	7.7
2831DBV0701	GRIP	-28.516261	31.932553	163.009	48.4
2831DBV0708	GRIP	-28.537650	31.902275	113.012	3
2831DBV0709	GRIP	-28.544016	31.906554	138.983	20.3
2831DBV0710	GRIP	-28.549586	31.907823	150.584	4.82
2831DBV0725	GRIP	-28.511535	31.908385	108.138	11.8
2831DBV0728	GRIP	-28.509871	31.922273	122.625	11.9
2831DBV0729	GRIP	-28.505984	31.916713	116.321	7.2
2831DBV0741	GRIP	-28.515698	31.873384	171.057	18.3
2832ACV0702	GRIP	-28.417927	32.020872	58.543	36
2832ACV0703	GRIP	-28.429593	32.020877	110.671	29.5

5.4 Aquifer Characteristics, Classification, and Groundwater Recharge

The general aquifer characteristics and aquifer classification are summarised in Table 5-3.

Table 5-3: Aquifer characteristics and classification

Characteristics	Aquifer Classification
The aquifer host rock comprises argillaceous and arenaceous rock (shale/mudstone/siltstone/sandstone) of the Volksrust, Emakwezini, Ntabene, Nyoka, Clarens and Letaba Formation. The aquifer has a low to medium hydraulic conductivity (K-value) and porosity (n-value). The aquifer is mainly secondary. The aquifer can be referred to as being primarily intergranular and fractured (King, et al., 1998), with some areas only being classified as fractured aquifer (nearing the successions of the Nyoka and Letaba formations in the Nthuthunga Area. Groundwater is typically encountered in: • Dolerite dyke and sill contacts with host rocks. • Contacts between different lithologies or at unconformities. • Faults and associated fracture zones; and • Contacts between argillaceous and arenaceous units (King, et al., 1998) Recharge to the underlying aquifer is estimated to be in the range of 3.1% to 4% of the MAP (638 mm) which falls within quaternary catchment W21L and W23A (DWAF, 2006). The aquifer's weathered zone is reported to be approx. 14 m thick, with the fractured zone approx. 97 m thick (DWAF, 2006). The combined aquifer thickness is estimated to be in the order of 112 m. The aquifer is an important contributor to groundwater baseflow to streams and rivers (King, et al., 1998) Baseflow is estimated to range from 15.6 mm/yr {PITMAN] to 41.28 mm/yr [Hughes].	Available literature and site observation data suggest that two (2) aquifers exist in the area: 1. A shallower semi-unconfined aquifer system associated with weathered intergranular and fractured sedimentary rock (Volksrust, Emakwezini, Ntabene, Nyoka, Clarens and Letaba Formation); and 2. A deeper confined fractured aquifer network is associated with the older Emakwezini and Ecca sediments (older Karoo basement rock). The aquifer present is classified as a Minor Aquifer system (Parsons, 1995) The aquifers underlying the project area can be regarded as low to moderate-yielding aquifers, with reported yields ranging from 0.1 to 2 l/sec - Class D1 and D3 aquifers, with occurrences of fractured type B3 aquifers. Yields may increase to a range of >5 l/sec for successful boreholes drilled into geological contacts, weathered fractures zones, faults, or intrusive rock contacts (King, et al., 1998).

5.5 Depth to Groundwater

According to (Vegter, 1995), (DWAF, 2006), and the Vryheid Hydrogeological Map the groundwater levels within the region is in the order of 25 mbgl (meters below ground level). Available SADAC GIP and GRIP boreholes for the greater project area suggest a water level range from 2.37 to 63.9 mbgl (refer to Table 5-2).

Figure 5-3 plots available groundwater elevation data for the area. There is a good relationship (R = 87 %), between groundwater and topography elevation which suggests that the regional groundwater table mimics the topography. The data suggest that groundwater levels are shallower close to non-perennial and perennial streams (and wetland units) where groundwater contributes to streamflow as baseflow seepage. These areas are typically prominent groundwater-surface water interaction areas.

Bayesian interpolation of available groundwater level data was applied to the area to conceptualize the groundwater flow. Figure 5-5 indicates the generated Bayesian interpolated groundwater elevations for the area. The data suggest that the general groundwater movement is from SW to NE for the project area.

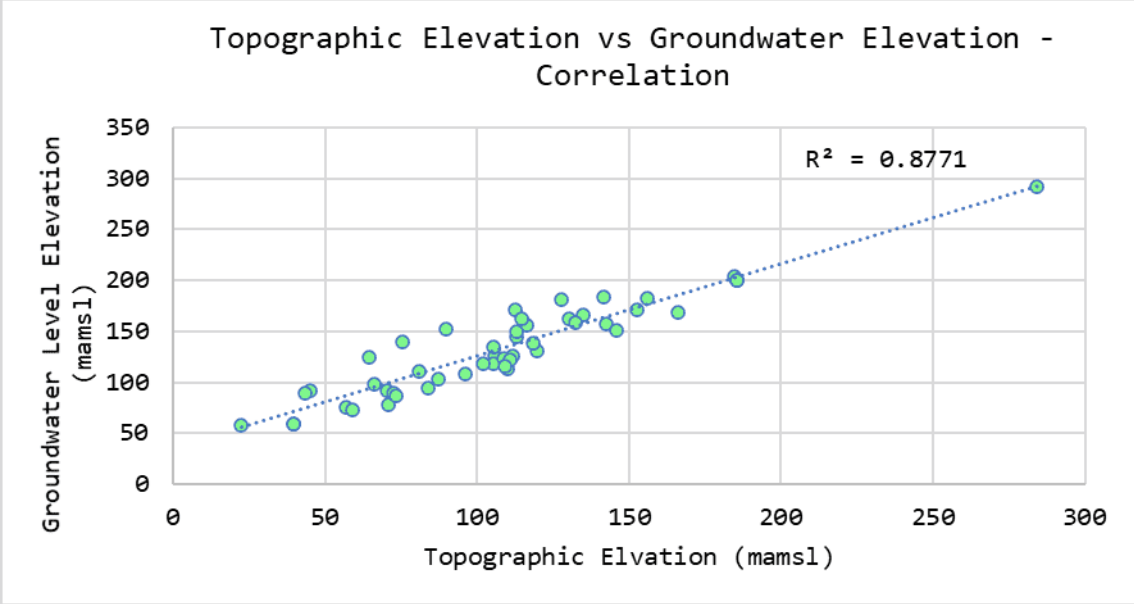


Figure 5-3: Groundwater elevation vs topography elevation correlation

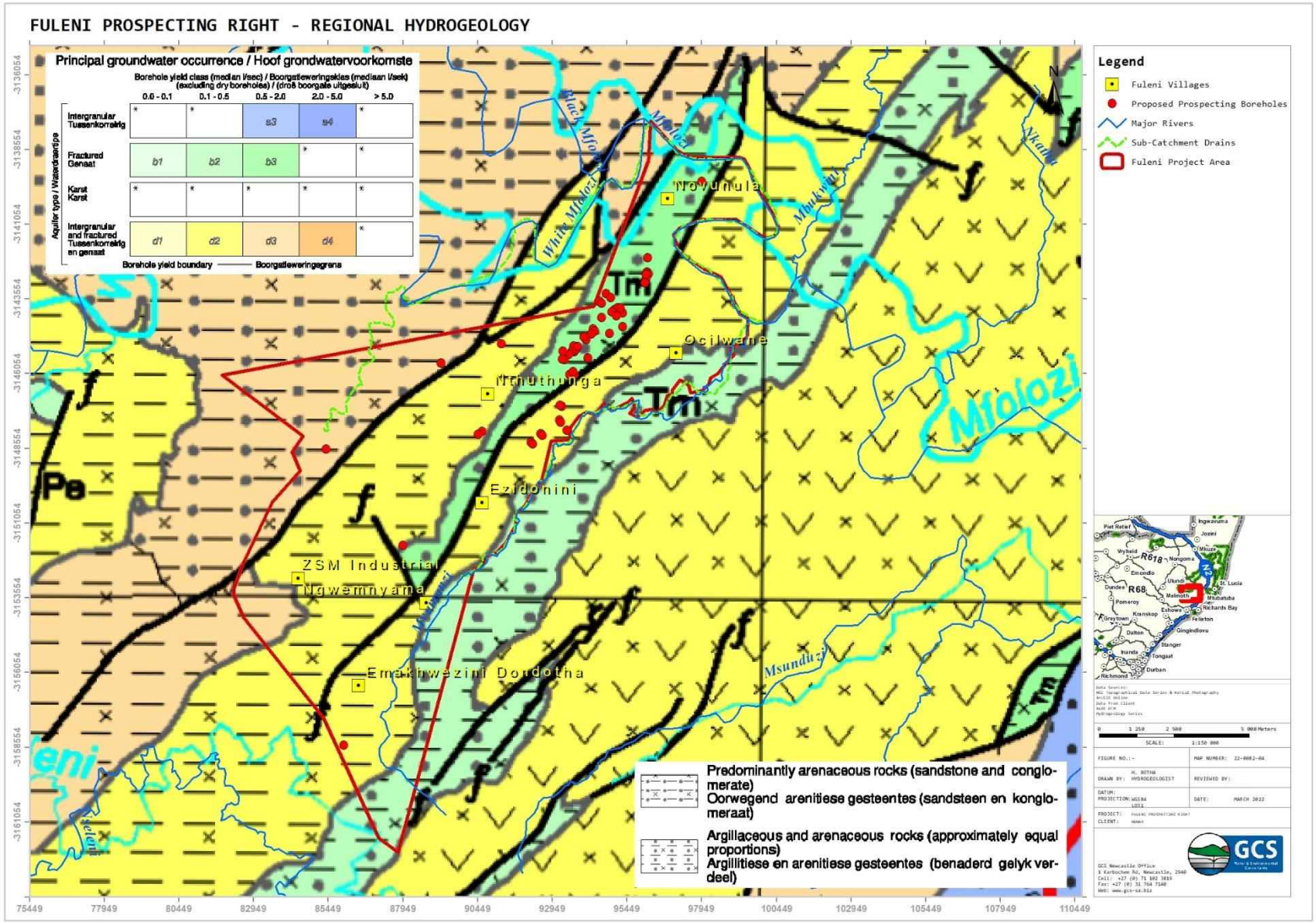


Figure 5-4: Regional hydrogeology

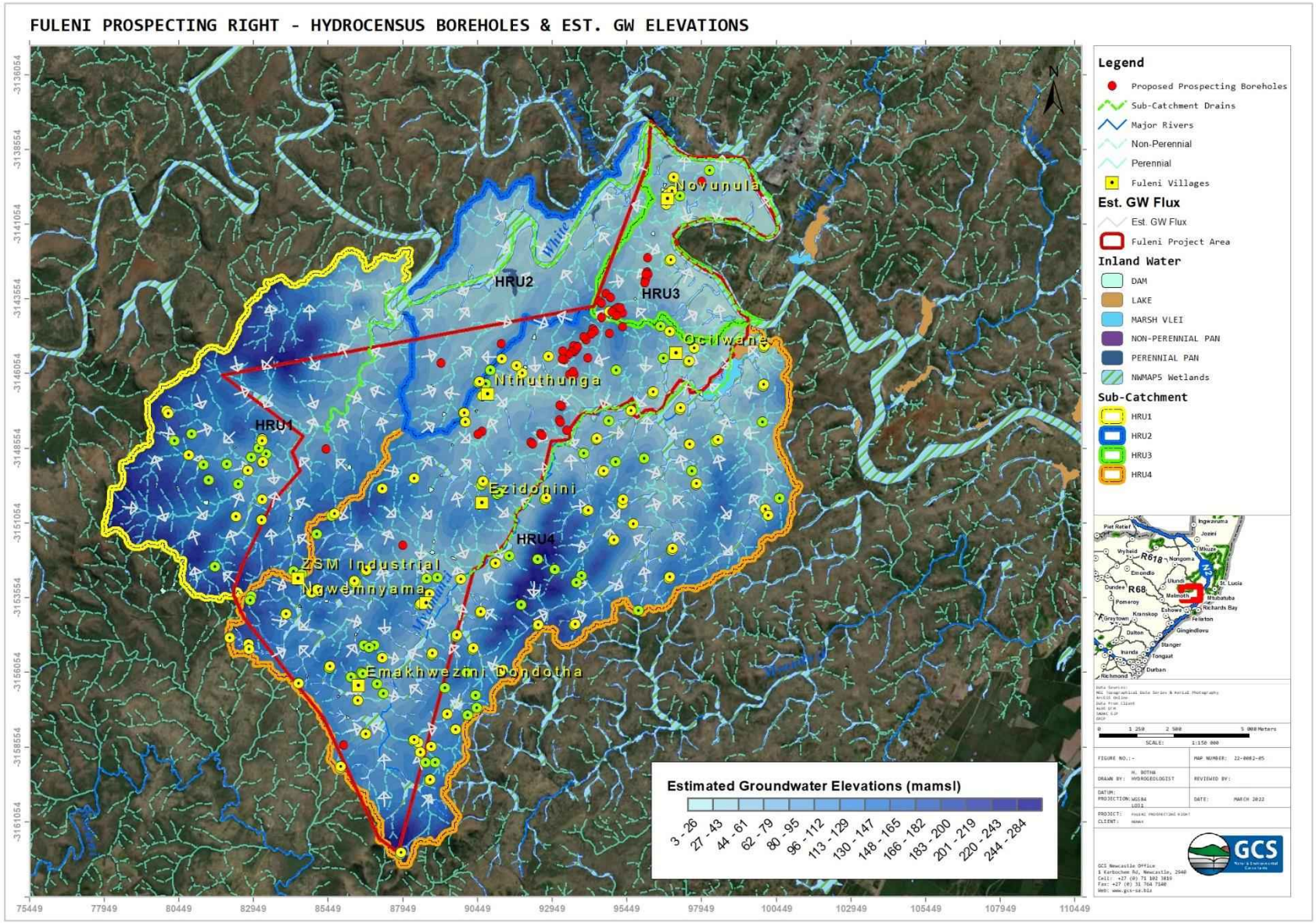


Figure 5-5: Estimated groundwater elevations and flow directions for the project area

5.6 Groundwater quality

The groundwater quality for the region will be variable and will depend on the underlying geology and hydrogeology characteristics associated with groundwater recharge (i.e., older rock and aquifers with ion exchange will have higher EC, and recently recharged more permeable younger rocks will have lower EC). Literature and available hydrogeology maps for the area (refer to Figure 5-6) suggests that the electrical conductivity (EC) for the underlying aquifers generally ranges from 70 to 300 mS/m (milli Siemens/metre) which translates into groundwater that may have a high total dissolved solids (TDS) or be of better quality depending on the underlying geological formation. It is known from other work undertaken in the project area, that groundwater associated with the Volksrust, Emakwezini, Ntabene, Nyoka, Clarens and Letaba Formation Formations is generally high in Ca, Mg, Na, K, and Cl. The pH for the region ranges from 6 to 8.

Hydrochemistry data would need to be confirmed in areas where prospecting right is granted, to establish ambient / pre-mining groundwater conditions.

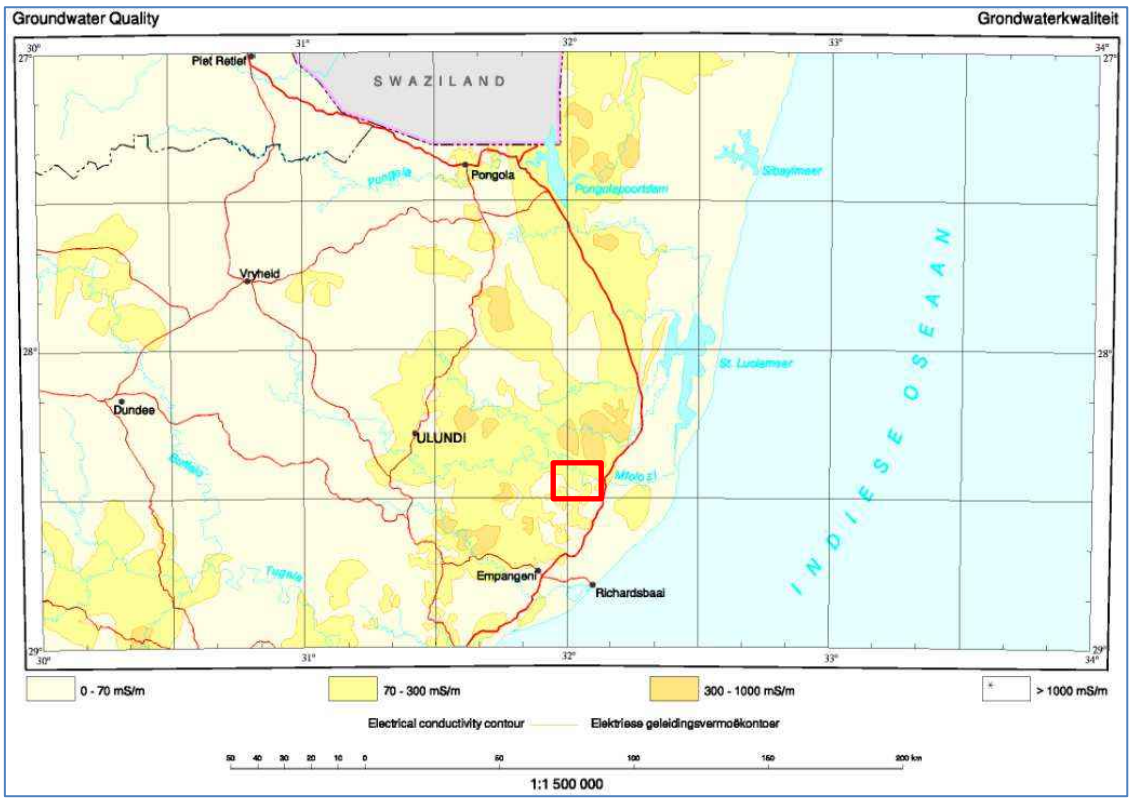


Figure 5-6: Groundwater quality (King, et al., 1998)

5.7 Groundwater Quantity

Intermediate groundwater Reserve Determination (IGRD) was conducted for the study area to establish the groundwater reserve. The IGRD aims to quantify the likely impact of the site on the groundwater reserve.

It is necessary, from a groundwater point of view, to quantify the groundwater reserve in terms of potential impacts associated with the development (i.e., areas that may become impermeable or increased runoff will reduce groundwater recharge).

The IGRD considers the following parameters:

- Effective recharge from rainfall and specific geological conditions.
- Basic human needs for the sub-catchment.
- GW contribution to surface water (baseflow).
- Existing and proposed abstraction; and
- Surplus reserve.

The data used for the calculation was derived from the WRC 90 Water Resources of South Africa 2012 Study (WR2012) and GW Resource Assessment Ver. 2 (GRAII) datasets.

5.7.1 Quaternary catchment

Data from relevant hydrogeological databases, including the Groundwater Resource Directed Measures (GRDM), was obtained from the Department of Water and Sanitation and associated Aquiworx software (Aquiworx, 2015). The borehole falls within quaternary catchments W21L and W23A as indicated in Table 5-4.

Table 5-4: Summarised Quaternary Catchment Information (Aquiworx, 2015)

Quaternary Catchment	Total Area (km²)	Recharge (mm/a)	Rainfall (mm/a)	Baseflow (mm/a)
W21L	532.8	61	733	7.49 [Pitman]
W23A	413.8	69	833	15.64 [Pitman]

5.7.2 Existing groundwater usage (EU)

There are 141 boreholes within the Fuleni prospecting right area. However, of the 141 boreholes, only 49 (30%) have groundwater level data available. EU for the 141 boreholes is reserved in the water balance (as a best-case scenario).

Based on the median aquifer yield (0.5 l/sec as the average for the area) the EU for the combined extent of the project area is in the order of 6 091.2 m^3/yr.

5.7.3 Basic human needs (BHN)

As EU already accounts for possible BHN, no BHN is assigned to the water balance.

5.7.4 Proposed groundwater usage (PU)

As this report is for the prospecting right application, no PU is allocated.

5.7.5 Land use (LU)

Based on available land cover types for the study area, limited impacts in terms of recharge reduction to the aquifers is anticipated.

5.7.6 Groundwater balance

The groundwater balance and the reserve determination on a sub-catchment scale are summarised below:

- $GW_{available}$ = (Re) - (EU + BHN + BF + PU)

Where:

- $GW_{available}$ = Available GW for use.
- Re = Effective recharge to the aquifer.
- BF = Baseflow to surface water streams.
- EU = Existing GW abstraction / use (identified on sub-catchment, excluding applicant).
- BHN = Basic Human Needs.
- PU = Proposed Use.

Calculations:

- Re (sub-catchment) =299.375 km^2 x 69 mm/yr = 15 826 875 m^3/a (43 361.30 m^3/day)
- BHN = 0 m^3/day (based on available data).
- EU = 0 m^3/day (based on available data).
- BF = 15.64 mm/yr x 299.37 km^2 = 4 682 146.8 m^3/a (12 827.79 m^3/day)
- $GW_{available}$ = (15 826 875- [0 + 0 + 4 682 146.8 + 0]) m^3/day

  = + 11 144 728.2 (+ 30 533.50 m^3/day)

The groundwater balance indicates a surplus value of approx. +30 533.50 m^3/day is available for abstraction on a sub-catchment scale.

6 GEOHYDROLOGICAL RISK ASSESSMENT

Based on the activity proposed, the drilling of no more than 54 core exploration boreholes within an area as large as 14 720 Ha, no geohydrological risk in terms of quantity and quality are anticipated.

The drilling will entail the drilling of no more than 54 holes via core drilling methods, to maximum depths of 180 to 200 metres below ground level. After core logs are taken, the borehole will be backfilled with bentonite and the steel casing will either be removed completely or sealed for future use.

As the drilling activity will be controlled, taking place on an area limited to a 14t drill rig with highly likely a mounted compressor, the impact on the local groundwater regime is anticipated to be zero.

The only risk to the groundwater will be in the event of deliberate pollution by the appointed drilling contractor, which goes against standards of ethics and SABS guidelines for the drilling exploration of boreholes.

7 CONCLUSIONS

Based on the findings of this geohydrological assessment, the following conclusions are drawn:

- The proposed prospecting right area encompasses a large area, that falls over the extent of two (2) quaternary catchments, namely W23A (90% of the total prospecting right area) and W21L (10%) of the Mtamvuna Water Management Area (WMA) (DWS, 2016). The drainage for the Fuleni prospecting area can further be described by four (4) sub-catchments, which describe the drainage towards the White Umfolozi and Umfolozi Rivers.
- Available rainfall data suggest a MAP ranging from 318.5 (30th percentile) to 1247 (90th percentile) mm/yr. The average rainfall is in the order of 638 mm/yr.
- Available literature and site observation data suggest that two (2) aquifers exist in the area:
    - A shallower semi-unconfined aquifer system associated with weathered intergranular and fractured sedimentary rock (Volksrust, Emakwezini, Ntabene, Nyoka, Clarens and Letaba Formation); and
    - A deeper confined fractured aquifer network is associated with the older Emakwezini and Ecca sediments (older Karoo basement rock).
- The aquifers underlying the project area can be regarded as low to moderate-yielding aquifers, with reported yields ranging from 0.1 to 2 l/sec. The aquifer present is classified as a Minor Aquifer system (Parsons, 1995).
- A desktop-level screening of database boreholes for the proposed prospecting right area revealed at least 141 boreholes within the Fuleni prospecting right area. However, of the 141 boreholes, only 49 (30%) have groundwater level data available.

- The groundwater level for the project area is expected to range from 2.37 to 63.9 mbgl, depending on the aquifer intercepted and the position of the borehole on the landscape. Available data suggest that the groundwater table mimics the topography.
- Groundwater is typically encountered in:
    - Dolerite dyke and sill contacts with host rocks.
    - Contacts between different lithologies or at unconformities.
    - Faults and associated fracture zones; and
    - Contacts between argillaceous and arenaceous units (King, et al., 1998)
- Recharge to the underlying aquifer is estimated to be in the range of 3.1% to 4% of the MAP (638 mm) which falls within quaternary catchment W21L and W23A (DWAF, 2006).
- No impact on the groundwater regime is anticipated for the prospecting phase.
-

7.1 Recommendations

Based on the desktop evaluation, and limitations captured in this report, the following recommendations are made for the prospecting phase:

- During drilling, it is advised that rock samples/drill chippings be collected for geochemical characterisation of the rock sampled. It is important to evaluate the acid potential of the rock, and management thereof for future reference.

8 BIBLIOGRAPHY

Aquiworx, 2015. *Aquiworx Software Integrated Information,* s.l.: s.n.
Bailey, A. & Pitman, W., 2015. *Water Resources of South Africa 2012 Study (WR2012): Executive Summary Version 1. WRC Report No. K5/2143/1,* Gezina, South Africa: Water Research Commission Report.
Botha, J. et al., 1998. *Karoo Aquifers: Their Geology, Geometry and Physical Properties,* s.l.: WRC Report No: 457/1/98.
CGS, 2011. *Council for Geoscience (GCS) – 1:250 000 Raster image 2732 ST LUCIA,* s.l.: s.n.
DEA, 2019. *South African National Land-Cover (SANLC) 2018,* South Africa: DEA on 1st October 2019.
DMEA, 1998. *1:250 000 Geological Series – 27 ½ 32 St Lucia,* s.l.: s.n.
DMEA, 1998a. *1:250 000 Geological Series – 2830 Dundee,* s.l.: s.n.
DWA, 2012. *Aquifer Classification of South Africa map,* s.l.: Hydrological Services - Groundwater Information..
DWAF, 2006. *Groundwater Resource Assessment II,* s.l.: s.n.
DWS, 2016. *New Water Management Areas,* South Africa: Government Gazette No. 40279.
Eyring, V. B. S. M. G. A. S. C. A. S. B. S. R. J. a. T. K. E., 2016. *Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organization, Geosci. Model Dev., 9, 1937-1958, doi:10.5194/gmd-9-1937-2016.* s.l.:s.n.
GRIP, 2016. *Groundwater Resource Information Project ,* s.l.: s.n.
JAXA, 2022. *Advanced Land Observation Satellite (ALOS) Global Digital Surface Model (DSM),* Tokyo: Earth Observation Research Center (EORC), Japan Aerospace Exploration Agency (JAXA).
King, G., Maritz, E. & and Jonck, F., 1998. *2730 Vryheid - 1:500 000 Hydrogeological map series of the Republic of South Africa.,* s.l.: s.n.
Kottek, M. et al., 2006. *World Map of the Köppen-Geiger climate classification updated. Meteorol. Z.15, 259-263. doi:10.1127/0941-2948/2006/0130.* s.l.:s.n.
Lourens, P., 2013. *The relationship between South African geology and geohydrology,* s.l.: IGS, University of the Free State, Bloemfontein. Masters Dissertation..
Lynch, S., 2004. *Development of a Raster Database of Annual, Monthy and Daily Rainfall for Southern Africa, WRC Report No. 1156/1/04,* Pretoria: Water Research Commission.
Meteoblue, 2022. *Climate Data.* s.l.:https://www.meteoblue.com.
Meteoblue, 2022. *Climate Data.* s.l.:https://www.meteoblue.com.
NGA, 2019. *National Groundwater Archive.* [Online]
Available at: https://www3.dwa.gov.za/NGANet/Security/WebLoginForm.aspx
Parsons, R., 1995. *A South African Aquifer System Management Classification,* s.l.: Water Research Commission Report No. KV 7795.
SADAC GIP, 2022. *SADC Groundwater Information Portal,* s.l.: s.n.
SADAC GIP, 2022. *SADC Groundwater Information Portal,* s.l.: s.n.
Schulze, R., 1997. *South African Atlas of Agrohydrology and Climatology. WRC Report No. TT85/96,* Pretoria: Water Research Commission.
Vegter, J., 1995. *An explanation of a set of National Groundwater Maps. Water Research Commission. Report No TT 74/95.*. s.l.:s.n.
Woodford, A. V. T. G. T. A. T. G. R. P. G. M. O. R. V. D. a. E. C., 2013. *Karoo Groundwater Atlas Volume 2,* s.l.: Karoo Groundwater Expert Group (KGEG).
WRC, 2015. *http://www.waterresourceswr2012.co.za/resource-centre/.* [Online].

APPENDIX A: DISCLAIMER

The opinions expressed in this Report have been based on site /project information supplied to GCS Water and Environment (Pty) Ltd (GCS) by Imvukuzane Resources (Pty) Ltd and is based on public domain data and data supplied to GCS by the client. GCS has acted and undertaken this assessment objectively and independently.

GCS has exercised all due care in reviewing the supplied information and public and scientific data. Whilst GCS has compared key supplied data with expected values, the accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. GCS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Opinions presented in this report, apply to the site conditions, and features as they existed at the time of GCS's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GCS had no prior knowledge nor had the opportunity to evaluate.

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Desktop Geohydrological Screening for the Fuleni Prospecting Right Application

SPECIALIST INFORMATION

Specialist Company Name:	GCS Water and Environment SA			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement recognition	
Specialist name:	Hendrik Botha			
Specialist Qualifications:	MSc Environmental Sciences (Geohydrology & Geochemistry) BSc. Hons. Environmental Sciences (Hydrology) BSc. Geology and Chemistry			
Professional affiliation/registration:	PR SCI NAT 400139/17			
Physical address:	1 Karbochem Road, Newcastle, KZN			
Postal address:				
Postal code:	2940	Cell:		
Telephone:	071 102 3819	Fax:		
E-mail:	hendrikb@gcs-sa.biz			

DECLARATION BY THE SPECIALIST

I, Hendrik Botha, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application objectively, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken concerning the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

10/03/2022
3:33:48

Signature of the Specialist

GCS

Name of Company:

12 April 2022

Date

CV OF SPECIALIST

Hendrik Botha

Snr. Hydro-geologist / Modeller

CORE SKILLS

- Project management
- Analytical and numerical groundwater modelling
- Geochemical assessments and geochemical modelling
- Hydropedology and hydrological assessments
- Hydrology, floodline modelling & storm water management
- Groundwater vulnerability, impact, and risk assessments
- Technical report writing
- GIS and mapping

DETAILS

Qualifications

- BSc Chemistry and Geology (Environmental Sciences) (2012)
- BSc Hons Hydrology (Environmental Sciences) (2013)
- MSc Geohydrology and Hydrology (Environmental Sciences) (2014-2016)

Membership

- Groundwater Division of GSSA
- Groundwater Association of KwaZulu Natal Member
- International Mine Water Association (IMWA)

Languages

- Afrikaans - Speak, read, write.
- English - Speak, read, write.

Countries Worked In

- South Africa

PROFILE

Hendrik (Henri) Botha is currently the manager of the GCS Newcastle Office and occupies the role of principal hydrogeologist. Groundwater, geochemistry and surface hydrology, as well as knowledge of water chemistry together with GIS, analytical and numerical modelling skills, is some of his sought-after expertise. General and applied logical knowledge are his key elements in problem-solving.

Professional Affiliations:

SACNASP Professional Natural Scientist (400139/17)

Areas of Expertise:

- Waste classification and Impact Assessments
- Aquifer vulnerability assessments
- Geochemical sampling, data interpretation and modelling
- Geophysical surveys and data interpretation
- GIS
- Water quality sampling and data interpretation
- Groundwater impact and risk assessments
- Numerical and Conceptual Visual Modelling (Visual Modflow, ModflowFLEX, Voxler, RockWorks, Surfer and Excel)
- Hydropedology (Hydrological Soil Types) & Soils Assessments
- Floodline Modelling (HEC-RAS)
- Stormwater Management Systems and Modeling
- Surface Water Yield Assessments
- Water and Salt Balances

Page 1 of 8

Work Experience

Period	Employer	Position	Role/ Responsibility
2014 - Current	GCS (Pty) Ltd	Snr. Hydrogeologist	Client liaison, client management, hydrology, geohydrology, hydropedology and geochemistry related work GCS Newcastle Office manager since July 2020.
2013	Centre for Water Science and Management at North-West University	Modeller	Hydrological rainfall-runoff modelling with EPA SWMM
2013	Chemistry Department at North-West University	Demonstrator	▫ Preparation of chemical agents used during experiments ▫ Demonstration of some chemistry principles to undergraduate students ▫ Helped students during experiments

PROFESSIONAL EXPERIENCE

Scan here for full record

PROFESSIONAL EXPERIENCE - EARTH SCIENCES FIELD

Year	Client	Project Description	Role / Responsibility
Geochemistry, Waste Classification, Geochemical Modelling, Soil Chemistry and Water Chemistry Assessments			
2021	Modikwa Platinum	Modikwa Platinum Soil Study	Project Manager, Field Specialist, Reporting, Client liaison
2020	Tendele Coal (Pty)ltd	Somkhele Water & Geochemical Report	Project Manager, Field Specialist, Reporting, Client liaison
2019	Thalo Environmental	Waste Classification for the Fortuna WTW	Project Manager, Assessor, Reporting, Client liaison
2019-2020	Tendele Coal (Pty) Ltd	Area 9 (KwaQubuka Pit) Waste Evaluation & Risk-Based Approach Geohydrological Closure Assessment	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2019	Tendele Coal (Pty) Ltd	Geochemical Model Update for Somkhele Anthracite Mine	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2019	Buffalo Coal (Pty) Ltd	Aviemore Colliery Decant and Stream Loss Assessment	Project Manager, Modler, Analyst, Reporting, Client liaison
2019	Buffalo Coal (Pty) Ltd	Aviemore Colliery AMD Treatment Strategy	Project Manager, Modler, Analyst, Reporting, Client liaison
2018	Tendele Coal (Pty) Ltd	Geochemical Model Development for the Somkhele Anthracite Mine	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2016	Tendele Coal (Pty) Ltd	Somkhele Co-Disposal Assessment	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
2015	Crest Choice Chicken	Potchefstroom Bottling Facility WQ Analysis	Interpretation and Analysis, Reporting
2015	Total Coal South Africa (TCSA)	Springbok Siding Soil Analyses	Interpretation and Analysis, Reporting
2015	Exxaro	(Matla Mine) Water Chemistry Analysis	Interpretation and Analysis, Reporting
2015	Tendele	AdHoc: Somkhele Sample Water Quality	Interpretation and Analysis, Reporting
2015	Hatch Goba	Mukuiu Soil Analysis	Interpretation and Analysis, Reporting
2015	Northam Platinum	Soil Chemistry Interpretation	Interpretation and Analysis, Reporting
2015	Private Client	Soil Chemistry Analysis and Interpretation	Interpretation and Analysis, Reporting
2015	Molo	Molo Graphite Project Soil Analysis	Interpretation and Analysis, Reporting
2014	Estima	Soil and water chemistry analyses	Interpretation and Analysis, Reporting
2014	Kangra	Bokoni Platinum - Soil Monitoring	Interpretation and Analysis, Reporting
2014	Booysendal Mine	Soils, Land-Use and Land Capability Assessment for Booysendal Mine: Soil Chemistry Analysis	Interpretation and Analysis, Reporting
2014	Kangra	Longridge Soil Testing to Identify Fertilizer Use: Soil Chemistry Interpretation	Interpretation and Analysis, Reporting
2017-ongoing	Tendele Coal (Pty) Ltd	Kinetic Column Leach Test Assessments for Mining Area 8 and Area 9 at the Somkhele Anthracite Mine	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
Geohydrological, Hydrological and Hydropedological Assessments (EIA, WULA, BA, IWULA, EMP) - Groundwater Investigations, Numerical and Analytical Modelling Application, Floodline Modelling, CSWMP, Water Balances and Hydropedology			
2021	Wallace & Green	Izinga Eco Estate Floodline Update	Project Manager, Field Specialist, Reporting, Client liaison
2021	KSEMS Environmental Consulting	Dingo Animal Kingdom Floodline	Project Manager, Field Specialist, Reporting, Client liaison

Page 4 of 5

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
2021	Mkhoba Trust	Mkhoba Trust water use license Application - Geohydrology Assessment	Project Manager, Field Specialist, Reporting, Client liaison
2021	Joseph Baynes Estate (Pty)ltd	Baynesfields Groundwater Supply	Project Manager, Field Specialist, Reporting, Client liaison
2020	Triplo4 Sustainable Solutions (Pty) Ltd	Karpowership SA - Geohydrological, hydropedology and hydrological assessments	Project Manager, Field Specialist, Reporting, Client liaison
2020	Green Door Environmental	Justin Lusso Poultry Farm - Geohydrology and Hydrological Assessments	Project Manager, Field Specialist, Reporting, Client liaison
2020	Metamorphosis Environmental Consulting	Proposed Shongweni Landfill Hydrological Assessment	Project Manager, Field Specialist, Reporting, Client liaison
2020	Green Door Environmental	Middeldrift Bulk Augmentation Hydrological and Hydropedological Assessment	Project Manager, Field Specialist, Reporting, Client liaison
2020	EnviroMatrix	Manyatseng Cemetery Geohydrological and Flood Line Assessment	Project Manager, Field Specialist, Reporting, Client liaison
2021	ECA Consulting	Hydrological study - Okhahlamba	Project Manager, Field Specialist, Reporting, Client liaison
2020	Wallace & Green	Glendale Sugar Mill Hydrology Assessment & Groundwater Numerical Model Development	Project Manager, Field Specialist, Reporting, Client liaison
2020	GIBB	Newcastle Cemetery (Roy Point) Expansion Geohydrological & Hydrological Assessment	Project Manager, Field Specialist, Reporting, Client liaison
2020	GIBB	Newcastle Cemetery (Roy Point) Expansion Hydropeoldogy Assessment	Project Manager, Field Specialist, Reporting, Client liaison
2019	Green Door Environmental	Hydrological Assessment for the Chep Weatherboard Dam	Project Manager, Field Specialist, Reporting, Client liaison
2019	Triplo4 Sustainable	Elalani Hydropedology Assessment	Project Manager, Field

Page 5 of 5

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
	Solutions (Pty) Ltd		Specialist, Reporting, Client liaison
2019	Green Door Environmental	Geohydrological Assessment for the Sani Pass Hotel Expansion	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2019	Green Door Environmental	Evergreen Hilton Retirement Village Geo hydrological Assessment	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2019	Cato Scrap CC	Cato Scrap Metal Facility Geohydrological Assessment	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2019	Green Door Environmental	Hydrogeological Assessment for the Goedgedacht Farm	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2019	ACER (Africa) Environmental Consultants	Hydrogeological Assessment for the Mtuzini Sewage Works	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2019	Tripo4 Sustainable Solutions (Pty) Ltd	Hydrogeological Assessment for the Sezela Mill Molasses Bladder Development Site	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2018	GIBB	Illovo Automotive Supplier Park (ASP) Geohydrological Assessment	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2018	Kangra Coal (Pty) Ltd	Numerical Groundwater Model update for the Maquasa East, Maquasa West and Hooltgezien mining operations	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2018	Tripo4 Sustainable Solutions (Pty) Ltd	Hydrogeological Assessment and Numerical Groundwater Model Development for the Illovo Hoodsburg Sugar Mill	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
2018	Zululand Anthracite Colliery (ZAC)	Hydrogeological Assessment and Numerical Model Development for the Deep E Opencast and New Mngeni Shaft operational areas.	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2018	Green Door Environmental	Hydrogeological Assessment for the Isandlwana Settlement Development	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2018	Green Door Environmental	Hydrogeological Assessment for the Rem 8532 Northington Farm Bottling Plant	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2018	EnvironMatrix	Hydrogeological Assessment for the Spilsbury Piggery	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2018	Tripo4 Sustainable Solutions (Pty) Ltd	Hydrogeological Assessment for the UCL Sugar Mill	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2018	Tripo4 (Pty) Ltd	Hydrogeological Investigation for the Hoodsburg Sugar Mill	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2018	Green Door Environmental	Hydrogeological Assessment for the Bumlea farm, situated near Underberg.	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2018	EcoLeges	Hydrogeological Assessment for the Proposed Development of Chicken Farms near Klippan	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2018	EcoLeges	Hydrogeological Assessment for the E&T Abattoir	Project Manager, Assessments, Reporting, Client liaison
2017	Zinoju Coal (Buffalo Coal)	Numerical Groundwater Model Update for the Magdalena Colliery	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2017	Tendele Coal (Pty) Ltd (Somkhele Anthracite Mine)	Hydrogeological Investigation for KwaQubuka and Luhlanga Opencast Operations	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison

Page 7 of 5

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
2017	Glencore	Numerical Groundwater Flow and Transport Model Development for the Lydenburg Smelter	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2017	Tripo4 Sustainable Solutions (Pty) Ltd	Hydrogeological Investigation for the Illovo Eston Sugar Mill	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2017	Frame Knitting Factory	Hydrogeological Investigation for the Frame Knitting Factory - As part of the WULA	Project Manager, Analyst, Reporting, Client liaison
2017	Royal HaskoningDHV - South Africa	Hydrogeological Assessment for the proposed Ballito Hills Development project	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2016	Tripo4 Sustainable Solutions (Pty) Ltd	Geohydrological Assessment for the Priority 1 Sewer Pipeline Development Project	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2016	Tongaat Hulett Developments (Pty) Ltd	Geohydrological Assessment for the Tinley Manor Development Project	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2016	Tongaat Hulett Developments (Pty) Ltd	Geohydrological Assessment for the Inyaninga Development Project	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2016	GIBB	Umzimkhulu WWTW Geohydrological Assessment	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2015	Magalela and Associates	Geohydrological Assessment Elandspruit	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2015	Tripo4 Sustainable Solutions (Pty) Ltd	Gledhow Sewer Pipeline Geohydrological Assessment	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2015	Ground Truth	Matuba Mall Geohydrological Assessment for WULA	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2015	Royal HaskoningDHV	Desktop Geohydrological Assessment for Sibaya Sewer Pump Stations	Project Manager, Field Specialist, Analyst,

Page 8 of 5

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
			Reporting, Client liaison
2015	Anglo Gold Ashanti	AngloGold Ashanti VR, MW5 and WW Salt Load Allocations per Source Facility Update	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2014	Anglo Gold Ashanti	Surface and Groundwater Monitoring Assessment	Reporting, Analyst, Reporting, Client liaison
2014	EIMS	De Wittekrans Groundwater Update and Hydrocensus	Field Specialist
2014	Kangra Coal (Pty) Ltd	Ballengeich Pollution Control Project	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2014	Kemafahla and Trading	Cornfields Geohydrological Assessment	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2014	Total Coal South Africa (TCSA)	Doirsfontein and Forzando Geohydrological Assessment	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2014	Sivest	Preliminary and Desktop Hydrogeological Assessment for the Msinga Local Municipality Landfill Site in the Pomeroy Area	Reporting
2014	Tripo4 Sustainable Solutions (Pty) Ltd	King Shaka Mall Geohydrological Assessment	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2014	Tripo4 Sustainable Solutions (Pty) Ltd	Steve Biko Housing Development Geohydrological Assessment	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2014-2016	Tendele Coal (Pty) Ltd	Somkhele Waste and Geochemical Management Plan	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2016-2018	Tendele Coal (Pty) Ltd	Area 1 Pit Lake Feasibility Assessment	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
Water Supply			

Page 9 of 5

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
2021	Joseph Baynes Estate (Pty)Ltd	Baynesfields Groundwater Supply	Project Manager, Field Specialist, Reporting, Client liaison
2020	Wallace & Green	Izinga Eco Estate & Balito Hills Water Supply	Project Manager, Field Specialist, Reporting, Client liaison
2020	Tripto4	Stza Water Groundwater Supply & Geohydrological Evaluation	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
2018	MBB Projects	Groundwater Supply Investigation for the iSimangaliso Wetland Park	Project Manager, Analyst, Reporting, Client liaison
2018	MBB Projects	Groundwater Supply Investigation for the iSimangaliso Wetland Park	Project Manager, Analyst, Reporting, Client liaison
2016	Condor Construction (Pty) Ltd	Geohydrological Investigation and Drilling Feasibility for Mount Ayliff Police Station	Project Manager, Field Specialist, Analyst, Reporting, Client liaison
2015	Tendele Coal (Pty) Ltd	Somkhele Water Supply	Project Manager, Field Specialist, Reporting, Client liaison
2015	DWS	Rural Water Supply & Resource Management	Field Specialist
2016-2017	Focus Project Management	KZN Drought Relief Borehole Feasibility Study	Project Manager, Field Specialist, Modler, Analyst, Reporting, Client liaison
Water Monitoring			
2014 2016	Buffalo Coal	Buffalo Coal Water Monitoring	Field Specialist, Reporting
2018	Tripo4 Sustainable Solutions (Pty) Ltd	Groutville D Sanitation Programme - Water Monitoring	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2016	Tripo4 Sustainable Solutions (Pty) Ltd	Monitoring Plan for the Proposed Bhamshela Filling Station	Project Manager, Field Specialist, Reporting, Client liaison

Page 10 of

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
2014-2015	Total Coal South Africa (TCSA)	Steincoalspruit Colliery Water Monitoring for Closure	Project Manager, Field Specialist, Reporting, Client liaison
2016-2019	Tripo4 Sustainable Solutions (Pty) Ltd	Avon Peaking Power Plant Groundwater and Surface Water Monitoring	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2015-2019	Tripo4 Sustainable Solutions (Pty) Ltd	King Shaka Mall Monitoring Plan and Water Monitoring	Project Manager, Field Specialist, Reporting, Client liaison
2014-Ongoing	Tendele Coal (Pty) Ltd	Somkhele Anthracite Mine Water Monitoring	Project Manager, Field Specialist, Reporting, Client liaison
2019	Wallace & Green	Glendale Sugar Mill Groundwater Model	Project Manager, Field Specialist, Reporting, Client liaison
Hydropedological Assessments			
2019	Rokwil Civils	InyaningaSoil Pollution Study	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2020	GIBB AFRICA	Newcastle Cemetery Geohydrology & Hydropedology	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2020	EnviroPro	N12 Filling stations Geohydrological & Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison
2020	Nemai Consulting	Duvha Power Station Seepage Drains Hydropedological Assessment	Project Manager, Field Specialist, Reporting, Client liaison
2020	KSEMS Environmental Consulting	Renishaw Hills Estate Hydropedology	Project Manager, Field Specialist, Assessments, Reporting, Client liaison
2020	Zimbali Coastal Resort	Hydropedology study	Project Manager, Field Specialist, Reporting, Client liaison
2020	KJS Developments	Mainsl Mews Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison

Page 11 of

PROFESSIONAL EXPERIENCE

Scan here for full record

Year	Client	Project Description	Role / Responsibility
2020	Eco-Pulse Environmental Consulting Services	Langefontein Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison
2020	Eco-Pulse Environmental Consulting Services	South Coast Stone Crushers Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison
2020	Eco-Pulse Environmental Consulting Services	Widenham Development Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison
2020	Triplo4 Sustainable Solutions	Glendow Sugar Mill Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison
2020	Acer Africa	Mtunzini Development Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison
2021	Modikwa Platinum	Modikwa Platinum Soil Study	Project Manager, Field Specialist, Reporting, Client liaison
2021	Thirsti Bottling Plant	Thirsti Hydropedology	Project Manager, Field Specialist, Reporting, Client liaison

Page 12 of

PROFESSIONAL EXPERIENCE

Scan here for full record

PAPERS / DISSERTATIONS: -

Year	Title	Presented
2013	*Hydrological Modelling of the Boskop Dam Catchment with SWMM (Thesis)*	*North-West University*
2015	Understanding Site Hydrology of the Northern Kwazulu-Natal Anthracite Coal Fields With Special Reference to Discard and Tailings Disposal Practices (Paper)	14th Biennial Groundwater Division Conference: From Theory to Action
2016	Geohydrological impact of co-disposed coal material into an opencast pit (Thesis)	North-West University
2018	Viability Of Converting A South African Coal Mining Pit Lake System Into A Water Storage Facility	ICARD 2018
2019	Evaluating Groundwater Availability Based on Land Cover and Local Hydrogeology - A Groundwater Balance Approach	*16th Groundwater Conference and Exhibition, Port Elizabeth, 20-23 October 2019.*
2021	Impact of Engineered Tree Plantations on Water Transfer through the Upper Vadose Zone and Implications on Vertical Groundwater recharge.	*17th Biennual GWD Groundwater Conference and Exhibition*

CONFERENCES/ TRAINING: -

Year	Course/ Conference
2015	14th Biennial Groundwater Division Conference: From Theory to Action
2015	Fire Prevention and Protection Training Course
2018	*International Mine Water Association (IMWA) - International Convention for Acid Rock Drainage (ICARD) Conference*
2019	*16th Groundwater Conference and Exhibition, Port Elizabeth, 20-23 October 2019.*

Page 13 of

PROFESSIONAL EXPERIENCE

Scan here for full record

2021	Digital Soils Africa (DSA) Webinar - Hydropedology Requirements in South Africa
2021	17th Biennial GWD Groundwater Conference and Exhibition

Page 14 of

DECELERATION

DECLARATION

I, **Henrik Botha** hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.

Signature:  Date: 28 February 2022

Page **15** of

Proposed coal prospecting application on the Fuleni reserve 14375 UG, Mtubatuba area,

KwaZulu-Natal Province

Ecological Impact Assessment and Wetland Report

Prepared by
P.J du Preez (Ph.D., Pr.Sci.Nat.)
208 PostNet Suite,
Private Bag x 16,
Hermanus
7200,

July 2018

ENVIRO-NICHE CONSULTING
(Sandersonia Trust trading as Enviro-Niche)
BIODIVERSITY AND ENVIRONMENTAL CONSULTANTS

PO BOX 11945
UNIVERSITAS
BLOEMFONTEIN
9321
greenrsa@gmail.com
Contact no.: 0823764404
Fax: 0866452222

EXECUTIVE SUMMARY

The proposed project site triggers a number of listed activities as included in the Environmental Impact Assessment Regulations (08 December 2014), GN R 982 – 985, in accordance with the National Environmental Management Act, No. 107 of 1998 (NEMA), as amended. The Environmental Assessment Practitioner, EnviroNiche Consulting, was appointed to conduct a wetland and riparian delineation, Present Ecological State (PES) and function assessment for project site as well as an ecological impact assessment to determine the impacts which may be triggered by the proposed development.

The requirements of this assessment were to undertake a specialist study to assess the biodiversity and ecology of the project sites as well as to determine the significance of the impacts that the proposed project will have on the identified project site. Outcomes required from this report in terms of the riparian and wetland assessment include the following:

- To identify Management Units within the study area according to Hydro-geomorphic (HGM) units following the guidelines in the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013) and according to location in relation to project site;
- To delineate all wetland and riparian zones within the study area according to the guidelines for delineation as defined by (DWA, 2005);
- Determine function and service provision of wetland and riparian features according to the method supplied by Kotze *et al.* (2005);
- To define the health of the systems within the study area according to the Wetland Index of Habitat Integrity according to the method described by the DWA (2007) and thereby define the Present Ecological State (PES) of the aquatic resources to be affected by the proposed mine development;
- To define the Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC) for the features (DWA, 1999);
- To consider potential impacts on the wetland and riparian habitat and the ecological communities likely as a result of the proposed development;
- To present management and mitigation measures in order to minimise the impact on the receiving environment should the proposed expansion proceed; and

The project site is on the Fuleni reserve 14375 UG, Mtubatuba area, KwaZulu-Natal Province

The following general conclusions were drawn upon completion of the literature review:

- The study area falls within the North Eastern Uplands Ecoregion, and
- According to the NFEPA database the study area falls within the Usuto to Umhlathuze Water Management Area (WMA), and
- the subWMA indicated for the study area is the Mfolozi sub-water management area;
- This subWMA is not regarded important in terms of fish sanctuaries, rehabilitation or corridors (NFEPA 2011);
- The subWMA is not considered important in terms of translocation and relocation zones for fish (NFEPA 2011);
- The subWMA is not listed as a fish-FEPA (NFEPA 2011);

- The DWS database indicates that the Mfolozi is classified as having a Present Ecological State (PES) as a Class **B** river, with EI classification of **Moderate** and an ES classification of **Moderate**;
- The NFEPA database indicates that there are wetlands present within the study area;
- The WetVeg group of the riparian system is Zululand Lowveld;
- The NFEPA database indicates that there are no RAMSAR wetlands within the study area or within 500m of the study area;
- According to the National Biodiversity Assessment (2011), the study area borders the Hluhluwe – Umfolozi Park as well as the Somopho Community Nature reserve;
- According to Mucina & Rutherford (2006) the study site is situated in the Northern Zululand Sourveld (SVI22), Zululand Lowveld (SVI23), Zululand Coastal Thornveld (SVI24) and a small patch of Eastern Scarp Forest (FO2 Vi) is present on the slopes of Mduba peak. The wetland areas are classified as Freshwater wetlands: Subtropical Wetlands – Short grassy/sedge Freshwater wetlands
- The Northern Zululand Sourveld (SVI22), Zululand Coastal Thornveld (SVI22) and Zululand Lowveld (SVI23) are also a provincial protected vegetation types.
- According to the National List of Threatened Terrestrial Ecosystems (2011) a small patch of Eastern Scarp Forest is situated within the study area boundaries.
- According to KwaZulu-Natal Biodiversity Plan (2015) the villages and crop fields in the study area are in a degraded condition. The natural veld between the various villages are classified as Critical Biodiversity areas and Ecological support areas. The wetlands and rivers are aquatic Critical Biodiversity areas and many are NFEPA – listed.
- There is also a ESA buffer along the Hluhluwe – Umfolozi Park boundary
- According to SANBI's POSA species list a number of protected and Red Data species occur in the quarter degree square. These species were listed in terms of the National Threatened species list, the National Forest Act (Act 84 of 1998) and the KwaZulu-Natal Conservation Act (Act 9 of 2009).

Upon completion of the riparian and wetland assessment the following general conclusions were drawn: The entire landscape of the study area is drained by ephemeral drainage lines of wich many drain into the Mvamanzi and Mfolozi Rivers the only perennial systems in the area. An extensive valley-bottom wetland is situated where the Mvamanzi River joins the Mfolozi River. A few smaller floodplain wetlands are situated along the Mfolozi River. These features were assessed during the field assessment and the relevant assessment protocols applied. The following points summarise the results obtained:

- These features were classified according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al.*, 2013), as Inland Systems falling within the North Eastern Uplands Aquatic Ecoregion;
- At Level 4 of the Classification System, the features within the study area were classified as: Rivers, and channelled and unchannelled Valley-bottom wetlands;
- The riparian features found in the perennial drainage lines (Umfolozi River and Mvamanzi River) received a score of 40%, indicating that the VEGRAI Ecological Category falls in Category D indicating a largely modified ecostatus. The riparian features found in the seasonal drainage lines received a score of 55%, indicating that the VEGRAI Ecological Category falls in Category C indicating a moderately modified ecostatus.

- The Index of Habitat Integrity (IHI) was applied to Mfolozi and Mvamanzi Rivers' to assess the Present Ecological State (PES). The riparian features of the Mfolozi and Mvamanzi Rivers were assessed separately to the floodplain wetlands;
- The results of the IHI assessment are summarised in the table below, and indicate that the features within the study area have undergone moderate to large modifications to vegetation, hydrology and geomorphology.

Summary of results of the WET-IHI assessments conducted for the Mfolozi and Mvamanzi Rivers' and tributaries and the wetlands within the study area.

Features	**Present State Score (%)**	**Present State Category**
Mfolozi River	57,2	D
Mvamanzi River	58	D
Channelled valley-bottom wetland	83	B
Unchannelled valley-bottom wetland	85	B
Seasonal drainage lines	61	C

Summary of results of the WET-Health assessments conducted for the valley-bottom wetlands

Feature	**Hydrology**		**Geomorphology**		**Vegetation**		**Overall PES Category**
	Impact score	Change score	Impact score	Change score	Impact score	Change score	
Channelled valley bottom wetlands	B	⬇	B	⬇	C	⬇	B
Unchannelled valley bottom wetlands	B	⬇	B	⬇	C	⬇	B

The overall score for the channelled valley bottom wetland and unchannelled valley bottom wetland HGM Units which totals the scores for the three modules, namely hydrology, geomorphology and vegetation, was calculated using the formula as provided by the Wet-Health methodology. The overall score calculated was 1.6, falling within Category B, which refers to ecosystem processes which have been moderately modified with a moderate change in ecosystem processes and moderate loss of natural habitats and biota within the study area.

- Wetland and riparian ecological functionality and ecological service provision was assessed utilising the method described by Kotze *et al.* (2008). The results of the Eco-Services assessment are summarised in the table below.

Summary of the wetland and riparian ecological function and service provision assessments for the Mfolozi and Mvamanzi Rivers'and floodplain wetland.

Features	Score	Category
Mfolozi River & Mvamanzi River	1.2	C
Umfolozi floodplain wetland & valley-bottom wetlands	1.2	C
Seasonal drainage lines	1.3	C

These results indicate that the Mfolozi and Mvamanzi Rivers' riparian wetland with its seasonal drainage lines are estimated to fall within and EIS Category C, indicating that this system is considered to be ecologically important and sensitive on a provincial and local scale.

The degraded floodplain wetland is estimated to fall within and EIS Category D, indicating that this system is considered to be ecologically unimportant and not sensitive on a provincial and local scale (Table 4.9).

- The EIS assessment was applied to all riparian and wetland features within project site in order to ascertain the levels of sensitive and ecological importance of the features, as well as to assist in informing a suitable REC for each. The results of these assessments are summarised in the table below; and
- The Recommended Ecological Category (REC) for the Umfolozi River and Mvamanzi Rivers and their tributaries, the seasonal drainage lines and wetland features were determined taking into account the results of the IHI, wetland and riparian function, EIS and the WET-Health assessments. The REC deemed appropriate for the wetland and riparian features are presented in the table below.

Summary of the REC categories assigned to the various features for all riparian and wetland features within the project site.

Features	REC Category
Umfolozi and Mvamanzi River systems and its associated tributaries,	Upper C
Valley-bottom wetlands	Upper C
Floodplain wetland	Upper C

Upon completion of the Impact Assessment, the following general conclusions were drawn:

Based on the impact assessment it is evident that there are a number of activities which will have varying levels of impacts on the watercourse/riparian and wetland resources within the project site. The findings indicate that should no mitigation measure be put into place, the proposed prospecting activities will have a relatively medium-negative impact on the features

within the project site. However, many of the impacts can be reduced to acceptable levels if the recommended mitigation measures are applied.

During the prospecting phase it is vital that well planned and executed mitigation measures and rehabilitation plans must be implemented to ensure that impacts are reduced as well as ensuring that long term negative impacts are reduced, e.g. erosion and the spread of alien invasive species. Mitigation measures such as infilling of voids, installation of berms, gabions and encouraging growth of indigenous vegetation should be implemented where necessary.

The results of the impact assessment indicate that although the impacts prior to mitigation may potentially be high, strict and effective implementation of mitigation measures will reduce the impact significance to medium-low, or low levels.

In view of the fact that large portions of the study area has already been impacted due to impacts by local residents, fire wood collection, bush clearing for roads, villages and crop fields, overgrazing of the veld, of roads, dams, borrow pits, etc. it is the opinion of the specialist that should the mitigation measures, as stipulated in Chapter 5 of this report be adhered to, the proposed prospecting phase (drilling of holes to take core samples) may proceed without posing a significant negative risk to the wetland or riparian resources within the project site.

<u>Key mitigation measures which must be implemented include:</u>

- There should be a pre-activity walk-through of the drill sites in order to locate individuals of plant species of conservation concern. Scattered individuals of the protected Marula (*Sclerocarya birrea*) were found in the study area.
- A search and rescue exercise must be done to locate any translocatable protected species. They must be relocated to a suitable and similar habitat where these plants can grow without any further disturbance;
- In case specimens of Marula (*Sclerocarya birrea*) are found to be on a drill site it is recommended that the drill site should be relocated. If it is not possible to move the drill site, permits must be obtained from Department of Agriculture, Forestry and Fisheries (DAFF) to remove the Marula individuals. The applicant must apply for these permits in a phased manner as prospecting proceeds.
- Any fauna threatened by the drilling operation activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit (<30km/h) to avoid collisions with susceptible species such as snakes and tortoises as well as domestic animals.
- Trenches and deep excavations should not be left open for extended periods of time as fauna (including sheep, goats, cattle, etc.) may fall in and become trapped in them. Trenches which are exposed should contain soil ramps allowing fauna to escape the trench.
- Ensure that erosion management and sediment controls are strictly implemented from the beginning of site clearing activities, particularly as the soils in the study area are prone to erosion;
- All areas should be re-sloped and top-soiled where necessary and reseeded with indigenous grasses.
- Edge effects such as erosion must be strictly monitored and managed;
- Proliferation of alien and invasive species is expected within any disturbed areas particularly as there is a high degree of alien and invasive species presence. Especially the noxious Famine weed (*Parthenium hysterophorus*) – Category 1b) occurs widespread through the study area. These species should be eradicated and controlled to prevent further spread beyond the study area. Black wattle (*Acacia*

mearnsii) occurs along some of the drainage lines and in the riparian vegetation of the Mvamanzi River;

- It is suggested that an alien plant removal program be initialised within the study area in order to help reinstate more natural hydrological and ecological functions to within the project site;
- Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Care should be taken with the choice of herbicide (must be applied by a qualified pest control officer) to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
- Footprint areas should be kept as small as possible when removing alien plant species;
- No vehicles should be allowed to drive through designated sensitive drainage lines and riparian areas during the eradication of alien and weed species.
- Rehabilitation must ensure that riparian structure and function are reinstated in such a way as to ensure the ongoing functionality of the larger riparian systems at pre activity levels.
- Sensitivity maps have been developed for the study area, indicating the drainage lines and riparian systems, and their relevant buffer zones. It is recommended that this sensitivity map be considered during all phases of the prospecting phase, in order to aid in the conservation of and minimise impact on the riparian and aquatic habitat and resources within the study area;
- Rehabilitation must ensure that the floodplain wetland structure and function are reinstated in such a way as to ensure the ongoing functionality of the larger wetland systems at pre-activity levels.
- All prospecting footprint areas should remain as small as possible and should as far as possible not encroach into surrounding areas. It must be ensured that the riparian and drainage line systems, and their associated buffer zones are off-limits to vehicles and personnel;
- Any activities that take place within 32 meters of a wetland or watercourse or the 1:100 year flood lines will require authorisation in terms of the relevant regulations of NEMA, however as far as possible infrastructure should be placed outside of wetlands.
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Any areas where bank failure is observed, due to the prospecting impacts, should be immediately repaired;
- As far as possible the existing road network should be used, minimising the need to develop new access routes resulting in an increased impact on the local environment. Should temporary roads or access routes be necessary and unavoidable, proper planning must take place and the site sensitivity plan must be taken into consideration. If additional roads are required, then wherever feasible such roads should be constructed a distance from the more sensitive riparian areas and not directly adjacent thereto. If crossings are required they should cross the systems at right angles, as far as possible to minimise impacts in the receiving environment;
- The duration of impacts on the riverine and drainage line systems should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised;
- Appropriate sanitary facilities must be provided for the period of the prospecting activities and all waste removed to an appropriate waste facility (landfill);
- No informal fires should be permitted in within the study area;
- Ensure that an adequate number of rubbish bins are provided so as to prevent litter and ensure the proper disposal of waste generated during prospecting activities;
- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent entry of hydrocarbons into topsoil;

- All spills, should they occur, should be immediately cleaned up and treated accordingly.
- Ensure that as far as possible all infrastructure is placed outside of drainage lines and riparian areas and their respective buffer zones. Where this is not possible, prospecting footprints must be kept as small as possible and impacts must be minimized as far as possible.
- Stabilisation of banks by employing one of the individual techniques below or a combination thereof, is essential, given the inherent susceptibility of the soils to erosion. Such measures include:
    - Re-sloping of banks to a maximum of a 1:3 slope;
    - Revegetation of re-profiled slopes;
    - Temporary stabilisation of slopes using geotextiles; and
    - Installation of gabions and reno-mattresses.
    - To prevent the further erosion of soils, management measures may include berms, soil traps, hessian curtains and storm water diversion away from areas particularly susceptible to erosion;
- Install erosion berms during prospecting to prevent gully formation:
    - Berms every 50m should be installed where any disturbed soils have a slope of less than 2%,
    - Berms every 25m where the track slopes between 2% and 10%,
    - Berms every 20m where the track slopes between 10% and 15% and
    - Berms every 10m where the track slope is greater than 15%;
- Sheet runoff from access roads should be slowed down by the strategic placement of berms and sandbags;
- All soils compacted as a result of prospecting activities falling outside of project areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat;
- As far as possible, all rehabilitation activities should occur in the low flow season, during the drier winter months.
- All alien vegetation in the riparian zones should be removed upon completion of prospecting activities and reseeded with indigenous grasses as specified by a suitably qualified specialist (ecologist);
- All areas affected by the drilling operations should be rehabilitated upon closure of the prospecting phase.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ANNEXURES

LIST OF TABLES

GLOSSARY OF TERMS

Alien vegetation: Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.

Alluvial soil: A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.

Base flow: Long-term flow in a river that continues after storm flow has passed. Biodiversity The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.

Buffer: A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.

Catchment: The area contributing to runoff at a particular point in a river system.

Chroma: The relative purity of the spectral colour which decreases with increasing greyness.

Delineation (of a wetland): To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.

Ecoregion: An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".

Ephemeral stream: A stream that has transitory or short-lived flow.

Facultative wetland species: Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas.

Fluvial: Resulting from water movement.

Gleying: A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.

Groundwater: Subsurface water in the saturated zone below the water table.

Hydromorphic soil: A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils).

Hydrology: The study of the occurrence, distribution and movement of water over, on and under the land surface.

Hydromorphy: A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.

Hydrophyte: Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.

Intermittent flow: Flows only for short periods.

Indigenous vegetation: Vegetation occurring naturally within a defined area.

Mottles: Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.

Obligate wetland species: Species almost always found in wetlands (>99% of occurrences).

Perched water table: The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater.

Perennial: Flows all year round.

RAMSAR: The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.

RDL (Red Data listed) species: Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.

Seasonal zone of wetness: The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface.

Temporary zone of wetness: the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year.

Indigenous vegetation: Vegetation occurring naturally within a defined area

Riparian system: Riparian wetlands are recognised as boundaries between the terrestrial and riverine systems

Ecoregion: An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region

LIST OF ACRONYMS

DMEC: Desired Ecological Management Class

DWS: Department of Water Affairs and Sanitation

EIA: Environmental Impact Assessment

EIS: Ecological Importance and Sensitivity

EMC: Ecological Management Class

EAP Environmental Assessment Practitioner

FEPA: Fresh Water Priority Areas

GIS: Geographic Information System

GPS: Global Positioning System

Ha: Hectares

HGM: Hydro-geomorphic

m Metres

mm Millimetres

NEMA: National Environmental Management Act

PEMC: Present Ecological Management Class

PES: Present Ecological State

REC: Recommended Ecological Category

RHP: River Health Program

SANBI: South African National Biodiversity Institute

SASS: South African Scoring System

1. INTRODUCTION

EnviroNiche Consulting has been appointed by **Greenmined (Pty) Ltd** to conduct an ecological impact and wetland assessment of the project site as part of an impact assessment process to obtain environmental authorisation for the proposed right to prospect for coal, pseudocoal, tobanite, clay and aggregate on the Fuleni reserve 14375 UG, Mtubatuba area, KwaZulu-Natal Province .

1.1. Scope

The following was to be provided / undertaken:

Terrestrial assessment:

- A brief discussion, using available literature, on the vegetation type in which the broader study area and project site is situated in order to place the study in context.
- A broad-scale map of the vegetation and land cover of the project site using available aerial photography. A description of the dominant and characteristic species within the broad-scale plant communities comprising each of these units was to be provided. This was to cover the entire project site.
- List of all plant species recorded during the survey.
- A list of Red List plant species previously recorded within the quarter degree grids in which the study area and project site is situated, obtained from the relevant authorities.
- List of naturalised plant species recorded on the project site, indicating which are declared weeds or alien invasive species, according to the *National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014*.
- Identification of sensitive habitats and plant communities. A map of sensitive areas within the project site was to be provided.

A detailed investigation into the status of the vegetation located within the project site was undertaken, including:

- Assessment of the natural vegetation;
- General floristic diversity;
- Habitat suitability for Red Data flora species;
- Potential presence of Red Data flora species;
- Potential presence of sensitive ecosystems

Wetland and riparian resource assessment:

- To identify Management Units within the study area according to Hydro-geomorphic (HGM) units following the guidelines in the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013);
- To delineate all wetland and riparian zones within the project site, as well as within a 500m buffer zone of the proposed activity, according to the guidelines as defined by (DWA, 2005);

- Determine function and service provision of wetland and riparian features according to the method supplied by Kotze *et al*. (2005);
- To define the health of the systems within the study area according to the Wetland Index of Habitat Integrity according to the method described by the DWA (2007) and thereby define the Present Ecological State (PES) of the aquatic resources to be affected by the proposed development;
- To define the Ecological Importance and Sensitivity (EIS) and Recommended Ecological Category (REC) for the features (DWA, 1999);
- To consider potential impacts on the wetland and riparian habitat and the ecological communities likely as a result of the proposed development;
- To present management and mitigation measures in order to minimise the impact on the receiving environment should the proposed project proceed.

1.2 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The riparian zone and wetland delineations as presented in this report are regarded as a best estimate of the riparian / wetland boundaries based on the site conditions present at the time of assessment. Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies, due to the use of handheld GPS instrumentation, may occur. If more accurate assessments are required the riparian zones and ephemeral drainage line features will need to be surveyed and pegged according to surveying principles. The delineations are however deemed sufficiently accurate to ensure that the wetland and riparian resources are adequately protected if the management and mitigation measures of this report are adhered to and adequate buffers are implemented;
- Due to the extent of the study area, use was made of aerial photographs, digital satellite imagery as well as provincial and national wetland databases to identify areas of interest prior to the field survey. Any additional wetland areas, watercourses and drainage lines noted during the field survey were also assessed and added to the number of survey points. Although all possible measures were undertaken to ensure all wetland features, riparian zones and drainage lines (watercourses) were assessed and delineated, some smaller marginal features may have been overlooked that are not to be directly impacted by the proposed prospecting activity.
- Wetlands and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative wetland species. Within this transition zone some variation of opinion on the wetland boundary may occur, however, if the DWA (2005) and DWAF (2008) method is followed, all assessors should get largely similar results; and
- Aquatic, wetland and riparian ecosystems are dynamic and complex. Some aspects of the ecology of these systems, some of which may be important, may have been overlooked. The wetland data presented in this report are based on a single site visit, undertaken in June 2018, at a time when low flows were being experienced. The effects of natural seasonal and long-term variation in the ecological conditions are therefore unknown.

1.3. Legislative framework

Acts such as those listed below (Table 1.3.1); ensure the protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment. It also ensures the protection of the environment against disturbance, deterioration, defacement or destruction as a result of man-made structures, installations, processes or products or human activities.

Table 1.3.1: List of relevant legislation

Title of legislation, policy or guideline	**Applicability to the project**	**Administering authority**	**Date**
National Environmental Management Act, No. 107 of 1998 (NEMA), as amended & NEMA EIA Regulations, 2014: GN544, published in Government Gazette 33306 in 2014	An EIA report (EIAr) is required for this project	Department of Minerals Resources (DMR)	2014
National Environmental Management: Biodiversity Act (10/2004): Amendments, 2014	Protected species may occur on site	Department of Minerals Resources (DMR)	2014
National Water Act, No. 36 of 1998	The proposed development may trigger a section 21(C and/or i) water use.	Department of Water and Sanitation (DWS)	1998
KwaZulu-Natal Nature Conservation Ordinance (No 15 of 1974)	Protected species could occur on the proposed sites	Ezemvelo KZN Wildlife	1974
KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (No 5 of 1999)	Protected trees could occur on the proposed sites	Ezemvelo KZN Wildlife	1999
National Forests Act (Act 84 of 1998)	Protected trees could occur on the proposed sites	Department of Agriculture, Forestry and Fisheries (DAFF)	1998
Mineral And Petroleum Resources Development Act (MPRDA) (Act 28 of 2002)	Regulates the prospecting and mining of minerals	Department of Mineral Resources (DMR)	2002

2. STUDY APPROACH AND METHODOLOGY

Date of fieldwork: June 2018.

2.1 Terrestrial vegetation survey

2.1.1 Literature Review

- Satellite imagery (Google Earth photos) and
- 1:50 000 topographic maps were used to find features within the project site.
- VEGMAP data was consulted to determine vegetation types in the vicinity of the project site

Quantitative data was collected in each quadrat by undertaking vegetation sampling according to the Braun-Blanquet approach (Mueller-Dombois & Ellenberg 1974; Westhoff & van der Maarel 1978). In each sample site the following data was collected:

Habitat data:

- amount of bare soil;
- rock cover;
- slope;
- aspect in degrees;
- latitude and longitude position (from GPS) in decimal degrees;
- presence of biotic disturbances, e.g. grazing, animal burrows, etc.

Vegetation data

- species present;
- cover estimation of each species according to the Braun-Blanquet scale;
- vegetation height.

Data analysis

- The plant communities that were identified were described using the vegetation sample data.
- Additional checklists of plant species were compiled by traversing the project site on foot and recording species as they were encountered. Plant names follow those of POSA (2015).
- All exotic species categorised as alien invaders or weeds as listed in the *National Environmental Management: Biodiversity Act (10/2004): Alien and Invasive Species Regulations, 2014* were also recorded.

Due to the brief duration of the survey, the species list provided for the project site cannot be regarded as comprehensive, but is nevertheless likely to include the majority of the dominant and common species present.

2.1.1.1 Red Data plant species

A list of species collected within the quarter degree squares **2831BD, 2831DB & 2832AC** are listed (Annexures B) together with the species noted during the site visit (Tables 4.1. 4.2, 4.3 & 4.4). For all threatened plants that occur in the general geographical area of the project site, a rating of the likelihood of it occurring within the project site is given as follows:

- LOW: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- MEDIUM: habitats on site match the general habitat description for species (e.g. grassland), but detailed microhabitat requirements (e.g. rocky grassland on shallow soils overlying dolomite or dolerite) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- HIGH: habitats found on site match very strongly the general and microhabitat description for the species (e.g. rocky grassland on shallow soils overlying granite);
- DEFINITE: species found on site.

2.1.1.2 Impact rating methodology

Direct, indirect and cumulative impacts of the issues identified in the EIA phase must be assessed in terms of the following criteria:

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

The significance is calculated by combining the criteria in the following formula:

$S=(E+D+M)P$
S = Significance weighting
E = Extent
D = Duration
M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
- 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

2.2 Method of wetland and riparian resource assessment:

2.2.1 Literature Review

A desktop study was compiled with all relevant information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Wetland specific information resources taken into consideration during the desktop assessment of the study area included:

- National Freshwater Ecosystem Priority Areas (NFEPAs, 2011)
- NFEPA water management area (WMA)
- FEPA (sub)WMA % area
- Sub water catchment area FEPAs
- Water management area FEPAs
- Fish sanctuaries
- Wetland ecosystem types
- Threatened Terrestrial Ecosystems for South Africa (2009)
- National Protected Area Expansion Strategy (2011)
- Northern Cape Biodiversity Sector Plan (2015)

2.2.1.1 National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present within the study area.

2.2.1.2 Classification System for Wetlands and other Aquatic Ecosystems in South Africa

All wetland or riparian features encountered within the study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems, hereafter referred to as the "classification system" (Ollis *et al.*, 2013). A summary of Levels 1 to 4 of the classification system are presented in Table 2.1 and 2.2, below:

Table 2.1: Proposed classification structure for inland systems (Level - 3).

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table 2.2: Proposed classification structure for inland systems (Level - 4).

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

a) Level 1: Inland systems

From the classification system, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically.

b) Level 2: Ecoregions

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.*, 2005)(Fig 2.1).

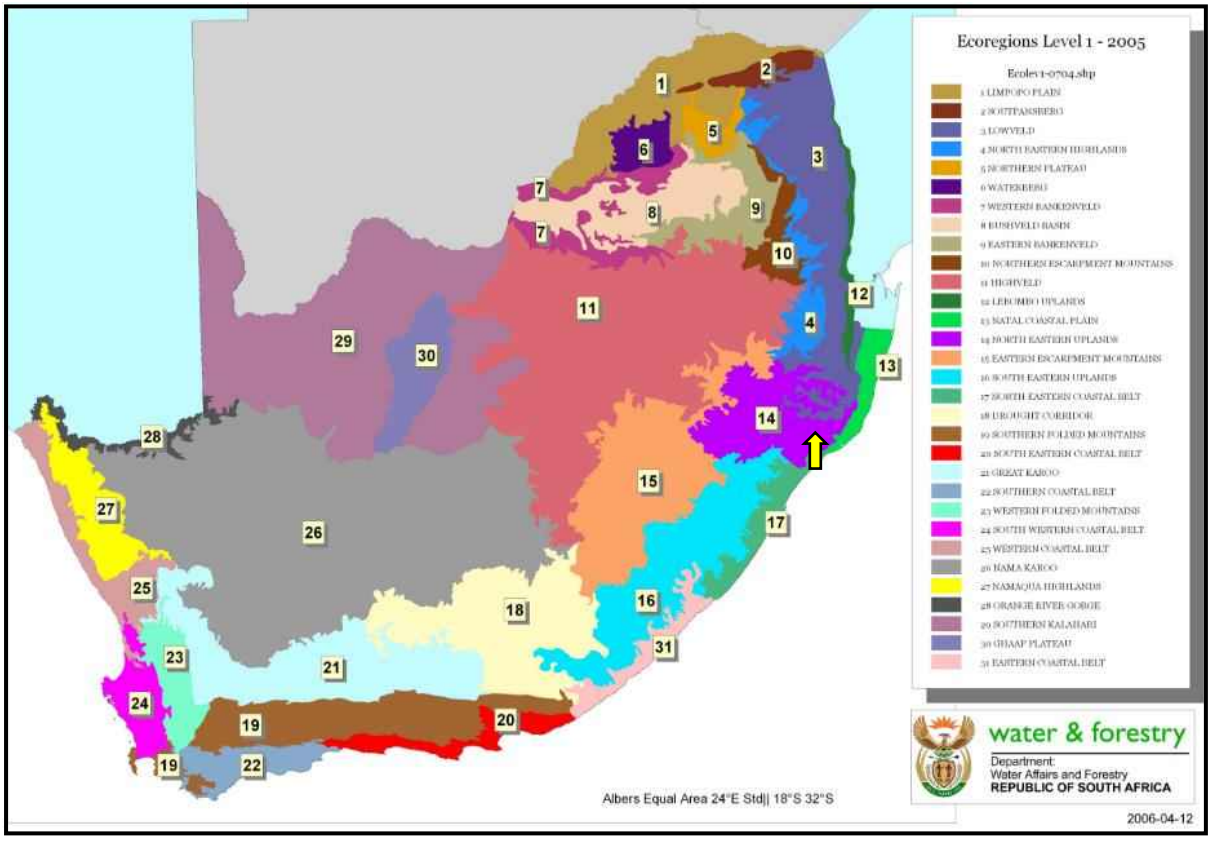


Figure 2.1: There are a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. Yellow arrow indicates project site's location.

b) Level 2: NFEPA Wet Veg Groups

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the NFEPA project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting Bioregions into smaller groups through expert input (Nel *et al.,* 2011). There are currently 133 NFEPA WetVeg Groups.

c) Level 3: Landscape Setting

At Level 3 of the proposed classification System, for Inland Systems, a distinction is made between four Landscape Units (Table 2.3) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope**: a stretch of ground on an incline that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley.
- **Valley floor**: The base of a valley, situated between two distinct valley side-slopes.
- **Plain**: an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.
- **Bench (hilltop/saddle/shelf)**: an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

d) Level 4: Hydrogeomorphic Units

Eight primary HGM Types are recognised for Inland Systems at Level 4A of the classification system (Table 2.2), on the basis of hydrology and geomorphology (Ollis et al., 2013), namely:

- **River**: a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.
- **Channelled valley-bottom wetland**: a valley-bottom wetland with a river channel running through it.
- **Unchannelled valley-bottom wetland**: a valley-bottom wetland without a river channel running through it.
- **Floodplain wetland**: the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank.
- **Depression**: a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat**: a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat
- **Seep**: a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

2.2.1.3 Riparian Vegetation Response Assessment Index (VEGRAI)

Riparian vegetation is described in the NWA (Act No 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.

The Riparian Vegetation Response Assessment Index (VEGRAI) is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results. Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Table 2.3: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

2.2.1.4 Index of Habitat Integrity (IHI)

To assess the PES of the wetland and riparian features, the IHI for South African floodplain and channelled valley bottom wetland types (Department of Water Affairs and Forestry Resource Quality Services, 2007) was used.

The WETLAND-IHI is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The WETLAND-IHI has been developed to allow the NAEHMP to include floodplain and channelled valley bottom wetland types to be assessed. The output scores from the WETLAND-IHI model are presented in A-F ecological categories (Table 2.3), and provide a score of the PES of the habitat integrity of the riparian system being examined.

Table 2.4: Descriptions of the A-F ecological categories.

HABITAT INTEGRITY CATEGORY	DESCRIPTION	RATING (% OF TOTAL)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

2.2.1.5 WET-Health Assessment

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing promote their conservation and sensible management. Within the project site, the WET-Health of the floodplain wetland features was assessed.

a) Level of assessment

Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site assessment. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

b) Framework for the Assessment

A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments:

- hydrology (water inputs, distribution and retention, and outputs),
- geomorphology (sediment inputs, retention and outputs) and
- vegetation (transformation and presence of introduced alien species).

c) Units of Assessment

Central to WET-Health is the characterisation of HGM Units, which have been defined based on:

- geomorphic setting (e.g. hillslope or valley-bottom and whether drainage is open or closed),
- water source (surface water dominated or sub-surface water dominated) and
- pattern of water flow through the wetland unit (diffusely or channelled) as described in Section 2.2.1.3.

d) Quantification of Present State of a Wetland

The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial extent of impact of individual activities and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The impact scores and Present State categories are provided in the table below.

Table 2.5: Impact scores and categories of Present State used by WET-Health for describing the integrity of the wetland.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

e) Assessing the Anticipated Trajectory of Change

As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (Table 2.6).

Table 2.6: Trajectory of change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

f) Overall Health of the Wetland

Once all HGM Units have been assessed, a summary of health for the wetland as a whole needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM Unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provides a summary of impacts, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

2.2.1.6 Riparian and Wetland Function Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class". The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al*. (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation
- Stream flow regulation
- Sediment trapping
- Phosphate trapping
- Nitrate removal
- Toxicant removal
- Erosion control
- Carbon storage
- Maintenance of biodiversity
- Water supply for human use
- Natural resources
- Cultivated foods
- Cultural significance
- Tourism and recreation
- Education and research

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the wetland.

Table 2.7: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

2.2.1.7 Ecological Importance and Sensitivity (EIS)

The method used for the EIS determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 2.8 below.

Table 2.8: Descriptions of the EIS categories.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

2.2.1.8 Recommended Ecological Category

“A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability, but carries a higher risk of ecosystem failure.”

The Recommended Ecological Category **(**REC) (Table 2.9) was determined based on the results obtained from the PES, reference conditions and EIS of the resource (sections above). Followed by realistic recommendations, mitigation, and rehabilitation measures to achieve the desired REC.

A wetland may receive the same class for the PES as the REC if the wetland is deemed in good condition, and therefore must stay in good condition.

Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the wetland feature.

Table 2.9: Descriptions of the REC categories.

EIS Category	Range of Mean	Recommended Ecological Management Class[5]
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

2.2.1.9 Wetland and Riparian Resource Delineation

For the purposes of this investigation, a wetland is defined in the National Water Act (1998) as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

The wetland zone delineation took place according to the method presented in the DWAF (2005) document “A practical field procedure for identification and delineation of wetlands and riparian areas. An updated draft version of this report is also available and was therefore also considered during the wetland delineation (DWAF, 2008). The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The position in the landscape, which will help identify those parts of the landscape where wetlands are more likely to occur;
- The type of soil form (i.e. the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types;
- The presence of wetland vegetation species; and
- The presence of redoxymorphic soil feature, which are morphological signatures that appear in soils with prolonged periods of saturation.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWAF, 2005 and 2008). Riparian and wetland zones can be divided into three zones (DWAF, 2005):

- The permanent zone of wetness is nearly always saturated.
- The seasonal zone is saturated for a significant periods of wetness (at least three months of saturation per annum) and
- the temporary zone surrounds the seasonal zone and is only saturated for a short period of saturation (typically less than three months of saturation per annum), but is

saturated for a sufficient period, under normal circumstances, to allow for the formation of hydromorphic soils and the growth of wetland vegetation.

The object of this study was to identify the outer boundary of the temporary zone and then to identify a suitable buffer zone around the wetland / riparian area.

2.2.1.10 Ecological Impact Assessment Methodology

In order for the EAP or specialist to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/ impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/ impacts have been assessed. The method to be used for assessing risks/ impacts is outlined in the sections below.

The following parameters are used to describe the impact/issues in this assessment:

1. Nature

This is a brief written statement of the environmental aspect being impacted upon by a particular action or activity.

2. Extent (E)

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

- Site (1) – Within the project site,
- Local (2) – Within a radius of 2km of the project site,
- Regional (3) – the scale applies to impacts on a provincial level and parts of neighbouring provinces,
- National (4) – the scale applies to impacts that will affect the whole of South Africa.

3. Duration (D)

Duration indicates what the lifetime of the impact will be.

- Short-term (1) – less than 5 years,
- Medium-term (2) – between 5 and 15 years,
- Long-term (3) – between 15 and 30 years,
- Permanent (4) – over 30 years and resulting in a permanent and lasting change that will always be there.

4. Intensity (I) Intensity describes whether an impact id destructive or benign.

- Very high (4) – Natural, cultural and social functions and processes are altered to an extent that they permanently cease,
- High (3) – Natural, cultural and social functions and processes are altered to an extent that they temporarily cease,
- Moderate (2) – Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way,
- Low (1) – Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.

5. Probability (P)

Probability describes the likelihood of an impact actually occurring.

- Improbable (1) – Likelihood of the impact materializing is very low,
- Possible (2) – Most likely that the impact will occur,
- Highly probable (3) – Most likely that the impact will occur,
- Definite (4) – Impact will certainly occur.

6. Cumulative (C)

In relation to an activity, means the impact of an activity that in itself 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.

7. Significance (S)

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

a) Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- Mitigation and performance improvement measures and actions that address the risks and impacts are identified and described in as much detail as possible;
- Measures and actions to address negative impacts will favour avoidance and prevention over minimization, mitigation or compensation;
- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation.

b) Sensitivity Mapping

All the ecological features of the study area were considered and sensitive areas were delineated with the use of a Global Positioning System (GPS). The sensitivity map should guide the design and layout of the proposed development.

c) Recommendations

Recommendations address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through prospecting, operation and closure through to after care and maintenance.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Description of the broader study area and project site

3.1.1 Location

The project site is on the Fuleni reserve 14375 UG, Mtubatuba area, KwaZulu-Natal Province (Figures 3.1, 3.2 and 3.3). The project site falls within the quarter degree squares **2831BD, 2831DB & 2832AC**

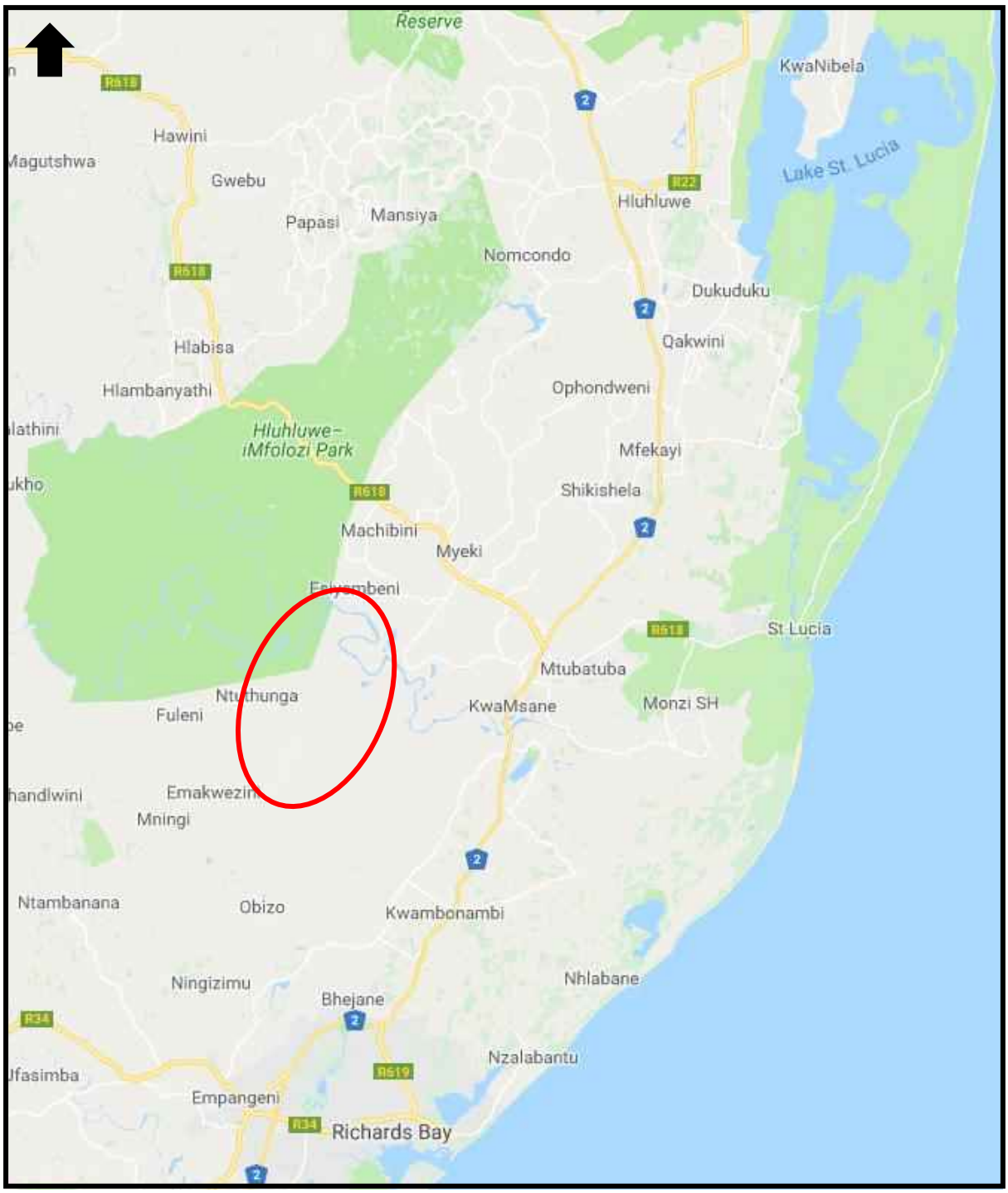


Figure 3.1: Locality map of the project site area (red polygon) in relation to the region (after Map Data AfriGIS (Pty) Ltd).

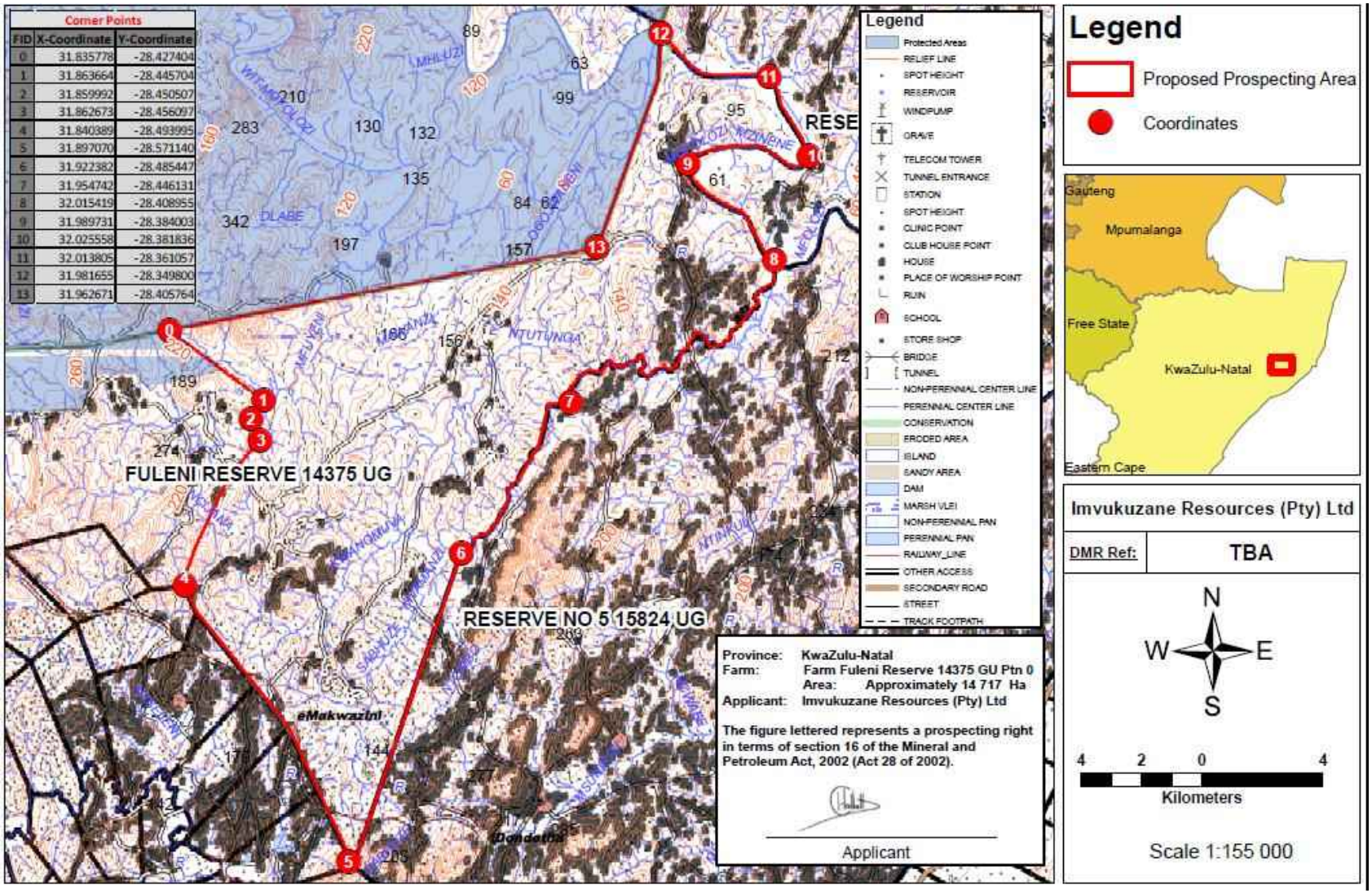


Figure 3.2: A topographic map of project sites (red polygon)(Imvukazane Resources (Pty)Ltd).

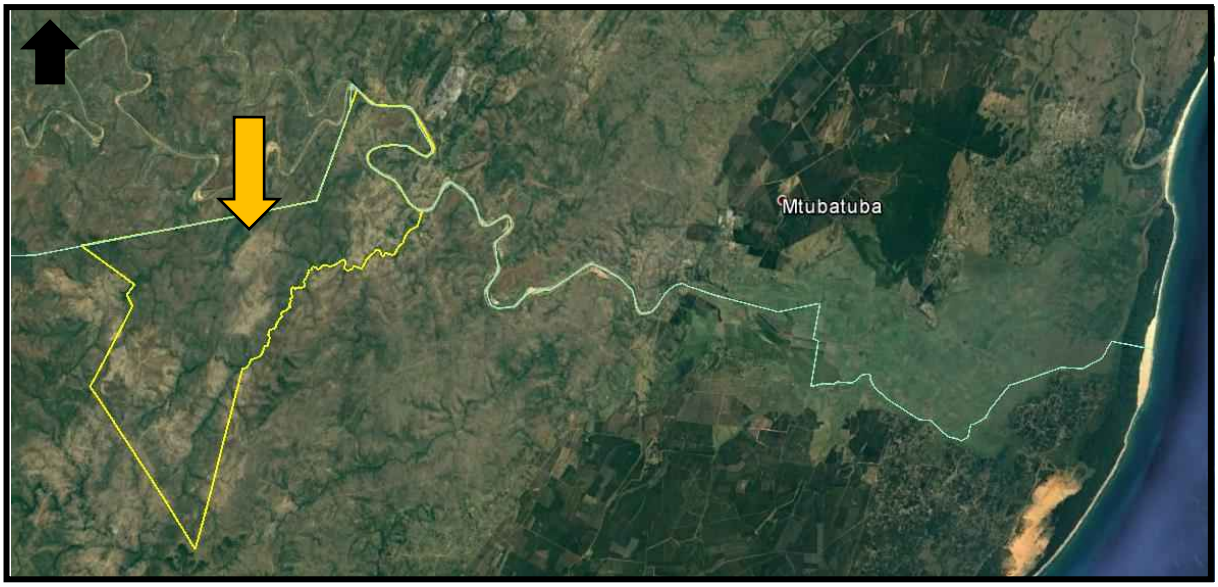


Figure 3.3: A satellite image of the project site (yellow polygon)(orange arrow)(Google Earth).

3.1.2 Topography

The topography of the landscape is undulating with dolerite – capped hills and deep drainage lines. The landscape is drained by the tributaries of the Mvamanzi and Umflolozi Rivers.

3.1.3 Geology & soils

The geology consists of sedimentary layers (mud and sandstones) of the Dwyka, Ecca and Beaufort Groups of the Karoo Supergroup. The soils varies from shallow Mispa and Glenrosa soil form on crests and upper slopes of hills to deep dark clayey deposits of the Arcadia and Rensburg soil forms in the low-lying areas (MacVicar *et al.* 1974).

3.1.4 Climate (Rainfall & temperatures)

The area receives summer rainfall and is approximately 795 mm per annum. The mean annual temperature is 18.8°C (Mucina & Rutherford, 2006).

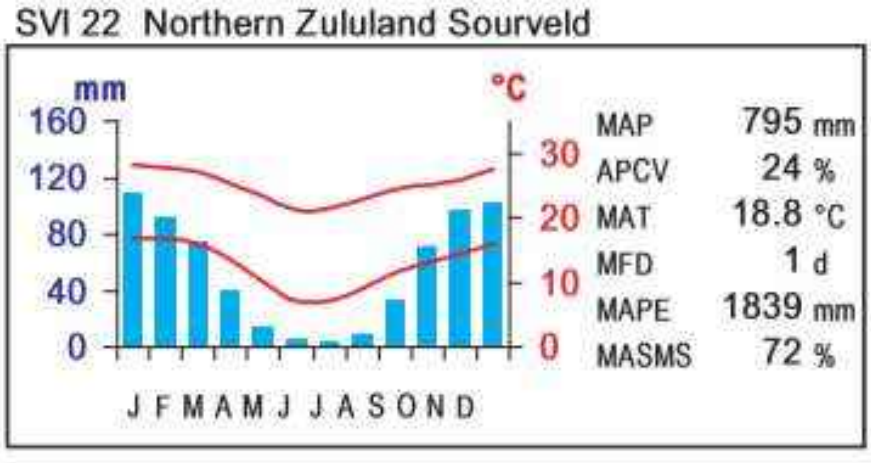


Figure 3.4: A climate-diagram of the Northern Zululand Sourveld vegetation type (Mucina & Rutherford, 2006).

3.1.5 Land use & land cover

The project site is situated in a tribal area where a subsistence agricultural system exists. Most of the arable land is used for crop production, mainly for private use. The natural veld is used as grazing for mainly goats, but also sheep and cattle. Large areas in and around the various village are in a degraded state due to agricultural practices.

3.1.6 Broad vegetation types

The most recent description of the broader study area's vegetation is the general description by Mucina & Rutherford (2006) relating to the vegetation which is considered to be the "Vegetation of South Africa, Lesotho and Swaziland" as well as its accompanying map of the country by (Mucina *et al.*, 2005). This memoir contains species information and a comprehensive conservation assessment of all vegetation types.

Four vegetation types are present at or near the project site. The project site is covered by savanna vegetation of which the Northern Zululand Sourveld (SVI 22), Zululand Lowveld (SVI 23) cover the largest portion on the crests and slopes of the hills. Zululand Coastal Thornveld (SVI 24) is limited to the low-lying areas near the Mvamanzi and Umfolozi Rivers (Mucina & Rutherford, 2006). Although not mapped in Figure 3.5, a small isolated pocket of the Eastern Escarp Forests (FOz 5) occurs on the eastern slopes of Mduba Peak on the border with the Hluhluwe-Umfolozi Park. Another pocket of forest (mapped by Mucina & Rutherford, (2006)) is situated just outside the project site in the Somopho community Nature Reserve.

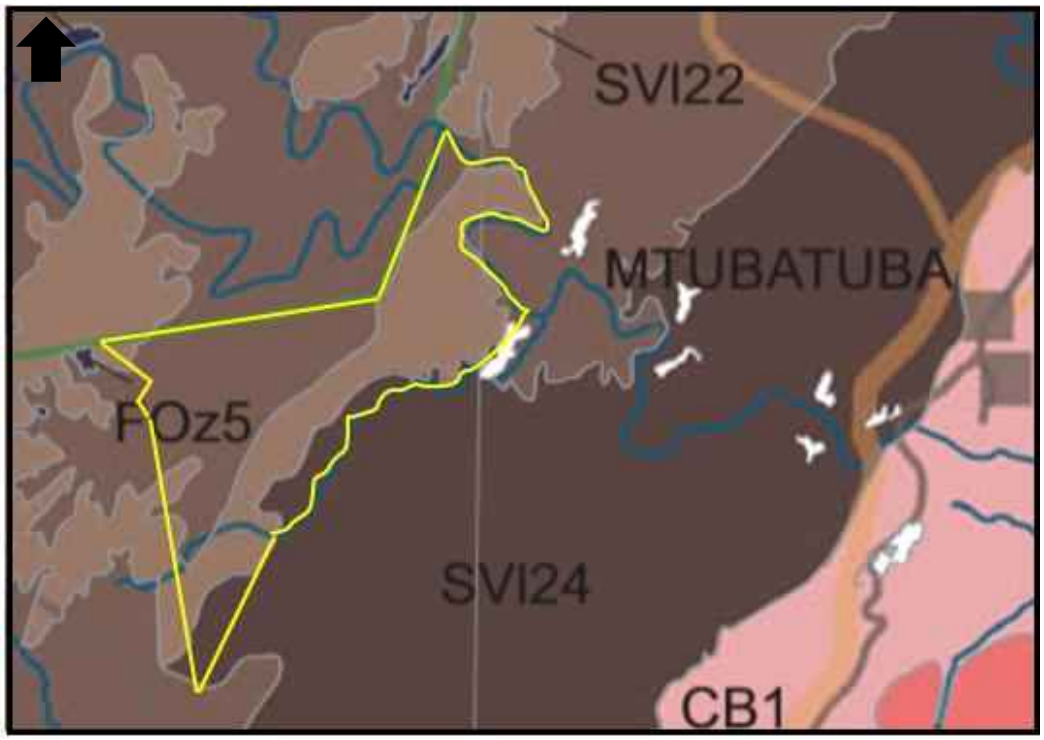


Figure 3.5: The vegetation map of the project site (yellow polygon) and the surrounding area.

- Light brown areas represent the Zululand Lowveld (SVI 23)
- Dark brown areas represent the Northern Zululand Sourveld (SVI 22)
- Very brown areas represent the Zululand Coastal Thornveld (SVI 24)
- Purple dot represents the Eastern Escarp Forests (FOz 5)
- The white dots are freshwater systems (Mucina & Rutherford, 2006).

3.1.7 Conservation status of broad vegetation types

The vegetation types of South Africa have been classified according to their conservation status which is, in turn, assessed according to the degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in the table below, as determined by best available scientific approaches (Driver *et al.* 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver *et al.* 2005).

Table 3.1: Determining ecosystem status (from Driver *et al.* 2005). *BT = biodiversity target (the minimum conservation requirement.

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Threatened ecosystems which are in need of protection (GN1002 of 2011), was published under the National Environment Management: Biodiversity Act (Act No. 10 of 2004). It lists national vegetation types that are afforded protection on the basis of rates of transformation. The threshold for listing in this legislation is higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature.

Table 3.2: Conservation status of the vegetation type occurring in and around the study area according to Rutherford & Mucina (2006).

Vegetation Type	**Target (%)**	**Conserved (%)**	**Transformed (%)**	**Conservation Status** Driver et al., 2005; Mucina & Rutherford, 2006
Northern Zululand Sourveld (SVI 22)	19%	4%	22%	Vulnerable
Zululand Lowveld (SVI 23)	19%	11%	26%	Vulnerable
Zululand Coastal Thornveld (SVI 24)	19%	0%	58%	Endangered
Eastern Escarp Forests (FOz 5)			Degraded in unprotected areas	Vulnerable

3.1.8 Ecoregions

Ecoregion: North Eastern Uplands (Fig 2.1). Main attributes: Table 3.3.

Table 3.3: Summary of the main attributes of the North Eastern Uplands Ecoregion

Main Attributes	North Eastern Uplands
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Moderate Relief (limited); **Lowlands; Hills and Mountains; Moderate and High Relief;** Open Hills; Lowlands; Mountains; Moderate to High Relief; **Closed Hills; Mountains; Moderate and High Relief**
Vegetation types (dominant types in bold) (Secondary)	Natal Lowveld Bushveld (limited); **Natal Central Bushveld;** Coast Hinterland Bushveld; Coastal Bushveld/Grassland; **Valley Thicket;** Short Mistbelt Grassland; North Eastern Mountain Grassland; Moist Upland Grassland Patches Afromontane Forest
Altitude (m a.m.s.l) (modifying)	0-100 (limited), 100-1500
MAP (mm) (modifying)	600 to 1000
Coefficient of Variation (% of annual precipitation)	<20 to 30
Rainfall concentration index	15 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (°C)	14 to >22
Mean daily max. temp. (°C): February	20 to 30
Mean daily max. temp. (°C): July	16 to >24
Mean daily min. temp. (°C): February	12 to >20
Mean daily min temp. (°C): July	0 to >10
Median annual simulated runoff (mm) for quaternary catchment	40 to 250; >250 (limited)

The study area falls within the Mfolozi sub-water management area.

3.2 National Freshwater Priority Areas (NFEPA)

The FEPA database was consulted with regards to wetland areas and river systems in close proximity to or traversed by the project site that may be of ecological importance. Aspects applicable to the study area are discussed below:

- The study area falls within the North Eastern Uplands Aquatic Ecoregion:
- According to the NFEPA database the study area falls within Usuto to Umhlathuze Water Management Area (WMA), and the subWMA indicated for the study area is the Mfolozi sub-water management area;
- The subWMA is not regarded important in terms of fish sanctuaries, rehabilitation or corridors;
- The subWMA is not considered important in terms of translocation and relocation zones for fish;
- The subWMA is not listed as a fish FEPA;
- The NFEPA database indicates that there are no depressions (pans) present within the project site;
- The NFEPA database indicates that there are floodplain wetlands and valley-bottom wetlands present within the project site;
- The NFEPA database indicates that there are no RAMSAR wetlands within the study area or within 500m of the study area;

3.3 National List of Threatened Terrestrial Ecosystems for South Africa (2011)

The National Environmental Management: Biodiversity Act (Act 10 of 2004)(NEMBA) provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, BGIS). The National threatened ecosystem classification is based on Mucina & Rutherford's map.

A small pocket of Eastern Escarp Forest is present in the project site and is listed according to the National List of Threatened Terrestrial Ecosystems (BGIS 2011)(Figure 3.6).

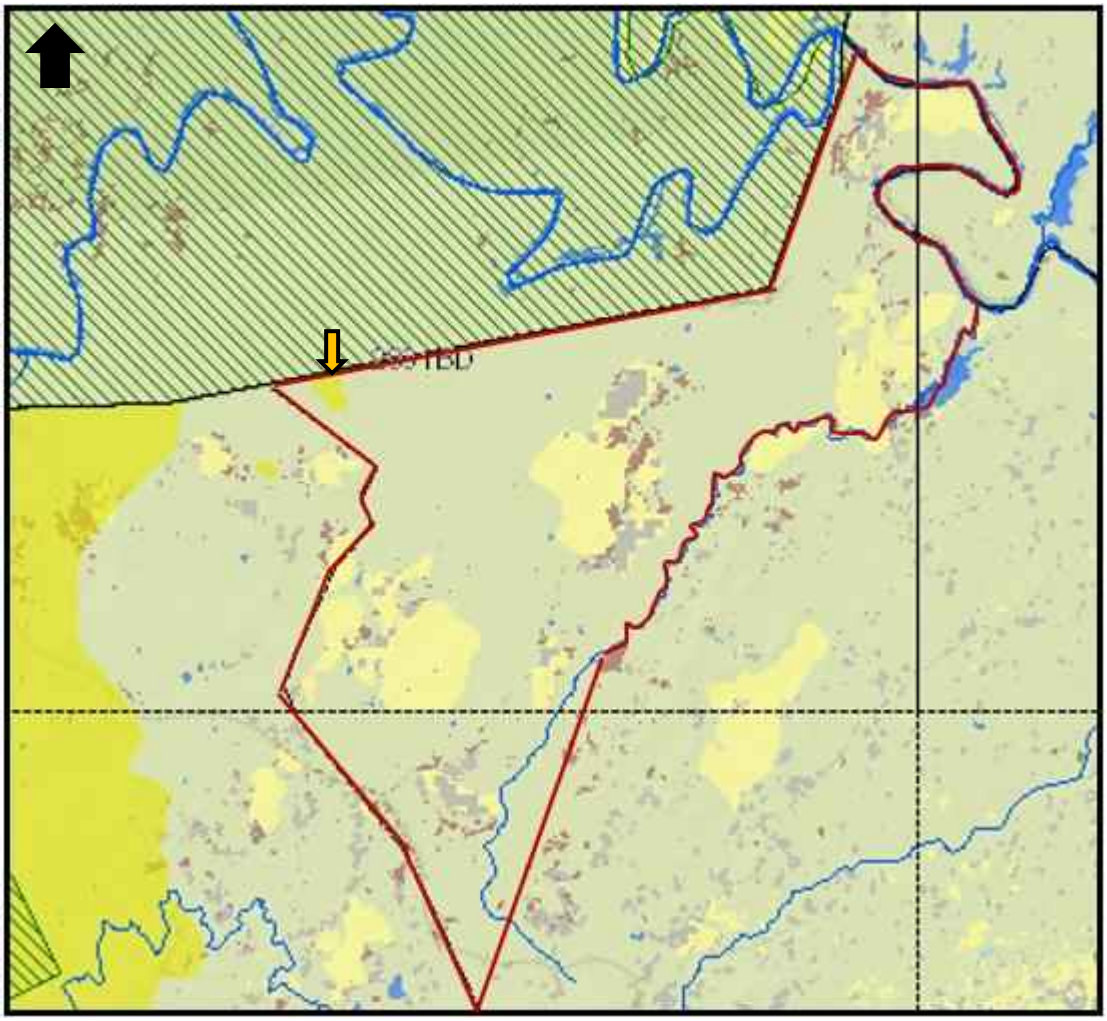


Figure 3.6: A map to the threatened ecosystems present in and around the project site. The dark yellow areas are listed threatened ecosystems. The orange arrow indicates a pocket of Eastern Escarp Forest present in the project area. The light yellow and grey areas indicate degraded areas in and around villages (BGIS 2011).

3.4 National Biodiversity Assessment (NBA, 2011)

The National Biodiversity Assessment (NBA) (2011) provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators such as ecosystem threat status and ecosystem protection level, and national maps for the terrestrial, freshwater, estuarine and marine environments.

3.5 KwaZulu-Natal Biodiversity Plan (2014)

3.5.1 Definitions and descriptions of Critical Biodiversity Areas of the Province

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. These form the key output of a systematic conservation assessment and are the biodiversity sectors inputs into multi-sectoral planning and decision making tools. The use of CBAs within the province follows the definition laid out in the guideline for publishing bioregional plans (Anon, 2008).

The identification and mapping of CBAs forms part of the biodiversity assessment of the province which will be used to inform the development of the Provincial Biodiversity Sector plans, bioregional plans, and also be used to inform Spatial Development Frameworks (SDFs), Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and in the Environmental Impact Assessment (EIA) process in the province.

Simply put, the purpose of the CBA is to indicate spatially the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which the province would like to keep this biodiversity. Therefore, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category based on the perceived impact of each activity on biodiversity pattern and process. According to the guidelines for bioregional plans, three basic CBA categories can be identified based on three high-level and management objectives (Table 3.4).

Table 3.4: Definitions and framework for linking CBAs to land-use planning and decision-making guidelines based on a set of high-level land biodiversity management objectives (Adapted from the guidelines for bioregional plans (Anon 2008)).

CBA category	**Land Management Objective**
Critical Biodiversity Areas (CBAs) Definition: CBAs are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses.	

Protected Areas (PA) & CBA 1	**Natural landscapes:** Ecosystems and species are fully intact and undisturbed. These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. These are landscapes that are at or past their limits of acceptable change.
CBA 2	**Near-natural landscapes:** Ecosystems and species are largely intact and undisturbed. Areas with intermediate irreplaceability or some flexibility in terms of the area required to meet biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve targets. These are landscapes that are approaching but have not passed their limits of acceptable change.
Ecological Support Areas (ESAs) Definition: ESAs are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of critical biodiversity areas and / or in delivering ecosystem services that support socio-economic development, such as water provision, food mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for critical biodiversity areas.	
ESA	**Functional landscapes:** Ecosystem is moderately to significantly disturb but still able to maintain basic functionality. Individual species or other biodiversity indicators may be severely disturbed or reduced. These are areas with a low irreplaceability with respect to biodiversity pattern targets only.
ONA (Other Natural Areas) and Transformed	Production landscapes: Manage land to optimisze sustainable utilisation of natural resources.

- According to the KwaZulu-Natal Biodiversity Plan (2014), the project area is not located within either a formal or an informal protected area although it borders the Somopho Community Nature Reserve as well as the Hluhluwe – Umfolozi Park. According to the KwaZulu-Natal Systematic Conservation Plan (2012) the irreplaceable Critical Biodiversity Areas)(category R1), the Critical Biodiversity Areas)(category R0) and the Aquatic Critical Biodiversity Areas)(category IGN) hve been earmarked as potential protected areas. The National Protected Area Expansion Strategy (NPAES)(BGIS 2010) also earmarked an area which borders the Hluhluwe – Umfolozi Park (Fig 3.7).

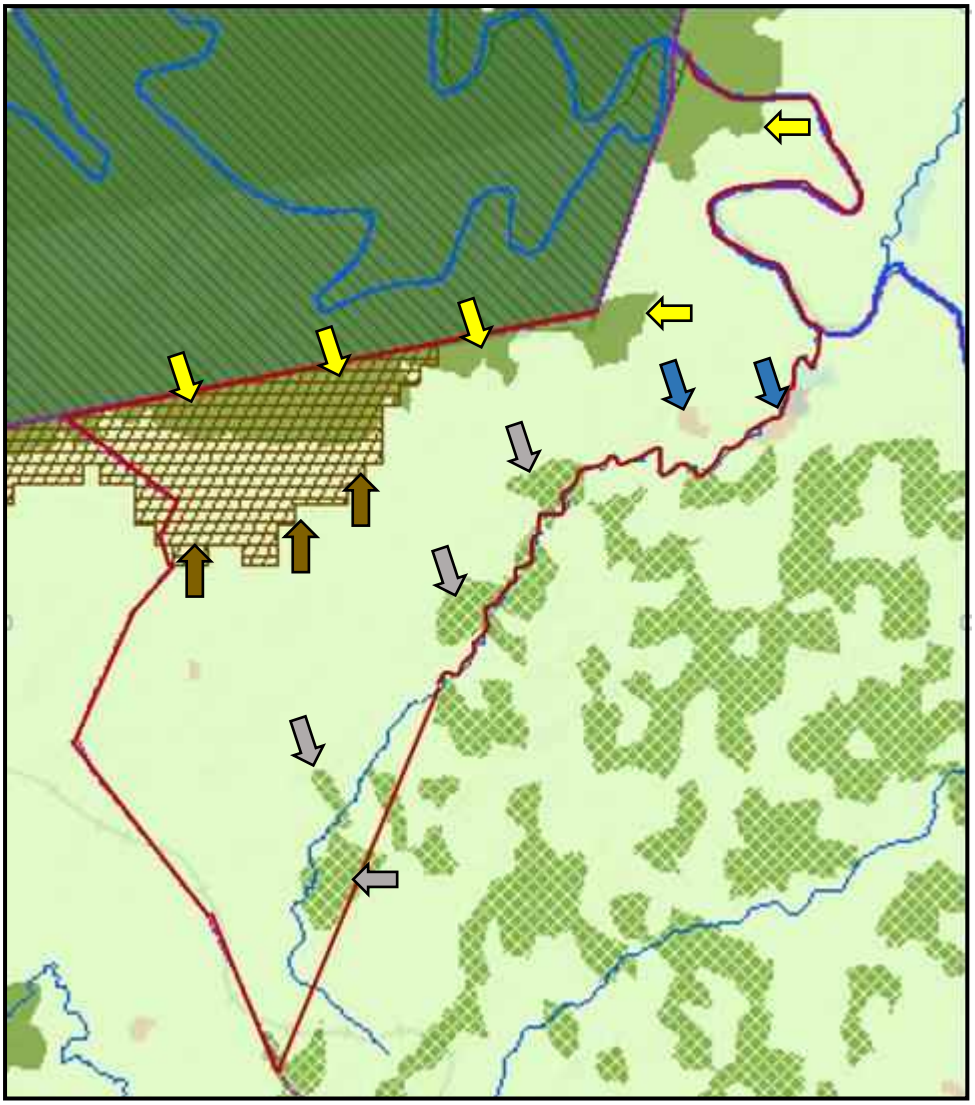


Figure 3.7: This map indicates planned protected areas as earmarked by the KwaZulu-Natal Systematic Conservation Plan (2012)(solid green areas = irreplaceable Critical Biodiversity Areas)(category R1)(Yellow arrows), the green areas with the light crosses are also Critical Biodiversity Areas)(category R0)(grey arrows) and the Aquatic Critical Biodiversity Areas)(category IGN)(blue arrows). The National Protected Area Expansion Strategy (NPAES)(BGIS 2010) earmarked a larger area which borders the Hluhluwe – Umfolozi Park (brown areas)(brown arrows).

4. RESULTS

4.1 Fine- scale vegetation description

A species list from POSA (http://posa.sanbi.org, Grid reference **2831BD, 2831DB & 2832AC** of the area was obtained. POSA generated species lists also contain updated Red Data species status according to the Red List of South African Plants published by SANBI in *Strelitzia* 25 (Raimondo *et al.* 2009, updated 2013). The protected and red data species that may potentially occur in the study area and project site have been marked (Annexure C).

4.1.1 Terrestrial vegetation

The project site consists of several high dolerite capped hills which are drained by numerous seasonal drainage lines creating an undulating landscape

Findings:

- The natural vegetation in and around the villages are in a highly degraded state. This is due to the communal grazing system applied in the project area;
- Small areas in the project area, especially away from the villages and along the seasonal drainage lines are in a relatively good condition;
- One protected species, in terms of the Forest Act (Act 84 of 1998), was noted in the project areas namely the Marula (*Sclerocarya birrea*).

Ecosystem function

- The natural ecosystem around the villages is in most cases in a low-moderate condition;
- The natural ecosystem away from the villages is in most cases in a moderate-good condition
- The savanna has areas of dense shrubland and grassland which provide nesting areas for avifauna and occasional shelter for terrestrial fauna;
- Niche habitats for fauna – providing sheltered burrows and nesting sites;
- Micro-climate is created by the shrubs housing species sensitive to direct sunlight or frost.

4.1.2 Vegetation community considerations

The floral community structure and composition throughout the project site, in both the terrestrial and wetland/riparian ecosystems, has under gone widespread transformation as a result of historical and current subsistence crop production, overgrazing by livestock, roads, and extensive alien vegetation invasion.

Two river systems drain the project site namely the Mvamanzi and Umfolozi Rivers. The Mvamanzi River drains into the Umfolozi River. Just before the confluence it forms a huge wetland system which is further upstream in the Mvamanzi a channelled valley-bottom wetland and closer to the confluence an unchannelled valley-bottom wetland. This wetland system is dominated by aquatic grasses and sedges. Both rivers are NFEPA – listed systems.

The entire landscape is drained by numerous seasonal drainage lines. Along these drainage lines are denser shrub and tree communities and is dominated by the Tamboti Tree (*Spirostachys africana*).

Ecosystem function

- Grass and sedges provide nesting areas for avifauna and occasional shelter for terrestrial fauna;
- Niche habitats for fauna – providing sheltered burrows and nesting sites;
- Micro-climate is created by the shrubs and trees housing species sensitive to direct sunlight or frost.

The following tables present the dominant floral species noted within each HGM type, although it should be noted that these lists are not an extensive listing of the floral species found within the study area.

Table 4.1: Dominant aquatic plant species noted in the Mvamanzi River and man-made dams * indicates exotic species.

Trees / shrubs	**Grasses / reeds**	**Forbs/sedges**
**Ipomoea carnea*	*Echinochloa holubii*	*Cyperus articulatus*
	Echinochloa pyramidalis	*Cyperus congestus*
	Leptochloa fusca	*Cyperus difformis*
	Phragmites mauritianus	*Cyperus indecorus*
	Typha capensis	*Cyperus marginatus*
	Leersia hexandra	*Cyperus sexangularis*
	Paspalum distichum	*Cyperus sphaerospermus*
		Mariscus solidus
		**Oenothera rosea*
		Persicaria lapathifolia
		Schoenoplectus confusus
		Schoenoplectus paludicola
		Schoenoplectus scirpoides
		Schoenoplectus senegalensis

Table 4.2: Dominant plant species noted within the riparian zone of drainage lines, Mvamanzi River and Umfolozi River. * indicates exotic species.

Colours relate as follow:

Threatened Status: Critically (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient (DDD), NE (NE)

- Protected according to National Forest Act 1998 / NFA (No 84 of 1998).
- Protected according to KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (No 5 of 1999)

Trees / shrubs	Grasses/reeds/bulrushes	Forbs
**Acacia mearnsii*	*Hyparhenia hirta*	**Achyranthes aspera*
Capparis tomentosa	*Hyparhenia tamba*	**Bidens pilosa*
Celtis africana	*Paspalum dilatatum*	**Tagetes minuta*
Canthium inerme	*Panicum maximum*	**Verbena bonariensis*
**Chromolaena odorata*	*Phragmites mauritianus*	**Verbena braziliensis*
Combretum erythrophyllum	*Typha capensis*	** Xanthium strumarium*
Dombeya cymosa	*Setaria incrassata*	
Gymnosporea senegalensis		
Grewia occidentalis		
Erythroxylum delagoense		
Euclea crispa		
Euclea divinorum		
Lycium acutifolium		
Ficus sycomorus		
**Lantana camara*		
**Melia azadarach*		
Phoenix reclinata		
**Psidium guajava*		
**Ricinus communis*		
**Schinus terebinthifolius*		
Searsia chirindensis		
**Senna didymobotrya*		
Sideroxylon inerme		
Solanum mauritianum		
Spirostachya africana		
Trichilia emetica		

Trema orientalis		
Vachellia [Acacia] natalitia		
Vachellia schweinfurthii		
Ziziphus mucronata		

Table 4.3: Dominant plant species noted within the terrestrial zone away from the drainage lines and riparian vegetation. * indicates exotic species.

Colours relate as follow:

Threatened Status: Critically (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient (DDD), NE (NE)

- Protected according to National Forest Act 1998 / NFA (No 84 of 1998).
- Protected according to KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (No 5 of 1999)

Trees / shrubs	**Grasses/reeds/bulrushes**	**Forbs**
Albizia adianthifolia	*Aristida congesta*	*Abutilon austro-africanum*
Aloe marlothii	*Aristida scabrivalvis*	*Aloe umfoloziensis*
Asparagus africanus	*Aristida bipartita*	*Barleria obtusa*
Berchemia zeyheri	*Bothriochloa insculpta*	*Berkheya robusta*
**Cereus jamacaru*	*Brachiaria arrecta*	**Bidens bipinnata*
Dichrostachys cinerea	*Brachiaria eruciformis*	*Ceratotheca triloba*
Mystroxylon aethiopicum	*Brachiaria serrata*	*Chascanum hederaceum*
Ehretia rigida	*Cenchrus ciliaris*	*Cissus rotundifolia*
Euclea divinorum	*Chloris gayana*	**Conyza bonariensis*
Euphorbia ingens	*Cynodon dactylon*	*Cleome monophylla*
Euphorbia tirucallii	**Cymbopogon pospischilii*	**Gomphrena celosioides*
Euphorbia cooperi	*Dactylocteniam australe*	*Helichrysum nudifolium*
Gymnosporea senegalensis	*Digitaria eriantha*	*Felicia muricata*
Heteropyxis natalensis	*Digitaria eriantha*	**Flaveria bidentis*
Lycium acutifolium	*Digitaria natalensis*	*Indigastrum costatum*
Lippia javanica	*Digitaria ternata*	*Justicia flava*
Ozoroa paniculosa	*Diheteropogon amplectens*	*Jatropha zeyheri*
Ochna natalitia	*Elionurus muticus*	*Ocimum gratissimum*
Olea europaea subsp africana	*Enneapogon cenchroides*	**Parthenium hysterophorus*
Opuntia ficus-indica	*Eragrostis curvula*	**Tagetes minuta*
Pappea capensis	*Eragrostis rigidior*	*Senecio inaequidens*

*Senna didymobotrya	*Eragrostis heteromera*	*Thunbergia neglecta*
Senegalia burkei	*Eustachys paspaloides*	*Tribulus terrestris*
Senegalia caffra	*Heteropogon contortus*	
Searsia pentheri	*Melinis repens*	
Spirostachya africana	*Panicum coloratum*	
Sclerocarya birrea	*Perotis patens*	
Vachelia sieberiana	*Setaria sphacelata*	
Vachelia grandicornuta	*Themeda triandra*	
Vachelia natalitia	*Urochloa mosambicensis*	
Vachellia tortilis	*Tragus berteronianus*	
Zanthoxylum capense		

4.1.3 Alien Invasive Plants (AIPs) confirmed during the survey

Due to the agricultural activities extensive disturbance of the natural vegetation occurred in places. Several alien species and pioneer species were noted on these disturbed areas. On the riverbanks and near the villages are Black Wattle (*Acacia mearnsii*), *Melia azedarach, Ricinus communis, Senna didymobotrya, Cereus jamacaru, Ipomoea carnea, Xanthium strumarium, Tagetes minuta, Bidens bipinnata*, *Flaveria bidentis, Gomphrena celosioides, Chromolaena odorata, Psidium guajava* are present on heaps of overburden and disturbed soil. Of particular concern is the presence of Famine weed (*Parthenium hysterophorus*) in the area. It is classified as a Category 1b weed and it widespread in the project area.

4.1.4 Conservation status of species

a) Red List and protected plant species of the study area

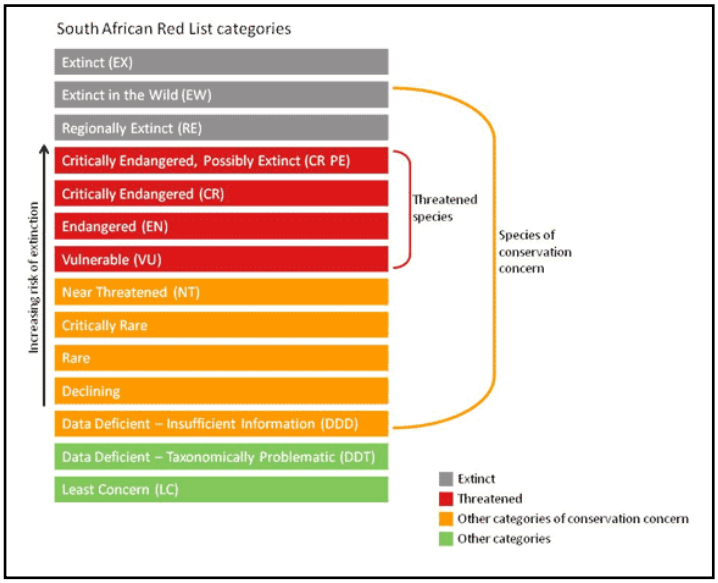


Figure 4.1: Schematic representation of the South African Red List categories. Taken from http://redlist.sanbi.org/redcat.php

Annexure C lists those Red Data species present in the **2831BD, 2831DB & 2832AC** quarter degree square. Some of these species do have the potential to occur on the project site.

4.2 Riparian and wetland system characterisation

During the site assessment of the banks of the Mvamanzi and Umfolozi Rivers and some of the many seasonal drainage lines which drain into the above-mentioned river were assessed as one unit while the Mvamanzi floodplain was assessed as a separate unit. The wetlands were all assessed separately according to their various classifications. It should be noted that although the drainage line/riparian features identified may extend beyond the project site, only portions located within the study area (including the 500m buffer) were assessed and ground-truthed. Furthermore, the study focused on features located within the study area and features located outside of this area were delineated using digital satellite imagery with limited field verification. Nonetheless, the potential impacts of activities such as crop production, man-made dams, erosion and clearing of natural vegetation within the greater catchment were taken into consideration during the assessment.

All wetland and watercourse/riparian features identified within the study area were classified as Inland Systems falling within the North Eastern Uplands Aquatic Ecoregion. The table below presents the classification on level 3 and 4 of the wetland classification system.

Table 4.4: Characterisation of the riparian and wetland systems within the study area according to the classification system (Ollis *et al.* 2013)

System	**Level 3: Landscape unit**	**Level 4: Hydro-geomorphic Unit**	
		HGM type	**Longitudinal zonation / landform / Inflow drainage**
Umfolozi & Mvamanzi River	Plain	River	Lowland river with active channel & riparian zone
Channelled Valley-bottom wetland	Floodplain depression	Floodplain wetland	Floodplain depression
Unchannelled Valley-bottom wetland	Floodplain depression	Floodplain wetland	Floodplain depression

Wetland habitat is land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil (NWA; Act No. 36 of 1998).

Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas. The rivers and non-perennial drainage lines with riparian characteristics are defined as watercourses, whilst the smaller ephemeral drainage lines without riparian zones are not considered wetlands or systems with an associated riparian zone but may still be defined as watercourses if the features have floodlines applicable to them.

Much of the functionality of the wetland and riparian features has been altered due to water abstraction, damming of drainage lines, anthropogenic, and agricultural activities as well as excessive growth levels of alien vegetation. Currently, the highest value to the local community is that of water provision from the resources. Water is used for both domestic and agricultural purposes; the result of which is that there is a notable decrease in downstream flow as well as an increase in water pollution which can be considered critical in many instances.

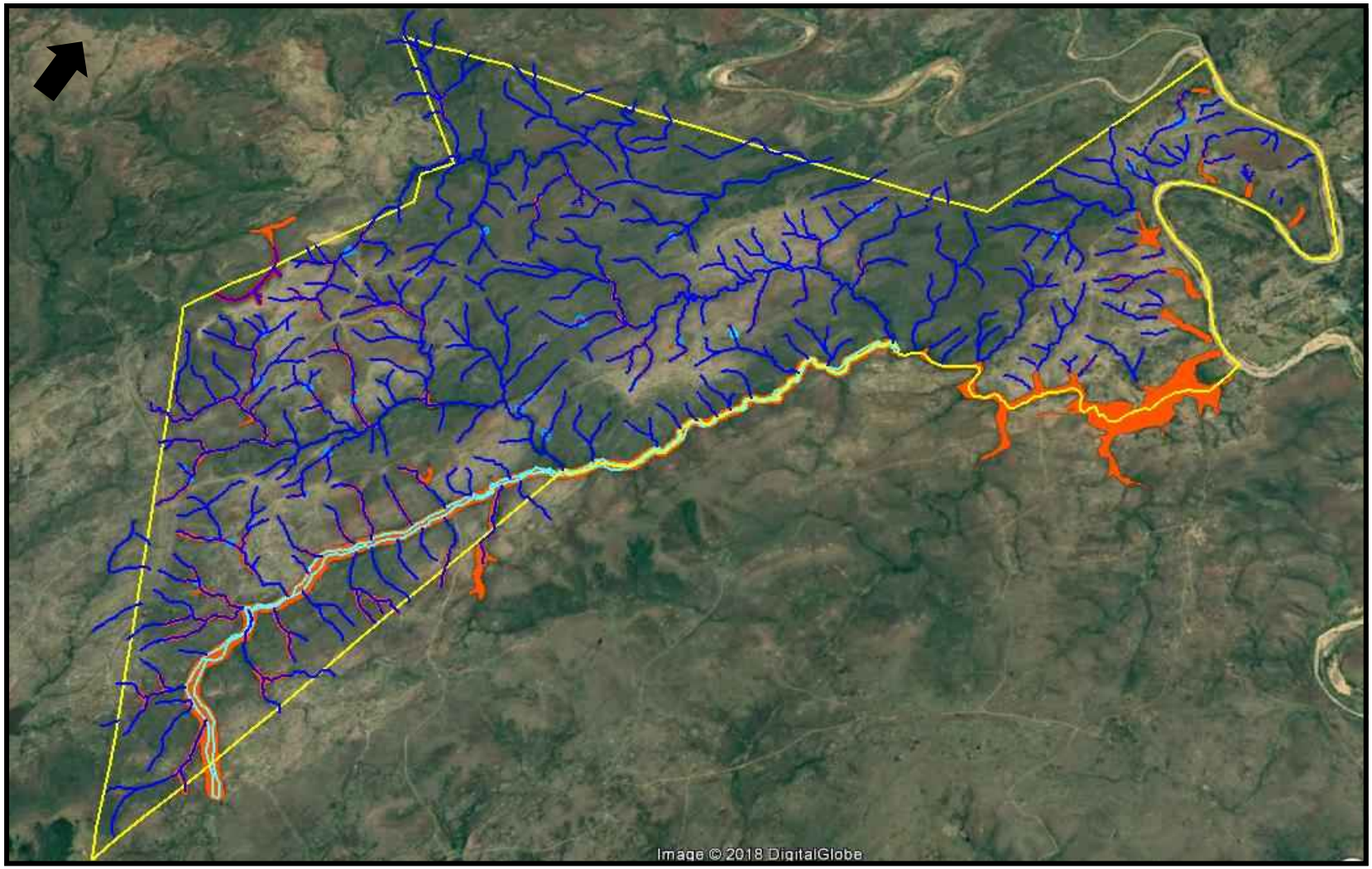


Figure 4.2: The orange polygons illustrate the approximate localities of the NFEPA-listed wetland and riparian features in relation to the study area (yellow polygon).The blue lines represent seasonal drainage lines and the light blue areas are man-made dams

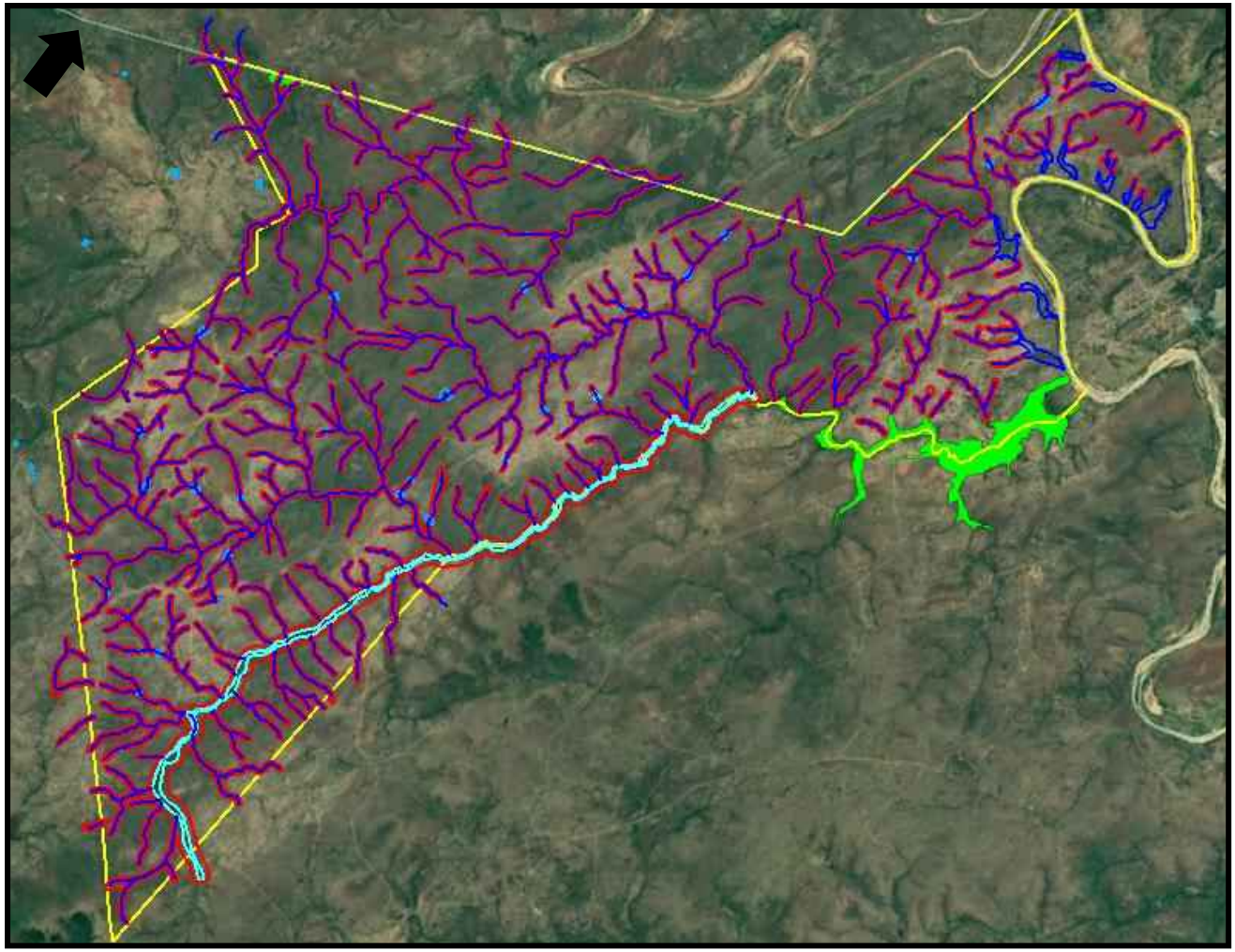


Figure 4.3: The project site with its wetlands (green areas) and riparian features and the specific buffer zones (red lines around the drainage lines and wetlands).The light blue circles are man-made dams

4.3 Riparian Vegetation Response Index (VEGRAI)

The VEGRAI method was applied in order to assess the impacts of modifications to the system on the riparian vegetation of the Umfolozi and Mvamanzi Rivers and its seasonal drainage lines. The riparian zones located along the river have been impacted by the growth of alien vegetation. The resultant encroachment of alien vegetation has led to an impediment of water flow and displacement of indigenous floral and faunal species within the riparian areas. Furthermore, all of these systems have been impacted upon by agriculture (crop cultivation and grazing of domestic livestock) and also sand mining activities. The riparian features found in the perennial drainage lines (Umfolozi River and Mvamanzi River) received a score of 40%, indicating that the VEGRAI Ecological Category falls in Category D indicating a largely modified ecostatus. The riparian features found in the seasonal drainage lines received a score of 55%, indicating that the VEGRAI Ecological Category falls in Category C indicating a moderately modified ecostatus.

Loss of some of the marginal and non-marginal vegetation of the Umfolozi River and Mvamanzi River, as a result of clearing the riparian vegetation to access the river, of the streambank of the river, grazing by livestock etc. has resulted in encroachment of both invasive alien species in many sections of the riparian zone. Furthermore, bank incision and erosion is evident within the perennial drainage lines and to a smaller extent along the seasonal drainage lines as a result of poor soil stability due to the increase in the alien vegetation component as well as livestock grazing reducing the herbaceous layer.

4.4 Index of Habitat Integrity

The Index of Habitat Integrity (IHI) as described by the DWA (2007) was utilised to assess the present Habitat Integrity state of the Umfolozi and Mvamanzi River system and the numerous seasonal drainage lines on the project site.

Wetland health is defined as a measure of the similarity of a wetland to a natural or reference condition. “Deviations” from this natural or reference state, particularly the extent of human impacts which may have caused the wetland to differ from this natural state, are considered when ascertaining the “health” of a wetland (Macfarlane *et al.,* 2008).

The table below provides a summary of the IHI results for each group of features and the rivers which are discussed in detail in the sub-sections that follow.

Table 4.5: Summary of results of the WET-IHI assessments conducted for the rivers and wetlands and seasonal drainage lines.

Features	Present State Score (%)	Present State Category
Mfolozi River	57,2	D
Mvamanzi River	58	D
Channelled valley-bottom wetland	83	B

Unchannelled valley-bottom wetland	85	B
Seasonal drainage lines	61	C

4.4.1 Umfolozi and Mvamanzi Rivers and associated wetlands and seasonal drainage lines

The PES score indicates that the Umfolozi and Mvamanzi have undergone large loss and change of natural habitats. The system has been exposed to a loss and change in the composition of the natural habitat and biota. The seasonal drainage lines are in general moderately modified however the basic ecosystem functions are still predominantly unchanged.

Utilisation of the river (crop production, and mining of the streambanks for sand, erosion gullies caused by animal tracks) within the project site are the predominant modifiers to the system. These factors have resulted in a reduction of indigenous riparian vegetation with the resultant influx of alien vegetation contributing to the change in the natural functioning of the riparian zones of the river systems. In some instances this loss of natural vegetation has resulted in an increased exposure of soils contributing to an accelerated rate of erosion and incision within the system thus altering the geomorphology of the systems. Additionally, the extensive dirt road, footpath and animal track networks within the project site are likely to be responsible for further sediment inputs which will be transported to the rivers in runoff during rainfall events.

The Umfolozi and Mvamanzi Rivers are perennial systems and are subjected to periods of low flow during the drier winter months. These periods of low flow result in an accumulation of sediment within the systems leading to sediment deposition and infilling of the channel. During the wetter months floods can result in the removal of these deposits due to the lack of soil stability as a result of the increased alien vegetation within the riparian zones. Additional water inputs originating from such runoff may alter hydrological patterns to some extent.

The majority of the seasonal drainage lines surveyed can be defined as shallow streams encroached with vegetation. However, these drainage lines still perform an important ecological function insofar as they transport water down into the Umfolozi and Mvamanzi Rivers and their riparian vegetation is relatively well preserved.

4.5 Wet-Health Assessment

A Level 1 Wet-Health assessment of the floodplain HGM Units was undertaken. Three modules, namely hydrology, geomorphology and vegetation, were assessed as a single unit for the HGM Units and subsequently an area weighted score was obtained for the HGM Units. The potential impacts of activities such as sand mining, agriculture, altered hydrological functions and clearing of natural vegetation within the greater catchment were taken into consideration during the assessment. These results are summarised in the table below.

Table 4.6: Summary of results of the WET-Health assessments conducted for the valley-bottom wetlands

Feature	Hydrology		Geomorphology		Vegetation		Overall PES Category
	Impact score	Change score	Impact score	Change score	Impact score	Change score	
Channelled valley bottom wetland	B	⬇	B	⬇	C	⬇	B
Unchannelled valley bottom wetland	B	⬇	B	⬇	C	⬇	B

The overall score for the channelled valley bottom wetland and unchannelled valley bottom wetland HGM Units which totals the scores for the three modules, namely hydrology, geomorphology and vegetation, was calculated using the formula as provided by the Wet-Health methodology. The overall score calculated was 1.6, falling within low Category B, which refers to ecosystem processes which have been moderately modified with a moderate change in ecosystem processes and moderate loss of natural habitats and biota within the study area.

Impacts on the hydrology of the HGM Units include the increased runoff volumes from surrounding villages and cleared areas associated with the overgrazing, which places this module within a low Category B with a chance to deteriorate in future. Topographic alterations associated with surrounding agricultural (crop cultivation, grazing, etc.) activities have also affected the HGM Units, resulting in geomorphological modifications also falling within low Category B. The vegetation assemblage of the study area has been undergone extensive impact as a result of natural vegetation clearing practices for crop production, as well as a high level of alien plant proliferation throughout the study area. Species such as *Ipomoea carnea, Acacia mearnsii, Lantana camara* and *Chromolaena odorata* have the potential to encroach aggressively and could alter a system's functions significantly. With this in mind the wetlands achieved a score which placed the module in a low Category B. The overall **PES Category for the Floodplain wetland is a B which means that t**he system have been moderately modified with a moderate change in ecosystem processes and moderate loss of natural habitats and biota within the study area

What needs to be considered is that if the spread of alien invasive plants is allowed to continue unchecked and proposed prospecting activities are not planned for properly, and without proper rehabilitation it is highly likely that the remaining wetlands and riparian vegetation in the project site will be further degraded to the point where they are no longer able to fulfil the wetland function capabilities.

4.6 Riparian and Wetland Function Assessment

The ecological functions and service provision for the Umfolozi River and Mvamanzi River riparian zones as well as the floodplain wetland were assessed utilising the WET-EcoServices method (Kotze *et. al.* 2009) as described in the methodology (Chapter 2) of this report. The results of the assessments are tabulated and discussed below. This assessment was applied to valley-bottom wetlands, riparian vegetation of the Umfolozi and Mvamanzi Rivers and the seasonal drainage lines.

Table 4.7: Results of the ecological function and services provision assessment applied to the riparian features within the project site.

Ecosystem service	Wetland			
	Unchannelled valley-bottom wetland of the Mvamanzi River	Channelled valley-bottom wetland of the Mvamanzi River	Umfolozi floodplain wetlands	Riparian vegetation of the seasonal streams
Flood attenuation	2.9	2.3	1.5	2.5
Streamflow regulation	1.3	1.3	0.8	1.4
Sediment trapping	2.3	2.2	1.5	1.5
Phosphate trapping	2.6	2.3	2.3	1.3
Nitrate removal	2.1	2.0	2.1	1.1
Toxicant removal	2.4	2.2	2.2	2.2
Erosion control	2.5	2.5	2.4	1.6
Carbon storage	1.7	1.7	2.0	2.0
Maintenance of biodiversity	0.9	0.9	1.1	2.1
Water supply for human use	1.7	1.7	1.6	0.6
Natural resources	2.4	2.4	2.4	2.4
Cultivated foods	1.4	1.4	1.6	1.6
Cultural significance	0.3	0.3	0.3	0.3
Tourism and recreation	0.3	0.1	0.0	0.0
Education and research	0.0	0.0	0.0	0.0
Threats	2.0	2.0	1.0	1.0
Opportunities	2.0	2.0	1.0	1.0
TOTAL	**28.8**	**27.3**	**23.8**	**21.1**
Mean	**1.7**	**1.6**	**1.4**	**1.2**

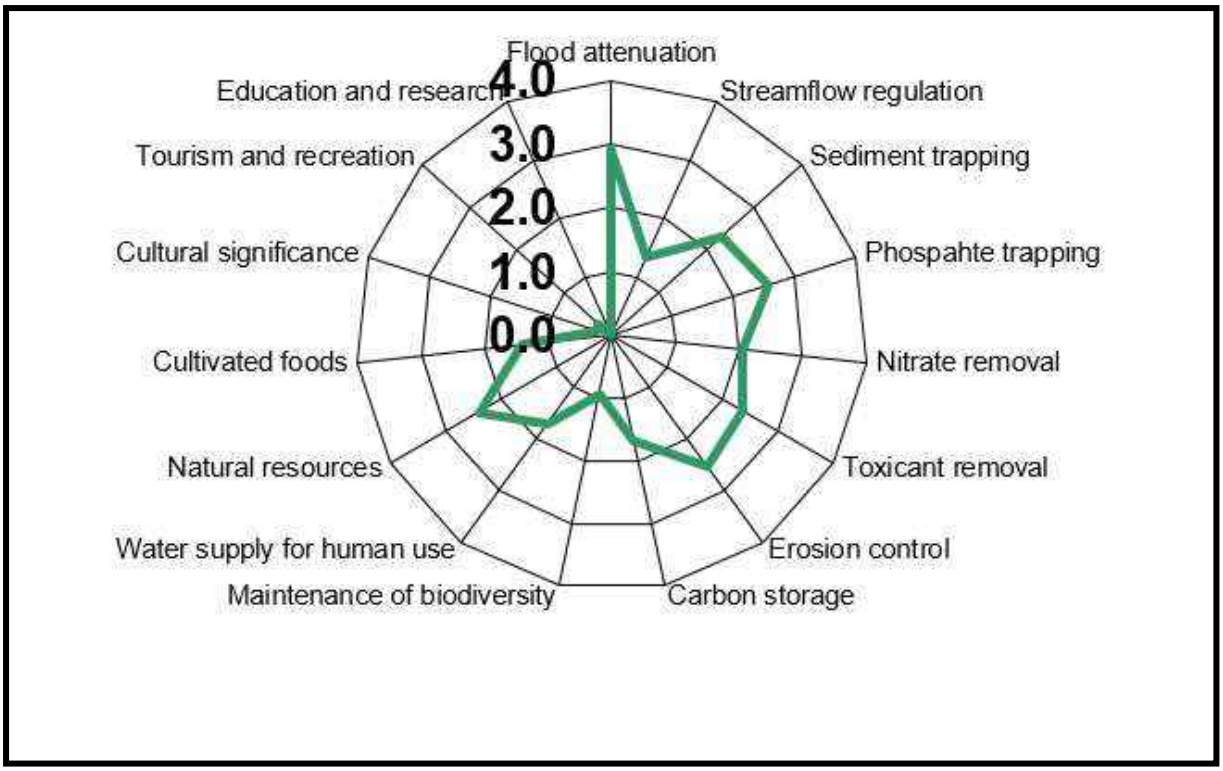


Figure 4.4: A spider diagram of the ecological function and services provision assessment applied to the unchannelled valley – bottom wetland of the Mvamanzi River's features within the project site.

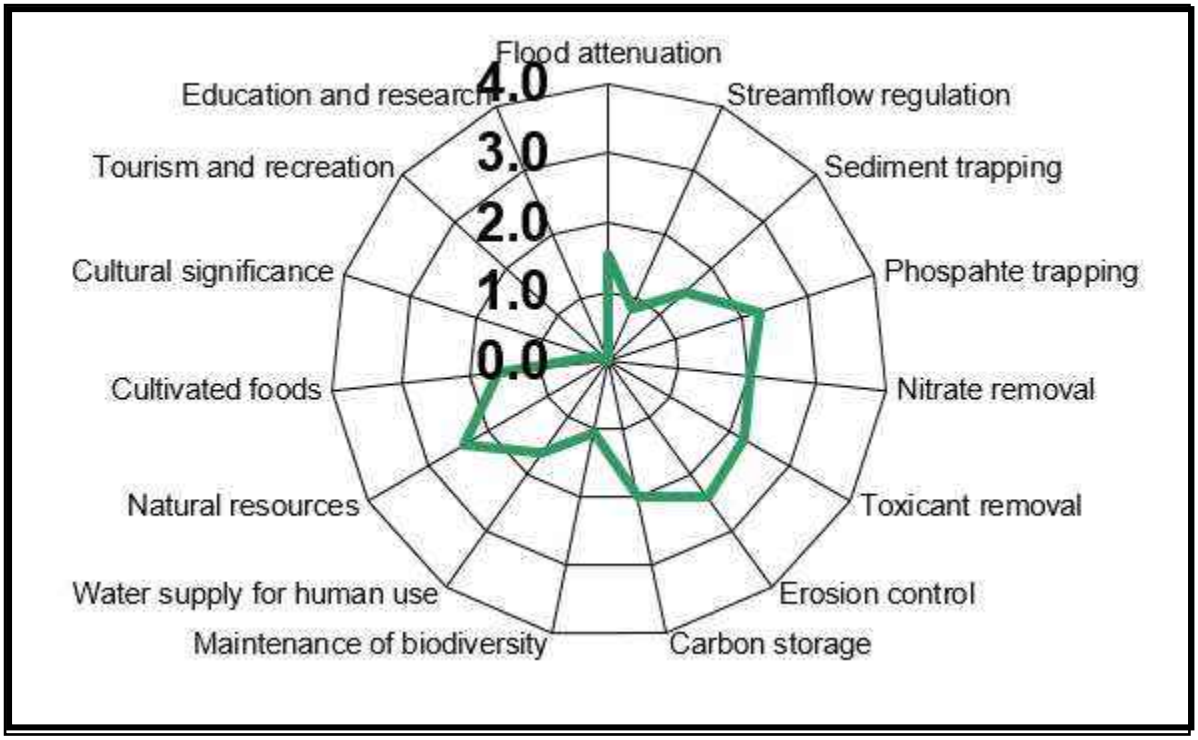


Figure 4.5: A spider diagram of the ecological function and services provision assessment applied to the channelled valley – bottom wetland of the Mvamanzi River's features within the project site.

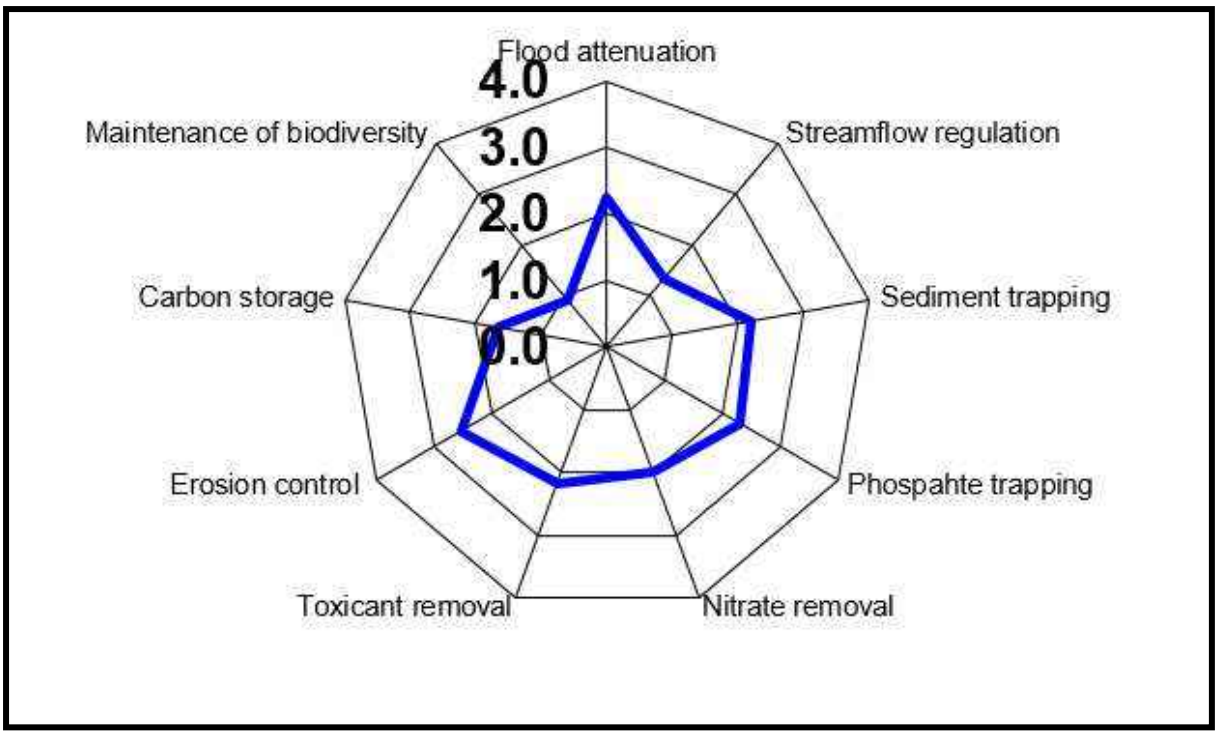


Figure 4.6: A spider diagram of the ecological function and services provision assessment applied to the floodplain wetlands of the Umfolozi River's features within the project site.

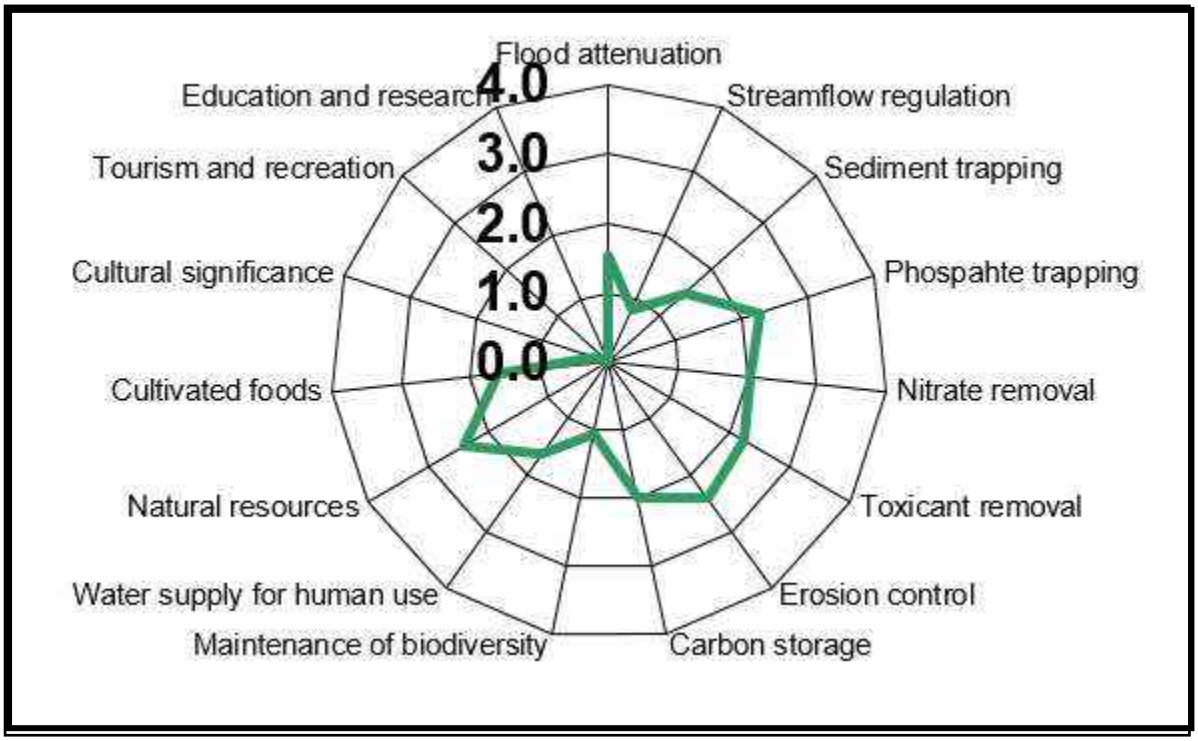


Figure 4.7: A spider diagram of the ecological function and services provision assessment applied to the riparian vegetation of the seasonal stream's features within the project site.

Umfolozi and Mvamanzi Rivers and seasonal drainage lines:

The Umfolozi and Mvamanzi River systems and the active seasonal drainage lines are important for functions that are dependent on perennial water flow, such as water supply. It is important to note that from the results and observations within the field it is evident that currently the river systems are actively utilised as a permanent source of water for both domestic and agricultural purposes. Due to the perennial character of the Umfolozi and Mvamanzi River systems and their associated tributaries, these systems are the most capable systems within the region to assimilate toxicants in the water. However, toxicant input further upstream, irregular rainfall, increased water abstraction and further degradation of the riparian zones due to human activities, crop production, alien vegetation encroachment and others will result in a notable decrease in the rate of toxicant assimilation.

Biodiversity maintenance was a bit higher along the riparian vegetation of the seasonal streams, in comparison to the floodplain wetland. It can be attributed to the denser vegetation along the streams and the lower impact from an agricultural perspective. However, the presence of exotic species in the riparian fringe has a definite limiting factor in this area in terms of biodiversity maintenance and support. The spread of alien vegetation as a result of removal of indigenous floral species (resulting in habitat loss) also contribute to an increased silt load being carried into the Mvamanzi and eventually the Umfolozi River system.

These systems scored low values in terms of tourism, recreation, education and research and they also do not play any form of cultural importance to the surrounding communities.

Floodplain wetlands:

The floodplain wetlands and valley-bottom wetlands are connected directly with the Umfolozi River. A levee separates the river from the floodplain and during floods it retains water on the floodplain wetland. During heavy downpours stormwater also collects here for short periods of time. The deep sediment on the floodplain wetlands is ideal arable soil and subsequently a number of crop fields have been established along the Umfolozi and Mvamanzi Rivers. It is also utilised as grazing area for cattle. Due to the location of these wetlands, during periods of rainfall these wetlands are likely to form an important role in trapping excessive sediment runoff, limiting the amount top soil loss.

These systems scored low values in terms of tourism, recreation, education and research and they also do not play any form of cultural importance to the surrounding communities.

4.7 Ecological Importance and Sensitivity (EIS) Assessment

The EIS assessment was applied to all watercourse/riparian and wetland features within the study area in order to ascertain the levels of sensitive and ecological importance of the features, as well as to assist in informing a suitable REC for each. The results of these assessments are summarised in the table below.

Table 4.8: Results of the EIS assessments all riparian and wetland features within the project site.

Determinant		Umfolozi & Mvamanzi Rivers	Floodplain and valley-bottom wetlands	Seasonal streams	Confidence
	PRIMARY DETERMINANTS				
1	Rare & endangered species	0	0	0	4
2	Populations of unique species	0	0	0	4
3	Species/Taxon richness	1	1	2	4
4	Diversity of habitat types or features	1	1	2	4
5	Migration route/breeding & feeding site for wetland species	2	2	2	4
6	PES as determined by WET-Health assessment	2	2	2	4
7	Importance in terms of function & service provision	1	1	1	4
	MODIFYING DETERMINANTS				
8	Protected Status according to NFEPA WetVeg	2	2	1	4
9	Ecological integrity	2	2	2	4
TOTAL		**11**	**11**	**12**	**36**
MEAN		**1.2**	**1.2**	**1.3**	**4**
Overall EIS		**C**	**C**	**C**	

These results indicate that the Umfolozi and Mvamanzi River systems and their associated tributaries, are estimated to fall within and EIS Category C, indicating that this system is considered to be ecologically important and sensitive on a provincial and local scale.

Historically it is likely that these systems would have been scored as more sensitive than currently. However, although in its current form it may not be as effective in providing suitable intact habitat to a variety of species, it still performs an important role in resource provision (Table 4.8).

4.8 Recommended Ecological Category (REC)

The Recommended Ecological Category for the Umfolozi and Mvamanzi River systems and its associated tributaries, was determined taking into account the results of the IHI, wetland function, and EIS assessments. These assessments show that all riparian and seasonal drainage line features within the project site have to an extent undergone fairly significant levels of transformation as a result of historical and current farming and to a lesser extent sand mining practices, disruption of the hydrological cycle and alien vegetation encroachment. Nevertheless, despite the lowered ecological integrity of these systems, they are considered to provide important ecological services. The REC estimated appropriate for the watercourse/riparian and perennial drainage line features are presented in Table 4.10.

Table 4.9: Summary of the REC categories assigned to the various features for all riparian and wetland features within the project site.

Features	REC Category
Umfolozi and Mvamanzi River systems and its associated tributaries,	Upper C
Valley-bottom wetlands	Upper C
Floodplain wetland	Upper C

Where applicable mitigation measures to lower the impacts associated with proposed prospecting activities must be implemented in order to at minimum, retain current levels of ecological integrity and functioning. It is preferable however that suitable rehabilitation measures be implemented, particularly to curb erosion, and to implement an invasive weed removal program to clear the drainage lines and riparian areas in order to improve the Present State of these systems and to improve the ecological service provision by these systems.

4.9 Delineation and Sensitivity Mapping

All features were delineated on a desktop level with the use of digital satellite imagery and topographical maps. Portions of the features were then verified during the field survey according to the guidelines advocated by DWA (2005, 2008) and the watercourse/riparian delineations as presented in this report are regarded as a best estimate of the temporary and riparian zone boundaries based on the site conditions present at the time of assessment. Ground-truthing of riparian boundaries focused on those areas that were accessible as well as within the proposed development footprint.

During the assessment, the following indicators were used to ascertain the boundaries of the perennial drainage lines with riparian characteristics and the wetland features:

- Terrain units were used as the primary indicator, as the drainage lines and depressions were the most likely areas through which water will flow. In some of the riparian areas, the presence of alien plant species made it difficult discern riparian / drainage line boundaries;
- Vegetation, although transformed, was considered informative at many features;
- Soil form was considered; and the presence of mottles (soils with variegated colour patterns) was used as an indicator for wetlands and riparian boundaries in some

instances. In some areas the mottling of soils did not provide an accurate delineation of boundaries, and as such the above mentioned characteristics were used in conjunction to determine boundaries.

Legislative requirements were used to determine the extent of buffer zone required for each group depending on whether a group is considered wetland/riparian habitat or not. The Umfolozi River and Mvamanzi River and their respective associated tributaries, as well as the seasonal drainage lines with riparian characteristics are defined as watercourses. As such, if any activities are to take place within 32 meters of a wetland or watercourse or the 1:100 year flood lines authorisation in terms of the relevant regulations of NEMA will be required. In addition the Section 21 of the National Water Act and Regulation 1199 of 2009 as it relates to the NWA will also apply and therefore a Water Use License will be required for the proposed development.

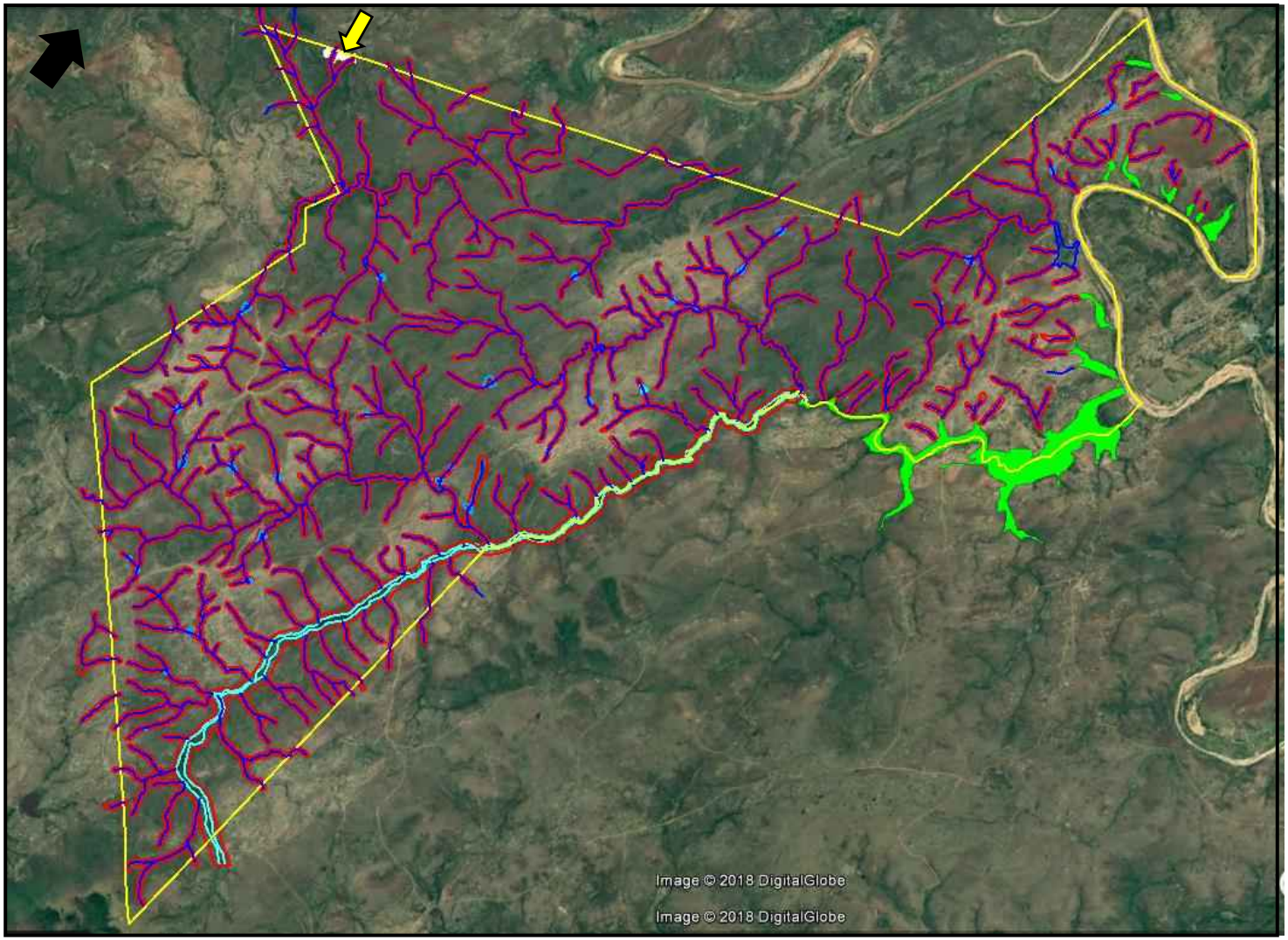


Figure 4.8: There are a numerous seasonal drainage lines on the project site. Almost all drain towards the Mvamanzi or Umfolozi Rivers. There are 100m buffer zone around the two rivers and 32m buffers around the seasonal drainage lines. The green areas are larger floodplain and valley-bottom wetlands and the light blue circles indicate man-made dams. Yellow arrow indicates the pocket of Eastern escarp forest.

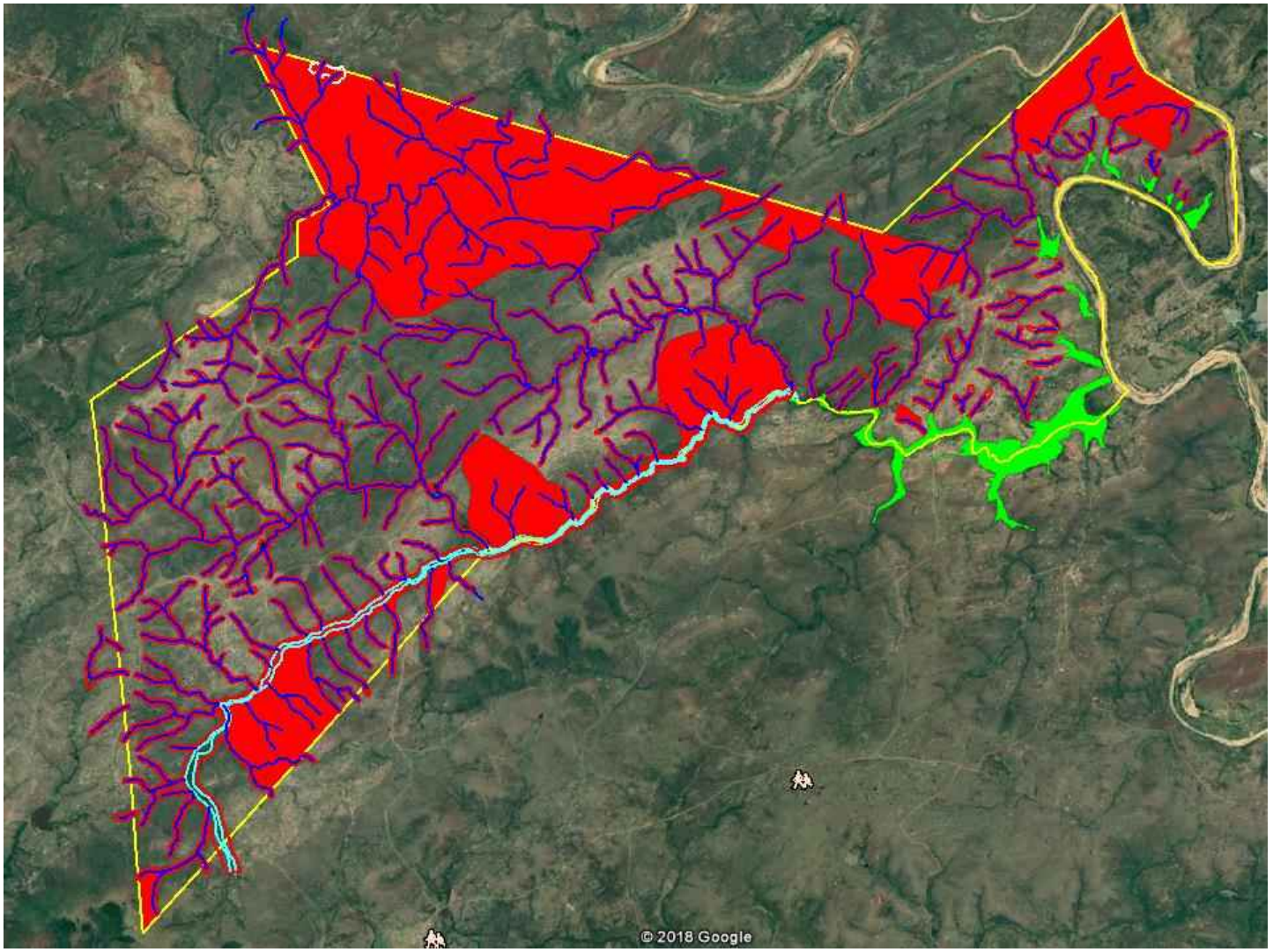


Figure 4.9: The red and green areas indicate no-go areas in terms of proposed protected area expansions, sensitive wetlands. There are 100m buffer zones around the two rivers and 32m buffers around the seasonal drainage lines (blue lines). The green areas are larger floodplain and valley-bottom wetlands.

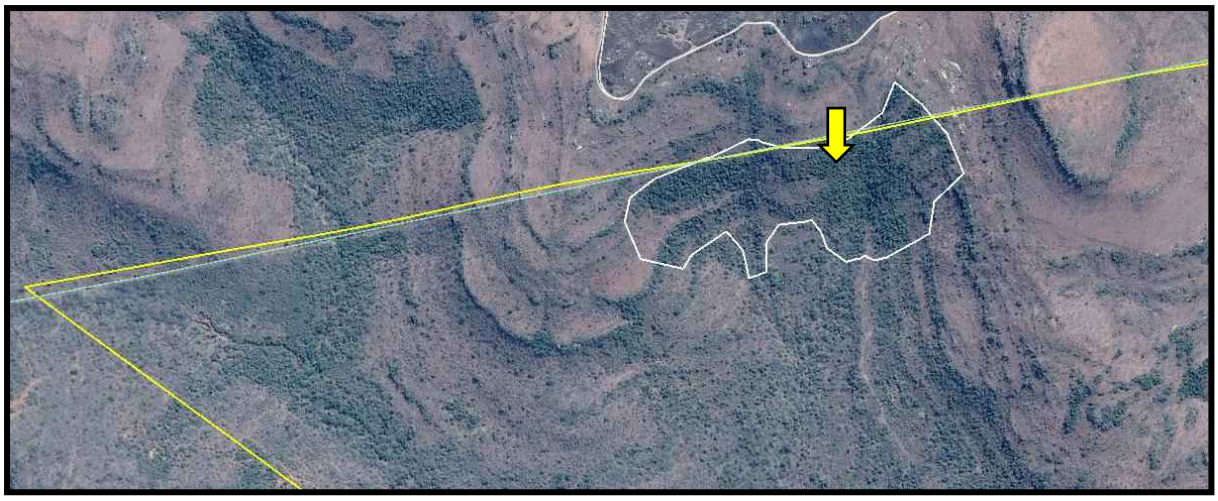


Figure 4.10: A close-up of the pocket of Eastern Escarp forest (arrow).

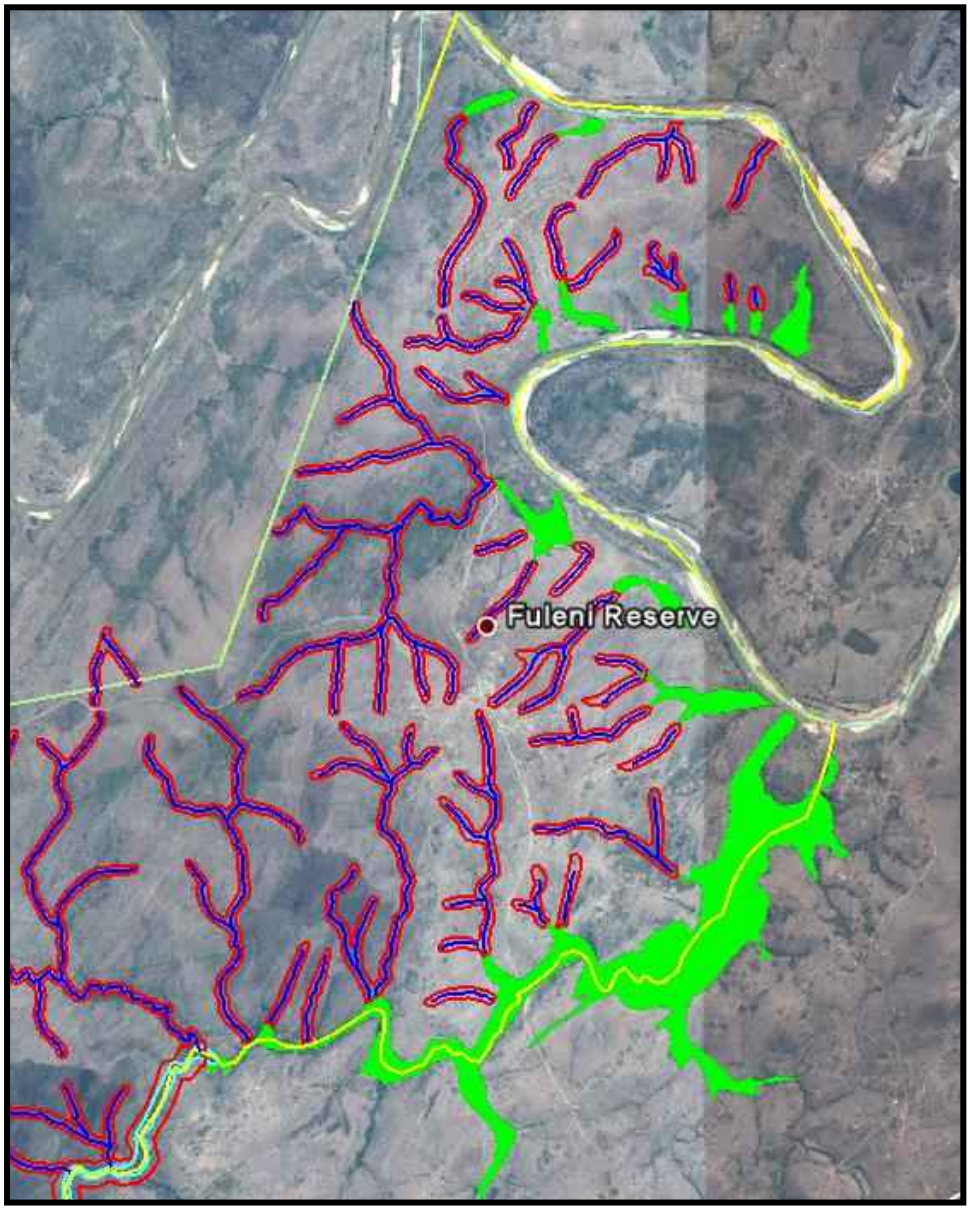


Figure 4.11: A close-up of the floodplain wetlands along the Umfolozi River and the Valley-bottom wetland at the confluence of the Mvamanzi and the Umfolozi Rivers.

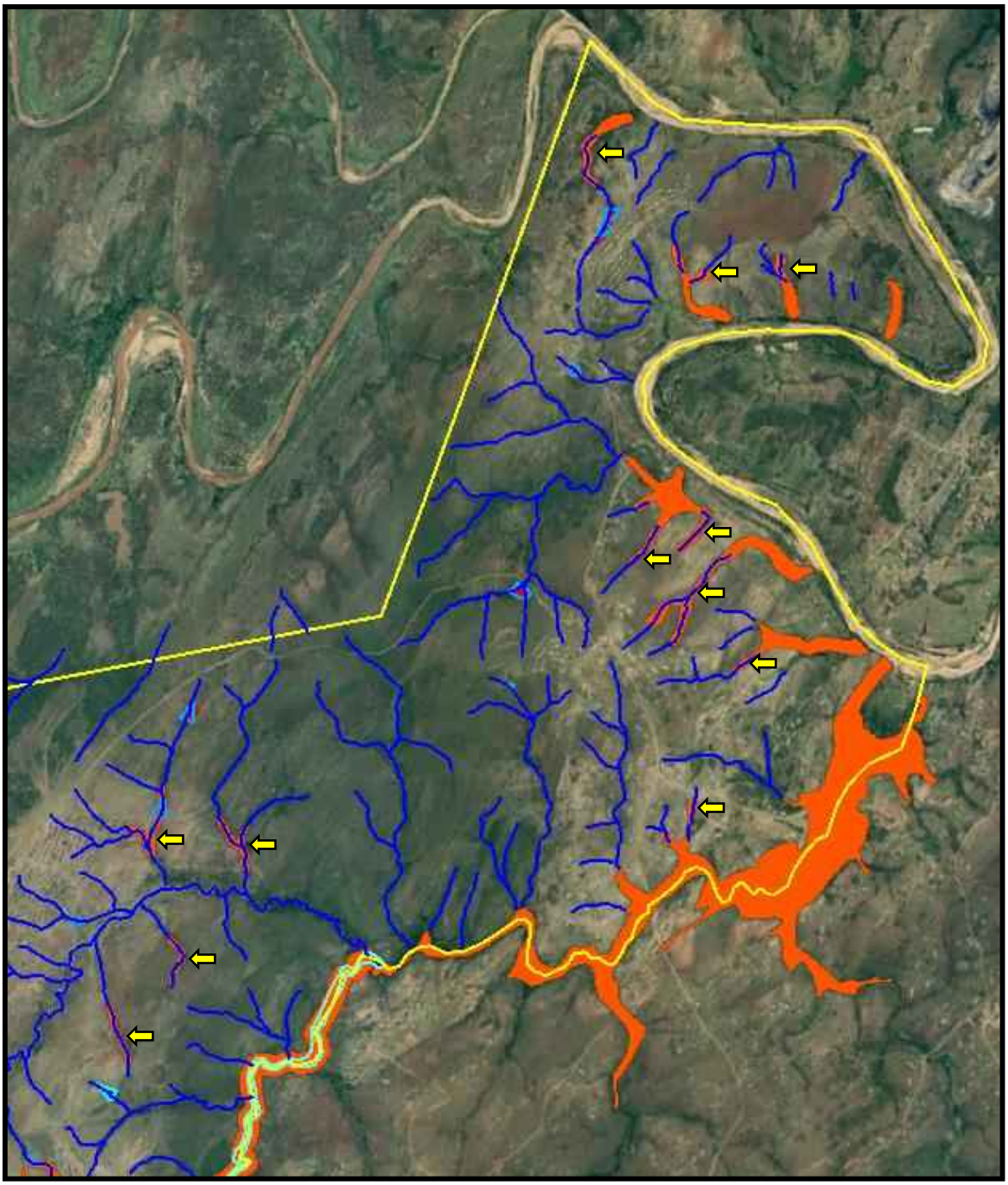


Figure 4.12: A close-up of the seasonal drainage lines (blue lines), floodplain wetlands along the Umfolozi River and the Valley-bottom wetland at the confluence of the Mvamanzi and the Umfolozi Rivers (orange polygons) as well as the NFEPA – listed wetlands (arrows) in the seasonal drainage lines.

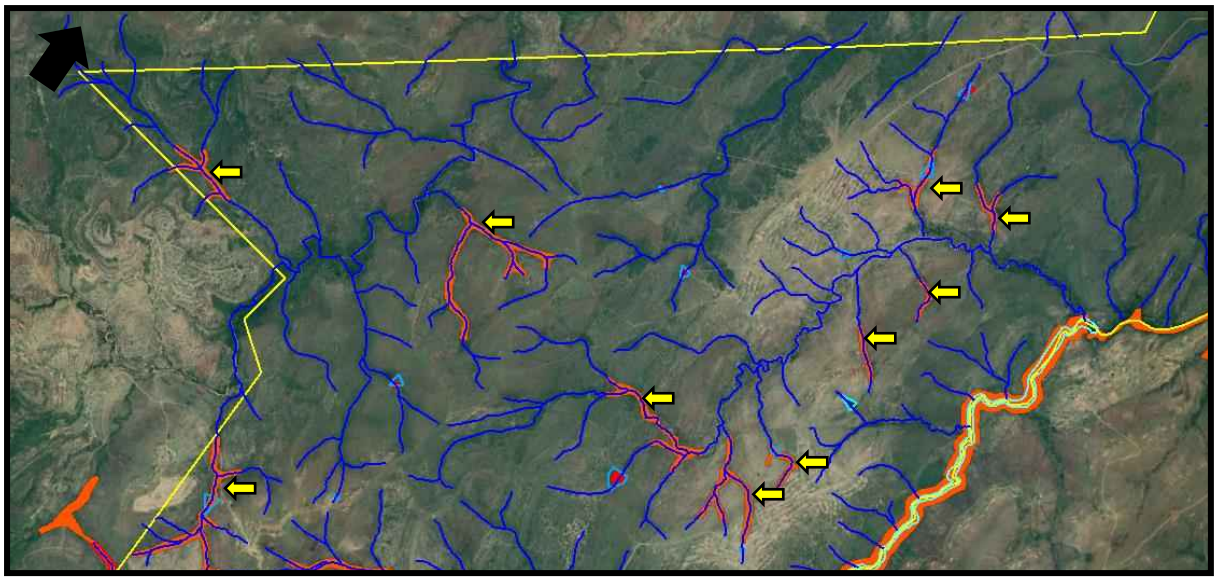


Figure 4.13: A close-up of the seasonal drainage lines (blue lines), as well as the NFEPA – listed wetlands (arrows) in the seasonal drainage lines on middle part of the project site.

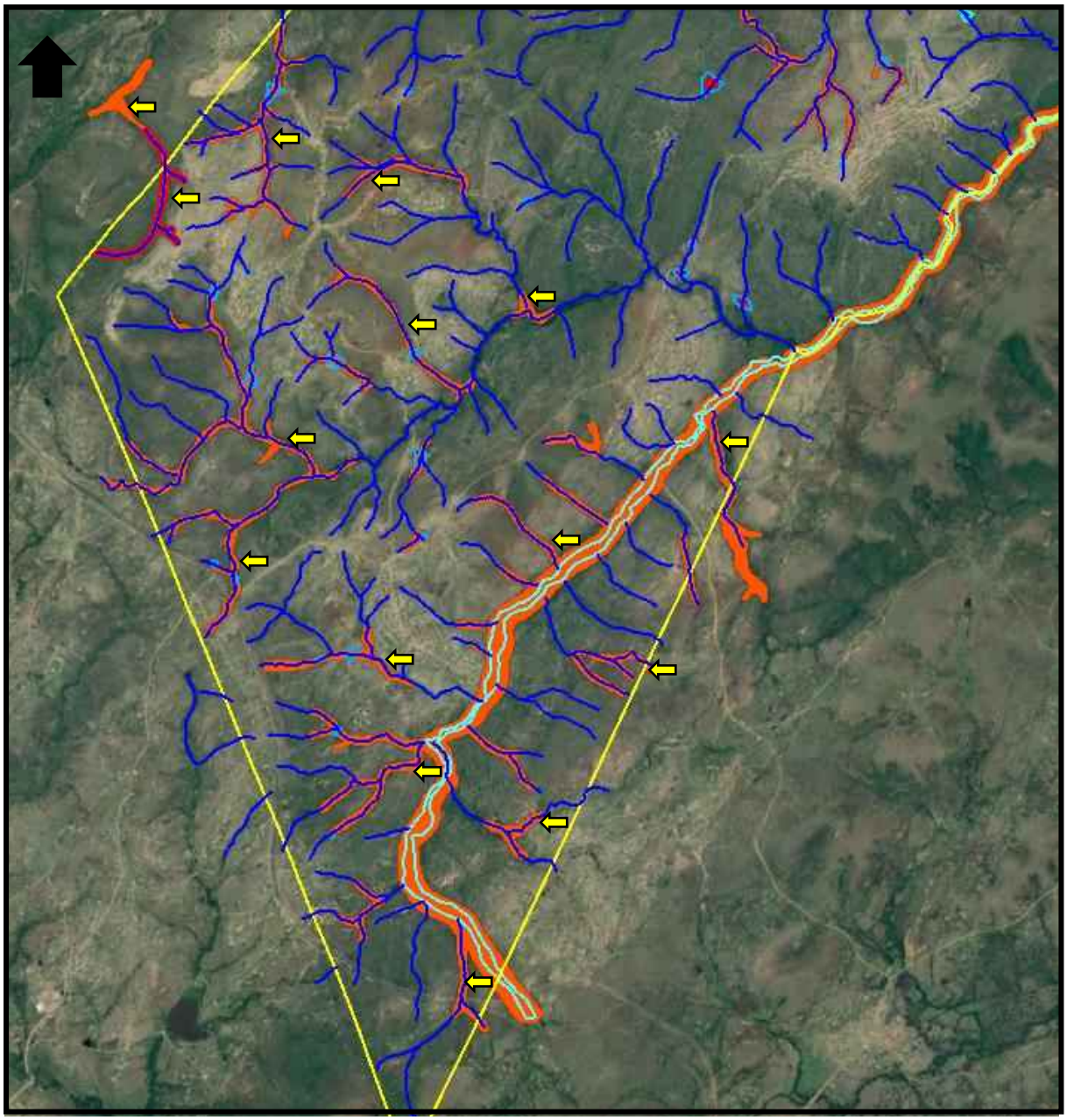


Figure 4.13: A close-up of the seasonal drainage lines (blue lines), as well as the NFEPA – listed wetlands (arrows) in the seasonal drainage lines on the southern part of the project site.

5 SITE ASSESSMENT OF IMPACTS, MITIGATION AND MANAGEMENT MEASURES

5.1 Impacts of the proposed prospecting activities, access roads and associated infrastructure

Table 5.1 serve to summarise the significance of potential impacts on the wetland and aquatic integrity of the existing and proposed prospecting activities based on a risk matrix. The sections below present the impact assessment according to the methods described in Chapter 2. In addition, it also indicates the required mitigatory measures needed to minimise the impact and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

Table 5.1: List of impacts and mitigation measures (Risk matrix)

1. Activity: Transport of materials to site, movement of vehicles on site during prospecting operation.		
Environmental Aspect: Compaction of soils, possible contamination by oils or fuels, possible introduction and spread of weeds and alien invasive species, temporary disturbance of terrestrial fauna.		
Environmental impact: Loss of vegetation, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible contamination of soil and groundwater by oil- or fuel spillages, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality.		
	Without mitigation	**With mitigation**
Extent (E)	Local (1)	Local (1)
Duration (D)	Short-term (2)	Short-term (1)
Magnitude (M)	Medium (6)	Small (4)
Probability (P)	Definite (5)	Definite (5)
Significance (S = E+D+M)*P	**Medium (45)**	**Low (30)**
Status (positive, neutral or negative)	Negative	Positive
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: • All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel; • Restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed. • Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. • Re-fuelling must take place on a sealed surface area to prevent infiltration of hydrocarbons into topsoil • Strict speed limits must be set and adhered to. • Driving between dusk and dawn should be permissible to emergency situations only. • Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution. • All spills, should they occur, should be immediately cleaned up and treated accordingly • All soils compacted as a result of prospecting activities falling outside of project areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.		
Cumulative impacts: • Possible pollution of surrounding areas if no mitigation is implemented. • Contamination of groundwater which is an extremely important source of water supply for the region.		

- Possible spread of alien invasive species beyond the site if no mitigation is implemented.

Residual impacts:

- Altered topsoil characteristics.
- Altered vegetation composition.

2. Activity: Destruction of riparian and wetland vegetation due to prospecting activities

Environmental Aspect: Destruction of riparian habitat and ecological structure, possible introduction and spread of weeds and alien invasive species, temporary or permanent disturbance of terrestrial fauna.

Environmental impact: Loss of vegetation, loss of habitat, loss of biodiversity, loss of ecosystem functioning, increase in runoff and erosion, disturbance or possible mortality incidents of terrestrial fauna, possible establishment and spread of undesirable weeds and alien invasive species that could further damage ecosystem functionality, loss off the ability of these systems to assimilate toxins, trap sediments and help with flood control during periods of high flow.

	Without mitigation	**With mitigation**
Extent (E)	Local (1)	Local (1)
Duration (D)	Long-term (4)	Medium-term (3)
Magnitude (M)	Definite (8)	Medium (4)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**High (65)**	**Medium (32)**
Status (positive, neutral or negative)	negative	Positive
Reversibility	Partially reversible	Partly reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- Limit the footprint area of the prospecting activities to what is absolutely essential in order to minimise environmental damage;
- During the prospecting phase, no vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas;
- Implement effective waste management in order to prevent construction related waste from entering the drainage line and riparian environments.
- Plant soil stabilizing species such as grasses
- Plant indigenous trees common to the habitat to replace riparian vegetation
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.

Cumulative impacts:

- Possible erosion of areas if no mitigation is implemented.
- Possible spread of alien invasive species beyond the site if no mitigation is implemented.

Residual impacts:

- Altered topsoil characteristics.
- Altered vegetation composition.

3. Activity: Prospecting could cause a change in hydrological functions of wetland and riparian vegetation		
Environmental Aspect: Compaction of soils, removal of clay layers, disturbance of groundwater movement, desiccation of wetland areas .		
Environmental impact: Loss of vegetation, loss of habitat functionality.		
	Without mitigation	**With mitigation**
Extent (E)	Local (1)	Local (1)
Duration (D)	Medium-term (3)	Short-term (2)
Magnitude (M)	High (8)	Small (5)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (60)**	**Medium (32)**
Status (positive, neutral or negative)	Negative	positive
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: • All soils compacted as a result of prospecting activities should be ripped and profiled. • Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat • Topsoil must be removed and stockpiled before major excavations is taking place.		
Cumulative impacts: • Possible erosion of disturbed areas • Possible spread of alien invasive species beyond the site if no mitigation is implemented.		
Residual impacts: • Altered topsoil characteristics. • Altered vegetation composition.		

4. Activity: Erosion of soil		
Environmental Aspect: High runoff could cause sediment deposition in the river, and drainage lines		
Environmental impact: Permanent loss of topsoil and the seedbank, increase in runoff and erosion could cover vegetation with sediment and destroy it, could cause deep gullies in the sediment. Create disturbed habitat where alien species could establish.		
	Without mitigation	**With mitigation**
Extent (E)	Local (1)	Local (1)
Duration (D)	Medium-term (3)	Short-term (2)
Magnitude (M)	High (8)	Low (4)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (60)**	**Low (28)**
Status (positive, neutral or negative)	Negative	positive
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: • Restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. • No off-road driving beyond designated areas may be allowed. • To prevent the further erosion of soils, management measures may include berms, soil traps, hessian curtains and storm water diversion away from areas particularly susceptible to erosion • Sheet runoff from access roads should be slowed down by the strategic placement of berms and sandbags • Install erosion berms during prospecting to prevent gully formation. Berms every 50m should be installed where any disturbed soils have a slope of less than 2%, every 25m where the track slopes between 2% and 10%, every 20m where the track slopes between 10% and 15% and every 10m where the track slope is greater than 15%; • Cover disturbed areas with soil-binding plants such as grasses • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.		
Cumulative impacts: • Possible spread of alien invasive species beyond the site if no mitigation is implemented.		
Residual impacts: • Altered topsoil characteristics. • Altered vegetation composition.		

5. Activity: Establishment and spread of alien invasive plants		
Environmental Aspect: Introduction and spread of weeds and alien invasive species		
Environmental impact: Further loss and displacement of indigenous vegetation; change in vegetation structure leading to change in various habitat characteristics; change in plant species composition; change in soil chemistry properties; loss of sensitive habitats; loss or disturbance to individuals of rare, endangered, endemic and/or protected species; fragmentation of sensitive habitats; change in flammability of vegetation, depending on alien species; hydrological impacts due to increased transpiration and runoff; and impairment of wetland functions.		
	Without mitigation	**With mitigation**
Extent (E)	Local (2)	Local (1)
Duration (D)	Medium-term (3)	Short-term (1)
Magnitude (M)	Moderate (6)	Small (4)
Probability (P)	Definite (5)	Highly Probable (4)
Significance (S = E+D+M)*P	**Medium (55)**	**Low (24)**
Status (positive, neutral or negative)	Negative	positive
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: • Disturbed areas must be rehabilitated and reseeded with indigenous grasses as specified by a suitably qualified specialist (ecologist) • Monitor its establishment and growth • Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment. • Bank vegetation cover should be monitored to ensure that sufficient vegetation is present to bind the bankside soils and prevent bankside erosion and incision • Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used; • Herbicide to be applied by a qualified pest control officer only • Footprint areas should be kept as small as possible when removing alien plant species; • No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.		
Cumulative impacts: • Possible spread of alien invasive species beyond the site if no mitigation is implemented.		
Residual impacts: • Altered topsoil characteristics. • Altered vegetation composition		

Assessment of Cumulative Impacts

1. Nature: Reduced ability to meet conservation targets		
Environmental Aspect: Reduced ability to meet conservation targets.		
Environmental impact: The loss of unprotected vegetation types on a cumulative basis from the broad area may impact the countries' ability to meet its conservation targets. Part of the project site is included within a National Protected Areas Expansion Strategy focus area, and is part of irreplaceable critical biodiversity area (CBA). Although the vegetation type in the study area are classified as Least Threatened, it is poorly protected and certain habitats or communities may be subsequently affected.		
	Overall impact of the proposed project considered in isolation	**Cumulative Impact of the project and other projects in the area**
Extent (E)	Local (1)	Local (1)
Duration (D)	Medium-term (4)	Medium-term (4)
Magnitude (M)	Medium (5)	Medium (5)
Probability (P)	Probable (3)	Probable (3)
Significance (S = E+D+M)*P	**Low (30)**	**Low (30)**
Status (positive, neutral or negative)	Neutral	Neutral
Reversibility	Partially reversible	Low reversibility
Irreplaceable loss of resources?	Not Likely	Probable
Confidence in finding	High	
Mitigation: • Implementation of the required mitigation measures for all developments within the area. • Implementation of the required buffer around the wetlands and watercourses • Pre-operation walk-through to ensure that sensitive habitats are avoided. • Minimise the development footprint as far as possible.		

In conclusion: The project site is covered by numerous seasonal drainage lines of which many are NFEPA-listed. The proposed prospecting activity will have a "Negative-moderate" impact on the above-ground ecology of the site as large areas of it are partly degraded. On undisturbed areas the impact will be high. The impacts such as erosion potential, dust generation and spread of alien weeds can be lowered if mitigated properly. The project site has a medium ecological sensitivity in the upland areas because of the presence of several man-made impacts on the site. The seasonal drainage lines as well as the various wetland areas have a high ecological sensitivity and must be avoided.

With the diligent implementation of mitigating measures by the applicant, contractors, and operational staff, the severity of these impacts can be minimised and reduced to acceptable levels. The impact on fauna is expected to be low as the area is densely populated and hunting with dogs is a common occurrence.

During the closure activities at the prospecting sites new disturbed areas could be created and erosion and dust pollution may occur

- Erosion may occur after thunderstorms. Eroded areas may occur on exposed areas on slopes. Care must be taken that rehabilitation of disturbed area must be done.
- Regular monitoring of these areas must take place to ensure successful rehabilitation.

6 REFERENCES

ALEXANDER, G. & MARAIS, J. 2007. A Guide to the Reptiles of Southern Africa. Struik Nature, Cape Town.

ANHAEUSSER, C.R., JOHNSON, M.R., THOMAS, R.J. (2008). The Geology of South Africa. Council for Geosciences.

APPS, P. (ed.). 2012. Smither's Mammals of Southern Africa. A field guide. Random House Struik, Cape Town, RSA

BATES, M.F., BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.J. & DE VILLIERS, M. S. 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Strelitzia 32. SANBI, Pretoria.

BRANCH W.R. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town.

BROMILOW, C. 2001. Revised Edition, First Impression. Problem Plants of South Africa. Briza Publications, Pretoria, RSA.

CRITICAL BIODIVERSITY AREAS MAPS (PER MUNICIPALITY) AND GIS DATA AVAILABLE FROM: Biodiversity GIS (BGIS), South African National Biodiversity Institute, Tel. +27 21 799 8739 or CapeNature, Tel. +27 21 866 8000. Or on the web at: http://bgis.sanbi.org/fsp/project.asp

DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa

DEPARTMENT OF WATER AFFAIRS (DWA). 2007. Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types by M. Rountree (ed); C.P. Todd, C. J. Kleynhans, A. L. Batchelor, M. D. Louw, D. Kotze, D. Walters, S. Schroeder, P. Illgner, M. Uys. and G.C. Marneweck. Report no. N/0000/00/WEI/0407. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa

DEPARTMENT OF WATER AFFAIRS AND FORESTRY (DWAF) 2005: Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY (DWAF), South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999 [Appendix W3].

DU PREEZ, L. & CARRUTHERS, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature., Cape Town.

FRIEDMANN, Y. & DALY, B. 2004. Red data book of the mammals of South Africa, a conservation assessment. Johannesburg, Endangered Wildlife Trust.

KLEYNHANS C.J., THIRION C. AND MOOLMAN J. 2005. A Level 1 Ecoregion Classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria

KOTZE D.C., MARNEWECK G.C., BATCHELOR A.L., LINDLEY D.S. AND COLLINS N.B. 2009. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report No. TT 339/09. Water Research Commission, Pretoria.

MACFARLANE DM, KOTZE DC, ELLERY WN, WALTERS D, KOOPMAN V, GOODMAN P AND GOGE C. 2007. WET-Health: A technique for rapidly assessing wetland health. WRC Report No TT 340/08, Water Research Commission, Pretoria.

MACVICAR, C. N., SCOTNEY, D. M. SKINNER, T. E. NIEHAUS, H. S. & LOUBSER, J. H., 1974. A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. S. Afr. J. Agric. Extension, 3(3): 1-4.MCDONALD, D.J. 1997. VEGMAP: a collaborative project for a new vegetation map of southern Africa. *South African Journal of Science* 93: 424–426.

MARAIS, J. 2004. Complete Guide to the Snakes of Southern Africa. Struik Nature, Cape Town.

MINTER LR, BURGER M, HARRISON JA, BRAACK HH, BISHOP PJ & KLOEPFER D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

MUCINA, L. AND RUTHERFORD, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.

MUCINA, L., HOARE, D.B., LÖTTER, M.C., DU PREEZ, P.J., RUTHERFORD, M.C., SCOTT-SHAW, C.R., BREDENKAMP, G.J., POWRIE, L.W., SCOTT, L., CAMP, K.G.T., CILLIERS, S.S., BEZUIDENHOUT, H., MOSTERT, T.H., SIEBERT, S.J., WINTER, P.J.D., BURROWS, J.E., DOBSON, L., WARD, R.A., STALMANS, M., OLIVER, E.G.H., SIEBERT, F., SCHMIDT, E., KOBISI, K., KOSE, L. 2006. *Grassland Biome.* In: Mucina, L. & Rutherford, M.C. (eds.) Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C. & POWRIE, L.W. (editors) 2005. Vegetation map of South Africa, Lesotho and Swaziland. South African National Biodiversity Institute, Pretoria. ISBN 1-919976-22-1

MUELLER-DOMBOIS, D. AND ELLENBERG, H. 1974. Aims and methods of vegetation ecology. Wiley, New York.

National Environmental Management Act (NEMA) 107 of 1998

National Water Act 36 of 1998. Section 21(c) and (i).

OLLIS, D.J., SNADDON, C.D., JOB, N.M., & MBONA, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria

RAIMONDO, D., VON STADEN, L., FODEN, W., VICTOR, J.E., HELME, N.A., TURNER, R.C. KAMUNDI, D.A. & MANYAMA, P.A. (Eds.). 2009. Red list of South African plants 2009. Strelitzia 25:1-668

SKINNER, J.D. & CHIMIMBA, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

VAN OUDTSHOORN, F. 2004. Second Edition, Third Print. Guide to Grasses of South Africa. Briza Publications, Pretoria, RSA.

WESTHOFF, V. AND VAN DER MAAREL, E. 1978. The Braun-Blanquet approach. In: Whittaker, R.H. (ed.) Classification of plant communities. W. Junk, The Hague.

ANNEXURE A:

PHOTOS OF THE PROJECT SITE:

Figure A1: The Mvamanzi wetland from a distance.

Figure A2: The Mvamanzi wetland just before the confluence with the Umfolozi River.

Figure A3: A man-made dam in one of the seasonal tributaries. These dams are important watering points for the cattle and other domestic stock

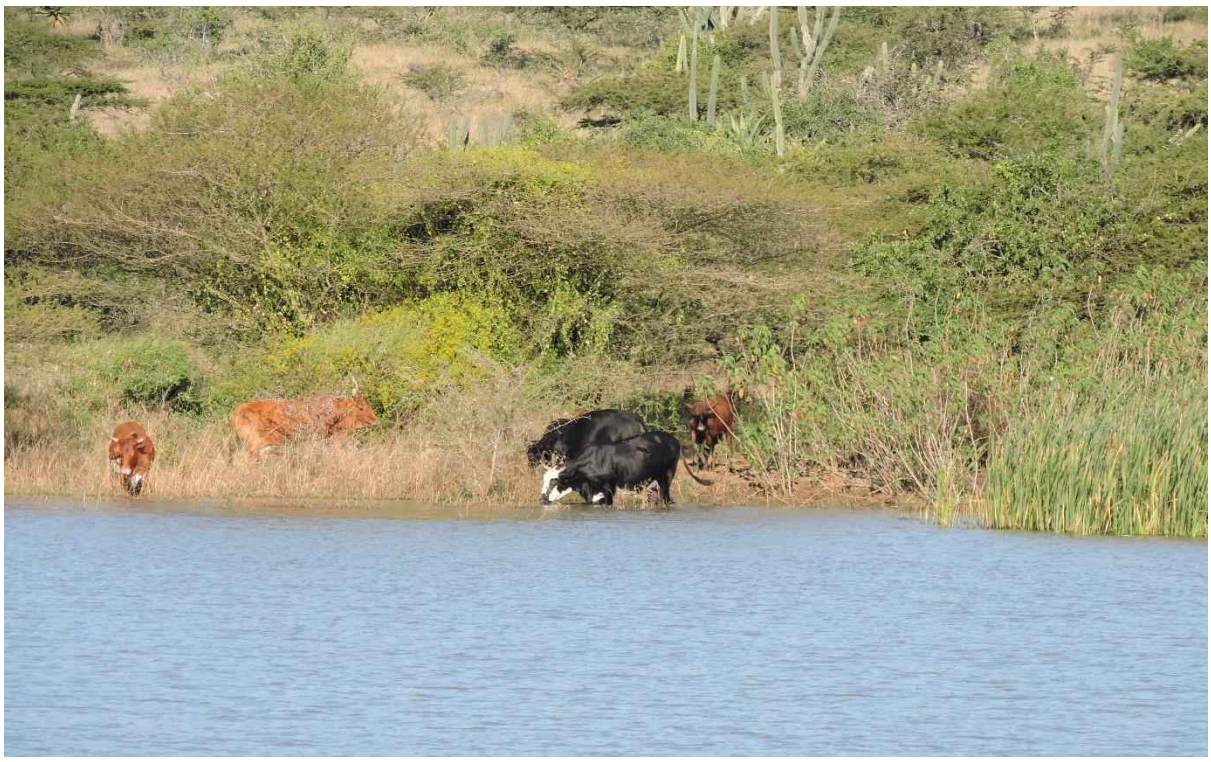


Figure A4: Cattle at one of the many man-made dams.

Figure A5: Denser vegetation near a seasonal stream.

Figure A6: An example of the Zululand Lowveld vegetation type. The aloe is *Aloe marlothii*.

Figure A7: A seasonal stream and its riparian vegetation invaded by exotic species.

Figure A8: Another seasonal stream.

Figure A9: Bank erosion due to a poor vegetation cover.

Figure A10: Degraded grassland near a seasonal stream

Figure A11: The Umfolozi River. Note the absence of a well – developed riparian vegetation

Figure A12: Note the exposed root systems of these Sycomore Figs (*Ficus sycomorus*). This is the result of erosion and a lack of proper vegetation cover.

Figure A13: Serious erosion near the Mvamanzi River.

Figure A14: Serious invasion by exotics such as Bugweed (*Solanum mauritianum*) and Lantana (*Lantana camara*)

Figure A15: *Ipomoea carnea* an aggressive invader of riparian systems

Figure A16: Famine weed *(Parthenium hysterophorus)* an aggressive invader of degraded areas

Figure A17: Paraffin weed *(Chromolaena odorata)* another aggressive invader of riparian area

Figure A18: Umfolozi aloe *(Aloe umfoloziensis)* an endemic of the region

ANNEXURE B:

LIST OF PLANT SPECIES OF CONSERVATION CONCERN WHICH ARE KNOWN TO OCCUR IN THE VICINITY OF STUDY AREA. THE LIST IS DERIVED FROM THE POSA WEBSITE.

Colours Relate as follow:

Threatened Status: Critically (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient (DDD), NE (NE)

- Protected according to National Forest Act 1998 / NFA (No 84 of 1998).
- Protected according to KwaZulu-Natal Nature Conservation Management Amendment Act, 1999 (No 5 of 1999)

Family	Species	Threat status
ACANTHACEAE	Blepharis acanthodioides Klotzsch	LC
ACANTHACEAE	Crossandra fruticulosa Lindau	LC
ACANTHACEAE	Crossandra greenstockii S.Moore	LC
ACANTHACEAE	Dicliptera clinopodia Nees	LC
ACANTHACEAE	Hypoestes forskaolii (Vahl) R.Br.	LC
ACANTHACEAE	Isoglossa woodii C.B.Clarke	LC
ACANTHACEAE	Justicia betonica L.	LC
ACANTHACEAE	Justicia capensis Thunb.	LC
ACANTHACEAE	Justicia odora (Forssk.) Vahl	LC
ACANTHACEAE	Justicia protracta (Nees) T.Anderson subsp. protracta	LC
ACANTHACEAE	Thunbergia alata Bojer ex Sims	LC
AMARYLLIDACEAE	Cyrtanthus galpinii Baker	LC
AMARYLLIDACEAE	Haemanthus albiflos Jacq.	LC
ANACARDIACEAE	Sclerocarya birrea (A.Rich.) Hochst. subsp. caffra (Sond.) Kokwaro	LC
ANACARDIACEAE	Searsia gueinzii (Sond.) F.A.Barkley	LC
ANACARDIACEAE	Searsia natalensis (Bernh. ex C.Krauss) F.A.Barkley	LC
ANACARDIACEAE	Searsia pyroides (Burch.) Moffett var. integrifolia (Engl.) Moffett	LC
ANTHERICACEAE	Chlorophytum galpinii (Baker) Kativu var. galpinii	LC
APIACEAE	Lichtensteinia interrupta (Thunb.) Sond.	LC
APOCYNACEAE	Brachystelma rubellum (E.Mey.) Peckover	LC
APOCYNACEAE	Gomphocarpus physocarpus E.Mey.	LC
APOCYNACEAE	Landolphia kirkii Dyer ex Hook.f.	LC
APOCYNACEAE	Pachycarpus appendiculatus E.Mey.	LC
APOCYNACEAE	Raphionacme palustris Venter & R.L.Verh.	LC
APOCYNACEAE	Rauvolfia caffra Sond.	LC
APOCYNACEAE	Tabernaemontana ventricosa Hochst. ex A.DC.	LC
ARALIACEAE	Cussonia zuluensis Strey	LC
ARCHIDIACEAE	Archidium ohioense Schimp. ex Müll.Hal.	
ARECACEAE	Hyphaene coriacea Gaertn.	LC
ASPHODELACEAE	Bulbine capitata Poelln.	LC
ASPHODELACEAE	Kniphofia tysonii Baker subsp. lebomboensis Codd	LC
ASPHODELACEAE	Trachyandra saltii (Baker) Oberm. var. saltii	LC
ASTERACEAE	Berkheya speciosa (DC.) O.Hoffm. subsp. speciosa	LC
ASTERACEAE	*Bidens pilosa L.	Not Ev
ASTERACEAE	Brachylaena discolor DC.	LC
ASTERACEAE	Brachylaena huillensis O.Hoffm.	LC
ASTERACEAE	Crassocephalum x picridifolium (DC.) S.Moore	Not Ev
ASTERACEAE	Distephanus angulifolius (DC.) H.Rob. & B.Kahn	LC

ASTERACEAE	Helichrysum appendiculatum (L.f.) Less.	LC
ASTERACEAE	Helichrysum athrixiifolium (Kuntze) Moeser	LC
ASTERACEAE	Helichrysum candolleanum H.Buek	LC
ASTERACEAE	Helichrysum nudifolium (L.) Less. var. pilosellum (L.f.) Beentje	LC
ASTERACEAE	Helichrysum spiralepis Hilliard & B.L.Burtt	LC
ASTERACEAE	Litogyne gariepina (DC.) Anderb.	LC
ASTERACEAE	Macledium zeyheri (Sond.) S.Ortíz subsp. argyrophyllum (Oliv.) S.Ortíz	LC
ASTERACEAE	Nidorella resedifolia DC. subsp. resedifolia	LC
ASTERACEAE	Osteospermum grandidentatum DC.	LC
ASTERACEAE	Osteospermum imbricatum L. subsp. nervatum (DC.) Norl. var. nervatum	LC
ASTERACEAE	Senecio coronatus (Thunb.) Harv.	LC
ASTERACEAE	Senecio inornatus DC.	LC
ASTERACEAE	Senecio latifolius DC.	LC
ASTERACEAE	Senecio speciosus Willd.	LC
ASTERACEAE	Senecio tamoides DC.	LC
ASTERACEAE	Sphaeranthus peduncularis DC. subsp. peduncularis	LC
ASTERACEAE	Tarchonanthus trilobus DC. var. galpinii (Hutch. & E.Phillips) Paiva	LC
ASTERACEAE	Vernonia gerrardii Harv.	LC
BIGNONIACEAE	Tecoma capensis (Thunb.) Lindl.	LC
BORAGINACEAE	Ehretia rigida (Thunb.) Druce subsp. nervifolia Retief & A.E.van Wyk	LC
BRYACEAE	Rhodobryum commersonii (Schwägr.) Paris	
BUDDLEJACEAE	Nuxia oppositifolia (Hochst.) Benth.	LC
BURSERACEAE	Commiphora harveyi (Engl.) Engl.	LC
BURSERACEAE	Commiphora neglecta I.Verd.	LC
CAMPANULACEAE	Wahlenbergia krebsii Cham. subsp. krebsii	LC
CAPPARACEAE	Capparis tomentosa Lam.	LC
CAPPARACEAE	Maerua rosmarinoides (Sond.) Gilg & Gilg-Ben.	LC
CELASTRACEAE	Elaeodendron transvaalense (Burtt Davy) R.H.Archer	NT
CELASTRACEAE	Gymnosporia maranguensis (Loes.) Loes.	LC
CELASTRACEAE	Gymnosporia senegalensis (Lam.) Loes.	LC
CELASTRACEAE	Maytenus peduncularis (Sond.) Loes.	LC
CELASTRACEAE	Mystroxylon aethiopicum (Thunb.) Loes. subsp. aethiopicum	LC
CELASTRACEAE	Putterlickia verrucosa (E.Mey. ex Sond.) Szyszyl.	LC
CELASTRACEAE	Salacia gerrardii Harv. ex Sprague	LC
CELASTRACEAE	Salacia kraussii (Harv.) Harv.	LC
CLUSIACEAE	Garcinia livingstonei T.Anderson	LC
COMBRETACEAE	Combretum molle R.Br. ex G.Don	LC
COMBRETACEAE	Combretum zeyheri Sond.	LC
COMMELINACEAE	Commelina erecta L.	LC
CONVOLVULACEAE	Convolvulus farinosus L.	LC
CONVOLVULACEAE	Ipomoea ficifolia Lindl.	LC
CONVOLVULACEAE	Ipomoea obscura (L.) Ker Gawl. var. obscura	LC
CRASSULACEAE	Cotyledon orbiculata L. var. oblonga (Haw.) DC.	LC
CRASSULACEAE	Crassula pellucida L. subsp. brachypetala (Drège ex Harv.) Toelken	LC
CRASSULACEAE	Kalanchoe neglecta Toelken	LC
CRASSULACEAE	Kalanchoe paniculata Harv.	LC
CRASSULACEAE	Kalanchoe rotundifolia (Haw.) Haw.	LC
CUCURBITACEAE	Coccinia rehmannii Cogn.	LC
CUCURBITACEAE	Momordica foetida Schumach.	LC
CYPERACEAE	Bulbostylis contexta (Nees) M.Bodard	LC
CYPERACEAE	Cyperus dives Delile	LC
CYPERACEAE	Cyperus latifolius Poir.	LC

CYPERACEAE	Cyperus solidus Kunth	LC
CYPERACEAE	Fuirena hirsuta (P.J.Bergius) P.L.Forbes	LC
CYPERACEAE	Isolepis cernua (Vahl) Roem. & Schult. var. cernua	LC
CYPERACEAE	Isolepis prolifera (Rottb.) R.Br.	LC
CYPERACEAE	Pycreus polystachyos (Rottb.) P.Beauv. var. polystachyos	LC
CYPERACEAE	Pycreus rehmannianus C.B.Clarke	LC
CYPERACEAE	Rhynchospora brownii Roem. & Schult.	LC
CYPERACEAE	Schoenoxiphium sparteum (Wahlenb.) C.B.Clarke	LC
CYPERACEAE	Scleria melanomphala Kunth	LC
EBENACEAE	Diospyros glandulifera De Winter	LC
EBENACEAE	Diospyros lycioides Desf. subsp. nitens (Harv. ex Hiern) De Winter	LC
ELATINACEAE	Elatine ambigua Wight	LC
ELATINACEAE	Elatine triandra Schkuhr	LC
EUPHORBIACEAE	Acalypha angustata Sond.	LC
EUPHORBIACEAE	Croton menyharthii Pax	LC
EUPHORBIACEAE	Ctenomeria capensis (Thunb.) Harv. ex Sond.	LC
EUPHORBIACEAE	Euphorbia trichadenia Pax var. trichadenia	LC
EUPHORBIACEAE	Macaranga capensis (Baill.) Benth. ex Sim var. capensis	LC
EUPHORBIACEAE	Shirakiopsis elliptica (Hochst.) Esser	LC
EUPHORBIACEAE	Suregada africana (Sond.) Kuntze	LC
EUPHORBIACEAE	Suregada zanzibariensis Baill.	LC
EUPHORBIACEAE	Tragia glabrata (Müll.Arg.) Pax & K.Hoffm. var. glabrata	LC
FABACEAE	Abrus precatorius L. subsp. africanus Verdc.	LC
FABACEAE	Acacia caffra (Thunb.) Willd.	LC
FABACEAE	Acacia karroo Hayne	LC
FABACEAE	Acacia senegal (L.) Willd. var. rostrata Brenan	LC
FABACEAE	Acacia theronii P.P.Swartz	LC
FABACEAE	Acacia tortilis (Forssk.) Hayne subsp. heteracantha (Burch.) Brenan	LC
FABACEAE	Albizia adianthifolia (Schumach.) W.Wight var. adianthifolia	LC
FABACEAE	Albizia suluensis Gerstner	EN
FABACEAE	Crotalaria pallida Aiton var. pallida	LC
FABACEAE	Eriosema psoraleoides (Lam.) G.Don	LC
FABACEAE	Eriosema zuluense C.H.Stirt.	LC
FABACEAE	Galactia tenuiflora (Willd.) Wight & Arn. var. villosa (Wight & Arn.) Benth.	LC
FABACEAE	Indigastrum costatum (Guill. & Perr.) Schrire subsp. macrum (E.Mey.) Schrire	LC
FABACEAE	Indigofera hilaris Eckl. & Zeyh. var. hilaris	LC
FABACEAE	Ormocarpum trichocarpum (Taub.) Engl.	LC
FABACEAE	Pearsonia sessilifolia (Harv.) Dummer subsp. filifolia (Bolus) Polhill	LC
FABACEAE	Rhynchosia albissima Gand.	LC
FABACEAE	Rhynchosia minima (L.) DC. var. minima	LC
FABACEAE	Rhynchosia nervosa Benth. ex Harv. var. nervosa	LC
FABACEAE	Rhynchosia sordida (E.Mey.) Schinz	LC
FABACEAE	Schotia brachypetala Sond.	LC
FABACEAE	Schotia capitata Bolle	LC
FABACEAE	Sphenostylis marginata E.Mey. subsp. marginata	LC
FABACEAE	Tephrosia longipes Meisn. subsp. longipes var. longipes	LC
FABACEAE	Tephrosia semiglabra Sond.	LC
FABACEAE	Zornia capensis Pers. subsp. capensis	LC
FISSIDENTACEAE	Fissidens erosulus (Müll.Hal.) Paris	
FISSIDENTACEAE	Fissidens palmifolius (P.Beauv.) Broth.	
FUNARIACEAE	Physcomitrium spathulatum Müll.Hal. var. spathulatum	

GERANIACEAE	Pelargonium alchemilloides (L.) L'Hér.	LC
GUNNERACEAE	Gunnera perpensa L.	Declining
HYACINTHACEAE	Eucomis autumnalis (Mill.) Chitt. subsp. clavata (Baker) Reyneke	Not Ev
HYACINTHACEAE	Ledebouria floribunda (Baker) Jessop	LC
HYACINTHACEAE	Resnova humifusa (Baker) U.& D.Müll.-Doblies	LC
HYMENOPHYLLACEAE	Crepidomanes melanotrichum (Schltdl.) J.P.Roux	LC
HYPOPTERYGIACEAE	Hypopterygium tamarisci (Sw.) Brid. ex Müll.Hal.	
HYPOXIDACEAE	Hypoxis rigidula Baker var. pilosissima Baker	LC
ICACINACEAE	Apodytes dimidiata E.Mey. ex Arn. subsp. dimidiata	LC
LAMIACEAE	Clerodendrum glabrum E.Mey.	LC
LAMIACEAE	Hoslundia opposita Vahl	LC
LAMIACEAE	Ocimum serratum (Schltr.) A.J.Paton	LC
LAMIACEAE	Plectranthus fruticosus L'Hér.	LC
LAMIACEAE	Plectranthus hadiensis (Forssk.) Schweinf. ex Spreng.	LC
LAMIACEAE	Plectranthus hadiensis (Forssk.) Schweinf. ex Spreng.	LC
LAMIACEAE	Plectranthus verticillatus (L.f.) Druce	LC
LAMIACEAE	Stachys nigricans Benth.	LC
LAURACEAE	Cryptocarya woodii Engl.	LC
LENTIBULARIACEAE	Utricularia livida E.Mey.	LC
LORANTHACEAE	Agelanthus gracilis (Toelken & Wiens) Polhill & Wiens	LC
MALVACEAE	Corchorus confusus Wild	LC
MALVACEAE	Dombeya burgessiae Gerrard ex Harv.	LC
MALVACEAE	Grewia bicolor Juss. var. bicolor	LC
MALVACEAE	Grewia flavescens Juss.	LC
MALVACEAE	Grewia microthyrsa K.Schum. ex Burret	LC
MALVACEAE	Grewia occidentalis L. var. occidentalis	LC
MALVACEAE	Grewia villosa Willd. var. villosa	LC
MALVACEAE	*Hibiscus trionum L.	
MALVACEAE	Sida cordifolia L. subsp. cordifolia	LC
MALVACEAE	Thespesia acutiloba (Baker f.) Exell & Mendonça	LC
MELIACEAE	Ekebergia capensis Sparrm.	LC
MYRSINACEAE	Rapanea melanophloeos (L.) Mez	Declining
MYRTACEAE	Eugenia natalitia Sond.	LC
MYRTACEAE	Syzygium cordatum Hochst. ex C.Krauss subsp. cordatum	LC
NECKERACEAE	Porothamnium stipitatum (Mitt.) Touw ex De Sloover	
OCHNACEAE	Ochna natalitia (Meisn.) Walp.	LC
ONAGRACEAE	Ludwigia abyssinica A.Rich.	LC
ORCHIDACEAE	Cyrtorchis praetermissa Summerh. subsp. zuluensis	LC
ORCHIDACEAE	Disa woodii Schltr.	LC
ORCHIDACEAE	Eulophia cucullata (Afzel. ex Sw.) Steud.	LC
ORCHIDACEAE	Eulophia streptopetala Lindl.	LC
ORCHIDACEAE	Satyrium macrophyllum Lindl.	LC
ORCHIDACEAE	Stenoglottis longifolia Hook.f.	LC
OROBANCHACEAE	Alectra sessiliflora (Vahl) Kuntze var. sessiliflora	LC
OROBANCHACEAE	Buchnera dura Benth.	LC
OROBANCHACEAE	Cycnium tubulosum (L.f.) Engl. subsp. tubulosum	LC
OROBANCHACEAE	Graderia scabra (L.f.) Benth.	LC
OROBANCHACEAE	Striga bilabiata (Thunb.) Kuntze subsp. bilabiata	LC
OXALIDACEAE	Oxalis semiloba Sond. subsp. semiloba	LC
PARMELIACEAE	Parmotrema praesorediosum (Nyl.) Hale	
PARMELIACEAE	Parmotrema reticulatum (Taylor) M.Choisy	
PASSIFLORACEAE	Adenia digitata (Harv.) Engl.	LC

PHYLLANTHACEAE	Flueggea virosa (Roxb. ex Willd.) Voigt subsp. virosa	LC
PHYSCIACEAE	Heterodermia allardii (Kurok.) Trass	
PHYTOLACCACEAE	Phytolacca dodecandra L'Hér.	LC
POACEAE	Alloteropsis papillosa Clayton	LC
POACEAE	Alloteropsis semialata (R.Br.) Hitchc. subsp. semialata	LC
POACEAE	Bothriochloa bladhii (Retz.) S.T.Blake	LC
POACEAE	Bothriochloa insculpta (Hochst. ex A.Rich.) A.Camus	LC
POACEAE	Brachiaria chusqueoides (Hack.) Clayton	LC
POACEAE	Dactyloctenium aegyptium (L.) Willd.	LC
POACEAE	Dactyloctenium geminatum Hack.	LC
POACEAE	Digitaria eriantha Steud.	LC
POACEAE	Digitaria natalensis Stent	LC
POACEAE	Digitaria perrottetii (Kunth) Stapf	LC
POACEAE	Digitaria ternata (A.Rich.) Stapf	LC
POACEAE	Elionurus muticus (Spreng.) Kunth	LC
POACEAE	Enneapogon cenchroides (Licht. ex Roem. & Schult.) C.E.Hubb.	LC
POACEAE	Eragrostis capensis (Thunb.) Trin.	LC
POACEAE	Eragrostis inamoena K.Schum.	LC
POACEAE	Eragrostis racemosa (Thunb.) Steud.	LC
POACEAE	Eriochloa stapfiana Clayton	LC
POACEAE	Fingerhuthia africana Lehm.	LC
POACEAE	*Olyra latifolia L.	Not Ev
POACEAE	Panicum aequinerve Nees	LC
POACEAE	Panicum coloratum L. var. coloratum	LC
POACEAE	Panicum laticomum Nees	LC
POACEAE	Pseudechinolaena polystachya (Kunth) Stapf	LC
POACEAE	Setaria sagittifolia (A.Rich.) Walp.	LC
POACEAE	Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	LC
POACEAE	Sporobolus ioclados (Trin.) Nees	LC
POACEAE	Sporobolus pyramidalis P.Beauv.	LC
POACEAE	Sporobolus stapfianus Gand.	LC
POACEAE	Trachypogon spicatus (L.f.) Kuntze	LC
POACEAE	Tripogon minimus (A.Rich.) Steud.	LC
POACEAE	Urochloa mosambicensis (Hack.) Dandy	LC
POLYGALACEAE	Polygala producta N.E.Br.	LC
POLYGONACEAE	Persicaria decipiens (R.Br.) K.L.Wilson	LC
PORTULACACEAE	Talinum caffrum (Thunb.) Eckl. & Zeyh.	LC
PROTEACEAE	Protea roupelliae Meisn. subsp. roupelliae	LC
PTAEROXYLACEAE	Ptaeroxylon obliquum (Thunb.) Radlk.	LC
PUTRANJIVACEAE	Drypetes gerrardii Hutch. var. gerrardii	LC
RAMALINACEAE	Ramalina celastri (Spreng.) Krog & Swinscow subsp. celastri	
RAMALINACEAE	Ramalina dumeticola Krog & Swinscow	
RAMALINACEAE	Ramalina thraustoides Vain.	
RANUNCULACEAE	Clematis brachiata Thunb.	LC
RHAMNACEAE	Lasiodiscus pervillei Baill. subsp. pervillei	LC
RUBIACEAE	Burchellia bubalina (L.f.) Sims	LC
RUBIACEAE	Coddia rudis (E.Mey. ex Harv.) Verdc.	LC
RUBIACEAE	Gardenia cornuta Hemsl.	LC
RUBIACEAE	Gardenia thunbergia L.f.	LC
RUBIACEAE	Kohautia amatymbica Eckl. & Zeyh.	LC
RUBIACEAE	Kraussia floribunda Harv.	LC
RUBIACEAE	Pavetta inandensis Bremek.	LC

RUBIACEAE	Pyrostria hystrix (Bremek.) Bridson	LC
RUBIACEAE	Rothmannia globosa (Hochst.) Keay	LC
RUBIACEAE	Tricalysia delagoensis Schinz	LC
RUBIACEAE	Tricalysia lanceolata (Sond.) Burtt Davy	LC
RUTACEAE	Teclea natalensis (Sond.) Engl.	LC
SALICACEAE	Scolopia zeyheri (Nees) Harv.	LC
SALICACEAE	Trimeria grandifolia (Hochst.) Warb. subsp. grandifolia	LC
SAPINDACEAE	Cardiospermum halicacabum L. var. halicacabum	LC
SAPINDACEAE	Pappea capensis Eckl. & Zeyh.	LC
SAPOTACEAE	Manilkara discolor (Sond.) J.H.Hemsl.	LC
SAPOTACEAE	Manilkara mochisia (Baker) Dubard	LC
SAPOTACEAE	Mimusops obovata Nees ex Sond.	LC
SCROPHULARIACEAE	Halleria lucida L.	LC
SCROPHULARIACEAE	Jamesbrittenia kraussiana (Bernh.) Hilliard	LC
SOLANACEAE	Lycium acutifolium E.Mey. ex Dunal	LC
SOLANACEAE	*Physalis angulata L.	Not Ev
SOLANACEAE	Solanum giganteum Jacq.	LC
SOLANACEAE	Solanum lichtensteinii Willd.	LC
SOLANACEAE	*Solanum nigrum L.	Not Ev
SOLANACEAE	*Solanum seaforthianum Andrews var. disjunctum O.E.Schulz	Not Ev
STRIGULACEAE	Strigula elegans (Fée) Müll.Arg. var. elegans	
STRYCHNACEAE	Strychnos henningsii Gilg	LC
STRYCHNACEAE	Strychnos madagascariensis Poir.	LC
TELOSCHISTACEAE	Teloschistes exilis (Michx.) Vain. var. exilis	
THYMELAEACEAE	Gnidia caffra (Meisn.) Gilg	LC
THYMELAEACEAE	Gnidia microcephala Meisn.	LC
URTICACEAE	Didymodoxa caffra (Thunb.) Friis & Wilmot-Dear	LC
URTICACEAE	Laportea peduncularis (Wedd.) Chew subsp. peduncularis	LC
VERBENACEAE	Priva cordifolia (L.f.) Druce var. abyssinica (Jaub. & Spach) Moldenke	LC
VITACEAE	Cissus cactiformis Gilg	LC
VITACEAE	Cyphostemma natalitium (Szyszyl.) J.J.M.van der Merwe	LC
VITACEAE	Rhoicissus tridentata (L.f.) Wild & R.B.Drumm. subsp. tridentata	Not Ev
ZYGOPHYLLACEAE	Tribulus terrestris L.	LC

ANNEXURE C
SITE SPECIFIC REHABILITATION PLAN

The objective of the site closure phase is to ensure that:

a) the site and areas disturbed by prospecting are rehabilitated and/or landscaped;
b) that the site and areas disturbed by prospecting are visually appealing and are left in a neat and tidy condition;
c) contaminants/pollution sources are removed from the site or that appropriate measures are in place to control long-term contamination sources;
d) the site and surrounding disturbed areas are in a stable condition.

Listed below are the provisional requirements for closure of the site. These are intended as a guideline and will be augmented and made specific by the ECO at the time of closure. The guidelines provided in the preceding sections still apply during site closure.

1. Backfill all remaining voids.
2. Remove all containers and temporary office structures from the site.
3. Drain all pollution sumps and dispose of all solid and liquid waste at a permitted landfill site.
4. Break up all concrete structures, cart concrete from the site and dispose of at a permitted landfill site.
5. Collect all litter and packaging from within the site as well as the peripheral areas and dispose at a permitted landfill site.
6. Remove all waste building components/parts from the site (whether scrap or not) including metal, wood, drums, plastic, cabling, tubing, etc.
7. Remove all stockpiled rubble from the site and dispose of at a permitted disposal site.
8. Ensure that no waste is buried on site.
9. Disconnect all temporary power, water and sewerage connections.
10. Disassemble and remove all ablution facilities.
11. Ensure that all infrastructure routes are rehabilitated and stable.
12. Clear weeds from the prospecting site and peripheral disturbed areas.
13. Identify actual and potential erosion sites and implement measures for control/prevention of erosion. Ensure that appropriate erosion control measures are installed around storm water outlets and stabilise and re-grass areas around storm water outlets with indigenous species.
14. Ensure that no bare, unvegetated areas remain.
15. Rehabilitate all disused tracks and roads.
16. Clear all litter and rubble from drainage lines and disposes of appropriately.
17. Make provision for the rehabilitation of peripheral areas not directly included within the site that were disturbed during the prospecting process. Rehabilitation may entail grading, leveling, fertilizing and re-grassing.
18. Ensure that all public roads are satisfactorily cleared of rubble.

19. Repair damaged road curbs or other structures
20. Complete the landscaping of the areas within the site including parking areas.
21. Where possible indigenous plants must be used as part of the landscaping process.
22. The Landscape Contractor is to ensure that adequate planting of indigenous plants is catered for. The ECO is to review and approve the landscaping plans.
23. It is recommended that efforts on invasive species management, erosion control and rehabilitation is coordinated to avoid negative effects of one development on the environmental state on and around the other.

ANNEXURE D:

ALIEN INVASIVE MANAGEMENT PLAN

1: Prospecting Phase					
Nr	**Task**	**Responsible Party**	**Frequency**		
			Footprint	**Area of Influence**	**Project Site**
1.1	Clearing of alien species must be organized and approved	Contractor	Daily	Daily	Daily
1.2	All manually cleared alien plants must be disposed of carefully and must not be dumped in any areas of indigenous vegetation, even temporarily.	Contractor	Daily	Daily	Daily
1.3	No mass clearing of vegetation should be done, but rather vegetation should be cleared as work progresses. No large areas should be cleared unless surfacing occurs immediately after.	Contractor	Weekly	N/A	N/A
1.4	Cleared areas that will not be surfaced for an extended period of time (over 2 weeks) should be stabilized with packed brush (from indigenous plants cleared from the site), or with jute pegged over the area.	Contractor	Weekly	N/A	N/A
1.5	Any exposed prospecting areas that have become invaded can be sprayed with herbicides (only those that break down on contact with the soil e.g. “Round-up”)	Contractor	Weekly	N/A	N/A
1.6	Any soil stockpiles that have become invaded should be cleared through manual control methods (weeding).	Contractor	Weekly	N/A	N/A
1.7	Areas that will be vegetated though rehabilitation must be done so through the rehabilitation plan. No organic matter from outside the site should be used to encourage regrowth of vegetation.	Contractor	Monthly	N/A	N/A

1.8	Introduction of alien plant species to the site should be prevented as far as practicable. Vehicles entering should be inspected, outside sources of soil and sand should be clear of invasive species.	Contractor	Daily		
1.9	Alien invasive species must be controlled throughout the entire site during the prospecting process.	Contractor	Monthly	Every 2 months	Every 6 months
1.10	Species-specific control measures should be used. These are provided in this plan for species recorded from the site. If any new species are recorded, best practice means of control must be researched and used.	Contractor	Monthly	Every 2 months	Every 6 months
1.11	Clearing must be restricted to the footprint of the site as defined in the Ecological Impact Assessment.	Contractor	Weekly	Weekly	Monthly
1.12	Any no-go areas (such as wetlands) should be demarcated and workers should be informed that no activities are to occur in these areas.	Contractor	Daily	N/A	N/A
2: Operational Phase					
Nr	**Task**	**Responsible Party**	**Frequency**		
			Footprint	**Area of Influence**	**Project Site**
2.1	Surveys of the site for alien invasive species must be conducted throughout the life of the project. These include new invasions by recorded species as well as new invader species on site.	Contractor	Monthly for 2 years (the defects notification period), then every 3 months.	Once a year for two years, then every second year.	Once in the first two years, then every 5 years.

2.2	To prevent increased invasion in areas cleared for prospecting but not needed for operation, rehabilitation of the natural vegetation should be done. This should follow the prescribed Rehabilitation Plan.	Contractor	Refer to Rehabilitation Plan		
2.3	Areas where vegetation is required to be kept low, should be managed using weedeaters above the soil line to maintain the indigenous vegetation and reduce invasion potential.	Contractor	When necessary	N/A	N/A

NOTIFICATION OF INTENT TO DEVELOP

FOR A PROSPECTING RIGHT FOR COAL, PSEUDOCOAL, TORBANITE, CLAY AND AGGREGATE ON THE FARM FULENI RESERVE 14375 GU, MAGISTERIAL DISTRICT EMPANGENI, KWAZULU-NATAL PROVINCE.

Client:

Imvukuzane Resources (Pty) Ltd

Client info:

Sarah Wanless

E – mail: sw@menar.com

Beyond Heritage

Private Bag X 1049

Suite 34

Modimolle

0510

Tel: 082 373 8491

Fax: 086 691 6461

E-Mail: Jaco@heritageconsultants.co.za

Report Author:

Mr. J. van der Walt

Project Reference:

2247

Report date:

April 20222

DOCUMENT PROGRESS

Notification of Intent to Develop

Document status

Document Version	v1.0
Report Purpose	Notification of Intent to Develop
Report Ref. No.	2247

Distribution List

Date	Report Reference number	Document Distribution	Number of Copies
04/11/2022	2247	Imvukuzane Resources (Pty(Ltd	Electronic copy

Contents

Figures

Tables

1. Introduction

Beyond Heritage was requested by Imvukuzane Resources (Pty) Ltd to compile a heritage Notice of Intention to Develop (NID) that will be submitted by the EAP to AMAFA as part of the environmental authorization process for a prospecting right application. The prospecting will target coal, pseudo coal, torbanite, clay and aggregate on of the farm Fuleni Reserve 14375 GU, Magisterial District Empangeni, KwaZulu-Natal Province. The prospecting includes the following activities distributed over an area of approximately 14 717ha:

Drill site establishment:

A drill site of approximately 400 m² will be established that will require:

- Clearing of vegetation for sumps and the drill entrance point;
- Earth sumps for water recycling;
- Laydown area for drill rods, fuel and chemical storage; and
- Chemical toilets.

Drilling and removal of geological cores:

- Drilling a hole of approximately 110 mm in diameter and removing of rock core.
- Number of boreholes: approximately 55

Casing of boreholes:

- 1m² per borehole. Number of boreholes limited to 55.

Rehabilitation of drill sites.

The proposed project triggers listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and the Environmental Impact Assessment Regulations, 2014 (as amended 2017) and therefore requires a basic assessment process to obtain environmental authorization.

2. Project Location

Province	KwaZulu-Natal Province
District Municipality	King Cetshwayo District Municipality
Nearest Town	Kwambonambi/ Mtubatuba
Property Name and Number	Portion 0 of Fuleni Reserve 14375 GU
1:50 000 Map Sheet	2832AC; 2831BD; 2831 DB
GPS Co-ordinates	-28.476632°
(Relative center point of study area)	31.892753°

The proposed prospecting footprint falls within a rural area partially altered through subsistence farming.

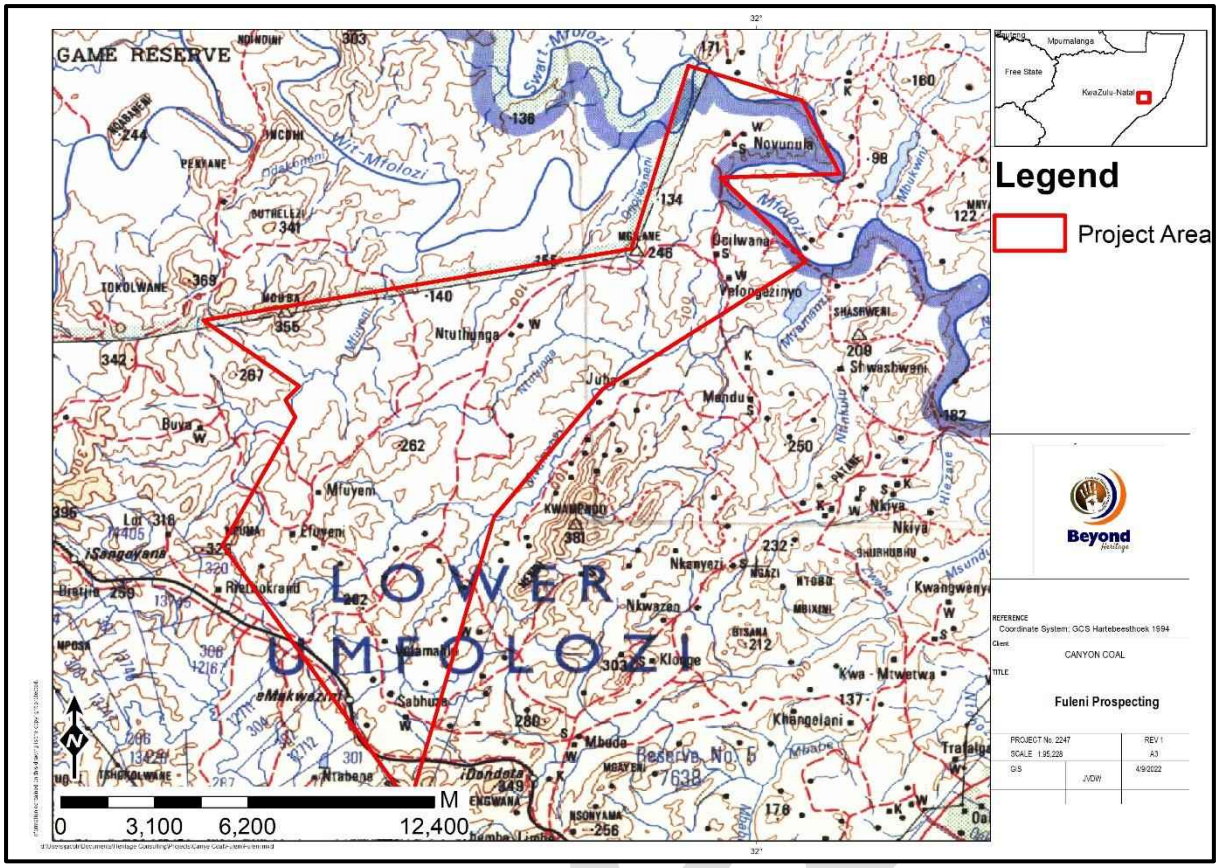


Figure 1.Locality map indicating the study area in red.

3. Project Details

The exact location where drilling will be carried out will be determined by the results of geophysical and geological work carried out in Phase 1 of the prospecting program.. The initial holes will be drilled on the Prospecting area that forms part of this application. Approximately 55 holes will be drilled. All drill holes will be approved by the environmental manager prior to approval thereof. The environmental management plan related to this project will consider environmental sensitivities and advise on the location of drilling holes. There will be clearly defined targets that will warrant testing by diamond, reverse circulation or percussions drilling. It is envisaged that a combination of HQ (63.5 mm) and NQ (47.63 mm) drilling will be used to drill targets. The borehole depths are expected to vary between 25 m and 125 m with an average of approximately70 m. The core will be logged, cut and sampled at a core yard to be located near the prospecting site. The samples will be crushed and milled and then analyzed at an accredited laboratory in for coal quality.

3.1. Activities

The following invasive activities will take place during the lifespan of the proposed prospecting.

Drill site establishment:

A drill site of approximately 400 m² will be established that will require:

- Clearing of vegetation for sumps and the drill entrance point;
- Earth sumps for water recycling;
- Laydown area for drill rods, fuel and chemical storage; and
- Chemical toilets.

Drilling and removal of geological cores:

- Drilling a hole of approximately 110 mm in diameter and removing of rock core.
- Number of boreholes will be finalised once non-invasive prospecting is completed.

Casing of boreholes:

- 1m² per borehole..

Rehabilitation of drill sites.

The existing farm roads/tracks will be used as far as practically possible. No additional roads are foreseen to be constructed.

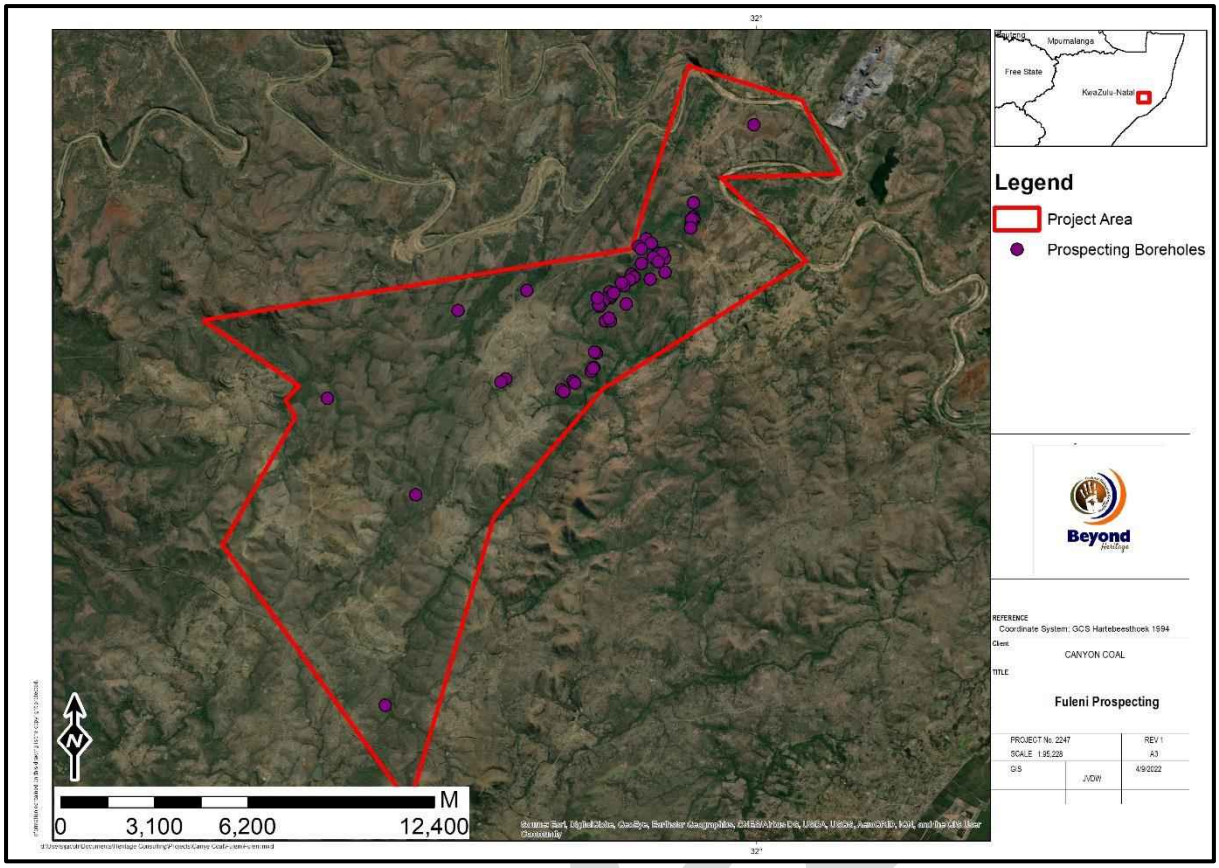


Figure 2.Aerial image indicating the Project area and proposed drill sites.

3.2 Receiving Environment

The project area is mostly undeveloped and rural with low-density dispersed settlements and associated subsistence agriculture. Dwellings are grouped as small family-sized homesteads located in undulating terrain. The foremost part of the prospecting area comprises of natural vegetated areas representative of the Zululand Lowveld, -Sourveld, and -Coastal Thornveld vegetation types.

The prospecting area falls within the Eastern Coal Basins that lie on the eastern margin of the Kaapvaal Craton. Several isolated coalfields including Kangwane, Maloma (Swaziland), Nongoma and Somkhele form the Eastern Coal Basins and lie within the Lebombo-Natal monocline. Stratigraphically, these eastern coalfields except for Somkhele occur within the sediments of the Ecca Group i.e., Pietermaritzburg, Vryheid (where coal beds are known to occur) and Volksrust Formations. The Somkhele coalfield consisting of Emakhwezini Formation has been classified into the Beaufort Group as supported by paleontological (fossil) evidence

Figure 3. Undulating terrain.

Figure 4. General site conditions in the southern section.

Figure 5. Homesteads in the study area.

Figure 6. General site conditions.

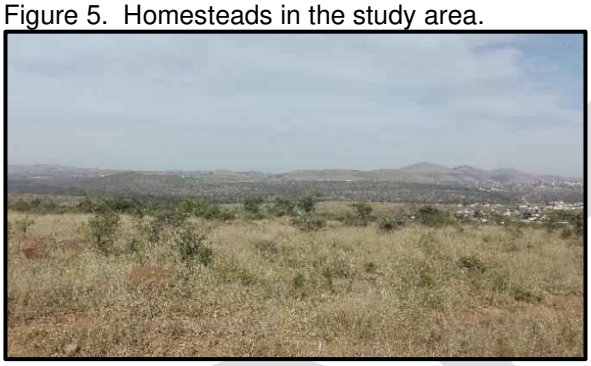


Figure 7. General site conditions.

Figure 8. General site conditions.

4. Legislative Framework

For this project the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) and the KZN Act 5 of 2018 are of importance and the following sites and features are protected:

a. Archaeological artefacts, structures and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures and sites older than 75 years
e. Historical objects, structures and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites or scientific or technological value.

The national estate includes the following:

a. Places, buildings, structures and equipment of cultural significance
b. Places to which oral traditions are attached or which are associated with living heritage
c. Historical settlements and townscapes
d. Landscapes and features of cultural significance
e. Geological sites of scientific or cultural importance
f. Archaeological and palaeontological importance
g. Graves and burial grounds
h. Sites of significance relating to the history of slavery
i. Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.)

Section 34 of the NHRA and Section 37 of the KZN Heritage Act deal with structures that are older than 60 years. Section 35(4) of the NHRA deals with archaeology, palaeontology and meteorites as does Section 40 of the KZN Heritage Act. Section 36 of the NHRA and Section 39 of the KZN Heritage Act, deal with human remains older than 60 years. Unidentified/unknown graves are also handled as older than 60 years until proven otherwise.

The Notification of Intent to Develop (NID) is submitted to AMAFA in terms of Sections 38(1) and 38(8) of the NHRA and Section 41 (1) of the KZN Heritage Act. This NID is submitted to outline what (if any) heritage resources are likely to be affected, how the character of the site will change and what processes need to be followed.

4.1 Heritage Site Significance and Mitigation Measures

The presence and distribution of heritage resources define a Heritage Landscape. In this landscape, every site is relevant. In addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area. In all initial investigations, however, the specialists are responsible only for the identification of resources visible on the surface.

This section describes the evaluation criteria used for determining the significance of archaeological and heritage sites. National and Provincial Monuments are recognised for conservation purposes. The following interrelated criteria were used to establish site significance:

- The unique nature of a site;
- The integrity of the archaeological/cultural heritage deposit;
- The wider historic, archaeological and geographic context of the site;
- The location of the site in relation to other similar sites or features;
- The depth of the archaeological deposit (when it can be determined or is known);
- The preservation condition of the site; and
- Potential to answer present research questions.

The criteria above will be used to place identified sites within the South African Heritage Resources Agency's (SAHRA's) (2006) system of grading of places and objects that form part of the national estate. This system is approved by the Association of South African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region.

Table 1. Heritage Field ratings

FIELD RATING	***GRADE***	***SIGNIFICANCE***	***RECOMMENDED MITIGATION***
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP. A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP. B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

4.2. NHRA Section 38 Triggers

The following aspects of Section 38 of the NHRA and Section 41 of the KZN Heritage Act may be triggered by the proposed project.

Table 2. NHRA Triggers

	NHRA Section 38 (1) Activities / Triggers			Summary description (e.g. 500 m road, etc.)
	A	Any linear development or barrier >300 m		The existing farm roads/tracks will be used as far as practically possible. No additional roads
	b	Any bridge or similar structure >50 m		No bridges will be constructed – not applicable
X	c	Any development or activity that will change the character of a site:		A drill site of approximately 400 m² will be established for 55 drill points resulting in a marginal temporary change to the study site
		i	≥5 000m^2 in extent	No. Each drill site will measure approximately 400 m²
		ii	Involving ≥3 existing erven/ Subdivisions	Not applicable
		iii	Involving ≥3 or more erven/ divisions consolidated within past 5 years.	Not applicable
	d	Rezoning of a site ≥10 000m^2 in extent.		No rezoning will take place as part of the prospecting right application – not applicable
X	e	Other triggers, e.g.: in terms of other legislation, (i.e.: National Environment Management Act, etc.)		NEMA, NWA, MPRDA

5. Limitations and assumptions

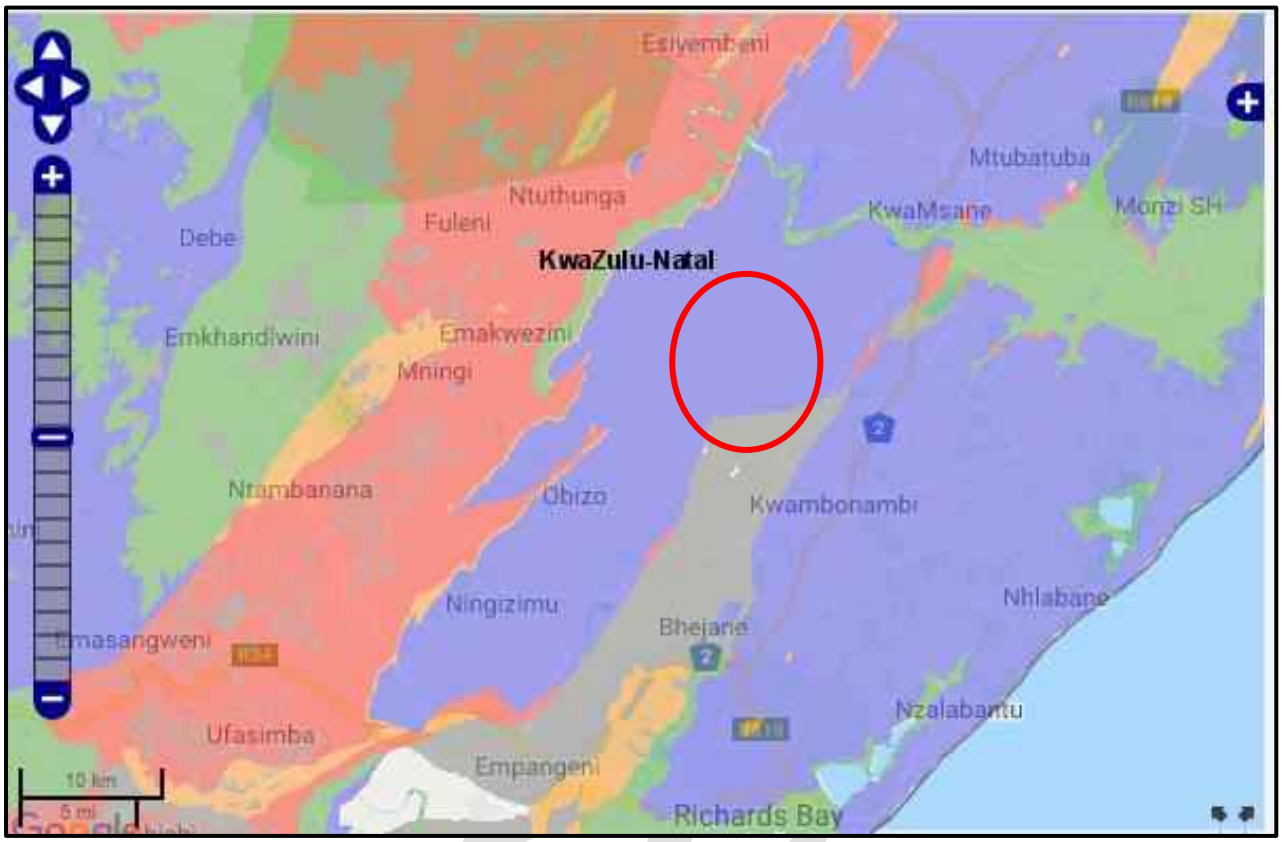
The study area was not subjected to a field survey at this stage in the process. It is assumed that information obtained for the wider area is applicable to the study area. Additional information could become available in future that could change the results of this report.

6. Heritage Resources

Heritage resources are defined in Section 2 of the NHRA as “any place or object of cultural significance”, where cultural significance can be understood as meaning “aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance”. Heritage resources together constitute the National Estate, as defined in Section 3 of the NHRA, and each resource is recognized and protected under the Act.

A variety of heritage resources contribute to the heritage character of the area, and these are briefly dealt with below. Categories of potential heritage resources expected was assessed to derive the heritage character of the area. This was done by consultation of heritage reports captured into SAHRIS as well as other archaeological databases.

6.1. Paleontological resources



Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map

Figure 9. The approximate study area (red polygon) as indicated on the SAHRA paleontological sensitivity map.

6.2. Archaeological background

The archaeology of KwaZulu-Natal can be divided in three main periods namely the Stone Age, Iron Age and Historical period.

6.2.1. Stone Age

South Africa has a long and complex Stone Age sequence of more than 2 million years. The broad sequence includes the Later Stone Age, the Middle Stone Age and the Earlier Stone Age. Each of these phases contains sub-phases or industrial complexes, and within these we can expect regional variation regarding characteristics and time ranges. For Cultural Resources Management (CRM) purposes it is often only expected/ possible to identify the presence of the three main phases.

Yet sometimes the recognition of cultural groups, affinities or trends in technology and/or subsistence practices, as represented by the sub-phases or industrial complexes, is achievable (Lombard et al 2012). The three main phases can be divided as follows;

- Later Stone Age; associated with Khoi and San societies and their immediate predecessors. - Recently to ~30 thousand years ago.
- Middle Stone Age; associated with Homo sapiens and archaic modern human - . 30-300 thousand years ago.
- Earlier Stone Age; associated with early Homo groups such as Homo habilis and Homo erectus. - 400 000-> 2 million years ago.

The LSA is well represented in KwaZulu-Natal with an abundance of rock art, like the rock paintings at Giants Castle and Kamberg in the Drakensburg Mountains (Vinnicombe, 1976). Rock art sites have been also been documented in the areas around Estcourt, Mooi River and Dundee. Several caves in KZN contain significant archaeological deposits like the well-known MSA site of Sibudu Cave on the coast of KwaZulu-Natal, which shows evidence for early forms of cognitive human behavioural patterns (Wadley, 2005). Another well-known cave called Border Cave is situated some 40 kilometres to the north east of the study area at the Ingodini Border Cave Museum Complex. The site was first investigated by Raymond Dart in 1934; here excavations exposed a thick deposit of archaeological material dating from the Iron Age overlaying MSA artefacts. Later excavations, by Beaumont in the early 1970's, revealed a complete MSA sequence succeeded by Early and Later Iron Age deposits (Klein 1977).

6.2.2. Iron Age and historical period

Bantu-speaking people moved into Eastern and Southern Africa about 2,000 years ago (Mitchell, 2002). These people cultivated sorghum and millets, herded cattle and small stock and manufactured iron tools and copper ornaments. Because metalworking represents a new technology, archaeologists call this period the Iron Age. Characteristic ceramic styles help archaeologists to separate the sites into different groups and time periods. The Iron Age as a whole represents the spread of Bantu speaking people and includes both the Pre-Historic and Historic periods. It can be divided into three distinct periods:

- The Early Iron Age: Most of the first millennium AD.
- The Middle Iron Age: 10th to 13th centuries AD.
- The Late Iron Age: 14th century to colonial period.

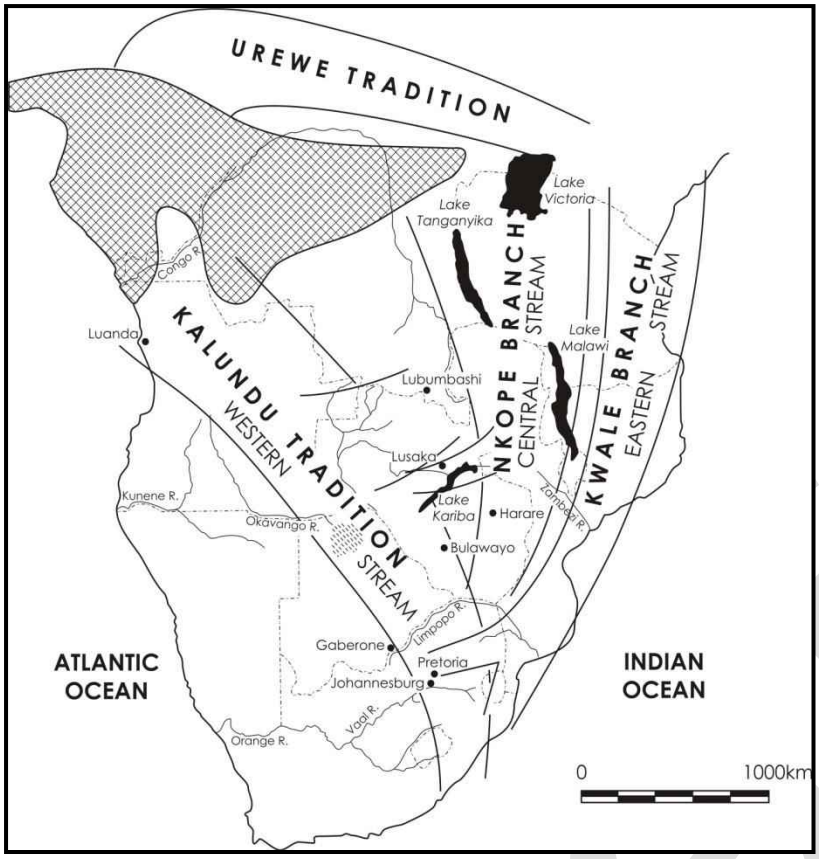


Figure 10: Movement of Bantu speaking farmers (Huffman 2007).

The first 1,000 years is called the Early Iron Age. Early Iron Age people made a living by mixed farming. They had the technology to work metals like iron. Existing evidence dates the Iron Age in southern Africa to the first millennium AD (Huffman, 2007). The site of Mzonjani, 15 km from Durban, is the oldest known Iron Age site in KwaZulu-Natal, dating to the 3rd Millennium AD (Huffman, 2007).

The area that was occupied by the Nguni speaking group of the Eastern Bantu language stream is characterised by settlement patterns defined as the Central Cattle Pattern (CCP) (Huffman, 2007). The Nguni ceramic sequence consists of the *Blackburn* (AD 1050-1500), *Moor Park* (AD 1350-1700) and, *Nqabeni* (AD 1700-1850), although excavated pottery is seldom decorated and therefore complicates archaeological interpretation (Huffman 2007: 441, 443).

Blackburn pottery is on record along the north and south coasts of KwaZulu-Natal, often in shell middens (Huffman 2007: 443). The available radiocarbon dates place *Blackburn* between about AD 1100 and perhaps 1500.

The earliest known type of stonewalling that characterises this settlement pattern (CCP) in the region is the Moor Park site, which dates from the 14th to 16th Centuries AD (Huffman, 2007). This type of stonewalling can be found in defensive positions on hilltops in the Midlands of KZN (Huffman, 2007). Archaeologists have concluded that the function of these structures was to serve mainly as defensive purposes (Huffman, 2007). Archaeologically, the Natal area was occupied by the Zulu people by AD 1050 (Huffman, 2007).

In the late 1400's, a Nguni group under the leadership of Dlamini settled in the Delagoa Bay area. By the late 1700's, the Dlamini clan moved into land settling on the banks of the Pongola River where it cuts through the Lebombo Mountains. An attempt was also made to occupy the area between the Pongola River and Magudu Hills (at that stage the area was under Ndwandwe rule), but they had to retreat back across the Pongola River (Bonner 2002; Fourie 2013).

Serious rivalry between the Ndwandwe under Zwide and the Ngwane (Swazi) under Sobhuza created a period of unrest and confrontation in the early 1800's. An attempt from Zwide to annex the grain fields on the south side of the Pongola River almost destroyed the Ngwane. These successive Ndwandwe attacks lead to the fleeing of the Ngwane to the far north (Bonner, 2002).

The Late Iron Age economy was based on agriculture and livestock. Both components were inextricably linked to cultural practices and even contributed to the evolution of other institutions. In the Nguni groups, economic activities were divided along gender lines; men were closely associated with cattle and women with farming. It is believed that maize was introduced to northern KwaZulu-Natal via the Delagoa Bay trade network and the crop soon became widely cultivated. According to oral tradition, the Mthethwa first produced maize in the late 18th century (Huffman 2007: 453, 457).

Along with cattle and trade beads, (both used as currency for bride wealth); metal objects also became markers of wealth, status and power. Iron and copper ornaments (bangles, neck-and earrings) were worn to indicate social position and were also used in trade (Wylie 2006: 58, 59). Other metal artefacts which may appear in the archaeological record are iron spear points and hoes used for agriculture (very few have been found in context). It is interesting that the deliberate burial of numerous metal objects (mostly spearheads and hoes) seems to have been a common practice in Late Iron Age KwaZulu-Natal (Maggs 1991). This phenomenon is probably connected to the period of instability leading up to the Mfecane.

The Difaqane (Sotho), or Mfekane/Imfecane ("the crushing" in Nguni) was a time of bloody upheavals in Natal and on the Highveld, which occurred around the early 1820's until the late 1830's (Berg 1999: 109-115). It came about in response to heightened competition for land and trade, and caused population groups like gun-carrying Griquas and Shaka's Zulus to attack other tribes (Berg 1999: 14; 116-119). In KwaZulu-Natal, this commenced in the early 1800's when the amaZulu were still under Senzangakona (Omer-Cooper, 1993).

The Mthethwa confederacy also arose in the 18th century as a consolidation of clans that formed part of the greater northern Nguni-speaking cultural group in southern Africa. Their ruling lineage (the Nyambose) originally settled between the Mfolozi and Mhlatuse rivers (Wylie 2006: 49).

Indian Ocean trade contributed to changes in the socio-political structures of many groups, including that of the Mthethwa: imported beads became part of bride-wealth/lobola currency, increased demand for meat and grain from east coast ships necessitated more control of agricultural labour, cattle-raids etc., and even influenced the evolution of the amabutho (age-set regiments) system. Ivory, hides, slaves, grain, and metal hoes were exchanged for incoming commodities such as beads and cloth (Mitchell & Whitelaw 2005: 228; Huffman 2007: 77-80). It was amid the ensuing power struggles between politically complex chiefdoms that the Mthethwa, Ndwandwe in the north and the Qwabe in the south emerged as prominent role-players.

Closer to the study area two areas are of significance as discussed below:

Hluhluwe-iMfolozi Park

Hluhluwe–iMfolozi Park is the oldest proclaimed natural park in Africa and lies west of the project area. It consists of 96 000 ha of hilly topography located 280 km north of Durban in central Zululand, KwaZulu-Natal and is known for its rich wildlife and conservation efforts. The park is the only state-run conservation area in KwaZulu-Natal where all the big five game animals occur. Due to conservation efforts, the park now has the largest population of white rhino in the world. Hluhluwe–iMfolozi was originally three separate reserves that joined under its current title in 1989. Throughout the park there are many signs of Stone Age archaeological sites. The area was originally a royal hunting ground for the Zulu kingdom, but was established as a park in 1895. The Umfolozi and Hluhluwe reserves were established primarily to protect the white rhinoceros, then on the endangered species list. The park is of high heritage significance (Van Schalkwyk 2013).

Mfolozi River

The Mfolozi River lies adjacent to the project area and is formed by the confluence of the Black (*Imfolozi emnyama*) and White Mfolozi (*Imfolozi emhlope*) Rivers near the south eastern boundary of the Hluhluwe-iMfolozi Park3. The isiZulu name *imFolozi* is generally considered to describe the zigzag course followed by both tributaries, though other explanations have been given.

The river flows in an easterly direction to the Indian Ocean at Maphelana, a coastal resort just south of the St Lucia River mouth. It originally meandered over the Monzi Flats, where it split into numerous slow-flowing channels before entering the St. Lucia Estuary at Honeymoon Bend. The slow-moving water and reed beds in channels operated as a natural filtering system that removed silt from the Mfolozi floodwaters and created a rich habitat for numerous species. During the 1950s, the Umfolozi Landowners Association contained and artificially channelled the river through the Monzi Flats to develop sugarcane farms. The new Mfolozi canal resulted in the unfiltered water depositing its silt load after entering the slower moving St. Lucia Estuary. This caused the estuary mouth to rapidly silt up. There had only been one record of this occurring until that time, during the sustained drought during the 1930s (Van Schalkwyk 2013).

6.3. Identified / Known Heritage Resources

Few CRM studies have been conducted in the area, the following reports have been consulted in this report:

Table 3. CRM studies consulted for this project.

Author	Year	Project	Findings
Van Schalkwyk, L.	2013	Heritage Scoping Assessment Report: Proposed Fuleni Anthracite Coal Mine, uMhlatuze Local Municipality, uThungulu District, KwaZulu-Natal	Places associated with oral traditions and living heritage; Landscapes and natural features; Traditional burial places; and Archaeological sites
Pelser, A.J.	2013	Report On A Heritage Survey On The Farm Koningskroon 447, Emakhosini Opathe Heritage Park Area, Near Ulundi, KZN.	Numerous Iron Age and Historic sites, A fort and also grave sites.
Anderson, G.	1998	Archaeological Survey of the Proposed Route for the Pongola-Vergenoeg Transmission Line, Pietermaritzburg: Institute for Cultural Resource Management	7 Iron Age sites

Information obtained from several archaeological databases show a high occurrence of heritage sites in the area (Figure 11) with several known sites located inside the study area (Figure 12). According to SAHRIS the study area itself has not been subjected to a HIA and it is expected that a high frequency of similar sites to finds in the greater area can be found in the Project area, including heritage resources such as:

- Middle and Late Stone Age sites;
- Rock art sites;
- Iron Age stone walled sites related to the rich Zulu heritage of the area;
- Cultural landscapes and also natural heritage of the area;
- Places associated with oral traditions and living heritage;
- Numerous Grave sites.

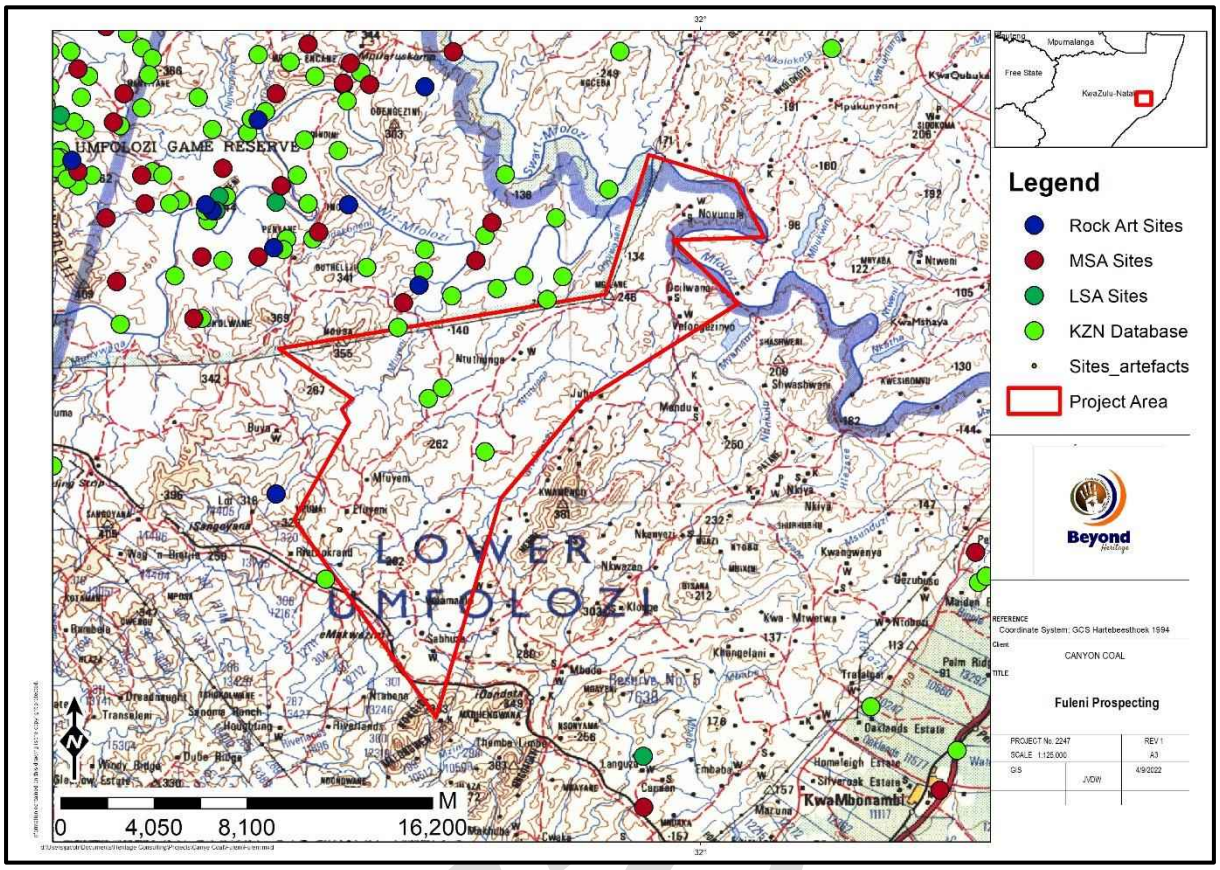


Figure 11. Known sites in the region.

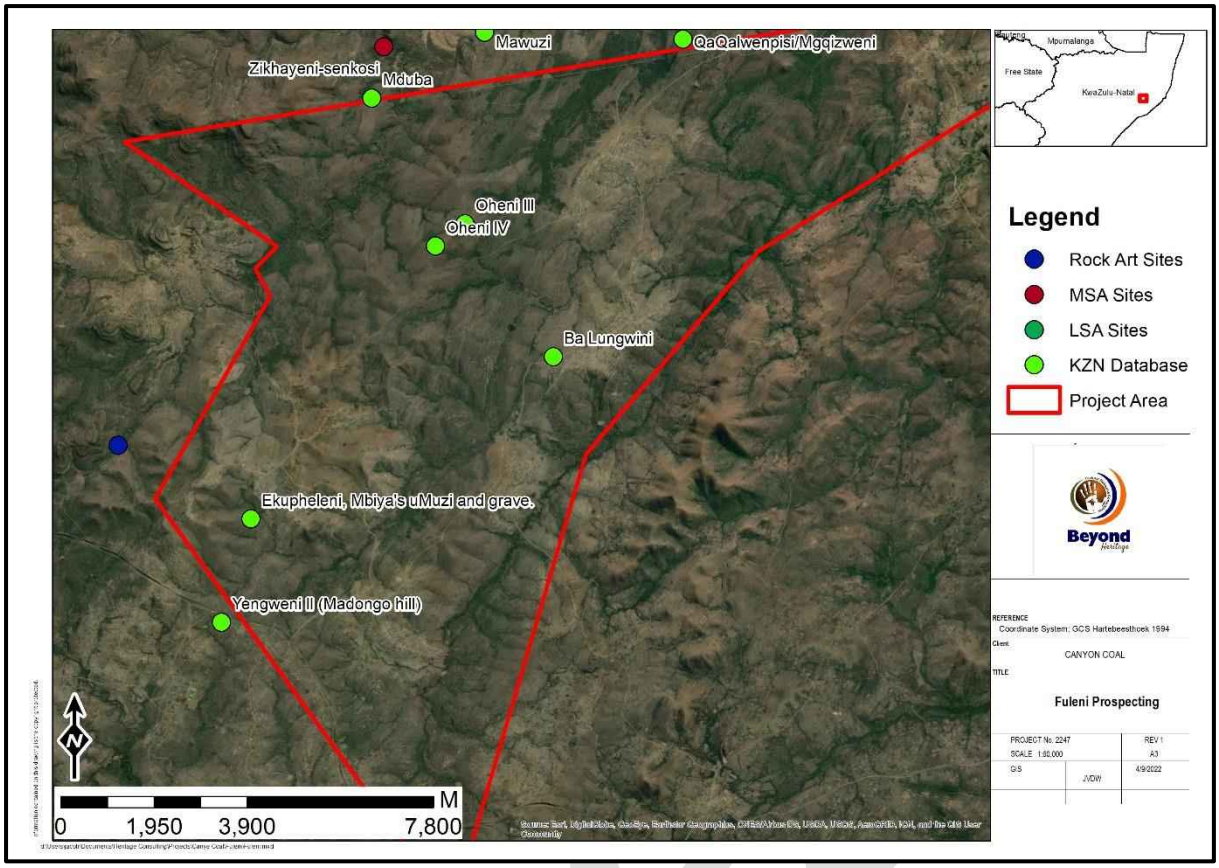


Figure 12. Known sites in prospecting area.

7. Potential Impact Assessment

The following categories of heritage resources as defined in Section 3 of the NHRA are protected by the Act and are expected to occur within the study area. Although all heritage resources are relevant to the Heritage Landscape and are non-renewable, it is anticipated that few sites in the study area could have conservation value. These sites should be avoided. As the presence and location of resources in the impact areas still need to be confirmed by a physical survey, at this level, the potential impacts will be assessed based on a worst-case scenario without mitigation measures in place to avoid direct impacts to heritage resources as outlined in Table 4.

Table 4. Heritage resources in the study area

	3(2)(a)	**Places, buildings, structures and equipment of cultural significance**
		Description of resource: Religious sites and intangible sites related to specific places on the landscape
		Potential impact: Accidental impact to these features
X	**3(2)(b)**	**Places to which oral traditions are attached or which are associated with living heritage**
		Description of resource: The area is known to include places associated with oral history and living heritage (Van Schalkwyk 2013)
		Potential impact: Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to the sense-of-place.
X	**3(2)(c)**	**Historical settlements and townscapes**
		Description of resource: Zulu background and settlements
		Potential impact: Alteration to the cultural landscape and sense-of-place
X	**3(2)(d)**	**Landscapes and natural features of cultural significance**
		Description of resource: As per van Schalkwyk (2013) landscapes and natural features can be impacted on by development in the area.
		Potential impact: Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to the sense-of-place.
	3(2)(e)	**Geological resources of scientific or cultural importance**
		Description of resource: The area is of low paleontological significance.
		Potential impact: None
X	**3(2)(f)**	**Archaeology and/or paleontology (*Including archaeological sites and material, fossils, rock art, battlefields & wrecks)***
		Description of resource: Numerous sites are indicated on the KZN Database and on SAHRIS including Stone age sites and rock art.
		Potential impact: Damage to and/or destruction of non-renewable archaeological resources.
X	**3(2)(g)**	**Graves and burial grounds (*e.g.: ancestral graves, graves of victims of conflict, historical graves & cemeteries)***
		Description of resource: Burial sites are indicated on the KZN database for the study area.

		Potential impact: Damage to and/or destruction of burial grounds.
X	**3(2)(a)**	**Other human remains**
		Description of resource: Unmarked graves.
		Potential impact: Unmarked graves can be accidentally exposed
	3(2)(h)	**Sites of significance relating to the history of slavery in South Africa**
		Description of resource: None
		Potential impact: None
	3(2)(i)	**Movable objects**
		Description of resource: None
		Potential impact: None

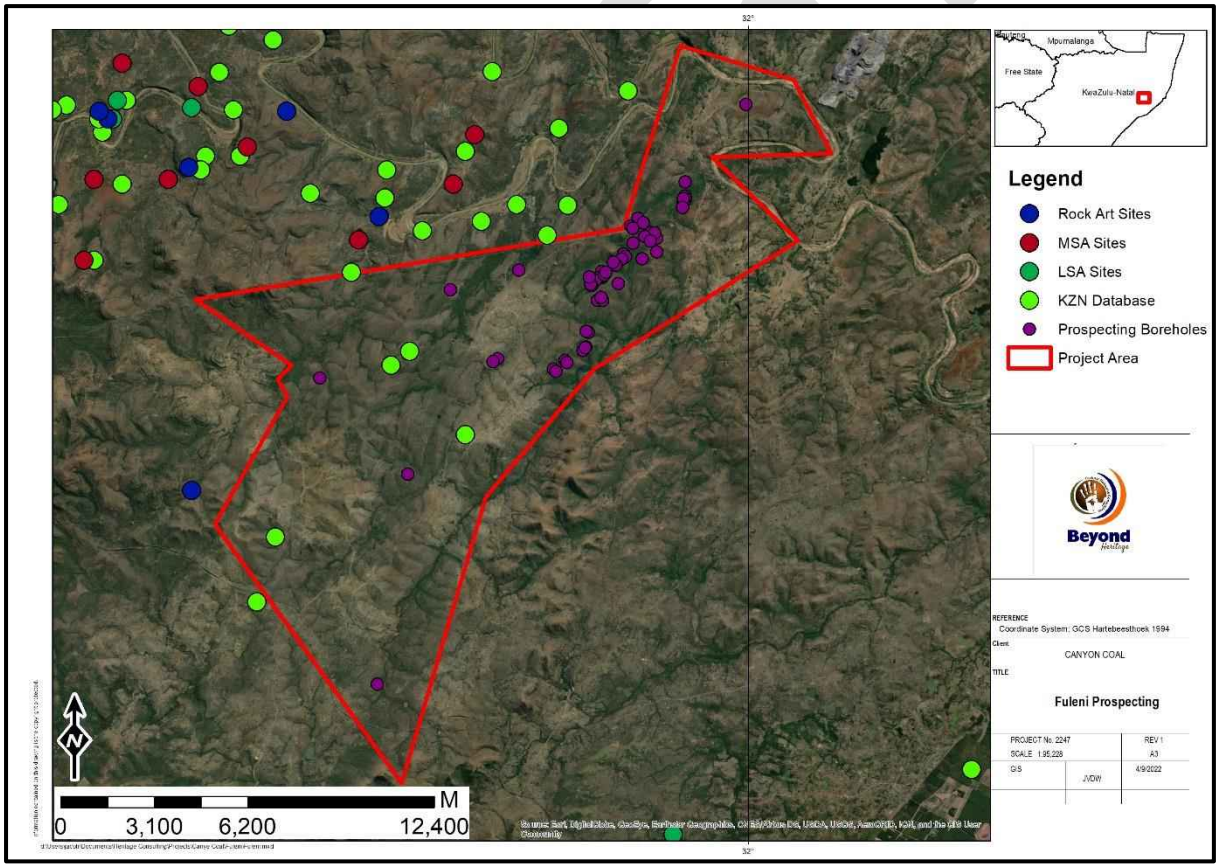


Figure 13. Drilling sites in relation to known sites.

8. Recommendation

This NID notes that the greater study area is rich in heritage resources and although the area of impact relating to drill sites has not been subjected to a HIA, similar resources can be expected in the drilling areas. Although the impact of the drill sites is small, without management action in place these activities could have a negative impact on non-renewable heritage resources.

Due to the size of the prospecting area, limited access, and the extended timeline of the prospecting plan it is not feasible to conduct an HIA. In order to mitigate against accidental damage and destruction of sites it is recommended that the following management actions should be included in the EMPR of the project as a condition of authorization.

- During Public Participation, stakeholders will be engaged where the local community indicate graves as well as places of social and spiritual significance;
- Each drill site must be physically inspected by the ECO for archaeological or burial sites prior to drilling;
- Existing roads must be used;
- A Chance find procedure should be implemented for the duration of the prospecting;
- A heritage management plan should be compiled that indicates buffer zones and management actions for known heritage sites and sites of social importance in the prospecting area.

The developer indicated that the following mitigation measures will be employed to minimize the potential impact on burial sites:

- All associated residential areas will have a buffer zone of 500m;
- Each drill site will be inspected, prior to drilling; and
- Drilling will include a maximum of 55 holes

With the implementation of the mitigation measures proposed in this report as a condition of authorisation in the EMPR it is recommended that the Project can commence without a full HIA subject to approval from AMAFA.

9. References

Archaeological database, University of the Witwatersrand.

Bonner, P., 2002. Kings, Commoners and Concessionaires: The Evolution and Dissolution of the Nineteenth-Century Swazi State. S.L.:Cambridge University Press.

Hall, M. The myth of the Zulu homestead: Archaeology and Ethnography. Africa: Journal of the International African Institute, vol 54 no 1: 65-79.

Huffman, T., 2007. Handbook to the Iron Age of Pre-Colonial Farming Societies in South Africa. University of KwaZulu-Natal Press.

Klein, R. G., 1977. The Mammalian Fauna from the Middle and Later Stone Age (Later Pleistocene) Levels of Border Cave, Natal Province, South Africa. The South African Archaeological Bulletin, pp. 14-27.

Kwa Zulu Natal Heritage Act 5 of 2018.

Lombard, M., L. Wadley, J. Deacon, S. Wurz, I. Parsonss, M. Mohapi, J. Swartt & P. Mitchelll. 2012. South African and Lesotho Stone Age Sequence Updated (I). South African Archaeological Bulletin 67 (195): 120–144, 2012

Maggs, T. 1991. Metalwork from Iron Age hoards as a record of metal production in the Natal Region. *The South African Archaeological Bulletin* 46(154): 131-136.

Mitchell, P. 2002. The Archaeology of Southern Africa. Cambridge: Cambridge University Press.

Mitchell, P & Whitelaw, G. The archaeology of southernmost Africa from c.2000 BP to the early 1800s: A review of recent research. Journal of African History, 46: 209-41.

National Heritage Resources Act NHRA of 1999 (Act 25 of 1999)

SAHRIS (Cited 2022)

Van Schalkwyk, L. & Wahl, E. 2013. Baseline Heritage Study: Proposed Richards Bay Port Expansion, uMhlatuze Local Municipality, uThungulu District, KwaZulu-Natal

Vinnicombe, P., 1976. People of the Eland: Rock Paintings of the Drakensberg Bushmen a Reflection of their Life and Thoughts. s.l.:University of Natal Press.

Wadley, L., 2005. A Typological Study of the Final Middle Stone Age Tools from Sibudu Cave, KwaZulu-Natal. The South African Archaeological Bulletin, pp. 51-63.

Wylie, D. 2006. Myth of iron: Shaka in history. University of KwaZulu-Natal Press: Pietermaritzburg.

APPENDIX C: DFFE ONLINE SCREENING REPORT

SCREENING REPORT FOR AN ENVIRONMENTAL AUTHORIZATION AS REQUIRED BY THE 2014 EIA REGULATIONS – PROPOSED SITE ENVIRONMENTAL SENSITIVITY

EIA Reference number: KZN 30/5/1/1/2/10747 PR

Project name: Fuleni

Project title: Prospecting Right

Date screening report generated: 29/03/2022 11:19:23

Applicant: Imvukuzane Resources

Compiler: J Callaghan

Compiler signature:

.....

Application Category: Mining|Prospecting rights

Table of Contents

Proposed Project Location

Orientation map 1: General location

General Orientation: Fuleni

Map of proposed site and relevant area(s)

Cadastral details of the proposed site

Property details:

No	Farm Name	Farm/ Erf No	Portion	Latitude	Longitude	Property Type
1	MHLANA	16922	0	28°30'17.44S	31°58'39.53E	Farm
2	FULENI RESERVE	14375	0	28°26'45.46S	31°55'9.08E	Farm Portion
3	MHLANA	16922	0	28°30'17.96S	31°58'39.65E	Farm Portion

Development footprint[1] vertices:
No development footprint(s) specified.

Wind and Solar developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed area

No	EIA Reference No	Classification	Status of application	Distance from proposed area (km)
1	14/12/16/3/3/2/2041	Solar PV	Approved	27.1
2	14/12/16/3/3/2/867	Solar PV	Approved	26.4

[1] "development footprint", means the area within the site on which the development will take place and incudes all ancillary developments for example roads, power lines, boundary walls, paving etc. which require vegetation clearance or which will be disturbed and for which the application has been submitted.

Environmental Management Frameworks relevant to the application

No intersections with EMF areas found.

Environmental screening results and assessment outcomes

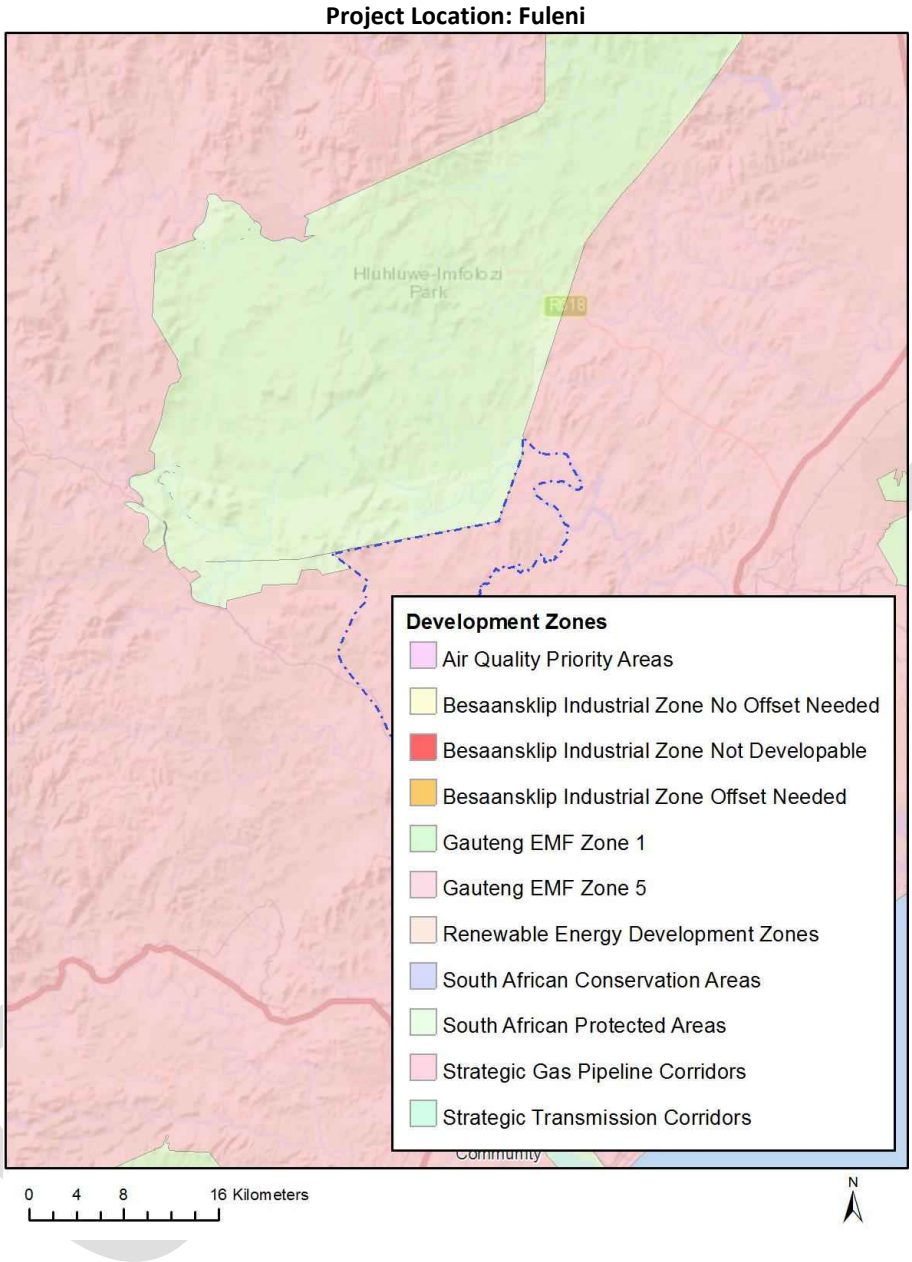
The following sections contain a summary of any development incentives, restrictions, exclusions or prohibitions that apply to the proposed development site as well as the most environmental sensitive features on the site based on the site sensitivity screening results for the application classification that was selected. The application classification selected for this report is: **Mining|Prospecting rights**.

Relevant development incentives, restrictions, exclusions or prohibitions

The following development incentives, restrictions, exclusions or prohibitions and their implications that apply to this site are indicated below.

Incentive, restriction or prohibition	Implication
Strategic Transmission Corridor-Expanded Eastern Corridor	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/Combined_EGI.pdf
Strategic Gas Pipeline Corridors-Phase 7: Coega to Richards Bay	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/Combined_GAS.pdf
South African Protected Areas	https://screening.environment.gov.za/ScreeningDownloads/DevelopmentZones/SAPAD_OR_2021_Q3_Metadata.pdf

Map indicating proposed development footprint within applicable development incentive, restriction, exclusion or prohibition zones



Proposed Development Area Environmental Sensitivity

The following summary of the development site environmental sensitivities is identified. Only the highest environmental sensitivity is indicated. The footprint environmental sensitivities for the proposed development footprint as identified, are indicative only and must be verified on site by a suitably qualified person before the specialist assessments identified below can be confirmed.

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme	X			
Animal Species Theme		X		

Aquatic Biodiversity Theme	X			
Archaeological and Cultural Heritage Theme	X			
Civil Aviation Theme		X		
Defence Theme				X
Paleontology Theme	X			
Plant Species Theme			X	
Terrestrial Biodiversity Theme	X			

Specialist assessments identified

Based on the selected classification, and the environmental sensitivities of the proposed development footprint, the following list of specialist assessments have been identified for inclusion in the assessment report. It is the responsibility of the EAP to confirm this list and to motivate in the assessment report, the reason for not including any of the identified specialist study including the provision of photographic evidence of the site situation.

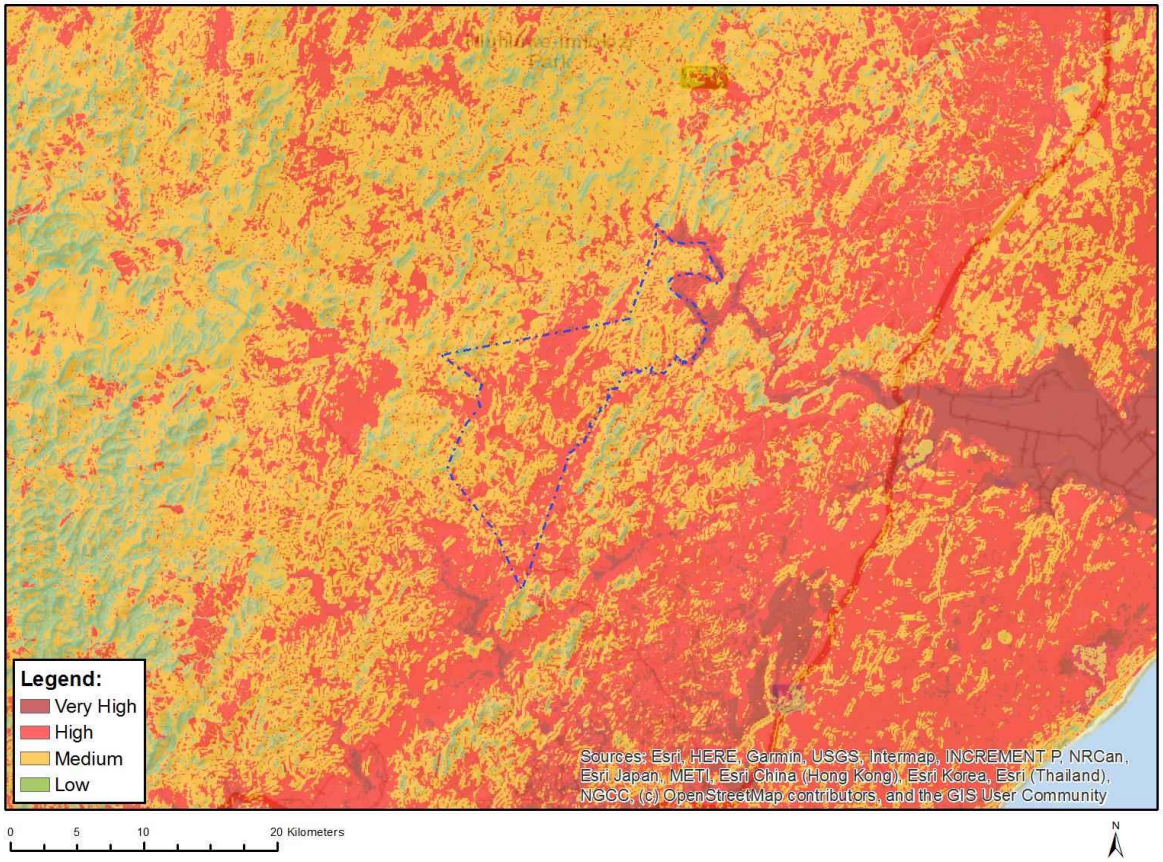
No	Specialist assessment	Assessment Protocol
1	Agricultural Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Agriculture_Assessment_Protocols.pdf
2	Archaeological and Cultural Heritage Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
3	Palaeontology Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
4	Terrestrial Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf
5	Aquatic Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Aquatic_Biodiversity_Assessment_Protocols.pdf
6	Noise Impact Assess	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Noise_Impacts_Assessment_Protocol.pdf

	ment	
7	Radioactivity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_General_Requirement_Assessment_Protocols.pdf
8	Plant Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Plant_Species_Assessment_Protocols.pdf
9	Animal Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/Gazetted_Animal_Species_Assessment_Protocols.pdf

Results of the environmental sensitivity of the proposed area.

The following section represents the results of the screening for environmental sensitivity of the proposed site for relevant environmental themes associated with the project classification. It is the duty of the EAP to ensure that the environmental themes provided by the screening tool are comprehensive and complete for the project. Refer to the disclaimer.

MAP OF RELATIVE AGRICULTURE THEME SENSITIVITY

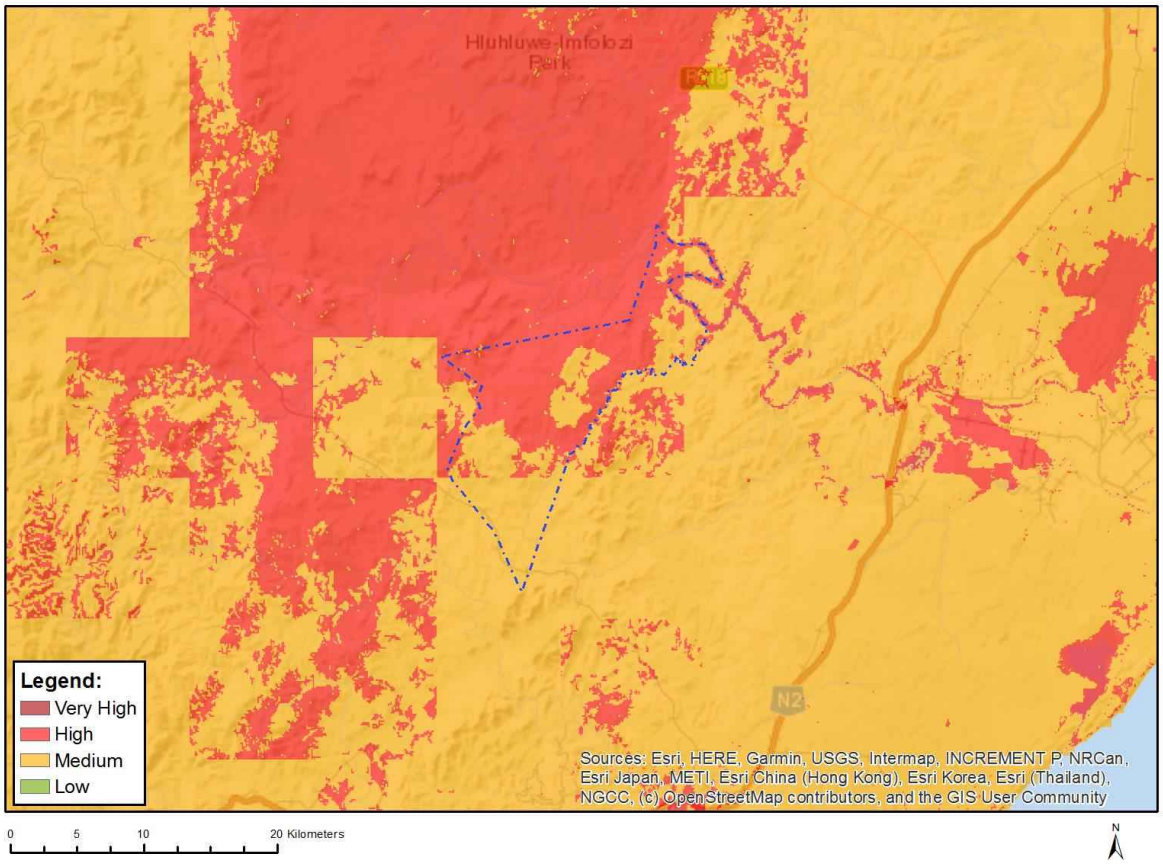


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Land capability;09. Moderate-High/10. Moderate-High
Low	Land capability;01. Very low/02. Very low/03. Low-Very low/04. Low-Very low/05. Low
Medium	Land capability;06. Low-Moderate/07. Low-Moderate/08. Moderate
Very High	Land capability;11. High/12. High-Very high/13. High-Very high/14. Very high/15. Very high

MAP OF RELATIVE ANIMAL SPECIES THEME SENSITIVITY



Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

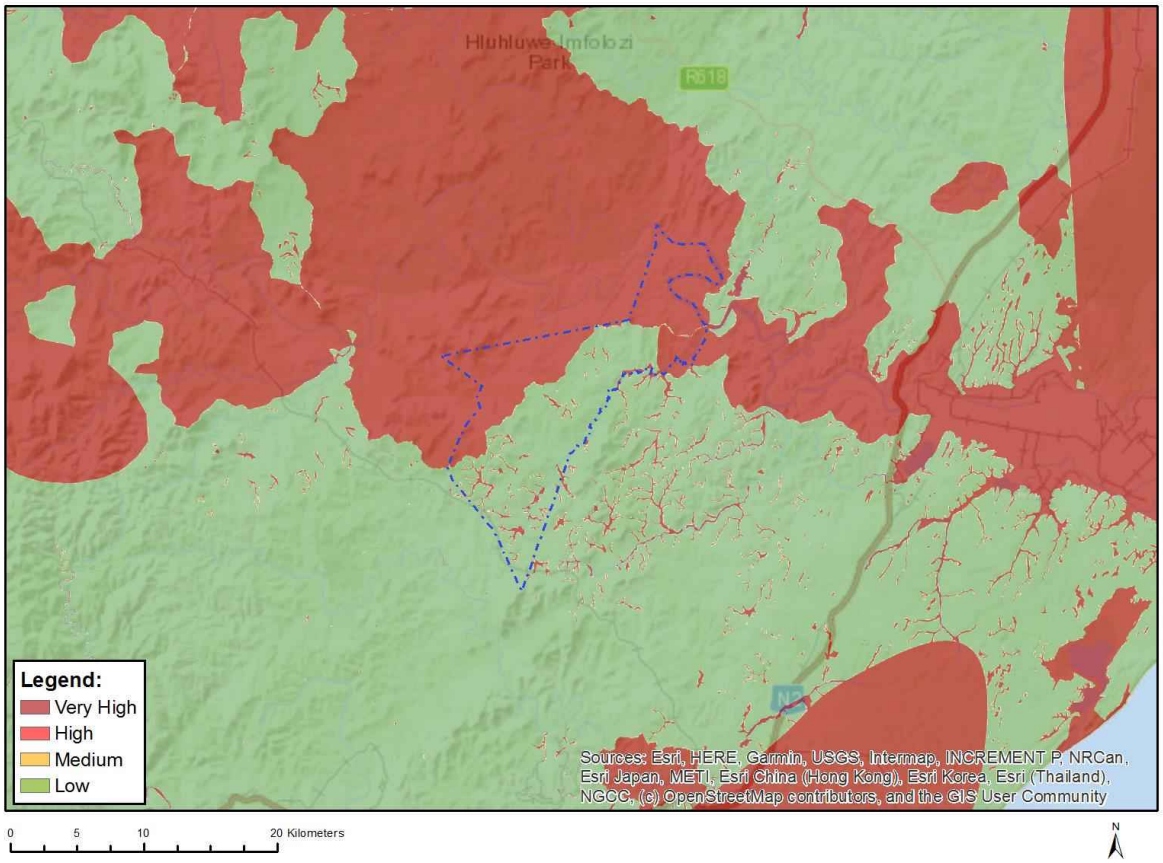
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Aves-Nettapus auritus
High	Aves-Terathopius ecaudatus
High	Mammalia-Panthera leo
Medium	Reptilia-Kinixys natalensis
Medium	Invertebrate-Anonychonitis freyi
Medium	Invertebrate-Arytropteris basalis
Medium	Invertebrate-Pomatonota dregii
Medium	Aves-Terathopius ecaudatus
Medium	Aves-Nettapus auritus
Medium	Aves-Ciconia nigra
Medium	Insecta-Deloneura millari millari
Medium	Insecta-Iolaus diametra natalica
Medium	Mammalia-Acinonyx jubatus

Medium	Mammalia-Lycaon pictus
Medium	Sensitive species 7
Medium	Sensitive species 1

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

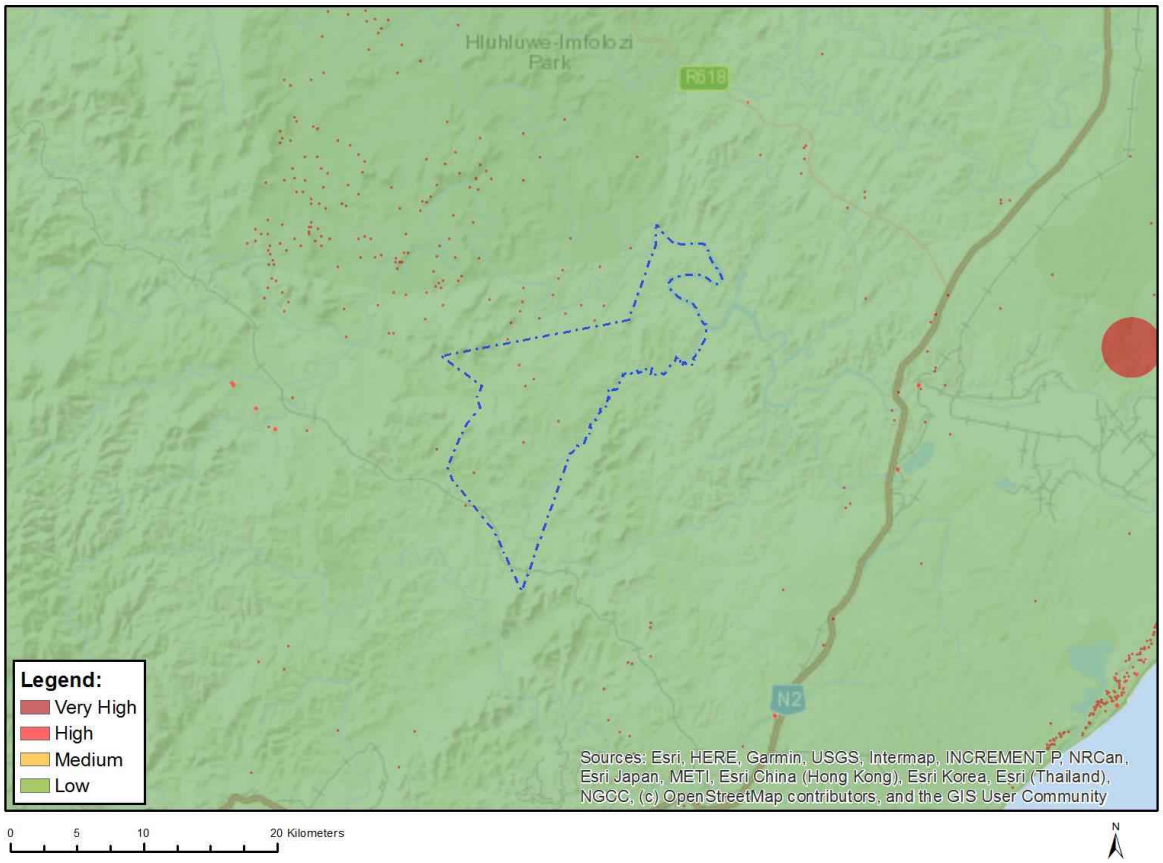


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Very High	Aquatic CBAs
Very High	Wetlands and Estuaries
Very High	Freshwater ecosystem priority area quinary catchments

MAP OF RELATIVE ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME SENSITIVITY

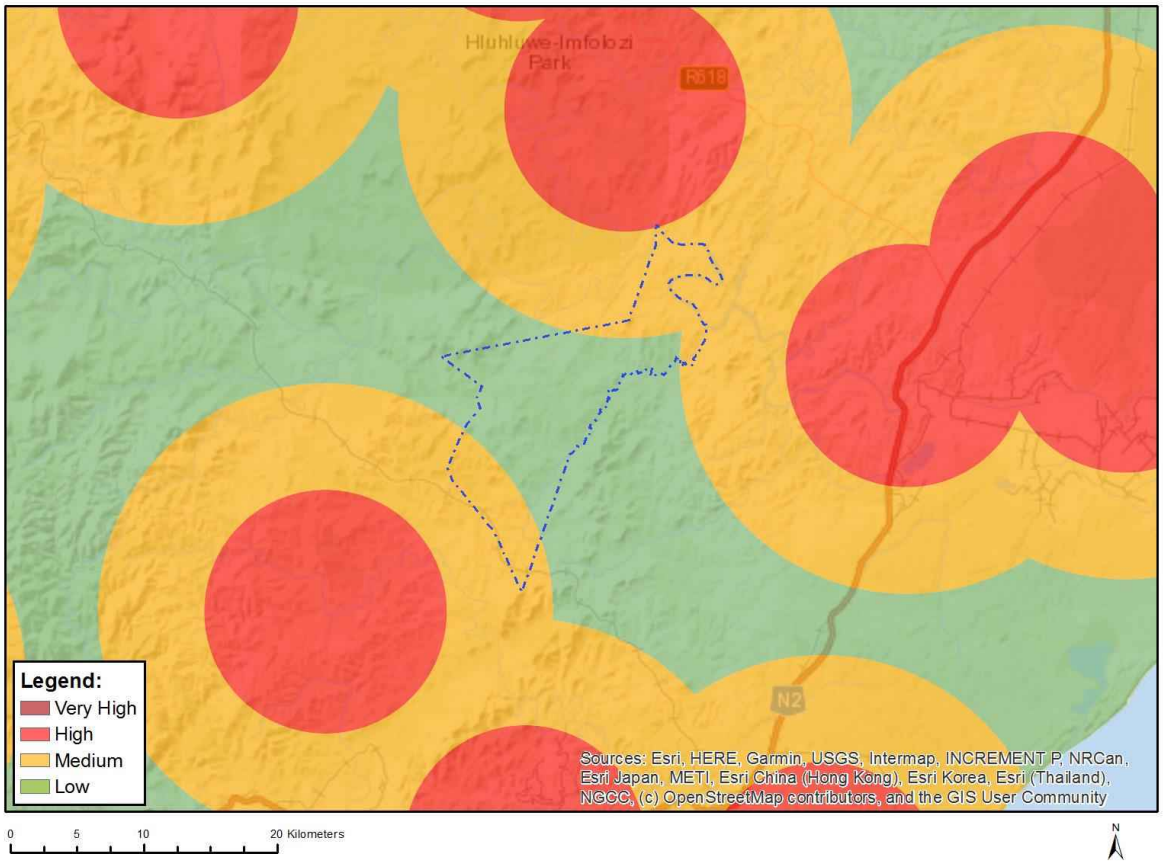


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity
Very High	Within 100m of an Ungraded Heritage site

MAP OF RELATIVE CIVIL AVIATION THEME SENSITIVITY

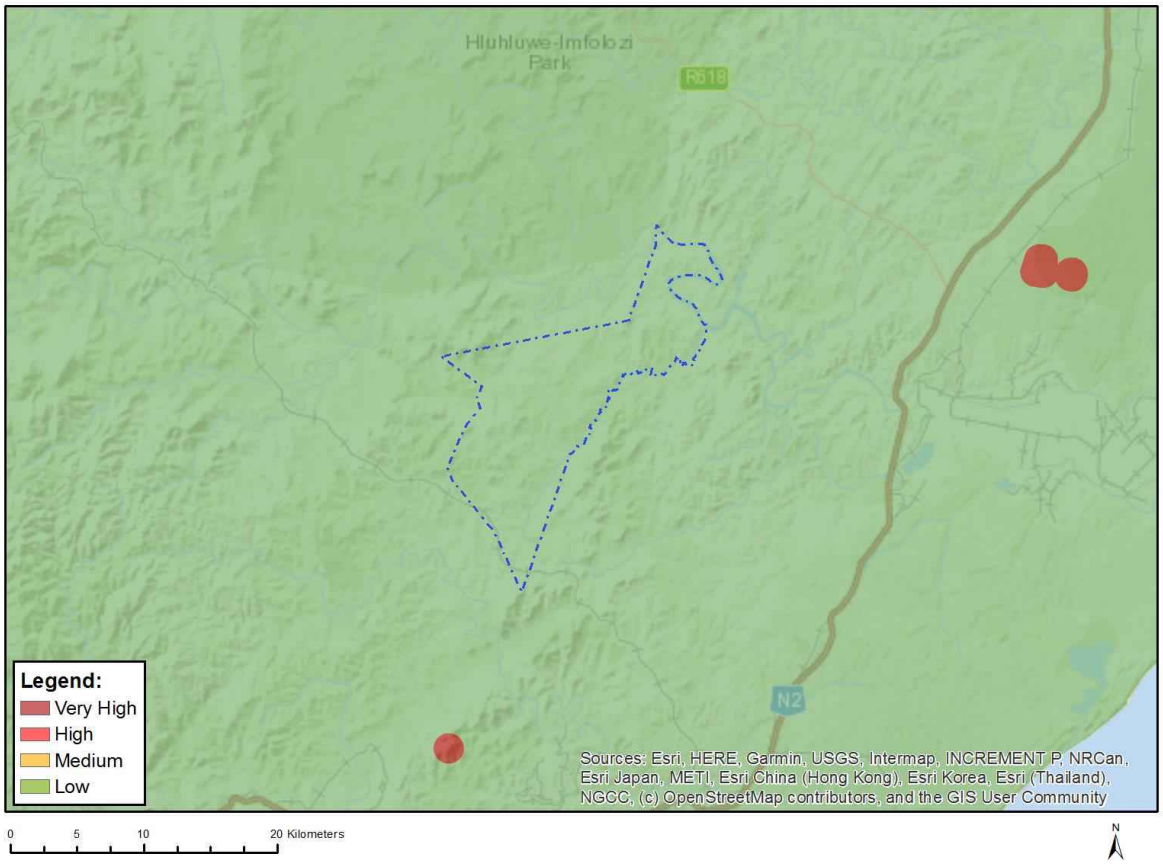


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Sensitivity Features:

Sensitivity	Feature(s)
High	Within 8 km of other civil aviation aerodrome
Low	Low sensitivity
Medium	Between 8 and 15 km of other civil aviation aerodrome

MAP OF RELATIVE DEFENCE THEME SENSITIVITY

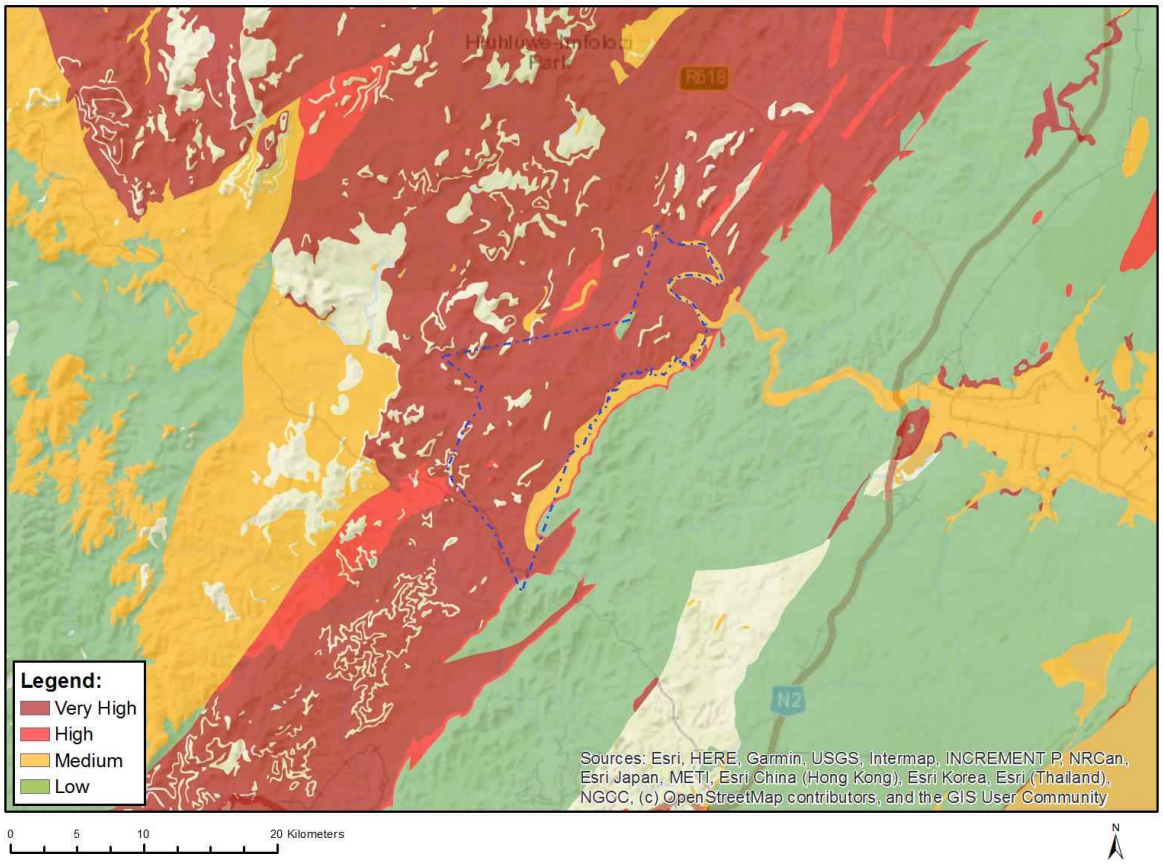


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY

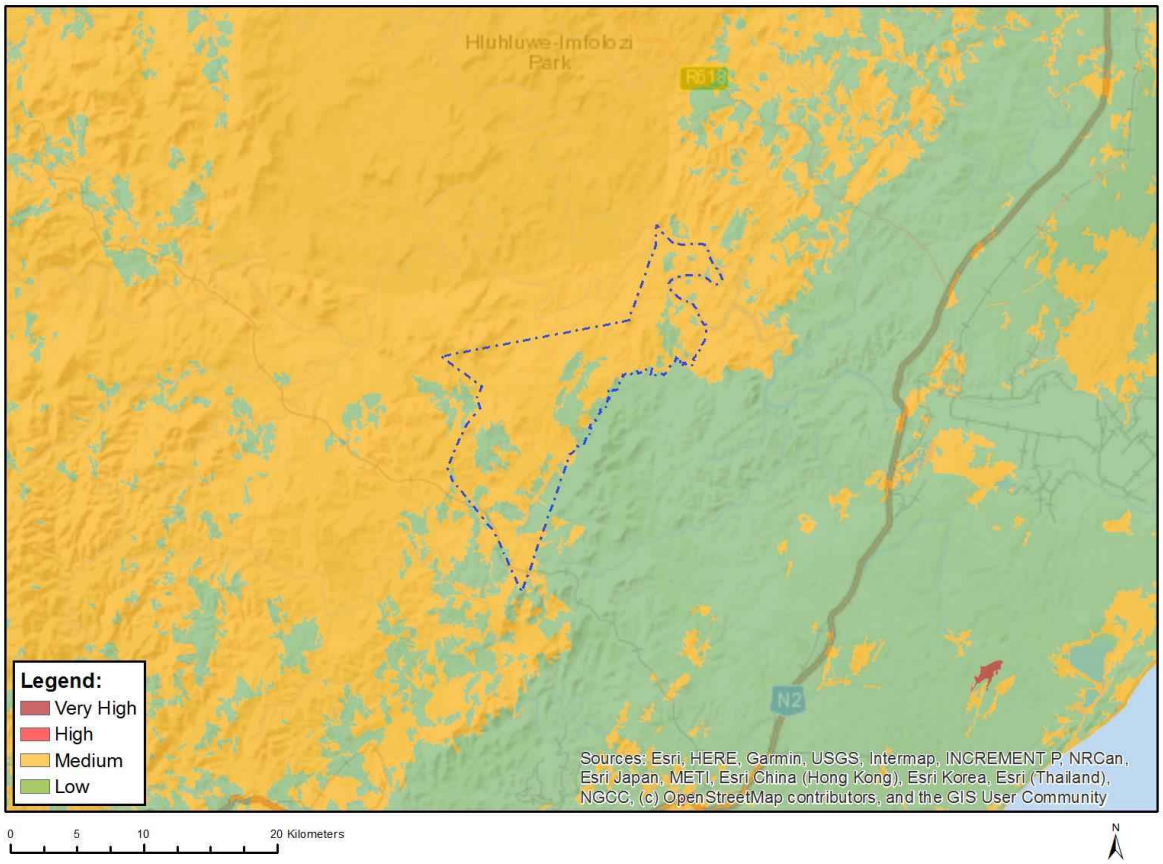


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Features with a High paleontological sensitivity
Low	Features with a Low paleontological sensitivity
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY



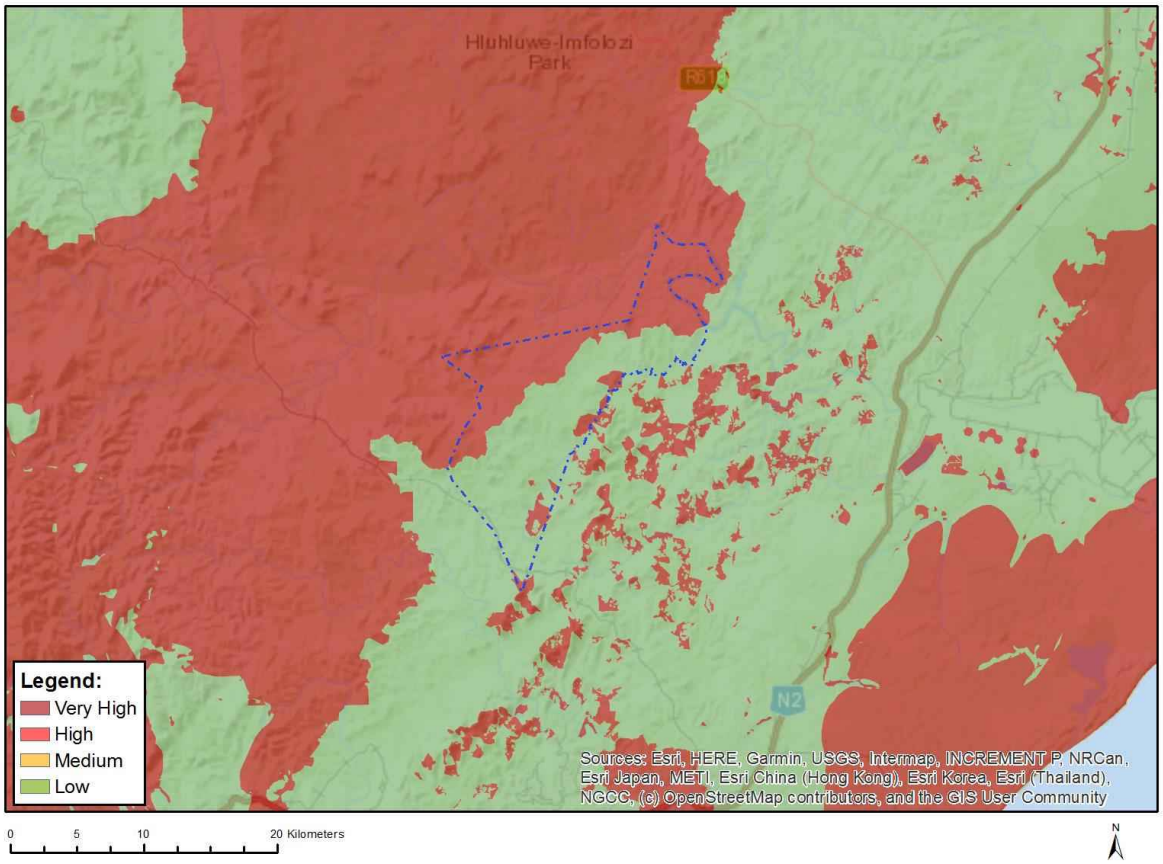
Where only a sensitive plant unique number or sensitive animal unique number is provided in the screening report and an assessment is required, the environmental assessment practitioner (EAP) or specialist is required to email SANBI at eiadatarequests@sanbi.org.za listing all sensitive species with their unique identifiers for which information is required. The name has been withheld as the species may be prone to illegal harvesting and must be protected. SANBI will release the actual species name after the details of the EAP or specialist have been documented.

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Melhania polygama
Medium	Salpinctium natalense
Medium	Sensitive species 1076
Medium	Oxygonum dregeanum subsp. streyi
Medium	Sensitive species 191

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Very High	Critical biodiveristy area 1
Very High	Critical biodiveristy area 2
Very High	Ecological support area
Very High	Ecological support area: species
Very High	FEPA Subcatchments
Very High	Protected Areas Expansion Strategy
Very High	Vulnerable ecosystem
Very High	Somopho Community Nature Reserve
Very High	Umfolozi Game Reserve
Very High	Hluhluwe-Imfolozi Park

APPENDIX D: PUBLIC PARTICIPATION

GCS Ref. No: 22-0082
DMRE Ref. No: KZN 30/5/1/1/2/10747 PR

NOTIFICATION OF AN APPLICATION FOR ENVIRONMENTAL AUTHORISATION AND A PROSPECTING RIGHT FOR AGGREGATE, CLAY (GENERAL), COAL, PSEUDOCOAL AND TORBANITE/OIL SHALE ON REMAINDER OF THE FARM FULENI RESERVE NO. 14375 GU, MAGISTERIAL DISTRICT EMPANGENI, KWAZULU-NATAL PROVINCE

Imvukuzane Resources (Pty) Ltd is applying for Environmental Authorisation (EA) in accordance with the National Environmental Management Act (NEMA) (Act No. 107 of 1998): Environmental Impact Assessment (EIA) Regulations (2014), as amended and a Prospecting Right in accordance with the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) for the proposed prospecting activities on the Remainder of the Farm Fuleni Reserve 14375 GU, Magisterial District Empangeni.

Process to be followed: The Application for EA will follow the Basic Assessment process as required by the NEMA EIA Regulations (2014), as amended and will make provision for the applying for the following Listed Activities:

- Government Notice R.327 (Listing Notice 1), Listed Activity 20
- Government Notice R. 324 (Listing Notice 3), Listed Activity 12

GCS Water and Environmental Consultants (Pty) Ltd has been appointed as an independent Environmental Assessment Practitioner (EAP) by Imvukuzane Resources (Pty) Ltd to undertake the necessary Basic Assessment and associated Public Participation Process (PPP) which is a regulated requirement of the above application. The PPP will be conducted in accordance with Chapter 6 of the NEMA: EIA Regulations (2014), as amended.

Nature and project location:
The Prospecting Right Application was lodged on the Remainder of the Farm Fuleni Reserve No. 14375 GU in Northern KwaZulu-Natal, approximately 45 km north-west of the town of Richards Bay. The prospecting area is situated within the uMfolozi Local Municipality and the King Chetshwayo District Municipality. The portion of land subject to the Prospecting Right Application is 14 720ha in extent with the prospecting activities making provision for the drilling of some 55 prospecting core boreholes within the total prospecting area.

How do I participate:
Interested and Affected Parties (IAPs) are invited to participate by providing comments and raising issues of concern regarding the proposed application. A draft Basic Assessment Report will be available from 13 April 2022 to 16 May 2022 for review and comment as follows:

Website download: http://www.gcs-sa.biz/documents/

Public places: The hard copy documents will be made available at the following localities:

- Mhlana Traditional Offices, Fuleni Area
- Empangeni Library, Corner of Union and Commercial Streets
- Kwambonami Library, 25 Bredilia Street, Kwa-Mbonambi

Please register yourself as an interested and affected party by contacting GCS by using the details below:

Janice Callaghan / Nathi Ngube
T: 031 764 7130, Email: Janicec@gcs-sa.biz / nathi.ncube@khapheni.co.za
Postal Address: PO Box 819, Gillitts, 3610

GCS Ref. No: 22-0082
DMRE Ref. No: KZN 30/5/1/1/2/10747 PR

ISAZISO SESICELO SOKUGUNYAZWA KWANGOKWEMVELO KANYE NELUNGELO LOKUHLONZA NAMA UKUHLOLA UHLOBO LWEZIMBIWA OLUSAMHLABATHI, AMALAHLE, PSEUDOCOAL AND TORBANITE/OIL SHALE ENDAWENI YASESABELWENI EFULENI ENGUNOMBOLO 14375 GU, KWISIFUNDANKANTOLO SASEMPANGENI, ESIFUNDAZWENI SAKWAZULU-NATALI

Imvukuzane Resources (Pty) Ltd ifaka isicelo sokuGunyazwa KwangokweMvelo (EA) ngokulandela uMthetho kaZwelonke Wokuphathwa kweMvelo (NEMA) (uMthetho 107 ka 1998): iMigomo yoCwaningo Lokungenzeka Emvelweni (EIA) engeka 2014, njengoba ichitshiyelwe kanye Nelungelo Lokuhlonza ngokulandela uMthetho Wokuthuthukiswa Kwezindawo Ezinezimbiwa Nezivuthisi (MPRDA) (uMthetho 28 ka 2002) isicelo ngezomsebenzi ohlongozwayo wokuhlola nom wokuhlonza izimbiwa engxenyeni yeNdawo YaseFuleni engu 14375 GU, eSifundankantolo SaseMpangeni.

Umgudu okumele ulandelwe: Isicelo sokuGunyazwa KwangokweMvelo sizolandela umgudu woCwaningo Lwemvelo njengoba kudinga Imigomo ye EIA ka NEMA (ka 2014), njengoba ichitshiyelwe, futhi sizobhekela ukufakwa kwesicelo saleMisebenzi Esohlwini elandelayo:

- ISaziso sikaHulumeni R.327 (Uhla Lwesaziso 1) uMsebenzi Osohlwini 20
- ISaziso sikaHulumeni R.324 (Uhla Lwesaziso 3) uMsebenzi Osohlwini 12

U GCS Water and Environmental Consultants (Pty) Ltd (Abeluleki KwezaManzi kanye Nemvelo) baqashwe Imvukuzane Resources (Pty) Ltd njengoNgoti abazimele Bocwaningo Lwemvelo (EAP) beqashelwa ukwenza uCwaningo Lwemvelo kanye noMgudu Wokubambiqhaza Komphakathi (PPP) okuyisidingo sesicelo esingenhla esilawulwa ngokomthetho. I PPP izokwenziwa ngokulandela iSahluko 6 seMigomo ye EIA ye NEMA (ka 2014), njengoba ichitshiyelwe.

Uhlobo kanye nendawo yohlelo-msebenzi (project):
ISicelo Selungelo Lokuhlonza safakwa mayelana neNdawo Eyingxenye yaseFuleni engu Nombolo 14375 GU eseNyakatho yeKwaZulu-Natali, ebangeni elilinganiselwa kumakhilomitha angu 45 enyakatho-ntshonalanga yedolobha lase Richards Bay. Indawo okuhlonzwa kuyo ingaphansi kukaMasipala WaseMfolozi kanye noMasipala Wesifunda iKing Cetshwayo. Ingxenye yendawo okuyiyona eqondene neSicelo Selungelo Lokuhlonza Izimbiwa ingamahektha angu 14720 ubukhulu, bese imisebenzi yokuhlonza izimbiwa ivumela ukubholwa kwemigodi yokuhlonza izimbiwa engu 55 endaweni yonkana okuhlolwa kuyo.

Ngilibamba kanjani iqhaza:
Amaqembu Abathintekayo Nabafisa Ukubambiqhaza (IAPs) ayamenywa ukuba abambe iqahaza ngokuthi aphawule nokuphakamisa izingqinamba eziwathintayo mayelana nesicelo esihlongozwayo. UMqulu Owumhlahlandlela woCwaningo Lwemvelo uzotholakala, ukuze uzobuyekezwa futhi kuphawulwe ngawo, kusukela ngomhlaka 13 April 2022 kuya kumhlaka 16 May 2022 (kanjengoba kulandela):

Ungatholwa kulesisizinda (website): http://www.gcs-sa.biz/documents/
Izindawo zomphakathi: Imiqulu izotholakala noma iyobekwa kulezizindawo ezilandelayo:

- Emahhovisi Esizwe saseMhlana, eDondotha
- Emtapweni Wolwazi Empangeni, Ekhoneni lika Union no Commercial Streets
- Emtapweni Wolwazi Kwambonambi, 25 Bredilia Street, Kwa-Mbonambi

Uyacelwa ukuba ubhalise njengeQembu Labathintekayo Nabafisa Ukubambiqhaza ngokuthi uxhumane no GCS usebenzise lemininingwane engezansi:

Janice Callaghan / Nathi Ncube
Ucingo: 031 764 7130, I email: Janicec@gcs-sa.biz / nathi.ncube@khapheni.co.za
Ikheli: PO Box 819, Gillitts, 3610

NOTIFICATION OF AN APPLICATION FOR ENVIRONMENTAL AUTHORISATION AND A PROSPECTING RIGHT FOR AGGREGATE, CLAY (GENERAL), COAL, PSEUDOCOAL AND TORBANITE/OIL SHALE ON REMAINDER OF THE FARM FULENI RESERVE NO. 14375 GU, MAGISTERIAL DISTRICT EMPANGENI, KWAZULU-NATAL PROVINCE

GCS Ref. No: 22-0082 **DMRE Ref. No: KZN 30/5/1/1/2/10747 PR**

Imvukuzane Resources (Pty) Ltd is applying for Environmental Authorisation (EA) in accordance with the National Environmental Management Act (NEMA) (Act No. 107 of 1998): Environmental Impact Assessment (EIA) Regulations (2014), as amended and a Prospecting Right in accordance with the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) for the proposed prospecting activities on the Remainder of the Farm Fuleni Reserve 14375 GU, Magisterial District Empangeni.

Process to be followed: The Application for EA will follow the Basic Assessment process as required by the NEMA EIA Regulations (2014), as amended and will make provision for the applying for the following Listed Activities:

- Government Notice R.327 (Listing Notice 1), Listed Activity 20
- Government Notice R. 324 (Listing Notice 3), Listed Activity 12

The Prospecting Right Application was lodge in accordance with Section 16 of the MPRDA (Act No. 28 of 2002).

GCS Water and Environmental Consultants (Pty) Ltd has been appointed as an independent Environmental Assessment Practitioner (EAP) by Imvukuzane Resources (Pty) Ltd to undertake the necessary Basic Assessment and associated Public Participation Process (PPP) which is a regulated requirement of the above application. The PPP will be conducted in accordance with Chapter 6 of the NEMA: EIA Regulations (2014), as amended.

Nature and project location: The Prospecting Right Application was lodged on the Remainder of the Farm Fuleni Reserve No. 14375 GU in Northern KwaZulu-Natal, approximately 45 km north-west of the town of Richards Bay. The prospecting area is situated within the uMfolozi Local Municipality and the King Chetshwayo District Municipality. The portion of land subject to the Prospecting Right Application is 14 720ha in extent with the prospecting activities making provision for the drilling of some 55 prospecting core boreholes within the total prospecting area. See the map below.

YOUR PARTICIPATION IS IMPORTANT

Interested and Affected Parties (I&APs) are invited to participate by providing comments and raising issues of concern regarding the proposed application. A draft Basic Assessment Report will be available from 13 April 2022 to 16 May 2022 for review and comment as follows:

Website download: http://www.gcs-sa.biz/documents/

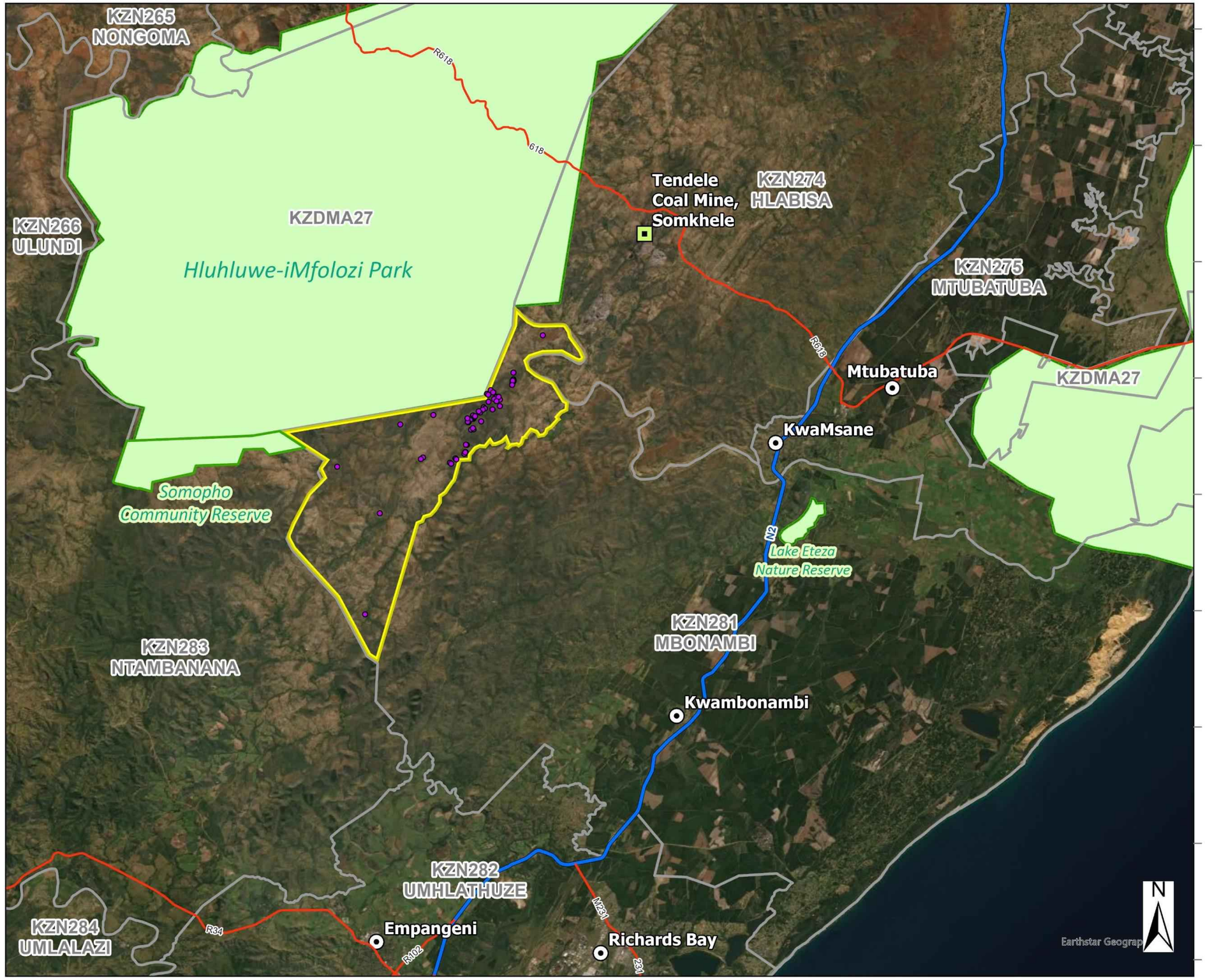
Public places: The documents will be made available at the following public places in the community

- Mhlana Traditional Offices, Fuleni Area
- Empangeni Library, Corner of Union and Commercial Streets
- Kwambonami Library, 25 Bredilia Street, Kwa-Mbonambi

Please register your interest to attend any of the above meetings by contacting GCS:

Janice Callaghan / Nathi Ngube
T: 031 764 7130, Email: Janicec@gcs-sa.biz / nathi.ncube@khapheni.co.za
Postal Address: PO Box 819, Gillitts, 3610

FULENI: REGIONAL LOCALITY MAP

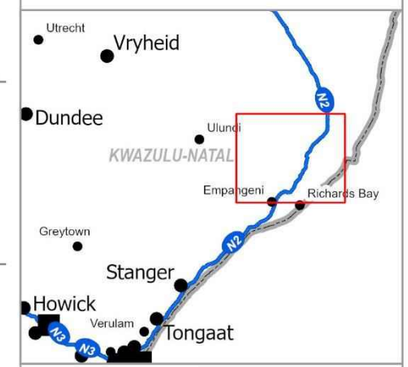


Legend

- Borehole
- Town
- Tendele Coal Mine, Somkhele
- Site Boundary
- PARKS
- Local Municipalities

Road Network

- National Route
- Main Road



Data Sources:
Esri World Imagery Basemap

0 5 10 Kilometers

SCALE: 1:250 000

FIGURE NO.:	-	MAP NUMBER:	22-0082-05-V2
DRAWN BY:	N MBOKAZI GIS INTERN	REVIEWED BY:	T DOMINY GIS ANALYST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC	DATE:	06 APRIL 2022
PROJECT:	FULENI PROSPECTING RIGHT APPLICATION		
CLIENT:	MENAR		

GCS Water & Environmental Consultants

Credits: 63 Wessel Road Woodmead
PO Box 2597 Rivonia 2128
South Africa

Tel: +27 (0) 11 803 5726
Fax: +27 (0) 11 803 5745
E-mail: jhb@gcs-sa.biz
www.gcs-sa.biz

ISAZISO SESICELO SOKUGUNYAZWA KWANGOKWEMVELO KANYE NELUNGELO LOKUHLONZA NAMA UKUHLOLA UHLOBO LWEZIMBIWA OLUSANHLABATHI, AMALAHLE, PSEUDOCOAL AND TORBANITE/OIL SHALE ENDAWENI YASESABELWENI EFULENI ENGUNOMBOLO 14375 GU, KWISIFUNDANKANTOLO SASEMPANGENI, ESIFUNDAZWENI SAKWAZULU-NATALI

GCS Ref. No: 22-0082 **DMRE Ref. No: KZN 30/5/1/1/2/10747 PR**

Imvukuzane Resources (Pty) Ltd ifaka isicelo sokuGunyazwa KwangokweMvelo (EA) ngokulandela uMthetho kaZwelonke Wokuphathwa kweMvelo (NEMA) (uMthetho 107 ka 1998): iMigomo yoCwaningo Lokungenzeka Emvelweni (EIA) engeka 2014, njengoba ichitshiyelwe kanye Nelungelo Lokuhlonza ngokulandela uMthetho Wokuthuthukiswa Kwezindawo Ezinezimbiwa Nezivuthisi (MPRDA) (uMthetho 28 ka 2002) isicelo ngezomsebenzi ohlongozwayo wokuhlola noma ukuhlonza izimbiwa engxenyeni yeNdawo YaseFuleni engu 14375 GU, eSifundankantolo SaseMpangeni.

Process Umgudu okumele ulandelwe: Isicelo sokuGunyazwa KwangokweMvelo sizolandela umgudu woCwaningo Lwemvelo njengoba kudinga Imigomo ye NEMA EIA (ka 2014), njengoba ichitshiyelwe futhi sizobhekela ukufakwa kwesicelo saleMisebenzi Esohlwini elandelayo:

- ISaziso sikaHulumeni R.327 (Uhla Lwesaziso 1) uMsebenzi Osohlwini 20
- ISaziso sikaHulumeni R.324 (Uhla Lwesaziso 3) uMsebenzi Osohlwini 12

ISicelo Selungelo Lokuhlola/Lokuhlonza Izimbiwa safakwa ngokulandela iSigaba 16 soMthetho i MPRDA (uMthetho 28 ka 2002).

U GCS Water and Environmental Consultants (Pty) Ltd (Abeluleki KwezaManzi kanye Nemvelo) baqashwe Imvukuzane Resources (Pty) Ltd njengoNgoti abazimele Bocwaningo Lwemvelo (EAP) beqashelwa ukwenza uCwaningo Lwemvelo kanye noMgudu Wokubambiqhaza Komphakathi (PPP) okuyisidingo sesicelo esingenhla esilawulwa ngokomthetho. I PPP izokwenziwa ngokulandela iSahluko 6 seMigomo ye EIA ye NEMA (ka 2014), njengoba ichitshiyelwe.

Uhlobo kanye nendawo yohlelo-msebenzi (project): ISicelo Selungelo Lokuhlonza safakwa mayelana neNdawo Eyingxenye yaseFuleni engu Nombolo 14375 GU eseNyakatho yeKwaZulu-Natali, ebangeni elilinganiselwa kumakhilomitha angu 45 enyakatho-ntshonalanga yedolobha lase Richards Bay. Indawo okuhlonzwa kuyo ingaphansi kukaMasipala WaseMfolozi kanye noMasipala Wesifunda iKing Cetshwayo. Ingxenye yendawo okuyiyona eqondene neSicelo Selungelo Lokuhlonza Izimbiwa ingamahektha angu 14720 ubukhulu, bese imisebenzi yokuhlonza izimbiwa ivumela ukubholwa kwemigodi yokuhlonza izimbiwa engu 55 endaweni yonkana okuhlolwa kuyo. Bheka ibalazwe ngezansi.

UKUBAMBIQHAZA KWAKHO KUBALULEKILE

Amaqembu Abathintekayo Nabafisa Ukubambiqhaza (IAPs) ayamenywa ukuba abambe iqahaza ngokuthi aphawule nokuphakamisa izingqinamba eziwathintayo mayelana nesicelo esihlongozwayo. UMqulu Owumhlahlandlela woCwaningo Lwemvelo uzotholakala, ukuze uzobuyekezwa futhi kuphawulwe ngawo, kusukela ngomhlaka 13 April 2022 kuya kumhlaka 16 May 2022 (kanjengoba kulandela):

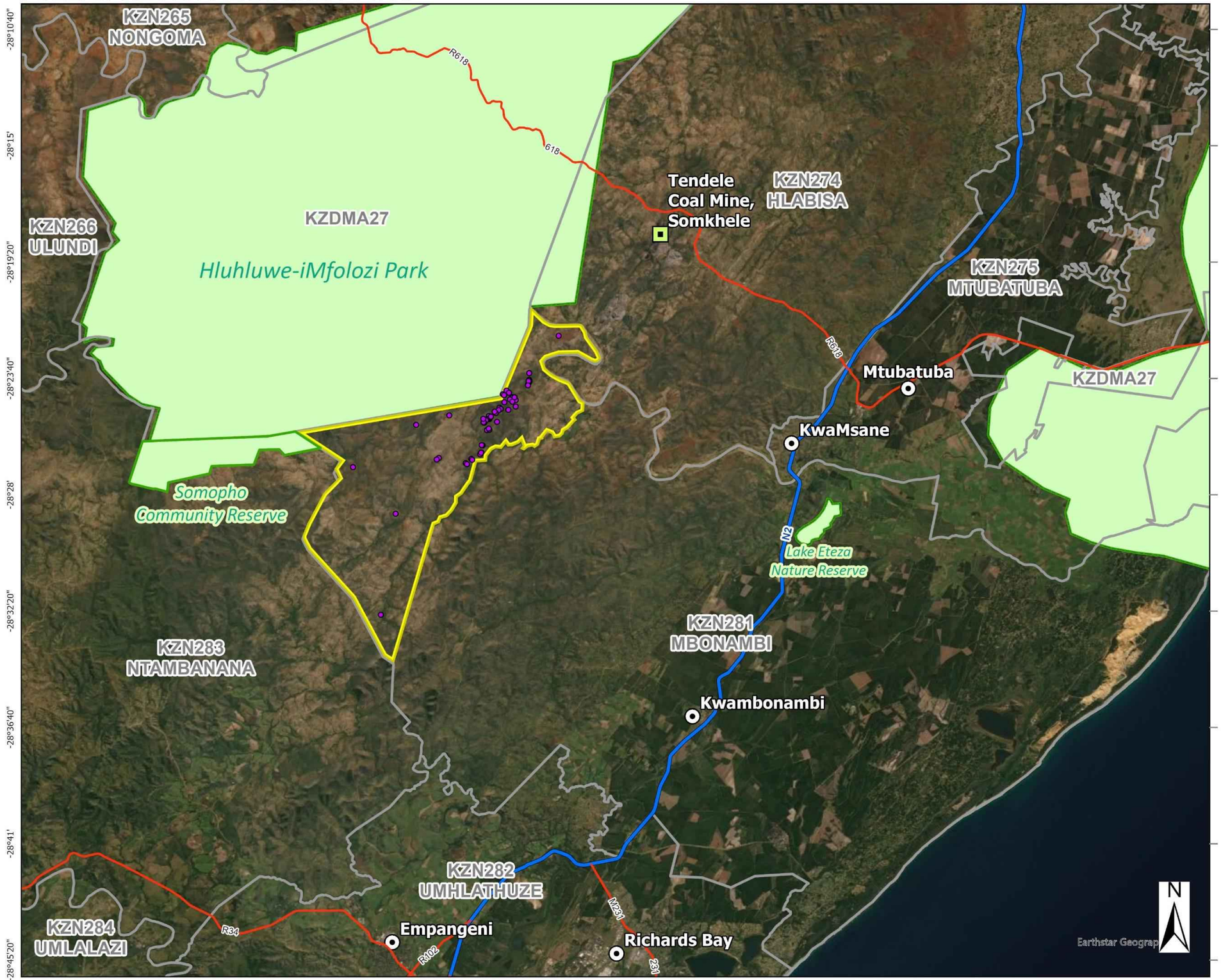
Ungatholwa kulesisizinda (website): http://www.gcs-sa.biz/documents/
Ezindaweni zomphakathi: Imiqulu izotholakala noma iyobekwa kulezizindawo ezilandelayo:

- Emahhovisi Esizwe saseMhlana, eDondotha
- Emtapweni Wolwazi Empangeni, Ekhoneni lika Union no Commercial Streets
- Emtapweni Wolwazi Kwambonambi, 25 Bredilia Street, Kwa-Mbonambi

Uyacelwa ukuba ubhalisele isifiso sakho sokwethamela nanoma yimuphi yalemihlangano engenhla ngokuthi uxhumane no GCS:

Janice Callaghan / Nathi Ncube
T: 031 764 7130, Email: Janicec@gcs-sa.biz / nathi.ncube@khapheni.co.za
Postal Address: PO Box 819, Gillitts, 3610

FULENI: REGIONAL LOCALITY MAP

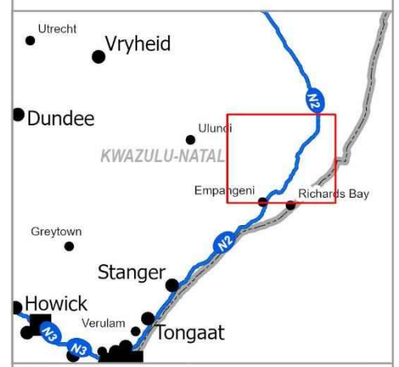


Legend

- Borehole
- Town
- Tendele Coal Mine, Somkhele
- Site Boundary
- PARKS
- Local Municipalities

Road Network

- National Route
- Main Road



Data Sources:
Esri World Imagery Basemap

0 5 10 Kilometers

SCALE: 1:250 000

FIGURE NO.:	-	MAP NUMBER:	22-0082-05-V2
DRAWN BY:	N MBOKAZI GIS INTERN	REVIEWED BY:	T DOMINY GIS ANALYST
DATUM: PROJECTION:	WGS84 GEOGRAPHIC	DATE:	06 APRIL 2022
PROJECT:	FULENI PROSPECTING RIGHT APPLICATION		
CLIENT:	MENAR		

GCS Water & Environmental Consultants

Credits: 63 Wessel Road Woodmead
PO Box 2597 Rivonia 2128
South Africa

Tel: +27 (0) 11 803 5726
Fax: +27 (0) 11 803 5745
E-mail: jhb@gcs-sa.biz
www.gcs-sa.biz

0900
LEGALS

0910
PUBLIC/ LEGAL NOTICES

FORM JJJ
LOST OR DESTROYED DEED

Notice is hereby given in terms of regulation 68 of the Deeds Registries Act, 1937, of the intention to apply for the issue of a certified copy of Title Deed Number TG323/1971KZ passed by UMHLATHUZE MUNICIPALITY in favour of CLIFFORD SIPHO MHLONGO in respect of certain ERF 96 NGWELEZANA A, REGISTRATION DIVISION GU, PROVINCE OF KWAZULU-NATAL which has been lost or destroyed.
All interested persons having objection to the issue of such copy hereby required to lodge the same in writing with the Registrar of Deeds at 111 High Court Building, 300 Pietermaritz Street, PIETERMARITZBURG within two weeks from the date of the publication of this notice.
Dated at EMPANGENI this 4th APRIL of 2022.

Applicant
c/o ROHRS DUVENAGE ATTORNEYS
1st FLOOR FNB BUILDING
8 SMITH STREET
EMPANGENI
3880
e-mail: zodwa@duvenage.co.za
Contact number: 035-7721111

11-04-2022

MA022550

• PUBLIC / LEGAL NOTICE •

GCS Ref. No: 22-0082
DMRE Ref. No: KZN 30/5/1/1/2/10747 PR

NOTIFICATION OF AN APPLICATION FOR ENVIRONMENTAL AUTHORISATION AND A PROSPECTING RIGHT FOR AGGREGATE, CLAY (GENERAL), COAL, PSEUDOCOAL AND TORBANITE/OIL SHALE ON REMAINDER OF THE FARM FULENI RESERVE NO. 14375 GU, MAGISTERIAL DISTRICT EMPANGENI, KWAZULU-NATAL PROVINCE

Imvukuzane Resources (Pty) Ltd is applying for Environmental Authorisation (EA) in accordance with the National Environmental Management Act (NEMA) (Act No. 107 of 1998): Environmental Impact Assessment (EIA) Regulations (2014), as amended, and a Prospecting Right in accordance with the Mineral and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) for the proposed prospecting activities on the Remainder of the Farm Fuleni Reserve 14375 GU, Magisterial District Empangeni.

Process to be followed: The Application for EA will follow the Basic Assessment process as required by the NEMA EIA Regulations (2014), as amended and will make provision for the application for the following Listed Activities:

- Government Notice R.327 (Listing Notice 1), Listed Activity 20
- Government Notice R. 324 (Listing Notice 3), Listed Activity 12

GCS Water and Environmental Consultants (Pty) Ltd has been appointed as an independent Environmental Assessment Practitioner (EAP) by Imvukuzane Resources (Pty) Ltd to undertake the necessary Basic Assessment and associated Public Participation Process (PPP) which is a regulated requirement of the above application. The PPP will be conducted in accordance with Chapter 6 of the NEMA: EIA Regulations (2014), as amended.

Nature and project location:
The Prospecting Right Application was lodged on the Remainder of the Farm Fuleni Reserve No. 14375 GU in Northern KwaZulu-Natal, approximately 45 km north-west of the town of Richards Bay. The prospecting area is situated within the uMfolozi Local Municipality and the King Chetshwayo District Municipality. The portion of land subject to the Prospecting Right Application is 14 720ha in extent with the prospecting activities making provision for the drilling of core boreholes within the total prospecting area.

How do I participate:
Interested and Affected Parties (IAPs) are invited to participate by providing comments and raising issues of concern regarding the proposed application. A draft Basic Assessment Report will be available from 13 April 2022 to 16 May 2022 for review and comment as follows:

Website download: http://www.gcs-sa.biz/documents/

Public places: The hard copy documents will be made available at the following localities:

- Mhlana Traditional Offices, Fuleni Area
- Empangeni Library, Corner of Union and Commercial Streets
- Kwambonami Library, 25 Bredilia Street, Kwa-Mbonambi

Please register yourself as an interested and affected party by contacting GCS by using the details below:

Janice Callaghan / Nathi Ngube
T: 031 764 7130, Email: Janicec@gcs-sa.biz / nathi.ncube@khapheni.co.za
Postal Address: PO Box 819, Gillitts, 3610

ma022542-15-22r©

CITY OF uMHLATHUZE
VISION INTO ACTION

CITY OF uMHLATHUZE

TENDER 8/2/1/UMH824-20/21: SUPPLY AND ERECT INVISIBLE FENCE AT RICHARDS BAY AIRPORT

Tenderers are hereby invited from suitably qualified suppliers for the following:

Bid Number	Bid Descriptions	Non-Refundable Tender Fee	Preferential point system	CIDB Grading	Opening Date for Bid Document Collection	Compulsory Briefing Session Date, Time and Venue	Bid Closing Date and time
8/2/1/UMH824-20/21	SUPPLY AND ERECT INVISIBLE FENCE AT RICHARDS BAY AIRPORT	R1 414.00	Price=80 Equity=20	6SQ or higher	11 April 2022	20 April 2022 at Veldenvlei Community Hall at 10:00	18 May 2022 12h00

Note: Mandatory requirements for tenders:

- Where applicable the designated sector will be subjected to a stipulated minimum threshold for local production and content requirements in compliance with Department of Trade and Industrial.
- ***Regulation 44 of the Supply Chain Management Regulations*** states that the Municipality may not make any award to a person who is in the service of the state (government), and if that person is not a natural person, of which any Director, Manager, Principal, Shareholder or Stakeholder is a person in the service of the state; or who is an advisor or consultant contracted with the municipality or municipal entity.
- All bids are subject to the terms and conditions contained herein and in the bid documentation as stipulated by various legislations governing public procurement including City of uMhlathuze's policies.
- uMhlathuze Municipality does not bind itself to accept the lowest or any tender, and reserves the right to accept any tender in whole or in part.

Submission of bids

- Sealed bids, **clearly endorsed: "TENDER NO : 8/2/1/UMH824-20/21"** must be placed in the Tender/Bid box at the **Stores and Procurement Offices, 22 Betalstraat, Alton, Richards Bay before 12:00 noon on 18 May 2022.**
- *The Tenderers **details and return address** must be indicated on the back of the sealed envelope in which the Tender is deposited, this is required for the purposes of returning tenders in cases where it may be required.*
- *Only Tender Document purchased from City of uMhlathuze will be acceptable.*

*Tender Documents will be available at the Customer Service Desk, Civic Centre, 5 Mark Strasse, Richards Bay as from **11 April 2022 at 12h00, up to the day before the site meeting. Please note that in order to obtain a Tender Document payment of the non- refundable deposit can be made at: Rates Hall-Civic, Richards Bay or payment may also be made directly into Council's bank account: ABSA Richards Bay Account number 2150000095.***

Reference: "Tender No: 8/2/1/UMH824-20/21, Name of Company: ……"

No documents will be handed out unless the tenderer or his representative produces a receipt for the deposit. Only Bank guaranteed cheques, EFT or cash will be accepted as payment method and cheques will be made in favour of uMhlathuze Municipality. It should be noted that the Rates Hall closes at 15:00 on weekdays for receipt of payments. Only Tender Documents procured from the Municipality will be acceptable.

Should use be made of a Courier Company to collect tender documents on behalf of your company, proof of payment and arrangement for the collection of the tender documents must be emailed to

Lungi Mbatha at Lungi.Mbatha@umhlathuze.gov.za
Wendy Wilke at Wendy.Wilke@umhlathuze.gov.za
Nonhlanhla Shabalala at ShabalalaNT@umhlathuze.gov.za
Faith Mkhwanazi at Faith.Mkhwanazi@umhlathuze.gov.za

Council will not accept responsibility for the late delivery of Tenders by courier services or any other means that are not placed in the tender box on or before the date and time of closing of the tender.

Enquiries can be directed to **Mr Sibusiso Kunene of the City of uMhlathuze** at email: kuneness@umhlathuze.gov.za alternative contact **Nontyatyambo Ndwandwa** email ndwandwan@umhlathuze.gov.za.

It is the requirement of this tender that the successful bidder must implement a successful Corporate Social Investment (CSI).

Tenderers who have not been contacted within 120 days after the closing date of this tender must accept that their tender was unsuccessful.

Civic Offices
Private Bag X1004
RICHARDS BAY
3900
(DMS1462333)
MN/25/2022

Mr NG ZULU
ACTING MUNICIPAL MANAGER

ma022510-15-22r©

APPENDIX E: DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

4a Old Main Road, Judges Walk, Kloof, Kwazulu-Natal, South Africa, 3610

PO Box 819, Gillitts, 3603, South Africa

Tel: +27 (0) 31 764 7130 **Fax:** +27 (0) 11 803 5745 **Web:** www.gcs-sa.biz

Draft Environmental Management Plan

Application for a Prospecting Right at Fuleni in the Empangeni Magisterial District, KwaZulu-Natal

Version - **Draft for Public Review**

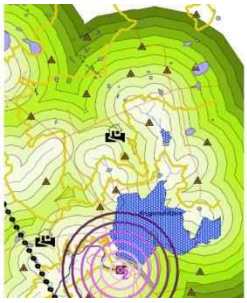
April 2022

Imvukuzane Resources (Pty) Ltd

GCS Project Number: 22-0082

DMRE Ref No: KZN 30/5/1/1/2/10747 PR



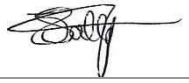




Draft Environmental Management Plan

Application for a Prospecting Right at Fuleni in the Empangeni Magisterial District, KwaZulu-Natal

April 2022

DOCUMENT ISSUE STATUS

Report Issue	Draft for Public Review		
GCS Reference Number	22-0082		
DMRE Reference	KZN 30/5/1/1/2/10747 PR		
Title	Draft Environmental Management Programme Application for a Prospecting Right at Fuleni in the Empangeni Magisterial District, KwaZulu-Natal		
	Name	**Signature**	**Date**
Author	Janice Callaghan		April 2022
Document Reviewer	Magnus van Rooyen		April 2022

ACRONYMS AND ABBREVIATIONS

BA	Basic Assessment
CA	Competent Authority
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CLO	Community Liaison Officer
DFFE	Department of Forestry, Fisheries and Environment
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners of South Africa
EAR	Environmental Audit Report
ECA	Environmental Conservation Act, 1989 (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ERAP	Emergency Response Action Plan
ESA	Ecological Support Area
FPA	Fire Protection Agency
FPO	Fire Protection Officer
GCS	GCS Water and Environmental Consultants (Pty) Ltd
GDP	Gross Domestic Product
GIS	Geographic Information System
GN	Government Notice
GNR	Government Notice Regulation
GPS	Global Positioning System
h	hours
ha	hectare
HCS	Hazardous Chemical Substance
HIA	Heritage Impact Assessment
HiP	Hluhluwe-iMfolozi Park
I&AP	Interested and Affected Party
IAP	Invasive Alien Plants
Imvukuzane Resources	Imvukuzane Resources (Pty) Ltd
km	kilometre
L	litres
m	metres

m^2	square metres
m^3	cubic metres
mamsl	metres above mean sea level
mm	millimetres
MSDS	Material Safety Data Sheets
NCR	Noise Control Regulations
NEMA	National Environmental Management Act, 1998 (Act No, 107 of 1998)
NEM: AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEM: BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM: WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NHRA	National Heritage Resources Agency
NFEPA	National Freshwater Ecosystems Priority Area
NPAES	National Protected Areas Expansion Strategy
NRTA	National Road Traffic Act, 1996 (Act No. 93 of 1996)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OHSA	Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
PM	Project Manager
PPE	Personal Protective Equipment
PPP	Public Participation Process
SABS	South African Bureau of Standards
SACNASP	South African Council for Natural Scientific Professionals
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANS	South African National Standards
SAPS	South African Police Services
SARTSM	South African Road Traffic Signs Manual
SCC	Species of Conservation Concern
SS	Site Supervisor
SWMP	stormwater management plan
TOPS	Threatened or Protected Species
WMA	Water Management Area
WUL	Water Use License
WULA	Water Use License Application

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

1.1 Background

GCS Water and Environmental Consultants (Pty) Ltd (GCS) was appointed by Imvukuzane Resources (Pty) Ltd (Imvukuzane Resources) to conduct the application for a prospecting right (PR) located on Portion 0 of Fuleni Reserve 14375 GU in the Empangeni Magisterial District. This application is being undertaken on behalf of Imvukuzane Resources, the applicant, and will be submitted to the Department of Mineral Resources and Energy (DMRE) as the competent authority. The resources being applied for are coal, pseudocoal, torbanite, clay and aggregate.

Owing to the nature and scale of the project, an Application for a PR is required. The Application has been undertaken in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). A detailed description of the aspects of the project covered in this Environmental Management Programme (EMPr) is provided in Section 2.

Figure 1-1 indicates the regional locality of the PR area, and the locations of the boreholes. Refer to Table 1-5 for the exact co-ordinates of the boreholes.

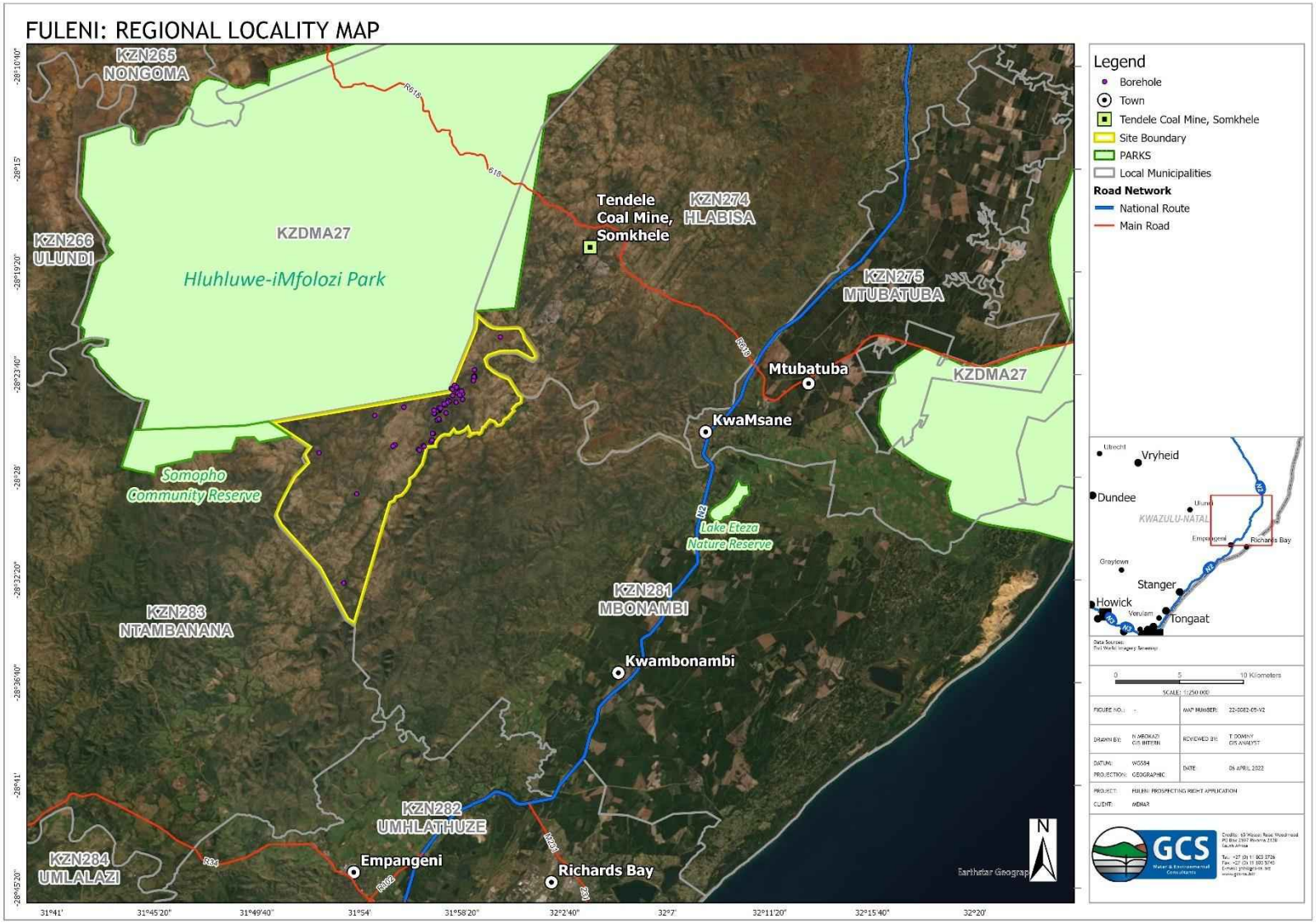


Figure 1-1: Regional Locality Map

1.2 Purpose of the EMPr

Section 19 of the NEMA Environmental Impact Assessment (EIA) Regulations of 2014, as amended (GN R982 in GG 38282, December 2014), requires that the Applicant submit an EMPr to the Competent Authority. This EMPr will form part of the PR, once approved.

The EMPr is an important environmental management tool, developed in line with best practices under NEMA and other environmental legislation, and informed by the EAP's professional experience as well as any relevant specialist information. The EMPr provides management guidance for activities undertaken at the development site. If correctly followed, the EMPr ensures that any adverse environmental impacts which could result from the development are adequately managed and mitigated.

The EMPr outlines all environmental management and monitoring actions required throughout the project lifecycle. The EMPr is legally binding and any person who contravenes the provisions herein is liable for imprisonment or a fine. This document should be viewed as "live" and thus, should be updated as and when necessary. The purpose of this document is therefore to guide environmental management throughout the various lifecycle phases of the proposed development.

The objectives of the EMPr are as follows:

- Ensure compliance with the relevant environmental legislation and conditions of the EA;
- Ensure that development activities are appropriately managed;
- Verify environmental performance through information on impacts as they occur;
- Respond to changes or unforeseen events; and
- Provide feedback on the continual improvement in environmental performance.

It is understood that all contract documentation related to the site establishment, prospecting and decommissioning of the proposed exploration programme will include the conditions of the PR and provisions of the EMPr. It is important to note that the contractual obligations must include the recording of any complaints on the project in the environmental register. Further, it is incumbent on the Site Supervisor (SS) to keep an accurate audit trail showing compliance with the EMPr during the construction phase.

This EMPr will remain a dynamic document throughout the life of the project. Once the PR has been issued by DMRE, the EMPr must be updated to include the specific conditions in the PR, as well as any required monitoring or reporting requirements of DMRE.

1.3 Content of the EMPr

According to Appendix 4 of the NEMA EIA Regulations of 2017, as amended (GNR 326 in GG 40772, April 2017), the EMPr for a project must include certain information. Table 1-1 describes how this report meets those requirements.

Table 1-1: Contents of this Environmental Management Programme (EMPr)

REQUIREMENT	SECTION IN THIS REPORT
Details of— (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.4 Appendix A
A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 1.7
A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Figure 5
A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including— (i) Planning and design; (ii) Pre-construction activities; (iii) Construction activities; (iv) Rehabilitation of the environment after construction and where applicable post-closure; and (v) Where relevant, operation activities;	Section 5
A description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated above will be achieved, and must, where applicable, include actions to— (i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) Comply with any prescribed environmental management standards or practices; (iii) Comply with any applicable provisions of the Act regarding the closure, where applicable; and (iv) Comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	Section 5 Section 6 Section 7

The method of monitoring the implementation of the impact management actions;	Section 5
The frequency of monitoring the implementation of the impact management actions;	Section 5
An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 5
The time periods within which the impact management actions must be implemented;	Section 5
The mechanism for monitoring compliance with the impact management actions;	Section 5
A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 5
An environmental awareness plan describing the manner in which— (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 4.15 Section 5
Any specific information that may be required by the competent authority.	NA

1.4 Details of the EAP

The details of the EAP who prepared this report can be found in Table 1-2. The EAP CV and registrations are attached as **Appendix A.**

Table 1-2: Details of the EAP

Name of EAP	Education qualifications and Registrations	Experience in environmental assessments (yrs)
Magnus van Rooyen	• MPhil Environmental Management • Pr.Sci.Nat (400335/11) • IAIAsa (1839)	18
Janice Callaghan	• BSc Hons Environmental Science • Cand.Sci.Nat (122924) • IAIAsa (6100) • AIEMA (0148361)	4

1.5 Details of the Applicant

The applicant is Imvukazane Resources (Pty) Ltd. The relevant contact details for the applicant are provided in Table 1-3.

Table 1-3: Details of the Applicant

ITEM	DETAILS		
Project Applicant	Imvukuzane Resources (Pty) Ltd		
Registration Number:	2018/228661/07		
Responsible Person:	Melissa Pillay		
Contact Persons	Sarah Wanless		
Postal Address	13 Fredman Drive, Fredman Towers, 7th Floor, Sandown,		
Postal Code:	2196	Cell:	
Telephone:	011 783 7996	Fax:	011 783 0816
E-mail:	sw@menar.com		

1.6 Assumptions and Limitations

This EMPr has been drafted with the acknowledgement of the following assumptions and limitations:

- Information used to guide the development of this EMPr was gained during the site visit, through the national web-based screening tool, through specialist input and using the EAP's experience in such developments;
- The mitigation measures recommended in this EMPr document are based on the preliminary risks/impacts identified in the BAR. These impacts were identified according to the activities described and the known receiving environment.

1.7 Applicable legislation, policy and best practice guidelines

The EMPr has been developed using knowledge of relevant national, provincial and local legislation and policy as well as best practice guidelines. The Applicant is bound to comply with the legislation and policy provisions throughout the life cycle of the project. Table 1-4 lists the relevant legislation and guidelines applicable to the development.

The environment is composed of biophysical, ecological, economic and social components. Prospecting is a minimally disruptive activity, limited to a small area at each drill site (25m x 25m) and all due consideration must be given to the environment, including the social environment during the execution of the exploration programme to minimize negative impacts on affected parties. Minimisation of areas disturbed by prospecting activities (i.e. the footprint of the individual boreholes) should reduce many of the prospecting-related environmental impacts of the project and reduce rehabilitation requirements and costs. All relevant standards relating to international, national, provincial and local legislation, as applicable, should be adhered to. This includes requirements relating to waste generation and emissions, waste disposal practices, noise regulations, road traffic ordinances, etc. Every

effort should be made to minimize, reclaim, and/or recycle waste materials.

Table 1-4: Applicable legislation, policy and best practice guidelines

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
The Constitution of the Republic of South Africa (Act 108 of 1996)	The Constitution is the supreme act to which all other acts must speak to and sets out the rights for every citizen of South Africa and aims to address past social injustices. With respect to the environment, Section 24 of the constitution states that: "Everyone has the right: a) To an environment that is not harmful to their health or well-being; b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: i. Prevent pollution and ecological degradation; ii. Promote conservation; and iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".	The Applicant must ensure that environmental impacts are avoided, mitigated or managed as far as possible throughout the life cycle of the project.
Environmental Conservation Act (73 of 1989) (ECA), as amended	The ECA has now largely been replaced by the NEMA but certain provisions remain in force. Section 21 of the ECA relates to the control of activities that may have a detrimental effect on the environment, which require written authorization issued by the relevant authority. The national Noise Control Regulations (NCR) (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCR) were promulgated In terms of Section 25 of the ECA, relating to noise, vibration and shock. The NCRs were revised under Government Notice Number R55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. In accordance with the Act, two procedures exist for assessing and controlling noise, respectively: • South African National Standard (SANS) 10328:2008 Methods for environmental noise impact assessments; • SANS 10103:2004 'The measurement and rating of environmental noise with respect to annoyance and speech communication'; and	The proposed activity is likely to increase ambient noise levels during the site establishment (temporary) and prospecting phases. Noise impacts are closely related to the drilling activities. The EMPr includes mitigation measures relating to the mitigation of noise impacts.

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
	• Other SANS.	
National Environmental Management Act (Act 107 of 1998) (NEMA), as amended	Framework law giving effect to the constitutional environmental right. Provides the framework for regulatory tools in respect of environmental impacts. Section 24 of NEMA regulates environmental authorisations. Section 28(1) states that "Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".	Applicable listed activities identified in terms of the 2014 NEMA EIA Regulations, as amended, are: • Listing Notice 1, Activity 20; and • Listing Notice 3, Activity 12. As such, a BA process must be followed to obtain the necessary EA in terms of the NEMA. The Applicant must ensure that environmental impacts are avoided, mitigated or managed as far as possible throughout the life cycle of the project.
National Environmental Management: Waste Act (Act 59 of 2008) (NEM: WA), as amended	Regulates inter alia the duty of care, management, transport and disposal of waste. Section 16(1) of the NEM: WA provides that: "A holder of waste must, within the holder's power, take all reasonable measures to – a) avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated; b) reduce, re-use, recycle and recover waste; c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner; d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through the noise, odour or visual impacts; e) prevent any employee or any person under his or her supervision from contravening this Act; and f) prevent the waste from being used for an unauthorised purpose." The NEM: WA also provides for a licensing regime specific to waste management activities.	While no Waste Management Licence is required for this development, the Applicant must ensure that waste is appropriately managed throughout the life cycle of the project.
National Environmental Management: Air Quality Act	Regulates activities which may have a detrimental effect on ambient air quality including certain processes and dust-generating activities.	An Air Emissions Licence will not be required, however, a duty of care should be employed during construction to minimise air

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
(Act 39 of 2004) (NEM: AQA), as amended	The NEM: AQA Dust Control Regulations (1 November 2013). prescribe dust fallout rates for residential and non-residential areas. For activities where the dustfall standard is exceeded, a dustfall monitoring report must be compiled and submitted.	pollution as far as possible. The Applicant must take all reasonable measures to minimise the generation of dust and ensure compliance with the Dust Control Regulations.
National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM: BA)	The Act aims for the management of all biodiversity within South Africa. The 2007 Threatened or Protected Species Regulations (GN R150, as amended) provides protection through a permit system as well as through the identification of restricted activities. If required, the relevant permits will be applied for. The Act also provides for duty of care with regards to control of alien species and provides a listing of threatened or protected ecosystems and species in one of the following four categories: critically endangered (CR), endangered (EN), vulnerable (VN), protected (species only), and least threatened (LT). The NEM: BA Alien and Invasive Species Regulations (Government Notice 590 of August 2014) categorises the different types of alien and invasive plant and animal species and how they should be managed: • Category 1a Listed Invasive Species – species that must be combatted or eradicated; • Category 1b Listed Invasive Species – species that must be controlled; • Category 2 Listed Invasive Species – species that require a permit and must not be allowed to spread outside of the designated area; and • Category 3 Listed Invasive Species – species which are subject to exemptions in terms of the section requiring a permit, but where such a species occurs in riparian areas, must, for these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to regulation 3.	According to the DFFE Screening Tool, the area is classified as a CBA 1 and 2, Ecological Support Area, National Protected Areas Expansion Strategy (NPAES), vulnerable ecosystem and falls within an aquatic CBA and NFEPA quaternary catchments. It is also adjacent to the HiP and Somopho Community Reserve. Care must be taken to ensure no protected species or ecosystems are lost, and permits must be applied for if necessary. The Applicant must also control and eradicate alien and invasive species in line with the NEM: BA Alien and Invasive Species Regulations.
Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA)	The purpose of CARA is to ensure that natural agricultural resources of South Africa are conserved through maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of water sources,	Measures to mitigate potential impacts on agricultural resources, such as soil erosion, alien invasion and protection of vegetation and water resources are included in the EMPr.

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
	protecting vegetation, and combating weeds and invader plants. Most of the provisions are accounted for in more recent legislation such as NEM: BA and NEMA and no applications are required in terms of CARA.	
National Water Act (Act 36 of 1998) (NWA)	Section 2 of the National Water Act, 1998 (Act No. 36 of 1998((NWA) provides for the protection, use, development, conservation and control of water resources while ensuring: • Promoting sustainable use of water; • Protection of aquatic and associated ecosystems and biological diversity; and • Reducing and preventing pollution and degradation of water resources. Sections 12 -20 of the NWA include provisions relating to the protection of water resources, including the water reserve and water quality. Section 13 relates to the establishment of water quality objectives, including: • The presence and concentration of particular substances in the water • The characteristics and quality of the water resource and the in-stream and riparian habitat • The characteristics and distribution of aquatic biota • The regulation and prohibition of in-stream and land-based activities which may affect the quantity and quality of the water resources Section 19 of the NWA provides for pollution prevention and requires that a person who owns, controls occupies or uses the land in question, is responsible for taking reasonable measures to prevent pollution of water resources. A catchment management agency may take action to prevent or remedy the pollution and recover all reasonable costs from the responsible party. The 'reasonable measures' which have to be taken may include measures to: • Cease, modify or control any act or process causing the pollution; • Comply with any prescribed waste standard or management practice; • Contain or prevent the movement of pollutants;	Specialists have confirmed that the proposed boreholes and infrastructure fall outside of a 100m buffer of all watercourses and a 500m buffer of all wetlands on site. No water use triggers have been identified, as such, a water use license is not required.

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
	• Eliminate any source of pollution; • Remedy the effects of the pollution; and • Remedy the effect of any disturbance to the bed and banks of a watercourse". "Pollution may be deemed to occur when the following are affected: • The quality, pattern, timing, water level and assurance of instream flow; • The water quality, including the physical, chemical and biological • Characteristics of the water; • The character and condition of the in-stream and riparian habitat; • The characteristics, condition and distribution of the aquatic biota". Section 21 of the NWA recognises and defines water uses that require the approval of the Department of Water and Sanitation (DWS) in the form of a General Authorisation or Water Use Licence (WUL). There are restrictions on the extent and scale of identified activities, determined through a risk assessment, for which General Authorisations apply.	
The National Heritage Resources Act (Act 25 of 1999) (NHRA)	In terms of the NHRA, any person who intends to undertake "any development … which will change the character of a site exceeding 5,000 m2 in extent", "the construction of a road…powerline, or pipeline…exceeding 300 m in length" must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency.	A Notice of Intent to Develop was compiled by Heritage Contracts and Archaeological Consulting. All recommendations in this report must be adhered to.
Carbon Tax Act (Act 15 of 2019)	Regulates and guides the imposition of taxes on businesses or organisations in relation to their carbon emissions.	The Applicant must adhere to the reporting stipulations within the Act.
Occupational Health and Safety Act (Act 85 of 1993) (OHSA) Regulations for Hazardous Chemical Substances (GN R1179, 1995)	Makes provision to protect the health and safety of employees at work or others affected by activities undertaken by businesses or industries.	The Applicant must adhere to the stipulations within the Act throughout the lifecycle of the activity. Contractors must comply with the Construction Regulations which lay out the framework for construction-related activities.

LEGISLATION/ GUIDELINES	DESCRIPTION	APPLICABILITY
2014 Construction Regulations		
Hazardous Substances Act (Act 15 of 1973)	Hazardous Substances Act aims to control the production, import, use, handling and disposal of hazardous substances. Under the Act, hazardous substances are defined as substances that are toxic, corrosive, irritant, strongly sensitising, flammable and pressure generating under certain circumstances and may injure, cause ill-health or even death in humans. Where hazardous substances from any of the 4 groups below are to be used, (see below) care must be taken to ensure that or sourced from a licensed sourced, transported, handled and disposed of in compliance with the provisions of the Act. • Group I: industrial chemicals (IA) and pesticides (IB); • Group II: 9 classes of wastes excluding Class 1: explosives and class 7: radioactive substances; • Group III: electronic products and group; and • Group IV: radioactive substances. The list of group IA hazardous substances is provided in the Act.	Hazardous substances may be stored, handled or transported as part of the proposed project and include diesel and other liquid fuel, oil and hydraulic fluid, cement, etc.

1.8 Aspects of the activity that are covered by the EMPr

The proposed PR area comprises various activities which fall within the 14 717ha project area, and which are the subject of this EMPr. It must be noted that a minimal portion of the project area will be affected by prospecting activities. A maximum of 55 boreholes will be drilled, and each site will disturb a 25m x 25m area.

The GPS co-ordinates of the proposed boreholes are indicated in Table 1-5.

Table 1-5: GPS coordinates of the proposed boreholes

Point	Latitude	Longitude
1	28°26'37.86"S	31°55'29.77"E
2	28°26'41.06"S	31°55'24.62"E
3	28°26'29.38"S	31°57'1.60"E
4	28°26'58.60"S	31°52'17.94"E
5	28°28'42.24"S	31°53'52.98"E

6	28°32'28.58"S	31°53'19.97"E
7	28°22'4.50"S	31°59'57.02"E
8	28°23'28.00"S	31°58'51.67"E
9	28°24'6.94"S	31°58'0.78"E
10	28°24'11.69"S	31°58'6.44"E
11	28°24'15.15"S	31°57'52.83"E
12	28°24'17.77"S	31°57'55.31"E
13	28°23'43.26"S	31°58'51.33"E
14	28°23'45.76"S	31°58'52.17"E
15	28°23'51.90"S	31°58'49.11"E
16	28°23'49.03"S	31°58'50.36"E
17	28°23'45.96"S	31°58'49.71"E
18	28°23'55.33"S	31°58'48.67"E
19	28°24'24.31"S	31°58'11.75"E
20	28°24'28.12"S	31°58'21.01"E
21	28°24'22.41"S	31°58'14.74"E
22	28°24'22.54"S	31°58'18.48"E
23	28°24'26.78"S	31°58'8.26"E
24	28°24'31.50"S	31°58'13.87"E
25	28°24'43.02"S	31°58'21.14"E
26	28°24'33.48"S	31°57'55.73"E
27	28°24'50.36"S	31°58'5.16"E
28	28°24'45.47"S	31°57'45.18"E
29	28°24'48.20"S	31°57'47.48"E
30	28°24'51.01"S	31°57'42.80"E
31	28°25'17.12"S	31°57'39.30"E
32	28°24'57.24"S	31°57'36.97"E
33	28°24'54.18"S	31°57'34.27"E
34	28°25'4.12"S	31°57'21.31"E
35	28°26'9.88"S	31°57'7.17"E
36	28°26'25.25"S	31°57'4.41"E
37	28°26'26.27"S	31°57'3.71"E
38	28°26'39.98"S	31°56'42.05"E
39	28°26'42.14"S	31°56'44.00"E
40	28°26'49.49"S	31°56'29.61"E
41	28°26'51.47"S	31°56'32.28"E
42	28°25'23.92"S	31°54'38.56"E
43	28°26'8.73"S	31°57'5.12"E
44	28°25'35.29"S	31°57'17.18"E

45	28°25'35.11"S	31°57'22.48"E
46	28°25'32.27"S	31°57'20.96"E
47	28°25'2.57"S	31°55'52.57"E
48	28°25'10.56"S	31°57'22.40"E
49	28°25'10.09"S	31°57'19.34"E
50	28°25'13.73"S	31°57'15.12"E
51	28°25'7.68"S	31°57'24.66"E
52	28°25'19.29"S	31°57'10.99"E
53	28°25'17.92"S	31°57'9.65"E
54	28°25'5.16"S	31°57'26.03"E
55	28°25'10.24"S	31°57'8.46"E

The affected property is described in Table 1-6.

Table 1-6: Affected property information

Property Description	Portion Number	SG Code	Property Extent (ha)	Property Owner
Fuleni Reserve 14375 GU	Portion 0	N0GU00000001437500000	22039.1996H	Ingonyama Trust Board

1.8.1 Site infrastructure

The following infrastructure will be positioned on site:

- Drill equipment;
- Sump;
- Waste storage;
- Laydown area; and
- Chemical toilets.

No additional roads are foreseen to be required, existing tracks will be used as far as possible.

1.8.2 Non-invasive Methods

Ground magnetic survey, geophysical survey and field reconnaissance will be undertaken initially. This will assist with the identification of sites within the boundary of the farm, and obtaining detailed data for mapping of the ore body to be prospected. It is assumed that information from previous prospecting in the area will be incorporated into the study.

1.8.3 Invasive Methods

Diamond drilling will be undertaken to determine the stratigraphy and horizons of the ore body and confirm the information collected during the non-invasive investigations.

A maximum amount of 55 holes will be drilled. Please note these holes were plotted on a grid and basic consideration has been made with regards to environmental sensitivities for the purposes of this report. All drill holes will, however, be approved by the team's environmental manager prior to approval thereof. The environmental management plan related to this project will consider environmental sensitivities and approve or reject holes in Table 1-5. Clearly defined targets will warrant testing by diamond, reverse circulation or percussions drilling. It is envisaged that a combination of HQ (63.5mm) and NQ (47.63mm) drilling will be used to drill targets. The borehole depths are expected to vary between 25m and 125m with an average of approximately 70m. The core will be logged, cut and sampled at a core yard to be located near the prospecting site. The samples will be crushed and milled and then analysed at an accredited laboratory to determine quality.

A rigorous quality control and assurance program (insertion of reference standards, duplicates and blanks into each batch) will be used to monitor the analyses and make sure that valid results are achieved. An area of approximately 500m^2 will be cleared by means of a TLB around each borehole site. The area will be fenced off to prevent unauthorised access by people or animals. The recovered Cores will be constructed in core trays and stored for analysis. When completed, all boreholes will be cemented, sealed and capped, and the sites will be fully rehabilitated.

1.9 Project Phases and Activities

The proposed project will have the following phases which are included within the scope of this EMPr:

Planning and Design Phase activities will include:

- Exploration programme; and
- Identification of service infrastructure already present in the area.

Site Establishment activities will include:

- Vegetation clearance; and
- Establishment of drill rigs.

During the operational phase, activities will include:

- Drilling;
- Use of service infrastructure;
- Removal of alien invasive vegetation; and
- Use of roads.

Decommissioning and rehabilitation activities will include:

- Removal of drill rig and equipment;
- Loosening of compacted soil;
- Revegetation;
- Sealing of boreholes; and
- Ensuring all spills are clean and rehabilitated.

Throughout the project lifecycle, the site establishment, prospecting and decommissioning teams must be prepared for unplanned emergencies or incidents threatening human health or the environment.

1.10 Composite Environmental Sensitivity Map

Based on the results of the desktop assessment and specialist opinions, a composite environmental sensitivity map showing the proposed PR area and boreholes is shown in Figure 1-2 to Figure 1-5.

Key sensitive features identified within the proposed project footprint through the DFFE Screening Report include the following:

- Very High Aquatic Sensitivity based on the web-based national screening tool owing to the location within National Freshwater Ecosystem Priority Area (NFEPA). Site investigations have shown that there are numerous natural watercourses and wetlands

within the study area, and a buffer of 100m from all watercourses and 500m from all wetland areas must be maintained;

- Very High Terrestrial Biodiversity Sensitivity, indicating that the site is located within Critical Biodiversity Area (CBA) 1 and 2, ecological support area (ESA), Protected Areas Expansion Strategy and vulnerable ecosystem, and is located adjacent to the Hluhluwe-iMfolozi Park (HiP) and Somopho Community Nature Reserve; and
- Although the DFFE Screening Tool indicated low heritage sensitivity, site investigations indicate numerous potential heritage features on site. A 50m buffer needs to be maintained around all sites.

Figure 1-2: Environmental Sensitivity - Watercourses Buffer of 100m

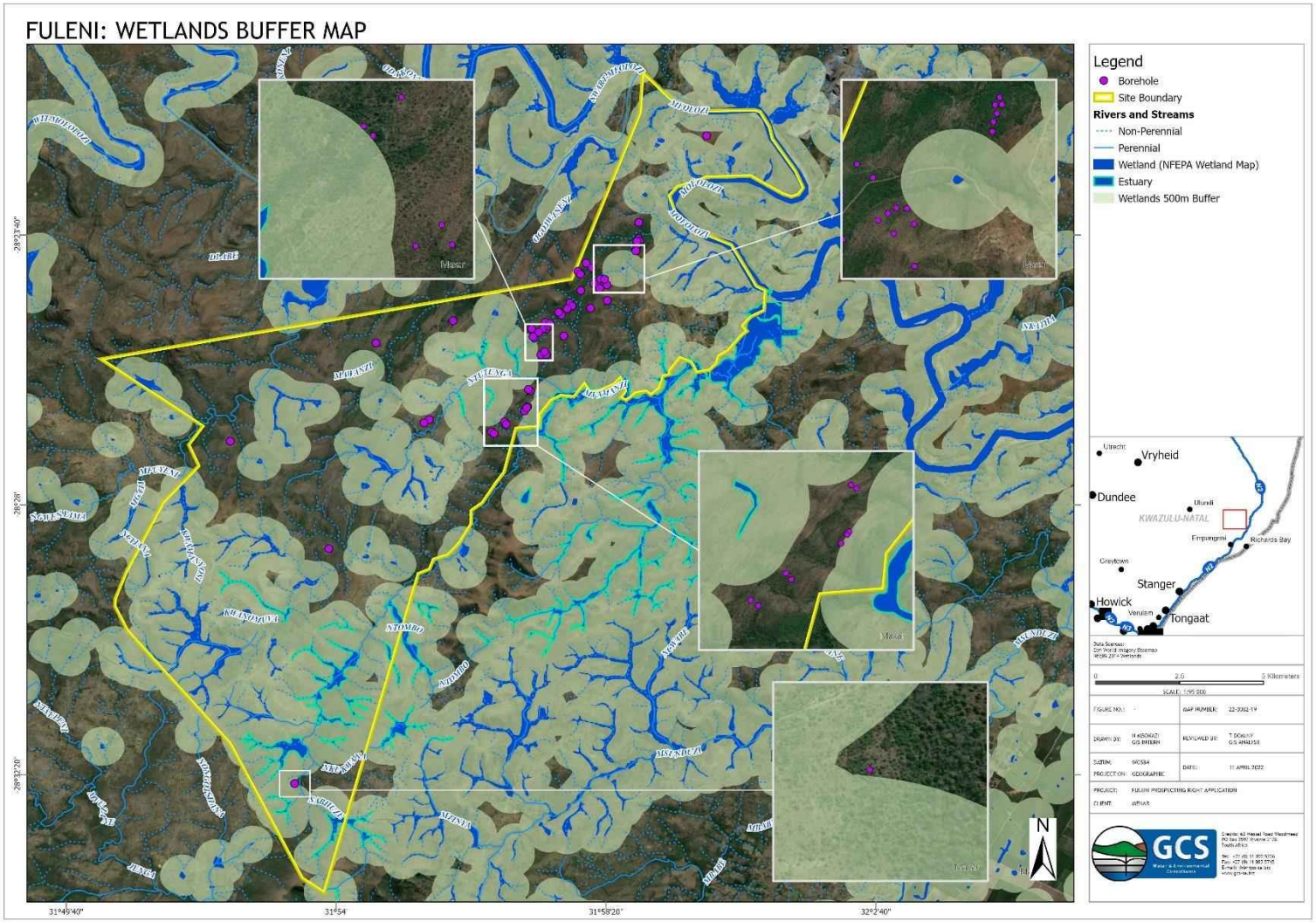


Figure 1-3: Environmental Sensitivity - Wetlands Buffer of 500m

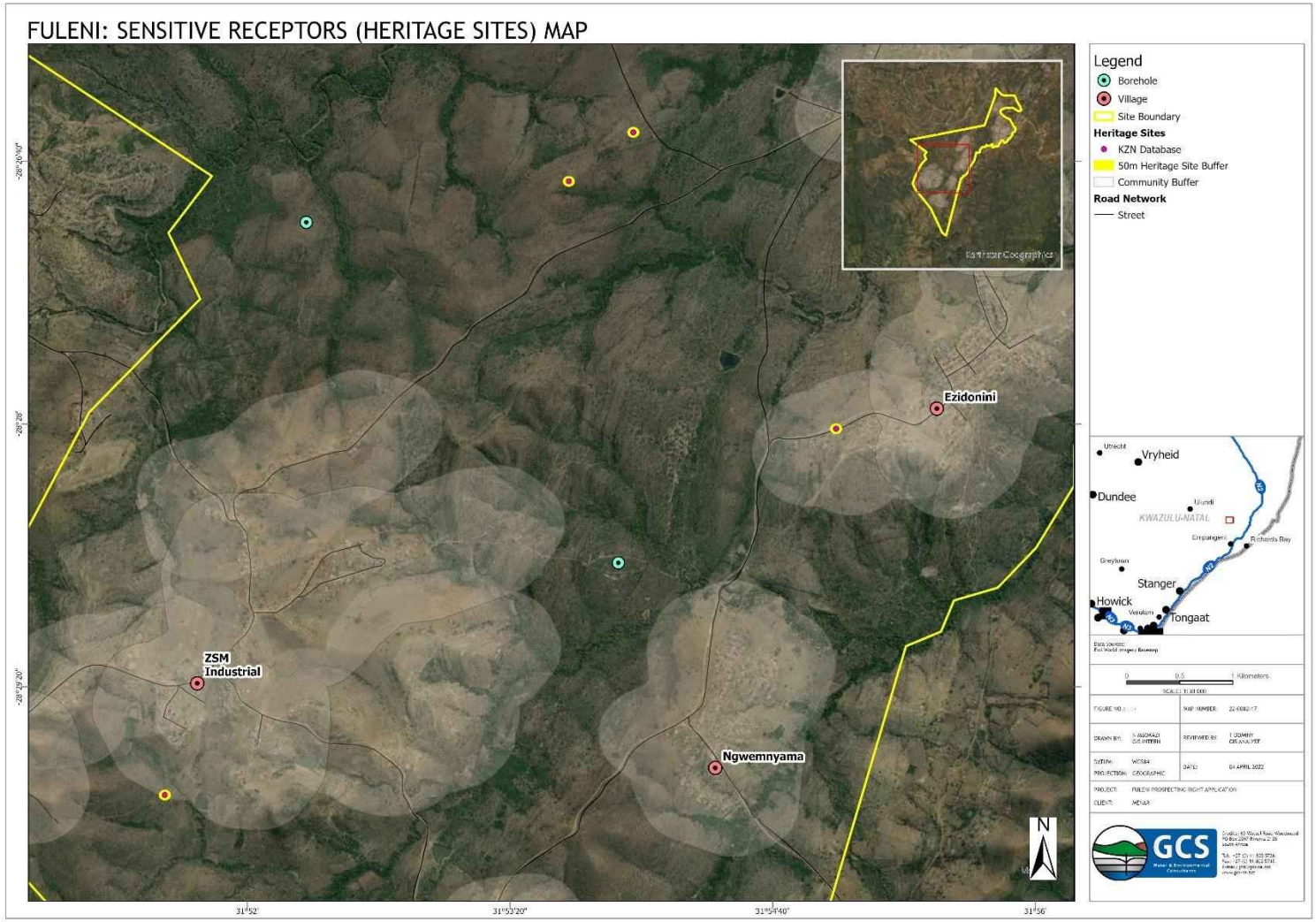


Figure 1-4: Environmental Sensitivity - Heritage sites Buffer of 50m

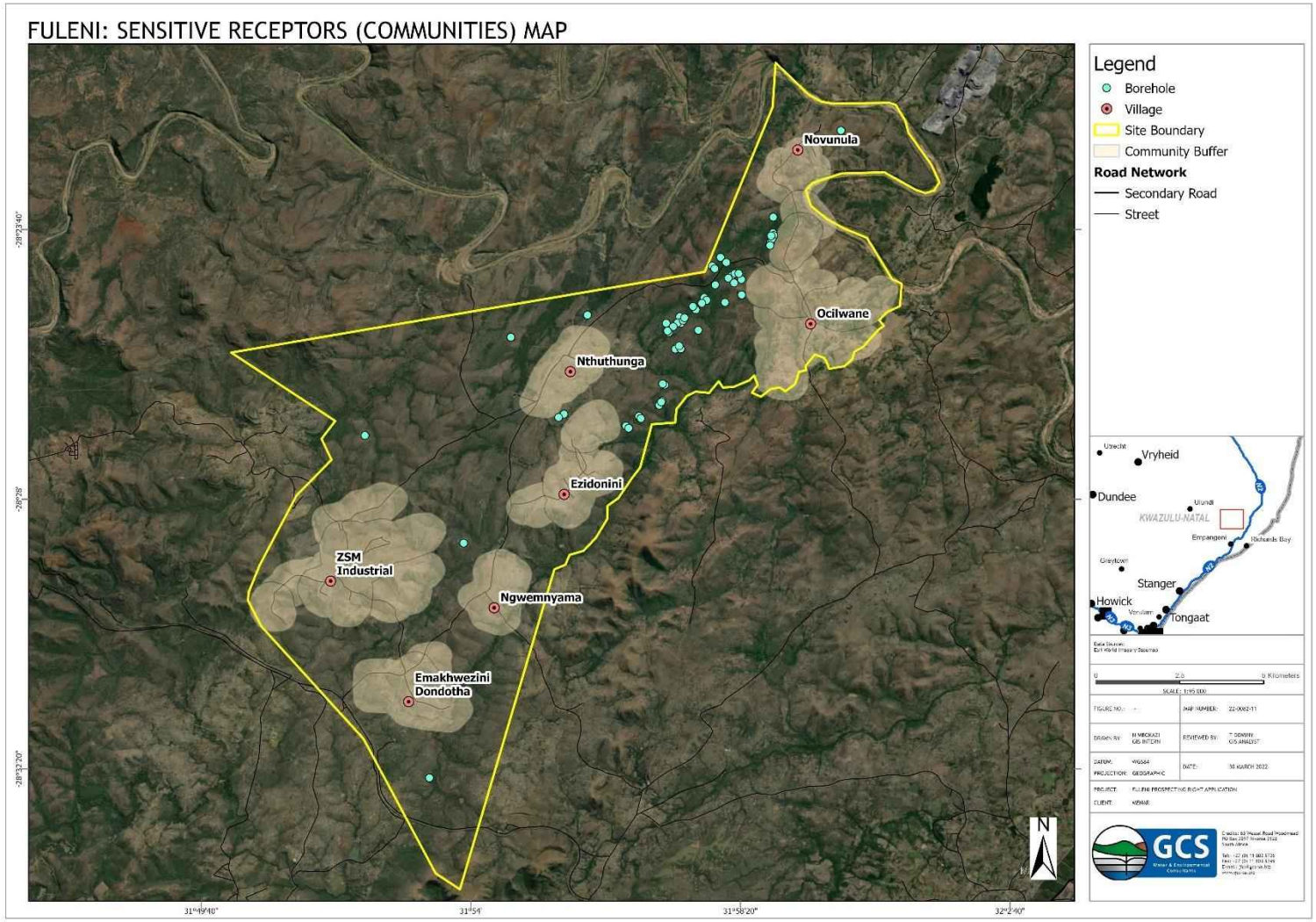


Figure 1-5: Environmental Sensitivity - Communities

2 ENVIRONMENTAL IMPACT STATEMENT

Appendix 4 of the 2014 NEMA EIA Regulations, as amended, requires that the EMPr include a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development. The impacts identified during the Basic Assessment phase are summarised in this Section.

There are no impacts rated “High” or Very High”. Most impacts are reduced to “Low” significance post-mitigation.

2.1 Negative Impacts

The following impacts associated with the proposed project are considered Medium (Negative) significance (pre-mitigation):

- Disturbance of habitats.
- Increase in human activity.
- Disturbance or possible mortality incidents of terrestrian fauna.
- Increase in alien invasive vegetation on cleared sites.
- Loss of ecosystem functioning.
- Increase in runoff and erosion.
- Loss off the ability of these systems to assimilate toxins.
- Trap sediments and help with flood control during periods of high flow.
- Small change in topography at sites where clearing and flattening takes place.
- Soil disturbance.
- Potential for soil erosion .
- Decrease in soil fertility/nutrient content.
- Removal of soil core and a portion of coal resource.
- Establishment of alien invasive vegetation on stockpiles.

All impacts can be mitigated to Low significance.

2.2 Positive Impacts

The following impacts associated with the proposed project are considered of **Positive** significance:

- Employment opportunities for local communities; and
- Determination of the potential and extent of the reserve.

In the decommissioning phase, the receiving environment will be rehabilitated as closely as possible to the pre-disturbed conditions.

3 ROLES AND RESPONSIBILITIES

The effective implementation of this EMPr is dependent on established and clear roles, responsibilities and reporting lines within an institutional framework. This section of the EMPr gives guidance to the various environmental roles and reporting lines, however, project-specific requirements will ultimately determine the need for the appointment of a specific person(s) to undertake specific roles and or responsibilities. See Table 3-1.

Table 3-1: Roles and Responsibilities for Implementation of the EMPr

Responsible Person	Roles and Responsibilities
Project Manager (PM)	Role The PM is accountable for ensuring compliance with the EMPr and any conditions of approval from the competent authority (CA). The PM is to objectively monitor the implementation of the EMPr according to relevant environmental legislation, and the conditions of the EA. Responsibilities - Be fully conversant with the conditions of the EA; - Ensure that all stipulations within the EMPr are communicated and adhered to by the Developer and its Contractor(s); - Issuing of site instructions to the Contractor for corrective actions required; - Monitor the implementation of the EMPr throughout the project through site inspections and meetings. Overall management of the project and EMPr implementation; and - Ensure that periodic environmental performance audits are undertaken on the project implementation.
Site Supervisor (SS)	Role The SS reports directly to the PM, oversees site works, liaises with the contractor(s). The SS is responsible for the day-to-day implementation of the EMPr and for ensuring the compliance of all contractors with the conditions and requirements stipulated in the EMPr. Responsibilities - Must be fully conversant with the conditions of the EMPr and EA. - Oversees site works, liaison with Contractor and PM; - Be conversant with relevant environmental legislation, policies and procedures, and ensure compliance with them; - Be aware of the findings and conclusions of all EA related to the development; - Must ensure that all landowners have the relevant contact details of the site staff, SS and PM; - Issuing of site instructions to the Contractor for corrective actions required; - Will issue all non-compliances to contractors; - Undertake regular and comprehensive site inspections/audits of the site according to the generic EMPr and applicable licenses to monitor compliance as required; - Educate the construction team about the management measures contained in the EMPr and environmental licenses; - Compilation and administration of an environmental monitoring plan to ensure that the environmental management measures are implemented and are effective; - Monitoring the performance of the Contractors and ensuring compliance with the EMPr and associated Method Statements (to be compiled once detailed designs have been completed);

	- In consultation with the SS order the removal of person(s) and/or equipment which are in contravention of the specifications of the EMPr and/or environmental licenses; - Liaison between the PM, Contractors, authorities and other lead stakeholders on all environmental concerns; - Compile a regular Environmental Audit Report (EAR) highlighting any non-compliance issues as well as satisfactory or exceptional compliance with the EMPr; - Keep a record of environmental incidents (spills, impacts, legal transgressions etc.) as well as corrective and preventive actions taken; - Keep a public complaints register in which all complaints are recorded, as well as action taken; - Facilitate training for all personnel on the site – this may range from carrying out the training to reviewing the training programmes of the Contractor; - Follow-up on pre-warnings, defects, non-conformance reports; - Measure and communicate environmental performance to the Contractor; - Maintenance, update and review of the EMPr; and - Communication of all modifications to the EMPr to the relevant stakeholders
Contractor	Role The Contractor has overall responsibility for ensuring that all work, activities, and actions linked to the delivery of the contract are in line with the EMPr and that Method Statements are implemented as described (to be compiled once detailed designs have been completed). External contractors must ensure compliance with this EMPr while performing the onsite activities as per their contract with the Project Developer. The contractors are required, where specified, to provide Method Statements setting out in detail how the impact management actions contained in the EMPr will be implemented (to be compiled once detailed designs have been completed). Responsibilities - Project delivery and quality control for the development services as per appointment; - Employ a suitably qualified person to monitor and report to the Project Developer's appointed person on the daily activities on-site during the construction period; - Ensure that safe, environmentally acceptable working methods and practices are implemented, and that equipment is properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely; - Attend on site meeting(s) prior to the commencement of activities to confirm the procedure and designated activity zones; - Ensure that contractors' staff repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in EMPr, to the satisfaction of the SS.

4 ENVIRONMENTAL DOCUMENTATION REPORTING AND COMPLIANCE

To ensure accountable and demonstrated implementation of the EMPr, several reporting systems, documentation controls and compliance mechanisms must be in place as a minimum requirement.

4.1 Document control/Filing system

The holder of the PR is solely responsible for the upkeep and management of the EMPr file. As a minimum, all documentation detailed below will be stored in the EMPr file. A hard copy of all documentation shall be filed, while an electronic copy may be kept where relevant. A duplicate file will be maintained in the office of the SS (where applicable). This duplicate file must remain current and up-to-date. The filing system must be updated, and relevant documents added as required. The EMPr file must be made available at all times on request by the Competent Authority (CA) or other relevant authorities. The EMPr file will form part of any environmental audits undertaken as prescribed in the EIA Regulations.

4.2 Documentation to be available

At the outset of the project the following preliminary list of documents shall be placed in the filing system and be accessible at all times:

- A full copy of the signed PR from the CA in terms of NEMA;
- Any amendments to the PR;
- Copy of the generic and site-specific EMPr as well as any amendments thereof;
- Copy of declaration of implementing generic EMPr and subsequent approval of site-specific EMPr and amendments thereof;
- All method statements (to be compiled once detailed designs have been completed);
- Completed environmental checklists;
- Minutes and attendance register of any environmental site meetings;
- An up-to-date environmental incident log;
- A copy of all instructions or directives issued;
- A copy of all corrective actions signed off. The corrective actions must be filed in such a way that a clear reference is made to the non-compliance record;
- Complaints register.

4.3 Monthly Environmental Checklist

The SS is required to complete a Monthly Environmental Checklist, the format of which is to be agreed upon prior to commencement of the activity. The SS is required to sign and date the checklist, retain a copy in the EMPr file and submit a copy of the completed checklist to the PM weekly. The checklists

will form the basis for the Monthly Environmental Reports. Copies of all completed checklists will be attached as Annexures to the EAR as required in terms of the EIA Regulations.

4.4 Required Method Statements

The method statement will be done in such detail that the SS can assess whether the contractor's proposal is in accordance with the EMPr (to be compiled once detailed designs have been completed).

The method statement must include the following:

- Development procedures;
- Materials and equipment to be used;
- Getting the equipment to and from the site;
- How the equipment/ material will be moved while on site;
- How and where the material will be stored;
- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
- Timing and location of activities;
- Compliance/ non-compliance with the EMPr; and
- Any other information deemed necessary by the SS.

Unless indicated otherwise by the Project Manager, the Contractor shall provide the following method statements to the Project Manager no less than 14 days prior to the commencement date of the activity:

- Site establishment;
- Vegetation management – Protected, clearing, aliens, felling;
- Access management – Fencing, gates, crossings etc.;
- Fire plan;
- Waste management -transport, storage, segregation, classification, disposal (all waste streams);
- Social interaction – complaints management, compensation claims, access to properties etc.;
- Emergency preparedness – Spills, training, other environmental emergencies;
- Dust and noise management methodologies; and
- Heritage and palaeontology management.

The SS shall monitor and ensure that the contractors perform in accordance with these method statements. Completed and agreed method statements between the holder of the PR and the contractor must be included in the environmental file. A generic format of a method statement is supplied as Appendix B.

4.5 Environmental Incident Log

The SS is required to maintain an up-to-date and current Environmental Incident Log. The Environmental Incident Log is a means to record all environmental incidents and/or all non-compliance notice would not be issued. An environmental incident is defined as:

- Any deviation from the listed impact management actions (listed in this EMPr) that may be addressed immediately by the SS. (For example, a contractor's staff member littering or a drip tray that has not been emptied);
- Any environmental impact resulting from an action or activity by a contractor in contravention of the environmental stipulations and guidelines listed in the EMPr which as a single event would have a minor impact but which if cumulative and continuous would have a significant effect (for example no toilet paper available in the ablutions for an afternoon); and
- General environmental information such as road kills or injured wildlife.

The SS is required to record all environmental incidents in the Environmental Incident Log. All incidents regardless of severity must be reported to the PM. The Log is to be kept in the EMPr file and at a minimum, the following will be recorded for each environmental incident:

- The date and time of the incident;
- Description of the incident;
- The name of the Contractor responsible;
- The incident must be listed as significant or minor;
- If the incident is listed as significant, a non-compliance notice must be issued, and recorded in the log;
- Remedial or corrective action taken to mitigate the incident; and
- Record of repeat minor offences by the same contractor or staff member.

The Environmental Incident Log will be captured in the EAR.

4.6 Non-compliance

A non-compliance notice will be issued to the responsible contractor by SS or PM. The non-compliance notices will be issued in writing; a copy filed in the EMPr file and will at a minimum include the following:

- Time and date of the non-compliance;
- Name of the contractor responsible;
- Nature and description of the non-compliance;
- Recommended / required corrective action; and
- Date by which the corrective action is to be completed.

The contractors shall act immediately when a notice of non-compliance is received and correct whatever is the cause for the issuing of the notice. Complaints received regarding activities on the

exploration site pertaining to the environment shall be recorded in a dedicated register and the response noted with the date and action taken. The SS should be made aware of any complaints. Any non-compliance with the agreed procedures of the EMPr is a transgression of the various statutes and laws that define how the environment is managed. Failure to redress the cause shall be reported to the relevant CA for them to deal with the transgression, as it deems fit. The contractor is deemed not to have complied with the EMPr if, inter alia, there is a deviation from the environmental conditions, impact management outcomes and impact management actions activities, as approved in generic and site-specific EMPr as relevant as set out in the EMPr, which deviation has, or may cause, an environmental impact.

4.7 Corrective action records

For each non-compliance notice issued, a documented corrective action must be recorded. On receiving a non-compliance notice from the SS, the contractor will ensure that the corrective actions required take place within the stipulated timeframe. On completion of the corrective action, the contractor is to issue a Corrective Action Report in writing to the SS. If satisfied that the corrective action has been completed, the SS is to sign-off on the Corrective Action Report and attach the report to the non-compliance notice in the EMPr file.

Corrective action is considered complete once the report has been signed off by the SS.

4.8 Photographic record

A digital photographic record will be kept. The photographic record will be used to show before, during and post-rehabilitation evidence of the project as well used in cases of damages claims if they arise. Each image must be dated, and a brief description note attached.

The Contractor shall:

- Allow the SS access to take photographs of all areas, activities and actions.
- The SS shall keep an electronic database of photographic records which will include:
    - Pictures of all areas designated as work areas, camp areas, development sites and storage areas taken before these areas are set up;
    - Road conditions and road verges;
    - Condition of all farm fences;
    - All areas to be cordoned off during site establishment;
    - Waste management sites;
    - Ablution facilities (inside and out);
    - Any non-conformances deemed to be “significant”;
    - All completed corrective actions for non-compliance;
    - All required signage;
    - Photographic recordings of incidents;

- All areas before, during and post-rehabilitation; and
- Include relevant photographs in the Final Environmental Audit Report.

4.9 Complaints register

The SS shall keep a current and up-to-date complaints register. The complaints register is to be a record of all complaints received from communities, stakeholders and individuals. The Complaints Record shall:

- Record the name and contact details of the complainant;
- Record the time and date of the complaint;
- Contain a detailed description of the complaint;
- Where relevant and appropriate, contain photographic evidence of the complaint or damage (SS to take relevant photographs); and
- Contain a copy of the SS's written response to each complaint received and keep a record of any further correspondence with the complainant. The SS's written response will include a description of any corrective action to be taken and must be signed by the Contractor, SS and affected party. Where a damage claim is issued by the complainant, the SS shall respond as described below.

4.10 Claims for damages

If a Claim for Damages is submitted by a community, landowner or individual, the SS shall:

- Record the full detail of the complaint as described above;
- The PM will evaluate the claim and associated damage and submit the evaluation to the Senior Site Representative for approval;
- Following consideration by the PM, the claim is to be resolved and settled immediately, or the reason for not accepting the claim communicated in writing to the claimant. Should the claimant not accept this, the SS shall, in writing report the incident to the Contractor's negotiator and legal department; and
- A formal record of the response by the SS to the claimant as well as the rectification of the method of making payments not amount will be recorded in the EMPr file.

4.11 Interactions with I & APs

Open, transparent and good relations with affected landowners, communities and regional staff are an essential aspect to the successful management and mitigation of environmental impacts.

The SS shall:

- Ensure that all queries, complaints and claims are dealt with within an agreed timeframe;

- Ensure that any or all agreements are documented, signed by all parties and a record of the agreement kept in the EMPr file;
- Ensure that complaints telephone numbers are made available to all landowners and affected parties; and
- Ensure that contact with affected parties is courteous at all times.

4.12 Environmental audits

Internal environmental audits of the activity and implementation of the EMPr must be undertaken. The findings and outcomes are included in the EMPr file and submitted to the CA at intervals as indicated in the EA.

The SS must prepare a monthly EAR. The final report will be circulated to the PM and filed in the EMPr file. At a frequency determined by the EA, the SS shall submit the monthly reports to the CA. At a minimum, the monthly report is to cover the following:

- Environmental Checklists;
- Deviations and non-compliances with the checklists;
- Non-compliances issued;
- Completed and reported corrective actions;
- Environmental Monitoring; and
- General environmental findings and actions.

4.13 Final environmental audits

On completion of the rehabilitation and/or requirements of the PR, a final EAR is to be prepared and submitted to the CA. The EAR must comply with Appendix 7 of the EIA Regulations.

4.14 Environmental Training and Awareness-Raising

The Contractor, sub-contractors and employees require an appropriate level of environmental awareness and competence to ensure continued compliance with environmental legislation, conditions of the EA and the provisions in the EMPr. Training needs should be identified based on the available and existing capacity of site personnel (including all Contractors and sub-contractors) to undertake the required management actions and monitoring activities. All personnel must be adequately trained to perform their designated tasks to an acceptable standard.

Upfront environmental training is aimed at:

- Promoting environmental awareness;

- Informing the main contractor of all environmental procedures, policies and programmes applicable;
- Providing generic training on the implementation of environmental management specifications; and
- Providing job-specific environmental training to understand the key environmental features of the construction site and the surrounding environment.

Training will be offered in the main languages. In addition to the upfront environmental training by the SS, the Contractor should make provision for regular training or "Toolbox Talks".

General environmental awareness must be fostered to ensure that environmental incidents are minimised and there is environmental compliance.

5 PROPOSED IMPACT MANAGEMENT ACTIONS

This section outlines aspects related to the development of each drilling site within the PR area, associated boreholes and drill equipment for each aspect, a set of prescribed impact management outcomes and associated impact management actions have been identified. Holders of PRs are responsible to ensure the implementation of these outcomes and actions for all projects as a minimum requirement, to mitigate the impact of such aspects.

This must be signed and dated on each page by both the contractor and the holder of the PR prior to commencement of the activity. The method statements are prepared and agreed to by the holder of the PR (to be compiled once detailed designs have been completed - a generic format is supplied as Appendix B). Each method statement must also be duly signed and dated on each page by the contractor and the holder of the PR. This template, once signed and dated, is legally binding. The holder of the PR will remain responsible for its implementation.

Appendix 4 of the 2014 NEMA EIA Regulations requires that the EMPr aim to achieve the following through the proposed impact management actions:

- Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
- Comply with any prescribed environmental management standards or practices;
- Comply with any applicable provisions of the Act regarding the closure, where applicable; and
- Comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable.

Table 5-1: Environmental Training

Impact management outcome	Impacts on the environment are minimised during site establishment and the development footprint is kept to the demarcated development area.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- All staff must receive environmental awareness training prior to the commencement of the activities; - The Contractor must allow for sufficient sessions to train all personnel; - Refresher environmental awareness training is available as and when required; - All staff are aware of the conditions and controls linked to the EA and within the EMPr and made aware of their roles and responsibilities in achieving compliance with the EA and EMPr; - The Contractor must erect and maintain information posters at key locations on site, and the posters must include the following information as a minimum: a) Safety notifications; and b) No littering. - Environmental awareness training must include as a minimum the following: a) Description of significant environmental impacts, actual or potential, related to their work activities; b) Mitigation measures to be implemented when carrying out specific activities; c) Emergency preparedness and response procedures; e) Procedures to be followed when working near or within sensitive areas; f) Wastewater management procedures; g) Water usage and conservation; h) Solid waste management procedures; i) Sanitation procedures; j) Fire prevention; k) Disease prevention; and l) Prevention and containment of spills, leaks and other impacts to watercourses - A record of all environmental awareness training courses undertaken as part of the EMPr must be available; - Educate workers on the dangers of open and/or unattended fires; - A staff attendance register of all staff to have received environmental awareness training must be available. - Course material must be available and presented in appropriate languages that all staff can understand.	SS	• Schedule training sessions with all contractors as required prior to construction • Document all trainees	Prior to the start of prospecting activities	SS	Schedule training sessions with all contractors as required prior to prospecting	• Training register/s • Information posters • Training materials

Table 5-2: Site Establishment Development

Impact management outcome	Impacts on the environment are minimised during site establishment and the development footprint is kept to the demarcated development area.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Where possible, it is recommended that prospecting activities be undertaken during the dry season/winter months to reduce erosion and sedimentation risks associated with summer rainfall in this region; - Minimize activity duration;	PM SS	• SS to approve method statements • Approved method statements to be included in the	Prior to the start of prospecting activities	SS	Prior to site establishment	• Approved method statements included in updated EMPr

- All drill areas will be cordoned off; - Limit the footprint; - A method statement must be provided by the contractor prior to any onsite activity that includes the layout of the propsecting areas in the form of a plan showing the location of key infrastructure and services (where applicable), including but not limited to ablution facilities, hazardous materials storage areas (including fuels), designated access routes, waste and wastewater management; - Location of infrastructure must be within approved area to ensure that the site does not impact on sensitive areas identified in the environmental assessment or site walkthrough; - Sites must be located where possible on previously disturbed areas; - The use of existing accommodation for contractor staff, where possible, is encouraged; - Identification of access restricted areas is to be informed by the environmental assessment, site walkthrough, and any additional areas identified during development; - To mitigate the localised visual impact through the storage of equipment and machinery, and the storage of reflective materials, a shade cloth fence can be erected around the construction camp/s. - Erect, demarcate and maintain a temporary barrier with clear signage around the perimeter of any access restricted area, colour coding could be used if appropriate; and - Unauthorised access and development related activity inside access restricted areas are prohibited.		updated EMPr - a generic format is supplied as Appendix B				(to be compiled once detailed designs have been completed - a generic format is supplied as Appendix B)

Table 5-3: Access Roads and Traffic

Impact management outcome	Minimise impact on traffic mobility and access and minimise the impact on the local road network					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- All contractors must be made aware of all these permissible access routes; - Adequate road signage according to the South African Road Traffic Signs Manual (SARTSM); - Any access route deviation from that in the written agreement must be closed and re-vegetated immediately, at the contractor's expense; - Maximum use of both existing servitudes and existing roads must be made to minimize further disturbance; and - Implementation of pedestrian safety initiatives.	PM Contractor SS	• Training of contractors • Road maintenance programme	Prior to the start of prospecting activities	SS	Prior to site establishment	• Training registers • Photographic records of affected access routes • Complaints register • Environmental incident register

Table 5-4: Water Use and Supply Management

Impact management outcome	Undertake responsible water usage.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Ensure water conservation is being practised by: a. Minimising water use during the cleaning of equipment; b. Undertaking regular audits of water systems; and c. Including a discussion on water usage and conservation during environmental awareness training.	PM Contractor SS	• Keep records of water sources and volumes on site	All phases (ongoing)	SS	All phases (ongoing)	• Records of water sources and volumes on site • Training registers • Training materials

Table 5-5: Stormwater and Wastewater Management

Impact management outcome	Impacts on the environment caused by stormwater and wastewater discharges during the life of the project are avoided.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Responsible waste management must be implemented to minimize pollution of water resources. - All spillage of hazardous substances onto concrete surfaces must be controlled by the use of an approved absorbent material and the used absorbent material disposed of at an appropriate waste disposal facility; - After every rainfall event, the contractor must check the site for erosion damage and rehabilitate this damage immediately. - Demarcated dirty areas to be limited to roads, parking areas and chemical storage areas. - Spills to be cleaned up immediately. - Vehicles and equipment to be regularly maintained and cleaned.	PM Contractor SS	• Implementation of specialist recommendations. • Certificates of safe disposal for general, hazardous and recycled waste • Record spills/ discharges and environmental incidents	All phases (ongoing)	SS	All phases (ongoing)	• Certificates of safe disposal for general, hazardous and recycled waste • Complaints register • Environmental incident register

Table 5-6: Rivers and Wetlands

Impact management outcome	Impacts on rivers and wetlands during the life of the project are avoided.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Spills to be cleaned up immediately. - Vehicles and equipment to be regularly maintained and cleaned. - Limit the footprint area of the prospecting activities to what is absolutely essential in order to minimise environmental damage; - During the prospecting phase, no vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas; - Implement effective waste management in order to prevent construction related waste from entering the drainage line and riparian environments. - Plant soil stabilizing species such as grasses - Plant indigenous trees common to the habitat to replace riparian vegetation - Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.	PM Contractor SS	• Audit the implementation of specialist recommendations. • Certificates of safe disposal for general, hazardous and recycled waste • Record spills/ discharges and environmental incidents	All phases (ongoing)	SS	All phases (ongoing)	• Certificates of safe disposal for general, hazardous and recycled waste • Complaints register • Environmental incident register

Table 5-7: Solid and Hazardous Waste Management

Impact management outcome	Wastes are appropriately stored, handled and safely disposed of at a recognised waste facility.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- All measures regarding waste management must be undertaken using an integrated waste management approach; - Sufficient, covered waste collection bins (scavenger and weatherproof) must be provided; - A suitably positioned and demarcated temporary waste collection site must be identified and provided; - The temporary waste collection site must be maintained in a clean and orderly manner and managed in accordance with the National	PM Contractor SS	• Compile and implement the approved SWMP • Certificates of safe disposal for general, hazardous and recycled waste	All phases (ongoing)	SS	All phases (ongoing)	• Certificates of safe disposal for general, hazardous and recycled waste • Complaints register

Impact management outcome	Wastes are appropriately stored, handled and safely disposed of at a recognised waste facility.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
Norms and Standards for the Storage of Waste (GNR.926, November 2013); - Waste must be segregated into separate bins and marked for each waste type for recycling and safe disposal; - Staff must be trained in waste segregation; - Bins must be emptied regularly; - General waste produced onsite must be disposed of at registered waste disposal sites/recycling companies; - Hazardous waste must be disposed of at an appropriately licensed waste disposal site; and - Certificates of safe disposal for general, hazardous and recycled waste must be maintained.		• Record spills/ discharges and environmental incidents				• Environmental incident register • Training register • Training materials

Table 5-8: Vegetation Clearing

Impact management outcome	Vegetation clearing is restricted to the authorised development footprint.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**

- Indigenous vegetation outside of the designated Works area must be left undisturbed;
- Restrict the movement of personnel and construction vehicles to where they are needed;
- Remove vegetation in a 'natural manner' when possible, avoiding any harsh lines;
- All disturbed areas should be rehabilitated after the construction phase;
- Permits for the damage or removal of protected plant species must be obtained from the relevant CA prior to the cutting or clearing of the affected species, and they must be filed;
- It is important to note that in accordance with the National Forests Act (Act No. 84 of 1998) the removal of the identified tree species can only occur upon the authorisation of a permit to do so.
- The number of these trees must be recorded before removal to ensure that an equal number of these species can be replanted during the closure/rehabilitation of the vegetation on the site.
- The need for collection and germination of seeds for these species are not necessary as all these species can be sourced from nurseries in the area.
- Alien invasive vegetation must be removed and disposed of at a licensed waste management facility.
- Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat
- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment
- The SS must undertake monthly compliance monitoring audits. Terrestrial ecosystem aspects that must be monitored related to monitoring freshwater ecosystem impacts include:
  - The condition of the demarcations/fence.
  - Evidence of any no-go area incursions.
	PM
	Contractor
	SS
		• Demarcation of SCC and sensitive habitats prior to construction
		• Implementation of the approved alien and invasive plant control and eradication plan
		
		• The daily register must be kept of all relevant details of herbicide usage
		• Certificates of safe disposal for general, hazardous and recycled waste
		• Implementation of the approved alien and invasive plant control and eradication plan
			All phases (ongoing)	SS	All phases (ongoing)	• Environmental incident register
						• Training register
						• Training materials
						• Monitoring of success of rehabilitation
						• Records of permits for the relocation of SCC and protected plants
						• Daily register of herbicide usage
						• Certificates of safe disposal for general, hazardous and recycled waste

- The condition of temporary runoff, erosion and sediment control measures and evidence of any failures or sediment deposits. - Evidence of erosion. - Visual assessment of stormwater quality. - The condition of waste bins and the presence of litter within the working area. - Evidence of solid waste dumping within the no-go areas. - Evidence of hazardous materials spills and soil contamination. - Presence of alien invasive and weedy vegetation within the working area. - Rehabilitation and revegetation methods and success.						

Table 5-9: Protection of Fauna

Impact management outcome	Disturbance to fauna is minimised.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- If possible, the activities are to commence in the winter months to ensure that the animal species that will actively move from the site is not currently rearing young as the movement with young animals could potentially cause mortality amongst the young animals; - No poaching must be tolerated under any circumstances. All animal dens close to the works areas must be marked as "No-Go" areas; - No deliberate killing of fauna is allowed; - In areas where snakes are abundant, snake deterrents to be deployed; and - No Threatened or Protected species (ToPs) and/or protected fauna as listed according to NEM: BA and relevant provincial ordinances may be removed and/or relocated without appropriate authorisations/permits. - All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel; - Restrict all movement of vehicles and heavy machinery to permissible areas, these being designated access roads, maintenance roads, turning points and parking areas. No off-road driving beyond designated areas may be allowed. - Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. - Re-fuelling must take place on a sealed surface area to prevent infiltration of hydrocarbons into topsoil - Strict speed limits must be set and adhered to. - Driving between dusk and dawn should be permissible to emergency situations only. - Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution. - All spills, should they occur, should be immediately cleaned up and treated accordingly - Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat	PM Contractor SS	• Demarcation of SCC, sensitive habitats prior to construction • Assessment of vulture nesting sites two months prior to construction • Records of permits for the relocation of SCC	All phases (ongoing)	SS	All phases (ongoing)	• Environmental incident register • Training register • Training materials • Monitoring of success of rehabilitation • Records of permits for the relocation of SCC

- Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.						

Table 5-10: Protection of Heritage Resources

Impact management outcome	Impact on heritage resources is minimised.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- All work must cease immediately if any human remains and/or other archaeological, palaeontological and historical material are uncovered; - Reporting of heritage findings to the SAHRA. - Such material, if exposed, must be reported to the nearest museum, archaeologist/palaeontologist (or the South African Police Services [SAPS]), so that a systematic and professional investigation can be undertaken; and - Sufficient time must be allowed to remove/collect such material before development recommences. - A stakeholder engagement process should be conducted (where the local community should indicate graves as well as places of social and spiritual significance) - Adhere to footprint areas - Adhere to 50m buffer around all resources identified. The buffer material (danger tape, fencing, etc.) must be highly visible to construction crews - If any fossils are found, a Palaeontologist must be notified immediately by the SS and/or EAP and a site visit must be arranged at the earliest possible time with the Palaeontologist. - In the case of the SS or the PM becoming aware of suspicious-looking palaeo-material. - The activities must be halted in that specific area and the Palaeontologist must be given enough time to reach the site and remove the material before excavation continues. - Mitigation will involve the attempt to capture all rare fossils and the systematic collection of all fossils discovered. This will take place in conjunction with the descriptive, diagrammatic and photographic recording of exposures, also involving sediment samples and samples of both representative and unusual sedimentary or biogenic features. The fossils and contextual samples will be processed (sorted, sub-sampled, labelled, and boxed) and documentation consolidated, to create an archive collection from the excavated sites for future researchers.	PM Contractor SS	• Reporting of heritage findings to SAHRA • Reporting of graves/ human remains to SAPS	All phases (ongoing)	SS	All phases (ongoing)	• Environmental incident register • Training register • Training materials • Permits for damage or repairs to heritage sites • Records of reports to heritage agencies/ SAPS

Table 5-11: Health and Safety

Impact management outcome	All precautions are taken to minimise the risk of injury, harm, illness or complaints.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**

- Identify fire hazards, demarcate and restrict public access to these areas as well as notify the local authority of any potential threats e.g. large brush stockpiles, fuels etc.; - All unattended drill sites must be adequately fenced or demarcated; - Ensure warning signs are erected on the perimeter of these areas. - Adequate protective measures must be implemented to prevent unauthorised access to the Works area; - Ensure structures vulnerable to high winds (drill rig) is secured; and - Maintain an incidents and complaints register in which all incidents or complaints involving the public are logged.	Community Liaison Officer (CLO)	• Appointment of CLO and implementation of the complaints register process	All phases (ongoing)	CLO	All phases (ongoing)	• Complaints register • Training register • Training materials
- Ensure that sanitation and social distancing protocols related to COVID-19 are implemented as per the Gazette on Consolidated Coronavirus COVID-19 Direction on Occupational Health and Safety Measures in Workplaces (Gazette 43400 of 4 June 2020); - Ensure that the workforce is sensitised to the effects of HIV/ acquired immunodeficiency syndrome (AIDS); - The Contractor must ensure that information posters on Coronavirus COVID-19 and AIDS are displayed in the Contractor Camp area; - Information and education relating to Coronavirus COVID-19 to be made available to both construction workers and the local community, where applicable; - Appropriate Personal Protective Equipment (PPE) to be provided to all staff on site; - Medical support must be made available as appropriate; and - Provide access to Voluntary HIV Testing and Counselling Services.	PM Contractor SS	• Awareness raising and posters • Access to appropriate PPE	All phases (ongoing)	SS	All phases (ongoing)	• Number of staff reporting as sick/ number of sick leave days • Complaints register • Training register • Training materials

Table 5-12: Sanitation

Impact management outcome	Clean and well-maintained toilet facilities are available to all staff to minimise the risk of disease and impact on the environment.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Minimum 1 toilet per 10 users. - Only portable chemical toilets with a sealed reservoir will be allowed on site. - The capacity of the reservoirs in the portable chemical toilets must be monitored daily to ensure that they can be serviced timeously. - The use of ablution facilities and or mobile toilets must be used at all times and no indiscriminate use of the veld for ablutions must be permitted under any circumstances; - Toilets must not be located within the 1:100yr flood line of a watercourse or the recommended buffer of any wetlands. - Toilets must be secured to the ground to prevent them from toppling due to wind or any other cause. - Spillage should be prevented when the toilets are cleaned or emptied. - Toilets must be emptied before long weekends and workers holidays and must be locked after working hours. - Toilets must be serviced weekly, and the SS must inspect toilets to ensure compliance with health standards. - Waste must be disposed of at a suitably licensed facility. - A copy of the waste disposal certificates must be maintained.	PM Contractor SS	• Demarcation of SCC, sensitive habitats prior to construction • Certificates of safe disposal for general, hazardous and recycled waste • Record spills/ discharges and environmental incidents	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • Certificates of safe disposal for general, hazardous and recycled waste • Environmental incident register

Table 5-13: Emergency procedures

Impact management outcome	Emergency procedures are in place to enable a rapid and effective response to all types of environmental emergencies.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Compile an Emergency Response Action Plan (ERAP) prior to the commencement of the proposed project; - The Emergency Plan must deal with accidents, potential spillages and fires in line with relevant legislation; - All staff must be made aware of emergency procedures as part of environmental awareness training; - The relevant local authority must be made aware of a fire as soon as it starts; and - In the event of an emergency, necessary mitigation measures to contain the spill or leak must be implemented.	PM Contractor SS	• Compile ERAP prior to the commencement of construction • Demarcation of SCC, sensitive habitats prior to construction • Certificates of safe disposal for general, hazardous and recycled waste • Record spills/ discharges and environmental incidents	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • ERAP • Environmental incident register

Table 5-14: Hazardous Substances

Impact management outcome	Safe storage, handling, use and disposal of hazardous substances.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- No refuelling, servicing or chemical storage should occur within 50m of any watercourse. - The use and storage of hazardous substances to be minimised and non-hazardous and non-toxic alternatives substituted where possible; - All hazardous substances must be stored in suitable containers as defined in the Method Statement (to be compiled once detailed designs have been completed – a generic format is supplied as Appendix B); - Containers must be marked to indicate contents, quantities and safety requirements; - All storage areas must be bunded. The bunded area must be of sufficient capacity to contain a spill/leak from the stored containers; - Bunded areas to be suitably lined with a South African Bureau of Standards (SABS) approved liner; - An Alphabetical Hazardous Chemical Substance (HCS) control sheet must be drawn up and kept up to date continuously; - All hazardous chemicals that will be used on site must have product-specific Material Safety Data Sheets (MSDS); - All employees working with HCS must be trained in the safe use of the substance and according to the safety data sheet; - Employees handling hazardous substances /materials must be aware of the potential impacts and follow appropriate safety measures. Appropriate personal protective equipment must be made available; - The Contractor must ensure that diesel and other liquid fuel, oil and hydraulic fluid is stored in appropriate storage tanks or bowsers; - The tanks/ bowsers must be situated on a smooth impermeable surface (concrete) with a permanent bund. The impermeable lining must extend to the crest of the bund and the volume inside the bund	PM Contractor SS	• Compile ERAP prior to the commencement of construction • Compile HCS control sheet • MSDS • Demarcation of SCC, sensitive habitats prior to construction • Certificates of safe disposal for general, hazardous and recycled waste • Record spills/ discharges and environmental incidents	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • ERAP • HCS control sheet and updates • MSDS • Spill kits available on site • Environmental incident register

must be 130% of the total capacity of all the storage tanks/bowsers (110% statutory requirement plus an allowance for rainfall); - The floor of the bund must be sloped, draining to an oil separator; - Provision must be made for refuelling at the storage area by protecting the soil with an impermeable ground cover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained; - All empty externally dirty drums must be stored on a drip tray or within a bunded area; - No unauthorised access into the hazardous substances' storage areas must be permitted; - No smoking must be allowed within the vicinity of the hazardous storage areas; - Adequate fire-fighting equipment must be made available at all hazardous storage areas; - Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used; - An appropriately sized spill kit kept onsite relevant to the scale of the activity/s involving the use of hazardous substances must be available at all times; - The responsible operator must have the required training to make use of the spill kit in emergencies; - An appropriate number of spill kits must be available and must be located in all areas where activities are being undertaken; - In the event of a spill, contaminated soil must be collected in containers and stored in a central location and disposed of according to the NEM: WA.						

Table 5-15: Equipment Maintenance and Storage Aspect

Impact management outcome	Soil, surface water and groundwater contamination are minimised.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- During servicing of vehicles or equipment, a suitable drip tray must be used to prevent spills onto the soil; - Leaking equipment must be repaired immediately or be removed from the site to facilitate repair; - All areas must be monitored for oil and fuel spills; - Appropriately sized spill kit kept onsite relevant to the scale of the activity taking place must be available.	PM Contractor SS	• Compile ERAP prior to the commencement of construction • Compile HCS control sheet • MSDS • Certificates of safe disposal for general, hazardous and recycled waste • Record spills/ discharges and environmental incidents	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • ERAP • HCS control sheet and updates • MSDS • Spill kits available on site • Environmental incident register

Table 5-16: Dust Emissions Aspect

Impact management outcome	Dust prevention measures are applied to minimise the generation of dust.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Take all reasonable measures to minimise the generation of dust as a result of project development activities to the satisfaction of the SS. - Comply with the National Dust Control Regulations, GN 36974 of 1 November 2013, in terms of the NEM: AQA, as amended, and all applicable local bylaws. - Excavation, handling and transport of erodible materials must be avoided under high wind conditions or when a visible dust plume is present. - During high wind conditions, the SS must evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level. - Vehicle speeds must not exceed 40 km/h along dust roads or 20 km/h when traversing unconsolidated and non-vegetated areas. - Avoid dust-generating works during extremely windy conditions. - Apply an appropriate dust suppression protocol to limit the generation of dust through construction activities and traffic on unsealed roads – there may be the need for frequent wetting of the access road. - When working near (within 100 m) a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible. - Ensure that all construction vehicles are maintained to the manufacturer's specifications.	PM Contractor SS	• Compile ERAP prior to the commencement of construction • MSDS • Certificates of safe disposal for general, hazardous and recycled waste • Record spills/ discharges and environmental incidents	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • ERAP • MSDS • Spill kits available on site • Certificates of safe disposal for general, hazardous and recycled waste • Environmental incident register

Table 5-17: Noise Mitigation Aspect

Impact management outcome	Prevent unnecessary noise to the environment by ensuring that noise from development activity is mitigated.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- The Contractor must keep the noise level within acceptable limits. - Comply with the Noise Control Regulations in terms of Section 25 of the ECA (GN R154 of 10 January 1992) and all local noise bylaws. - Any complaints received by the Contractor regarding noise must be recorded and communicated to the SS and PM. - Operating hours as determined by the environmental authorisation are adhered to during the development phase. Where not defined, it must be ensured that development activities must still meet the impact management outcome related to noise management.	PM Contractor SS	• Control of working hours	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • Environmental incident register

Table 5-18: Fire Prevention Aspect

Impact management outcome	Prevention of uncontrollable fires.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Ensure compliance with the National Veld and Forest Fire Act (101 of 1998); - Designate smoking areas where the fire hazard could be regarded as insignificant; - Smoking must be controlled as per the Tobacco Products Control Act, 1993 (Act No. 83 of 1993), as amended. - Firefighting equipment must be available on all vehicles located on site; - The local Fire Protection Agency (FPA) must be informed of construction activities; - Contact numbers for the FPA and emergency services must be communicated in environmental awareness training and displayed at a central location on site; - Two-way swop of contact details between SS and FPA.	PM Contractor SS	• Emergency contact details on site	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • Emergency contact details on site • Environmental incident register

Table 5-19: Socio-Economic Aspect

Impact management outcome	Enhanced socio-economic development.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Ensure that site workers are identifiable. All workers should carry identification cards and wear identifiable clothing. - Fence off the site and control access to the site. - Appoint an independent security company to monitor the site. - Develop and implement communication strategies to facilitate community liaison. - Communicate the limitation of opportunities created by the project through Community Leaders and Ward Councillors. - Wherever feasible, residents should be recruited to fill semi and unskilled jobs. - Women should be given equal employment opportunities and encouraged to apply for positions. - Develop and implement a collaborative and constructive approach to conflict resolution as part of the external stakeholder engagement process. - Sustain continuous communication and liaison with neighbouring owners and residents. - Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly. - Regularly monitor the effect that construction is having on infrastructure and immediately report any damage to infrastructure to the appropriate authority. - Ensure that where communities' access is obstructed that this access is restored to an acceptable state. - Ensure that all affected landowners and tourist associations are regularly consulted.	CLO	• Recording complaints/ grievances in the complaints register • Maintain records of correspondence with Interested and Affected Parties	All phases (ongoing)	SS CLO	All phases (ongoing)	• Complaints register • Training register • Training materials • HIV Infections Policy

Impact management outcome	Enhanced socio-economic development.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- A Grievance Mechanism should be put in place and all grievances should be dealt with transparently.						

Table 5-20: Visual Aspect

Impact management outcome	Minimise the visual impact					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- Ensure that the site is in a visually acceptable state at all times. - Use suitable building finishes/colours that blend in with the surrounding landscape. - Choose suitable types of lighting that minimize glare and sky glow. - Utilize motion sensor lights at security buildings. - Ensure a complaints register is in place to record and address complaints. - Implement concurrent rehabilitation, and ensure the smallest area possible is cleared of vegetation at a time.	PM Contractor SS	• Recording complaints/ grievances in the complaints register • Maintain records of correspondence with Interested and Affected Parties • Concurrent rehabilitation.	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • Environmental incident register

Table 5-21: Landscaping and Rehabilitation Aspect

Impact management outcome	Areas disturbed during the development phase are returned to a state that approximates the original condition.					
Impact Management Actions	**Implementation**			**Monitoring**		
	Responsible Person	**Method of Implementation**	**Timeframe for Implementation**	**Responsible Person**	**Frequency**	**Evidence of Compliance**
- A Rehabilitation Plan/ Strategy must be compiled and implemented. - The Rehabilitation Plan must make provision for the rehabilitation of the vegetation on the drilling sites to ensure that the vegetation resembles the of the surrounding areas. - Proper planning for rehabilitation is considered critical for ensuring that rehabilitation is successful. - Removal of all foreign debris, waste, cement/concrete, building materials and similar from the watercourse and dispose of properly at a suitable landfill site. - Any active erosion features (e.g. dongas) need to be fixed/stabilised. - Alien plants, particularly those considered invasive in terms of the NEM: BA will need to be removed/eradicated. - Where a rapid cover is required in the drier areas, the bare areas should be seeded with a suitable indigenous seed mix in addition to translocation planting where possible. This will need to be done under the instruction and guidance of a plant ecologist, botanist or horticulturalist. - It is recommended that landscaping promote the use of indigenous species common to the region and that as much natural ground cover is established (naturally) on the site to help with binding soils and encouraging water infiltration, thus reducing overland flows and the pressure on stormwater management infrastructure.	PM Contractor SS	• Rehabilitation Plan/ Strategy • Quantum Cost Calculation for Rehabilitation	All phases (ongoing)	SS	All phases (ongoing)	• Complaints register • Training register • Training materials • Environmental incident register

- The re-vegetation should be timed to occur before the wet season (November-January) so that watering requirement is minimized, and plant growth is most vigorous. - Any erosion damage resulting from watering/irrigation must be repaired immediately. - Aftercare, maintenance, monitoring and evaluation of rehabilitation and re-vegetation efforts must be undertaken during and after rehabilitation has been completed. The monitoring and evaluation of rehabilitation activities and outcomes are critical in assessing the extent to which the rehabilitation plan has achieved what it set out to accomplish. Thereafter, the rehabilitation must be signed off by the SS. - All areas disturbed by site establishment and prospecting activities must be subject to landscaping and rehabilitation; - All spoil and waste must be disposed of to a registered waste site; - Where impacted through site establishment-related activity, all sloped areas must be stabilised to ensure proper rehabilitation is effected and erosion is controlled; - Sloped areas are stabilised using vegetation as specified in the design to prevent erosion of embankments. - The design specifications must be adhered to and implemented strictly; - Spoil can be used for backfilling or landscaping as long as it is covered by a minimum of 150 mm of topsoil.						

6 CLOSURE

6.1 Closure Objectives

The closure objectives for the site have been identified as follows:

- As drill rigs move from one spot to the next concurrent rehabilitation will take place at sites that have been completed
- At closure, all infrastructure and equipment will be removed.
- All waste will be removed to a registered waste facility and scrap metal, if any, will be sold to a recycling company.
- Hydrocarbons and any contaminated soil will be removed from site.
- The revegetated areas will display adequate vegetation cover.
- Compacted areas will be ripped and rehabilitated.
- The aesthetics of the area will be largely reinstated as far as possible.
- The rehabilitated area will be kept clear of alien invasive species.
- Animals will be able to return safety to the site and the proposed land-use, grazing, will be achieved within 2 years after rehabilitation has been completed.
- Residents will not be subjected to any post closure social or environmental impacts.

6.2 Closure Goals

The closure vision is underpinned by the more specific closure objectives listed in this section. These objectives are stated qualitatively and would become more specific as the actual closure measures are devised, implemented and their performance determined:

- **Physical stability:** To remove and/or stabilise surface infrastructure that is present on the drill sites to facilitate the implementation of the planned final land use;
- **Environmental quality:** To ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the drill sites, as well as to sustain catchment yield as far as possible after closure;
- **Health and safety:** To limit the possible health and safety threats to humans and animals using the rehabilitated drill sites as it becomes available;
- **Land capability/land use:** To re-instate suitable land capabilities over the various portions of the drill sites to facilitate the progressive implementation of the planned final land use;
- **Aesthetic quality:** To leave behind rehabilitated drill sites that, in general, are not only neat and tidy, giving an acceptable overall aesthetic appearance, but which in terms of this attribute is also aligned to the planned final land use;
- **Biodiversity:** To encourage, where appropriate, the re-establishment of indigenous vegetation on the rehabilitated drill sites such that the terrestrial and aquatic biodiversity is largely re-instated over time; and

- **Social:** no infrastructure will remain, as a result there will not be any contributions made by the drill sites towards the long-term socio-economic benefit of communities, however there will be no negative impact either.

7 FINANCIAL PROVISION

Section 24P of NEMA requires that:

> *(1) An applicant for an environmental authorisation relating to prospecting, exploration, mining or production must, before the Minister responsible for mineral resources issues the environmental authorisation, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.*

The financial closure liability calculations are initial estimates that have been prepared by GCS and submitted as part of the BAR/EMP Report for the proposed site. The required closure costs were calculated using the infrastructure data and layouts as described in the BAR and EMPr Report, as per the rates from the "Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine", as published by the Department of Mineral Resources and Energy (DMRE), dated January 2005. The rates have been escalated based on inflation rates.

Currently there are no liabilities at the proposed site (Greenfield site). Upon completion of construction activities and commencement of operational activities at the proposed site, it is recommended that the financial provision be reviewed and updated to account for any shortfalls or differences. Table 7-1 indicates a preliminary total closure cost.

Table 7-1: Preliminary Financial Provisioning

	Fuleni PR Preliminary Financial Provisioning	Closure Cost
1	**Surface Infrastructure**	
	Profiling of disturbed areas (general)	R31 553.13
	Ripping of footprint area to alleviate compaction	R31 553.13
	Establishment of vegetation	R64 962.33
	Sealing and capping of borehole	R82 500.00
	Removal of portable ablution facilities	R1 000.00
	Sub Total 1	**R211 568.59**
	12% Preliminary and General	R25 388.23
	10% Contingency	R21 156.86
	Sub Total 2 (excluding VAT)	**R258 113.68**
	Grand Total (including VAT)	**R296 830.73**

8 DECLARATION

The proponent/applicant or holder of the PR affirms that he/she will abide and comply with the prescribed impact management outcomes and impact management actions and have the understanding that the impact management outcomes and impact management actions are legally binding. The proponent/applicant or holder of the PR affirms that he/she will provide written notice to the CA 14 days prior to the date on which the activity will commence of commencement of construction to facilitate compliance inspections.

---------- ----------

Signature Proponent/applicant/ holder of EA Date

NOTE:

Should the PR be transferred to a new holder, this declaration must be completed by the new holder and submitted with the application for an amendment of the PR in terms of Regulations 29 or 31 of the EIA Regulations, whichever applies. The information submitted for an amendment to an environmental authorisation will be considered to be incomplete should a signed copy of the EMPr not be submitted. Once approved, the EMPr becomes legally binding to the new PR holder.

APPENDIX A

Curriculum Vitae of Environmental Assessment Practitioner (EAP)

MAGNUS VAN ROOYEN
Technical Director

CORE SKILLS

- Environmental Impact Assessments
- Scoping Reports
- Preliminary Environmental Assessment
- Mining Right and Applications
- Environmental Management Programmes
- Strategic Environmental Assessments
- Wildlife Management Plans

DETAILS

Qualifications

- BSc – Botany & Zoology
- B.SC Honours - Botany
- Specialist Student
- Post Graduate Diploma in Teaching
- Masters Degree: Environmental Management

Memberships

- SACNASP
- International Association of Impact Assessors

Languages

- English - fluent
- Afrikaans- fluent
- German – fair
- Dutch – fair
- Zulu - adequate

PROFILE

In addition to holding a Masters Degree: Environmental Management, Magnus also holds a BSc degree in Botany and Zoology, an Honours Degree in Botany and a Post Graduate Certificate in Education.

Magnus has 13 years' experience in projects involving Environmental Impact Assessments in various developmental sectors (Mining and Agricultural Sector, National Roads, Pipelines, Dams, and Residential Developments), conducting of Specialist Biodiversity Assessments associated with Environmental Impact Assessments and Project Feasibility Studies. He has experience in the compilation of Resettlement Policy Framework Plans associated with infrastructure development projects.
Magnus has experience in working on various private and public sectors as well as rural and urban environments in various countries.
His expertise lies within the mining sector where he has gained extensive exposure to all the aspects of mining projects from the pre-feasibility, prospecting, environmental impact assessment

Magnus has experience in the following areas:

- Environmental Impact Assessments
- Scoping Reports
- Preliminary Environmental Assessment
- Mining Right and Permit Applications
- Environmental Management Programmes
- Strategic Environmental Assessments
- Wildlife Management Plans

WORK EXPERIENCE

Year	Employer	Position	Role and Responsibility
2007 – 2020	JG Afrika (Pty) Ltd	Executive Associate	Project Management of an environmental contingent of 4 people and conducting Environmental Impact Assessments
2006 – 2007	JG Afrika (Pty) Ltd	Environmental Scientist	Conducted a wide range of infrastructure related Environmental Impact Assessments
2002 – 2005	Department of Conservation Ecology, University of Stellenbosch	Biodiversity Researcher	Conducted field work, sampling, laboratory work and logistics associated with two projects within the Conservation Ecology Department
2002 – 2005	Department of Botany and Zoology, University of Stellenbosch	Junior Lecturer in Botany	Lectured Botany practical component of the first-year Natural Science Degree
2001 – 2002	Paul Roos Gymnasium	Biology Teacher	Teaching the South African Biology curriculum to high school students

Biodiversity Assessment Projects	**Biodiversity Assessment Projects** **Mamatwan Tailings Facility** Biodiversity and Wetland Assessment for the site to be used for the establishment of the new tailings facility on the South32 Mamatwan Manganese Mine near Hotazel. **Hillside Aluminum Desalination Plant** Biodiversity Screening Assessment for the infrastructure network associated with the South32 Hillside Aluminum Desalination Plant in Richards Bay. **Lichtenburg Siding Expansion** Biodiversity Assessment for the proposed expansion of the Lichtenburg Cement Siding, North West Province. **Nacala Dam Project** Riparian Vegetation Study for the Ecological Reserve Determination Specialist Study for the Environmental Impact Assessment for the Nacala Dam Project in Mozambique. **National Route N8** Vegetation Specialist Study for the Environmental Impact Assessment for the National Route N8. National Route N2 uMgeni Interchange ImprovementsEnvironmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process within the city of Durban, KwaZulu-Natal during the process. **Qudeni Link Road** Vegetation Specialist Study for the Environmental Impact Assessment for the Qudeni Rural Link Road. **Municipal Landfill Site Identification** Negative mapping and ground truthing for the options analysis for the identification of a District Municipality Landfill Site.
Port Related Projects	**Pier 1 Phase 2 expansion** Environmental Impact Assessment for proposed expansions to Pier 1 within the Durban Harbour. Locomotive Turning Table in the Port of Richards Bay Environmental Impact Assessment for proposed Locomotive Turn Table in within the Port of Richards Bay. **Rail line construction in the Port of Richards Bay** Environmental Impact Assessment for proposed additional rail line into the Richards Bay Coal Terminal in the Port of Richards Bay.

	Environmental Monitoring – RME Projects Durban Harbour Environmental Monitoring Duties for all the RME construction projects within the Durban harbour. **Ore Loading Facility at Kalia in Guinea** Environmental Impact Assessment for the proposed Ore Loading Facility in Kalia in Guinea, West.
Roads Projects	**National Route N2 uMgeni Interchange Improvements** Environmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process with a range of public and private sector stakeholders. **National Route N11 upgrade** Environmental Impact Assessment for proposed upgrade of the National Route N11. The project included a public participation process with a range of public and private sector stakeholders as well as specialist studies associated with the river crossings. **National Route N2 improvement and upgrade** Environmental Impact Assessment for proposed upgrade of the National Route N2. The project included a public participation process with a range of public and private sector stakeholders as well as specialist studies associated with the river crossings. **National Route N3 Chota Motala Interchange Environmental Audits** Environmental Monitoring for the construction of the Chota Motala Interchange on the National Route N3. N**ational Route R30 Environmental Audits** Environmental Monitoring for the construction of the National Route R30.
Agricultural Projects	**uMngano Community Dairy Development Project** Environmental and Social Impact Assessment for the Development of a 200ha dairy for the uMngano Community in KwaZulu-Natal, South Africa. **uMngano Community Vegetable Project** Environmental and Social Impact Assessment for the Development of a 180ha vegetable growing project for the uMngano Community in KwaZulu-Natal, South Africa. **Sundays River Citrus Project** Environmental and Social Impact Assessment for the Development of a 100ha citrus project in the Sundays River Valley in the Eastern Cape, South Africa.
Water Projects	**Nacala Dam project in Mozambique for the Millennium Challenge Corporation** Environmental and Social Impact Assessment for the Nacala Dam project in Nacala, Mozambique. The study included the management of a range of specialist studies which included; biodiversity (fauna and flora) assessments, health impact assessments, social impact assessments, a hydrocensus, geotechnical investigation and an ecological flow requirement assessment. The project was conducted under the auspices

	of the Millennium Challenge Corporation. **Mpofana Bulk Water Supply Scheme Environmental Impact Assessment for the Bulk Water Supply Scheme** which included an extensive public facilitation process with affected landowners and other specialist studies. **KwaHlokohloko Rural Water Supply Scheme Environmental Impact Assessment for the Rural Water Supply** Scheme which included an extensive public facilitation process with the rural landowners and tribal leaders. **Conservation Management Plans** **Ndumo Game Reserve Management Plan** Compilation of the Management Plan for the KwaZulu-Natal Wildlife Ndumo Game Reserve in northern KwaZulu-Natal. The compilation was conducted in accordance to the National Environmental Management: Protected Areas Act (No 57 of 2003).
Mining Projects	Uithoek Colliery for Miranda Mineral Holdings Environmental Impact Assessment for the establishment of the Uithoek Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Burnside Colliery for Miranda Mineral Holdings** Environmental Impact Assessment for the establishment of the Burnside Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Ultimate Goal Colliery for Corobrik (Pty) Ltd** Environmental Impact Assessment for the establishment of the Ultimate Goal Colliery including the management of a range of specialist studies which included a hydrological and geohydrological assessment, a biodiversity assessment, a social and heritage assessment and a repatriation plan for residents on the site. **Klipwaal Gold Mine for Miranda Mineral Holdings** Environmental Due Diligence assessment on the Klipwaal Gold Mine which included an assessment of completed and required rehabilitation, a contaminated land liability assessment and an evaluation of the structure and the possible impact of the slurry dams. **Afrimat Quarries Compliance Audits** Compliance audits and Due Diligence assessments of the Afrimat Quarry operations in South Africa. These audits are conducted on a two yearly basis. **Private and Public Sector Development Projects** Provincial Legislature Precinct Environmental and Social Impact Assessment for the proposed Provincial Legislature Precinct. This study consisted of a large public facilitation component and extensive engagement with private and public sector stakeholders.

	Camps Drift Canal Mixed Use Development Environmental Impact Assessment for proposed improvements to the uMgeni Road Interchange and the National Route N2. The project included an extensive public participation process within the city of Durban, KwaZulu-Natal during the process. **Tiger Lodge Development** Environmental Impact Assessment for the proposed Tiger Lodge Tourism Development. **Paradise Lodge Development** Environmental Impact Assessment for the proposed Paradise Lodge Tourism Development.

DECLARATION

I, Magnus Van Rooyen hereby declare that the details furnished above are true and correct to the best of my knowledge and belief and I undertake to inform you of any changes therein, immediately. In case any of the above information is found to be false or untrue or misleading or misrepresenting, I am aware that I may be held liable for it.

Signature: **Date: 27/02/2021**

THE SOUTH AFRICAN COUNCIL FOR NATURAL SCIENTIFIC PROFESSIONS

herewith certifies that

Magnus van Rooyen
Registration number: 400335/11

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice
(Schedule I of the Act)

Environmental Science	**31 August 2011**

31 August 2011
Pretoria

President

Chief Executive Officer

0058905

UNIVERSITY OF STELLENBOSCH

This is to certify that whereas

MAGNUS VAN ROOYEN

had complied with all the conditions prescribed in the Act, Statute and Rules of the University, the degree

MASTER OF PHILOSOPHY

(MPhil)

(Environmental Management)

with all the rights and privileges pertaining thereto was conferred on him at a congregation of the University in December 2004.

RECTOR AND VICE CHANCELLOR

DEAN

Endorsement: This is a duplicate of the original certificate, which was lost or destroyed as far as can be determined by the University.

REGISTRAR

21 November 2006

This certificate was issued in both Afrikaans and English. In the unlikely event of an inconsistency in the wording, the Afrikaans text shall have precedence.

This certificate is not authentic, unless printed on US watermark paper.

APPENDIX B
Generic Method Statement

Generic Method Statement

Information pertaining to the activity which will be undertaken:

What activity will take place?
How will the activity be undertaken (methods)?
Machinery/plant/equipment or vehicles which will be needed?
Materials required and relevant hazard status?
Where on site will the activity take place and what will the extent of the activity be?
Timeframes of activity (start and end dates)?

Impact and Risk Assessment of the Activity:

Impact sources	
Receptors	
Objective	
Risks	
Notes	

The following signatures represent a binding agreement to the Method Statement and EMPr by all Contractors and Sub-Contractors involved in the above activity.

Role	Name	Company	Date	Signature
Client				
Engineer/Applicant's representative				
Contractor				
SS				
PM				

APPENDIX F: DETAILED IMPACT ASSESSMENT

ACTIVITY	APPLICABLE AREA	POTENTIAL IMPACT(S)	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Site Establishment																	
Surface Water																	
Site Establishment	Borehole sites	•Clearing of vegetation. •Pollution of surface water resources from hydrocarbons.	4	2	1	4	28	-	L	•Measures should be put in place to prevent and contain spills and facilitate the safe collection and disposal of waste. •Restrict vehicle movement to designated access roads. No vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. •Restrict vegetation clearing to specific footprints. •Minimise areas where spills might occur. •Capture and contain runoff from these areas. •Safely dispose of captured pollutants immediately upon detection.	2	1	1	2	8	-	L
Vehicle Movements	Borehole sites Access Roads	•Pollution of surface water resources from hydrocarbons. •Compaction of soil leading to increased runoff velocity and erosion.	4	2	1	4	28	-	L		2	1	1	2	8	-	L
Fauna																	
Site establishment: clearing of vegetation	Borehole sites	•Disturbance of habitats. •Increase in human activity. •Disturbance or possible mortality incidents of terrestrian fauna.	6	2	1	4	36	-	M	•All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised personnel and maintenance vehicles. •Restrict all movement of vehicles and heavy machinery to permissible, designated areas. No off-road driving beyond designated areas may be allowed. •Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. •Strict speed limits must be set and adhered to. •Driving between dusk and dawn should be permissible to emergency situations only. •Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution. •All spills, should they occur, should be immediately cleaned up and treated accordingly.	4	1	1	2	12	-	L
Flora																	
Site establishment: clearing of vegetation	Borehole sites	•Increase in alien invasive vegetation on cleared sites	6	2	1	4	36	-	M	•All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel. •Restrict all movement of vehicles and heavy machinery to permissible areas. No off-road driving beyond designated areas may be allowed. •Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. •Re-fuelling must take place on a sealed surface or drip trays should be used to prevent infiltration of hydrocarbons into topsoil. •Disturbed areas must be rehabilitated and reseeded with indigenous grasses. •Monitor its establishment and growth. •Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment. •Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used. •Herbicide to be applied by a qualified pest control officer only. •Footprint areas should be kept as small as possible when removing alien plant species. •No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.	4	1	1	2	12	-	L
Rivers and Wetlands																	
Site establishment: clearing of vegetation	Borehole sites	•Loss of ecosystem functioning. •Increase in runoff and erosion. •Loss off the ability of these systems to assimilate toxins. •Trap sediments and help with flood control during periods of high flow.	10	5	2	5	85	-	H	•Limit the footprint area of the prospecting activities to what is absolutely essential in order to minimise environmental damage. •During the prospecting phase, no vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. •Implement effective waste management in order to prevent waste from entering the drainage line and riparian environments. •Plant soil stabilizing species such as grasses. •Plant indigenous trees common to the habitat to replace riparian vegetation. •Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.	6	2	1	4	36	-	M

Geology and Topography																		
Levelling of drill site	Borehole sites	•Small change in topography at sites where clearing and flattening takes place.	6	1	2	4	36	-	M	•Restrict disturbance to designated footprint. •Strict adhereance to the EMPr. •Ensure proper access control to the development area oFencing. oSecurity. oBarriers. •Ensure warning signs are erected on the perimeter of these areas. •Structural safety to be ensured according to engineering standards.	4	1	1	2	12	-	L
Soil																		
Clearing of vegetation	Borehole sites	•Soil disturbance. •Potential for soil erosion . •Decrease in soil fertility/nutrient content. •Increase in alien invasive vegetation.	6	2	2	4	40	-	M	•All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak. •Discontinue use of all faulty machinery / equipment on site until properly repaired. •Regular vehicle and equipment inspections. •All hazardous substances including hydrocarbons must be correctly stored. •Ensure vehicles are in good condition and not leaking fuel or oil. •All hydrocarbons spills on bare ground to be cleared immediately. •Restrict movement of employees outside of prospecting areas. •Vegetation stripping must be restricted to a minimum. •Erosion control measures must be implemented in areas sensitive to erosion. These measures include but are not limited to - the use of sandbags, geotextiles such as soil cells which are used in the protection of slopes, silt fences and retention or replacement of vegetation. •All soils compacted as a result of prospecting activities should be ripped and profiled. •Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat. •Sheet runoff from access roads should be slowed down by the strategic placement of berms or/and sandbags, although anticipated to be insignificant. •Cover disturbed areas with soil-binding plants such as grasses.	2	1	1	2	8	-	L
Construction of site infrastructure	Borehole sites	•Soil disturbance.	6	2	2	4	40	-	M		2	1	1	2	8	-	L
Vehicle Movements	Borehole sites Access Roads	•Soil disturbance. •Soil pollution.	6	2	2	4	40	-	M		2	1	1	2	8	-	L
Land Use																		
Site establishment	Borehole sites	•Temporary change in land use on borehole sites for the duration of the prospecting phase.	4	1	1	2	12	-	L	•Restrict disturbance to designated footprint. •Restrict vehicle movement to designated access roads. •Strict adherence to the EMPr. •All areas disturbed by activities must be subject to rehabilitation.	2	1	1	1	4	-	L
Traffic																		
Site establishment	Borehole sites	•Slight increase in traffic.	2	1	2	1	5	-	L	•None required – very minimal impact.	2	1	2	1	5	-	L
Cultural and Heritage																		
Site establishment	Borehole sites Access Roads Surrounding roads	•Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to sense of place. •Damage to and/or destruction of non-renewable archaeological resources. •Damage to and/or destruction of burial grounds. •Unmarked graves can be accidentally exposed.	6	1	1	3	24	-	L	•Adhere to footprint areas. •Adhere to 50m buffer around all resources identified. The buffer material (danger tape, fencing, etc.) must be highly visible to crews. •The local community should be engaged when identfying graves as well as places of social and spiritual significance. •A Chance find procedure should be implemented for the duration of the prospecting with inputs from stakeholders and the local community, should there be a heritage resource identified. •For any chance finds of heritage resources, such as graves, all work must cease in the affected area and the Contractor must immediately inform the Project Manager/Developer. A heritage specialist must be called to site for inspection. The relevant heritage resource agency (SAHRA) must also be informed about the finding. •Should any recent remains be found on site that could potentially be human remains, the South African Police Service (SAPS) as well as SAHRA and AMAFA must be informed. No SAPS official may remove remains until the correct permit/s have been obtained.	2	1	1	1	4	-	L
Socio-Economic																		
Site establishment: Clearing of vegetation	Prospecting area	•Potential employment opportunities for local communities. •Potential economic growth for the area if the resource is feasible.	4	2	2	2	16	+	L	•Positive impact, so no mitigation measures required.	4	2	2	2	16	+	L

Noise																		
Clearing of vegetation	Borehole sites Access Roads Surrounding areas	•Increase in ambient noise levels.	6	2	2	2	20	-	L	•The Contractor must keep noise level within acceptable limits. •Comply with the Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) (GN R154 of 10 January 1992) and all local noise bylaws. •Restrict the use of sound amplification equipment for communication and emergency only. •Any complaints received by the Contractor regarding noise must be recorded and communicated to the Site Supervisor (SS) and Project Manager (PM). •Develop a Code of Conduct for the site establishment phase in terms of the behaviour of construction staff.	4	2	2	1	8	-	L
Vehicle movements		•Increase in ambient noise levels.	6	2	2	2	20	-	L		4	2	2	1	8	-	L
Visual																		
Clearing of vegetation	Borehole sites Access Roads Surrounding areas	•Visual intrusion.	6	1	2	3	27	-	L	•Limit the site footprint to the designated works area. •Limit the site establishment duration. •Reinstating and rehabilitating disturbed areas as soon as possible. •Limiting site establishment activities to working hours. •Ensure that the site is in a visually acceptable state at all times. •Ensure a complaints register is in place to record and address complaints. •Undertake rehabilitation efforts as soon as feasibly possible	4	1	1	2	12	-	L
Site establishment			6	1	2	3	27	-	L		4	1	1	2	12	-	L
Vehicle movements			6	1	2	3	27	-	L		4	1	1	2	12	-	L
Air																		
Clearing of vegetation	Borehole sites Access Roads Surrounding areas	•Generation of dust. •Air pollution from equipment.	6	2	2	2	20	-	L	•Implement dust suppression measures if dust becomes a problem. •Ensure a complaints register is in place to record and address complaints. •Fuel-saving through optimal vehicle and equipment use scheduling. •Servicing and maintenance of vehicles, and machinery. •Use of fuel-saving technology. •Use of low carbon and sulphur fuels. •Restricting vehicle speeds on access routes and other unsurfaced areas of the work site. •Restrict vehicle access to defined areas to avoid unnecessary off-road vehicle movements outside of the active work sites.	4	1	1	1	6	-	L
Vehicle movements			6	2	2	2	20	-	L		4	1	1	1	6	-	L

ACTIVITY	APPLICABLE AREA	POTENTIAL IMPACT(S)	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Prospecting																	
Surface Water																	
Vehicle Movements	Borehole sites Access Roads	•Increase in runoff velocity. •Pollution of surface water resources from hydrocarbons.	4	2	1	4	28	-	L	•Measures should be put in place to prevent and contain spills and facilitate the safe collection and disposal of waste. •Restrict vehicle movement to designated access roads. No vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. •Restrict vegetation clearing to specific footprints. •Minimise areas where spills might occur. •Capture and contain runoff from these areas. •Safely dispose of captured pollutants immediately upon detection.	2	1	1	2	8	-	L
Drill maintenance and refuelling	Borehole sites Access Roads		4	2	1	4	28	-	L		2	1	1	2	8	-	L
Fauna																	
Vehicle Movements	Borehole sites	•Disturbance of habitats •Disturbance of fauna •Disturbance or possible mortality incidents of terrestrial fauna	6	2	1	4	36	-	M	•All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised vehicles as well as personnel; •Restrict all movement of vehicles and heavy machinery to permissible areas. •Parking areas and vehicles should be regularly inspected for oil spills. •Re-fuelling must take place on a sealed surface or drip trays should be used to prevent infiltration of hydrocarbons into topsoil. •Strict speed limits must be set and adhered to. •Driving between dusk and dawn should be permissible to emergency situations only. •Prevent spillage of any, oils or other chemicals, strictly prohibit other pollution. •All spills, should they occur, should be immediately cleaned up and treated accordingly. •Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.	4	1	1	2	12	-	L
Exploration drilling			6	2	1	4	36	-	M		4	1	1	2	12	-	L
Drill maintenance and refuelling			6	2	1	4	36	-	M		4	1	1	2	12	-	L
Flora																	
Site establishment: clearing of vegetation	Borehole sites	•Increase in alien invasive vegetation on cleared sites	6	2	1	4	36	-	M	•All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel. •Restrict all movement of vehicles and heavy machinery to permissible areas. No off-road driving beyond designated areas may be allowed. •Parking areas and vehicles should be regularly inspected for oil spills and covered with an impermeable or absorbent layer (with the necessary storm water control) if oil and fuel spillages are highly likely to occur. •Re-fuelling must take place on a sealed surface or drip trays should be used to prevent infiltration of hydrocarbons into topsoil. •Disturbed areas must be rehabilitated and reseeded with indigenous grasses. •Monitor its establishment and growth. •Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment. •Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used. •Herbicide to be applied by a qualified pest control officer only. •Footprint areas should be kept as small as possible when removing alien plant species. •No vehicles should be allowed to drive through designated sensitive drainage line and riparian areas during the eradication of alien and weed species.	4	1	1	2	12	-	L
Rivers and Wetlands																	
Site establishment: clearing of vegetation	Borehole sites	•Loss of ecosystem functioning •Increase in runoff and erosion •Loss off the ability of these systems to assimilate toxins •Trap sediments and help with flood control during periods of high flow	10	5	2	5	85	-	H	•Limit the footprint area of the prospecting activities to what is absolutely essential in order to minimise environmental damage. •During the prospecting phase, no vehicles should be allowed to indiscriminately drive through the drainage lines or riparian areas. •Implement effective waste management in order to prevent waste from entering the drainage line and riparian environments. •Plant soil stabilizing species such as grasses. •Plant indigenous trees common to the habitat to replace riparian vegetation. •Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, destroy all material to prevent re-establishment.	6	2	1	4	36	-	M

Geology and Topography																		
Exploration drilling	Borehole sites	•Removal of soil core and a portion of coal resource.	6	1	2	4	36	-	M	•Restrict disturbance to designated footprint. •Strict adhereance to the EMPr.	4	1	1	2	12	-	L
Soil																		
Vehicle Movements	Borehole sites Access roads	•Soil disturbance and compaction. •Potential for soil erosion. •Decrease in soil fertility/nutrient content. •Soil pollution. •Establishment of alien invasive vegetation on stockpiles.	6	2	2	4	40	-	M	•All equipment / machinery will be serviced and maintained within operating specifications to prevent the risks of leak. •Discontinue use of all faulty machinery / equipment on site until properly repaired. •Regular vehicle and equipment inspections. •All hazardous substances including hydrocarbons must be correctly stored. •Ensure vehicles are in good condition and not leaking fuel or oil. •All hydrocarbons spills on bare ground to be cleared immediately. •Restrict movement of employees outside of prospecting areas. •Vegetation stripping must be restricted to a minimum. . •Erosion control measures must be implemented in areas sensitive to erosion. These measures include but are not limited to - the use of sandbags, geotextiles such as soil cells which are used in the protection of slopes, silt fences and retention or replacement of vegetation. •All soils compacted as a result of prospecting activities should be ripped and profiled. •Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat. •Topsoil must be removed and stockpiled before major excavations is taking place. •Sheet runoff from access roads should be slowed down by the strategic placement of berms and sandbags, although anticipated to be insignificant. •Cover disturbed areas with soil-binding plants such as grasses.	2	1	1	2	8	-	L
Exploration drilling	Borehole sites	•Decrease in soil fertility/nutrient content. •Soil pollution.	6	2	2	4	40	-	M		2	1	1	2	8	-	L
Drill maintenance and refuelling	Borehole sites		6	2	2	4	40	-	M		2	1	1	2	8	-	L
Land Use																		
Exploration drilling	Borehole sites	•Temporary change in land use on borehole sites for the duration of the prospecting phase.	4	1	1	2	12	-	L	•Restrict disturbance to designated footprint. •Restrict vehicle movement to designated access roads. •Strict adherence to the EMPr. •All areas disturbed by prospecting activities must be subject to landscaping and rehabilitation.	2	1	1	1	4	-	L
Traffic																		
Exploration drilling	Borehole sites	•Slight increase in traffic.	2	1	2	1	5	-	L	•None required – very minimal impact.	2	1	2	1	5	-	L
Cultural and Heritage																		
Vehicle Movements	Borehole sites Access Roads Surrounding roads	•Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to sense of place. •Damage to and/or destruction of non-renewable archaeological resources. •Damage to and/or destruction of burial grounds. •Unmarked graves can be accidentally exposed.	6	1	1	3	24	-	L	•Adhere to footprint areas. •Adhere to 50m buffer around all resources identified. The buffer material (danger tape, fencing, etc.) must be highly visible to construction crews. •For any chance finds of heritage resources, such as graves, all work must cease in the affected area and the Contractor must immediately inform the Project Manager/Developer. A heritage specialist must be called to site for inspection. The relevant heritage resource agency (the Institute) must also be informed about the finding. •The heritage specialist will assess the significance of the resource and guide the way forward. •A heritage management plan should be compiled that indicates buffer zones and management actions for known and unknown heritage sites and sites of social importance in the prospecting area.Under no circumstances may any heritage material be destroyed or removed from the site unless under the direction of a heritage specialist. •Should any recent remains be found on site that could potentially be human remains, the SAPS as well as the Institute must be informed. No SAPS official may remove remains until the correct permit/s have been obtained. •The local community should be engaged when identfying graves as well as places of social and spiritual significance.	2	1	1	1	4	-	L
Exploration drilling			6	1	1	3	24	-	L		2	1	1	1	4	-	L
Drill maintenance and refuelling			6	1	1	3	24	-	L		2	1	1	1	4	-	L
Socio-Economic																		
Vehicle Movements	Prospecting area	•Potential employment opportunities for local communities. •Potential economic growth for the area if the resource is feasible.	4	2	2	2	16	+	L	•Positive impact, so no mitigation measures required.	4	2	2	2	16	+	L
Exploration drilling			4	2	2	2	16	+	L		4	2	2	2	16	+	L
Drill maintenance and refuelling			4	2	2	2	16	+	L		4	2	2	2	16	+	L

Noise																		
Vehicle Movements	Borehole sites Access Roads Surrounding areas	•Increase in ambient noise levels.	6	2	2	2	20	-	L	•The Contractor must keep noise level within acceptable limits. •Comply with the Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) (GN R154 of 10 January 1992) and all local noise bylaws. •Restrict the use of sound amplification equipment for communication and emergency only. •Any complaints received by the Contractor regarding noise must be recorded and communicated to the Site Supervisor (SS) and Project Manager (PM).	4	2	2	1	8	-	L
Exploration drilling			6	2	2	2	20	-	L		4	2	2	1	8	-	L
Drill maintenance and refuelling			6	2	2	2	20	-	L		4	2	2	1	8	-	L
Visual																		
Vehicle Movements	Borehole sites Access Roads Surrounding areas	•Visual intrusion.	6	1	2	3	27	-	L	•Limit the prospecting footprint to the designated works area. •Limit the duration of prospecting activities •Reinstating and rehabilitating disturbed areas as soon as possible. •Limiting prospecting to working hours. •Ensure that the site is in a visually acceptable state at all times. •Ensure a complaints register is in place to record and address complaints.	4	1	1	2	12	-	L
Exploration drilling			6	1	2	3	27	-	L		4	1	1	2	12	-	L
Drill maintenance and refuelling			6	1	2	3	27	-	L		4	1	1	2	12	-	L
Air																		
Vehicle Movements	Borehole sites Access Roads Surrounding areas	•Generation of dust. •Air pollution from equipment.	6	2	2	2	20	-	L	•Implement dust suppression measures if dust becomes a problem. •Ensure a complaints register is in place to record and address complaints. •Fuel-saving through optimal vehicle and equipment use scheduling. •Servicing and maintenance of vehicles, and machinery. •Use of fuel-saving technology. •Use of low carbon and sulphur fuels. •Restricting vehicle speeds on access routes and other unsurfaced areas of the work site. •Restrict vehicle access to defined areas to avoid unnecessary off-road vehicle movements outside of the active work sites.	4	1	1	1	6	-	L
Exploration drilling			6	2	2	2	20	-	L		4	1	1	1	6	-	L
Drill maintenance and refuelling			6	2	2	2	20	-	L		4	1	1	1	6	-	L

ACTIVITY	APPLICABLE AREA	POTENTIAL IMPACT(S)	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
			M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP
Decommissioning																	
Surface Water																	
Removal of drill rig and associated equipment	Borehole sites Access Roads	•Compaction of soil leading to increased runoff velocity and erosion. •Pollution of surface water resources from hydrocarbons.	4	2	1	4	28	-	L	•Measures should be put in place to prevent and contain spills and enable safe collection and disposal of waste. •Restrict vehicle movement to designated access roads. •Minimise areas where spills might occur. •Capture and contain runoff from these areas. •Safely dispose of captured pollutants immediately upon detection.	2	1	1	2	8	-	L
Rehabilitation of prospecting area	Borehole sites Access Roads		4	2	1	4	28	-	L		2	1	1	2	8	-	L
Fauna																	
Rehabilitation of prospecting area	Borehole sites	•Restoration of habitats will lead to fauna returning to the area.	4	2	1	4	28	+	L	•None required – positive impact.	4	2	1	4	28	+	L
Flora																	
Removal of alien vegetation	Borehole sites	•Restoration of prospecting area as closely as possible to the pre-disturbed state. •Improvement in biodiversity of the areas.	4	2	1	4	28	+	L	•None required – positive impact.	4	2	1	4	28	+	L
Rehabilitation of prospecting area			4	2	1	4	28	+	L		4	2	1	4	28	+	L
Rivers and Wetlands																	
Removal of alien vegetation	Borehole sites	•Restoration of prospecting area as closely as possible to the pre-disturbed state. •Improvement in biodiversity of the areas.	4	2	1	4	28	+	L	•None required – positive impact.	4	2	1	4	28	+	L
Rehabilitation of prospecting area			4	2	1	4	28	+	L		4	2	1	4	28	+	L
Geology and Topography																	
Rehabilitation of prospecting area	Borehole sites	•Disturbed areas returning to as closely as possible to the pre-disturbance state.	4	2	1	4	28	+	L	•None required – positive impact.	4	2	1	4	28	+	L
Soil																	
Removal of drill rig and associated equipment	Borehole sites Access roads	•Restoration of soil as closely as possible to the pre-disturbed state.	4	2	1	4	28	+	L	•All hydrocarbons spills on bare ground to be cleared immediately. •All soils compacted as a result of prospecting activities should be ripped and profiled. •Alien and invasive vegetation control should take place throughout all prospecting and rehabilitation phases to prevent loss of floral habitat.	4	2	1	4	28	+	L
Rehabilitation of prospecting area			4	2	1	4	28	+	L		4	2	1	4	28	+	L
Land Use																	
Rehabilitation of prospecting area	Borehole sites	•Restoration of disturbed areas as closely as possible to the previous land use.	4	1	1	2	12	+	L	•None required – positive impact.	4	1	1	2	12	+	L
Traffic																	
Rehabilitation of prospecting area	Borehole sites	•Decrease in exploration related traffic.	2	1	2	1	5	+	L	•None required – very minimal impact.	2	1	2	1	5	+	L
Cultural and Heritage																	
Removal of drill rig and associated equipment	Borehole sites Access Roads Surrounding roads	•Degradation of indigenous knowledge systems, intrinsic cultural significance and alteration to sense of place. •Damage to and/or destruction of non-renewable archaeological resources. •Damage to and/or destruction of burial grounds. •Unmarked graves can be accidentally exposed.	4	1	1	3	18	-	L	•Adhere to footprint areas. •Adhere to 50m buffer around all resources identified. The buffer material (danger tape, fencing, etc.) must be highly visible to construction crews. •For any chance finds of heritage resources, such as graves, all work must cease in the affected area and the Contractor must immediately inform the Project Manager/Developer. A heritage specialist must be called to site for inspection. The relevant heritage resource agency (the Institute) must also be informed about the finding. •The heritage specialist will assess the significance of the resource and guide the way forward. •A heritage management plan should be compiled that indicates buffer zones and management actions for known and unknown heritage sites and sites of social importance in the prospecting area.Under no circumstances may any heritage material be destroyed or removed from the site unless under the direction of a heritage specialist.	2	1	1	1	4	-	L
Rehabilitation of prospecting area			4	1	1	3	18	-	L	•Should any recent remains be found on site that could potentially be human remains, the SAPS as well as the Institute must be informed. No SAPS official may remove remains until the correct permit/s have been obtained. •The local community should be engaged when identfying graves as well as places of social and spiritual significance.	2	1	1	1	4	-	L

Socio-Economic																		
Removal of drill rig and associated equipment	Prospecting area	•Limited employment opportunities for local communities.	4	2	2	2	16	+	L	•Positive impact, so no mitigation measures required.	4	2	2	2	16	+	L
Rehabilitation of prospecting area			4	2	2	2	16	+	L		4	2	2	2	16	+	L
Noise																		
Removal of drill rig and associated equipment	Borehole sites Access Roads Surrounding areas	•Noise associated with rehabilitation activities (temporary).	6	2	2	2	20	-	L	•The Contractor must keep noise level within acceptable limits. •Comply with the Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) (GN R154 of 10 January 1992) and all local noise bylaws. •Restrict the use of sound amplification equipment for communication and emergency only.	4	2	2	1	8	-	L
Rehabilitation of prospecting area			6	2	2	2	20	-	L	•Any complaints received by the Contractor regarding noise must be recorded and communicated to the Site Supervisor (SS) and Project Manager (PM).	4	2	2	1	8	-	L
Visual																		
Removal of drill rig and associated equipment	Borehole sites Access Roads Surrounding areas	•Improvement in visual aspect of the site due to rehabilitation activities.	4	2	1	4	28	+	L	•Positive impact, so no mitigation measures required.	4	2	1	4	28	+	L
Rehabilitation of prospecting area			4	2	1	4	28	+	L		4	2	1	4	28	+	L
Air																		
Removal of drill rig and associated equipment	Borehole sites Access Roads Surrounding areas	•Generation of dust. •Air pollution from equipment.	6	2	2	2	20	-	L	•Implement dust suppression measures if dust becomes a problem. •Ensure a complaints register is in place to record and address complaints. •Fuel-saving through optimal vehicle and equipment use scheduling. •Servicing and maintenance of vehicles, and machinery. •Use of fuel-saving technology. •Use of low carbon and sulphur fuels. •Restricting vehicle speeds on access routes and other unsurfaced areas of the work site.	4	1	1	1	6	-	L
Rehabilitation of prospecting area			6	2	2	2	20	-	L		4	1	1	1	6	-	L