1world consultants

Environmental & Engineering Consultants
Postal Address: P.O Box 2311, Westville, 3630
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Dear Interested and Affected Party / Stakeholder,

RE: Distribution and Public Review of the Draft Basic Assessment Report for the Proposed Bhokwe Community Sanitation Project within the AbaQulusi Municipality, Ward 05, KwaZulu Natal.

As per EIA Regulation GNR 326, April 2017 the Draft BAR is provided for public review and comment for a 30-day period. ***Kindly note that when a State Department is requested to comment in terms of the EIA Regulations, 2017, such a State department must submit its comments in writing within 30 days from the date on which it was requested to submit comments and if such a State department fails to submit comments within such 30 days, it will be regarded that such a State department has no comments.*** All comments received will be responded to and included in the Final version of the Basic Assessment Report, which will be submitted to the KZN DEDTEA for review and decision-making.

Closing Date – 12 March 2020

Enclosed please find a copy of the Draft Basic Assessment with appendices that include the specialist studies completed and the Environmental Management Programme (EMPr) prepared.

Should there be any further enquiries please contact Hasan Mahomedy on hasan@1wc.co.za or by using the numbers provided above.

Yours faithfully,

Fatima Peer B.Sc. (Hons) Pr. Sci. Nat., IAIASA

Director (Environmental Services), Senior EAP

EIA REF. NO.: DC26/0001/2020

DRAFT BASIC ASSESSMENT REPORT

PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, VRYHEID, LOCATED WITHININ ABAQULUSI MUNICIPALITY, KWAZULU-NATAL

[January 2020]

Prepared by:

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DRAFT BASIC ASSESSMENT REPORT

For the Proposed Bhokwe Community Sanitation Project within the AbaQulusi Municipality

EIA Ref No.: DC26/0001/2020

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<tr><th>Verification</th><th>Capacity</th><th>Name</th><th>Signature</th><th>Date</th></tr>
<tr><td>Author</td><td>EAP</td><td>Hasan Mahomedy</td><td>Hasan Mahomedy</td><td>04 January 2020</td></tr>
<tr><td>Reviewed by</td><td>EAP</td><td>Adila Gafoor</td><td></td><td>17 January 2020</td></tr>
<tr><td>Approved by</td><td>Project Manager</td><td>Fatima Peer</td><td></td><td>17 January 2020</td></tr>
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Executive Summary

1World Consultants (Pty) Ltd have been appointed by Ukuza Consultants to undertake a Basic Assessment (BA) Process for the proposed Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 110 mm diameter uPVC housing connections, 150 meters of 200 mm diameter HD uPVC sewer fed piping, 37 precast ring manhole covers, an oxidation sewer treatment plant and evapotranspiration ponds, serving close to 112 households in the Bhokwe Community, Bhokwe, Zululand District Municipality, KwaZulu Natal. The project area is situated in Ward 05, AbaQulusi Local Municipality, approximately 27 kilometers, as the crow flies, from the town of Vryheid.

The Bhokwe and Enyathi communities within this region require rehabilitation of the sanitation systems, which are characterized by frequent bursts, blockages and overflowing resulting in a health hazard to the community. Municipal Infrastructure Support Agent (MISA) was requested by the Bhokwe community to assist with rehabilitation of the water and sanitation systems in these settlements. MISA appointed a service provider on a Turnkey basis to design and rehabilitate sewer reticulation facilities in Bhokwe village. The contractor subsequently abandoned the site. The previous service provider has since been liquidated resulting in the non-completion of the project. To resuscitate and complete the project, MISA initiated a procurement process during April 2019 for the appointment of a new Service Provider. Ukuza Consulting (Pty) Ltd have since been appointed as the professional service provider.

In this regard, the proposed reticulation and completion the proposed project will be ensured. Thus, the project comprises the construction of sewer reticulation infrastructure which will aid in servicing the Bhokwe Community. The proposed project will help to minimise sewage spillage, blockages and overflow and it should therefore result in improved surface and sub surface water quality. The proposed project will also enable additional housing projects to occur in the area as well as improve the local water quality. Additionally, quality of life for the households within the community will thus improve.

The proposed development involves inspection and assessment of work completed by the previous contractor, laying of new pipelines and construction of the sewer oxidation plant. The reticulation together with the sewer treatment plant triggers a need for a Basic Assessment. The approximate location of the project area is 27 ˚ 49'02.665'' S and 31 ˚ 05'05.687'' E.

The alternative site lies south easterly and contained a seep wetland passing through, making it unsuitable for the construction of a sewer oxidation pond system. The area is largely rural, with scattered dwellings, and surrounded by forestry farming. Majority of the land is degraded and disturbed. Environmental degradation and pollution are evident in most areas. A single portion of the sewer reticulation will intersect and pass through a wetland.

The impacts of the proposed activities included construction of a pipe bridge, which traverses a wetland, laying of pipelines and construction of a sewer treatment plant. These activities trigger a need for a Basic Assessment report. Additionally, impacts on Biodiversity, Socio-Economic, Wetland and Heritage aspects were also considered, and this report now provides all required information to advise on the applied environmental authorisation from KZN EDTEA. Some key impacts are:

- Loss of biodiversity
- Erosion
- Traffic and access
- Hydrological Impact of temporary alteration of stream flow and disturbance of stream bed due to construction activities
- Pollution due to site operations
- Disturbance to community by noise and dust from construction process
- Air quality degradation as a result of dust and odours
- Visual impacts
- Waste and litter
- Damage to existing services
- Injury to local people and construction workers
- Disturbance to existing infrastructure and impact on Heritage resources
- Socio-economic impacts

Specialist studies were conducted to aid in a thorough investigation of the impacts and included:

- **A Wetland Impact Assessment** by Malachite (Pty) Ltd to determine the impact the proposed development will have on watercourses;
- **A Socio-Economic Assessment Study** by Real Consulting, to determine the impacts the proposed development will have on the surrounding community;
- **A Heritage Impact Assessment** by JLB Consulting to ensure that no items of cultural or historical value would be impacted on by the construction;
- **A Desktop Paleontological Study** by Professor Marion Bamford, of the University of the Witwatersrand, to ensure no fossils would be impacted on by construction;
- **A Geotechnical Study** by iLZ Consulting to assess the prevailing geological and geotechnical conditions throughout the project area;
- **A Level 2 Hydro-pedological Assessment Study** by The Biodiversity Company to assess the condition of the soil and hydrology in the project area**;**
- **A Biodiversity Study** by Malachite (Pty) Ltd to assess, identify and record the presence of any protected fauna and flora; and
- **A Geohydrological Investigation** by Geomeasure Group (Pty) Ltd, to determine the status of the groundwater prior to development of the project.

A wetland impact assessment study was undertaken within a delineated 500m buffer surrounding the site. A total of five (5) wetland systems were identified and delineated. All five systems were identified as seep wetlands. HGM units 1 and 2 will be impacted by the proposed project layout. HGM units 3, 4 and 5 are situated within the 500m assessment area, however their locations are either upslope of the proposed project (HGM 4), located within a separate catchment (HGM 5) or situated approximately 200m to the east of the project (HGM 3) and will therefore not be affected. The closet wetland to the oxidation pond is HGM1, which is situated outside of the recommended 60m buffer, at 124m. No buffer was calculated for these wetlands as impacts to the systems will be short term in nature and mitigation measures utilised to reduce the impact.

No fatal flaws were identified by the Specialist Studies. Tree removal permits may be required and an inspection prior to construction must be undertaken to confirm if any critical species will be affected. A Water Use License Application is also being undertaken for the proposed activity with the Department of Water & Sanitation (DWS), due to the reticulation traversing a wetland. The process is ongoing.

Mitigation measures to minimise or eliminate impacts were identified by the specialists and EAP which were utilised towards the preparation of the Environmental Management Plan (EMPr). The EMPr must be read in conjunction with this BAR and is essential towards the protection of the environmental elements whilst establishing the water infrastructure.

A Public Participation Process (PPP) to review the BAR and EMPr involved consultation with the relevant authorities, the landowners affected along the way, community leaders and other identified Interested and Affected Parties (I&APs). Newspaper advertisements will be published to inform the general public of the Basic Assessment Process.

This BAR has been prepared in Accordance with the EIA Regulations, 2017 and follows the requirements for a BAR in Appendix 1 of GNR 326.

Table of Contents

1. INTRODUCTION

1World Consultants (Pty) Ltd have been appointed by Ukuza Consultants to undertake a Basic Assessment (BA) Process for the proposed Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 150 meters of 200 mm diameter HD uPVC sewer fed piping, an oxidation sewer treatment plant, evapotranspiration ponds and approximately 37 precast ring manhole covers, serving close to 112 households in the Bhokwe Community, AbaQulusi Municipality, KwaZulu-Natal. The purpose of this sewer reticulation project is to upgrade facilities in the area with the aim of eliminating pit latrines by constructing new waterborne sewage systems.

The proposed project aims to provide water borne reticulation to approximately 112 households within Bhokwe, via below ground laid pipes. The reticulation will end in a sewer oxidation treatment plant, which will eventually feed onto evapotranspiration beds in Bhokwe. The process is gravity fed, with minimal maintenance or costs. The service will be available to a population of approximately 750, with a capacity for almost 1200, taking into consideration population growth for the next 30 years.

Table 1 below provides project specific details for the proposed sewer reticulation.

Table 1: Project Specifications

	Bhokwe Community Sanitation Project
Ward	05
Property Description	Low to middle income residential
Pipeline Specifications	2.2 km long- 160mmØ, 165m- 200mmØ, max of 850mm trench width, 1m trench depth, 5m construction servitude
Pipeline Development Footprint	Length x breadth = 2 365m long x 0.850 wide = 2011 m^2
Oxidation Development Footprint	11 500 m^2
Evapotranspiration Ponds	27 216 m^2
Total Development Footprint	40 000 m^2

1.1 Terms of reference

As per GNR 327 and 324 of the EIA Regulations, 2017, a Basic Assessment (BA) Process has been undertaken. All the environmental outcomes impacts and residual risks of the proposed Listed Activity being applied for have been noted in this BA Report and assessed accordingly by the Environmental Assessment Practitioner. The requirements of the BA Process have been followed as per Appendix 1 of GNR 326 (2017) and are consequently adhered to in this report.

It must be noted that the Listed Activities in terms of GNR 327 of the 2017 EIA Regulations are applicable to this proposed project and will trigger activities in both the construction and operational phases. This BA Report focuses on the potential impacts that may arise during the construction and operational phases and provides recommended mitigation measures.

Ultimately, the outcome of a BA Process must be to provide the Competent Authority: the Department of Economic Development, Tourism and Environmental Affairs (EDTEA), with sufficient information to provide an informed decision on the Application, in terms of Environmental Authorisation (EA), in order to avoid or mitigate any detrimental impacts that the activity may inflict on the receiving environment.

1.2 Background

The Bhokwe Community area is located in the North of KwaZulu Natal and in an easterly direction from the town of Vryheid. The proposed Bhokwe Community Sanitation project is situated approximately 40 km away from the suburb of Vryheid, located within the AbaQulusi Municipality, in an easterly direction and approximately 20km away from Hlobane in a southerly direction. The area of the study site is approximately 2Ha and is surrounded by several unauthorised low to middle income residential dwellings without waterborne sewage. The residents in these areas have constructed pit latrines for sanitation purposes. The lack of formal sewer infrastructure in this area poses severe health, environmental and safety hazards.

Bhokwe settlement consists of No. 7 Village, Bhokwe Quarters, Bhokwe Hostels, Golozela Village, Mahowane Village, Mafuta Village and Mzimba Village. In Bhokwe Community, there is Bhokwe Primary School which caters for about 270 students.

The project proposes to provide the reticulation to Bhokwe Quarters and Bhokwe Hostels within Bhokwe, who do not have water borne sewage. They currently utilise pit latrines, with frequent blockages and associated health and environmental risks.

Demographic details are listed below, based on an average of 7 individuals per household.

Table 2:Demographic details of Bhokwe Community

Place	Households	Population Estimate
Bhokwe Quarters	26	182
Bhokwe Hostels	86	602
Total	**112**	**788**

A water use license application is required for this project in terms of section 21C of the National Water Act, Act 36 of 1998. The application is underway through the Department of Water & Sanitation. The pre-application with the department was held on 14/11/2019. Minutes of the WULA pre application meeting can be found in Appendix A.

A pre-application meeting for this project was held on 06/09/2019 with officials from EDTEA and 1WC. The purpose of the meeting was to discuss the proposed project, the listed activities and the EIA process as well as the process that will be followed with this application.

Refer to Appendix A for minutes of the pre-application meeting.

1.3 Pre-Application Meeting

A pre-application meeting was held at the KZN EDTEA on 06 September 2019. Minutes from the pre-application meeting and Acknowledgement of Application for EA are provided in Appendix A.

During the pre-application meeting, the EAP introduced the project and presented background information. The Draft Application for EA was reviewed by the Department official present. Based on the discussions held, the following were noted:

- The listing notices were confirmed once project details were explained and finalized.
- The PPP must include all community representatives of Bhokwe and relevant state departments
- A list of specialist studies and relevant state departments to contact was provided

1.4 Project Approach

Apply for Environmental Authorisation to the Department regarding the proposed sewage reticulation and associated treatment plant for the residents of Bhokwe Community, servicing close to 750 households.

The overall approach to this Basic Assessment Report included the following activities:

- Desktop Screening of the site in question, to identify environmental sensitivities and constraints;
- Specialist studies, as required per site, to further identify environmental constraints and elements of concern;
- Preparation of Basic Assessment Reports, that: -
    - Provide relevant background of the project,
    - Summarise key findings,
    - Identify and assess impacts of the project during construction and during operational phase,
    - Provide recommendations and mitigation measures for the responsible construction and operation of the facility,
    - Provide need and desirability, motivation and impact statement from an environmental perspective, and
    - Preparation of an Environmental Management Program (EMPr) for service providers and the Applicant to utilise as a guideline to allow and prohibit tasks, in keeping with the provided Environmental Authorisation that is granted.
- Public and Stakeholder Participation Process, which allows review of the aforementioned BAR, studies and EMPr, for positive engagement which allows holistic, legal and complete processes for the proposed project, and
- Application for Environmental Authorisation to the Department, which provides all the relevant information for the Competent Authority to make a decision regarding the development.

The Desktop Screening Report that was undertaken for the proposed project can be found under Appendix A.

1.5 Landowner Consent

The land is owned by both the Igalelo Trust and the Mnyathi Trust. Landowner consent has been provided by both trustees. The Igalelo Trust Landowner consent form was signed by the Chairperson, Mr Mtshali, while the Mnyathi Trust Landowner Consent form was signed by the Chairperson, Mr Ntombela.

Please find attached signed consent forms in Appendix A.

2. BASIC ASSESSMENT REPORT

2.1 Environmental Assessment Practitioner

Business name of EAP:	**1World Consultants (Pty) Ltd**		
Physical address:	**181 Winchester Drive, Reservoir Hills,**		
Postal address:	**P.O. Box 2311, Westville,**		
Postal code:	**3630**	Cell:	**082 640 4900**
Telephone:	**031 262 8327**	Fax:	**086 726 3619**
E-mail:	fatima@1wc.co.za		

Table 3: Names and Expertise of Representatives of the EAP

Name and Title	Qualifications and Affiliations	Role	Experience at Environmental Assessments
Fatima Peer	B.Sc (Hons) Pr. Sci. Nat., IAIAsa	Senior EAP	10 years
Adila Gafoor	B.Soc. Sci. (Geog) IAIAsa	EAP	5 years
Hasan Mahomedy	B.Sc (Hons)	Junior EAP	2 years

A company profile, Project Experience and CV's for 1World Consultants (Pty) Ltd is provided in Appendix B.

Table 4: Names and Expertise of Specialists

Name of specialist	Education qualifications	Field of expertise	Section/s contributed to in this basic assessment report	Title of specialist report/s as attached in Appendix E
Craig Widows	Pr.Sci.Nat.	Ecology	Biodiversity Assessment	Biodiversity Assessment Proposed Bhokwe Community s\Sanitation Project, AbaQulusi Local Municipality, KwaZulu Natal
Jean Beater	MA (Heritage Studies) MSc (Environmental Management)	Heritage and cultural studies	Heritage Assessment	Phase 1 Heritage Impact Assessment
Taryn Swales	Pr.Sci.Nat.	Geohydrology/ Geology	Geohydrological assessment	Final report on the desktop study and geohydrological investigation undertaken for the proposed Bhokwe village wastewater treatment works and sewer line completion- Vryheid area- Zululand district municipality
Rowena Harrison	Pr.Sci.Nat.	Soil Science	Wetland Delineation and Functional Assessment	Wetland Impact Assessment

Marion Bamford	PhD	Paleontology	Palaeontological Impact Assessment	Palaeontological Impact Assessment for the proposed upgrading of sanitation for Bhokwe Village, about 22km east of Vryheid, KwaZulu Natal Province
Sphesihle Mdlalose	Cert.Sci.Nat.	Geotechnical Engineering	Geotechnical Assessment	Geotechnical investigation report for the proposed reticulation and sewage treatment at Bhokwe Village
Luci Coelho	BSc (Hons)	Social Research	Socio-economic Assessment	Socio-economic Impact Assessment Bhokwe Village October 2019
Ivan Baker Andrew Husted	Cand. Sci Nat	Pedology	Hydro-pedological Assessment	Level 2 Hydropedological Assessment for the proposed Waste Water Treatment Works (WWTW)

3. OBJECTIVES OF THE BASIC ASSESSMENT PROCESS

According to the EIA Regulations (2017), Appendix 1 of GNR 326, the objective of the basic assessment process is to, through a consultative process:

"The objective of the basic assessment process is to, through a consultative process

(a) *determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;*

(b) *identify the alternatives considered, including the activity, location, and technology alternatives;*

(c) *describe the need and desirability of the proposed alternatives;*

(d) *through the undertaking of an impact and risk assessment process, inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine—*
  - *(i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and*
  - *(ii) the degree to which these impacts—*
    - *(aa) can be reversed;*
    - *(bb) may cause irreplaceable loss of resources; and*
    - *(cc) can be avoided, managed or mitigated; and*

(e) *through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—*
  - *(i) identify and motivate a preferred site, activity and technology alternative;*
  - *(ii) identify suitable measures to avoid, manage or mitigate identified impacts; and*
  - *(iii) identify residual risks that need to be managed and monitored"*

4. LOCATION OF THE PROPOSED ACTIVITY

The proposed construction of the sewer reticulation is located in Bhokwe which falls within the Enyathi area situated in ward 05 of the AbaQulusi Municipality. Bhokwe is a township that is found in Northern KwaZulu-Natal, approximately 40 km from the town of Vryheid. Bhokwe occupies a small area of approximately 750 people. Primary activities surrounding the area is forestry and coal mining. The closest town is Hlobane, which is located 20km away north. The study area can be accessed via the R34 arterial route, along Suid street from Vryheid and the R69 from Hlobane.

The proposed project area is approximately 6.0 kilometers from the nearest town of Bloemendal. The study area is made up of rural dwellings and surrounded by forestry farming. The population density is sparse, and households are sprawled. Bhokwe Community is made up of approximately 750 families. Tar roads are evident throughout the study area. Habitat loss and transformation has occurred due to farming activities.

The proposed development site can be regarded as transformed, with pockets of indigenous vegetation remaining. The site falls within the 2731CC quarter degree square and surrounding land use is comprised of *Paul Pietersburg Grassland* and drainage lines associated with the escarpment. The general lack of naturally occurring vegetation is due to the human activity subjected to this local habitat in the form of mass clearing for informal residential areas and subsistence farming found throughout this area.

Map 1 below is a general locality map of Bhokwe and the surrounding area. Map 2 below is a zoomed in image of the study site, Bhokwe Community. The locality maps can be reviewed under Appendix C.

Table 5: Property descriptions for the project area

	Bhokwe Community Sanitation Project
Property Description	Informal Residential
GPS Coordinates of the center point of the reticulation	27°48'46.69"S 31° 6'8.21"E
21-digit surveyor general code for the proposed project	N0HU00000000015600000
	N0HU00000000037200000

The proposed project falls under two respective property ownership. The complete reticulation falls under the Igalelo Trust, while the wastewater treatment plant falls entirely under the ownership of the Mnyathi Trust. Land confirmation letters, together with landowner consent from both the respective property trustees, have been granted. Please find attached letters of permission from the Igaleleo Trust and Mnyathi. Trust in Appendix A. The table above provides property descriptions for the proposed project.

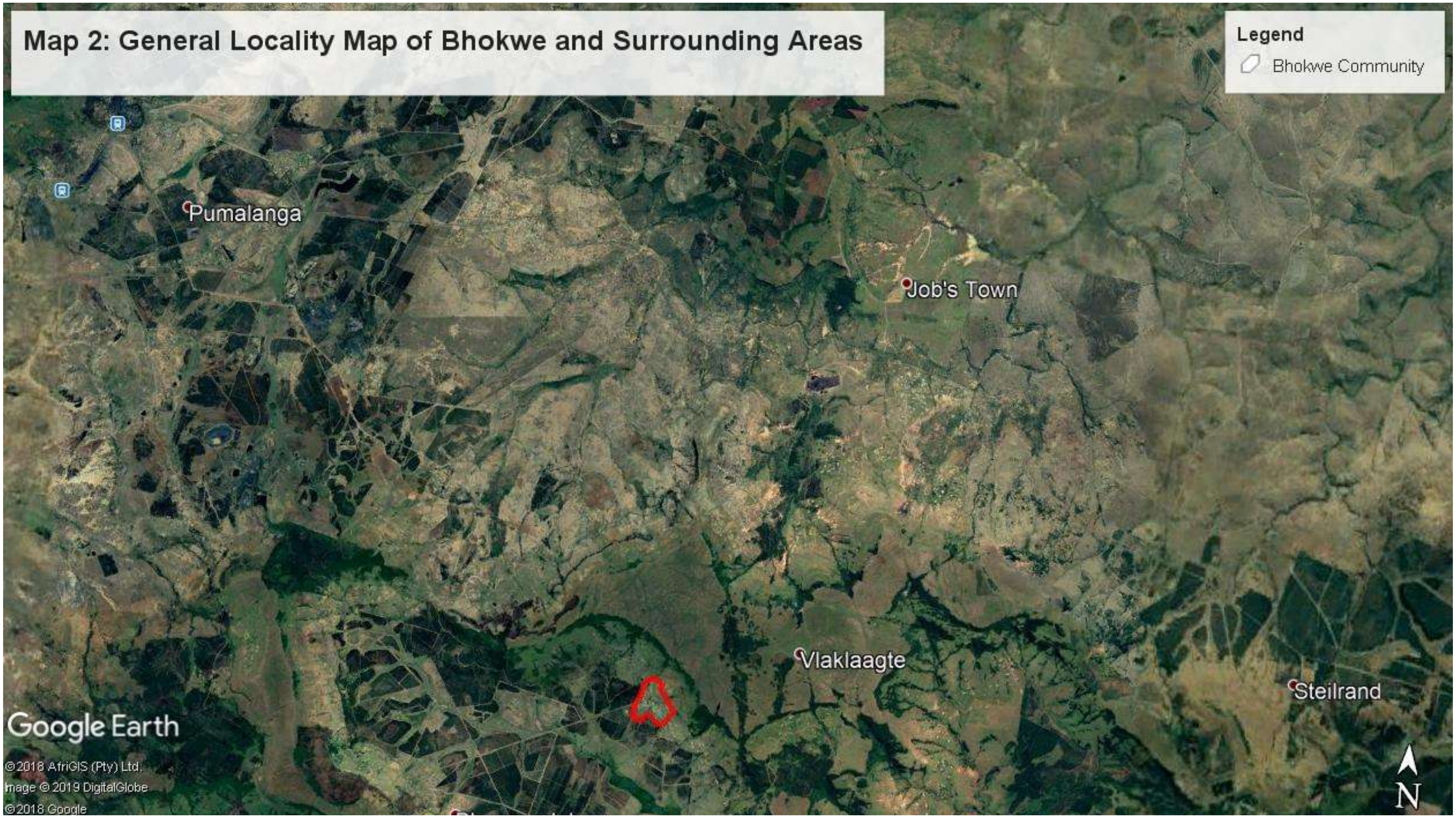

Figure 1: General locality map

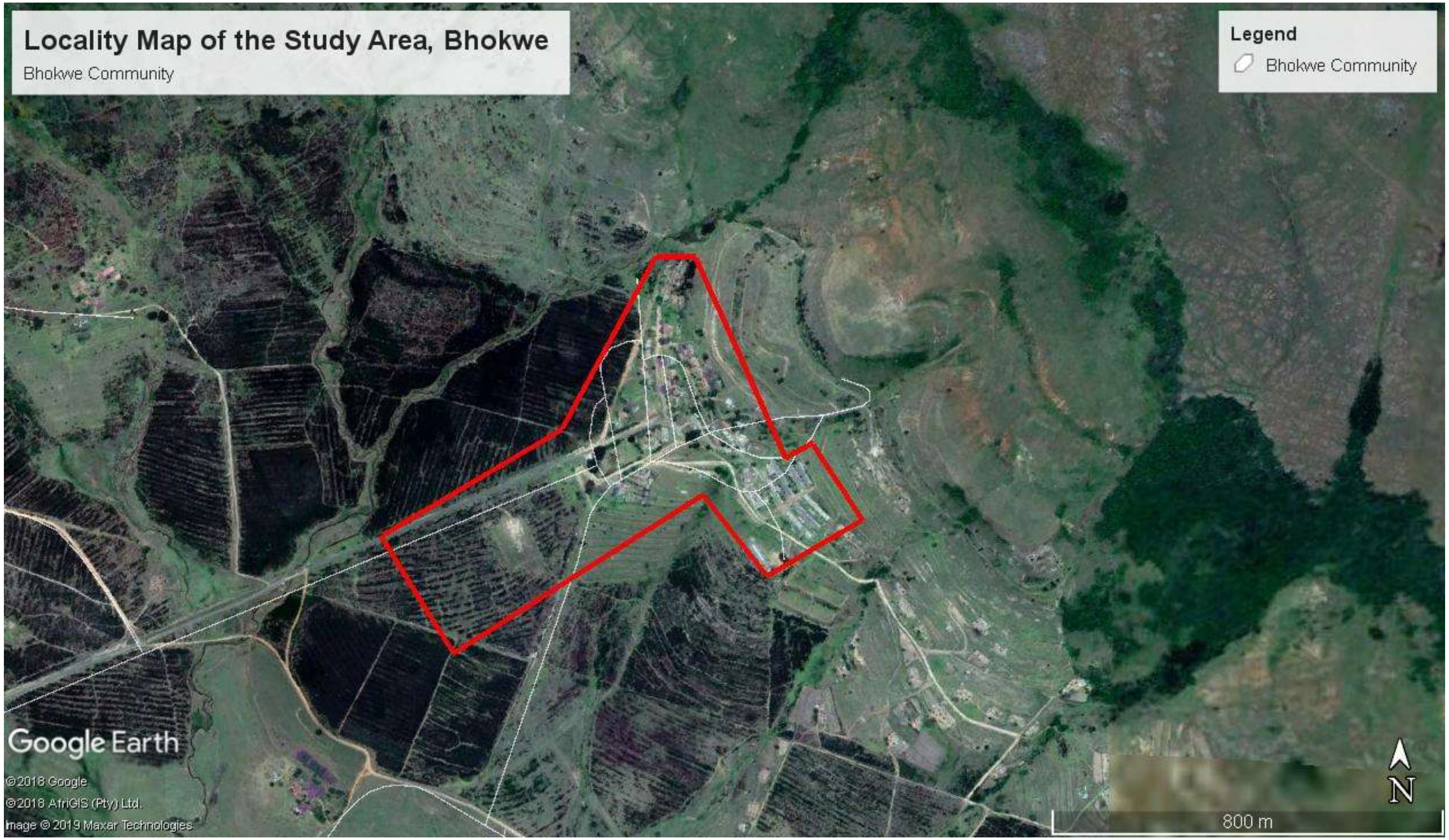

Figure 2: Localized map of the project area, Bhokwe

5. DEVELOPMENT ACTIVITY

Zululand District Municipality proposes the construction of a waterborne sewer reticulation for the existing housing units in Bhokwe Community to eliminate the use of pit latrines. The proposed project is aimed at uplifting the communities living standards due to existing infrastructure not suitable for the current needs. The proposed project will entail the following:

- A total of 1.8km long sewer reticulation
- An Oxidation Sewer Treatment Pond system, with associated evapotranspiration ponds
- 110mmØ uPVC housing connections
- 160mmØ HD uPVC sewer reticulation
- 200mmØ HD uPVC sewer reticulation
- Numerous 1250mmØ precast concrete ring manholes

The proposed reticulation will tie into a gravity fed sewer wastewater treatment plant, and housing connections is accounted for during the construction phase of the project. Zululand District Municipality is fulfilling its obligation to the residents by providing sewer reticulation and infrastructure to the area.

As per the Department of Water & Sanitation liaison, the proposed sewage infrastructure is a water use identified in terms of Section 21 of the National Water Act, 1998 (Act 36 of 1998). The proposed sewage infrastructure triggers Section 21 (g) water use. The activity reads as follows: 21(g) disposing of waste in a manner which may detrimentally impact on a water resource. A water use application must therefore be lodged with the Department of Water and Sanitation (DWS) in order to obtain the necessary water license prior to commencement of the construction of the proposed sewage infrastructure. A Water Use License Application (WULA) is currently underway by 1World Consultants.

Construction is likely to require the use of a Tractor-Loader-Backhoe (TLB) for excavation along the line and vegetation clearance along the proposed Wastewater Treatment Plant area. Whereas hand excavation will be required within properties that are in the wetland crossing. The construction corridor where construction vehicles are permitted and outside of sensitive areas is to be 10m total, 5m on either side of the proposed pipeline route. The final pipeline servitude width required for maintenance purposes is 3m. Omnibus servitudes will be followed in all properties along the reticulation. An omnibus servitude is a servitude within property boundaries, and for which no diagram or servitude is registered. These servitudes can vary in width and depends on the conditions of the original township establishment. A municipality can install services within an omnibus servitude, even if there is no registered servitude. This applies to every township in South Africa.

Figure 3 below depicts the Bhokwe Community Sanitation Project. The proposed sewer reticulation of 160mmØ uPVC is depicted in **red** and the proposed rising main of 200mmØ uPVC is depicted in **green.** The proposed reticulation in **red** provides a clear indication on the layout in terms of servicing existing properties in the Bhokwe area. The proposed sewer reticulation will “tie-in” to the gravity fed sewer oxidation pond system. The sewer pond system is depicted in **blue**. The proposed sewer reticulation will have a wetland crossing depicted in **yellow**. The construction site camp will be located at 27°48'38.33"S 31° 6'13.56"E. The site camp is an existing and enclosed area from the previous contractor., with provision made to safely store construction material. The site is cleared of vegetation and will be suitably located within the construction area, out of any wetland crossing or environmentally sensitive areas.. The site camp is depicted in **orange**.

The construction camp site is 650 m^2, and is located:

1. 98m from HGM 1;
2. 216m from HGM 2;
3. 35m from wetland buffer;
4. 10m to the closest sewage pipeline section; and
5. 120m from the pipe-bridge

An A3 copy of the map can be reviewed under Appendix C

Figure 3: Layout of the proposed project

Table 5 below summarizes features marked A to E as per figure 3 above.

Table 6: Proposed project features and co-ordinates

Description		Coordinates	
A	Northern Boundary	27°48'28.71"S	31° 6'10.38"E
B	Southern Boundary	27°48'45.97"S	31° 6'22.57"E
C	Oxidation Ponds	27°48'46.12"S	31° 5'59.69"E
D	Pipe Bridge	27°48'42.79"S	31° 6'15.84"E
E	Rising Main	27°48'44.27"S	31° 6'2.85"E

The northern area of Bhokwe is known as Bhokwe Quarters, with 26 houses. The south eastern area of Bhokwe is known as Bhokwe Hostels, with 86 houses. This brings the total housing to 112. The proposed project aims to provide housing connections to all 112 houses within the area.

As per the detailed topographical survey on the study area; the proposed sewer reticulation will intersect existing services as detailed below:

- Water Lines: - MH10 to MH11; MH11 to MH12; MH23A to MH23 and MH30 to MH31
- Storm water culverts: - MH10 to MH11
- Road / Track / Paved Driveways: - MH10 to MH12, MH14 to MH15, MH30 to MH31, MH32 to MH33; MH35 to MH36, MH21A to MH21, MH23A to MH23, MH29 to MH32 and MH25 to MH26

The remainder of the sewer reticulation runs parallel to numerous services. Therefore, care will be taken to ensure that the existing services will be proven prior to trenching and earthworks to ensure that they are protected. The proposed site for the sewer ponds is predominately used for agricultural purposes and no services were observed during the detailed topographic survey.

6. LEGISLATION AND GUIDELINES APPLICABLE

6.1 Applicable listed activities

In terms of the Environmental Impact Assessment (EIA) Regulations (2017), promulgated in terms of the National Environmental Management Act, 1998 (NEMA), certain Listed Activities are specified for which either a Basic Assessment (GNR 327 and 324) or a full Scoping and EIA (GNR 325) is required. The following Listed Activity in Government Notice (GN) R 327 (Listing Notice 1) are triggered, requiring a Basic Assessment (BA) Process for the proposed construction of the Bhokwe Community Sanitation Project..

Table 7: Relevant Activities from EIA Regulations 2017

Regulation Year	Listing Activity NEMA	Description of Activity	Applicability to the Project
2017	LN 1; Activity 19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	The proposed activity requires the laying of a sewer reticulation, which includes the excavation, dredging and removal of soil from a watercourse.
2017	LN 1, Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	The proposed sewer treatment plant will require the clearing of approximately 2.4Ha of vegetation.

Hence, a BA Process is required.

The applicable listed activities, as per Table 5 above, have been identified as triggers for the proposed development. The development triggers this activity as it traverses a wetland in the following places;

Please refer to Map 5 above and Appendix C for points of intersection on maps.

In terms of the Environmental Impact Assessment (EIA) Regulations (2017), promulgated in terms of the National Environmental Management Act, 1998 (NEMA), the following definitions apply to this report:

"watercourse" means -
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, pan, lake or dam into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (Act No. 36 of 1998); and a reference to a watercourse includes, where relevant, its bed and banks;

"wetland" means 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 South African classification system categorises wetland systems based on the characteristics of different Hydrogeomorphic (HGM) Units. An HGM unit is a recognisable physiographic wetland-unit based on the geomorphic setting, water source of the wetland and the water flow patterns (Macfarlane et al., 2008). There are five broad recognised wetland systems based on the abovementioned system and these are depicted in the figure below. The classification of these wetlands is then further refined as per the 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).

Based on the current identification of the four wetland indicators, five HGM units were delineated within the 500m assessment area. These were all classified as seep systems. These seep systems are depicted in Figure 4, with the flow directions depicted in Figure 4. A closer view of the crossing position of HGM 1 is depicted in Figure 5.

The seep systems were associated with drainage channels which flow in a generally southern direction toward the valley bottom associated with the Black Mfolozi River, situated 1.2km south of the study site.

Seepage wetlands are characterised by their association with topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to seep down-slope as subsurface interflow. Water movement through the seep is primarily attributed to interflow, with diffuse overland flow often being significant during and after rainfall events (Kotze et al., 2008; Ollis et al., 2013). Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.

The proposed project will only have a direct impact on HGM unit 1. The previous contractors cleared a section through HGM 1. No section of the previous contractors' work will be used. Furthermore, the reticulation pipeline will be laid within approximately 95m of HGM 2.

The pipe bridge will require the excavation and construction of ten piers. Each pier will be placed approximately 6 meters apart, spanning the seep wetland. The excavation will be done by hand to mitigate impacts on the wetland. The table below indicates the details of the wetland crossing.

Table 8: Proposed wetland crossing details

Activity	**Water Resource**	**Start Coordinate**	**End Coordinate**	**Length of Water Resource affected**	**Volume of excavation (Length X Breadth X Height)**
Pipe Bridge with 10 piers	HGM 1	27°48'42.04"S; 31° 6'15.13"E	27°48'43.75"S 31° 6'17.13"E	75.8m	1.8m x 1.8m x 1.0m = 3.24m^3 10 piers x 3.24m^3 = 32.4m^3
			Total	75.8m	32.4m^3

Wetland buffers are areas that surround a wetland and reduce adverse impacts to wetland functions and values from adjacent development. Buffer zones outside the boundary of wetlands are required to ensure that the ecotones between aquatic and terrestrial environments are effectively managed and conserved.

The closest wetland to the oxidation ponds is HGM 1. This HGM unit is situated outside of the recommended 60m buffer (Figure 4) at a distance of approximately 124m. The pipeline will furthermore be laid within approximately 95m of HGM 2. No buffer was calculated for these wetlands as impacts to the systems will be short term in nature. Due to the previous contractor clearing the pipeline route across HGM1, the selection of this route provides an opportunity to rehabilitate areas that have been degraded.

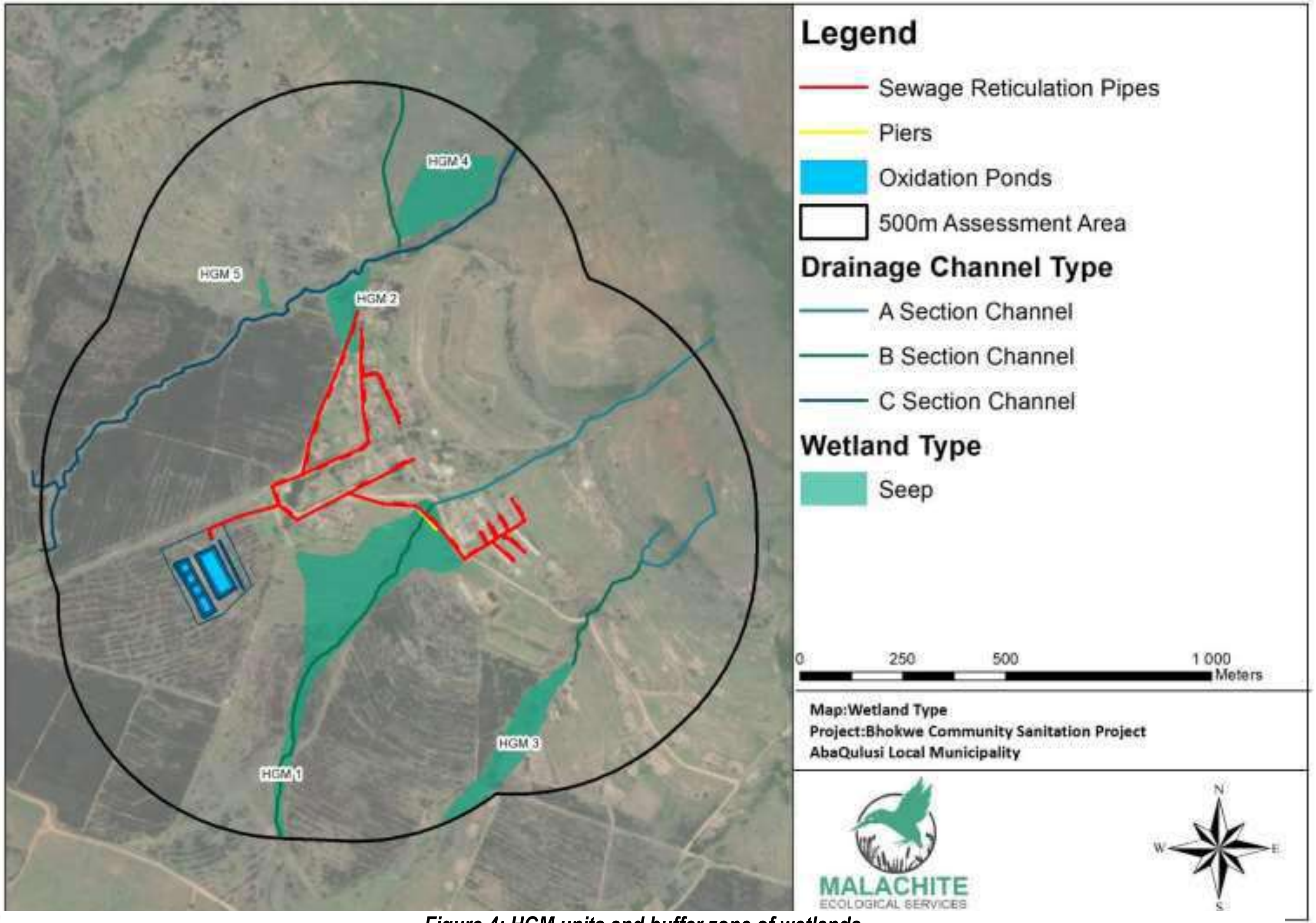

Figure 4: HGM units and buffer zone of wetlands

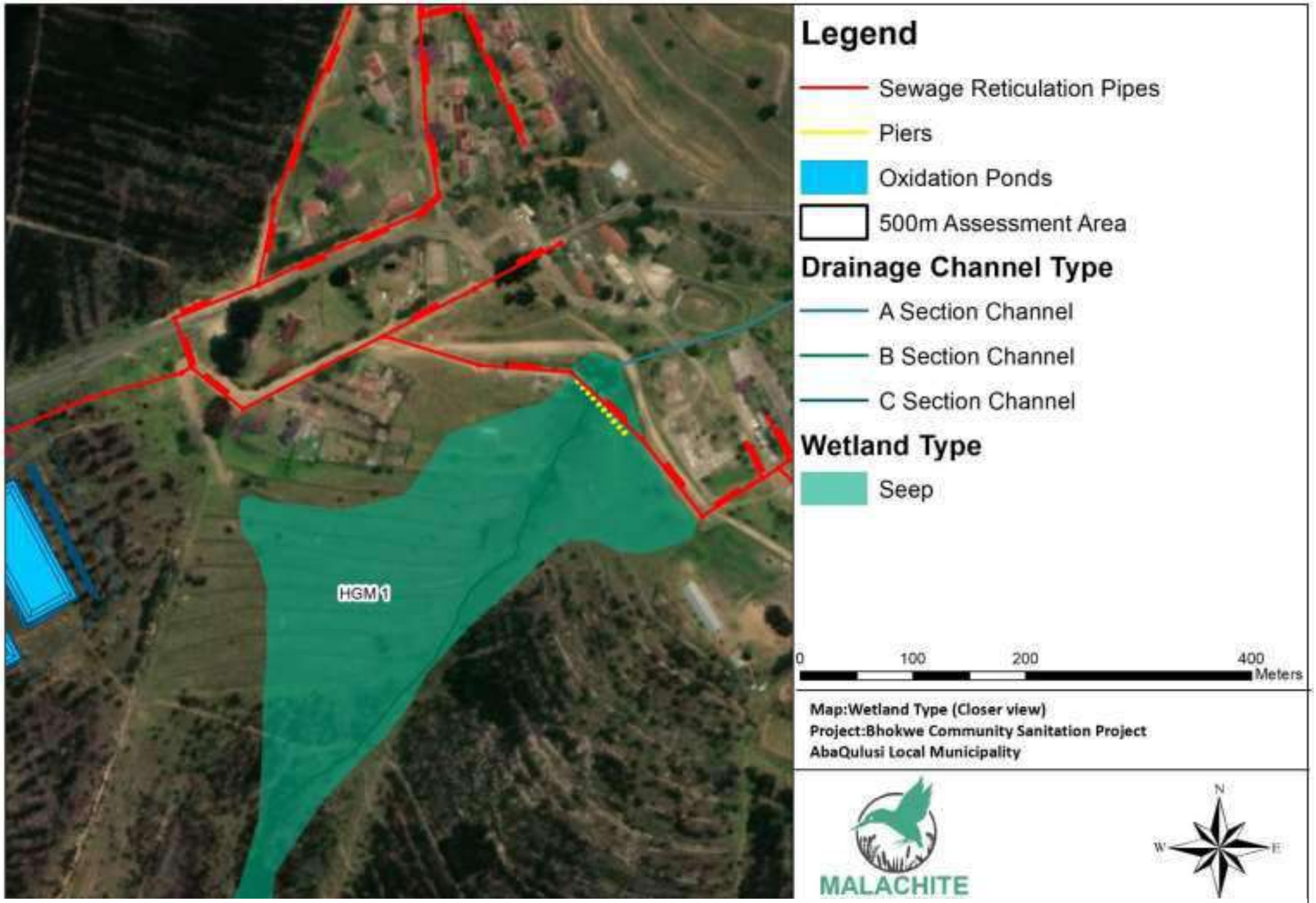

Figure 5: Close up preview of HGM 1 pipe bridge crossing

6.2 Policy and Legislative Context

Table 7 provides a list of all applicable legislation, policies and/or guidelines of any sphere of government that are relevant to the application as contemplated in the EIA regulations.

Table 7: Applicable Legislation, Policies and/or Guidelines

Title of Legislation, Policy or Guideline	*Administering authority*	*Date*
National Environmental Management Act (Act 107 of 1998) – for its potential to cause degradation of the environment (Section 28).	Department of Environmental Affairs	1998
EIA Regulations GNR 327 and 324 – for identifying the triggers for a basic assessment.	Department of Economic Development, Tourism and Environmental Affairs	2017
Environmental Conservation Act (Act 73) – for potential environmental degradation.	Department of Environmental Affairs	1989
National Water Act (Act 36 of 1998) – for potential to cause pollution of water resources defined under the Act (Section 19).	Department of Water Affairs and Forestry	1998
Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) – for protection of agricultural resources and for control and removal of alien invasive plants.	National Department of Agriculture	1983
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) – for protection of biodiversity.	Department of Agriculture and Environmental Affairs and Ezemvelo KZN Wildlife	2004
The National Heritage Resources Act (Act No 25 of 1999 as amended) – for the identification and preservation of items of heritage importance.	Department of Arts and Culture (AMAFA KwaZulu-Natal)	1999
Guideline 4: Public Participation in support of the EIA Regulations (2005) and EIA Regulations GNR 982 for Public Participation Guidelines.	Department of Economic Development, Tourism and Environmental Affairs	2006 and 2014
EIA Regulations GNR 326 – for guidelines on the process to be followed and the format of the BAR.	Department of Economic Development, Tourism and Environmental Affairs	2017
Public Participation guideline in terms of NEMA EIA Regulations	Department of Economic Development, Tourism and Environmental Affairs	2017
Spatial Development Framework	AbaQulusi Municipality	2017-2018
Integrated Development Plan	AbaQulusi Municipality	2013/12 to 2016/17
AbaQulusi Municipality By-Laws	AbaQulusi Municipality	Current

7. NEED AND DESIRABILITY

The activity is desirable in order to address an obvious general problem with pit latrines within a relatively densely developed area as well as the need to develop additional housing in the area. The proposed project will enable all houses and proposed development within the catchment to be connected to water borne sewer. Pit latrines are the most common and simplest forms of sanitation in rural areas. Pit latrines are highly inappropriate and unsanitary; however, it is promoted in rural areas in order to discourage open defecation. There are serious disadvantages of using pit latrines such as odour nuisance; flies may be attracted to lay their eggs within poorly built latrines; and improper lining of pits may lead to the collapse of the structure.

The fact that centralised treatment is proposed doesn't necessarily mean that problems relating to sewage contamination will be totally resolved within the area as; It is likely to take some time for all houses within the area to be connected to the sewer line. Sewer blockage in rural areas frequently occurs, due to pollution activities that are inevitable in rural areas that lack proper infrastructure and basic services. The response time from the municipality is generally good with blockages generally being cleared within 24 hours of reporting.

Problems with centralised systems tend to be intermittent but can result in larger spillages than from individual systems although the cumulative impact of numerous pit latrines could be comparable. The main benefit of a centralised system within Bhokwe is that responses when problems are found are relatively quick and contamination periods are usually relatively short. A general reduction in contamination from pit latrines is likely to occur from the proposed development. The proposed project will help to minimise sewage spillage and it should therefore result in improved surface and sub surface water quality. The proposed project will also enable additional housing projects to occur in the area. The proposed development will also improve the local water quality.

8. MOTIVATION FOR THE PREFERRED SITE, ACTIVITY AND TECHNOLOGY ALTERNATIVE

The proposed construction of the sewer reticulation triggers Listing Notice GNR 327, Activity 19 of the EIA Regulations (2017). As per GNR 326 (2017), Appendix 1(2)(b) and 1(3)(g), alternatives for the proposed development are to be identified and considered. Chapter 1 of the EIA Regulations provides an interpretation of the word "alternatives", which are options *"in relation to a proposed activity, mean(ing) different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -*

a) Property on which or location where the activity is proposed to be undertaken;
b) Type of activity to be undertaken;
c) Design or layout of the activity;
d) Technology to be in the activity; or
e) Operational aspects of the activity;

And includes the option of not implementing the activity."

Based on the above, the following alternatives are presented for the proposed Bhokwe Community Sanitation Project.

8.1 Site Photographs

Wastewater Treatment Plant Area

Bhokwe Community Surrounding Area

8.2 Preferred Site

The proposed sewage infrastructure is designed to service the existing 112 households within the Bhokwe area, with a population of approximately 750. These houses currently utilize pit latrines which is not sustainable. Frequent blockages and burst pipes are causing a hazard to the community and surrounding environment. The area falls under the Zululand District Municipality. ZDM has proposed to provide reliable sanitation for the community by creating a waterborne sewage reticulation system.

8.3 Route Alternative/ Layout Alternative

Alternatives take into consideration all possible means by which the purpose and the need of the proposed activity can be accomplished taking into account the interest of the applicant. Route alternatives are informed by specific circumstances of the activity and its environment. The proposed project aims to service housing sewer needs in the Bhokwe area, with the shortest possible and feasible piping route, taking the surrounding environment into consideration. Housing connections limits the alternative designs of the reticulation layout.

Alternative reticulation layout:

An alternative route was looked at to avoid crossing the seep wetland in HGM 1. A design alternative followed the path of the roadway and thus avoided the wetland crossing. This design was not preferred due to the following reasons:

- The geotechnical investigation had refusal at 2.7m. This indicates that directional drilling and pipe jacking will be excluded as it is not an option. Open trench would be used, together with blasting. This would cause damage to both the roadway and neighboring wetland.
- The pipe will be laid at a depth of approximately 6m. This will lead to probable maintenance issues arising if there is a problem or leak within the pipe route.
- The pipe bridge will have flanged steel and will be epoxy coated. It is more robust and stronger than uPVC piping. It will also be laid above ground. Possible leakages is low and maintenance is quick. Any leaks will be visible if it is above ground.

The alternative pipe route alternative is illustrated in yellow while the preferred route is depicted in red.

Figure 6: Alternative wetland crossing design

Wastewater treatment works alternatives

Three Wastewater Treatment Works (WWTW) options were evaluated viz. Oxidation Pond System, Activated Sludge System, Rotating bio-contactors System. The Oxidation Pond System is the preferred WWTW option. Bhokwe climate can be considered typical of KZN, year-round mild to warm climates. Bhokwe Village also has large land area available. These environmental and spatial factors favor the use of such a system. It is robust - handles varying wastewater types (Industrial or Domestic). Final Effluent does not require disinfection. Completes sludge treatment. Lower maintenance and operating costs (generally periodic dredging). Low Technology solution i.e.. self-sufficient treatment system hence reduction of operator responsibilities to manage treatment plant - a reduction in labor costs (require only part-time staff).

The Sewage Effluent emanating from the Bhokwe Village is domestic in composition. The following are the main sewer characteristics which can be divided into four categories:

1. the concentration of oxidizable organic material, or substrate - normally expressed as an oxygen demand and is a measure of the strength of the sewage.
2. the concentration of nutrients present - generally refer to nitrogen and phosphorus present and is a measure of the propensity for the treated effluent to give rise to eutrophication (algal growth) downstream from the works.
3. the solids concentration - an indicator of the relative amount of sludge likely to be produced.
4. the pH and alkalinity value - needs to be adequate to sustain full nitrification (oxidation of ammonia to nitrate).

WWTW Design Constraints:

Environmental:

The treated final effluent cannot be discharged directly into the watercourse downstream of the site. Effluent to be passed through a reed bed system or irrigated on the vacant land below the ponds - non-edible grasses (not for human consumption) and not directly to the river.

Geotechnical:

The WWTW site is underlain by between 0.45 m and 0.95 m of colluvial soils comprising slightly moist, dark brown to orange brown, medium dense to dense, intact, silty sands.

These are generally underlain by residual shale soils comprising slightly moist, orange brown mottled reddish brown, soft to firm, intact, silty sandy clay, which grades into highly weathered, dark brown stained yellow and orange, fine grained, very closely jointed, thinly bedded, fissile, soft to medium hard rock shale bedrock.

The colluvial soils is unsuitable for a pond system without a suitable lining. Ponds should be as shallow as possible. In general, it is recommended that cut slopes and fill embankments have a maximum slope of 1 vertical to 2 horizontals to promote stability.

Option 1 WWTW: Oxidation Pond System

Oxidation ponds are large, shallow ponds designed to treat wastewater through the interaction of sunlight, bacteria, and algae. Algae grow using energy from the sun and carbon dioxide and inorganic compounds released by bacteria in water. During the process of photosynthesis, the algae release oxygen needed by aerobic bacteria. The figure following illustrates the oxidation pond process.

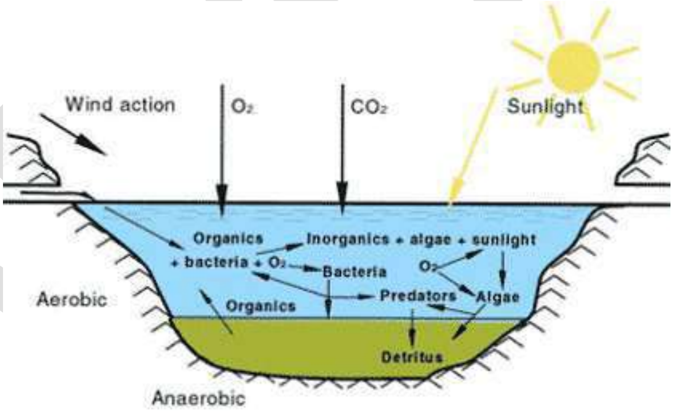

Figure 7: Oxidation Pond system design

Type
Aerobic pond with Facultative and Tertiary/Maturation ponds

Advantages	**Disadvantages**
Easy to construct	Requires a large land area
Reduction of operator responsibilities to manage treatment hence a reduction in labor costs (require only part-time staff)	Odour can become a nuisance during algal blooms
BOD, fecal coliform, and helminth removal is higher than by other treatment methods such as activated sludge,	Unmaintained lagoons can provide a breeding area for mosquitoes and other insects

biological filters, and rotational biological contactors	
Final Effluent does not require disinfection	High BOD and TSS with algae concentrations
Ideal for small communities and mild to warm climates	
Completes sludge treatment	
Low Technology - self-sufficient treatment system	
Does not require electricity to operate	

Discharge - Options to be considered for the final discharge from the treatment plant are:
✓ Irrigated on the vacant grasslands below the ponds
✓ Use of sub-surface irrigation distribution lines/soak ways
✓ Use of a reedbed system

Operation and Maintenance
Low tech hence reduced operator responsibilities. Generally periodic dredging. Surface cleaning of weeds, non-biological solids etc. which could block out sunlight. No Electrical and mechanical equipment maintenance.

Option 2 WWTW: Package Treatment Plant - Activated Sludge System

The activated sludge treatment system consists of a pre-treatment step (e.g. septic tank), an aeration tank followed by a secondary clarifier. Settled sewage, mixed with fresh sludge that is recirculated from the secondary clarifier, is introduced into the aeration tank.
Compressed air is then injected into the mixture through porous diffusers located at the bottom of the tank. As it bubbles to the surface, the diffused air provides oxygen and a rapid mixing action. Under such oxygenated conditions, microorganisms thrive, forming an active, healthy suspension of biological solids—mostly bacteria—called activated sludge.

Type **-** Not a Single Batch Reactor - hydraulic retention times to be a minimum of 3 days, If the final effluent is only required for irrigation purposes, the disinfection step could be omitted.

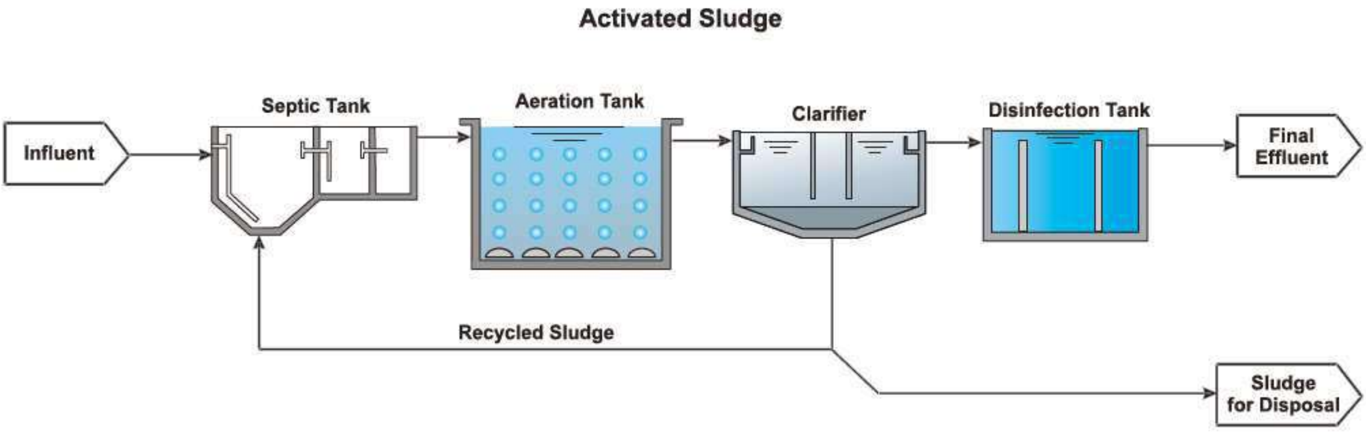

Figure 8: Package treatment plant with activated sludge system

Advantages	Disadvantages
Compact and space efficient	Specialist installation

Odours are generally contained	Requires power supply with backup system
Ideal for small communities	Sludge disposal location, costs
Sewer is not exposed hence fewer mosquitoes and other insects	Not robust to handle varying wastewater types (Industrial or Domestic)
Final Effluent requires disinfection	
High technical capabilities of operator	
High maintenance costs	

Operation and Maintenance

Operation and Maintenance plans and manuals required. Skilled/Trained personnel required. Maintenance of several electrical and mechanical components (screening, valves, pumps, motors etc.). Maintenance must be periodic. Higher OM budgets required.

Discharge **-** Options to be considered for the final discharge from the treatment plant are:

✓ Irrigated on the vacant grasslands below the ponds
✓ Use of sub-surface irrigation distribution lines/soak ways
✓ Use of a reedbed system

Option 3 WWTW: Package Treatment Plant - Rotating bio-contactors System

Rotating bio-contactors (RBCs) consist of a series of discs attached to a horizontal shaft. These systems are modular and additional shafts and discs can be added in series. The pre-treatment step is generally a septic tank.

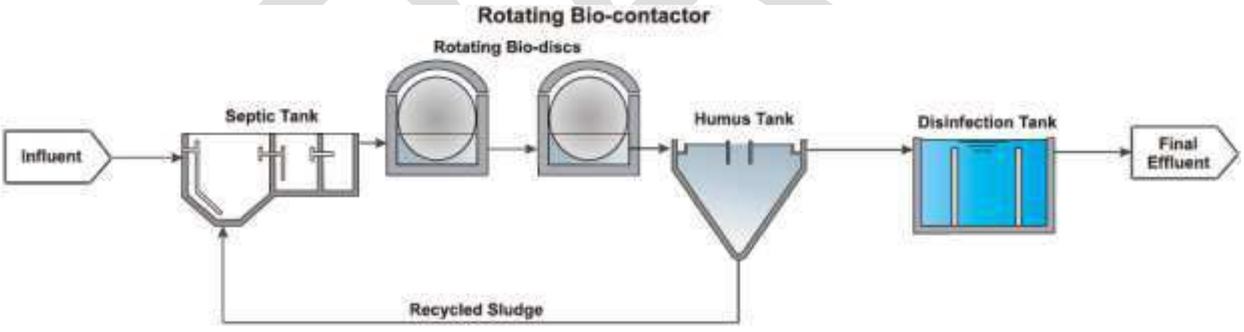

Figure 9: Package treatment plant system with bio contractors

RBCs are generally housed in a concrete or carbon steel tank, such that 40% of the disc surface area is submersed in the wastewater. The shafts (up to 9m long) rotate by either a mechanical or compressed air drive at a rate of between 1 and 4 revolutions a minute. The biomass is aerated whilst exposed to air above the wastewater. Variable rotational speeds should be provided to control media growth.

The bio-discs must, however, not be exposed to sunlight and are therefore covered with a fiber glass cover with air vents. The biomass attaches to these discs and drops off into the wastewater as the biofilm becomes too thick.

The next step in the process is a humus tank, in which the solids and liquid phases are separated. The effluent flows into a disinfection chamber, whilst the settled solids are returned to the septic tank. The septic tank will need to be de-sludge regularly.

Advantages	**Disadvantages**
Compact and space efficient	Specialist installation
Odours are generally contained	Uneven media growth can lead to an unbalanced RBC, which increases torque loads on the shaft
Sewer is not exposed hence fewer mosquitoes and other insects	Requires power supply with backup system
Septic Tank Sludge disposal location, costs	
Final Effluent requires disinfection	
High technical capabilities of operator	
High maintenance costs	

Operation and Maintenance
Easy access to the bearings, discs and mechanical drives is required for maintenance. Operation and Maintenance plans and manuals required. Skilled/Trained personnel required. Maintenance of several electrical and mechanical components (screening, valves, pumps, motors etc.). Maintenance must be periodic. Higher OM budgets require

Discharge - Options to be considered for the final discharge from the treatment plant are:
✓ Irrigated on the vacant grasslands below the ponds
✓ Use of sub-surface irrigation distribution lines/soak away
✓ Use of a reedbed system

The **Oxidation Pond System** is the preferred WWTW option. Bhokwe climate can be considered typical of KZN, year-round mild to warm climates. Bhokwe Village also has large land area available. These environmental and spatial factors favour the use of such a system.
Further, it is robust - handles varying wastewater types (Industrial or Domestic). Final Effluent does not require disinfection. The system completes the sludge treatment. Comparatively it has lower maintenance and operating costs (generally periodic dredging). Low Technology solution i.e.. self-sufficient treatment system hence reduction of operator responsibilities to manage treatment plant - a reduction in labor costs (require only part-time staff).

Wastewater treatment works alternative layout

An alternative layout alternative was looked at for the oxidation treatment plant south of the reticulation system, fed by gravity action. The location was not considered as it was found within a seep wetland. An oxidation pond would not be suitably located within a wetland system. Refer to Figure 10 for the alternate oxidation pond location.

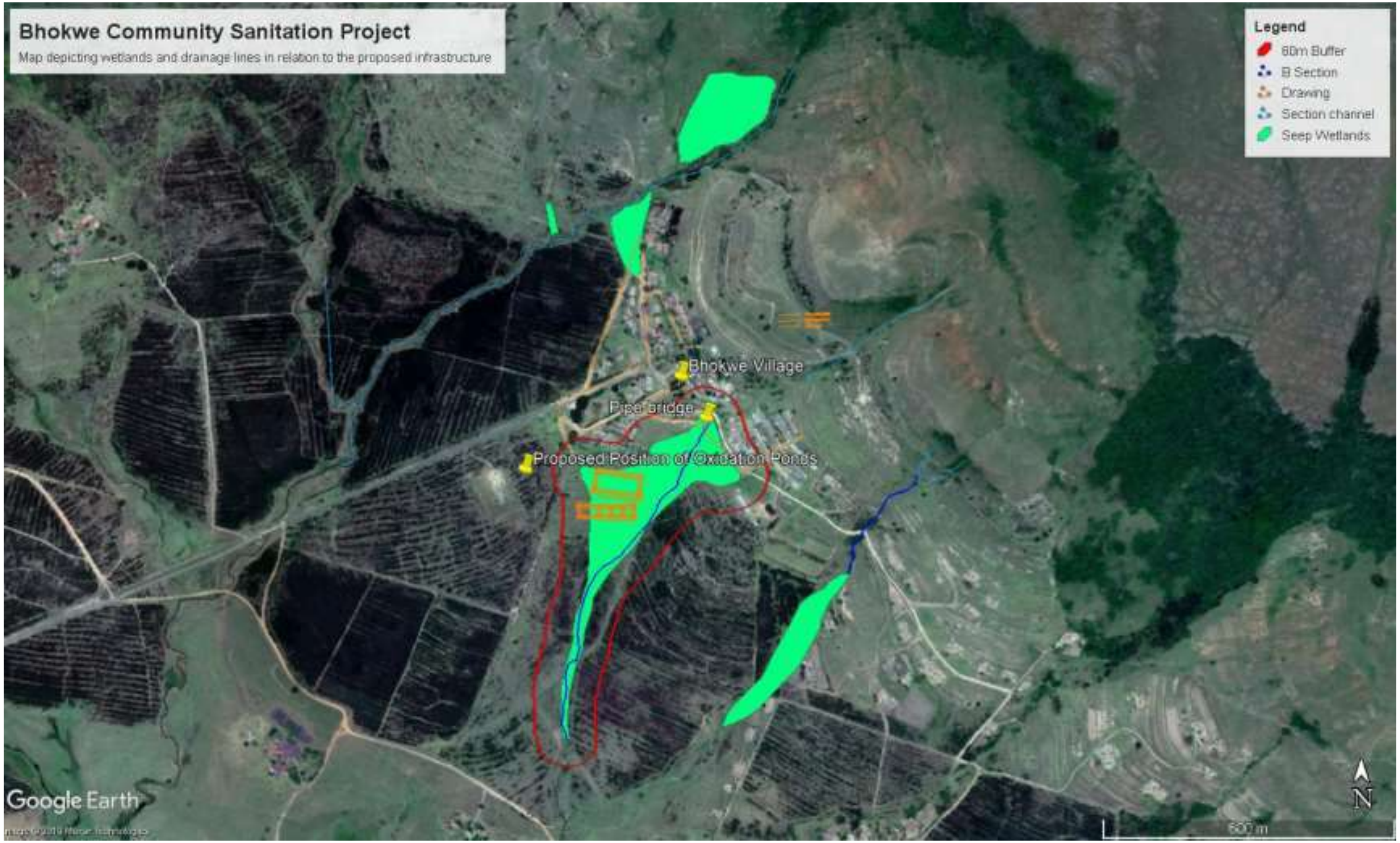

Figure 10: Alternative WWTW design

8.3 Preferred Technology Alternative

8.3.1 Pipeline Construction Methodology

Materials

The proposed project consists of pipelines under low pressure for gravity flow. The house connections will be 110mm uPVC class 51. The main reticulation will be 160mm and 200mm uPVC class 34 (HD). The concrete rings will be 1250mm diameter with heavy duty concrete covers. The elevated pipe will be 150mm NB flanged steel epoxy coated and lined.

Gravity sewer reticulation

The proposed gravity sewer reticulation of 1.8km long, 160mm Ø uPVC HD pipeline with 1250mmØ precast concrete ring manholes constructed at every change in grade and direction. Once the pipeline is considered to be mechanically completed and accepted, a request for filling the pipe with water will be issued to the Engineer, and after the approval to proceed has been given by Engineer the section of pipeline to be tested can be filled up.

The following operations will be undertaken to test the pipeline:

1. The section of the pipeline under test should be filled up with water such that the manhole chamber at the upper end shall be filled with water to such depth that every portion of the pipeline is subjected to a pressure of not less than 12Kpa and no more than 60Kpa.

2. During the test there shall be no discernible leakage of water.

3. An appropriate period which shall be at least 10min shall be allowed for initial absorption, and the loss of water over the next 30min shall be noted. The amount lost shall not exceed the applicable of the following rates per 100m of pipeline per hour.

4. Should any section of the pipeline fall pass the water test, a re-test will be permitted and, in such case acceptance or rejection of the section shall be determined on the result of the re-test

5. Each connecting sewer line shall be tested between its upper end and the junction at the main sewer (Lower end).

Sewer manhole covers

All manholes cover shall be precast reinforced concrete rings. Minimum internal dimensions of circular manhole shaft will be 750mm. Minimum internal dimensions of circular manhole chamber will be 1250mm -The maximum height of manholes above ground shall be 150mm. Manhole covers not subject to traffic loads shall be heavy duty reinforced concrete. Manhole cover subject to traffic loads shall be type 2B according to SANS 558. Manholes will be placed at all junctions and all changes of grade and/ or direction of reticulation. The maximum spacing of manholes must be 80m. The manholes shall be tested separately from the pipeline for water tightness.

Construction corridor and servitude

Excavations and backfill for pipe trenches will be in accordance to SANS 1200DB and pipe bedding will be in accordance to SANS 1200LB. The design and construction of sewer lines will be in accordance with SANS 1200LD. The village is not formally laid out except for the school. The position of the pipes will be dictated by the position of the existing fences and roads. No pipeline servitudes will be registered after construction.
The construction corridor where construction vehicles are permitted and outside of sensitive areas is to be 10m in total, 5m

on either side of the proposed pipeline route.

Pipes laid below ground

Pipelines are to be laid below ground by conventional open trench excavation. The depth of the various trenches varies according to location and topography of the existing ground level but generally an average depth of 1.5m below ground level to the top of the pipe is adhered to. The trench widths are to be in accordance with SANS 1200- 300mm wider on either side of the pipeline. This allows for compaction with a motorised rammer. Before laying, pipes will be visually checked for scratches, puncture, ovality, correct marking. Heavy Duty uPVC is to be laid on flexible bedding as shown in the Figure below. The selected cradle and blanket are to be river sand.

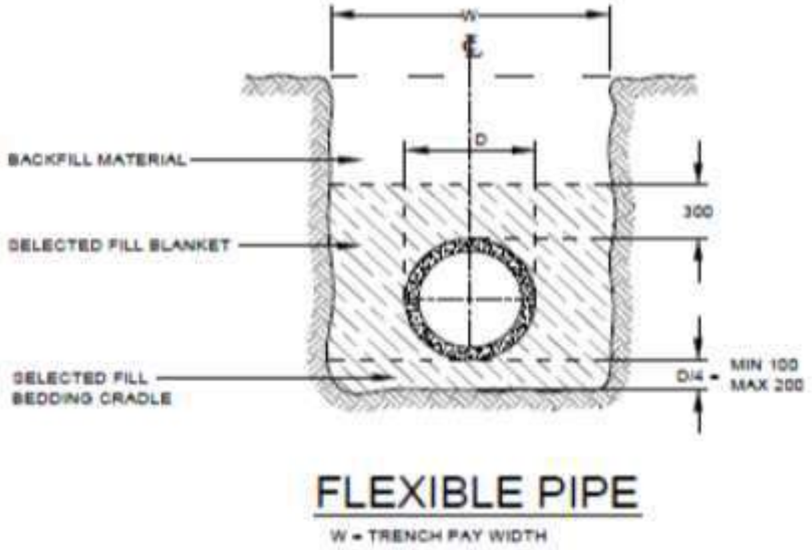

Figure 11: Design of flexible pipe layout below ground

More river sand is then placed on the sides of the pipe to 100mm above the crown of pipe (bedding cradle). This is then hand stamped to secure the position of the pipe. Suitable material from the trench excavation or river sand, if the sand taken from the trench has too many large particles, it is then placed a further 200mm on top of the pipe (bedding blanket) and then compacted. The trench will then be backfilled with normal backfill material or the material excavated from the trench that does not contain large rock fragments and boulders. This backfill is compacted in 300mm layers until the ground profile is reached. Topsoil which will be removed prior to excavation will be stored, maintained and reinstated after backfilling.

The distance and methods of crossings were identified as two pivotal aspects that determined the design of the proposed reticulation, and is described further below:
a) Distance –
The shortest distance was considered in sections of the reticulation that serviced houses, as well as, the tie-in point that exist within identified wetlands. As a result, crossing these wetlands is inevitable but limiting the crossing distances is a means of mitigating impacts to the watercourses.

b) Method of watercourse crossing –
From an engineering perspective the use of elevated sewage pipelines (i.e. Pipe Bridges), as opposed to, below ground pipelines are determined by the terrain and topography of the area. Based on these factors, it was deemed more favourable

to place the reticulation below ground for most parts, however, a pipe bridge was deemed more favorable for crossing of HGM 2.

Road Crossings

Where the pipeline crosses the road, conventional open cut trenching with traffic controls will be utilised followed by temporary reinstatement. Once completed formal reinstatement will proceed. The pipeline is to be laid at a depth of 1.2m above the crown of pipe.

Wetland Crossings

There is one wetland crossing in HGM 1. There is no significant water flow in the seep wetland. The pipe piers, ten in total, will be placed at 6m intervals on crushed stone approximately 1.8m x 1.8m in plan and 1m thick. The piers will be reinforced concrete.

The position of the pier foundations will be marked out. The existing vegetation will be carefully removed in manageable clumps to a stockpile area nearby. The stockpiled vegetation will be maintained during the construction of the piers. The pier foundations will be hand excavated to prevent excessive damage. Soil will be placed on plastic sheets so as not to contaminate the existing vegetation. The piers will be backfilled on completion and any plant damage in the construction zone repaired with the vegetation from stockpile.

8.3.2 Wastewater Treatment Construction Methodology

Wastewater Treatment Ponds

Pond systems provide a low cost means of handling domestic wastewater from small communities. Their function relies on the natural self-purification process that occurs in a body of water and is dependent on natural factors such as sunshine, temperature and wind action. Generally, their size is limited to 5000 persons or 800 kl/day. The ADWF at Bhokwe is 84.2 kl/day which is substantially less.

The pond system considers suitable for this application is the standard facultative and secondary ponds i.e. no anaerobic ponds and no recirculation.

The essential elements are :-

1. 1 Grit channel
2. 1 Facultative (Primary pond)
3. 4 Secondary ponds (Secondary plus three tertiary)
4. 1 Evapotranspiration bed

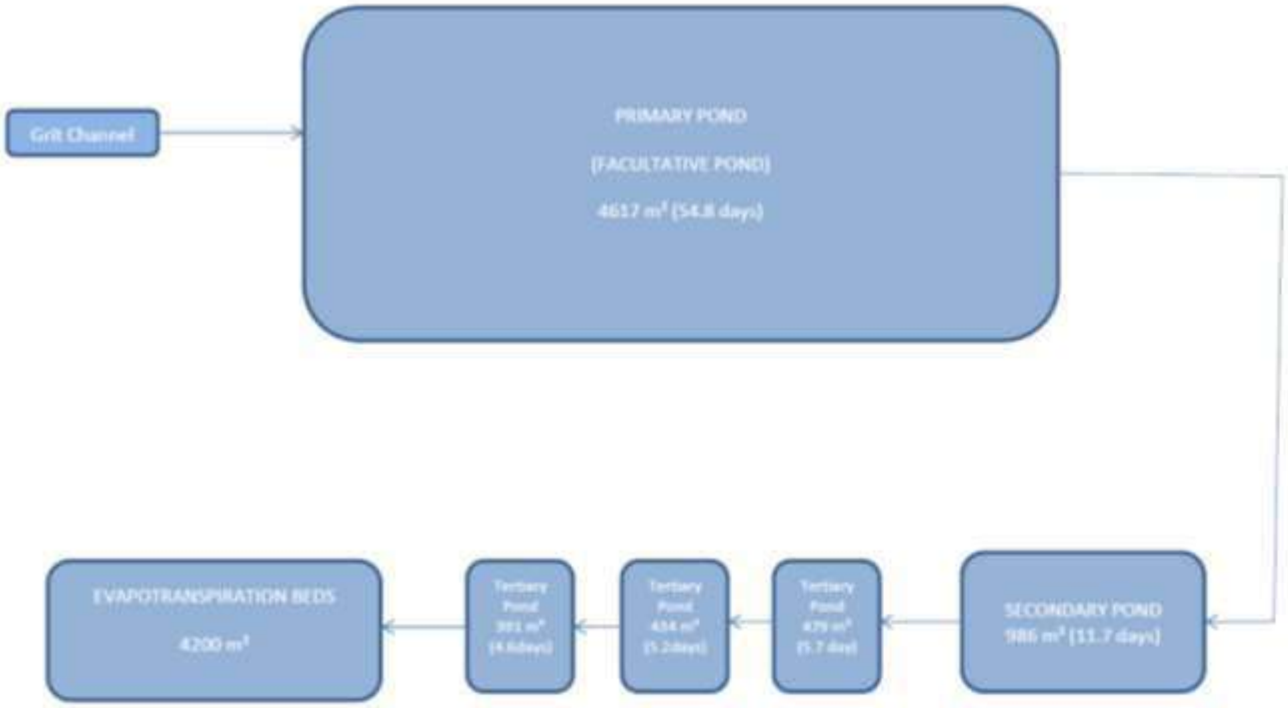

Figure 12: Design flow of the WWTW

Oxidation pond material and construction:

- The grit channel will be constructed from reinforced concrete and brickwork. The screens will be stainless steel.
- The floor and banks of the ponds will be lined with 150mm concrete.
- The pond berms will be capped with 150mm G5 gravel
- The pond interconnecting structures will be brickwork with high alumina mortar and 200mm uPVC pipes.
- The topsoil channel and berm will be constructed to prevent runoff inundating the works.
- The area will be stripped of topsoil.
- Steep areas will be benched at 1:20 sloping into the slope.
- The fill will be compacted in layers to 95% mod AASHTO and then trimmed to line and level.
- The ponds will be lined with concrete in 5m square panels
- The inlet, outlet and inter-pond structures will be instated simultaneously.
- The 3m wide berms will be protected by a 150mm gravel capping
- The external banks will be topsoiled and grassed with endemic grass sods sourced locally.
- The permanent fence and gates will be installed.

Process Flow:

The effluent flows by gravity to the grit channel.

Grit Channel

The grit channel comprises three parts. The first part is manual screening. Large floating objects are trapped by the screen and raked to a draining platform by the operator. The second part is the grit channel. The grit channel is shaped to run at constant velocity to settle out the smaller grit particles. There are two grit channels to aid cleaning. The third part is the measuring flume.

From the grit channel the effluent flows into the Primary (facultative) pond.

Inlet and outlet structures

The pond inlets comprise a shallow open manhole on the berm and an inlet below water level. The pond outlet comprises a manhole that is open on one end in the pond. The manhole has a brick scum board to prevent floating matter leaving the pond and a birch overflow weir to set the pond top water level. The interconnecting structures comprise an outlet and an inlet combined into one structure. The inlets and outlets are placed diagonally opposite each other.

The freeboard in the primary pond and the secondary pond is 500mm. The freeboard in the three tertiary ponds increase as the depth decreases to 800mm. The weirs can be lowered if the estimated influent volume is not achieved or raised to accommodate any unexpected population increase.

Primary Ponds:

The Facultative pond serves as a reactor where both aerobic and anaerobic mechanisms take place. The aerobic in the upper levels of the pond (due to photosynthesis resulting in algal growth) and anaerobic in the lower levels of the pond where bacteria metabolise organic material releasing carbon dioxide (used in the photosynthetic process mentioned above). This ensure the effective breakdown of organic matter within the pond resulting in a stabilised settled sludge and effluent with lower organic loadings

Secondary Ponds

The sizing of the secondary ponds is based principally on detention time. The ponds are arranged in series for efficient faecal reduction. Nitrogen removals improve with increased detention times. The secondary system should not be oversized which will result in excessive evaporation and increased COD values.

Evapotranspiration beds

The evaporation ponds are designed to maximise surface area. They are in four compartments each 160m x 40m giving a combined surface area of 27 200 m and a total volume of 13200m^3. The ponds are 1m deep with 0.5m freeboard i.e. 0.5m water depth. The earth banks will be sloped at 1:2 like the oxidation ponds. Water in the upper pond will cascade to the lower pond via two - 2m wide concrete spillways. The final evaporation pond will have an emergency overflow to protect the pond banks against overtopping. The evaporation ponds will be lined with a 1.5mm HDPE liner on top of a geosynthetic clay liner (GCL).

The water balance for the sewer system is depicted in the following table below:

Table 9: Water balance of the WWTW

Month	Expressed monthly thus: - Average annual evaporation (mm)	Average annual rainfall (mm)	Month	Effluent from Reticulation (m³)	Rainfall (m³)	Evaporation (m³)
January	187	133	January	2561	4249	5974
February	157	112	February	2561	3578	5016
March	146	82	March	2561	2620	4664
April	125	35	April	2561	1118	3993
May	108	21	May	2561	671	3450
June	94	12	June	2561	383	3003
July	104	13	July	2561	415	3322
August	140	20	August	2561	639	4473
September	158	39	September	2561	1246	5048
October	163	74	October	2561	2364	5207
November	165	107	November	2561	3418	5271
December	193	130	December	2561	4153	6166
Year	1740	778	m³/year	30732	24854	55587
			m³/day	84.2	68.1	152.3

The area receives summer rainfall and peaks in the December to January period. The evaporation is greater than the rainfall amount. The Biological Oxygen Demand (BOD) is considered low for this treatment plant with a value of 84.2 m³/day. The yearly amount of BOD is 30732 m³/year. The evapotranspiration beds take into account both the BOD and the rainfall and are thus suitable for the treatment plant.

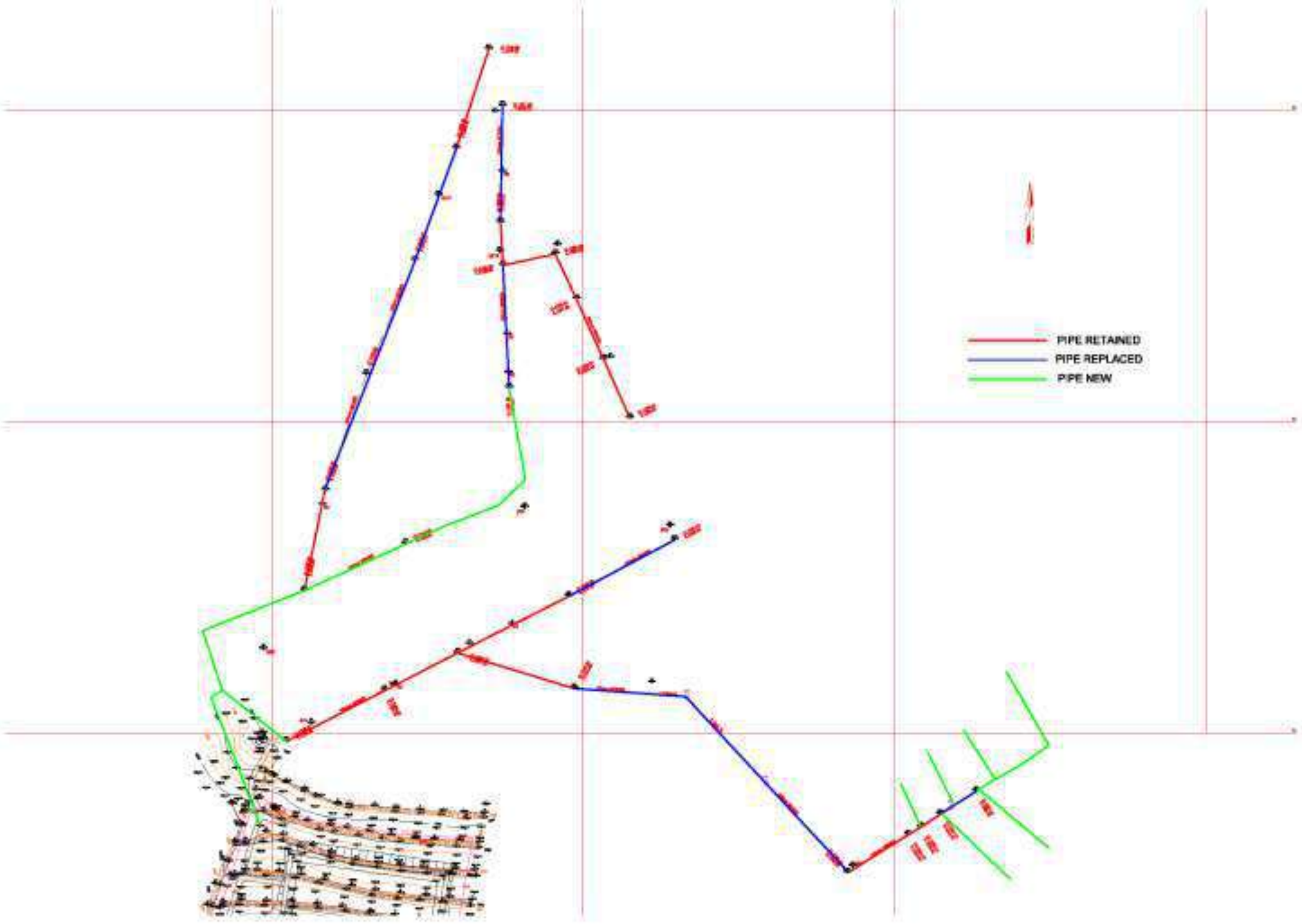

Figure 13: Schematic of the proposed pipeline and WWTW

8.4 No-Go Alternative

The ‘No Go’ alternative in the context of this project implies that the sewer reticulation would not be constructed, and the current status quo of pit latrines would prevail. Should the sewer line not be constructed and commissioned, the region would be negatively affected by an inadequate sewage reticulation (basic service) which would inhibit future development in the area and result in the continuance of lack of decent hygiene facilities in the area. Therefore, the need for stable and reliable sewage systems to meet current and future demand will likely outweigh the potential negative impacts to the surrounding environment. It is therefore concluded that the ‘No-go’ option is not in the best interests of future sustainable development in this region. The ‘No-Go’ Alternative will also not allow for the development of new housing and will not allow the upgrade/ formalisation of existing housing.

9. ENVIRONMENTAL ATTRIBUTES (GEOGRAPHIC, PHYSICAL, BIOLOGICAL, SOCIAL, ECONOMIC, HERITAGE AND CULTURAL ASPECTS)

Abaqulusi Local Municipality is located in the Northern part of KwaZulu-Natal Province and forms part of the Zululand District Municipality. The main towns within the region are Vryheid, Ulundi, Dundee and Paulpietersburg and Pongola. Vryheid is the main commercial, industrial and business centre within the region, and seen as ‘The Heart’ of the Zululand District. The town itself has a well-developed physical, social and institutional infrastructure and is located at the intersection of the major transportation routes which traverse the region. The municipality is estimated at 4185km2 in extent making it one of the largest in the province.

With a population of approximately +-243 795 people, according to Community Survey 2016. It at present constitutes approximately 27% of the Zululand District Municipality and is one of the five local municipalities that make up Zululand District Municipality. The 4 other local municipalities that make up the Zululand Family include eDumbe, uPhongolo, Nongoma and Ulundi. The municipality is also characterized as the main hub for the district and is also very strategically positioned, sharing its border with all of the 4 local municipalities within the district.

The Abaqulusi Municipality plays a major role in terms of its geographical location and regional access in Northern KwaZulu Natal, and has developed as a peripheral economy in the Provincial context, due to its distance from the main markets and corridors such as the N2 to Durban and Richards Bay, N3 to Pietermaritzburg and the N11 to Gauteng.

However, a secondary corridor, which is a coal line corridor runs from Richards Bay through Ulundi, to Vryheid and Paulpietersburg and into the mining areas of Mpumalanga. This is an important National rail and road network which passes/traverses through the Municipality. The other secondary corridors of National significance are the R 34 and R 69 transportation route. Vryheid is located at the intersection of the secondary corridors. The other major route of significance is the P 700 road that links Richards Bay to Gauteng via Ulundi and Vryheid.

The Zululand District has three main types of land use and settlements: traditional authority areas, commercial farms and towns/urban areas. The overall income level within the District is low, as it is very difficult for the various municipalities to build a proper tax base, which can be utilised for the provision and maintenance of services. There is a high social grant dependency and only a small portion of the population qualifies for payment of taxes, which leaves a huge burden on the current taxpayers to fund the grants as well as the maintenance of services. The region will not be able to implement or maintain any services with external funding. Therefore, it is essential that the district implement initiatives to grow its tax base through the successful implementation of economic development initiatives.

The biggest employment sector in the District Municipality is the Community, Social and Personnel sector that relates to the high dependency on government services provided to the communities. Thereafter, it’s Agriculture, hunting, forestry and fishing sector, which depicts the high rural nature. The wholesale and retail trade industries followed by the private households depicted the dependency of the rural areas for in the domestic environment. The remaining sectors are aimed that the smaller urban areas.

The current settlement structure within the rural areas make it difficult for the Municipality to provide services in an efficient and effective manner. The topography of the Abaqulusi Municipality is even and undulating topography, which further puts more strain on the limited resource the municipality has in terms of providing service to local residents etc. This introduces a major challenge, as the expansion of these settlements in areas that are not developed with bulk services (water, sanitation, roads, etc) is neither desirable nor sustainable.

The Abaqulusi Local Municipality had vast areas of vegetation land (refer to Vegetation Plan below). However, over the years, vegetation land transformed due to the land being used for other purposes. Approximately 302 977.6 ha (72.4% of municipality) remains natural, while no natural habitat comprises 115 484 ha (27.6%) of the municipality There are three (3) biomes and twelve (12) vegetation types found within the Abaqulusi Local Municipality. Of the three listed biomes (Forests, Savanna and Grasslands), the Grassland Biome covers more than 80% of the Municipal area.

Land Reform challenges in wards five and seven include low intensity tension and conflict between land restitution and labour tenants programs and traditional leaders, settlement patterns may hinder broader development, lack of infrastructure and other essential social development imperatives, lack of harmony and tolerance between land reform beneficiaries that have been packaged and settled on one piece of land, lack of post settlement support, lack or no coordinated and timeous intervention by other government agents and municipalities, post settlement and lack of finance in the acquisition of more land and resolution on remaining claims (Comprehensive Rural Development Programme (CRDP) Abaqulusi Local Municipality: 2009).

The responsibility for the delivery of water and sanitation in Abaqulusi is shared between Zululand District and Abaqulusi Municipality. Zululand district provides services in the rural areas while Abaqulusi is in charge of the urban areas. Although sanitation systems have improved, sanitation infrastructure being provided in rural areas (previously unserved communities) is limited to household VIP toilets. Urban sanitation consists of a 218 combination of waterborne sewerage linked to waste water treatment works as well as a system of septic tanks and conservancy tanks in less densely populated areas. Increasing urbanisation and population growth rates have placed increased pressure on the infrastructure in the urban areas, thus requiring further planning work by the district confirm the suitability of the bulk infrastructure. According to the Zululand District Municipality Growth and Development Strategy, 2017, there are currently 14 440 backlogs with regard to the provision of sanitation infrastructure.

10. PUBLIC PARTICIPATION PROCESS

The Public Participation Process (PPP) is a requirement in terms of the 2014 and 2017 EIA Regulations of the National Environmental Management Act, 1998 (Act 107 of 1998) and it forms an integral part of any EIA process. This section provides information pertaining to the PPP that was conducted by 1World Consultants during this Basic Assessment Process. The purpose of this process is to gather information from the community and relevant Stakeholders that could ultimately affect the decision-making process concerning the construction and operational phases of the development. The community and public have been identified as I&APs (Interested and Affected Parties) and have been given the opportunity to participate in this process. Their comments, whether positive or negative, will influence the decision of the Authorities and the developer's final actions.

10.1 Objectives of the PPP

The PPP has the following objectives:

- To inform I&APs as well as all Stakeholders of the development and the BA application;
- To provide an opportunity for I&APs and Stakeholders to raise concerns and make suggestions;
- To promote transparency and an understanding of the project and its consequences;
- To serve as a structure for liaison and communication with I&APs and Stakeholders.

Any conclusions agreed upon must be socially, financially and technically acceptable and feasible in order to meet the requirements of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), and the vision of the development.

10.2 Public Participation Process Followed

The following PPP was conducted for the development in light of the basic assessment:

10.3 Background Information Document (BID)

Stakeholders and Interested and Affected Parties (I&AP's) were identified and notified of the Draft BAR. A Background Information Document (BID) was prepared and distributed to stakeholders and I&AP's which provides an outline of the development and aims to:

(i) inform I&AP's on how to participate in the public participation processes,
(ii) encourage responses to documents that will be distributed for review, and
(iii) encourage I&AP's to attend any public meetings.

A copy of the distribution list and BID are included under Appendix D.

10.4 Newspaper Advertisement

A newspaper advertisement was published to inform the public of the proposed Bhokwe Community Sanitation Project. The advertisement was published in the predominant language of the project area, Isizulu and English, in the Zululand Observer, on 10 February 2020. A copy of the advertisement will be included in the final BAR.

10.5 Site Notice Boards

Site notice boards have been erected on the site and in close proximity to the development site on Thursday, 6 February 2020. The notice boards have been provided in Isizulu with illustrations of the plan.

Six notice board were erected on site at the following locations:

Table 10: Location of Site Notice Boards

No.:	Description of Location	Co-ordinates
1	Start Point of Reticulation Route	27°48'40.65"S 31° 6'3.77"E
2	Bhokwe School (Community Centre)	27°48'44.17"S 31° 6'18.96"E
3	Identified Wetland	27°48'42.66"S 31° 6'15.58"E
4	Near proposed Pipe Bridge	27°48'42.66"S 31° 6'15.58"E
5	End Point Near Tie-In	27°48'43.66"S 31° 5'59.46"E
6	Near proposed sewer pond	27°48'45.64"S 31° 5'54.45"E

A copy of the site notice board and pictures can be reviewed in Appendix D of the Final Basic Assessment Report. The purpose of the notice board is to inform the community members of the proposed BA Application and the proposed sewer reticulation project. Contact details of the EAP are also provided to facilitate public participation.

10.6 Landowner Notifications

Interested and Affected Parties (I&APs) were identified and notified of the Basic Assessment. A Background Information Document (BID) was distributed on Tuesday, 09 July 2019. The BID provided information on the proposed development, the site and on the process to be followed by the EAP. The residents where are made aware of the project via the appointed social facilitators, and community leaders.

10.7 Public Meeting

None requested or required meetings following distribution of the BID, publication of the advertisement and erection of the notice boards up to date of distribution of this Draft BAR.

Issues Raised by the I&APs

Copies of the Draft BAR were circulated to the following I&APs for review and comment:

- KZN Department of Transport
- Ezemvelo KZN Wildlife
- Department of Water and Sanitation
- AMAFA KZN Heritage
- KZN Corporate Governance and Traditional Affairs
- Commission on Restitution of Land Rights

- KZN Department of Economic Development, Tourism and Environmental Affairs
- AbaQulusi Municipality (various departments)
- Zululand District Municipality
- Municipal Infrastructure Support Agency
- Community Trust Leaders
- Ward Councilor – Ward 05

All registered I&APs were notified on the availability of the Draft BAR and of the deadline for comment. All I&APs were reminded that in terms of the EIA Regulations (2017), GNR 326 43(2), all State Departments that administer a law relating to a matter affecting the environment, specific to the Application, must submit comments within 30 days to the Environmental Assessment Practitioner (1World Consultants (Pty) Ltd). Should no comment be received within the 30-day commenting period, it is to be assumed that the relevant State Department has no comment to provide.

All comments received on the BID are summarised below and those following the distribution of Draft BAR will be inserted in the Final BAR. The full report is provided as the Comments and Responses Report in Appendix D.

Issues/ Comments Raised Following Review of the BID

No issues and comments were raised following the BID review.

Issues/ Comments Raised Following Review of the DBAR

Any issues or comments raised will be recorded in the Final BAR.

Issues/ Comments Raised Following the Pre-application Meeting:

No issues and comments were raised following the pre-application meeting.

Issues Raised by Landowners:

No issues were raised by the Igalelo or Mnyathi community trustees.

As per the National Environmental Management Act, 1998 and GNR 326 of the EIA Regulations (2017), the Bhokwe Community Sanitation project is a linear activity. A **Linear Activity** means: - an activity that is arranged in or extending along one or more properties and which affects the environment or any aspect of the environment along the course of the activity, and includes railways, roads, canals, channels, funiculars, pipelines, conveyor belts, cableways, power lines, fences, runways, aircraft landing strips, firebreaks and telecommunication lines.

11. IMPACT ASSESSMENT

11.1 Methodology

EIA Regulation GNR 326 (2017) prescribes the requirements and aims of environmental impact assessments. In terms of the regulations, the following objectives are specified:

- Determine the nature, significance, consequence, extent, duration and probability of impacts; and
- The degree to which these impacts:
  - Can be reversed,
  - May cause irreplaceable loss of resources, and
  - Can be avoided, managed or mitigated

The impacts of any development including the construction and operational phases are identified, using the following definitions:

Term	Description
significant Impact	*an impact that may have a notable effect on one or more of the aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds or targets and is determined through rating the positive and negative effects of an impact on the environment based on criteria such as duration, magnitude, intensity and probability of occurrence.*
cumulative impact	*In relation to an activity, means the past, present and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.*

The potential impacts are listed and assessed for significance. Significance is assessed by scoring each impact based on four variables viz. probability, severity, duration and spatial impact. The four variables, with their score criteria are detailed below:

Frequency/ Probability (FR)
(Frequency or likelihood of activities impacting on the environment)

- 1: Almost Never / impossible
- 2: Very seldom / highly unlikely
- 3: Infrequent / Seldom
- 4: Often / Regular
- 5: daily / Highly regular

Severity (SV)
(Degree of change to the baseline environment in terms of reversibility of impact; Sensitivity of receptor, duration of impact and threat to environment and health standards)

- 1: Insignificant / not harmful / totally reversible
- 2: Small / potentially harmful / reversible within 05 years
- 3: Significant / slightly harmful / needs specific mitigation to reverse in a time span of between 05 and 15 years
- 4: Great / harmful / irreversible
- 5: Disastrous / extremely harmful / totally irreversible and damaging

Duration (DR)
(Length of time over which activities will cause change to the environment)

- 1: One day to a month
- 2: One month to a year
- 3: One year to ten years
- 4: Life of project
- 5: Post closure

Spatial Scope (SS)
(Geographic overage)

- 1: Activity Specific
- 2: Site specific
- 3: Area
- 4: Regional
- 5: National

The impacts are also scored taking any mitigation into consideration. The impacts are scored and scaled for significance as follows:

- **Negligible** (scoring of 3 or less) – The impact is unimportant / indiscernible and hence insignificant – little or no mitigation adequately addresses the impact.
- **Low** (scoring of 4 to 9) – The impact is of little importance since it is easily and adequately mitigated.
- **Medium** (scoring of 10 to 15) – The impact is considerable and requires adequate mitigation to reduce potential damage to the environment.
- **High** (scoring of 16 or more) – the impact is adverse and may never be adequately mitigated. The impact has a high probability of causing cumulative effects of other less significant impacts. It may be considered to be a fatal flaw of the project and requires intense consideration.

11.2 Impacts Identified

The impacts of the construction and operational phases for the proposed Bhokwe Community Sanitation Project, in Bhokwe, are summarised in the Tables below.

The duration of the construction phase is estimated to take 15 months.

Table 11.2.1: General Construction Activities Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**General Construction Activities** Potential harm to the environment due to workers or contractors being unaware of how their activities may impact the environment or due to unauthorised access to the site.	Direct	**Without**	5	5	2	3	14	**Medium**
			With	3	3	2	2	10	**Medium**
			Mitigation measures: • The contractor is to ensure that all employees, including sub-contractors and their employees, are required to attend on-site Environmental Awareness Training prior to commencing work on site. • Follow-up Environmental Awareness Training may be required from time to time as new subcontractors or crews commence work or for specific activities that may potentially impact the environment, or if work is being undertaken in sensitive environments. • The contractor is to maintain accurate records of any training undertaken. • Training is to cover all aspects of the EMPr, procedures to be followed, the sensitivity of the site and importance of adhering to “no-go” areas. • The ECO shall monitor the contractor’s compliance with the requirement to provide sufficient environmental awareness training to all site staff. • Environmental signage is to be displayed on the site including – “no smoking”, “fire hazards”, etc. • Emergency numbers are to be clearly displayed. • Access to fuel and other equipment stores is to be strictly controlled.						
Construction	**Storage, mixing, and disposal of cement and concrete** Potential water pollution and damage to stormwater infrastructure due to incorrect	Direct	**Without**	4	3	2	2	11	**Medium**
			With	3	2	1	2	8	**Low**
			Mitigation measures: • No mixing of concrete or cement directly on the ground is permitted. The mixing of concrete will only be done on a mixing tray or on impermeable sheeting. This is to avoid damage to existing infrastructure and built environment. • Ready-mix trucks are not permitted to clean chutes on site. Cleaning into foundations or a dedicated cleaning pit is permitted. • Bricklayers and plasterers are to minimise any cement spill or runoff in their work area and are to ensure that the work area is cleaned of all cement spillage at the end of each workday.						

	management of concrete and cement.		• Both used and unused cement bags are to be stored in weatherproof containers so as not to be affected by rain or runoff. • Contaminated soil resulting from concrete or cement spills, Must be considered as hazardous waste and must be contained and stored on-site in an appropriate container for no more than 24 hours before being disposed of at a registered waste disposal site. • Clean stormwater must be kept away from areas where it could be contaminated and must be directed to the stormwater drainage system.

Table 11.2.2: Groundwater and surface water impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Clearing of areas for infrastructure:** Excavations for sewer reticulation and pond; construction of infrastructure; site stormwater management; operation of vehicles on site; stockpiling of soils; and storage area.	Direct	**Without**	4	4	3	3	14	**Medium**
			With	2	1	2	2	7	**Low**
			Mitigation measures: • The stormwater management design for the area must be evaluated to ensure that dirty water does not flow from the site into the stormwater drainage channels. • The contractor is to adhere to and implement the SWMP. • The earthworks operation must be carried out by a suitably qualified contractor. • Clearing of indigenous vegetation must be kept to a minimum. • Sediment trapping berms and temporary erosion control measures must be implemented during the construction phase. • During the construction phase vehicles and machinery must make use of existing access routes, before adjacent areas are considered for access. • Storage areas must be clearly demarcated and located away from open drainage infrastructure. • During construction contractors used for the project must have spill kits available to ensure that any fuel or oil spills are cleaned-up and discarded correctly. • All machinery and equipment must be inspected regularly for faults and possible leaks, these must be serviced off-site. • All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials must be supported.						
Construction		Direct	**Without**	2	2	2	2	8	**Low**
			With	2	1	1	1	5	**Low**

	The cleaning of vehicles, equipment and construction areas.		**Mitigation measures:** • No washing of vehicles or equipment is permitted on site. • Cleaning of equipment is to take place within designated areas. • A dedicated cleaning area is to be demarcated to facilitate washing of all cement and painting equipment. • No wastewater may be disposed on site, onto soil or into any water body. • Soil contaminated with hazardous substances, fuel or oil shall be treated as hazardous waste and removed from site. • Clean stormwater must be kept away from areas where it could be contaminated and must be directed to the stormwater drainage system. With correct implementation of these mitigation measure, the frequency can be reduced from a regular occurrence to seldom occurrences. While severity will be reduced from slightly harmful to potentially harmful.						
Operational	Potential contamination of groundwater due to sewage leaks and spills.	Direct	**Without**	5	3	4	4	16	**High**
			With	2	2	2	2	8	**Low**
			Mitigation measures: • A Spill Contingency or Emergency Response Plan must be prepared prior to the commencement of the operation of the Sewage Treatment Plant. • A suitable test must be performed on the reticulation infrastructure prior to commissioning of the facility to ensure that there are no leaks in the reticulation. • The infrastructure (manholes) must be monitored for overflows / blockages on a regular basis so that immediate corrective action can be taken by the operator of the infrastructure. • Monitoring of the reticulation pipes and oxidation ponds must be required to ensure that leakages are prevented during the operational phase.						

Table 11.2.3: Soil Erosion and Stormwater Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Soil Erosion**	Direct	**Without**	**5**	**2**	**3**	**4**	**14**	**Medium**
			With	**3**	**2**	**2**	**3**	**10**	**Low**

	Soil erosion of disturbed and unconsolidated soil in construction footprints and stockpiles		**Mitigation measures:** • Material lay-down areas, access routes, and No-Go areas should be clearly demarcated. • In order to limit vegetation disturbance outside the construction footprints, in particular, downslope of the excavated trenches, it is recommended that all excavated material be stockpiled upslope of the excavations. • Stormwater on the site must be controlled for the duration of the construction phase by employing appropriate temporary stormwater control structures e.g. cut-off berms. • Topsoil should be cleared in a phased manner to avoid large areas of unconsolidated soils. • Topsoil should be removed and stockpiled in an appropriate manner: - Stockpiled separately from subsoil, monitored for- and protected from erosion, kept clear of exotic vegetation • In order to limit vegetation disturbance outside the construction footprints, in particular, downslope of the excavated trenches, it is recommended that all excavated material be stockpiled upslope of the excavations • Re-vegetated areas should be watered until vegetation has become established. • Should erosion scars begin to form on the landscape, erosion counter measures should be implemented immediately. • Minimise the extent of disturbances in high risk areas. This is probably best achieved through hand excavation and backfilling of trenches. Otherwise strict control and use of the smallest machines possible should occur. • Ensure that work occurs during the dry periods and that appropriate erosion protection (sand bags, berms etc,) is used to protect the works during wet periods. • Soil management and rehabilitation is also important in order to ensure that vegetative cover established over the backfilled trench/ disturbed areas as rapidly as possible. • Erosion control and development disturbance should be an important monitoring facet falling under the control of an Environmental Control Officer (ECO), who should be appointed to implement the environmental management programme (EMPr) during the construction and site rehabilitation phases of this project.						
Construction	**Stormwater management** Increased soil erosion by wind and water due to the removal of the vegetation.	Cumulative	**Without**	3	3	3	3	12	**Medium**
			With	2	2	2	2	8	**Low**
			Mitigation measures: • The contractor is to adhere to and implement the SWMP. • Limit vegetation disturbance outside the construction footprints. • Stormwater on the site must be controlled for the duration of the construction phase by employing appropriate temporary stormwater control structures e.g. cut-off berms. • Cleared areas must be re-vegetated (grassed) as soon as possible after the installation of sewage reticulation.						

			- The earthworks operation must be carried out by a suitably qualified contractor. - Clean storm water must be kept away from ablution facilities where it could be contaminated and must be directed to the storm water drainage system. - The designs have allowed for sufficient stormwater drainage. Drainage channels must be lined to reduce the flow and velocity of stormwater runoff (where necessary). - Erosion monitoring must be carried out at the sites where the sewerage reticulation has been installed through the drainage lines to ensure that the reticulation does not become exposed.

Table 11.2.4: Vegetative Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Clearance of site –** Loss of degraded vegetation during site clearance and potential disturbance of natural vegetation on No-Go areas.	Direct	**Without**	5	4	2	3	14	**Medium**
			With	2	2	2	2	10	**Medium**
			Mitigation measures: - Before any construction takes place the proposed area for the reservoir construction and camp laydown areas will be pegged out. All construction activities will be limited to these areas in order to reduce the footprint of the proposed activity and avoid impact on adjacent natural vegetation and animal life. - All sensitive environments or "no-go" areas are to be demarcated with danger-tape or temporary barrier fence. - All demarcation is to be regularly maintained and remain in place for the duration of the work on site. - Site clearing is to be limited to only the area necessary for carrying out the specified works. - The contractor is to draw up a plan for submission to the ECO indicating the locations of construction infrastructure including the paint or cement cleaning pits, toilets and "no-go" areas. - No unauthorised entry, stockpiling, dumping or storage of equipment in "no-go" areas, or outside the site boundary is permitted. - All construction activities, plant, labour and materials are to be restricted within the site boundary. - Disturbed areas should be rehabilitated once the construction activities have ended. - Vegetation clearance must be phased to ensure that the minimum area of soil is exposed to potential erosion at any one time.						
			Without	**3**	**4**	**5**	**4**	**16**	**High**

	Stockpiling of topsoil and cleared vegetation- Potential loss of valuable vegetation		**With**	**2**	**3**	**4**	**4**	**13**	**Medium**
			• Topsoil is to be stockpiled at the construction camp laydown area and retained for future landscaping efforts. • Topsoil stockpiles shall not exceed 2m in height and shall be protected from wind, erosion and runoff by covering with a suitable fabric approved by the ECO. Once earthworks are complete, disturbed areas are to be re-vegetated or rehabilitated. • Cleared indigenous vegetation can be stockpiled separately for possible reuse in later rehabilitation or landscaping, or as a brush pack for erosion prevention. • Stockpiles of vegetation are only to be located in areas approved by the ECO and may not exceed 2m in height. Methods of stacking must take cognizance of the possible creation of a fire hazard. • No burning of stockpiled vegetation is permitted. • The contractor is to ensure that all reasonable measures are taken to limit erosion and sedimentation from construction activities. Erosion protection measures include the use of sand bags and/or berms. • Any sub-soil or rocks removed should also be stockpiled separately and be used during the rehabilitation. • Once the construction activities have been completed, the remaining disturbed area must be top soiled, sloped and re-vegetated as soon as possible using suitable grass species. This re-vegetation will assist in reducing the potential of erosion. If sterilization of the topsoil during stockpiling has occurred inorganic fertilizers will be used to supplement the soils before seeding of the area takes place. Compacted soil should be ripped to ensure effective re-vegetation. • Any erosion channels developed during the construction period or during vegetation establishment period must be backfilled and compacted, and the areas restored to a proper condition						
Construction	• Flora- Species of conservation importance is expected to occur within the proposed corridor • Fauna- Species of conservation importance are expected to occur	Direct	**Without**	**3**	**5**	**2**	**3**	**13**	**Medium**
			With	**2**	**3**	**2**	**3**	**10**	**Low**
			Mitigation measures: • A pre-construction walk-through to identify any species of conservation importance must be undertaken with officials from EPCPD and Parks, Recreation and Culture (PRC) close to the commencement of works on site. This will be used to identify any species of conservation importance that may have occupied the site after the compilation of the biodiversity report. This must be done to finalise permit applications and any additional species that may need to be added or retracted from the species list found within the biodiversity report. • Prior to the clearing of sites, the ECO and the Biodiversity Specialist must ensure that all plants of conservation significance are removed; these plants can be replanted in nature reserves or otherwise stipulated by the appointed ECO,						

	within the proposed corridor		etc. Construction workers should take added precautions when engaging in maintenance and repair activities, so as to not cause significant damage to the vegetation and animals within the site area. • Prior to construction and vegetation clearance, a rescue and recovery programme should be initiated to remove any rare or threatened plant species along the proposed upgraded areas. • The applicant/ developer must take note of the species of trees found within the CBA areas that cannot be transplanted (maturity and species dependent) and the same species types must be used in post-construction rehabilitation. • Alien Invasive Plant Management Plan must be implemented on an ongoing basis to limit the establishment of exotic species during all the phases of development. • The ECO must supply the Contractor with list of problematic alien invasive plant species that are likely to occupy the site during construction. • Construction staff and vehicles must stick to the construction area and not be allowed to access sensitive areas. • Monitoring of all sites disturbed by construction activities must be done for colonisation by exotics or invasive plants and control these as they emerge. This requirement is in fulfilment of the terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004). Areas which have been disturbed will be quickly colonised by invasive alien plant species. • All trenches and deep excavations must always be clearly demarcated and barricaded on site. • All trenches and deep excavations must be checked daily while open for animals, which may be unable to get out. • Any animals found must be returned uninjured to suitable safe habitat. • Hunting and trapping of any animals by staff must be prohibited. This includes reptiles which must be handled by a professional. • Noise levels including vibrations caused by drilling must be kept to a minimum to prevent animals abandoning nearby habitats. • Harvesting of plants for medicinal use is prohibited. • During the construction phase workers must be limited to areas under construction within the site boundary and access to the undeveloped areas, especially forested pockets must be strictly regulated ("no-go" areas during construction as well as operational activities). • Sealant, coatings, adhesives and glazing's, can be toxic to flora and fauna, if released into the environment. Therefore, the products used must be stored and used carefully, to save resources as well as protect the environment. • The ECO is to ensure that a list of any indigenous trees/ shrubs which are to be removed is provided; this list must include the tree/ shrub species and the number of each species. • All 'rescued trees/ shrubs' must be utilised in the rehabilitation of areas affected by the project; this must be over seen by

			the ECO. • Severe contractual fines must be imposed and immediate dismissal on any contract employee who is found attempting to snare or otherwise harms remaining faunal species.

Table 11.2.5: Hydrology Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Reduction in Hydrophylic vegetation** Removal of vegetation from the crossing of HGM 1 and 2 impacting the area	Direct	**Without**	**5**	**2**	**3**	**4**	**14**	**Medium**
			With	**3**	**2**	**2**	**3**	**10**	**Low**
			Mitigation measures: • Prior to any construction activity, the boundary of each crossing point at both wetlands and channels by the proposed pipeline must be demarcated. • Existing disturbed corridors exist in both wetland systems where the original contractor dug the pipeline trench. These disturbed areas must be utilised. • Construction camps must be located outside of wetland and watercourse systems. • Protect as much indigenous vegetation as possible. Remove invasive alien species where construction activities occur and replace with indigenous vegetation. The pipeline route must be rehabilitated with appropriate indigenous species. • Keep the work servitude as narrow as possible, at all crossing points and this must be clearly demarcated. Movement by workers and machinery outside of this servitude must be prohibited. The reduction of disturbance within the wetland systems will increase the likelihood of success of the rehabilitation phase. • If any vegetation is present within disturbed areas, a rescue and storage operation of hydrophytic vegetation prior to construction must occur. This vegetation must be stored during the construction phase and replaced after construction in this area is completed. This must be conducted with input from a suitably qualified wetland ecologist or ECO. • Rehabilitation must be aimed at improving the status and function of the ecosystem, i.e. through the removal of invasive alien species and the planting of indigenous species, as well as increasing the basal cover. • Site preparation: • Utilise erosion and sediment control techniques where needed. • Loosen the soil by hand. • Should the re-vegetation with existing vegetation be unsuccessful, seeding and planting with appropriate species must						

<table>
<tr><td></td><td></td><td></td><td colspan="7">occur. This must be done in consultation with a qualified wetland ecologist and supervised by the ECO.
• Plant when the weather will permit e.g. suitable temperatures and moisture for plant growth. Spring plantings give the best results.
• On unstable soils use a soil saver such as fibre netting or a fibre mat or geotextiles such as soil cells. The sloped area must then be seeded and the mat placed on top to protect the bare soil.
• The recovery of vegetation along the pipeline route must be monitored and where re-vegetation is observed to not be occurring, then further remedial measures must be implemented.</td></tr>
<tr><td rowspan="3">**Construction**</td><td rowspan="3">**Soil erosion and sedimentation within the wetland system**

Construction activities (i.e. excavations and vegetation clearing) within the site will expose soil to environmental factors including rainfall and wind.</td><td rowspan="3">Direct</td><td>**Without**</td><td>3</td><td>3</td><td>3</td><td>3</td><td>12</td><td>**Medium**</td></tr>
<tr><td>**With**</td><td>2</td><td>2</td><td>2</td><td>2</td><td>8</td><td>**Low**</td></tr>
<tr><td colspan="7">**Mitigation measures:**
• The pipeline must not interfere with surface water movement leading to erosion. This is particularly so where the pipeline will cross HGM 1 and HGM 2. It is understood that a series of piers will be constructed within HGM 1 and the pipeline will cross this seep above ground. This is the preferred crossing method in order to protect the integrity of the seep at this point.
• Use existing tracks and roads to gain access to the work servitude as much as possible.
• When soil is excavated for the pipeline trench, the topsoil and subsoil must be separated.
• In the event of infilling, replacement of subsoil must precede the topsoil replacement, and all material must be well compacted.
• No stockpiling of any materials may take place within or directly adjacent to the wetland systems.
• Erosion control measures must be implemented in areas sensitive to erosion such as near water supply points, edges of slopes, etc. These measures include but are not limited to - sand bags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes.
• Install sediment barriers across the entire construction right of way, particularly when working in close proximity to HGM 1 and HGM 2. This will help to prevent sediment flow into the wetlands.
• Do not dig the pipeline trench during a storm event and install the pipeline within the wetlands during a dry period. This will reduce sediment movement and allow for quicker rehabilitation of the area.
• Disturbed sites must be rehabilitated as soon as construction in an area is complete or near complete and not left until the end of the project to be rehabilitated.
• Vegetation clearing must be kept as limited as possible to prevent excess sediment movement during rainfall.</td></tr>
</table>

Table 11.2.6: Traffic Pressures and Access

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Increased Traffic Frequency on Road Infrastructure**: Potential wear of access roads, potential accidents on access roads, potential unpermitted transport of materials and potential loss of materials being transported on the access roads.	Direct	**Without**	5	4	4	4	17	**High**
			With	4	2	3	3	12	**Medium**
			Mitigation measures: • Ensure that all construction vehicles are roadworthy. • All loads are to be securely fastened when being transported. • All speed limits and other traffic regulations on the public roadways must be adhered to. • Seatbelts are always to be worn. • Construction vehicles and personnel must adhere to business hours. This may be relaxed to accommodate abnormal vehicles, so they may not hinder daily life and/or regular traffic. • Construction vehicles to use predetermined and agreed routes to and from site. • Pointsmen to guide traffic for entry and exit of construction vehicles must be used where required. • Safety measures such as appropriate pavements, speed humps, signage boards for construction site and vehicles and for workmen will be implemented to slow down traffic within the development. • Construction phase must be as short as possible. Reliable building contractors must be employed to avoid delays. • Vehicles must park on demarcated site only.						

Table 11.2.7: Air Quality (i.e. dust emission)

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Dust emissions**	Direct	**Without**	4	4	2	3	13	**Medium**
			With	3	3	1	3	10	**Medium**

	- Construction vehicles travelling to and from the site will result in the generation of dust and fumes. - Construction activities will result in dust emissions from debris piles, mobile plant/ machinery and clearance of vegetation.		**Mitigation measures:** - All areas impacted by construction shall be regularly maintained including roads and pavements. - Dusty roads on dry windy days must be watered to prevent excessive dust generation. - Dust dispersion from construction activities, roads and soil stockpiles will be limited and suppressed to the maximum extent practical. - Stockpiles must be situated away from the site boundary, watercourses and nearby receptors. - Speed bumps or traffic speed signs need to be erected to reduce speeding onsite, which could result in the generation of dust. - All machinery, plant and equipment must be in good working order. - Regular maintenance of vehicles to address wear of tires and breaks. Optimal engine combustion will allow for 'cleaner' exhaust emissions. Mitigation measures listed above will aid in reducing the frequency and severity to seldom and slightly harmful respectively.						
Construction	**Installation and use of ablution facilities** Release of odours as a result of the chemical toilets on-site	Direct	**Without**	4	4	2	3	13	**Medium**
			With	3	3	1	2	9	**Low**
			Mitigation measures: - Chemical toilets must be cleaned on a regular weekly basis. - Servicing receipts must be maintained and kept on site within the site environmental file. - Sufficient ablution facilities shall be provided – minimum of 1 toilet per 20 workers. - Toilets must have properly closing doors and supplied with toilet paper. - The location of toilets must be approved by the ECO prior to site establishment but shall be located within 100m of any work front and 50m from the edge of a wetland. - Chemical toilets are to be serviced weekly. The contractor is to ensure that no spillage occurs and that the contents are removed from site according to approved methods. - Chemical toilets are to be emptied prior to temporary site closure for a period longer than 4 days.						
Operation	Air quality from sewer pond system	Cumulative	**Without**	3	4	5	4	16	**High**
			With	2	2	4	3	11	**Medium**
			Mitigation measures:						

			• Regular maintenance must be done to ensure the oxidation process is running efficiently • Any blockage or leakage must be reported and attended to immediately and must be documented. • Air quality monitoring must be done on a monthly basis on areas surrounding the oxidation ponds.

Table 11.2.8: Resource Utilisation Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Utilisation of resources such as electricity, water, oil, grease, fuel and construction materials** Potential wastage of valuable resources due to inefficient or redundant usage. Potential wastage of water and depletion of water resource as a result of poor management.	Indirect	**Without**	3	3	3	3	12	**Medium**
			With	2	2	2	2	8	**Low**
			Mitigation measures: • Regular maintenance and inspection of equipment, such as water pipes, to prevent leaks. • Regular site inspection by supervisors. • Proper environmental training and awareness. • Leaking water taps and hosepipes are to be repaired immediately. • Running water taps and hosepipes are not to be left unattended. • Unused water standpipes are to be buried to prevent damage and resultant water leaks. • Taps are to be attached to secured supports and used in preference to standpipes with no valve mechanism to open and close water supply. All hose and tap connections are to be fitted with correct and appropriate plumbing fittings.						
Operational	**Resource use during operational** Potential wastage of valuable resources due to inefficient or redundant use.	Cumulative	**Without**	2	2	2	2	8	**Low**
			With	1	1	2	1	5	**Low**
			Mitigation measures: • Regular maintenance and inspection of equipment, such as pipes, to prevent leakages or blockages. • Regular site inspection by supervisors. • Proper environmental training and awareness. • Leaking taps and hose pipes are to be repaired immediately.						

			• Running water taps and hosepipes are not to be left unattended. The impacts with mitigation will be further reduced from being potentially harmful to becoming insignificant.

Table 11.2.9: Waste Management Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Production of general waste and personal hygiene:** Construction and site personal waste generation.	Direct	**Without**	5	4	4	3	16	**High**
			With	3	2	2	2	9	**Low**
			Mitigation measures: • Personnel must be trained in etiquette regarding littering and waste management. • Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid). • A hazardous waste disposal certificate must be obtained from the waste removal company as evidence of correct disposal. • On-site chemical toilets will be provided for domestic purposes during construction phase. The should be screened from the neighbours as far as practically possible. • The contractors will be responsible for the maintenance of the chemical toilets. • Waste will be collected by an accredited waste company and disposed of at an appropriate and licensed waste disposal facility. • Proper management and disposal of personal waste must occur during the construction of the development. • Littering is prohibited and general housekeeping must be enforced. • All liquid fuels (petrol and diesel) are to be stored in tanks or containers with lids. • In the case of a spill of hydrocarbons, chemicals or bituminous, the spill should be contained and cleaned up and the material together with any contaminated soil collected and disposed of as hazardous waste to minimize pollution risk.						
Construction	**Production of general waste and building rubble Impact:**	Direct	**Without**	5	3	2	2	12	**Medium**
			With	2	2	1	1	6	**Low**
			Mitigation measures: • Refuse skips can be used but also need to be covered with shade cloth to ensure the containment of waste.						

	Soil, surface water and ground water contamination due to general waste generated.		• Refuse bins shall be provided for domestic waste (lunch litter) and placed in designated eating areas and any other areas where deemed necessary to control littering. • Refuse bins are not to overflow and are to be emptied regularly. No littering is permitted on site. • Building rubble is to be kept separate from other construction waste. Rubble is to be kept clean of brick ties, plastics, papers and cement bags at all times. • Proper management and disposal of construction waste must occur during the construction of the development. • Rubble stockpiles and refuse structures shall be positioned to permit easy access by removal trucks. • Accumulation of large stockpiles of rubble and waste is not permitted. Waste is to be removed at regular intervals at a minimum frequency of once a week. • All waste is to be disposed of at approved landfill sites, no burning or burying is permitted.

Table 11.2.10: Noise Impact

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Potential disturbance or nuisance to neighbours** as a result of the increase in ambient noise from construction vehicles and machinery.	Direct	**Without**	5	2	4	3	14	**Medium**
			With	3	1	3	2	9	**Low**
			Mitigation measures: • The site workers and contractors will adhere to the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993). • Personnel must be trained in etiquette regarding noise and trespassing, as well as in health issues and occupational safety. • Site inductions should cover the importance of noise control and available noise reduction measures. • Regular maintenance of vehicles and equipment. • All plant and machinery are to be fitted with adequate silencers. • Working hours must be restricted to daylight hours. • Working procedures must be structured so as to avoid the unnecessary generation of noise. • No sound amplification equipment such as sirens, loud hailers or hooters are to be used on site except in emergencies and no amplified music is permitted on site.						

			• If work is to be undertaken outside of normal working hours permission must be obtained from the Project Engineer and ECO • Construction staff working in an area where the 8 hour ambient noise levels exceeds 85 dBA must hace appropriate Personal Protective Equipment (PPE). • No noisy work is to be conducted over the weekends or on religious public holidays. • No noisy work is to be conducted over the weekends or on religious public holidays. • Route construction related traffic along roadways that will cause least disturbance. • A registered contractor providing a project schedule must be employed. Penalties for extending the timeline could be enforced to try and minimise the period of impact. • Electrically powered equipment instead of pneumatic or internal combustion powered equipment shall be used, where feasible; • Reduce operating periods for particularly noisy activities, to provide respite periods; • Where noise from equipment is highly directional, equipment should be directed in such a way that noise is minimised at sensitive receptors; • Shut down equipment which are not required (no unnecessary idling for extended periods); • Construction site speed limits shall be established and enforced during the construction period; • The use of noise-producing signals, including horns, whistles, alarms, and bells shall be for safety warning purposes only;						
Operational	**Increase in ambient noise level** as a result of operating pond system	Direct	**Without**	4	2	5	4	15	**Medium**
			With	3	1	4	3	11	**Low**
			Mitigation measures: • Ensure infrastructure are well serviced and maintained to provide noisy working system • Make sure that the workers on site stick to the prescribed working hours. • Keep equipment in good repair and attend to lose or rattling covers, worn bearings and broken equipment.						

Table 11.2.11: Visual Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Visual Impacts** An untidy site is visually unappealing.	Direct	**Without**	5	3	3	3	14	**Medium**
			With	4	1	2	2	9	**Low**
			Mitigation measures: • The site area must be well maintained and neat. • The contractor must adhere to project schedule in order to minimise the length of the construction period. • Inspections of the site by an Environmental Control Officer are required. • There is to be strict ban on any construction activities outside of the development area. • All stockpiles of buildings materials are to be protected against dispersion into the surrounding terrain. • All builders' rubble is to be removed from the site timeously and dumped at a registered dump site. • Minimize vegetation clearing and use a phased approach, only clearing vegetation when required. • Where possible, natural vegetation in all areas outside of the proposed development footprint should be retained. Particular attention should be given to retain or re-establish large trees. • All construction scars are to be rehabilitated immediately after construction is complete.						

Table 11.2.12: Health and Safety Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Injury to construction workers and the general public** Occupational safety, security and health for construction workers and the general public.	Direct	**Without**	5	3	4	3	15	**Medium**
			With	4	2	3	2	11	**Medium**
			Mitigation measures: • Where possible, natural vegetation in all areas outside of the proposed development footprint should be retained. Particular attention should be given to retain or re-establish large trees. • All procedures and equipment must eb accordance with the Occupational Health and Saefty Regulations (OHSA) of South Africa, Act No. 85 of 1993. The contractor must familiarise himself and his employees with the contents of the aforementioned legislation. • Nearby residents must be made aware of the works. • Trenches must not be left open and unmarked.						

			• Appropriate barricades and signs must be used where necessary. • First aid kits are required on site as well as an incident records file. • Construction related vehicles must adhere to speed limits of the surrounding roads. • Safety gear including hard hats and safety shoes must be provided and worn at all times while on site. • Trespassing and/or utilising the site area as a thorough fare is prohibited by unauthorised persons. • Contractor staff are prohibited from trespassing over the site boundaries. • Equipment is to be maintained in good working order to the satisfaction of local fire authorities. • No open fires are permitted. A dedicated braai facility may be permitted in an area approved by the ECO, if the campsite is in close proximity to firefighting equipment. At no time is a braai fire to be left unattended. • Smoking is prohibited near places where any readily combustible or flammable materials are present. Notices are to be prominently displayed prohibiting smoking in such areas. • Welding, flame cutting, and other hot work is only to be undertaken in places where the necessary safety precautions are in place (i.e. not near potential sources of combustion and with a fire extinguisher immediately accessible). • All flammable materials are to be stored in a suitable, lockable storage area. • Combustible materials may not accumulate on the construction site. • Interaction with neighbours and objecting parties at the site must be well documented. A complaints register must be readily available on site. Interaction with external parties must be courteous. • Although the Contractor is responsible for ensuring that the environmental awareness training of staff members is put in place, it must be the direct responsibility of the appointed ECO to carry out the training. Each staff member is to sign a register confirming their attendance at this training. This register must be included in the site Environmental file.						
Operational	**Sewer Pond** Injury to public, animals and safety concerns	Direct	**Without**	4	4	5	4	17	**High**
			With	3	2	4	3	12	**Medium**
			Mitigation Measures: • The sewer pond must have a clearly marked boundary wall. • Access must be limited to staff only • Signage clearly indicating the location of the sewer pond must be made to the public • Adequate lighting to clearly visual the sewer pond at night must be available						

Table 11.2.13: Fossil material

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	Construction related impacts on potential undiscovered archaeological material or artefacts on site.	Direct	**Without**	2	3	2	4	11	Medium
			With	2	1	1	1	5	**Low**
			Mitigation Measures: • It is recommended that in the unlikely event that any archaeological materials are exposed during the development, it should be reported immediately to the nearest museum/archaeologist or to the South African Heritage Resources Agency so that a systematic and professional investigation can be undertaken. • If any evidence of archaeological sites or artefact, palaeontological fossils, graves or other heritage resources are found during development or construction, SAHRA and an accredited professional archaeologist or palaeontologist must be alerted immediately. • If the newly discovered heritage resources prove to be of archaeological significance a phase 2 rescue operation might be necessary at the cost of the developer. Sufficient time must be allowed to remove / collect such material. • Site foremen should be informed before vegetation clearing and construction commences on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites: i.e. human skeletal material, mussel middens, stone artefacts, fossil bone, stone features and historical artefacts or features.						
Construction	Fossilised material may be uncovered and/or destroyed during excavations for the proposed development.	Direct	**Without**	**3**	**3**	2	**4**	**12**	**Medium**
			With	2	1	1	1	5	**Low**
			Mitigation Measures: • The sewer pond must have a clearly marked boundary wall. • Access must be limited to staff only • Should substantial fossil remains be exposed during vegetation clearing and construction, the ECO should safeguard these, preferably in situ, and alert SAHRA as soon as possible so that appropriate action (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. • If any evidence of archaeological sites or artefact, palaeontological fossils, graves or other heritage resources are found during development, SAHRA and an accredited professional archaeologist or palaeontologist must be alerted immediately. • ECO to monitor excavations of deeper than 1.5m into bedrock during construction, with recording and collection of any fossil remains. • Education of ECO, foremen and personnel about potential fossil heritage on site.						

			• A protocol for handling fossil material exposed during development should be developed by the palaeontologist responsible in collaboration with the ECO. • The palaeontologist will need to apply beforehand for a collecting permit from SAHRA for which an approved depository for any fossil material collected will need to be designated. • Sufficient time must be allowed to remove/collect such material.

Table 11.2.14: Disturbance to Local Businesses

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	**Existing Infrastructure Disturbance:** the roads, footpaths and crossings are infrastructure that are utilised by the community. Water, electricity, telecommunications, roads and railway infrastructure must also be considered.	Direct	**Without**	3	3	4	4	14	**Medium**
			With	2	2	3	3	10	**Medium**
			Mitigation measures: • Stakeholders must be notified as soon as possible. This includes the community, the municipalities, the service providers and ward councillor. • Servitudes of infrastructure must be confirmed prior to design of the development and permission granted. • No-Go areas must be demarcated. • Contractors staff are to stay within development area and not wonder onto neighbouring sites.						

Table 11.2.15: Socio Economic Impacts

Phase	Potential Impact	Impact Type	Mitigation	Frequency	Severity	Duration	Spatial Scope	Impact Score	Significance
Construction	Job creation and possible economic	Cumulative	**Without**	2	2	2	2	8	**Low**
			With	2	1	1	1	5	**Low**

	benefit to construction material suppliers in the area.		**Mitigation measures:** - Community members and leaders must be notified as soon as possible by posting notice boards with illustrations on site. - Local people should be employed where possible - Ward councilors must be involved in the public participation. - All recruitment must be in-line with Employment Equity Policy. - Employment of local labour must follow appropriate employment procedures in discussion with the municipality and traditional leadership in the area. - Where possible, priority must be given to job seekers from the local area.						
Construction	**Crime:** Theft and security impact	Cumulative	**Without**	4	3	5	4	16	**HIgh**
			With	3	2	4	3	12	**Medium**
			Mitigation measures: - Strict penalties must be built into tenders to deal with issues such as petty crime, fence cutting, trespassing etc. - A security guard will be appointed as a security measure. - A security fence will be erected around the site office boundary to prevent the possibility of theft.						
Operational	Additional employment opportunities	Cumulative	**Without**	2	2	2	2	8	**Low**
			With	2	1	1	1	5	**Low**
			Mitigation measures: - Increase employment for local people during the running of the sewer oxidation system						

11.3 Significance of Impacts

Construction Phase:

Based on the outcome of the impact assessment matrix noted in the Tables above, the overall significance of the impacts with mitigation measures for the construction phase, is noted to be **LOW** i.e. the impact is reasonable but requires mitigation to reduce potential impacts to the environment.

According to the socio-economic study, the project will have a positive impact on the lives of the Bhokwe Community, contributing to the sustainable development goals in the process. Further, two graduates from the local community will be employed and trained through the construction phase of the project, creating social upliftment.

The traffic impacts and health and safety impacts are noted to be MEDIUM and must therefore be deliberated in the EMPr. Mitigation measures are expected to be implemented to reduce these impacts.

Operational Phase:

Based on the outcome of the impact assessment matrix noted in the tables above, the overall significance of the impacts with mitigation measures for the operational phase, is noted to be **LOW** i.e. The impact is reasonable but requires mitigation to reduce potential impacts to the environment.

The proposed project primary function is to provide a safe sewage reticulation and treatment works to the local community of Bhokwe. Protection of the water resources and stormwater must be protected against contamination or spillage.

13. SUMMARY OF SPECIALIST STUDY AND FINDINGS

13.1 Wetland Delineation and Functional Assessment

Malachite Ecological Services was appointed to undertake a Wetland Impact Assessment for this project. The primary aim of the study is to provide a description of the current ecological integrity and impacts pertaining to any water resources occurring within the assessment area as well as providing appropriate management recommendations to reduce any identified impacts on the delineated systems.

The objectives of the study were as follows:

- Identify and delineate any wetland and/or watercourse systems within the defined study site as well as within a 500m assessment area according to the Department of Water Affairs and Forestry2 “Practical field procedure for the identification and delineation of wetlands and riparian areas”.

- Classify the identified wetland habitats and/or watercourses in accordance with the latest approach; ‘Classification System for Wetlands and other Aquatic Ecosystems in South Africa’ (Ollis et al., 2013).

- Determine the Present Ecological State score (PES) and Functional Integrity of any identified wetlands using the WET-Health and Wet-EcoServices approach.

- Determine the Ecological Importance and Sensitivity (EIS) of the identified wetlands.

- Identify current and possible negative impacts on any identified wetlands/watercourses. Recommend mitigation measures to lessen these impacts on wetlands or watercourses delineated within the study site and the implementation of suitable rehabilitation measures.

Typically, surface water attributed to wetland systems, rivers and riparian habitats comprise an important component of natural landscapes. These systems are often characterised by high levels of biodiversity and fulfil various ecosystems functions. As a result, these systems are protected under various pieces of legislation including; the National Water Act, 1998 (Act No. 36 of 1998) and the National Environmental Management Act, 1998 (Act No. 107 of 1998).

Based on the current identification of the four wetland indicators, five HGM units were delineated within the 500m assessment area. Only HGM units 1 and 2 were assessed in this report as they will be impacted by the proposed project.

The reticulation pipelines will cross HGM 1 and HGM 2, however the oxidation ponds are situated outside of any wetlands systems and the recommended 60m buffer.

HGM units 1 and 2 were assessed with regards to the health according to the Wet-Health methodology. HGM unit 1 is classified as Seriously Modified (PES Category E), while HGM 2 is classified as Largely Modified (PES Category D). Ecosystem goods and services were calculated for both HGM units. Both HGM units received low to moderate scores with regards to ecosystem services. The Ecological Importance and Sensitivity scores received for the HGM units is Low.

Common impacts associated with pipeline projects include erosion and sedimentation of impacted wetlands, reduction in hydrophytic vegetation where the pipeline will be laid, pollution of the wetlands, and the encroachment of alien invasive species as a result of the disturbance.

The Risk Assessment for the proposed project was undertaken in accordance with the General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21 (c) and (i) (Notice 509 of 2016). Impacts associated with the sanitation project received Low Risk Scores with impacts to the water resources and resource quality being small and easily mitigated. This is due to the disturbed nature of the wetlands along the pipeline route as a result of a previous contractor which dug the trenches but did not complete the job. Low risk scores are provided all mitigation measures recommended in this report form part of the Environmental Management Programme for the project. The installation of the reticulation pipes provides an opportunity for the rehabilitation of the area disturbed by the previous contractor and it is the author’s recommendation that the proposed project is approved.

The full report can be reviewed under Appendix E.

13.2 Heritage Impact Assessment

JLB Consulting was appointed to Undertake a Phase 1 Heritage Impact Assessment in order to determine the possible existence of heritage resources that could be impacted by the proposed sanitation project. Provide mitigation measures to limit or avoid the impact of the proposed project on heritage resources (if any).

The length of the pipeline is 2.2 km in length hence it triggers section 41 (1)(a) of the KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No 5 of 2018) which lists developments or activities that may require an HIA. The relevant section of the Act refers to the following development: *"the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length"*.

In addition, the ponds comprising the wastewater treatment system are 11 812m² in size hence triggering section 41 (1)(c)(i) of the same Act that refers to *any development or other activity which will change the character of a site exceeding 5 000m²*.

In addition, the proposed project may impact on graves, structures, archaeological and palaeontological resources that are protected in terms of sections 37, 38, 39, and 40 of the KwaZulu-Natal Amafa and Research Institute Act, 2018.

In terms of section 3 of the NHRA, heritage resources are:

(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 natural features of cultural significance;

(e) geological sites of scientific or cultural importance;

(f) archaeological and paleontological sites;

(g) graves and burial grounds, including—

(i) ancestral graves;

(ii) royal graves and graves of traditional leaders;

(iii) graves of victims of conflict;

(iv) graves of individuals designated by the Minister by notice in the *Gazette*;

(v) historical graves and cemeteries; and

(vi) other human remains which are not covered in terms of the Human Tissue Act, 1983

(Act No. 65 of 1983);

(h) of significance relating to the history of slavery in South Africa;

(i) movable objects, including:

(i) objects recovered from the soil or waters of South Africa, including archaeological and

palaeontological objects and material, meteorites and rare geological specimens;

(ii) objects to which oral traditions are attached or which are associated with living heritage;

(iii) ethnographic art and objects;

(iv) military objects;

(v) objects of decorative or fine art;

(vi) objects of scientific or technological interest; and

(vii) books, records, documents, photographic positives and negatives, graphic, film or video

material or sound recordings, excluding those that are public records as defined in section 1(xiv)

of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

An inspection of the project area was undertaken on 02 July 2019. Visibility was good and the specialist spoke to several residents in terms of the presence of heritage resources.

The pipeline and components of the water treatment system were inspected on foot. Many buildings within the village have been dismantled with only the foundations and some walls remaining. A resident told the specialist that when the mine ceased production, the owner, Anglo- American, dismantled the buildings and took useful building material with them. Some of the existing buildings could be older than 60 years but will not be impacted by the proposed development. The areas where the pipeline has been laid and is to be laid is disturbed by roads and residential activity.

Two residents told the specialist that the Municipality did not want burials within the village and the residents use a cemetery situated a distance from the village to bury their dead.

The section of pipeline that has already been laid was inspected as well as trenches that had already been dug but not used as yet. The associated infrastructure for the sanitation and water project were clearly visible including yellow markers indicating the alignment of pipelines. Much of the pipeline runs along the road before entering properties. No impacted heritage resources were found along the sections of laid pipeline.

Some alignments of the pipelines that comprise the sanitation project could run close to structures that could be older than 60 years. Structures over 60 years are protected by section 37 (1)(a) of the Amafa and Research Institute Act (2018), which states that no structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without prior written approval of the Institute having been obtained on written application to the Institute. It is therefore recommended that the pipeline alignments avoid impacting on structures. A Fossil Chance Find Protocol, as included in Chapter 8 of the desktop palaeontological study, must be added to the (EMPr).

The full report can be reviewed under Appendix E.

13.3 Biodiversity Impact Assessment

Malachite Ecological Services was appointed by 1World Consultants to conduct a biodiversity assessment for the proposed project. Broad-scale vegetation within the project area is associated with Paulpietersburg Moist Grassland (Gm15) and Northern Zululand Mistbelt Grassland (Gs1). Although not within the project area, the northern boundary is classified an Irreplaceable Critical Biodiversity Area and extends into an Ecological Support Area (KZN: BSP). The majority of the sanitation project occurs within the Bhokwe village and as such large portions have been transformed through housing, gardens, internal roads, verges, dumping of waste, compaction of soils, spread of invasive alien vegetation and continued disturbance. The vegetation communities within the village have been completely transformed. *Acacia mearnsii* plantations have replaced large portions of grasslands extending southwards of the project area. Remaining grassland systems were isolated and degraded to some extent. Invasive alien vegetation was noted throughout the project area, with high densities occurring within areas largely associated with anthropogenic disturbances such as road reserves, erosion gullies, infrastructure developments where rehabilitation measures have not been successful and historically cultivated lands.

The primary aim of the investigation is to assess vegetation communities present within the project area through a site investigation and impact assessment. Further to this, an assessment of faunal communities associated with the project area was also conducted. The findings of this assessment must be used in conjunction with other specialist assessments to ensure the project has a limited impact on the receiving environment.

Taking into consideration the nature of the proposed sanitation project, impacts are likely associated with the degradation of habitats surrounding the reticulation route and further encroachment of invasive alien vegetation. However, as represented in this assessment large portions of habitats within the project area are associated with the Bhokwe village whilst adjacent habitats have experienced a high degree of transformation through edge effects. Therefore, given the nature and location of the project coupled with the site-specific impacts and proposed mitigation opportunities, the specialist is of the opinion that impacts arising can be mitigated to an acceptably low level.

The full report can be reviewed under Appendix E.

13.4 Stormwater Management Plan

The objectives of the Storm Water Management Plan (SWMP) are:

- To minimise the threat of flooding;
- Protect watercourses; and
- Ensure proper disposal of storm water.

Storm water control measures pre- and post-construction will be discussed further in section 14.4 below.

The SWMP can reviewed under Appendix E.

13.5 Geotechnical Investigation

iLZ Consulting was appointed to carry out a Geotechnical investigation for the project. The objective of the investigation was to complete a geotechnical investigation of the site giving: -

- The soil/rock profiles.
- The engineering properties of the near surface soils.
- An assessment of the near surface soils for their use as bedding and backfill material.
- Bearing capacity of the soil/rock;
- Design parameters for embankments; and
- Comments on any perceived geotechnical problems that may affect either the design or construction of the proposed structures.

The investigation concluded that the site is suitable for the proposed development, provided that the recommendations provided are adhered to.

The full report can be reviewed under Appendix E.

13.6 Socio-economic Impact Assessment

This Socio-economic Impact Assessment (SIA) was undertaken by Real Consulting and focuses on the impacts on the receiving environment of the installation of sewer infrastructure, specifically including the areas surrounding the proposed intervention.

The SEIA is based therefore on the following:

- A broader understanding of the context that would inform the *desirability* of the proposed intervention (in this case the sanitation infrastructure close to a residential village);
- A broader understanding of the areas around the site, from a socioeconomic, spatial, political and cultural perspective, at varying degrees of proximity to the development site.
- A detailed understanding of the proposed intervention itself.
- A detailed understanding of the proposed site of development.
- An investigation into the potential socioeconomic impacts of the development on the surrounding communities, addressing such issues as the following:
    - Quality of life impacts – on standard of living, sense of place, aesthetics and heritage, perception of belonging, security and liveability, and aspirations for the future.
    - Lifestyle impacts – on the way people live, behave and relate as communities.
    - Cultural impacts – on shared customs, obligations, values, language, religious belief and other elements which make a social or ethnic group distinct.
    - Community impacts – on infrastructure, services, voluntary organisations, activity networks and social cohesion.
    - Health impacts – on mental, physical and social well-being, in general terms.

This Socio-Economic Impact Assessment has looked at the project in the context of a small rural village in a somewhat under-developed local municipality in a district with limited economic infrastructure. It has noted the legislative and political context of sanitation as a basic service, in a time where service delivery has become a political rallying point. The summary statement regarding the impacts of this Project is that it is positive in every way and will add real value to the quality of life of the residents of Bhokwe Village.

The full report can be reviewed under Appendix E.

13.7 Geohydrological Investigation

Geomeasure group were appointed to undertake a geohydrological investigation to determine the status of the groundwater prior to development of the proposed project. The report followed three steps: a desktop assessment, a hydrocensus investigation and data evaluation and reporting.

The scope of work is detailed hereafter:

Phase A – Initial Desktop Assessment

- Identification and delineation of all surface water sources / bodies in proximity to the site
- Assessment of any applicable existing reports / information pertaining to the project, should they be available
- Desktop study of, and collation of information pertaining to, the geology and geohydrology of the area
- Undertaking of a desktop hydrocensus within a 5 km radius of the site, utilising the Department of Water and Sanitation (DWS) KwaZulu-Natal Groundwater Resource Information Database (GRIP), the DWS National Groundwater Archives (NGA) and in-house (Geom) borehole database
- Assessment of DWS-mapped structures in proximity to the site, in accordance with the regional geological map
- Assessment of other relevant GIS data and mapping information pertaining to the site and this project

Phase B – Hydrocensus Investigation

- Site walkover inspection and reconnaissance of the receiving environment to identify surface and subsurface migration pathways as well as potential receptors located in the ward.
- Performance of a hydrocensus with the aim of identifying functional and abandoned groundwater, spring and surface water sources within the ward and gathering the following information, where possible
- borehole ages, depths, construction types, water strikes, static water levels, equipment and volumes of water currently being abstracted groundwater and surface water physical parameters, including temperature, pH, electrical conductivity (EC) levels and total dissolved solids (TDS) concentrations
- Collection of up to six (6) water samples from boreholes / springs and possibly surface water sources located within the ward for submission to a SANAS-accredited laboratory for analysis according to the abbreviated SANS 241: 2015 suite of determinants with the addition of ammonia (NH3), free and saline ammonia and ammonium (NH4), to allow for the assessment of baseline water quality on-site / within the study area.
- Identification and delineation of existing point-source pollution sources within the study area, should any be in evidence

Phase C – Data Evaluation and Reporting

- Preparation of a geohydrological investigation report, where the following will be included:
    - field investigation methodologies and applicable principles
    - results of the hydrocensus, including the position of, and distance to, identified groundwater sources as well as the gathered pertinent groundwater field characteristics
    - inferred geology and geohydrology of the area, through the inclusion of gathered field data, laboratory data and the available desktop information
    - possible impacts of this project on the downstream environment and groundwater resources in its vicinity, and any existing geohydrological constraints
    - compilation of detailed maps showing water sources and pollution sources
    - interpretation of the water quality results from the selected water sources within the ward
    - interpretation of field and desktop data to give estimated anticipated water table levels
    - identification of the geohydrological risks
    - recommendations for potentially significant impacts

The full report can be reviewed under Appendix E.

13.8 Paleontological Impact Assessment

A palaeontological Impact Assessment was undertaken by Professor Marion Bamford, of the University of the Witwatersrand, to comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA).

The full report can be reviewed under Appendix E.

13.9 Hydropedological Impact Assessment

The Biodiversity Company was commissioned to conduct a hydropedological level two (2) assessment for the proposed Wastewater Treatment Works (WWTW) and associated pipeline infrastructure.

The scope of work is as follows:

A hydropedology assessment on a local scale, a hillslope scale or a catchment scale must be completed in cases where the infiltration or sub-surface hydrology is expected to be affected by a proposed activity. A wide variety of services must be provided (i.e. modelling, classification of soil, hydropedological soil types and hillslope hydrology), depending on the intensity of the proposed activity. The following terms of reference has been identified to meet the criteria of such a hydropedology assessment:

- Conduct field work to acquire information regarding soil physical properties and
- morphology of soils;
- Construct conceptual models of hydrological response for each of the transects based on hydropedological interpretations;
- Assess dominant hydropedological flow paths through the dominant soil forms/associations;
- Determine (conceptually) the extent of disturbance to the natural hydropedological
- model; and
- Compile a report which includes recommendations and conclusions regarding the proposed activity to ultimately inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making.

. **The full report can be reviewed under Appendix E.**

13. ENVIRONMENTAL IMPACT STATEMENT

In terms of Government Regulation Notice 326: Environmental Impact Assessment Regulations, the environmental practitioner is required to provide an opinion as to whether the activity should or should not be authorised. The assessment process has shown that the proposed development will not have any detrimental impacts on the environment but will contribute to socio-economic development in the area.

From a planning perspective, the development complies with the relevant plans and policies.

In terms of Geotechnical Impact, the site is considered GOOD. According to the geotechnical investigation and the fieldwork conducted, it is considered that the site, in the most part, is generally stable and suitable for development, provided that earthworks are carried out along the guidelines provided in SANS1200. However, the recommendations provided in the Geotechnical report under Appendix E must be adhered too.

In terms of social impacts, the proposed project is considered GOOD. The community will be provided with a reticulation system avoiding the need for pit latrines which cause blockages, bursts and environmental hazards. Workers will be first employed from the local community, creating community development and upliftment. The proposed project also leads to increased employment and job creation. The added service to the area will create increased opportunities for development.

In terms of environmental hazard to the surrounding environment, due to the sewer reticulation, the proposed project is considered GOOD, provided the measures outlined in the EMPr are adhered and followed. It will be the responsibility of the contractor to implement the EMPr and an ECO will be appointed.

In conclusion, the environmental practitioner is of the opinion that, based on socio economic and biophysical implications, the application as it is currently articulated in the proposal should proceed, provided the essential mitigation and monitoring measures are implemented while all the municipal by-laws are followed in totality.

14. IMPACT MANAGEMENT MEASURES FROM SPECIALIST STUDIES

14.1 Wetland Delineation and Functional Assessment

Wetland System:

- The pipeline must not interfere with surface water movement leading to erosion. This is particularly so where the pipeline will cross HGM 1 and HGM 2. It is understood that a series of piers will be constructed within HGM 1 and the pipeline will cross this seep above ground. This is the preferred crossing method in order to protect the integrity of the seep at this point.
- Use existing tracks and roads to gain access to the work servitude as much as possible.
- When soil is excavated for the pipeline trench, the topsoil and subsoil must be separated.
- In the event of infilling, replacement of subsoil must precede the topsoil replacement, and all material must be well compacted.
- No stockpiling of any materials may take place within or directly adjacent to the wetland systems.
- Erosion control measures must be implemented in areas sensitive to erosion such as near water supply points, edges of slopes, etc. These measures include but are not limited to - sand bags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes.
- Install sediment barriers across the entire construction right of way, particularly when working in close proximity to HGM 1 and HGM 2. This will help to prevent sediment flow into the wetlands.
- Do not dig the pipeline trench during a storm event and install the pipeline within the wetlands during a dry period. This will reduce sediment movement and allow for quicker rehabilitation of the area.
- Disturbed sites must be rehabilitated as soon as construction in an area is complete or near complete and not left until the end of the project to be rehabilitated.
- Vegetation clearing must be kept as limited as possible to prevent excess sediment movement during rainfall.

Hydrophic Vegetation:

- Prior to any construction activity, the boundary of each crossing point at both wetlands and channels by the proposed pipeline must be demarcated.
- Existing disturbed corridors exist in both wetland systems where the original contractor dug the pipeline trench. These disturbed areas must be utilised.
- Construction camps must be located outside of wetland and watercourse systems.
- Protect as much indigenous vegetation as possible. Remove invasive alien species where construction activities occur and replace with indigenous vegetation. The pipeline route must be rehabilitated with appropriate indigenous species.
- Keep the work servitude as narrow as possible, at all crossing points and this must be clearly demarcated. Movement by workers and machinery outside of this servitude must be prohibited. The reduction of disturbance within the wetland systems will increase the likelihood of success of the rehabilitation phase.
- If any vegetation is present within disturbed areas, a rescue and storage operation of hydrophytic vegetation prior to construction must occur. This vegetation must be stored during the construction phase and replaced after construction in this area is completed. This must be conducted with input from a suitably qualified wetland ecologist or ECO.

- Rehabilitation must be aimed at improving the status and function of the ecosystem, i.e. through the removal of invasive alien species and the planting of indigenous species, as well as increasing the basal cover.
- Site preparation:
  - Utilise erosion and sediment control techniques where needed.
  - Loosen the soil by hand.
  - Should the re-vegetation with existing vegetation be unsuccessful, seeding and planting with appropriate species must occur. This must be done in consultation with a qualified wetland ecologist and supervised by the ECO.
  - Plant when the weather will permit e.g. suitable temperatures and moisture for plant growth. Spring plantings give the best results.
  - On unstable soils use a soil saver such as fibre netting or a fibre mat or geotextiles such as soil cells. The sloped area must then be seeded and the mat placed on top to protect the bare soil.
  - The recovery of vegetation along the pipeline route must be monitored and where re-vegetation is observed to not be occurring, then further remedial measures must be implemented.

Pollution:

- All waste generated during construction is to be disposed of as per an Environmental Management Programme (EMPr) and washing of containers, wheelbarrows, spades, picks or any other equipment that has been contaminated with cement or chemicals in the wetland systems.
- Proper management and disposal of construction waste must occur during the construction of the development.
- No release of any substance i.e. cements, oil, or any other substance that could be toxic to fauna or faunal habitats within the wetland systems.
- Spillages of fuels, oils and other potentially harmful chemicals must be contained and cleaned up immediately. Contaminants must be properly drained and disposed of using proper solid/hazardous waste facilities (never to be disposed of within the natural environment). Any contaminated soil must be removed, and the affected area rehabilitated immediately.
- Monitoring of the reticulation pipes and oxidation ponds will be required to ensure that leakages are prevented during the operational phase.

Alien Vegetation:

- Construction staff and vehicles must stick to the construction area and not be allowed to access sensitive areas.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. This requirement is in fulfilment of the terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004). Areas which have been disturbed will be quickly colonised by invasive alien plant species.

14.2 Heritage Impact Assessment

- Workers should be made aware of the types of heritage resources, such as protected structures, that could be impacted by the construction of the sanitation project.
- For any chance heritage finds (graves, etc.), all work must cease in the area affected and the Contractor must immediately inform the Project Manager. A registered heritage specialist must be called to site to inspect the finding/s. The relevant heritage resource agency (the Institute) must be informed about the finding/s.
- The heritage specialist will assess the significance of the resource and provide guidance on the way forward.

- Permits must be obtained from the Institute if heritage resources are to be removed, destroyed or altered.
- Under no circumstances may any heritage material be destroyed or removed from the project site unless under direction of a heritage specialist.
- Should any recent remains be found on site that could potentially be human remains, the South African Police Service as well as the Institute must be contacted. No SAPS official may remove remains (recent or not) until the correct permit/s have been obtained.

14.3 Biodiversity Assessment and Report

Vegetation

- All construction activities must be carried out according to the generally accepted environmental best practice and the spatial footprint must be kept to a minimum.
- Retain as much natural vegetation as possible, removing it immediately ahead of construction activities. This will assist in the maintenance of groundcover and reduce erosion potential surrounding the working servitude.
- Where practical, existing roads must be used and driving 'off-road' in sensitive habitats (ie. Wetlands buffers) is prohibited.
- Avoid impacts to sensitive wetland systems (including the prescribed buffer zones). No dumping of waste into adjacent drainage systems.
- No further clearing of indigenous woody vegetation must occur within the drainage channel. The existing pipeline route must be utilised.
- Erosion control measures must be put in place during the construction phase in areas prone to erosion. These include slopes adjacent to the servitude, trenches and areas of exposed soils.
- Prevent spillages and should these occur they must be contained and treated immediately in
- accordance with the approved EMPr.
- Construction personnel, contractors etc must be informed of the following through an induction process:
  - Harvesting of species of conservation concern is prohibited
  - Areas where no vegetation clearing can take place
- Construction camps must be set up in areas of low ecological sensitivity (already disturbed habitats), taking into consideration buffers prescribed within this report and other specialist studies. There appears to be an existing construction camp within the village (set up by previous contractors) and this should be selected for the continuation of the project. Once the construction phase has been completed, disturbed areas must be rehabilitated and all waste materials, equipment must be removed. This includes the re-vegetation and seeding of the servitude with appropriate, locally sourced grass species to not only stabilize the soils but also to facilitate the recovery of vegetation. The implementation of an invasive alien management plan in terms of the National Environmental Management: Biodiversity Act. This plan must form part of an approved environmental management plan and should take into consideration:
  - Type and density of IAPs on site.
  - Control methods to be implemented ie. Hand pulling, ring-barking, foliar spraying etc.
  - Post removal follow up and rehabilitation.
  - Monitoring to determine success/failure. The pipeline servitude must be monitored and,should new invasive species be noted, these must be removed immediately.
- Topsoil and overburden stockpiles must be created. Top soils which are colonised by invasive alien vegetation must not be used during the rehabilitation of pipeline corridors/surrounding the oxidation pond site as the existing seed bed within the soil will facilitate continued invasive alien growth.
- Construction equipment must be cleaned on a regular basis.

- The spatial footprint of the project must be kept to a minimum (especially where the route traverses the drainage system). This can be achieved through the demarcation of the project footprint (including construction camps) as well as sensitive areas.

Oxidation pond:

- No wild animals may under any circumstance be handled, removed or be interfered with by construction workers or any personnel.
- The implementation of an environmental awareness programme for all construction personnel.
- The hunting or collection of fauna is prohibited.
- Disturbance should be contained within the project footprint and unnecessary disturbance to adjacent habitats must be avoided.
- Any faunal species located on the site during the construction phase, that are unable to evade construction (e.g. fossorial species), must be moved to a suitable location with optimal habitat.
- This should be undertaken by a suitable qualified ecologist/faunal specialist.

14.4 Stormwater Management Plan

Sandbag berms must be placed at regular intervals on all steep slopes on the trench line before and after backfilling in order to minimize erosion and contaminate stormwater runoff into water courses.

Contamination of surface water and stormwater must be well controlled. This can be achieved by managing activities such as mixing concrete on wooden boards in a plastic lined and bunded area and by reducing spills of hazardous substances.

When the trench line runs across sloping ground, the topsoil excavated from the trench must be stored on the down-slope side of the trench and the sub-soil on the up-slope side. This is important for two reasons, firstly, the larger volume of soil is stored upslope of the trench so that if soil fines and silt are washed off the stockpile during rainfall events, these are washed into the trench and not into a water course, and secondly, it is important to separate the two so that the topsoil is placed on top of the subsoil when the trench is backfilled. This is essential to promote rapid growth of vegetation during the rehabilitation phase.

Newly excavated pipeline trenches on steep slopes should have sandbag berms placed on either side of the trench line radiating out from the soil stockpiles at 10 m intervals. The berms should point very slightly downhill to prevent storm water build up. These berms will greatly reduce the volume of storm water polluted with silt and soil fines which could impact on rivers and streams below the pipelines and will minimize erosion of bare areas. Silt and soil fines that build up on the inside of these berms should be removed and placed back on the soil stockpiles. Stone packs should be placed at the discharge points at the ends of these berms to prevent erosion if necessary.

Once the trenches have been backfilled and the soil compacted, sandbag berms should be placed across the trench lines at 10 m intervals. Berms should be angled just off 90º to the slope to prevent the build up of storm water on the inside of the berm.

Surface water and stormwater must be minimised and not allowed to flow down cut or fill slopes or along pipeline routes without erosion protection measures, as previously discussed, being in place.

All overflow and scours channels shall be lined with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge must be at a point where there is dense natural grass cover.

Channels shall not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient.

All runoff shall be collected and channelled to discharge via surface spreaders into drainage lines.

Upon completion of backfilling, sandbag berms must be placed across the bare area created by the trench line. These berms must be angled just off 90º.

The intention is to have a minimum distance of open trench with stockpiled soils exposed to rainfall and storm water flow at any one time. It is essential that construction and rehabilitation is completed as quickly as is reasonably possible.

14.5 Geotechnical Investigation

- **None** of the insitu materials sampled meet the grading requirements for "Selected Granular Material" laid down in SABS 1200 LB (1983). Selected granular material is defined as *"granular, non-cohesive and singularly graded between 0.6mm and 19mm. The material must be free draining and have a compactability factor not exceeding 0.4"*. Therefore, all selected granular bedding material will need to be imported to the site.
- The majority of materials identified will not be suitable for "Selected Fill" purposes. Selected fill is defined as *"a material with a Plasticity Index (PI) not exceeding 6, free from lumps, vegetation and stones of a diameter exceeding 30mm"*. Therefore, most of the selected fill materials will also need to be imported to the site.
- All soil materials excavated from trenches may be used as general backfill over the bedding layers.
- Caution may be taken that, gravel and boulders consisting of excavated shale bedrock will disintegrate or exfoliate over time and will result in loss of backfill volume. It is recommended that where shale gravel/boulders are used for backfilling, the general backfill profile to the pipe be overbuilt to compensate for this.
- Compaction of the general backfill soils over the bedding layer should be carried out in layers maximum loose thickness 150mm and compacted to minimum 93% MAASHTO density. This is critical to ensure that settlement over pipes and within trench outlines is limited, particularly where they cross underneath roads or paved areas.
- Bedding material for pipe placement shall be non-frost susceptible material
- Before placing any bedding material the bottom of the trench shall be hand raked ahead of the pipe laying operation to remove stones and lumps which will interfere with smooth and complete bedding of the pipe.
- The specified bedding material shall then be placed in layer(s) the full width of the trench, each layer not exceeding eight inches in thickness loose measure, and compacted to 95% of maximum density as determined by AASHTO T 180 D, until the elevation of the plan grade for the pipe invert is attained.
- After the pipe has been laid and approved for covering, the specified bedding material shall be placed evenly on both sides of the pipe for the full width of the trench.
- After backfilling of the trench is completed, any excess material from trench excavation shall be hauled to a CONTRACTOR furnished disposal site off of the Project.
- It is important to ensure that soil removed from the trench is placed no closer than 1.5m from the edge of the trench. It is generally required that trenches deeper than 1.5m must be adequately shored where there is a possibility of collapse. With pipeline trenches in particular there is a tendency to open the trench over large lengths thereby increasing the risk of sidewall collapse. In any event there must be provision for safe access not more than every 50m along the trench length.

14.6 Socio-Economic Impact Assessment

- As a precautionary, local community leaders and security services must be informed of the start and finish of the construction phase.

- The construction service providers should ensure that their own equipment and vehicles are safeguarded during the construction phase.
- The construction teams must contact the councillor and make appropriate arrangements and maintain clear and constant communication.
- The Construction team must institute road safety measures within the community, briefing people of higher road use periods, and liaising with the primary school, crèche and clinic to institute road safety monitoring.
- The safety of learners, school staff and parents is critical. The developers must take all measures possible to ensure safety. School-based traffic education programmes must be carried out.
- No repeat of the previous contractors liquidation issues must be followed.

14.7 Geohydrological Study

- Design of the chosen treatment facility by a competent engineer.
- Construction of the facilities under the supervision of a competent engineer and using competent contractors.
- Provision of training to the site supervisors and staff to ensure the efficient management of the site once the site is developed.
- Regular groundwater monitoring to identify any impacts, so that they can be remediated as soon as possible.

14.8 Palaeontological Impact Assessment

- Fossil Chance Find Protocol should be added to the EMPr.
- If fossils are found once excavations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

14.9 Hydropedological Impact Assessment

- In the event that an attenuation pond will be installed to accommodate the Stormwater Management Plan (SWMP), water from the attenuation pond must be reintroduced into the watercourse by means of its natural hydropedological flow path, which in this case is recharge. This must be done by irrigating lawns and flower beds anywhere on the slope. The wetland areas must be demarcated to avoid irrigation on these areas.
- During the dry season, or any time the attenuation pond does not have enough water to supply sprinklers, manual labourers must make use of buckets to remove water from the attenuation ponds and irrigate the project area to avoid loss to evaporation, especially after rainfall events.

14.10 Method Statement

According to the method statement which is based on the assessment of the site area and the intended pipeline development, The following rehabilitation options were recommended for non-sensitive and sensitive areas;

- **Rehabilitation Non-Sensitive Areas**

  There are three rehabilitation options.

  The options are:

  - For gentle slopes (>1:10) and not in the path of high flows.

A product produced by Macafferri called Biomac will be installed, Biomac is a bio-degradable product used after reinstating banks and promotes vegetation growth. After the backfilling of the trench is complete the surrounding bank is then shaped and trimmed. A sheet of Biomac is then placed on this area and is anchored down by either steel or wooden pegs. Topsoil of about 20mm thick is then raked over and this area is then hydo-seeded.

- For steeper slopes (between 1:2 and 1:10) and where there is medium velocity flows

  A product produced by Macafferri called Mac-mat will be installed. Mac-mat is a woven mesh application which can take a tensile force of up to 30kN (kilonewtons) and is used after reinstating banks and promotes vegetation growth. After the backfilling of the sewer trench is complete the surrounding bank is then shaped and trimmed. A sheet of Mac-mat is then placed on this area and is anchored down by either steel or wooden pegs. Topsoil of about 20mm thick is then raked over and this area is then hydro seeded.

- For steeps banks ($> 1:2$) and in areas of high flows

  A stepped terrace of gabion baskets will be installed along the banks width, if required, Reno mattress will be constructed on the river bed at its existing level. This is specially for areas which run through private property were not much care or inadequate river protection was placed and as a result of flooding has washed away some of the banks.

- **Rehabilitation-Sensitive Areas**

  Rehabilitation for these areas will be in accordance with the EMPr and Plant Rescue and rehabilitation. The EMPr can be reviewed under Appendix F of this BAR.

15. CONDITION OF AUTHORISATION

In terms of Monitoring and Auditing, the following are recommended to ensure protection of the environment during construction:

- An ECO must monitor the construction site and activities on a monthly basis,
- An ECO must document the findings and submit a monthly report to the Competent Authority;
- The Project Manager and Contractor are responsible for the implementation of the EMPr and protection of the environment for the duration of the construction period.
- An ECO must monitor the facility on a bimonthly basis for the operational phase, for a period of 6 months following completion of construction to ensure that rehabilitation has been successful.

16. ASSUMPTIONS, UNCERTAINTIES AND GAPS IN THE KNOWLEDGE

Assumptions and limitations as per the **Wetland Delineation and Functional Assessment** are as follows:

- The findings, results, observations, conclusions and recommendations provided in this report are based on the author's best scientific and professional knowledge as well as available information regarding the perceived impacts on the water resources. The author, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document

- In order to obtain definitive data regarding the biodiversity, hydrology and functioning of rivers and wetlands, studies should ideally be conducted over a number of seasons and over a number of years. This study took place during a single site visit conducted on the 18th September 2019.
- Water resource boundaries are essentially based on GPS coordinate waypoints taken onsite of indicator features. The accuracy of the GPS device therefore affects the accuracy of the maps produced. A hand-held Garmin eTrex 30x was used to delineate the water resources and this has an accuracy of 3-6m.
- The assessment of the wetlands' Present Ecological State (PES), Functional Integrity (Wet-Ecoservices) and Ecological Importance and Sensitivity (EIS) was based on a single day field investigation. Once-off assessments such as this may potentially miss certain ecological information, thus limiting accuracy, detail and confidence.

Assumptions and limitations as per the **Geohydrological Assessment** are as follows:

- No groundwater samples from boreholes could be attained during the hydrocensus. However, three (3) spring / stream samples were attained and springs are defined as surface expressions of groundwater.

Assumptions and limitations as per the **Biodiversity Impact Assessment** are as follows:

- The current assessment focuses on a defined project area (as defined by 1World Consultants) and vegetation communities outside this area were not assessed.
- Modelled biodiversity databases have accuracy limitations and as a result, must be ground-truthed for verification.
- In order to obtain a comprehensive understanding of the dynamics and diversity of the biota on a site, including species of conservation concern, studies should include investigations through the different seasons of the year.
- A hand-held Garmin eTrex 30x was used to delineate the vegetation communities and record protected species and this has an accuracy of 3-6m.

17. RECOMMENDATIONS OF THE EAP

The information contained in this report and the documentation attached hereto, in the view of the EAP, is sufficient for the Public Participation Process (PPP). Should the Competent Authority request additional studies to be conducted, this shall be conducted and obtained to assist the Competent Authority in making and informed decision.

The EMPr, which includes recommended conditions and mitigation measures that should be considered for inclusion in any authorisation that may be granted by the competent authority in respect of the application, is provided.

Refer to Appendix F for a full Environmental Management Plan. The EMPr must be read in conjunction with the BAR.

18. TIMEFRAMES

An environmental authorisation is valid for five (05) years. Commencement of construction begin at any time within this 5-year period.

19. UNDERTAKING UNDER OATH OR AFFIRMATION BY THE EAP

(i) 1World Consultants (Pty) Ltd hereby confirms that the information provided in this Basic Assessment Report is correct at the time of the compilation and distribution for review. Input from specialists was utilised in the compilation of the Report.

(ii) 1World Consultants (Pty) Ltd confirms that all comments received from Stakeholder and I&APs have been included in this report. It is to be noted that in terms of the EIA Regulations (2014), GNR 982 43(2), all State Departments that administer a law relating to a matter affecting the environment, specific to the Application, must submit comments within 30 days to the EAP. Should no comment be received within the 30-day comment period, it will be assumed that the relevant State Department has no comment to provide.

(iii) All information from the specialist studies have been included in this Basic Assessment Report. Recommendations from the specialists have been included in the EMP.

(iv) All information and comments received in response to this Basic Assessment Report will be summarised and responded to in a final version of the Report, which will be submitted to EDTEA for consideration in terms of issuing Environmental Authorisation.

For 1World Consultants (Pty) Ltd:

Fatima Peer B.Sc. (Hons) Pr. Sci. Nat.
SENIOR ENVIRONMENTAL ASSESSMENT PRACTITIONER

APPENDICES

The following appendixes must be attached as appropriate:

Appendix	Description of Contents
A	WULA Directive for the proposed development Minutes of the Pre-application Meeting with EDTEA Acknowledgement of Receipt of the Application for Environmental Authorisation
B	Company Profile of EAP Project Experience of EAP EAP Declaration Curricula Vitae of EAP Team Specialist Declarations
C	Map 1: General Locality Map of Bhokwe and Surrounding Area Map 2: Locality Map of the Study Area, Bhokwe Map 3: Environmental Sensitivities Map 4: Proposed plans for the project Map 5: HGM units Method Statement Water Balance Report Preferred Layout Alternative
D	Distribution list Background Information Document Newspaper advertisement Copy of notice board Photograph of notice boards at site Comments and Responses Report Copies of correspondence with I&AP's
E	Wetland Delineation and Functional Assessment Heritage Impact Assessment Biodiversity Assessment and Report Storm Water Management Plan Geotechnical Investigation Geohydrological Investigation Hydro pedological Investigation Paleontological Investigation Socio Economic Impact Assessment
F	Draft Environmental Management Plan

Appendix A

1world consultants

Environmental & Engineering Consultants
Postal Address: P.O Box 2311, Westville, 3630
Tel: 031 262 8327
Fax: 086 726 3619

Date:	14 November 2019		
Time:	09:00-10:00		
Venue:	12th Floor, Department of Water and Sanitation, 88 Joe Slovo Street, Durban		
Attendees:	Colleen Moonsamy	(CM)	(Department of Water and Sanitation)
	Adila Gafoor	(AG)	(1World Consultants (Pty) Ltd)
	Graham Payne	(GP)	(TGC Engineers)

Proposed Bhokwe Community Sanitation Project: Key Points from DWS Pre-application Meeting

Client	Ukuza Consulting
Project Description	1World Consultants (Pty) Ltd have been appointed by Ukuza Consulting, to facilitate the required Water Use License Application, for the proposed construction of the Bhokwe Sewage Reticulation and Waste Water Treatment Works

A meeting was held to discuss the above-mentioned project with the DWS regarding the Water Use License Application.

The following key points should be noted:

1. **WULA vs GA:**
    a. DWS has confirmed that the project must follow the full WULA as the project involves sewage.
    b. CM has assured that DWS will assist in getting it approved quicker.

2. **Additional specialist studies requested:**
    a. Hydropedology Assessment – Hydropedology is the study of the soils unsaturated zone and the movement of water through a landscape at the hillslope level. By understanding these processes, DWS can link the surface water, wetland, and groundwater interactions.
        - The specialist has indicated that this study will be ready by the end of November.
        - Quotation attached to email. 1World charges a 15% handling fee above the specialist costs.

    b. Hydrology Assessment - Hydrology is the study of the amount and quality of water being stored or conveyed on the land surface, and in soils and rocks near the surface.
        - A hydrogeology assessment was initially provided by the Water Project, however this will not suffice for the hydrology assessment.
        - The specialist has indicated that due to various samples that need to be tested this study may only be ready in December.

  - Quotation attached to email. 1World charges a 15% handling fee above the specialist costs.
  - A water balance must be informed by a Hydrology Assessment. The application will not be accepted without these two studies incorporated.

3. **Oxidation Ponds :**
   a. CM does not want any discharge from the ponds. DWS would prefer that the ponds be enlarged so that there is no discharge to the reed beds. Therefore, negating the need for the reedbed system that was suggested by DWS in the first meeting. This is because in DWS previous experience, rural communities are likely to use the discharged water for irrigation and other gardening purposes (i.e. spreading contamination). This is to be avoided at all costs.
   b. DWS will not accept concrete lined pond and suggest either clay or HDPE Lining. The design as it stands will be rejected and the WULA not approved.

4. **Wetland Crossings:**
   a. Regardless of the concern brought up in the last meeting (i.e. contamination of aquifers by sewage leakage. Aquifer contamination would result in contamination of springs which feed the water pipeline project). DWS was fairly relaxed with the pipe encroachments into the wetlands.
   b. Adequate engineering mitigation measures to prevent the pipe being damaged etc. Typically this could be a sleeve around the pipes where they are in the wetland.
   c. Engineering mitigation measures must be provided in the civil design report together with updated drawings (please ensure that ONE clear and concise report is provided and not multiple design reports). This civil report will incorporated into the WULA technical report.

5. **Households in wetlands:**
   a. There is a house located in one of the wetlands (i.e. HGM2). DWS explicitly mentioned that they do not allow for houses to be constructed in wetlands therefore they will not allow for any connections to the house.
   b. DWS has reiterated that they will not be liable for damage to the house or any other impacts. In their previous experience people have gotten ill due to the high water tables and flooding of the houses which ultimately results in pollution of houses by raw sewage from the pipeline.
   c. CM had initially suggested that we try to move the house outside the wetland. The political situation in the area was explained, however, CM indicated that as a department they need to be covered.
   d. The license will include a condition to say that there should be NO HOUSES in the wetlands.
   e. The end result was to double encase the pipeline for additional protection. This should all be included in the engineering mitigations.

6. The WULA technical report must include all the houses within 500m of the identified wetlands. DW Forms must be filled for these as well.

7. **DW Forms:**
    a. The DW Forms are to be signed by ZDM and the affected landowners.
    b. In this instance the Igalelo Trust has given consent as the landowner.
    c. However, the title deed for the oxidation pond site shows that the landowner is not Igalelo Trust but is ***MNYATHI COMMUNITY TRUST-TRUSTEES.***
    d. Currently liaising with Mr. Mtshali from Igalelo Trust to get clarification.

8. **Water Pipeline Project:**
    a. DWS expressed concerns that of there is irregular water supply for the water pipeline project, this would result in lack of water for the sewage reticulation pipeline as well. This is a major concern for the operation phase of this project and must be addressed on the water project.

WULA PROJECT PROGRAM

		Months		
Item No.	**Description**	**November**	**December**	**January**
1	**CONSULTATIONS**			
1.1.	Consultation with DWS - Meeting to Determine Authorisation Required (as and when needed)	🟥	🟥	🟥
2	**SOURCING & COMPILING OF SUPPORTING DOCUMENTATION**			
2.1.	Source Project Information (landowner details etc.)	🟥		
2.2.	Clearance letter from the Department of Rural Development and Land Reform indicating that the property where the water uses are taking place are not under land claims.	🟥		
2.3.	Engineering Designs and Civil Report with mitigations	🟥		
3	**DW FORMS**			
3.1.	License application forms: Fully and correctly completed.	🟥	🟥	
4	**MAPPING**			
4.1.	Master Layout Plan	🟥		
4.2.	Additional Maps (Sensitivities Map, Locality Map, etc.)	🟥	🟥	
5	**PUBLIC PARICIPATION**			
5.1.	Landowner Consultation including preparation of forms.	🟥		
5.2.	Newspaper Adverts x2 (Zulu and English) - 60 days	🟥	🟥	
6	**Additional Specialist Studies**			
6.1.	Hydropedology Assessment	🟥		
6.3	Hydrology Assessment	🟥	🟥	
7	**TECHNICAL REPORT**			
7.1	Integrated Waste Water Management Plan (IWWMP)	🟥	🟥	

PROPOSAL FOR A HYDROLOGY STUDY OF THE WATERCOURSES ASSOCIATED WITH THE PROPOSED BHOKWE WWTW

TENDER REF

Email Request

DATE

12 November 2019

CLIENT

1World Consultants

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

1 Introduction

The Biodiversity Company received a request to compile a proposal to complete a hydrology study on the watercourses associated with the proposed Waste Water Treatment Works (WWTW) and associated pipelines in Bhokwe, KwaZulu-Natal. The assessment will be completed in support of the required environmental authorisation and water use licensing applications.

2 Methodology

2.1 Riverine Study

A single survey is proposed. The survey and reporting will be completed within 1 month of appointment.

2.1.1 Present Ecological Status of the River Reaches

The overall Present Ecological Status of the associated aquatic ecosystems will be determined using the River Eco-status Monitoring Programme (REMP) Ecological Classification manual (Kleynhans and Louw, 2007). The PES will be calculated based on the results of the various abovementioned biological indexes. The methods that will be utilised are summarised in the table below (**Table** 2-1).

Table 2-1: Summary of the proposed Riverine Ecology Methods

Aspect	Analyses
Water Quality	*In situ* (DWAF, 1996)
Habitat	Intermediate Habitat Integrity Assessment (Kleynhans, 1998) Integrated Habitat Assessment System (McMillan, 1998) Biotope assessment (Tate and Husted, 2015)
Biotic indices	SASS5 (Dickens and Graham, 2002); The Average Score Per Taxon (ASPT); Macroinvertebrate Response Assessment Index (MIRAI); (Thirion,2007) Fish Response Assessment Index (Kleynhans, 2007)

2.1.2 Riparian Delineation

The riparian delineation will be completed according to DWAF (2005a). Typical riparian cross sections and structures are provided in Figure 1. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Contour data obtained from topography spatial data was also utilised to support the infield assessment.

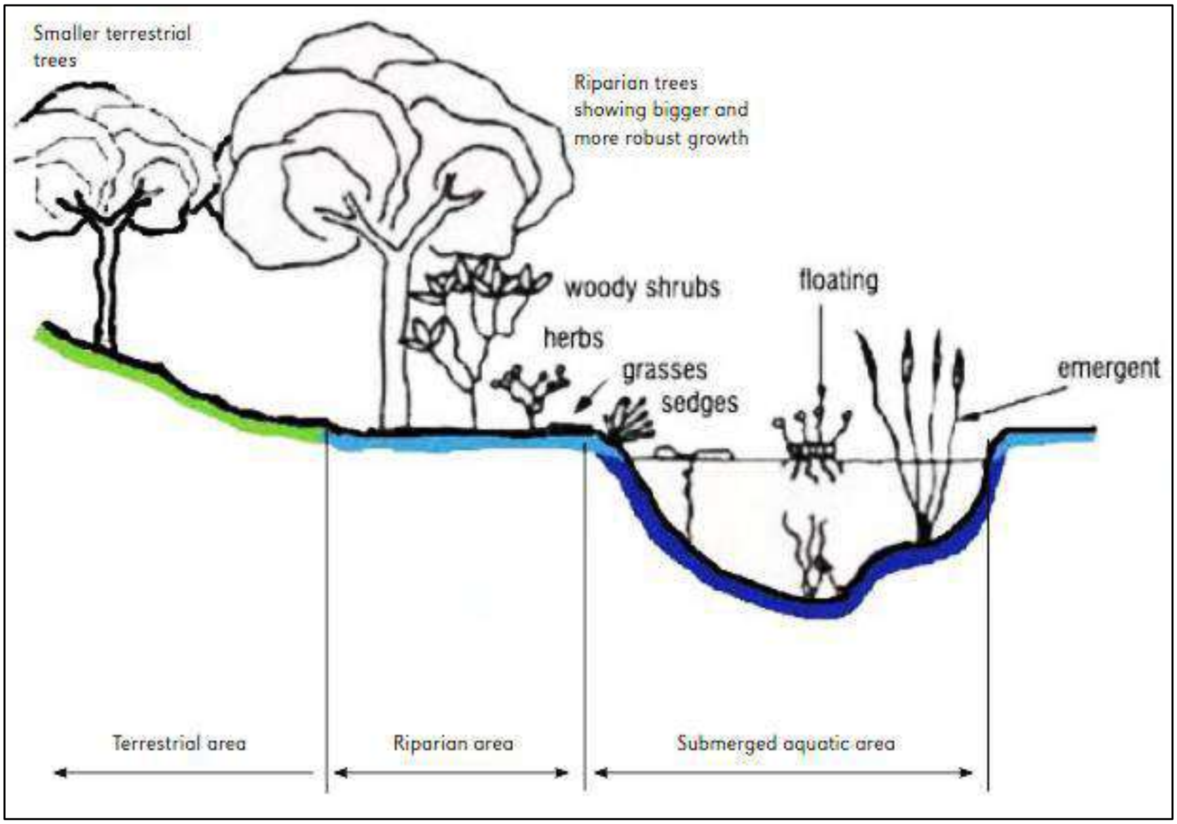

Figure 1: Riparian Habitat Delineations (DWAF, 2005a)

2.1.3 Hydrological Investigation

The considered watercourse is located on an ungauged river system. Therefore, standard hydrological yield models will be utilised to derive the discharge of the associated watercourses.

Through this generated data, the impact of the discharge of treated water into the watercourse can be derived. In addition, standard water chemistry analyses will be completed. Two samples will be obtained up and downstream of the proposed located of the reedbeds to derive the baseline water quality in the associated waterbody. Standard water quality constituents will be measured via this assessment and will be completed according to the data presented in Table 2-2.

Table 2-2: Measures to be applied in the hydrology study

Method	Reference
***In situ* Water Quality**	ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams
Chemical Analysis	DWAF Quality of domestic water supplies, Volume 02: Sampling Guide, 2003.

2.2 Risk Assessment

The risk assessment will be completed in accordance with the requirements of the DWS General Authorisation (GA) in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 509 of 2016).

3 Budget

Invoices will be submitted on a task completion basis. A breakdown of the budget is provided in Table 3-1.

Table 3-1: Breakdown of the budget

Survey (Travel and Subsistence)	R 4 000.00
Survey	R 4 000.00
Modelling	R 2 000.00
Water Samples (2 water samples)	R 2 000.00
Reporting	R 6 000.00
Review	R 1 000.00
Sub-Total (Excl VAT)	R 19 000.00
Total	R 21 850.00

4 Assumptions and Limitations

A budget has been prepared for activities outlined in this proposal. A number of assumptions were made in the development of this budget. These include:

- The timeframe for the completion of this report has been set for the 15th of December, delays in the approval of the project will result in this being moved to 2020.
- Time has been allocated for two reviews (and the addressing of comments), its is suggested that each review consist of a consolidated review for the respective reviewers. Should additional reviews be required, this may result in the request for a budget extension.
- Considering that the river system is located in an ungauged catchment, the hydrological modelling exercise will be of low confidence.
- The costs have excluded the printing of hard copies of the report.
- The costs exclude the attendance of meetings.

PROPOSAL FOR A LEVEL 2 HYDROPEDOLOGICAL ASSESSMENT FOR THE PROPOSED WWTW PROJECT

TENDER REF

Email Request

DATE

12 July 2019

CLIENT

1world consultants

Prepared by:

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1 INTRODUCTION

The Biodiversity Company received a request to compile a proposal to complete a hydropedology assessment for the proposed Waste Water Treatment Works (WWTW) facility in Bhokwe, KwaZulu-Natal. This will constitute a level 2 assessment. The assessment will be completed in support of the required environmental authorisation and water use licensing applications. The report will comply with Appendix 6 of the 2014 EIA Regulations (GNR. 982 of 2014).

1.1 Terms of Reference

The ToR of this proposal are based on the generic guidelines for hydropedology assessments (October 2017) as provided by the Department of Water and Sanitation. According to these guidelines a hydropedology study is required for the following:

- A hydropedological study is required whenever a geohydrological and/or hydrological study is required as hydropedology focus on the vadose zone between these focus areas. This is essential for a holistic understanding of the flow drivers in ecosystems and landscapes in order to propose sound mitigation for the impacts of the development. The hydropedological assessment includes parts of the hydrological cycle hidden between the land surface hydrology and groundwater hydrology.

Developments have different intensities (minor, moderate or severe) and spatial extent (local, hillslope or catchment) and the investigations vary accordingly (Table 1). Based on Table 1, a level 2 hydropedology assessment has been proposed due to the “minor” intensity associated with the proposed construction. There will be no quantification of flow rates, a requirement of a level 3 assessment.

Table 1: Selecting appropriate scale and intensity of the survey to match the impact of the development

INTENSITY	*AFFECTED AREA	SURVEY PRESCRIBED	Products in the report
Minor **Impact limited to <500 mm below surface.**	**Local**	Hydropedological interpretation of soil morphology of representative profile Observations on site.	1. Hydrological soil type. 2. Soil response to impact. 3. Advice for mitigation the risk.
	Hillslope	Hydropedological interpretation soil morphology including the soils of the hillslope. Interpretation of the transect survey.	1. As above. 2. Conceptual hydrological response of the hillslope. 3. Predicted response to the relevant activity. 4. Hazards indicated. 5. Level of risk indicated. 6. Advice on mitigation risk.
	Catchment	Hydropedological interpretation of soil morphology of the soils of the dominant hillslopes of the catchment interpreted from field observations of representative hillslopes.	1. As above. 2. Rating the contribution of hillslopes for its contribution to the wetland or river taking wetland controls into account.
Moderate **Impact >500mm distribute to other areas.**	**Local**	In addition to procedure under 'minor local' impacts: Quantify hydraulic conductivity as well as water retention characteristics of representative soil horizons	Additional information: quantification of flow rates and storage capacities
	Hillslope	In addition to procedure to under 'minor hillslope' impacts: Quantify hydraulic conductivity as well as water retention characteristics of the dominant (3 or more) soils profiles and horizons.	
	Catchment	In addition to the procedure under 'minor catchment' impacts: quantify hydraulic conductivity and water retention characteristics of representative soils horizons and their spatial distribution.	
Severe **The soil, fractured rock and groundwater can be**	**Local, hillslope and catchment**	Additional to the conceptual model(s) impact one dimensional (local) or two dimensional (hillslope) from data as accumulated in moderate. Model impact on catchment scale.	1. Additionally to the above, quantify the proposed impact on local, hillslope or catchment scale.

2 APPROACH

Scope of hydropedological assessment

A. Identification of representative hillslopes from satellite imagery, terrain analysis and legacy soil data.
B. Hydropedological survey of representative hillslopes on the site according to the methodology of van Tol et al., 2017.
C. Conceptualisation of hydrological behaviour of representative hillslopes based on interpretations of soil morphological properties and their spatial distribution (dominant drivers and responses).

2.1 Hydropedology

Hydropedology is the study of the soil vadose zone and the movement of water through a landscape at the hillslope level. By understanding these processes, we are able to link the surface water, wetland, and groundwater interactions.

Hydropedology provides an interactive understanding to the pedologic and hydrologic processes and the respective properties in the Critical Zone (Figure 1).

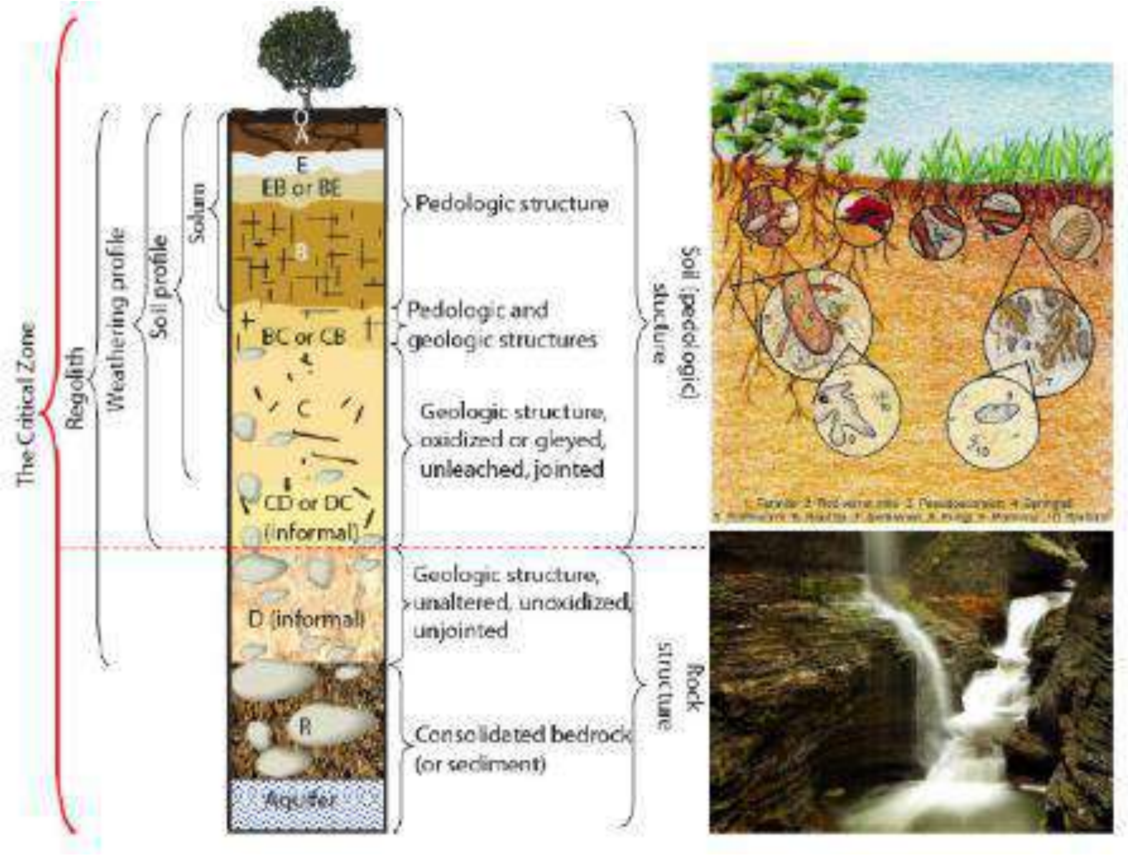


Figure 1: Concepts of the Critical Zone, regolith, weathering profile, soil profile, and solum (modified from Schaetzl and Anderson, 2005), adopted from (Lin, 2010).

Hydropedology aims to address two fundamental questions (Lin, 2012):

1. How do soil architecture and the associated distribution of soils over the landscape exert a first-order control on hydrologic processes (and related biogeochemical dynamics and ecological functions)?
2. How do hydrologic processes (and the associated transport of energy and mass) influence soil genesis, evolution, variability, and function across space and time?

According to Lin (2012) the successful management and use of land, and also effective point scaling from point observations to landscape processes is an in situ understanding of flow and transport processes in natural soils. The focus of pedology has shifted from classification and inventory, to now understanding and quantifying variable processes upon which the water cycle and ecosystems depend (Lin et al., 2005, 2006b).

2.1.1 Hydrological Soil Types

Soils have been grouped into various hydrological response units in order to classify them into a hydropedological category as shown in Table 2.

Table 2: Hydrological soil types of the studied hillslopes (Le Roux, et al., 2015).

Hydrological Soil Type	Description
Recharge	Soils without any morphological indication of saturation. Vertical flow through and out the profile into the underlying bedrock is the dominant flow direction. These soils can either be shallow on fractured rock with limited contribution to evapotranspiration or deep freely drained soils with significant contribution to evapotranspiration.
Interflow (A/B)	Duplex soils where the textural discontinuity facilitates build up of water in the topsoil. Duration of drainable water depends on rate of ET, position in the hillslope (lateral addition/release) and slope (discharge in a predominantly lateral direction).
Interflow (Soil/Bedrock)	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.
Responsive (Shallow)	Shallow soils overlying relatively impermeable bedrock. Limited storage capacity results in the generation of overland flow after rain events.
Responsive (Saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation excess.

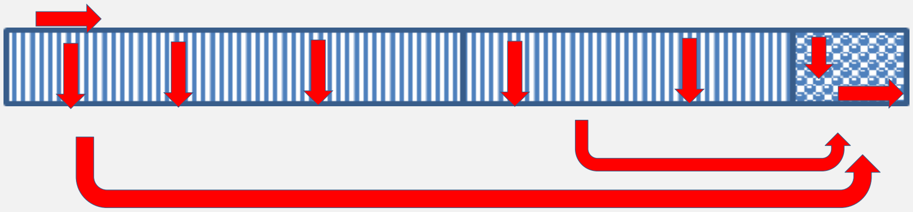
2.2 Hydrological Hillslope Classes

The classification system is based on the perceptual hydrological behaviour of hillslopes and the soils that are formed on them. The flow paths from the crest of a slope to the valley bottom is assessed and classified. The classification takes predominantly into account the flow drivers during a peak rain event and the associated flow path of water through the hillslope (Le Roux, et al., 2015). The hillslope classes are:

- Class 1 – Interflow (Soil/Bedrock Interface);
- Class 2 – Shallow responsive;
- Class 3 – Recharge to groundwater (Not connected);
- Class 4 – Recharge to wetland;
- Class 5 – Recharge to midslope; and
- Class 6 – Quick interflow.

The hillslope classes are represented as 2-dimensional block diagrams with the left side indicating the crest position, and the right side indicating the valley bottom. The soils are indicated as various shades or colours as they would occur in the hillslope catena. Arrows indicate the dominant hydrological flowpaths and the size of the arrow indicating the relative dominance as shown in Table 3.

Table 3: an example of the hydrological hillslope classes and how they are represented (Le Roux, et al., 2015).

Transect	**Hydrological response diagram**
No. 1	

3 DELIVERABLES

3.1 Baseline Assessment

A hydropedology report will be compiled and will include the following:

- Detailed analysis of desktop data;
- Conceptualisation of potential hydropedological drivers;
- Assessing the potential impacts to relevant drivers; and
- Providing recommendations and mitigations to ensure the conservation of sensitive receptors.

4 BUDGET

The budges for the study is presented in the table below.

Table 4: Breakdown of budget

OBJECTIVE, Tasks (Deliverables)	**Hours / Qty**	**Prof Fee**	**Task Total**	**OBJECTIVE TOTAL**
Desktop analysis	8	R 500.00	R 4 000.00	
Reporting	16	R 500.00	R 8 000.00	
TOTAL (VAT excluded)				**R 12 000.00**
			VAT @ 15%	**R 1 800.00**
TOTAL (VAT included)				**R 13 800.00**

5 ASSUMPTIONS AND LIMITATIONS

A budget has been prepared for activities outlined in this proposal. A number of assumptions were made in the development of this budget. These include:

- It has been assumed that the extent of the proposed footprint areas is correct;

- The timeframe set for the hydropedological report is by the end of November 2019;
- No site work will be conducted;
- No quantification and modelling will be undertaken;
- Only slopes that will be affected will be assessed; and
- Worst case scenarios and a conservative approach will be taken into consideration for the proposed activities given the lack of baseline findings.

6 CONCLUDING REMARKS

On behalf of the proposed project team I want to thank you for providing us with the opportunity to submit this proposal.

If there are any queries or concerns regarding this proposal, please do not hesitate to contact me.

Yours faithfully

Andrew Husted

edtea
Department :
Economic Development, Tourism and
Environmental Affairs
PROVINCE OF KWAZULU-NATAL

	(For official use only)
Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Date Received by Department:	
Date Received by District:	
Application fee paid on:	

APPLICATION FOR ENVIRONMENTAL AUTHORIZATION

Submitted in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and regulation 6 (1) and 16 (1) of the Environmental Impact Assessment (EIA) Regulations, 2014.

PROJECT TITLE

BASIC ASSESSMENT REPORT - PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, VRYHEID, LOCATED WITHININ ABAQULUSI MUNICIPALITY, KWAZULU-NATAL

DISTRICT MUNICIPALITY

Zululand District Municipality

IMPORTANT INFORMATION

PLEASE NOTE:

1. It is the responsibility of the applicant to confirm that the Department is the competent authority to which this application must be submitted (refer to NEMA section 24C).
2. This form is current as of **October 2019**. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.
3. The application must be typed within the spaces provided in the form. The size of the space provided is not necessarily indicative of the amount of information required. A legible font type and size must be used when completing this form. The font size should not be smaller than 10pt.
4. Where required, place a tick (✓) in the box you select.
5. Incomplete applications or applications that do not meet the requirements in terms of Regulation 16 of the 2014 NEMA EIA Regulations will not be accepted.
6. The use of the phrase "not applicable" in the form must be done with circumspection. Should it be done in respect of material information required by the competent authority for assessing the application, it may result in the rejection of the application as provided for in the Regulations.
7. An application for Environmental Authorisation/Amendment lapses if the applicant fails to meet any of the timeframes prescribed in terms of the EIA Regulations, 2014, as amended.

PRE-APPLICATION MEETING

8. This Department requires that a pre-application meeting be held at the discretion of the relevant district office. Kindly liaise with the relevant district office to determine if a pre-application meeting is required for this application, **before** it is submitted. The Head Office Registry may be contacted on **033 - 264 2898 / 2572** for details of the relevant district office for this application.

- Provide details of the Pre-Application Meeting below (if applicable):

Date of Pre-Application Meeting	Time and Venue of Pre-Application Meeting
06 September 2019	10.00 AM, 165 President Street, Vryheid (ZDM offices)

- If a Pre-application meeting was held, the minutes of the Pre-Application Meeting **MUST BE ATTACHED** as **Appendix 1**, to this application (refer to the List of Appendices).

SCREENING TOOL

9. A report generated by the national web-based environmental screening tool as required in terms of regulation 16(1)(b)(v) of the environmental impact assessment regulations, 2014 is required to be appended as an **Appendix**, in order for an application to be considered.

SUBMISSION OF COMBINED APPLICATIONS FOR ENVIRONMENTAL AUTHORIZATION

1. If applicable, written confirmation that the Department has granted permission for the combination of applications for an environmental authorization in terms of the provisions of sub-regulation 11(1) of the EIA Regulations, 2014, must be attached to this application form.

FEES APPLICABLE FOR APPLICATIONS FOR ENVIRONMENTAL AUTHORIZATIONS

2. The following fees for the consideration and processing of applications for an environmental authorization will be applicable from **01 April 2014** (refer to the Annexure in Government Notice No.141 dated 28 February 2014):

Application	**Fee**
Application for an environmental authorization subject to a **Basic Assessment** in terms of the EIA Regulations	R2 000.00
Application for an environmental authorization subject to a **Scoping and Environmental Impact Report** in terms of the EIA Regulations	R10 000.00

3. Where an applicant is required to pay fees for an application for environmental authorization as contemplated in this form, this must be made by means of a bank deposit or electronic fund transfer into the bank account of this Department (refer to section 8).

4. **Payment reference number for applications for environmental authorizations** and **banking details** for the Department:

Reference number (**only reference number to be used for environmental authorization applications**):	**04003903**
Account name:	**KwaZulu-Natal Provincial Government - Economics**
Bank name:	**ABSA**
Branch code:	**630495**
Account number:	**4072482787**

5. Proof of payment of fees (if applicable) for an environmental authorization application must be attached as an **Appendix** to this application form and submitted with it. Proof of payment is either a stamped deposit slip or an electronic fund transfer payment advice.

INSTANCES WHERE FEES FOR APPLICATIONS FOR ENVIRONMENTAL AUTHORIZATIONS ARE NOT APPLICABLE

6. Where an application is for a community based project funded by a government grant or the application is made by an organ of state, the fees for considering and processing applications for an environmental authorization do not apply (refer to regulation 2 in Government Notice No.141 dated 28 February 2014).

7. Where an applicant is not required to pay a fee as contemplated in this form, a **written motivation** (with proof of funding if a government grant is applicable) must be attached as an **Appendix t**o this application form and submitted with it.

8. If you have any queries regarding the EIA process or fees applicable for applications for environmental authorizations please contact the Head Office of this Department. (see below).

COMMENTS BY THE DEPARTMENT

9. According to sub-regulation 40(1) of the EIA Regulations the Department, as the competent authority**, MUST during the public participation process be given a period of at least 30 days to comment** on the basic assessment report, EMPr, scoping report or environmental impact assessment report as applicable.

HEAD OFFICE REGISTRY DETAILS

10. The original applications with original signatures must be hand delivered or posted to the Head Office Registry of this Department at the address provided below:

Postal address:

Head Office
KwaZulu-Natal Department of Economic Development, Tourism & Environmental Affairs
Private Bag X9152
PIETERMARITZBURG
3200

Physical address:
270 Jabu Ndlovu Street
PIETERMARITZBURG
3201

Contact Person: **Ms Zama Mbanjwa**

Telephone No: **033 - 264 2898**
Cellular No.: **081 - 271 9541**

Email: **Zama.Mbanjwa@kznedtea.gov.za**

11. All documentation delivered to Head Office must be delivered during the official Departmental Office Hours visible on the Departmental premises.

12. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box or Job Application Box will NOT be accepted, only hardcopy submissions are accepted.

13. Should a specialist report or report on a specialised process be submitted at any stage for any part of this application, the declaration of interest of the specialist must also be submitted.

14. Unless protected by law, all information filled in on this application will become public information on receipt by this Department. Any interested and affected party must be provided with the information contained in this application on request, during any stage of the application process.

15. Please note an exemption application (if applicable) must be finalized before lodging an application for environmental authorization with the Department.

16. If an Environmental Assessment Practitioner (EAP) has not been appointed at the time of the submission of this application form, the declaration from the EAP must be included in the Basic Assessment Report.

TABLE OF CONTENTS

LIST OF APPENDICES

		SUBMITTED (tick (✓) the relevant option)	
Appendix 1	Minutes of the Pre-Application Meeting held with the Department.	✓	
Appendix 2	Written consent from the land owner or the person in control of the land (Regulation 39(1) (If the applicant is not the land owner and Regulation 39(2) does not apply).	✓	
Appendix 3	Correspondence from the Department confirming the Listing Notice 3 activities triggered (if applicable)		
Appendix 4	Approval by the Department that a combined application in terms of Regulation 11 of the EIA Regulations, 2014 may be submitted (if applicable)		
Appendix 5	A description of the location of the development footprint and a plan which locates the proposed activity/ies (Regulation 16 (1) (vi) (vii)	✓	
Appendix 6	Proof of payment of environmental authorization fees (if applicable). Proof of payment includes a stamped deposit slip or an electronic fund transfer payment advice.		
Appendix 7	A written motivation explaining why the payment of environmental authorization fees are not applicable (an application for a community based project funded by a government grant or an application by an organ of state).	✓	
Appendix 8	A report generated from the national web based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations, 2014 is <u>compulsory</u> when submitting an application for environmental authorisation in terms of regulation 19 and 21 of the EIA Regulations, 2014 from 04 October 2019	✓	

PROJECT DESCRIPTION

Please provide a **detailed** description of the project.

1World Consultants (Pty) Ltd have been appointed by Ukuza Consultants to undertake a Basic Assessment (BA) Process for the proposed Bhokwe Community Sanitation Project; with a proposed construction of approximately 2.2 kilometres of 160 mm diameter uPVC piping, 110 mm diameter uPVC housing connections, 165 meters of 200 mm diameter uPVC sewer fed piping, 39 precast ring manhole covers an oxidation sewer treatment plant and evapotranspiration ponds, serving close to 56 households in the Bhokwe Community, Bhokwe, Zululand District Municipality, KwaZulu Natal. The project area is situated in Ward 05, AbaQulusi Local Municipality, approximately 27 kilometers, as the crow flies, from the town of Vryheid.

The Bhokwe and Enyathi communities within this region require rehabilitation of the sanitation systems, which are characterized by frequent bursts, blockages and overflowing resulting in a health hazard to the community. Municipal Infrastructure Support Agent (MISA) was requested by the Bhokwe community to assist with rehabilitation of the water and sanitation systems in these settlements. MISA appointed a service provider on a Turnkey basis to design and rehabilitate sewer reticulation facilities in Bhokwe village. The contractor subsequently abandoned the site. The previous service provider has since been liquidated resulting in the non-completion of the project. To resuscitate and complete the project, MISA initiated a procurement process during April 2019 for the appointment of a new Service Provider. Ukuza Consulting (Pty) Ltd have since been appointed as the professional service provider. In this regard, the proposed reticulation and completion of existing works will be continued. Thus, the project comprises the construction of sewer reticulation infrastructure which will aid in servicing the Bhokwe Community. The proposed project will help to minimise sewage spillage, blockages and overflow and it should therefore result in improved surface and sub surface water quality. The proposed project will also enable additional housing projects to occur in the area as well as improve the local water quality. Additionally, quality of life for the households within the community will thus improve.

The proposed development involves inspection and assessment of work completed by the previous contractor, laying of new pipelines and construction of the sewer oxidation plant. The reticulation together with the sewer treatment plant triggers a need for a Basic Assessment. The approximate location of the project area is 27 ˚ 49’02.665’’ S and 31 ˚ 05’05.687’’ E.

The alternative site lies south easterly and contained a seep wetland passing through, making it unsuitable for the construction of a sewer oxidation pond system. The area is largely rural, with scattered dwellings, and surrounded by forestry farming. Majority of the land is degraded and disturbed. Environmental degradation and pollution are evident in most areas. A single portion of the sewer reticulation will intersect and pass through a wetland.

(a) Strategic Infrastructure Projects

	Tick (✓) the relevant option	
Does the project form part of any of the Strategic Infrastructure Projects (SIPs) as described in the National Development Plan, 2011?	✓	

1. BACKGROUND INFORMATION

Project applicant:

Trading name (if any):	
Contact person:	Zamokwakhe Wesley Mcineke

Physical address:	400 Ngangane Street, Ulundi
Postal address:	Private Bag X76, Ulundi
Postal code:	3838
Telephone:	(035) – 874 5500
Cellular	078 804 2806
E-mail:	zmcineka@zululand.org.za

PLEASE NOTE: The following information is required for each site (location) on which the project will be undertaken:

Owner or person in control of the land:(if the applicant is not the owner or the person in control of the land or Regulation 39(2) in the EIA Regulations 2014 does not apply)

Contact person:	P M Mtshali- Igalelo Trust
Postal address:	P O BOX 142
	Langkrans
Postal code:	3114
Telephone:	( ) -
Cellular:	083 619 2074
E-mail:	pmmtshali1@gmail.com

Contact person:	M T Ntombela- Mnyathi Trust
Postal address:	P O BOX 100
	Langkrans
Postal code:	3114
Telephone:	( ) -
Cellular:	082 403 3329
E-mail:	qalindaban@gmail.com

District Municipality: Zululand District Municipality

Local Municipality: AbaQulusi Local Municipality

In instances where the project includes more than one local or district municipality, please provide a list.

Contact person at Local Municipality: Mr Mtshali

Postal address:

Postal code:

Telephone:

Cellular: pmmtshali1@gmail.com

E-mail: 083 619 2074

In instances where there is more than one local authority involved, please include details of local authorities with their contact details in an Appendix.

Property description/physical address: Farm Boschoek
Farm Riversdale

(Farm name, portion etc.) Where a large number of properties are involved (e.g. linear activities), please attach a full list in an Appendix to the application.

Hlobane, Bloemendal

Nearest town/s:

Directions to the physical address:

Current land-use zoning: Agricultural

In instances where there is more than one current land-use zoning, please attach a list of current land use zonings in the Appendix and also indicate which portions are relevant to this application.

	Tick (✓) the relevant option	
Is a change of land-use or a consent use application required?		✓
Must a building plan be submitted to the local authority?		✓

Locality map:	An A3 locality map must be attached to the back of this document, as Appendix 9. The scale of the locality map must be relevant to the size of the development (at least 1:50 000. For linear activities of more than 25 kilometres, a smaller scale e.g. 1:250 000 can be used. The scale must be indicated on the map.) The map must indicate the following: • an accurate indication of the development footprint for the project in relation to known landmarks such as towns/villages, as well as the positions of the alternative sites, if any; • road access from all major roads in the area; • road names or numbers of all major roads as well as the roads that provide access to the site(s); • all roads within a 1km radius of the site or alternative sites; and • a north arrow; • a legend; and • GPS co-ordinates for each activity (indicate the position of the activity/ies). The co-ordinates should be in degrees, minutes and seconds.

Site identification and linkage

Please indicate all the Surveyor-General 21 digit site reference numbers for all sites (including portions of sites) that are part of the application.

N	0	H	U	0	0	0	0	0	0	0	0	0	3	7	2	0	0	0	0	0
N	0	H	U	0	0	0	0	0	0	0	0	0	1	5	6	0	0	0	0	1

(if there are more than 6, please expand the list with the rest of the numbers)
(These numbers will be used to link various different applications, authorizations, permits etc. that may be connected to a specific site)

Please provide the **geographical coordinates** for the site:

Latitude /Longitude	**Degrees**	**Minutes**	**Seconds**
South	27	49	02.665
East	31	05	05.687

2. ACTIVITIES APPLIED FOR

a. For an application for authorization that involves more than one listed or specified activity that, together, make up one development proposal, all the listed activities pertaining to this application must be indicated.

Indicate the Activity Number:	Provide the relevant **Activity (ies)** as set out in **Listing Notice 1, 2 & 3** (GN R327, GNR325 & GNR324)	**Describe each listed activity as per the project description (and not as per wording of the relevant Government Notice)[1]:**
LN 1; Activity 19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	The proposed activity requires the laying of a sewer reticulation, which includes the excavation, dredging and removal of soil from a watercourse.
LN 1, Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	The proposed sewer treatment plant will require the clearing of approximately 2.3Ha of vegetation.

Please note that any authorization that may result from this application will only cover activities specifically applied for.

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[1] Please note that this description should not be a repetition of the listed activity as contained in the relevant Government Notice, but should be a brief description of activities to be undertaken as per the project description, i.e. describe the components of the desired development.

3. NATIONAL SECTOR CLASSIFICATION IN TERMS OF REGULATION 9 OF THE EIA REGULATIONS, 2014

Please indicate which sector the project falls under in terms of Regulation 9 of the EIA Regulations, 2014:

Select the applicable sector by ticking (✓) the relevant block / s in the table below:

Infrastructure /Transport Services/Roads - Public	
Infrastructure /Transport Services/Roads - Private	
Infrastructure /Transport Services/Rail - Public	
Infrastructure /Transport Services/Rail - Private	
Infrastructure /Transport Services/Airport/Runways/Landing Strip/Helipad - Commercial	
Infrastructure /Transport Services/Airport/Runways/Landing Strip/Helipad - Private	
Infrastructure /Transport Services/Airport/Runways/Landing Strip/Helipad - Public Services	
Infrastructure /Transport Services - Ports	
Infrastructure /Transport Services - Inland Waterways	
Infrastructure /Transport Services - Marina	
Infrastructure /Transport Services - Canal	
Infrastructure /Localised infrastructure - Infrastructure in the Sea/Estuary/Littoral Active Zone/Development Setback/100M Inland/or coastal public property.	
Infrastructure /Localised infrastructure - Zip Lines & Foefie Slides	
Infrastructure /Localised infrastructure - Cableway or Funiculars	
Infrastructure /Localised infrastructure - Billboards	
Infrastructure /Localised infrastructure/Storage/Dangerous Goods/Hydrocarbon - Gas	
Infrastructure /Localised infrastructure/Storage/Dangerous Goods/Hydrocarbon - Petroleum	
Infrastructure /Localised infrastructure/Storage/Dangerous good – Chemicals	
Utilities Infrastructure/Pipelines/water - Fresh/Storm Water	
Utilities Infrastructure/Pipelines/water - Waste Water	✓
Utilities Infrastructure/Pipelines/Dangerous Goods - Chemicals	
Utilities Infrastructure/Pipelines/Hydrocarbon – Petroleum	
Utilities Infrastructure/Pipelines/Hydrocarbon - Gas	
Utilities Infrastructure/Telecommunications/ Radio Broadcasting - Tower	
Utilities Infrastructure/Telecommunications/ Radio Broadcasting - Mast	
Utilities Infrastructure/Telecommunications/ Radio Broadcasting - Receivers	
Utilities Infrastructure - Marine Cables	
Utilities Infrastructure/Electricity /Generation/Non Renewable/Hydrocarbon - Petroleum	

Utilities Infrastructure/Electricity /Generation/Non Renewable/Hydrocarbon - Coal	
Utilities Infrastructure/Electricity /Generation/Non Renewable - Nuclear	
Utilities Infrastructure/Electricity /Generation/Renewable - Hydro	
Utilities Infrastructure/Electricity /Generation/Renewable/Solar - PV	
Utilities Infrastructure/Electricity /Generation/Renewable/Solar - CSP	
Utilities Infrastructure/Electricity /Generation/Renewable - Wind	
Utilities Infrastructure/Electricity /Generation/Renewable - Biomass/ biofuels	
Utilities Infrastructure/Electricity /Generation/Renewable - Wave	
Utilities Infrastructure/Electricity /Distribution and Transmission - Power line	
Utilities Infrastructure/Electricity /Distribution and Transmission – Substation	
Utilities Infrastructure/Gas /Distribution and Transmission – Compressor Station	
Services/Waste Management Services/Disposal facilities - Hazardous	
Services/Waste Management Services/Disposal facilities - Nuclear	
Services/Waste Management Services/Disposal facilities - General	
Services/Waste Management Services/Treatment facilities - Hazardous	
Services/Waste Management Services/Treatment facilities - General	
Services/Waste Management Services/Storage Facilities - General	
Services/Waste Management Services/Storage Facilities - Hazardous	
Services/Waste Management Services/Storage Facilities - Nuclear	
Services/Burial and cemeteries - Cemeteries	
Services/Burial and cemeteries - Cremators	
Services/Water services/Storage - Dams	
Services/Water services/Storage - Reservoirs	
Services/Water services - Desalination	
Services/Water services - Treatment & Waste Water	
Services - Hospitality	
Mining - Prospecting rights	
Mining - Mining Permit	
Mining - Mining Right	
Mining/Exploration Right - Gas or Oil Marine	
Mining/Exploration Right - Gas or Oil Terrestrial	
Mining/Production Right - Gas or Oil Marine	
Mining/Production Right - Gas or Oil Terrestrial	
Mining/Underground gasification of coal - Oil	

Mining/Beneficiation - Hydrocarbon	
Mining/Beneficiation - Mineral	
Agriculture/Forestry/ Fisheries - Crop Production	
Agriculture/Forestry/ Fisheries - Animal Production	
Agriculture/Forestry/ Fisheries - Afforestation	
Agriculture/Forestry/ Fisheries/Aquaculture/Inland- Alien	
Agriculture/Forestry/ Fisheries/Aquaculture/Inland- Indigenous	
Agriculture/Forestry/ Fisheries/Aquaculture/Marine - Alien	
Agriculture/Forestry/ Fisheries/Aquaculture/Marine - Indigenous	
Agriculture/Forestry/ Fisheries - Agro-Processing	
Transformation of land - Indigenous vegetation	
Transformation of land - From open space or Conservation	
Transformation of land - From agriculture or afforestation	
Transformation of land - From mining or heavy industrial areas	
Any activities within or close to a watercourse	
Any activity in an estuary, on the seashore, in the littoral active zone, or in the sea.	
Activity requiring permit or licence in terms of National or Provincial legislation governing the release or generation of emissions - Emissions	
Activity requiring permit or licence - Marine Effluent	
Activity requiring permit or licence - Fresh Water Effluent	
Release of Genetically Modified Organisms	

4. STATE DEPARTMENTS CONSULTED

Please indicate to which State departments reports related to your application will be forwarded to provide comments in terms of section 24 0 (2) of NEMA:

Please note: details of the relevant contact person and the address of the State department must be provided. Add the names and other details for State departments not listed.

Tick (✓) relevant option/s				
YES	**NO**	**Name of Department**	**Contact person**	**Address**
✓		Department of Economic Development, Tourism & Environmental Affairs	Sbusiso Ndwandwe	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs King Dinizulu Highway Legislative Assembly Building / Offices

				Second Floor; Suite 229 Ulundi 3838
✓		Ezemvelo KZN Wildlife	Dominic Wieners	Ezemvelo KZN Wildlife P.O.Box 13053 Cascades 3202
✓		Amafa KZN	Bernadet Pawandiwa	P O BOX 2685 Pietermaritzburg 3200
✓		Department of Water & Sanitation	Siyabonga Buthelezi	Department of Water and Sanitation 88 Joe Slovo Street Durban 4001
✓		Department of Cooperative Governance and Traditional Affairs	Vishnu Govender	KwaZulu-Natal: Corporate Governance and Traditional Affairs 7 Buro Crescent Mayville Durban 4091
✓		Department of Transport	Judy Reddy	KwaZulu-Natal Department of Transport 224 Prince Alfred Street Pietermaritzburg
✓		Commission on Restitution of Land Rights	Lynn Boucher	Commission on Restitution of Land Rights Private Bag X9120 Pietermaritzburg 3200
✓		AbaQulusi Local Municipality	L Mduglwa	Corner of Mark and Hoog Street Vryheid 3100
✓		Zululand District Municipality	Xolani Buthelezi	Gagane Street Ulundi 3838

Please note that: The EAP must request comments from all relevant State departments and remind such departments that failure to submit comments with 30 days will, in terms of sub-regulation 3(4) of the EIA Regulations, 2014 be regarded as no comments..

5. ECONOMIC AND SOCIAL INFORMATION

Details on the anticipated socio-economic values associated with the proposed project MUST be provided below:

Anticipated CAPEX value of the project on completion	**R 7.5 million**

What is the expected annual turnover to be generated by or as a result of the project?	N/A
New skilled employment opportunities created in the <u>construction</u> phase of the project	30
New skilled employment opportunities created in the <u>operational</u> phase of the project	5
New un-skilled employment opportunities created in the <u>construction</u> phase of the project	28
New un-skilled employment opportunities created in the <u>operational</u> phase of the project	2
What is the expected value of the employment opportunities during the operational and construction phase?	R 450 000

6. TYPE OF APPLICATION

(a) Application for Basic Assessment (BA)

This is an application that is subject to a basic assessment (EIA Regulations 2014: Chapter 4, Part 2)) and Regulation 19 in the EIA Regulations 2014 will be complied with.

Tick (✓) relevant option	
✓	

(b) Application for Scoping and Environmental Impact Assessment (S/EIA)

This is an application that is subject to Scoping and EIA (EIA Regulations 2014: Chapter 4: Part 3) and Regulation 21 in the EIA Regulations 2014 will be complied with.

Tick (✓) relevant option	
	✓

7. DECLARATIONS

(a) Declaration by the applicant

I, ____ ,declare that I-

- am, or represent[2], the applicant in this application;
- have appointed an environmental assessment practitioner to act as the independent environmental assessment practitioner for this application;
- will provide the environmental assessment practitioner and the KZN Department of Economic Development, Tourism & Environmental Affairs with access to all information at my disposal that is relevant to this application;
- will be responsible for the costs incurred in complying with the Environmental Impact Assessment Regulations, 2014, including but not limited to –
  - costs incurred in connection with the appointment of the environmental assessment practitioner;
  - costs incurred in respect of the undertaking of any process required in terms of the Regulations;
  - costs in respect of any fee prescribed by the Minister or MEC in respect of the Regulations;
  - costs in respect of specialist reviews, if the competent authority decides to recover costs; and
  - the provision of security to ensure compliance with conditions attached to an environmental authorization, should it be required by the KZN Department of Economic Development, Tourism & Environmental Affairs;
- will ensure that the environmental assessment practitioner is competent to comply with the requirements of the EIA Regulations, 2014 and will take reasonable steps to verify whether the EAP complies with the Regulations;
- will inform all registered interested and affected parties of any suspension of the application, as well as of any decisions taken by the KZN Department of Economic Development, Tourism & Environmental Affairsin this regard;
- am responsible for complying with the conditions of any environmental authorization issued by the KZN Department of Economic Development, Tourism& Environmental Affairs;
- hereby indemnify the Government of the Republic of South Africa, the KZN Department of Economic Development, Tourism & Environmental Affairs and all its officers, agents and employees, from any liability arising out of the content of any report, any procedure or any action which the applicant or environmental assessment practitioner is responsible for in terms of the EIA Regulations, 2014;
- will not hold the KZN Department of Economic Development, Tourism & Environmental Affairs responsible for any costs that may be incurred by the applicant in proceeding with an activity prior to obtaining an environmental authorization or prior to an appeal being decided in terms of the EIA Regulations, 2014;
- I will perform all other obligations as expected from an applicant in terms of the EIA Regulations, 2014;
- all the particulars furnished by me in this form are true and correct; and

I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B-(1) of the National Environmental Management Act, 1998 (Act 107 of 1998)

____

Signature of the applicant[3]/ Signature on behalf of the applicant

____

Trading name (if applicable)

____

Date

---

[2] If this is signed on behalf of the applicant, proof of such authority from the applicant must be attached.

[3] If the applicant is a juristic person, a signature on behalf of the applicant is required as well as proof of such authority.

(b) Declaration by the environmental assessment practitioner.

Environmental assessment practitioner (EAP):[4]

Trading name (if any):			
Contact person:			
Postal address:			
Postal code:		Cell:	
Telephone:			
E-mail:			
Education Qualifications[5]:			
Professional affiliation(s) (if any)[6]			

I, ____ , declare that I

- am the independent environmental practitioner in this application;
- will comply with the requirements for an EAP as stipulated in Regulation 13 of the EIA Regulations, 2014;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 20144;
- will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- declare that there are no circumstances that may compromise my objectivity in performing such work;
- have expertise in conducting environmental impact assessments, including knowledge of the National Environmental Management Act, 1998 (Act107 of 1998), regulations and any guidelines that have relevance to the proposed activity;
- will comply with the National Environmental Management Act, 1998 (Act107 of 1998), regulations and all other applicable legislation;
- 2014undertake to disclose to the applicant and the KZN Department of Economic Development, Tourism & Environmental Affairs all material information in my possession that reasonably has or may have the potential of influencing its decision with respect to this application;
- will ensure that information containing all reports in respect of this application is distributed or made available to interested and affected parties and that their participation is facilitated in such a manner that they will be provided with a reasonable opportunity to participate and provide comments on the reports;
- will provide the competent authority with access to all information at my disposal regarding this application, whether such information is favourable to the applicant or not;
- declare that all the particulars furnished by me in this form are true and correct;
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998); and
- I will comply with all the requirements as indicated in the National Environmental Management Act, 1998(Act 107 of 1998) and Environmental Impact Assessment Regulations, 2014.

____

Signature of the environmental assessment practitioner

____

Trading name

____

Date

---

[5][8]Please include details of names, education qualifications and professional affiliations of the EAP and each representative of the EAP appointed to manage this application.

Minutes of Meeting: Pre-application for the Bhokwe Community Sanitation Project

Attendees: Hasan Mahomedy- 1World Consultants as the EAP

Sbusiso Ndwandwe- KZN EDTEA (Ulundi) as the CA

Apologies: Mfaniseni Bukhosini- ZDM Municipality

Date: 06/09/2019, Friday

Time: 10:20

1. Confirmation of project
    a. There was some uncertainty of the project. This was cleared up by the EAP who explained in detail all aspects surrounding the project.

2. Explanation of the listed notices by the CA
    a. The CA explained the listed notices and how it affects the project. The CA also explained the triggers and activities related to this specific project.

3. Specialist studies
    a. The EAP and CA discussed the specialist studies required for this project.
    b. Geotechnical, Heritage, Paleontological, Geohydrological studies have already been conducted.
    c. A biodiversity, wetland and socio-economic studies are still going to be conducted
    d. The CA highlighted that other state departments should be contacted to be made aware of the project and they may require additional specialists' studies. E.g. KZN transport might request a traffic assessment as they are the competent authority with regards to transport

4. State Departments
    a. A list of state departments to contact was provided
    b. The state departments can provide specialist recommendations
    c. It is important to contact all respective and associated state departments

5. Project details and foreseeable issues
    a. Socio-economic issues must be highlighted in the BA. This includes the number of jobs, estimate project total.

   b. The public participation meeting must include all respected parties, including all community leaders and representatives. The EAP must remain apolitical at all times to avoid any conflict.
   c. Land ownership must be clear.
   d. 'Alternative' section in the BA must be populated. Alternatives includes design, location etc.

6. Environmental Application
   a. The environmental application process was explained. A guideline document covering all aspects was provided

7. Site Visit
   a. A site visit was conducted by the EAP and CA. The CA assessed the site and was made familiar with the Pier and Pond areas.

8. Meeting closed
   a. The meeting closed at 13:30

UMNYANGO WEZOKUTHUTHUKISWA KOMNOTHO, EZOKUVAKASHA NOKONGIWA KWEMVELO KZN
Private Bag X9152, Pietermaritzburg, 3200
2020 -01- 24
270 Jabu Ndlovu Street, Pietermaritzburg, 3200
DEPARTMENT OF ECONOMIC DEVELOPMENT, TOURISM AND ENVIRONMENTAL AFFAIRS

Thank you

B.S. NDWANDWE

Hasan Mahomedy, BSc (Hons)
Environmental Assessment Practitioner
Cell: 072 730 7866

1world consultants
Tel: 031 262 8327 Fax: 086 726 3616 Email: hasan@1wc.co.za
P O Box 2311, Westville, 3630

Attendance Register

DATE:	06/09/2019- FRIDAY				
SUBJECT OF MEETING:	PRE-APPLICATION MEETING FOR THE BHOKWE COMMUNITY SANITATION PROJECT				
Name	**Surname**	**Organisation**	**Contact Number**	**Email Address**	**Signature**
B.S. Ndwandwe	Ndwandwe	EDTEA	082 719 9883	Sbusiso2257@gmail.com	
HASAN ~~MAHOMEDY~~	MAHOMEDY	1WORLD CONSULTANTS	072 780 7866	hasan@1world.co.za	

Attendance Register

DATE:	06/09/2019- FRIDAY				
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edtea
Department : Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

	(For official use only)
Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

CONSENT FROM THE LANDOWNER / PERSON IN CONTROL OF THE LAND, ON WHICH THE ACTIVITY IS TO BE UNDERTAKEN

Submitted in terms of the requirements of sub-regulation 39(1) of the Environmental Impact Assessment Regulations, 2014 (if the applicant is not the owner or person in control of the land on which the activity is to be undertaken).

KINDLY NOTE THAT:

1. This document should be attached as Appendix 2 to:
   - The application form for **Environmental Authorization** in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998).
2. This form is current as of **October 2019**. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.

1. DETAILS OF APPLICANT

Project applicant:	Zululand District Municipality		
Trading name (if any):			
Contact person:	Xolani Buthelezi		
Physical address:	400 Ngangane Street, Ulundi		
Postal address:	Private Bag X76, Ulundi		
Postal code:	3838	**Cell:**	072 099 9024
Telephone:	035 874 5500	**Fax:**	035 874 5591
E-mail:	xbuthelezi@zululand.org.za		

2. DETAILS OF LANDOWNER OR PERSON IN CONTROL OF THE LAND

(where the applicant is not the landowner or person in control of the land)

Landowner or person in control of the land:	Igalelo Trust		
Contact person:	P M Mtshali		
Postal address:	Private Bag 100 Langkrans		
Postal code:	3114	**Cell:**	076 391 6213
Telephone:		**Fax:**	
E-mail:	pmmtshali1@gmail.com		

3. PROJECT DETAILS AND ACTIVITIES APPLIED FOR

Project title:	**BASIC ASSESSMENT REPORT - PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, VRYHEID, LOCATED WITHININ ABAQULUSI MUNICIPALITY, KWAZULU-NATAL**

Activities applied for:
Describe each listed activity in Listing Notices 1, 2 or 3 (GNR 983 -985, 04 December 2014) which is being applied for as per the project description:

Indicate the Activity Number:	Provide the relevant **Activity (ies)** as set out in **Listing Notice 1, 2 & 3** (GN R327, GNR325 & GNR324)	**Describe each listed activity as per the project description (and not as per wording of the relevant Government Notice)**[1]**:**
LN 1; Activity 19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	The proposed activity requires the laying of a sewer reticulation, which includes the excavation, dredging and removal of soil from a watercourse.
LN 1, Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	The proposed sewer treatment plant will require the clearing of approximately 2.3Ha of vegetation.

---

[1] Please note that this description should not be a repetition of the listed activity as contained in the relevant Government Notice, but should be a brief description of activities to be undertaken as per the project description, i.e. describe the components of the desired development.

4. PROPERTY DESCRIPTION

Property description:	N0HU00000000015600001
	(Farm name, portion etc.) Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application.
Town(s) or district(s):	Zululand District Municipality
Physical (street) address of project:	

5. CONSENT FROM LANDOWNER OR PERSON IN CONTROL OF THE LAND TO UNDERTAKE THE ACTIVITY/IES

I, ____, declare that, I:-

- **Am the landowner or person in control of the property described in Section 4 of this document; and**
- **That I hereby give consent to the applicant ____ as described in section 1 of this document to undertake the activity/ies as described in section 3 of this document on the property described in section 4.**

____

Signature of the landowner or person in control of the land

____

Date

edtea
Department :
Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

	(For official use only)
Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

CONSENT FROM THE LANDOWNER / PERSON IN CONTROL OF THE LAND, ON WHICH THE ACTIVITY IS TO BE UNDERTAKEN

Submitted in terms of the requirements of sub-regulation 39(1) of the Environmental Impact Assessment Regulations, 2014 (if the applicant is not the owner or person in control of the land on which the activity is to be undertaken).

KINDLY NOTE THAT:

1. This document should be attached as Appendix 2 to:
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1. DETAILS OF APPLICANT

Project applicant:	Zululand District Municipality		
Trading name (if any):			
Contact person:	Zamokwakhe Wesley Mcineke		
Physical address:	400 Ngangane Street, Ulundi		
Postal address:	Private Bag X76, Ulundi		
Postal code:	3838	**Cell:**	078 804 2806
Telephone:	035 874 5500	**Fax:**	035 874 5591
E-mail:	zmcineka@zululand.org.za		

2. DETAILS OF LANDOWNER OR PERSON IN CONTROL OF THE LAND

(where the applicant is not the landowner or person in control of the land)

Landowner or person in control of the land:	Mnyathi Trust		
Contact person:	M T Ntombela		
Postal address:	Private bag 100 Langkrans		
Postal code:	3114	**Cell:**	082 403 3329
Telephone:		**Fax:**	
E-mail:	qalindaban@gmail.com		

3. PROJECT DETAILS AND ACTIVITIES APPLIED FOR

Project title:	**BASIC ASSESSMENT REPORT - PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, VRYHEID, LOCATED WITHININ ABAQULUSI MUNICIPALITY, KWAZULU-NATAL**

Activities applied for:
Describe each listed activity in Listing Notices 1, 2 or 3 (GNR 983 -985, 04 December 2014) which is being applied for as per the project description:

Indicate the Activity Number:	Provide the relevant **Activity (ies)** as set out in **Listing Notice 1, 2 & 3** (GN R327, GNR325 & GNR324)	**Describe each listed activity as per the project description (and not as per wording of the relevant Government Notice)**[1]**:**
LN 1; Activity 19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	The proposed activity requires the laying of a sewer reticulation, which includes the excavation, dredging and removal of soil from a watercourse.
LN 1, Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	The proposed sewer treatment plant will require the clearing of approximately 2.3Ha of vegetation.

---

[1] Please note that this description should not be a repetition of the listed activity as contained in the relevant Government Notice, but should be a brief description of activities to be undertaken as per the project description, i.e. describe the components of the desired development.

4. PROPERTY DESCRIPTION

Property description:	N0HU00000000037200000
	(Farm name, portion etc.) Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application.
Town(s) or district(s):	Zululand District Municipality
Physical (street) address of project:	

5. CONSENT FROM LANDOWNER OR PERSON IN CONTROL OF THE LAND TO UNDERTAKE THE ACTIVITY/IES

I, ____, declare that, I:-

- **Am the landowner or person in control of the property described in Section 4 of this document; and**
- **That I hereby give consent to the applicant ____ as described in section 1 of this document to undertake the activity/ies as described in section 3 of this document on the property described in section 4.**

____

Signature of the landowner or person in control of the land

____

Date

4. PROPERTY DESCRIPTION

Property description:	N0HU00000000037200000
	(Farm name, portion etc.) Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application.
Town(s) or district(s):	Zululand District Municipality
Physical (street) address of project:	

5. CONSENT FROM LANDOWNER OR PERSON IN CONTROL OF THE LAND TO UNDERTAKE THE ACTIVITY/IES

I, NTOMBELA MUZIKAYISE Thomas, declare that, I:-

- **Am the landowner or person in control of the property described in Section 4 of this document; and**
- **That I hereby give consent to the applicant ZULULAND DISTRICT MUNICIPALITY as described in section 1 of this document to undertake the activity/ies as described in section 3 of this document on the property described in section 4.**

Signature of the landowner or person in control of the land

2019/12/06

Date

4. PROPERTY DESCRIPTION

Property description:	N0HU00000000015600001
	(Farm name, portion etc.) Where a large number of properties are involved (e.g. linear activities), please attach a full list to this application.
Town(s) or district(s):	Zululand District Municipality
Physical (street) address of project:	

5. CONSENT FROM LANDOWNER OR PERSON IN CONTROL OF THE LAND TO UNDERTAKE THE ACTIVITY/IES

I, PHENEAS MPHUMZENI MTSHALI, **declare that, I:-**

- **Am the landowner or person in control of the property described in Section 4 of this document; and**
- **That I hereby give consent to the applicant** ZULULULAND D. MUNICIPAL **as described in section 1 of this document to undertake the activity/ies as described in section 3 of this document on the property described in section 4.**

Signature of the landowner or person in control of the land

06-12-2019

Date

P.O Box 2311, Westville, 3630
Tel: 031 262 8327
Fax: 086 726 3619

Attention: **KZN EDTEA** **Date:** *04 December 2019*

Our ref.: ***ENV 19011*** **Contact Person:** *fatima@1wc.co.za*

Dear Sir/Madam,

WAIVER OF SUBMISSION FEES FOR ENVIRONMENTAL AUTHORISATION FOR THE PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, ZULULAND DISTRICT MUNICIPALITY, KWAZULU-NATAL

This letter serves to confirm that this is a project for the Zululand District Municipality, who aim to provide water borne sewage system within the local Bhokwe Community.

Should you require any further information, kindly contact Xolani Buthelezi using the following details:

(T): **072 099 9024**
(E): **xbuthelezi@zululand.org.za**

Further information on the project may be obtained from 1World Consultants (Pty) Ltd.

Appendix 5

A description of the location of the development footprint and a plan which locates the proposed activity/ies (Regulation 16 (1) (vi) (vii)

1World Consultants (Pty) Ltd have been appointed by Ukuza Consultants to undertake a Basic Assessment (BA) Process for the proposed Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 110 mm diameter uPVC housing connections, 150 meters of 200 mm diameter HD uPVC sewer fed piping, 37 precast ring manhole covers an oxidation sewer treatment plant and evapotranspiration ponds, serving close to 112 households in the Bhokwe Community, Bhokwe, Zululand District Municipality, KwaZulu Natal. The project area is situated in Ward 05, AbaQulusi Local Municipality, approximately 27 kilometers, as the crow flies, from the town of Vryheid.

The Bhokwe and Enyathi communities within this region require rehabilitation of the sanitation systems, which are characterized by frequent bursts, blockages and overflowing resulting in a health hazard to the community. Municipal Infrastructure Support Agent (MISA) was requested by the Bhokwe community to assist with rehabilitation of the water and sanitation systems in these settlements. MISA appointed a service provider on a Turnkey basis to design and rehabilitate sewer reticulation facilities in Bhokwe village. The contractor subsequently abandoned the site. The previous service provider has since been liquidated resulting in the non-completion of the project. To resuscitate and complete the project, MISA initiated a procurement process during April 2019 for the appointment of a new Service Provider. Ukuza Consulting (Pty) Ltd have since been appointed as the professional service provider.

In this regard, the proposed reticulation and completion of existing works will be continued. Thus, the project comprises the construction of sewer reticulation infrastructure which will aid in servicing the Bhokwe Community. The proposed project will help to minimise sewage spillage, blockages and overflow and it should therefore result in improved surface and sub surface water quality. The proposed project will also enable additional housing projects to occur in the area as well as improve the local water quality. Additionally, quality of life for the households within the community will thus improve.

The proposed development involves inspection and assessment of work completed by the previous contractor, laying of new pipelines and construction of the sewer oxidation plant. The reticulation together with the sewer treatment plant triggers a need for a Basic Assessment. The approximate location of the project area is 27 ˚ 49’02.665’’ S and 31 ˚ 05’05.687’’ E.

The alternative site lies south easterly and contained a seep wetland passing through, making it unsuitable for the construction of a sewer oxidation pond system. The area is largely rural, with scattered dwellings, and surrounded by forestry farming. Majority of the land is degraded and disturbed. Environmental degradation and pollution are evident in most areas. A single portion of the sewer reticulation will intersect and pass through a wetland.

The impacts of the proposed activities included construction of a pipe bridge, which traverses a wetland, laying of pipelines and construction of a sewer treatment plant. These activities trigger a need for a Basic Assessment report. Additionally, impacts on Biodiversity, Socio-Economic, Wetland and Heritage aspects were also considered, and this report now provides all required information to advise on the applied environmental authorisation from KZN EDTEA. Some key impacts are:

- Loss of biodiversity
- Erosion
- Traffic and access
- Hydrological Impact of temporary alteration of stream flow and disturbance of stream bed due to construction activities
- Pollution due to site operations
- Disturbance to community by noise and dust from construction process
- Air quality degradation as a result of dust and odours
- Visual impacts
- Waste and litter
- Damage to existing services
- Injury to local people and construction workers
- Disturbance to existing infrastructure and impact on Heritage resources
- Socio-economic impacts

Specialist studies were conducted to aid in a thorough investigation of the impacts and included:

- **A Wetland Impact Assessment** by Malachite (Pty) Ltd to determine the impact the proposed development will have on watercourses;
- **A Socio-Economic Assessment Study** by Real Consulting, to determine the impacts the proposed development will have on the surrounding community;
- **A Heritage Impact Assessment** by JLB Consulting to ensure that no items of cultural or historical value would be impacted on by the construction;
- **A Desktop Paleontological Study** by Professor Marion Bamford, of the University of the Witwatersrand, to ensure no fossils would be impacted on by construction;
- **A Geotechnical Study** by iLZ Consulting to assess the prevailing geological and geotechnical conditions throughout the project area;
- **A Level 2 Hydro-pedological Assessment Study** by The Biodiversity Company to assess the condition of the soil and hydrology in the project area**;**
- **A Biodiversity Study** by Malachite (Pty) Ltd to assess, identify and record the presence of any protected fauna and flora; and
- **A Geohydrological Investigation** by Geomeasure Group (Pty) Ltd, to to determine the status of the groundwater prior to development of the project.

A wetland impact assessment study was undertaken within a delineated 500m buffer surrounding the site. A total of five (5) wetland systems were identified and delineated. All five systems were identified as seep wetlands. HGM units 1 and 2 will be impacted by the proposed project layout. HGM units 3, 4 and 5 are situated within the 500m assessment area, however their locations are either upslope of the proposed project (HGM 4), located within a separate catchment (HGM 5) or situated approximately 200m to the east of the project (HGM 3) and will therefore not be affected. The closet wetland to the oxidation pond is HGM1, which is situated outside of the recommended 60m buffer, at 124m. No buffer was calculated for these wetlands as impacts to the systems will be short term in nature and mitigation measures utilised to reduce the impact.

No fatal flaws were identified by the Specialist Studies. Tree removal permits may be required and an inspection prior to construction must be undertaken to confirm if any critical species will be affected. A Water Use License Application is also being undertaken for the proposed activity with the Department of Water & Sanitation (DWS), due to the reticulation traversing a wetland. The process is ongoing.

Mitigation measures to minimise or eliminate impacts were identified by the specialists and EAP which were utilised towards the preparation of the Environmental Management Plan (EMPr). The EMPr must be read in conjunction with this BAR and is essential towards the protection of the environmental elements whilst establishing the water infrastructure.

A Public Participation Process (PPP) to review the BAR and EMPr involved consultation with the relevant authorities, the landowners affected along the way, community leaders and other identified Interested and Affected Parties (I&APs). Newspaper advertisements will be published to inform the general public of the Basic Assessment Process.

This BAR has been prepared in Accordance with the EIA Regulations, 2017 and follows the requirements for a BAR in Appendix 1 of GNR 326.

SCREENING REPORT FOR AN ENVIRONMENTAL AUTHORIZATION OR FOR A PART TWO AMENDMENT OF AN ENVIRONMENTAL AUTHORISATION AS REQUIRED BY THE 2014 EIA REGULATIONS – PROPOSED SITE ENVIRONMENTAL SENSITIVITY

EIA Reference number:

Project name: Bhokwe Community Sanitation Project

Project title: Bhokwe Community Sewage Reticulation and Waste Water Treatment Works

Date screening report generated: 21/11/2019 13:23:55

Applicant: Zululand District Municipality (ZDM)

Compiler: 1World Consultants (Pty) Ltd

Compiler signature:

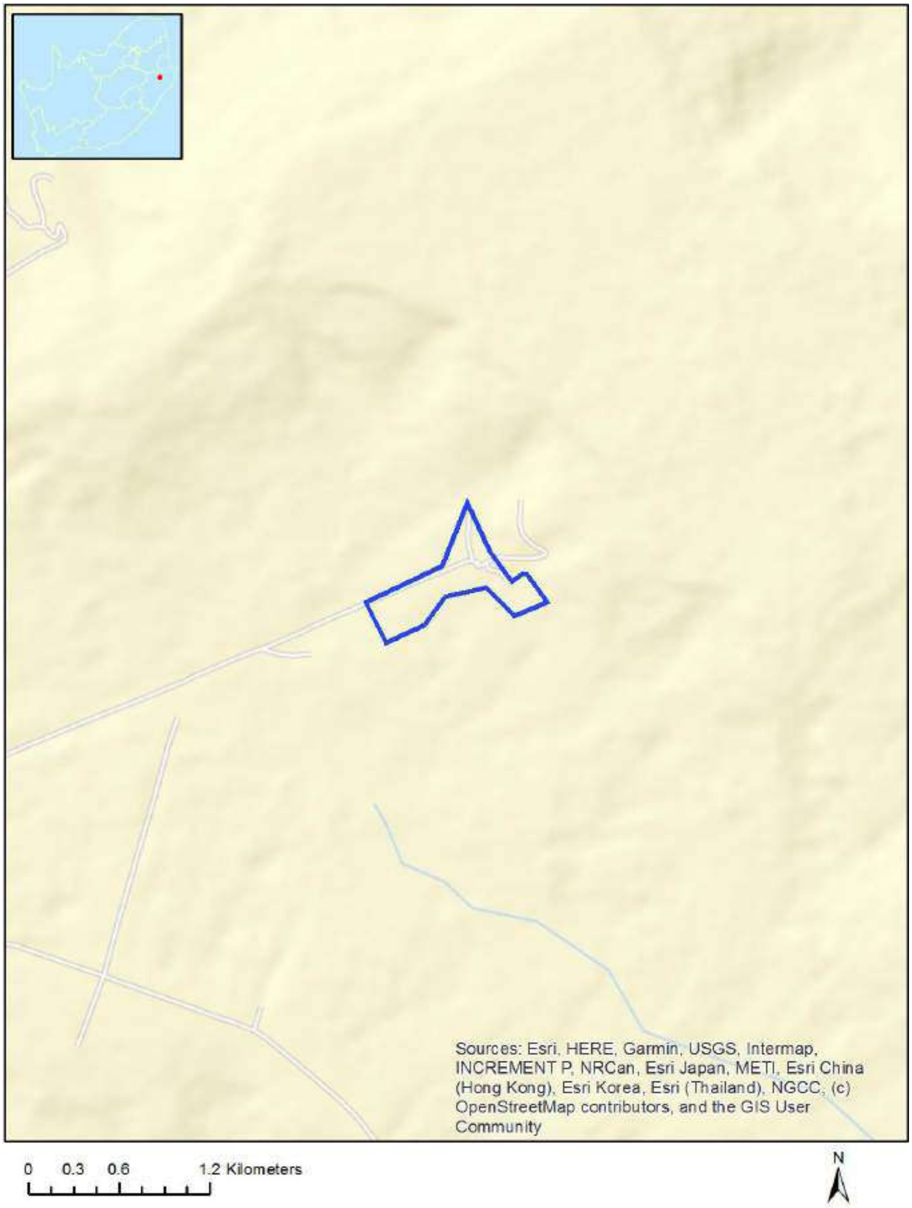
……………………………………………………………………………………………

Table of Contents

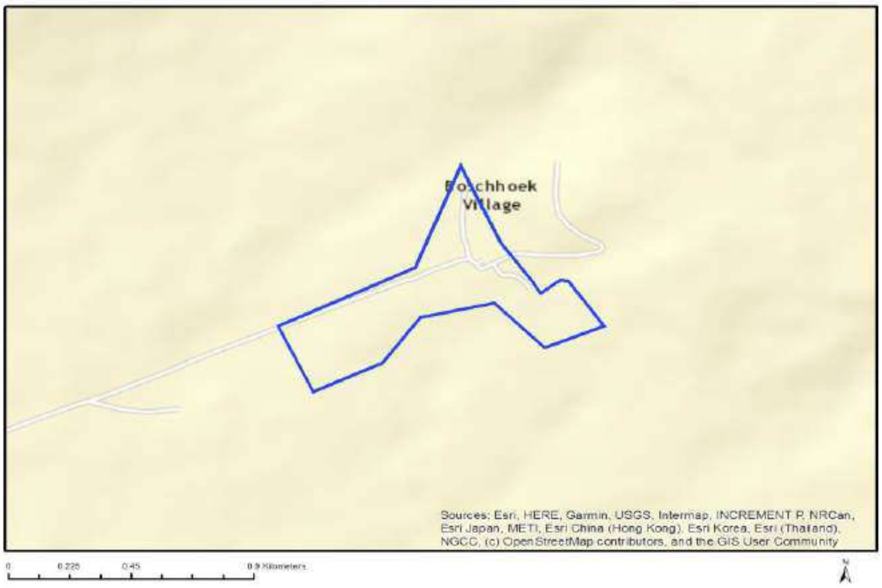
Proposed Project Location

Orientation map 1: General location

General Orientation: Bhokwe Community Sanitation Project



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	BOSCHHOEK	156	0	27°48'15.28S	31°7'18.89E	Farm
2	RIVERSDALE	372	0	27°47'37.19S	31°5'10.14E	Farm
3	BOSCHHOEK	156	1	27°48'13.54S	31°6'35.36E	Farm Portion
4	RIVERSDALE	372	7	27°48'13.72S	31°5'46.23E	Farm Portion
5	RIVERSDALE	372	10	27°48'12.73S	31°5'3.96E	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 nearby wind or solar developments found.

Environmental Management Frameworks relevant to the application

No intersections with EMF areas found.

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[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 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: Services|Waste Management Services|Disposal facilities|General|Disposal facilities - General.

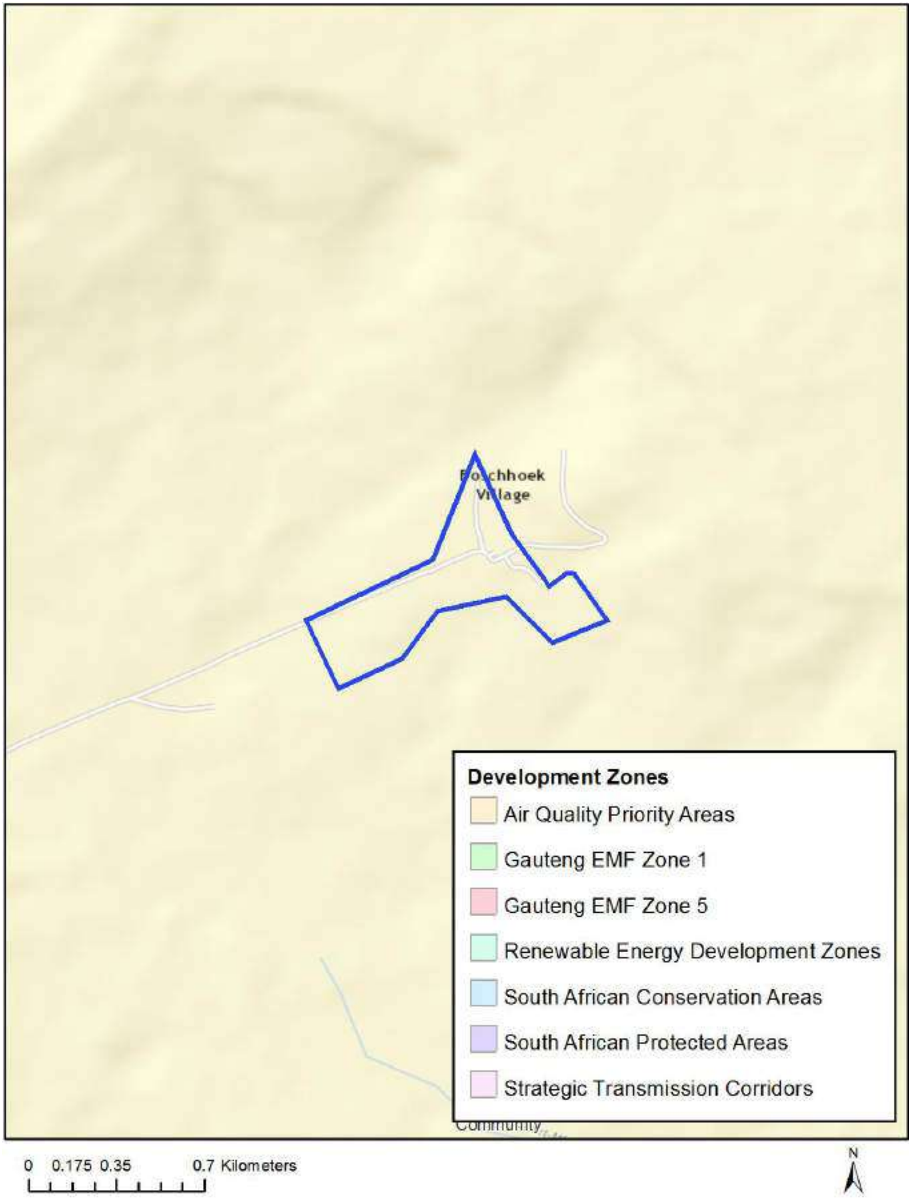
Relevant development incentives, restrictions, exclusions or prohibitions

The following development incentives, restrictions, exclusions or prohibitions and their implications that apply to this site are indicated below.

No intersection with any development zones found.

Map indicating proposed development footprint within applicable development incentive, restriction, exclusion or prohibition zones

Project Location: Bhokwe Community Sanitation Project



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			
Aquatic Biodiversity	X			

Theme				
Civil Aviation Theme				X
Plant Species Theme			X	
Defence 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.

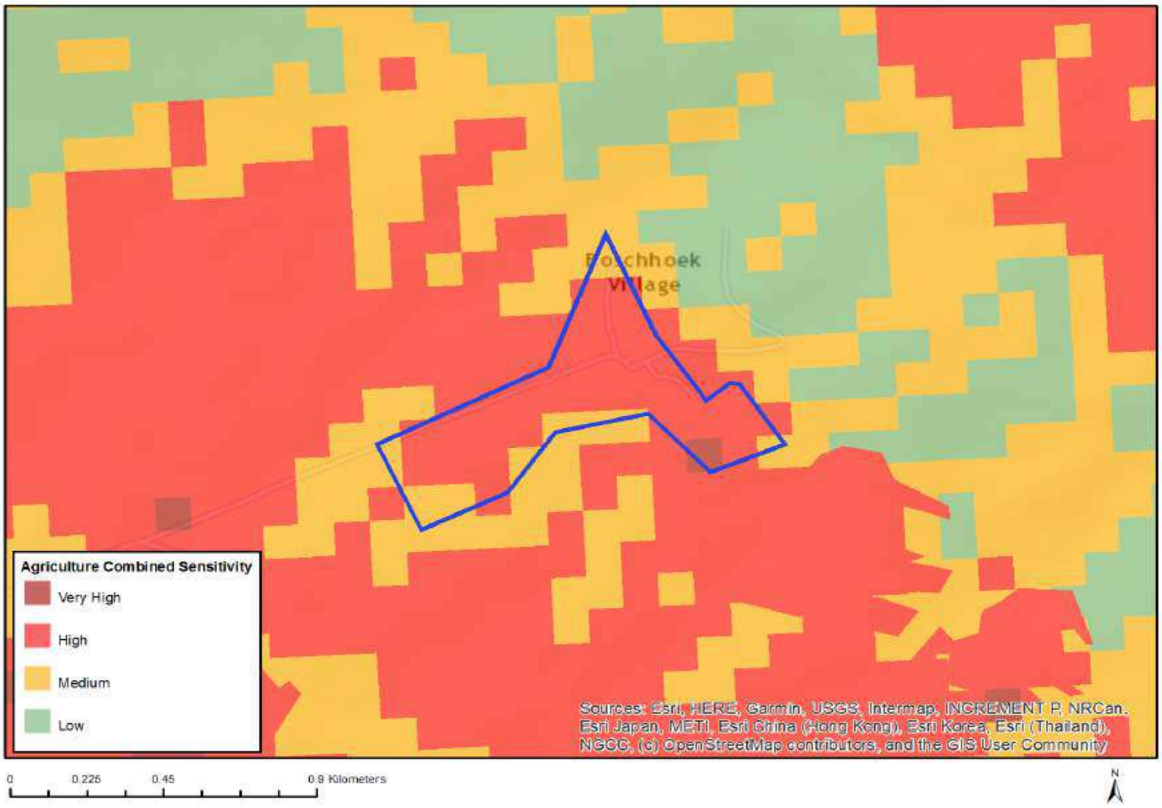
No	**Specialist assessment**	**Assessment Protocol**
1	Agricultural Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_Agriculture_Assessment_Protocols.pdf
2	Landscape/Visual Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
3	Archaeological and Cultural Heritage Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
4	Palaeontology Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
5	Terrestrial Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_Terrestrial_Biodiversity_Assessment_Protocols.pdf
6	Aquatic Biodiversity Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_Aquatic_Biodiversity_Assessment.pdf
7	Noise Impact Assessm	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_Noise_Impacts_Assessment_Protocols.pdf

	ent	
8	Traffic Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
9	Geotechnical Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
10	Climate Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
11	Health Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
12	Socio-Economic Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
13	Ambient Air Quality Impact Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
14	Plant Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_Assessment_Protocols.pdf
15	Animal Species Assessment	https://screening.environment.gov.za/ScreeningDownloads/AssessmentProtocols/DraftGazetted_General_Requirement_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

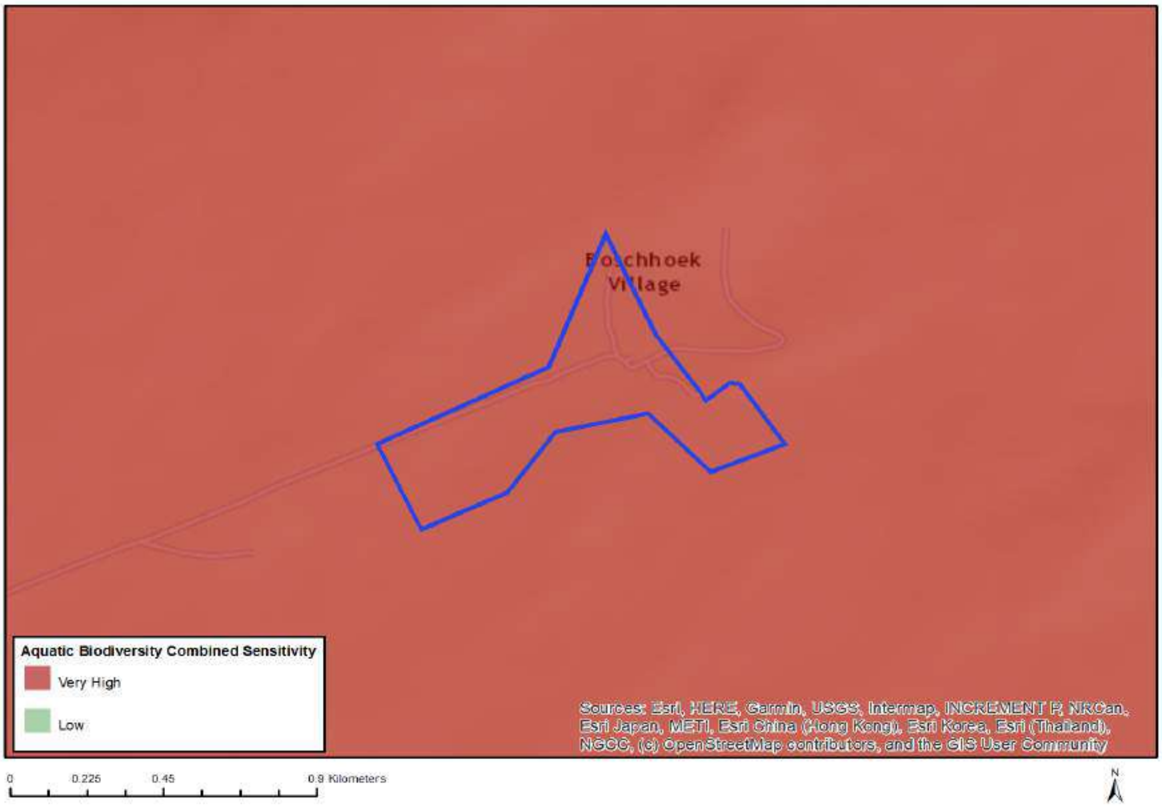


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
High	Land capability;09. Moderate-High/10. Moderate-High
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 AQUATIC BIODIVERSITY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Strategic water source area

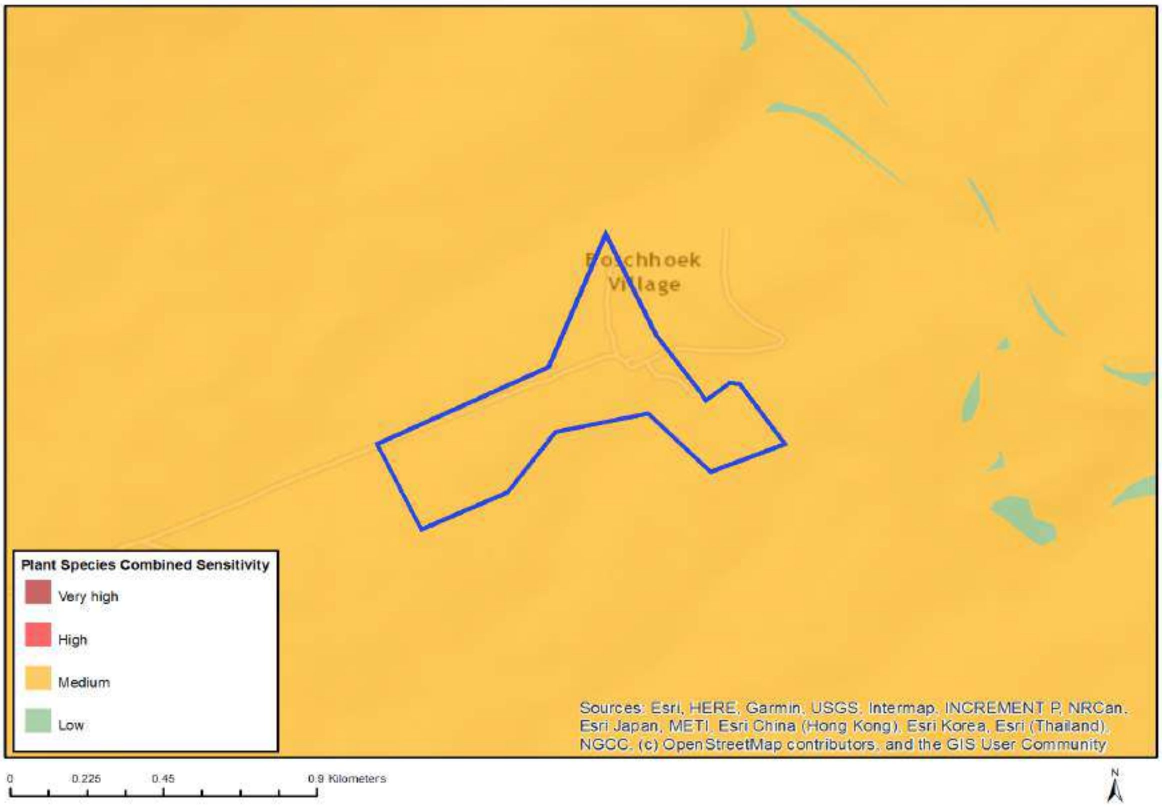
MAP OF RELATIVE CIVIL AVIATION THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

MAP OF RELATIVE PLANT SPECIES THEME SENSITIVITY

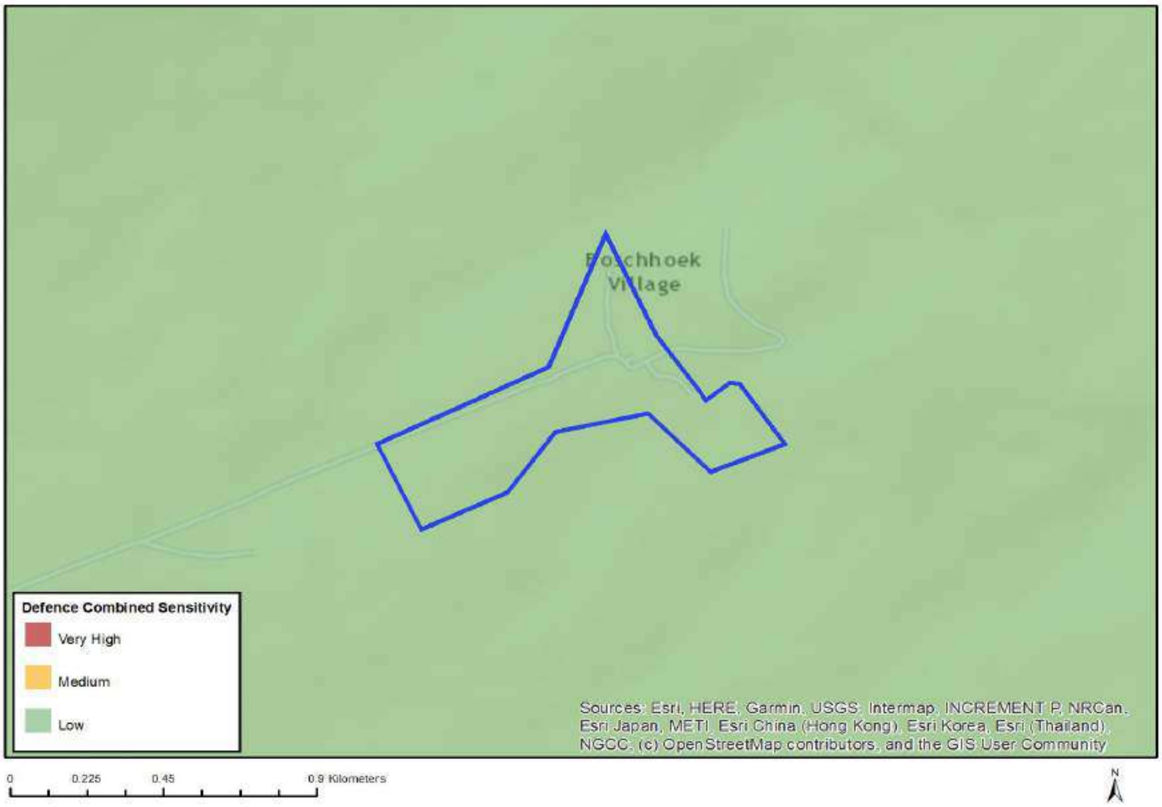


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Dierama erectum
Medium	Sensitive species 275
Medium	Sensitive species 14
Medium	Dracosciadium italae
Medium	Sensitive species 118
Medium	Gerbera aurantiaca

MAP OF RELATIVE DEFENCE THEME SENSITIVITY

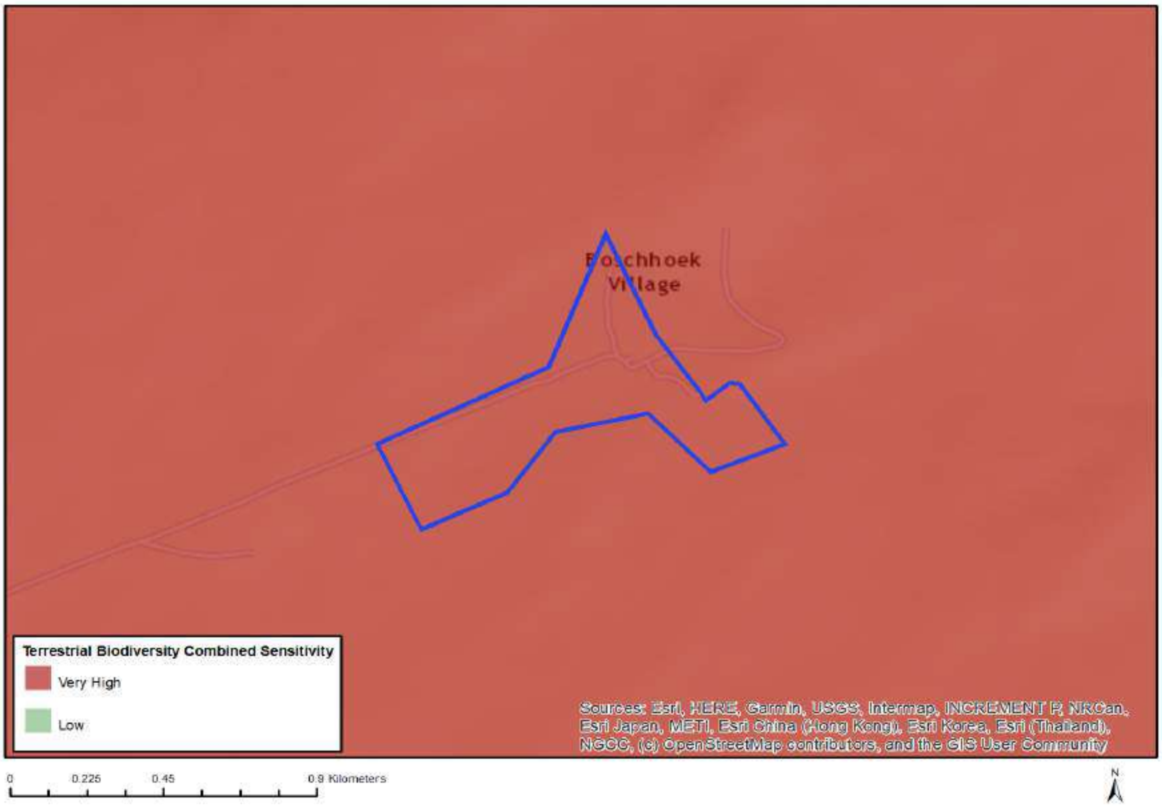


Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

MAP OF RELATIVE TERRESTRIAL BIODIVERSITY THEME SENSITIVITY



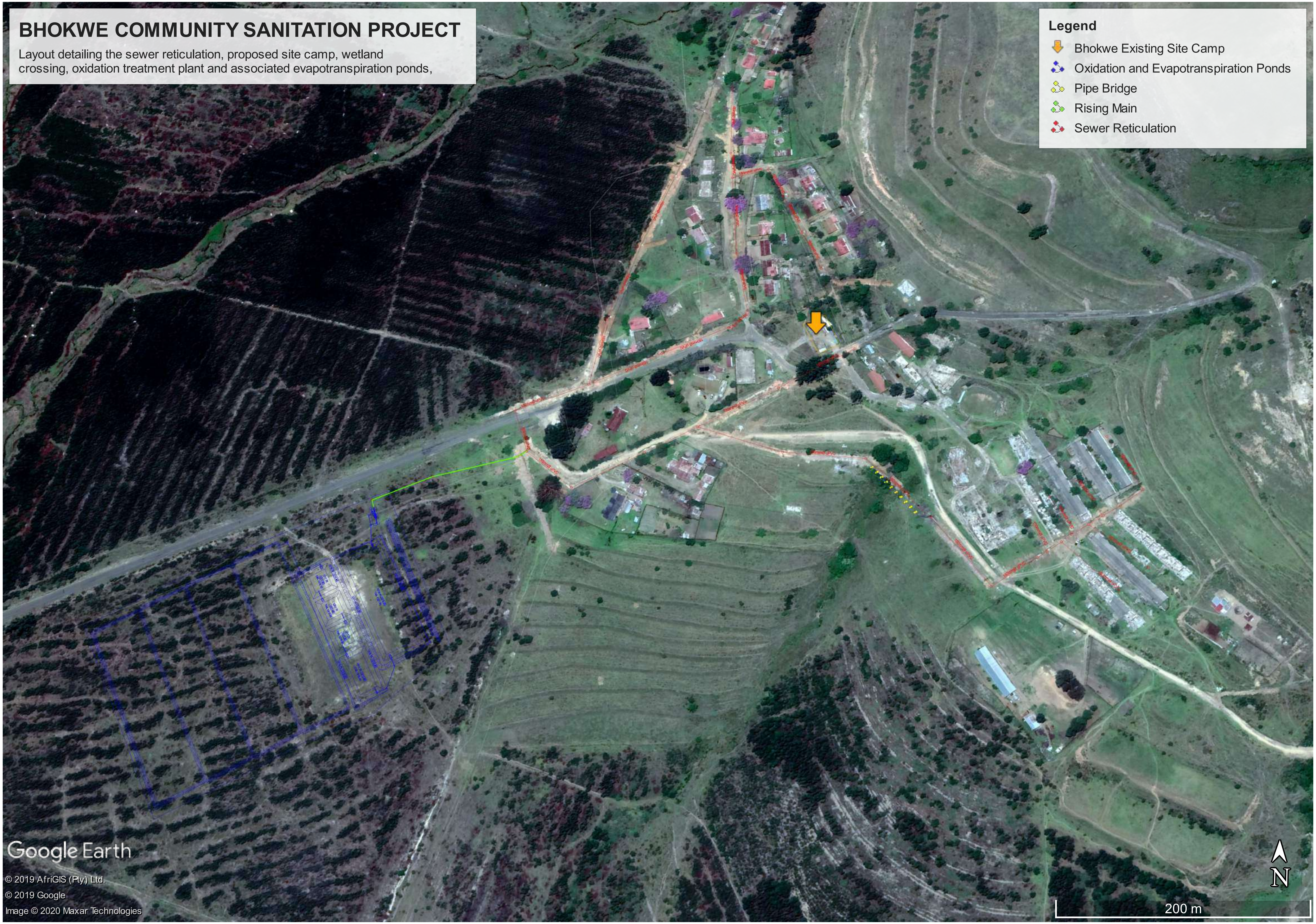
Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Low	None
Very High	Endangered ecosystem
Very High	Strategic Water Source Area

BHOKWE COMMUNITY SANITATION PROJECT

Layout detailing the sewer reticulation, proposed site camp, wetland crossing, oxidation treatment plant and associated evapotranspiration ponds,



edtea
Department :
Economic Development, Tourism and
Environmental Affairs
PROVINCE OF KWAZULU-NATAL

Enquiries: Ms Z Mbanjwa
Imibuzo :
Navrae :

Telephone: 033 264 2898
Ucingo :
Telefoon :

Private Bag : X9152
Isikhwama Seposi : Pietermaritzburg
Privaat Sak : 3200

Reference No: DC26/0001/2020
Inkomba : KZN/EIA/0001302/2020
Verwysing:

iFeksi :
Faks : 033 264 2672

Date :
Usuku :
Datum : 31 January 2020

Email Transmission

1 World Consultants (Pty) Ltd
P.O. Box 2311
Westville
3630
Attention: Ms Fatima Peer
Email: **Fatima@1wc.co.za**

Dear Sir

DC26/0001/2020: KZN/EIA/0001302/2020: ACKNOWLEDGEMENT OF RECEIPT OF AN APPLICATION FOR ENVIRONMENTAL AUTHORIZATION SUBJECT TO A BASIC ASSESSMENT FOR **PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, VRYHEID, LOCATED WITHIN ABAQULISI MUNICIPALITY KZN.**

1. The application for environmental authorization for the abovementioned activity, submitted in terms of the requirements of regulation 6(1) of the EIA Regulations, 2014, was received by this Department on **29 January 2020** this application complies with the EIA Regulations 2014 and has been accepted.

2. Please note that this application has been registered on the National Environmental Authorization System (NEAS) and that the final Basic Assessment Report is **due 04 May 2020.** In terms of regulation 45 of the EIA Regulations 2014, an application lapses if the applicant fails to meet any of the prescribed timeframes (unless an extension has been granted in terms of regulation 3(7).

3. The public participation process for this application must comply with sub-regulation 40(1) of the EIA Regulations 2014 and all potential or registered interested and affected parties, including this Department, must be given a period of at least 30 days to submit comments on each of the applicable reports.

4. Please quote the above-mentioned reference number for this application in all future correspondence.

5. You are reminded that the activity/ies applied for may not commence prior to an environmental authorization being granted by this Department.

6. Enquiries regarding this application may be directed to the Assistant Director: Impact Assessment: **Mr. Sibusiso Ndwandwe: Tel No: 035 870 9377 at the Zululand District Office**.

Yours faithfully,

for: Head of Department:
KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs.
Cc:Mr. Zamokuhle Wesley Mcineka: Zululand District Municipality: zmcineka@zululand.org.za

Appendix B

1WORLD CONSULTANTS (PTY) LTD

COMPANY PROFILE

P.O. BOX 2311
WESTVILLE, 3630
TEL: 031 262 8327
FAX: 086 726 3619

INTRODUCTION

1World Consultants (PTY) Ltd. is a Professional Environmental and M&E Engineering services to a variety of clients in both the public and private sectors.

At 1World, we have extensive experience in the environmental and energy sectors mostly developed through practical involvement in projects for utilities and private consultants. Both our environmental and engineering divisions offer personalised attention on every project. The environmental consultants on our team have successfully executed work for large municipalities, namely eThekwini, Msunduzi and Kwadukuza Municipalities. Our consultants in the recently formed Engineering divisions have added knowledge and skills, ranging across many fields of the Built Environment. The unique combination of engineering and environmental knowledge, and experience enables 1World to provide holistic solutions to a vast range of projects.

VISION

1World Consultants (Pty) Ltd. prides itself on providing individual attention to every project. We aim to be a leading provider of consultancy services for projects in South Africa and beyond.

MISSION

We aim to deliver a quality and efficient service by:

- ✓ Using highly skilled and motivated professionals
- ✓ Consulting with all stakeholders
- ✓ Training and developing our staff
- ✓ Working with local communities
- ✓ Being honest and humble in dealings with stakeholders, providing best value in all aspects of our services

FIELDS OF EXPERTISE

1World Consultants (PTY) Ltd. provide a wide range of services with specialist expertise in the following key core areas and tasks:

- Environmental Services
- Electrical Engineering
- Control and Instrumentation Engineering
- Mechanical Engineering
- Land Surveying Services

ENVIRONMENTAL SERVICES

Drawing on our extensive experience with private and public sector clients, we are able to offer our clients the following services:

- Environmental Planning/Risk Assessments/Screenings/ Due Diligence
- Basic Assessments
- Full scoping and Environmental Impact Assessments (EIA's) and reporting
- Strategic Environmental Assessments
- Facilitation of the Public Participation process
- Water Use License Applications (NWA)
- Waste Management License Applications (NEM:WA)
- Section 24G Rectification Applications
- Environmental Auditing and Site Compliance
- Environmental Control Officer (ECO)
- Environmental Management Plans, recommendations and advice
- Biodiversity/Vegetation Assessments

ELECTRICAL ENGINEERING EXPERTISE AND SERVICES

Our past involvement and ongoing engagements with Eskom, especially in KZN, allow us to afford our clients the comfort of knowing that, on matters involving Eskom, the correct people are being addressed to resolve issues quickly and completely.

We offer the following professional services:

Building Services

- ➢ Supply alternatives – whether municipal power, backup or power-wheeling agreements.
- ➢ Electrical reticulation & distribution design,

- Lighting Design
- Security, Access Control,
- Standby Power generation
- Energy Efficiency Analysis – base line establishment, projects scoping, ROI analysis and roll out co-ordination.
- Building Information Management (BIM) Systems.

Reticulation & Electrification design

- Rural and urban electrification design;
- Building reticulation and refurbishment;
- Highway and Street Lighting Designs;
- Cathodic Protection Design

Substation & Line design

- High and medium voltage substation design;
- High and medium voltage line design;
- High and medium voltage cable design;

Demand Side Management / Energy Audits

DSM is the process by which electric utilities achieve predictable changes in customer demand, which can be considered as alternatives to the provision of additional generation plant. The following services are offered:

- Commercial
  - Energy efficiency and load management in buildings;
  - In line water heaters;
  - Thermal energy storage;
  - Tariff analysis;
  - Power factor correction
- Industrial
  - Industrial and Power Station energy efficiency;
  - In line water heaters;
  - Industrial Load Control;
  - Tariff analysis;
  - Power factor correction

Power System modelling and simulation

1World has expertise in the following simulation software; PSS/e, DigSILENT, Reticmaster and PowaMaster providing the following broad services:

- Master planning;
- Network development planning (NDP);
- Long term load forecasting.
- System analysis and optimisation

Project management

1World offers project management and on-site supervision capabilities for any type of electrical project, especially where we are responsible for detail design of such projects. This allows our engineers to ensure that required standards and quality is maintained during the construction/implementation phases of the project, given the budget and schedule constraints.

CONTROL AND INSTRUMENTATION ENGINEERING

Our exposure to the mining and chemical processing industries provide in-depth understanding of the C&I function within a production plant. We offer the following services:

- Process Engineering
- P & ID generation
- Communication Architecture specification
- Equipment specification

MECHANICAL ENGINEERING EXPERTISE AND SERVICES

Engineering Project Management

Inspection and Evaluation; Status Quo Reports; Repair & Maintenance Programs; Facilities Management; Engineering Construction Management

HVAC Engineering

Design of a Wide Variety of HVAC Systems; Retail; Commercial; Special Process; Chilled water; Air/Water cooled; VRV Ventilation; Smoke extract; Fume/Dust extract

Rational Fire Design

Rational Fire Design, Firefighting Equipment; Fire detection, Public address, Gas Suppression; SCADA Monitoring systems; Fire Department Consultation; And National Building Regulation Fire assessments

Lifts and Escalators

Traffic study; Design of Lifts

Winches and Cranes

Design of Escalators; Winches and Cranes; Weighbridges

Occupational Health & Safety

Risk assessments, HASOP Study; Guidelines to Occupational Health & Safety; Compliance to Construction Regulations; Health & Safety Inspections & reporting

Green Building Design

Analysis of Heat transmission into Building Structures; Solar/Heat pump Hot Water Generation systems; Grey water recycling, Rain water harvesting, boreholes; Energy efficient Electrical systems; Analysis of Electrical and water usage; Compliance SANS204-2011 Energy efficiency in buildings; SANS 10400:XA calculations.

LAND SURVEYING SERVICES

Topographic Surveys

We combine the latest in surveying technology with highly skilled and experienced personnel to deliver cost-effective, high accuracy surveys in both hardcopy and digital mediums, tailored to meet your requirements.

Our Contour Surveys also known as Detail Surveys, Tache /Topographic Surveys, detail all noteworthy features relevant to a particular site. We include positions of buildings, trees, sewerage, draining, communication points, roads, driveways, municipal utilities / services, and levels across the property. This survey can be used as the base plan for your subdivision design/ Development plan.

The professionally drafted plans record:

- Property levels/ spots shots
- Contours at 0.5m intervals (or as required)
- Benchmark level on site
- Building footprint and floor levels
- Noteworthy physical / manmade features
- Utility services (drainage, gas, power, sewer, phone, water, etc)

Infrastructure Surveys

We are able to meet all your Infrastructure Surveying needs from project concept, through to completion. Benefits of our surveys include:

- Achieve optimal conformance of excavation, shotcrete and final lining layers
- Existing conditions or as-built can be captured rapidly using 3D laser scanning
- Location and survey of underground services prior to works commencing

- Accurate installation and erection of structural steel components on complex and high tolerance structures
- We can manage the entire survey package or work integrated with the main contractors survey team

Services we offer on Infrastructure Surveying projects are:

- Roads setting out
- Pipeline Surveys
- Setting out civils work for construction sites
- Setting out buildings
- Solar farms
- Powerline Surveys
- Underground utility detection
- Volumetric surveys

Cadastral Surveys

From simple property Subdivisions, New township establishments, Consolidations of stands, Beacon certificates and relocations and Sectional title surveys, the team can give you the best advice. By utilizing our range of specialized services such as site surveys and sectional title units development, we can partner with you through the entire 'survey to final sale' process.

We are equipped for every aspect of the job requirement, providing the complete solution. By using the latest technology we're able to be efficient and reactive, with the team available whenever you need them. From topographic and site surveys, through to site subdivisions, township pegging and sectional titles development projects. We also provide assistance on cadastral land advisory (Expropriations, Land reform and management) as well as arbitration on boundary disputes.

If you need advice on how best to utilize your land or assistance through the entire land development process, talk to us.

Building Construction Surveys

Benefits include:

- Efficient systems that ensure accuracy and precision without causing delays to construction of high-rise and low-rise buildings
- Calculate and set-out structures accurately and efficiently
- Rapidly capture precise 3D data to compare as-built to design
- Create 3D modeling of structural modules prior to their mobilization to site
- Unreachable or constricted places can be captured due to highly mobile measuring systems

- Ensure items are within fabrication tolerance specification, safeguarding against compliance issues
- Improved safety through precision monitoring of movement of structures

Services we offer on Building Construction Surveys projects are:

- Super High-rise construction
- Hospitals
- Residential complex and houses
- Schools
- Refurbishments
- Low to medium-rise

KEY PERSONNEL

Environmental:	Fatima Peer, BSc (Hons) Chemistry, Pr Sci Nat fatima@1wc.co.za
Electrical:	Mohamed Peer, BSc Electrical Eng, Pr Eng mohamed@1wc.co.za
C&I	Goolam Jajbhai, BSc Elec Eng goolam@1wc.co.za
Mechanical:	Mahomed Suhale Baksh, BSc Mechanical Eng, Pr Eng suhale@1wc.co.za
Land Survey:	Yusuf Kajee, BSc Land Surveying, GPrLS yusufk@1wc.co.za

SUPPORT PERSONNEL

Environmental:	Adila Gafoor, BSoc Sci Geography and Environmental Management Roschel Maharaj, BSc Environmental Sciences Wasila Votajee, BSc Hons Geological Sciences
Electrical:	Ubaidullah Pandor, BSc Electrical Eng Ashley Naidoo, BTech Electrical Eng Nikhil Ganas, BTech Electrical Eng Dave Schutte, Pr Techni Eng.
Mechanical:	Aasif Moosa, BEng Mechanical
Land Survey:	Congress Mafukele, GPrLS

Surveying

PROFESSIONAL REGISTRATION

The team members at 1World Consultants (PTY) Ltd are affiliated to and registered with, amongst other industry specific organisations, the following recognised institutions:

- South African Council for Natural Scientific Professions (SACNASP)
- International Association for Impact Assessment South Africa (IAIAsa)
- Engineering Council of South Africa (ECSA)
- South African Federation of Hospital Engineering (SAFHE)
- South African Institute of Mechanical Engineers (SAIMechE)
- South African Institute of Electrical Engineers (SAIEE)
- South African Geomatics Council (SAGC), ex PLATO
- South African Geomatics Council (SAGC)

COMPANY DETAILS

Legal Name:	1World Consultants (PTY) Ltd.
Operational Years:	8 years (originally operated as a Sole Proprietor from 2011)
Company Reg No.:	2015/084540/07
VAT Registration No.:	445 0271 756
B-BBEE Level:	01

Current & Previous Work Experience

NAME OF CONTRACT/ NATURE OF WORK	DURATION		VALUE OF WORK		NAME, ADDRESS & TELEPHONE NO. OF CLIENT AND/ OR PROJECT LEADER
	FROM	TO	FEE	CONTRACT (RMILLIONS)	
CURRENT PROJECTS					
Basic Assessment Process for the proposed development of residential/ serviced apartments. Location: 49 Casuarina Road, Tongaat Beach	March 2019	Current	R 127 000	Undisclosed	Arup (Pty) Ltd Address: Postnet Suite No. 93, Private Bag X1 Melrose Arch 2076 Tel: 082 734 1168 Email: Yusuf.raja@arup.com
Basic Assessment and Water Use License Application for the Bhokwe Community Sanitation Project Location: Vryheid	June 2019	Current	R 250 000	R 4 000 000	UKUZA Consulting (Pty) Ltd Name: Chris Govender Address: 15 The Boulevard, Westway Office Park, 3630 Tel: 031 265 0444 Email: chris@ukuza.co.za
Basic Assessment Process for the proposed Klerksdorp filling station. Location: Klerksdorp	July 2019	Current	R 77 100	Undisclosed	DMC Holdings Name: Naeem Karim Tel: 018 462 9477
Basic Assessment Process for the proposed filling station and associated food outlets. Location: Grimsby Road, Mobeni	April 2019	Current	R 45 000	Undisclosed	Aniston Investments (Pty) Ltd Name: Zakir Mahomedy Address: 2 Grimsby Road, Mobeni Tel: 079 513 1025 Email: zmahomedy@gmail.com
Basic Assessment Report for the proposed Eskom Battery Energy Storage System (BESS) Elandskop and Pongola Substations. Location: Elandskop and Pongola	February 2019	Current	R 650 000	Undisclosed	Eskom Holdings SOC Ltd Name: Mhleli Vezi and Bruce Burger Address: 25 Valley Value Road, New Germany Tel: 031 710 5689/ 031 710 5386 Email: vezimm@eskom.co.za / burgerbj@eskom.co.za

Current & Previous Work Experience

Water Use License Applications for the Grootvlei Power Station Location: Grootvlei, Gauteng	September 2018	Current	R 115 000	Undisclosed	Eskom Soc Ltd. Name: Hulisani Mutati Address: N3 South Between Heidelberg and Villiers Tel: 017 779 7146 Email: MutatiH@eskom.co.za
Water Use License for the construction of a proposed graveyard located in the Mandeni Municipality Location: Mandeni, KZN	October 2018	Current	R 167 000	Undisclosed	Mandeni Local Municipality Name: Masupha Mathenjwa Address: 2 Kingfisher Road, Mandeni, KwaZulu-Natal Tel: 082 218 4737 Email: Masupha.Mathenjwa@ilembe.gov.za
2 x EIA Enquiry for proposed new Bethlehem Graveyard Location: Bethlehem, Free State	October 2018	October 2018	R 10 000	Undisclosed	MSS Design Group Name: Mohamed Sayed Address: Unit 24, 53 Anthony Road, Durban North Tel: 031 563 3379 Email: mssarch@wol.co.za
Environmental Services to facilitate Wetland Delineation and Functional Assessment for the Orthman Road Shopping Centre Location: Orthman Road, PMB	October 2018	November 2018	R 32 000	Undisclosed	Royal Rice Company Name: Imraan Badrudin Address: 397 Victoria Road, PMB Tel: 033 345 9751 Email: imraan@royalrice.co.za
Biodiversity Assessment for the Lodge Uitval and Conference Centre with 26 accommodation chalets and associated infrastructure and related buildings Location: Uitval, KZN	September 2018	September 2018	R 30 000	Undisclosed	Mondli Consulting Name: Brian Mthembu Address: 66 Main Street, Howick Tel: 033 330 2513 Email: mondlib@webmail.co.za
Ecological Assessment for 2 Proposed Borrow Pits Associated with the Upgrade of the R61 National Route Location: Ray Nkonyeni Municipality, KZN	September 2018	September 2018	R 30 000	Undisclosed	Kerry Seppings Environmental Consulting Name: Nishkar Maharaj Address: 4 Woodville Lane, Summervelt, Assagay Tel: 063 684 9195

Current & Previous Work Experience

					Email: nishkar@ksems.co.za
Vegetation Assessment and Environmental Screening for the Proposed Solevita Gardens Housing Development Location: Amanzimtoti, KZN	April 2018	April 2018	R 30 000	Undisclosed	ARUP Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
Basic Assessment for the construction of the Umdloti Beach far South sewage pump station, rising main, gravity sewer reticulation and access road. **Location:** Umdloti Beach, KZN	February 2018	Current	R 209 000	Undisclosed	eThekwini Municipality: Water & Sanitation Name: Vernon Ndlhozi Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8549 Email: Vernon.Ndlhozi@durban.gov.za
Environmental Screening for the Proposed Nodal Development Location: Umbumbulu, Kzn	December 2017	December 2017	R 20 000	Undisclosed	ARUP Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
Environmental Screening for the Proposed Cato Ridge Abattoir Location: Cato Ridge, KZN	December 2017	December 2017	R 20 000	Undisclosed	ARUP Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
ECO Monitoring for the Rehabilitation of the Jukskei River and refurbishment of the Jukskei Park **Location:** Jukskei, JHB	October 2017	June 2018	R 50 000	Undisclosed	VCAQS Name: Casandra Naidoo Address: 4 Rockdale Avenue, Westville Tel: 031 266 8615 Email: cas@vcaqs.co.za

Current & Previous Work Experience

Section 24G application for the rectification of the unlawful commencement and Continuation of a listed Activity situated at 56 Ocean Terrace. **Location**: Isipingo Beach, KZN	October 2017	Current	R 85 000	Undisclosed	AKR Property Development (Pty) Ltd Name: Trivolan Govender Tel: 031 507 7473 Email: accounts@akrgroup.co.za
Environmental Impact Report for Proposed Residential Development Location: Pinetown, KZN	May 2017	May 2017	R 15 000	Undisclosed	ARUP Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
Environmental authorisation, EMP and WULA for the 52km, 300mm diameter Pipeline and associated reservoirs and pump stations for the Umshwathi Bulk Infrastructure Upgrade Project. **Location:** Ndwedwe Local Municipality, KZN	May 2017	Current	R683 000	R 75m	Umgeni Water Name: Zethu Jili Address: 310 Burger St, Pietermaritzburg, 3201 Tel: 033 341 1083/ 083 306 7435 Email: zethu.jili@umgeni.co.za
Biodiversity Assessment for the Proposed Port Edward Housing Development Location: Port Edward, KZN	April 2017	April 2017	R 20 000	Undisclosed	ARUP Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
Nonoti Abattoir - Basic Assessment, EMP and WULA for the establishment of a new bovine abattoir **Location:** Stanger, KZN	April 2017	Current	R80 000	R 12m	ARUP Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
ECO Monitoring for the Village Walk Shopping Centre (construction of a high rise, mixed-use, building) located on Rivonia Road, Sandton **Location:** Sandton, JHB	February 2017	October 2018	R 100 000	Undisclosed	ARUP Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com

Current & Previous Work Experience

Eastmoor Crescent - Basic Assessment, EMP for the demolishing and re-building of a residential dwelling **Location:** Eastmoor Crescent, La Lucia	January 2017	Current	R80 000	R 5m	ARUP & Nxasana Sizwe Errol Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
Glebe Sewer Reticulation; Amendment of Environmental Authorisation **Location:** Inanda Glebe, Inanda, Durban	November 2016	Current	R172 000	R 25m	eThekwini Municipality: Water & Sanitation Name: Silondiwe Gumede Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8751 Email: Silondiwe.gumede@durban.gov.za
Lagoon Drive (Fleetwood on Sea) - Basic Assessment, EMP for the refurbishment and extension of a residential block **Location:** Umhlanga Rocks, Durban	November 2016	Current	R72 000	R 30m	ARUP & Dalmatian Duo Investments Name: Yusuf Raja Address: 167 Florida Road, Durban, 4001 Tel: 031 328 8700/ 082 734 1168 Email: yusuf.raja@arup.com
Vegetation Assessment, EMP, ECO Monitoring and Contractor Training **Location:** Donnelly Road, Wentworth	July 2016	Current	R60 693.60	R 8m	eThekwini Municipality: Department of Human Settlements & Infrastructure- Social Housing Name: Nokuthula Madondo Address: Shell House, 221 Anton Lembede Street, Durban, 4001 Tel: 031 311 - 3218 Email: nokuthula.madondo@durban.gov.za
ECO Monitoring for the Pipeline Projects, Wartburg to Bruynshill and South Coast Phases 2B & 2A and Amendment to Environmental Authorisation **Location:** Wartburg to Bruynshill and South Coast (Scottburg & Kelso)	June 2016	Current	R928 487.93	R 120m	Umgeni Water Name: Asha Ramjatan Address: 310 Burger St, Pietermaritzburg, 3201 Tel: 033 3411 335/ 083 679 4423 Email: Asha.Ramjatan@umgeni.co.za
Basic Assessment for the construction of a petrol station and associated infrastructure **Location:** Overport	June 2016	Current	R90 345	R 6m	Brickfield Investments (Pty) Ltd Name: E.C Vayej Address: 296 Jan Smuts Hwy, Durban, 4091 Tel: 031 207 5683/082 768 0700 Email: evayej@gmail.com

Current & Previous Work Experience

SANRAL National Route 2 ECO Monitoring: Routine Road Maintenance Environmental Compliance Monitoring **Location:** Umdloti	February 2016	Current	R90 288	R 12m	Aurecon & SANRAL Name: Johan Calitz Address: 4 Daventry Street, Lynnwood manor, 0081 Tel: 012 427 2634 Email: Johan.Calitz@aurecongroup.com
EAP & ECO Monitoring, Environmental Training **Location:** Adams Mission	March 2016	Current	R124 650	R 30m	eThekwini Municipality Name: Nomagugu Ncemane Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8148 / 071 855 8124 Email: nomagugu.ncemane@durban.gov.za
Basic Assessment, Vegetation Assessment, Water Use License Application, Environmental Control Officer Monitoring and Environmental Training for a water pipeline. **Location:** Alverstone, Hillcrest, Durban	January 2016	Current	R325 500	R 47m	eThekwini Municipality: Water & Sanitation Name: Leisel Bowes Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8656/ 082 395 8195 Email: leiselbowes@durban.gov
Basic Assessment, Water Use License Application, Environmental Control Officer Monitoring and Environmental Training for a water pipeline. **Location:** Maphephetheni, Inanda, Durban	December 2015	Current	R355 000	R 68m	eThekwini Municipality Name: Nomagugu Ncemane Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8148 / 071 855 8124 Email: nomagugu.ncemane@durban.gov.za
Basic Assessment, Water Use License Application, Environmental Control Officer Monitoring and Environmental Training for the Mbhele Pedestrian Bridge **Location:** Margate	November 2015	Current	R260 000	R 4m	PGA Consulting Name: Marcus Sadhai Address: 53 Intersite Avenue, Umgeni Business Park Tel: 031 263 2583 Email: marcus.sadhai@pgaconsulting.co.za
Basic Assessment, Water Use License Application, Environmental Control Officer Monitoring and Environmental Training for a Dressing Pedestrian Bridge **Location:** Bhomela	November 2015	Current	R260 000	R 4m	PGA Consulting Name: Marcus Sadhai Address: 53 Intersite Avenue, Umgeni Business Park

					Tel: 031 263 2583 Email: marcus.sadhai@pgaconsulting.co.za
Basic Assessment, Water Use License Application and ECO Monitoring for Burbreeze Reservoir and Pipeline **Location:** Tongaat	October 2015	Current	R280 000	R 70	eThekwini Municipality & RHDHV Name: Roxanne Mans Address: 3 Prior Road, Durban Central, 4001 Tel: 083 776 0626 Email: Roxanne.mans@rhdhv.com
Training and ECO Monitoring for Reforestation Hub within Buffelsdraai Landfill Site **Location:** Buffelsdraai	September 2015	Current	R112 176	+-R20m	eThekwini Municipality (EPCPD) Name: Errol Douwes Address: 166 K.E Masinga Road, Durban, 4001 Tel: 031 311 7952 Email: Errol.Douwes@durban.gov.za
Environmental Control Monitoring **Location:** Cedara, PMB	November 2015	Current	+-R20 000	R 2	Madrassa An-Noor for the Blind Name: Mohamed Timol Address: Lot 3 Cedara Road, Pietermaritzburg, 3201 Tel: 033 343 3301 Email: admin@mnblind.org
Basic Assessment, Water Use License Application and ECO Monitoring for Midnite Café Reservoir and Pipeline **Location:** Craigieburn	August 2015	Current	R420 889	R50m	Royal Haskoning DHV & Ethekwini Municipality Name: Roxanne Mans Address: 19 Park Lane. Umhlanga, 4319 Tel: 083 776 0626 Email: Roxanne.mans@rhdhv.com
ECO Monitoring for construction of Brookside Taxi Holding Area **Location:** Pietermaritzburg	May 2014	Current	R28 000	R10m	Msunduzi Municipality: Dept. of Transportation Name: Khethiwe Mvelase Address: 333 Church Street, AS Chetty Building, Pietermaritzburg Tel: 073 593 1885 Email: khethiwe.mvelase@msunduzi.gov.za

Current & Previous Work Experience

Formulation of EMP for Rehabilitation of Pipeline Bridge. ECO Monitoring for Rehabilitation of Pipeline Bridge **Location:** Canelands, Verulam	May 2014	Current	R94 000	R10m	eThekwini Municipality & SMEC Name: Leisel Bowes Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8656/ 082 395 8195 Email: leiselbowes@durban.gov
PREVIOUS PROJECTS					
Environmental Screening for Strip Mall in Newlands West Inanda Square Basic Assessment **Location:** Newlands West	June 2014	June 2015	R52 500	R6.5m	Arup & SMFT Properties Name: Nadheem Sheik Address: 167 Florida Road, Durban, 4001 Tel: 072 437 8299 Email: nsa@vodamail.co.za
Environmental Screening for two sites for waste management facilities **Location:** Merebank and Verulam	May 2014	July 2014	R2 500	R5m	We're Recyclling Pty (Ltd) Name: Riaz Vanker Address: Myrtle Road, Green Office Building, New Germany, 3600 Tel: 082 080 9764 Email: vankersinternational@telkomsa.net
Environmental Screening for Warehousing. **Location:** Newlands West	May	2014	R2 500	R6m	Eminen Architects Name: Muhammed Naroth Address: 292 Grey Street, Durban, 4001 Tel: 078 573 9970 Email: muhammed@eminen.co.za
Halpin Avenue Muslim Cemetery – Environmental Screening **Location:** Halpin Avenue, Reservoir Hills	July 2014	August 2014	R5 000	R3m	PAR Quantity Surveyors Name: Rasheed Peer Address: 2 Chesham Pl, Westville, 3630 Tel: 082 876 5887 Email: arpqs@wol.co.za
Sewage Pipeline Basic Assessment, Public Participation and EMP Water Use License Application **Location:** Pietermaritzburg	August 2014	July 2016	R182 000	R10m	Msunduzi Municipality Water and Sanitation Name: Dhamendra Ragunanthan Address: 333 Church Street, AS Chetty Building, Pietermaritzburg

					Tel: 033 392 2115 Email: Dhamendra.Ragoonandan@msunduzi.gov.za
EMP for Fuel Retail License **Location:** Marian Hill	July 2014	August 2014	R30 000	R5m	Woodford Motors cc Name: Owaiys Soleman Address: 41 Woodford Grove, Berea, 4001 Tel: 083 577 8600 Email: owaiys@woodford.co.za
Application of Water Use License and coordination of Specialist Study for Rehabilitation of Pipeline Bridge **Location:** Canelands, Verulam	May 2014	April 2015	R25 000	R10m	eThekwini Municipality: Water & Sanitation Name: Leisel Bowes Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8656/ 082 395 8195 Email: leiselbowes@durban.gov
Formulation of Vegetation Rehabilitation Plan for Pipeline Bridge. ECO Monitoring for Vegetation Rehabilitation **Location:** Umgeni	July 2014	October 2015	R47 000	R10m	eThekwini Municipality & SMEC Name: Leisel Bowes Address: 3 Prior Road, Durban Central, 4001 Tel: 031 311 8656/ 076 412 8575 Email: leiselbowes@durban.gov
Environmental screening for seven sites earmarked for places of worship. **Location:** Kwadukuza	May 2014	July 2014	R17 000	R7m	Kwadukuza Municipality Name: Nokubonga Kunene Address: 14 Chief Albert Luthuli Street, KwaDukuza, 4450 Tel: 071 897 9366 Email: nokubongak@kwadukuza.gov.za
Application for Waste Management License and related Environmental Authorisation (Basic Assessment) for sewage, contaminated stormwater and food grease storage facilities within the Proposed Drag Race Track and Entertainment Complex. **Location:** Eddie Hagen Drive, Cato Ridge, Kwazulu Natal	February 2012	May 2013	R22 000	R5m	Pilson Developers cc Name: Rajan Pillay Address: 198 Saunders Circle, Tongaat, 4400 Tel: 084 440 0887 Email: ranap@sanlamsky.co.za
Environmental Authorisation (Basic Assessment) for a Proposed Drag Race Track and Entertainment Complex. **Location**: Eddie Hagen Drive, Cato Ridge, Kwazulu Natal	January 2011	March 2013	R35 000	R5m	Pilson Developers cc Name: Rajan Pillay Address: 198 Saunders Circle, Tongaat, 4400

Current & Previous Work Experience

					Tel: 084 440 0887 Email: ranap@sanlamsky.co.za
Appeals Process (S24G) for Diesel Storage facilities. **Location:** Erf 104, Cliffdale, Kwazulu Natal	November 2012	December 2012	R10 000	R5m	Trans Africa Farms Name: Rishi Sookoo Address: 20 Montague Drive, Umhlanga Ridge, 4320 Tel: 082 418 6599 Email: transafrica@mweb.co.za
Retrospective Environmental Authorisation (Basic Assessment) for unlawful clearing of vegetation and for proposed hydroponic tunnel farm and associated warehousing and facilities. **Location:** Erf 104, Cliffdale, Kwazulu Natal	January 2010	March 2011	R30 000	R5m	Trans Africa Farms Name: Rishi Sookoo Address: 20 Montague Drive, Umhlanga Ridge, 4320 Tel: 082 418 6599 Email: transafrica@mweb.co.za
Appeals Process (S24G) for unlawful clearing of vegetation in a D'MOSS protected area. **Location**: Erf 104, Cliffdale, Kwazulu Natal	March 2011	November 2011	R10 000	R5m	Trans Africa Farms Name: Rishi Sookoo Address: 20 Montague Drive, Umhlanga Ridge, 4320 Tel: 082 418 6599 Email: transafrica@mweb.co.za

is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;

- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998)

Disclosure of Vested Interest (**delete whichever is not applicable**)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;

Signature of the environmental assessment practitioner:

1World Consultants (Pty) Ltd

Name of company:

Date:

PROJECT ROLE: SENIOR ENVIRONMENTAL ASSESSMENT PRACTITIONER

Name:	Fatima Peer	
Telephone:	031 262 8327	
Fax:	086 726 3619	
Email:	fatima@1wc.co.za	
Professional Registration:	SACNASP – Membership No.: 400287/11 IAIAsa – Membership No.: 3974	

Nationality at birth	South African				
Present nationality	South African				
Date of birth (day,month,year)	13/12/1976				
Place of birth	Durban				
sex	Male		Female	x	

EDUCATION AND TRAINING
(ADD SEPARATE ENTRIES FOR EACH RELEVANT COURSE YOU HAVE COMPLETED, STARTING WITH MOST RECENT)

Date (from – to)	January 1995 – December 2000
Name and type of organization providing education and training	UKZN - University
Principal subject/ occupational skills covered	Chemistry and Cell Biology Environmental Management Science, Photochemistry, Wood and Paper Milling, Computational Chemistry
Title of qualification awarded	Bachelor of Science in Chemistry (Hons)

WORK EXPERIENCE
(ADD SEPARATE ENTRIES FOR EACH RELEVANT POST OCCUPIED STARTING WITH THE MOST RECENT)

Date (from- to)	August 2010- Present
Name and address of employer	1World Consultants 181 Winchester Drive, Reservoir Hills, Durban, 4091
Type of business sector	Engineering and Environmental Consultants
Occupation or position held	Owner Senior Environmental Assessment Practitioner
Main activities and responsibilities	Facilitation of environmental authorisations from Department of Environmental Affairs, Public Participation of projects for authorisation processes Water Use License Applications Waste Management Applications and/or Plans Environmental Management Plans Environmental Control Officer Monitoring Appeals processes Environmental Screening Processes and general advice to clients

Date (from- to)	2008 – May 2010
Name and address of employer	PAR Quantity Surveyors
Type of business sector	Quantity Surveying
Occupation or position held	Environmental Consultant
Main activities and responsibilities	Environmental Screening Processes and general advice to clients

Date (from- to)	May 2002 - March 2004
Name and address of employer	Sasol Ltd Research and Development
Type of business sector	Coal Research and Development
Occupation or position held	Senior Scientist
Main activities and responsibilities	Research coal processes and investigate novel equipment and/or processes. Lead teams of research. Present at conferences.

Date (from- to)	June 2002- December 2003
Name and address of employer	Sasol Ltd Research and Development
Type of business sector	Coal Research and Development
Occupation or position held	Safety Representative for Coal & Syngas Research
Main activities and responsibilities	Ensure the Coal Processing Unit adhered to safety plans and protocols, by inspections and monitoring

Date (from- to)	January 2001- April 2002
Name and address of employer	Sasol Ltd Research and Development
Type of business sector	Coal Research and Development
Occupation or position held	Grade 01 Scientist
Main activities and responsibilities	Research coal processes and investigate novel equipment and/or processes.

Date (from- to)	1999-2001
Name and address of employer	University of Natal (Durban)
Type of business sector	Academic
Occupation or position held	First Year Chemistry Laboratory Demonstrator
Main activities and responsibilities	Coach students on lab protocols Assess students on research done in laboratories

Date (from- to)	December 1998
Name and address of employer	Sasol Technology (Process Water)
Type of business sector	Research
Occupation or position held	Vacation Student
Main activities and responsibilities	Investigate used process water and attempt to mitigate it by researching novel ways to reduce the volumes released into rivers.

PERSONAL SKILLS AND COMPETENCES

(ACQUIRED IN THE COURSE OF LIFE AND CAREER BUT NOT NECESSARILY COVERED BY FORMAL CERTIFICATES AND DIPLOMA)

MOTHER TONGUE	ENGLISH
OTHER LANGUAGES	AFRIKAANS (BASIC) ZULU (BASIC)

(SPECIFY LANGUAGE)	**ENGLISH**	**AFRIKAANS**	**ZULU**
READING SKILLS	PERFECT	GOOD	POOR
WRITING SKILLS	PERFECT	GOOD	POOR
VERBAL SKILLS	PERFECT	GOOD	FAIR

DRIVING LICENSE(S)	CODE 8

ADDITIONAL INFORMATION	**SACNASP** MEMBER **IAIASA** MEMBER **ENVIRONMENTAL LAW COURSE** **ENVIRONMENTAL IMPACT ASSESSMENT : THEORY AND PRACTICE (**BY VICKI KING OF METAMORPHOSIS ENVIRONMENTAL CONSULTANTS) **ROLES AND RESPONSIBILITIES OF AN ECO** (BY IAIASA- INTERNATIONAL ASSOCIATION FOR IMPACT ASSESSMENT SOUTH AFRICA) **SPATIAL PLANNING AND LAND USE MANAGEMENT ACT (SPLUMA)** **(**BY IAIASA- INTERNATIONAL ASSOCIATION FOR IMPACT ASSESSMENT SOUTH AFRICA)

Brief Project History: (Selected Projects)	**Cato Ridge Racetrack & Entertainment Complex** Environmental consulting services for the proposed development of a Drag Race Track, with recreational and entertainment facilities in Cato Ridge, KwaZulu-Natal. • Basic Assessment • Waste Management License • Environmental Management Plan • Public Participation Process
	Cliffdale Hydroponic Farm & Associated Warehousing Environmental consulting services for the development of a Hydroponic Farm and related warehousing facilities, in Cliffdale, Outer West Durban, KwaZulu-Natal. • Basic Assessment • Environmental Management Plan • Public Participation Process • Appeals Process
	Rehabilitation of a Pipeline Bridge Environmental consulting services for the rehabilitation of a Pipeline Bridge, for eThekwini Municipality, Department of Water & Sanitation, in Verulam, Durban, KwaZulu- Natal. • Environmental Management Plan • Water Use License • ECO Monitoring • Environmental Training
	Sewage Reticulation System Environmental consulting services for the proposed sewage reticulation system, for the Msunduzi Municipality, Department of Water & Sanitation, in Ward 20 Edendale, Pietermaritzburg. • Basic Assessment • Water Use License • Public Participation • Heritage Impact Assessment
	Umgeni Vegetation Rehabilitation Environmental consulting services for vegetation rehabilitation plan for a Pipeline Bridge, in Umgeni. • Vegetation Rehabilitation Plan • ECO Monitoring
	Alverstone Water Pipeline Project Environmental consulting services for a proposed water pipeline for the eThekwini Water & Sanitation, in Alverstone, Hillcrest, KwaZulu-Natal. • Basic Assessment • ECO Monitoring • Water Use License • ECO Monitoring • Environmental Training
	Buffelsdraai Reforestation Hub Environmental consulting services for a Building upgrade project at the Buffelsdraai Landfill Site, Buffer zone (Community Reforestation Project), Buffelsdraai, Verulam, Durban, KwaZulu-Natal. • ECO Monitoring • Environmental Training
	Felix Dlamini Petrol Filling Station and Convenience Store Environmental consulting services for the construction of a Filling station and convenience store located in Overport, Durban, KwaZulu-Natal. • Basic Assessment • Public Participation • Environmental Authorisations
	Umgeni Bulk Water Supply Environmental consulting services for Umgeni Water bulk water pipeline project, from Wartburg to Bryunshill and South Coast. • ECO Monitoring • Environmental Training • Project Environmental Expert

	DONNELLY ROAD SOCIAL HOUSING PROJECT ENVIRONMENTAL CONSULTING SERVICES FOR THE CONSTRUCTION OF SOCIAL HOUSING, IN WENTWORTH, DURBAN, KWAZULU-NATAL, FOR THE DEPARTMENT OF HUMAN SETTLEMENTS & INFRASTRUCTURE: SOCIAL HOUSING UNIT. • VEGETATION ASSESSMENT • ENVIRONMENTAL MANAGEMENT PLAN • ECO MONITORING • ENVIRONMENTAL TRAINING

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Fatima Peer

Registration Number: 400287/11

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 fields(s) of practice (Schedule 1 of the Act)

Chemical Science
Environmental Science

Effective **31 August 2011**

Expires **31 March 2020**

Botha

Chairperson

Chief Executive Officer

Scan this code to view online version of this certificate

University of Natal

We, the Vice-Chancellor, the Registrar,
and the Dean of the Faculty,
hereby certify
that

Fatima Peer

has this day been admitted to
the degree of

Bachelor of Science Honours (Chemistry)

Vice-Chancellor

Registrar

Dean

20 April 2001

UV PROTECTED – TAMPER EVIDENT UV

IAIAsa
International Association
for Impact Assessment
South Africa

IAIAsa Secretariat
Tel +27(0)11 655 7183
Fax 086 662 9849
Address:
43 Birchwood Court, Montrose
Street, Vorna Valley, Midrand, 1618
Postal address:
PO Box 11666, Vorna Valley, 1686
Email: operations@iaiasa.co.za
Website: www.iaiasa.co.za

IAIAsa Confirmation of Membership: 2019/2020
Fatima Peer Membership Number: 3974

13 February 2019

TO WHOM IT MAY CONCERN

Ms Fatima Peer, 1 World Consultants (Pty) Ltd (IAIAsa membership Number 5238) is a paid-up full member in good standing of the South African Affiliate of the International Association for Impact Assessment and has been a member of IAIAsa since 31 March 2015.
Membership has been continous from 31 March 2015 to date.

This membership is valid from 1 March 2019 to 28 February 2020.

IAIAsa is a voluntary organisation and is not a statutory body regulating the profession. Its members are however expected to abide by the organisation's code of ethics which is available on our website.

Any enquiries regarding this membership may be directed to the Secretariat at the above contact details.

Yours Sincerely

Robyn Luyt
IAIAsa President 2018/2019

CURRICULUM VITAE

ROWENA HARRISON

MALACHITE
ECOLOGICAL SERVICES

345 Peter Mokaba Road

Morningside

Durban

4001

PERSONAL DETAILS

Name	Rowena Harrison
Date of Birth	21 April 1982
Identity Number	8204210320081
Marital Status	Single
Nationality	South African
Current Position	Director (Wetland Specialist and Soil Scientist)
Office Location	Durban, KwaZulu-Natal
Website	www.malachitesa.co.za
Tel	+27 (0)78 023 0532
Email	rowena@malachitesa.co.za

ACADEMIC QUALIFICATIONS

2019 - present	PhD Soil Science (University of Free State and the University of Burgundy, France)
2015	Certificate in Wetland Rehabilitation – University of the Free State
2009	MSc (Soil Science) – University of KwaZulu-Natal
2008	Certificate course in Wetland Delineation, Legislation and Rehabilitation, University of Pretoria
2006	BSc (Environmental Science) – University of KwaZulu-Natal
2005	BSc (Applied Environmental Science) – University of KwaZulu-Natal

PROFESSIONAL AFFILIATION

- South African Council for Natural Scientific Professions – SACNASP (Pr. Sci.Nat 400715/15: Soil Science)
- International Association for Impact Assessments – IAIAsa
- South African Wetland Society

CONFERENCES ATTENDED

NAME	DATE
Biodiversity Symposium – Presenter on Hydropedology and Carbon dynamics	November 2019
IAIAsa – KZN Branch – Presenter on wetland offsets from a soils perspective	October 2019
Zoological Society of Southern Africa Conference	July 2019
Grass Identification Course hosted by African Land-Use Training	March 2019
Groundwater Modelling Course hosted by the Nelson Mandela Metropolitan University	February 2019
Hydropedology Course hosted by TerraSoil Science and the Water Business Academy	November 2018
Wetland National Indaba	October 2018
Wetland National Indaba	October 2017
Wetland Vegetation training course	February 2017
National Biodiversity and Business Network (NBBN). Biodiversity Indaba	March 2017
Certificate course in Wetland Rehabilitation and Management, University of the Free State	March 2015
Gauteng Wetland Forum: Basic Wetland Delineation course	February 2013
EIA Training Course: Real World EIA, Metamorphosis Environmental Consultants	November 2008
Certificate course in Wetland Delineation, Legislation and Rehabilitation, University of Pretoria	May 2008

EMPLOYEMENT RECORD

April 2016 – Present:

Malachite Ecological Services – Director (Wetland Ecologist and Soil Scientist)

March 2014 – March 2016:

Afzelia Environmental Consultants (Pty) Ltd - Soil Scientist and Wetland Specialist

Sept 2012 – Feb 2014:

Strategic Environmental Focus (Pty) Ltd - Junior Wetland Specialist

Feb 2008 – Dec 2009:

Afzelia Environmental Consultants cc - Soil Scientist/Junior Wetland Specialist and Environmental Assessment Practitioner

PROJECT EXPERIENCE

Rowena has obtained a MSc. in Soil Science from the University of KwaZulu Natal, Pietermaritzburg. She is professionally affiliated to the South African Council for Natural Scientific Professions (Pr. Sci. Nat) and has 10 years consulting experience in the wetland and soil science field. She has conducted numerous wetland and soil assessments for a variety of development types across South Africa, Swaziland and into West Africa. She is a member of the International Association for Impact Assessment (IAIA) as well as a founding member of the South African Wetland Society. She is currently a joint PhD candidate at the University of the Free State and the University of Burgundy in France. Her research is focused on the interactions of dissolved organic carbon and hydropedology at a catchment scale.

Below is an abridged list of projects completed:

Wetland Impact Assessments

- Wetland and ecological sensitivity of Farm 1287, Mbabane Swaziland
- Ulundi Crossings Shopping Centre, KwaZulu-Natal
- Somkhele Mine, Mtubatuba, KwaZulu-Natal
- Lynton Hall housing development, Pennington KwaZulu-Natal
- Pennington PumpStation – Wetland Monitoring

- Enyathi Water Supply project, Vryheid, KwaZulu-Natal
- Agulhus Vryheid Eskom powerline and Substation, Swellendam, Western Cape
- D1095 road upgrade, KwaZulu-Natal
- Juno-Gromis 230km power line corridor, Northern and Western Cape Provinces
- Mt Albert Mixed Use Development, KwaZulu Natal
- Saldanha Strengthening Project, Saldanha, Western Cape Province
- Intaba Ridge Housing Development, Pietermaritzburg, KwaZulu-Natal
- Yoyo Mixed Use Development, Republic of Cameroon
- Elandspruit Colliery, Middleburg, Mpumalanga
- Bokoko Infrastructure Development, Douala, Republic of Cameroon
- Erf 223 Port Edward, Wetland Assessment for a Section 24G application
- Mbewu-Invubu power line corridor, Richards Bay, KwaZulu- Natal Province
- P483 Road Upgrade; KwaZulu- Natal Province
- P254/1 Road Upgrade; KwaZulu- Natal Province
- P187/1 Road Upgrade; KwaZulu- Natal Province
- L1524 Road Upgrade; KwaZulu- Natal Province
- Paulpietersburg Shopping Centre; KwaZulu- Natal Province
- Tshipi e Borwa Strengthening Projects, Postmasburg, Northern Cape
- Portion 68 Hammarsdale, Wetland Assessment for a Section 24G application
- Esikhumbeni Stand Alone Water Supply System; KwaZulu- Natal Province
- AMI Colliery; Vryheid; KwaZulu- Natal Province
- Ephateni Bulk Water Supply System; KwaZulu- Natal Province
- Vlakfontein Mine extension, Ogies, Mpumalanga Province
- Brakfontein Colliery, Delmas, Mpumalanga Province
- Samrand Estate; Centurion, Gauteng Province

Rehabilitation Plans

- De JagersKraal Compensation, wetland rehabilitation plan, KwaZulu-Natal
- Intaba Ridge Housing Estate, Pietermaritzburg, KwaZulu-Natal
- Greytown Bulk Water Supply, Greytown, KwaZulu-Natal
- Hluhluwe iMfolozi Park Bitumen Spill Rehabilitation Plan
- Hollingwood Housing Development, Pietermaritzburg, KwaZulu-Natal
- Samrand Estate; Centurion, Gauteng Province
- Paulpietersburg Shopping Centre; KwaZulu- Natal Province
- L1524 Road Upgrade; KwaZulu- Natal Province
- P187/1 Road Upgrade; KwaZulu- Natal Province

- P254/1 Road Upgrade; KwaZulu- Natal Province
- P483 Road Upgrade; KwaZulu- Natal Province
- N2/R56 Interchange
- Hluhluwe iMfolozi Park Bitumen Spill Rehabilitation Plan

Soil and Agricultural Assessments

- Soil and Agricultural Assessment for the cultivation of soil within pivot irrigation systems, Kokstad, KwaZulu-Natal.
- Pedological rehabilitation report for the implementation plan for the restoration of the conservation area within the Dube Tradeport Precint, Ethekwini Metropolitan Municipality.
- Macadamia Orchards, Paddock, KwaZulu-Natal
- Geluk Mine, Limpopo Province
- Madundube Housing Development, KwaZulu-Natal
- Vryheid Substations, Swellendam Local Municipality; Western Cape Province
- Gunther Muhl Agricultural Project; Vryheid; KwaZulu Natal Province
- Sokhulu Agricultural Development Project; KwaZulu Natal Province
- Portion 22 of the Farm Vaalkop Camperdown; KwaZulu-Natal Province
- Vlakfontein Mine, Ogies, Mpumalanga Province
- Silverhill Retreat; Kamberg KwaZulu Natal; KwaZulu Natal Province
- Cleopatra Extension Development; Kamberg; KwaZulu Natal Province
- Bartlett Estate, Hammarsdale KwaZulu Natal Province
- Etafuleni Housing Project; Phoenix; KwaZulu Natal Province
- Valley View Estate Residential Development; Camperdown; KwaZulu Natal

REFERENCES

COMPANY NAME	CONTACT PERSON	WORK UNDERTAKEN
GCS Water and Environmental Consultants	Natalie Way Jones Email: nataliew@gcs-sa.biz Tel: 083 254 6602	Numerous wetland assessments across KwaZulu-Natal
Greendoor Environmental (Pty) Ltd	Dr. Rebecca Bowd Tel: (0) 72 181 4236 Email: rebecca@greendoorgroup.co.za	Numerous wetland assessments across South Africa
SAT Environmental (Pty) Ltd	Sheldon Singh Tel: 072 455 5168 Email: sheldon@satenviro.co.za	Numerous wetland assessments across KwaZulu-Natal

OTHER

Malachite Specialist Services is a biodiversity company specialising in a variety of ecological services across Africa. We pride ourselves on making developments, no matter what size work for the environment and to always conduct our assessments to a high scientific and professional standard.

Andrew Husted

M.Sc Aquatic Health (*Pr Sci Nat*)

Cell: +27 81 319 1225

Email: andrew@thebiodiversitycompany.com

Identity Number: 7904195054081

Date of birth: 19 April 1979

Profile Summary

Working experience throughout South Africa, West and Central Africa and also Armenia.

Specialist experience with on-shore drilling, mining, engineering, hydropower and renewable energy.

Considerable experience with project management of national and international multi-disciplinary projects. Including managing and compiling ESHIAs and EMPs

Specialist guidance, support and facilitation for the compliance with legislative processes, for in-country requirements, and international lenders.

Specialist expertise include Instream Flow and Ecological Water Requirements, aquatic ecology and wetlands resources.

Areas of Interest

Mining, Oil & Gas, Renewable Energy & Bulk Services Infrastructure Development, Sustainability and Conservation.

Instream flow requirements

Publication of scientific journals and articles.

Key Experience

- Familiar with World Bank, Equator Principles and the International Finance Corporation requirements
- Environmental, Social and Health Impact Assessments (ESHIA)
- Environmental Management Programmes (EMP)
- Ecological Water Requirement determination experience
- Wetland delineations and ecological assessments
- Rehabilitation Plans and Monitoring
- Fish population structure assessments
- The use of macroinvertebrates to determine water quality
- Aquatic Ecological Assessments
- Aquaculture

Country Experience

Botswana, Cameroon

Democratic Republic of Congo

Ghana, Ivory Coast, Lesotho

Liberia, Mali, Mozambique

Nigeria, Republic of Armenia,

Senegal, Sierra Leone, South Africa

Tanzania

Nationality

South African

Languages

English – Proficient

Afrikaans – Conversational

German - Basic

Qualifications

- MSc (University of Johannesburg) – Aquatic Health.
- BSc Honours (Rand Afrikaans University) – Aquatic Health
- BSc Natural Science
- Pr Sci Nat (400213/11)
- Certificate of Competence: Mondi Wetland Assessments
- Certificate of Competence: Wetland WET-Management
- SASS 5 (Expired) – Department of Water Affairs and Forestry for the River Health Programme
- EcoStatus application for rivers and streams

SELECTED PROJECT EXPERIENCE

Project Name: Biodiversity baseline assessment for the Kingline Gas Power Project

Personal position / role on project: Project Manager/ Mammal Lead

Location: Nigeria

Main project features: To conduct a wet season terrestrial and aquatic ecological baseline assessment for the proposed project. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed Nondvo Dam

Personal position / role on project: Project Manager.

Location: Swaziland

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the proposed dam. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: The Lower Mara Environmental Flow Assessment

Personal position / role on project: Specialist Ichthyologist.

Location: Tanzania

Main project features: To determine and prescribe environmental flows (eflows) for the Mara River system, with specific consideration for the Mara Wetland.

Project Name: The Environmental and Social Impact Assessment (ESIA) the proposed solar photovoltaic facility and transmission in Cuamba

Personal position / role on project: Project Manager.

Location: Mozambique

Main project features: To conduct a single season terrestrial and aquatic ecological baseline and impact assessment for the proposed dam. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: A biodiversity baseline assessment for the proposed Siguiri Gold Mine Project, in Kankan Province, Guinea.

Personal position / role on project: Project Manager.

Location: Siguiri, Guinea, West-Africa (2018).

Main project features: To conduct a dual season ecological baseline assessment for the expected impact footprint area. The study was required to meet national and IFC requirements, including a Critical Habitat assessment.

Project Name: A biodiversity baseline and impact assessment for the proposed Lesotho Bulk Water Supply Scheme, Lesotho.

Personal position / role on project: Wetland & Aquatic Ecologist, PROBFLO and Project Manager.

Location: Mohale's Hoek, Lesotho (2018).

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the pipeline route and proposed weir. The study was required to meet national and IFC requirements, including a Critical Habitat assessment. The study also contributed to prescribing Instream Flow Requirements using PROBFLO for the system.

Project Name: A biodiversity baseline and impact assessment for the proposed Pavua Hydropower Project, in Sofala Province, Central Mozambique.

Personal position / role on project: Project Manager.

Location: Sofala Province, Mozambique (2017).

Main project features: To conduct a dual season terrestrial and aquatic ecological baseline and impact assessment for the expected impact footprint area, including Gorongosa National. The study was required to meet national and IFC requirements, including a Critical Habitat assessment. The study also contributed to prescribing Instream Flow Requirements for the system.

Project Name: An aquatic and wetland specialist baseline and impact assessment for the proposed Onshore 2D seismic Survey in Block P5-A, in Maputo and Gaza Provinces.

Personal position / role on project: Wetland / Aquatic Specialist.

Location: Maputo & Gaza Provinces, Mozambique (2016).

Main project features: To conduct a dry season (Winter) ecological baseline and impact assessment of the watercourses for the proposed Delonex Energy project.

Project Name: The ecological constraints mapping and Critical Habitat re-evaluation for the Anadarko LNG project: Specialist Consultant to conduct Ecological Studies (Fauna and Habitat) and the delineation of wetland systems.

Personal position / role on project: Wetland Specialist.

Location: Afungi, Mozambique (2015).

Main project features: To identify and map the ecological constraints is to support contractor activities. To redefine the critical habitats within the project area

Project Name: A Joint Basin Survey of the Upper Orange, Lower Orange and Vaal catchments to determine the current status of the systems: Specialist Consultants to conduct Ecological Studies (Fish, Macroinvertebrate, Diatoms, Water Quality and Habitat) and report on the current status (defining system trends).

Personal position / role on project: Specialist Ichthyologist.

Location: South Africa (including Namibia, Botswana & Lesotho) (2015).

Main project features: To determine the current status of the catchments and to discuss the temporal and spatial trends of the monitoring reaches.

Project Name: Ecological baseline assessment of local river systems for the Ntem Iron Ore Mine: Specialist Consultants to Undertake Baseline Studies (Fish, Macroinvertebrate, Water Quality and Habitat).

Personal position / role on project: Senior Ichthyologist.

Location: Cameroon (2013).

Main project features: Establishment of the ecological baseline status and functioning assessment of the local river systems.

Project Name: Instream Flow Requirement determination study for the Kibali River hydropower project: Specialist Consultants to Undertake Baseline Studies (Flow, Water Quality and Geomorphology) and Instream Flow Requirement (IFR) Assessment.

Personal position / role on project: Ichthyologist and IFR.

Location: DRC (2012).

Main project features: Establishment of the ecological flow requirements of fishes within the Kibali River.

Project Name: Cost analysis, including the current and potential earing potential of an aquaculture facility: Specialist Consultants to determine the Cost (Current & Potential Earnings) and the Construction of an identical facility (Physical Costs).

Personal position / role on project: Ichthyologist.

Location: Ghana (2012).

Main project features: Conduct a detailed costs analysis of an aquaculture facility for the compensation for the removal of the operation.

Project Name: Instream Flow Requirement determination study for the Nzoro River hydropower project: Specialist Consultants to Undertake Baseline Studies (Flow, Water Quality and Geomorphology) and Instream Flow Requirement (IFR) Assessment.

Personal position / role on project: Ichthyologist and IFR.

Location: DRC (2011).

Main project features: Establishment of the ecological flow requirements of fishes within the Nzoro River.

Project Name: Environmental study to establish the baseline biological and physical conditions of the Letsibogo Dam.

Personal position / role on project: Ichthyologist.

Location: Selebi-Phikwe, Botswana (2007 - 2009).

Main project features: Evaluation of the existing fish communities within the Letsibogo Man-made lake with specific consideration of the threats of alien invasive fishes in the lake. The study resulted in the publication of two peer-reviewed papers titled: Comparative behavioural assessment of an established and a new Tigerfish *Hydrocynus vittatus* population in two man-made lakes in the Limpopo (O'Brien et al., 2013) and First observation of Africa Tigerfish (*Hydrocynus vittatus*) predating on Barn Swallows (*Hirundo rustica*) in flight (O'Brien et al., in press).

Project Name: Environmental and Social Impact Assessment of the Kazungula Bridge, Zambezi River.

Personal position / role on project: Ichthyologist.

Location: Botswana, Zambia, Namibia and Zimbabwe (2009-2010).

Main project features: Evaluation of the current ecological integrity status of various living and non-living components of the Zambezi River ecosystem and the potential ecological and social consequences of the construction and use of the Kazungula Bridge. The study showed that although water quality and habitat modification impacts will occur as a result of the construction and use of the bridge the long term impacts associated with the operation of the bridge should not result in any major impacts to the local aquatic ecosystem.

OVERVIEW

An overview of the specialist technical expertise include the following:

- Aquatic ecological state and functional assessments of rivers and dams.
- Instream Flow Requirement or Ecological Water Requirement using PROBFLO studies for river systems.
- Ecological wetland assessment studies, including the integrity (health) and functioning of the wetland systems.
- Wetland offset strategy designs.
- Wetland rehabilitation plans.
- Monitoring plans for rivers and other wetland systems.
- Toxicity and metal analysis of water, sediment and biota.
- Bioaccumulation assessment of fish communities.
- Fish telemetry assessment that included the translocation of fish as well as the monitoring of fish in order to determine the suitability of the hosting system.
- Faunal surveys which includes mammals, birds, amphibians and reptiles.
- The design, compilation and implementation of Biodiversity and Land Management Plans and strategies.

TRAINING

Some of the more pertinent training undergone includes the following:

- Wetland and Riparian Delineation Course for Consultants (Certificate of Competence) – DWAF 2008
- The threats and impacts posed on wetlands by infrastructure and development: Mitigation and rehabilitation thereof – Gauteng Wetland Forum 2010
- Ecological State Assessment of Lentic Systems using Fish Population Dynamics – University of Johannesburg/Rivers of Life 2010
- Soil Classification and Wetland Delineation – Terra Soil Science 2010
- Wetland Rehabilitation Methods and Techniques - Gauteng Wetland Forum 2011
- Application of the Fish Response Assessment Index (FRAI) and Macroinvertebrate Response Assessment Index (MIRAI) for the River Health Programme 2011
- Tools for a Wetland Assessment (Certificate of Competence) – Rhodes University 2011

- PROBFLO for conducting Ecological Flow Assessments – 2018/19

EMPLOYMENT EXPERIENCE

CURRENT EMPLOYMENT: The Biodiversity Company (January 2015 – Present)

I founded The Biodiversity Company in 2015, now consisting of experienced ecologists who provide technical expertise and policy advice to numerous sectors, such as mining, agriculture, construction and natural resources. The team at The Biodiversity Company have conducted stand-alone specialist studies, and provided overall guidance of studies with a pragmatic approach for the management of biodiversity that takes into account all the relevant stakeholders, most importantly the environment that is potentially affected. We manage risks to the environment to reduce impacts with practical, relevant and measurable methods.

EMPLOYMENT: Digby Wells Environmental (October 2013 – December 2014)

Digby Wells assigned me to the role of Country Manager for the United Kingdom. This was a new endeavour for the company as the company's global footprint continues to increase. The primary responsibilities for the role included the following:

- **Client liaison** to be able to interact more efficiently and personally with current mining clients, mining industry service providers, legal firms and banking institutions in order to introduce Digby Wells as a services provider with the aim of securing work.
- **Project management** for international projects which may require a presence in the United Kingdom, this was dependent on the location and needs of the client. These projects would mostly be based on the Equator Principles (EP) and International Finance Corporation (IFC) Performance Standards.
- **Technical input** to provide specialist technical expertise for projects, this included fauna, aquatic ecology, wetlands and rehabilitation. Continued with the design and implementation of Biodiversity and Land Management Plans to assist clients with managing the natural resources. Responsibilities also included the mentorship and management (including reviewing and guiding) other expertise such as flora, fauna and pedology.

EMPLOYMENT: Digby Wells Environmental (March 2012 – September 2013)

Manager of a multi-disciplinary department of scientists providing specialist services in support of national and international requirements as well as best practice guidelines, primarily focussing on the mining sector. In addition to managing the department, I was also expected to contribute specialist services, most notably focusing on water resources. Further responsibilities also included the management of numerous projects on a national or international scale. A general overview of the required responsibilities are as follows:

- **Project management** for single as well as multi-disciplinary studies on a national and international scale. This included legislation and commitments for the respective country being operated in, as well as included the World Bank (WB), EP and IFC requirements.
- **Individual and/or team management** in order to provide mentoring and supportive structures for development and growth in support of the company's strategic objectives.
- **Scientific report writing** to ensure that the relevant standards and requirements have been attained, namely local country legislation, as well as WB, EP and IFC requirements.
- **Report reviewing** in order to ensure compliance and consideration of relevant legislation and guidelines and also quality control.
- **Specialist management** to facilitate the collaboration and integration of specialist skills for the respective projects. This also included the development of Biodiversity and Land Management Plan for clients.
- **Client Resource Manager** for numerous clients in order to establish as well as maintain working relationships.

An overview of the tenure working with the company is provided below**:**

- **October 2013 – December 2014: London Operations Manager** – Deployed to establish a presence for the company (remote office) in the United Kingdom by means of generating project work to support the employment of staff and operation of a business structure.

- **March 2012 – September 2013: Biophysical Department Manager** – Responsible for the development and growth of the department to consist of four specialist units. This included the development of a new specialist unit, namely Rehabilitation.
- **January 2011 - February 2012: Ecological Unit Manager** – In addition to implementing aquatic and wetland specialist services, the role required the overall management of additional specialist services which included fauna & flora.
- **June 2010 - December 2010: Aquatic Services Manager** – This required the marketing and implementation of specialist programmes for the client base such as biomonitoring and wetland off-set strategies. In addition to this, this also included expanding on the existing skill set to include services such as toxicity, bioaccumulation and ecological flow assessments.
- **August 2008: Aquatic ecologist** – Employed as a specialist to establish the aquatic services within the company. In addition to this, wetland specialist services were added to the existing portfolio.

PREVIOUS EMPLOYMENT: Econ@UJ (University of Johannesburg)

- June 2007 – July 2008: Junior aquatic ecologist
    - Researcher
    - Technical assistant for fieldwork
    - Reporting writing
    - Project management

ADDITIONAL EXPERIENCE

Compliance audits	Conducting site investigations in order to determine the level of compliance attained, ensuring that the client maintains an appropriate measure of compliance with environmental regulations by means of a legislative approach
Control officer	Acting as an independent Environmental Control Officer (ECO), acting as a quality controller and monitoring agent regarding all environmental concerns and associated environmental impacts
Screening studies	Project investigations in order to determine the level of complexity for the environmental and social studies required for a project. This is a form of risk assessment to guide the advancement of the project.
Public consultation	The provision of specialist input in order to communicate project findings as well as assist with providing feedback if and when required.
Water use licenses	Consultation with the relevant authorities in order to establish the project requirements, as well as provide specialist (aquatics/wetland) input for the application in order to achieve authorisation.
Closure	Primarily the review of closure projects, with emphasis on the closure cost calculations. Support was also provided by assisting with the measurements of structures during fieldwork.
Visual	The review of visual studies as well as the collation of field data to be considered for the visual interpretation for the project.

ACADEMIC QUALIFICATIONS

University of Johannesburg, Johannesburg, South Africa (2009): MAGISTER SCIENTIAE (MSc) - Aquatic Health:

Title: *Aspects of the biology of the Bushveld Smallscale Yellowfish (Labeobarbus polylepis): Feeding biology and metal bioaccumulation in five populations.*

Rand Afrikaans University (RAU), Johannesburg, South Africa (2004): BACCALAUREUS SCIENTIAE CUM HONORIBUS (Hons) – Zoology

Rand Afrikaans University (RAU), Johannesburg, South Africa (2001 - 2004): BACCALAUREUS SCIENTIAE IN NATURAL AND ENVIRONMENTAL SCIENCES. Majors: Zoology and Botany.

PUBLICATIONS

Desai M, Husted A., Fry C., Downs CT, & O'Brien GC (2019). Spatial shifts and habitat partitioning of ichthyofauna within the middle–lower region of the Pungwe Basin, Mozambique. *Journal of Freshwater Ecology*, 34(1), 685–702. doi: 10.1080/02705060.2019.1673221

Tate RB and Husted, A. 2015. Aquatic Biomonitoring in the upper reaches of the Boesmanspruit, Carolina, Mpumalanga, South Africa. African Journal of Aquatic Science.

Tate RB and Husted A. 2013. Bioaccumulation of metals in *Tilapia zillii* (Gervai, 1848) from an impoundment on the Badeni River, Cote D'Iviore. African Journal of Aquatic Science.

O'Brien GC, Bulfin JB, Husted A. and Smit NJ. 2012. Comparative behavioural assessment of an established and new Tigerfish (*Hydrocynus vittatus*) population in two manmade lakes in the Limpopo catchment, Southern Africa. African Journal of Aquatic Science.

Tomschi H, Husted A, O'Brien GC, Cloete Y, Van Dyk C, Pieterse GM, Wepener V, Nel A and Reisinger U. 2009. Environmental study to establish the baseline biological and physical conditions of the Letsibogo Dam near Selebi Phikwe, Botswana. EC Multiple Framework Contract Beneficiaries.8 ACP BT 13 – Mining Sector (EDMS). Specific Contract N° 2008/166788. Beneficiary Country: Botswana. By: HPC HARRESS PICKEL CONSULT AG

Husted A. 2009. Aspects of the biology of the Bushveld Smallscale Yellowfish (*Labeobarbus polylepis*): Feeding biology and metal bioaccumulation in five populations. The University of Johannesburg (Thesis).

CURRICULUM VITAE

Lucinda Coelho
+27 (0) 82 780 3549
+27 (0) 31 765 6670
luci@realconsulting.co.za

1. Family Name: Coelho
2. Name: Lucinda Jane
3. Date of birth: 08.03.1961
4. Nationality: South African
5. Civil status: Married
6. Education: BA H dip Ed

Institution	
Institution [Date from-Date to]	**Degree(s) of Diploma(s) obtained**
University of KwaZulu-Natal February 2017 – in progress	Masters in Education & Development
University of KwaZulu-Natal February 2015 – 2016	Honours in Education & Development
University of the Witwatersrand February 1996 to November 1996	Higher Diploma of Education
University of Cape Town February 1983 to November 1985	BA: English Literature and Economic History

7. Language skills : (1 excellent; 5 basic)

Language	Passive	Spoken	Written
English	1	1	1
Zulu	5	5	5
Afrikaans	3	3	4

8. Membership of professional/relevant bodies: (SAMEA, AEA, etc.)

Nil

9. Other skills (e.g. computer literacy, etc.):

Computer literacy: - MS Office suite; MS Excel; Bookkeeping & Pastel; PACA

10. Present position:

Senior Associate Consultant: Real Consulting

11. Years within the firm:

15 years.

12. 12. Key qualifications: (Relevant to the project)

I have a range of skills related to research, impact assessments and capacity building. I am an experienced regional & local economic development and social specialist. I have skills in the areas of programme and project management, research and report writing, training and capacity building, and facilitation and stakeholder engagement. I have worked at a community, provincial and national level, in both rural and urban settings. Specifically, I have managed large and long term community and economic development interventions; conducted capacity building and organisational development processes with community leadership structures; carried out baseline studies and socio-economic impact assessments; managed Public Participation Processes; and have facilitated several public processes in various contexts of Southern Africa, Rwanda, South Sudan and Papua New Guinea. I have worked in the field of social and economic development since 2002, prior to which she worked in the education sector for over 10 years as a teacher, HOD and Teacher Trainer.

13. Professional Experience

I have been working since 1987. The following table provides examples of relevant assignments carried out.

Date from-date to	Company & Location	Position	Description of Evaluation projects/ responsibilities etc/ Client/ Date.
2002 - 2019	Real Consulting, Durban	Senior Consultant	Report writing and support to the moderator for the International Municipal Climate Change partnerships project **2019 (BMZ and LAG 21)**
			Research and report writing for various **socio-economic impact assessments** in KwaZulu-Natal **2019**
			Social Impact Assessment for a tertiary Institution in eThekwini. **Tongaat Hulett, 2018**
			Investigation into enterprise development opportunities around the provision of ecosystems services, **UWASP, 2018**
			Business Plan for Sawmill & Charcoal enterprise using AIP timber extracted from threatened river catchments, **CASIDRA, 2017**
			Sustainability Plan for Witzenberg Water Savers. **GIZ, 2017**
			Training materials development for university level courses for private teacher training college (History, Life Skills), **Intelesi, 2017**
			Training materials development for teacher training college (Assessment), **Intelesi, 2017**
			Business Plan development for Big Five Game Reserve. **Big 5, 2016-7**
			Business Plan development for Morgenstond Dam Tourism Lodge. **GIZ, 2016-7**
			Assisting Jabulani CPA & KwaZiqongwana Community Trust with Organisational Development. **GIZ, 2015 - 16**
			Participatory socio-economic analysis & economic development change strategy with 6 communities in Papua New Guinea. **FORCERT, 2016**
			Socio-economic Impact Assessment of R102 Development, **Iyer Urban Design Studio, 2015**
			Socio-economic Impact Assessment of Umlazi Town Centre, **Iyer Urban Design Studio, 2015**
			Socio-economic Impact Assessment of Durban Point Development, **Durban Point Development Company, 2015**

			Social Impact Assessment for the Cornubia Development. **Tongaat Hulett Developments, 2007 – 2015**
			Management of Public Participation Process for Cornubia Development. **Tongaat Hulett Developments, 2007 – 2015**
			Social Impact Assessment for Dudley Pringle development for **Tongaat Hulett, 2014**
			Social Impact Assessment for Jozini Mall Petrol Station. **Triple04 Environmental Solutions, 2014**
			Socio-economic study of Blackburn Village informal settlement. **Tongaat Hulett Developments, 2012-2013**
			Review & revision of materials for Unit Standards 117893 & 117894 on Gender Equality & Women's Empowerment. **Initiative Consulting, 2015**
			Capacity Building with Land Claimant Trusts re co-management of conservation sites within iSimangaliso Wetland Park. **iSimangaliso Authority, 2010-2014**
			Materials development for Further Education & Training Certificate: Community Health Work. **Initiative Consulting, 2013**
			Capacity Building of councillors as part of the ALEDI programme to support AbaQulusi Municipality **KZNDED, 2011-2012**
			Design & Implementation of Nqabara Integrated Development Initiative, including project management of R6million investment (ECape), **SURUDEC/ EU, 2009-2014**
			Conducting Rapid Appraisal of Income Generating Opportunities in several locations in South Africa & Lesotho, & training WV staff in the methodology, **World Vision, 2010-2011.**
			Establishment & management of the Bridge City Stakeholder Forum in KwaMashu, Durban. **Tongaat Hulett, 2007-9**
			Local Economic Development training in Rwanda & various Summer Schools in Durban for WV Programme managers. **World Vision, 2011**
			Conceptualising & operationalising a Local Economic Development Online School. **World Vision, 2010**
			Mentoring of World Vision LED officer in Soweto. **World Vision, 2010-11**
			Enterprise development training for Mseleni Market **iSmangaliso Authority, 2010**
			Project facilitation for Eshowe Medicinal Plant Project. **INR, 2004-2011**
			Socio-economic baseline study for La Lucia Ridge Office. **Tongaat Hulett, 2009**
			Socio-economic baseline study for RiverHorse Valley Business Park .**Tongaat Hulett, 2008**
			End of Programme Assessment of the Mefakeng, Limpopo Programme, **Irish Aid, 2007**
2001	College Campus, Johannesburg	Lecturer	Language, life skills and HIV / AIDS awareness for,

1989 – 1999	St Barnabas College, Johannesburg	Teacher trainer	The Educational Support Programme, programme targeted teachers in rural schools in the Mpumalanga & Limpopo rural areas.
1989 – 1999	St Barnabas College, Johannesburg	Educator	School librarian, Geography teacher (Gr 7- 8); English teacher (Gr 9 – 10); History teacher (Gr 8 – 12); History HOD

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
June 2019

I) Personal details

Surname : **Bamford**
First names : **Marion Kathleen**
Present employment : Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone : +27 11 717 6690
Fax : +27 11 717 6694
Cell : 082 555 6937
E-mail : marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d’Anatomie des Bois, Musée Royal de l’Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+

Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	6	1
Masters	8	1
PhD	10	3
Postdoctoral fellows	9	3

viii) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing

Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics

- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO

xi) Research Output

Publications by M K Bamford up to June 2019 peer-reviewed journals or scholarly books: over 130 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 26; Google scholar h index = 30;
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)

CURRICULUM VITAE

DR. CRAIG WIDDOWS

MALACHITE
ECOLOGICAL SERVICES

PERSONAL DETAILS

Name	: Craig David Widdows
Date of Birth	: 23 October 1988
Identity Number	: 8810235028085
Marital Status	: Married
Nationality	: South African
Current Position	: Ecologist
Office Location	: Durban, KwaZulu-Natal
Website	: www.malachitesa.co.za

ACADEMIC QUALIFICATIONS

2016	: PhD (Ecology) – University of KwaZulu-Natal
2014	: MSc (Ecology) – University of KwaZulu-Natal
2012	: BSc (Biological Sciences) Cum Laude – University of KwaZulu-Natal
2011	: Certificate in GIS – ESRI
2007-2011	: BSc (Biological Sciences) – University of KwaZulu-Natal

SCIENTIFIC PUBLICATIONS

Since the completion of my PhD, I have published a series of scientific publications in Internationally Peer Reviewed Journals. In all papers I, Craig Widdows am the primary author. These include:

AUTHORS	**PUBLICATION TITLE**	**JOURNAL**
CD Widdows & CT Downs	Genets in the city: Community observations and perceptions of large-spotted genets in an urban environment	Urban Ecosystems: https://doi.org/10.1007/s11252-017-0722-x December 2017

AUTHORS	PUBLICATION TITLE	JOURNAL
CD Widdows, T Ramesh & CT Downs	Factors affecting the distribution of large-spotted genets (Genetta tigrina) in an urban environment in South Africa	Urban Ecosystems December 2015, Volume 18, Issue 4, pp 1401–1413
CD Widdows & CT Downs	A genet drive-through. Are large-spotted genets using urban areas for "fast food"? A dietary analysis.	Published in Urban Ecosystems (2015) 18: 907-920
CD Widdows & CT Downs	Urban roost temperature of large-spotted genets: The effect of anthropogenic structures	Journal of Thermal Biology 2016 April 57:66-71
Widdows CD, Roberts PD, Maddock AH, Carvalho F, Gaubert P, Do Linh San E.	A conservation assessment of *Genetta tigrina*.	In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa (2016).

CONFERENCES AND ORGANISATIONS

NAME	YEAR
IAIAsa: Biodiversity Offset Workshop	October 2019
Zoological Society of Southern Africa Conference	July 2019
Grass Identification Course hosted by African Land-Use Training	March 2019
Hydropedology Course hosted by TerraSoil Science and the Water Business Academy	November 2018
National Wetland Indaba	October 2018

NAME	YEAR
National Wetland Indaba	October 2017
National Biodiversity and Business Network (NBBN). Biodiversity Indaba	March 2017
Wetland Vegetation training course	February 2017
Zoological Society of Southern Africa Conference	July 2012. I not only attended this conference but presented a research topic.

Further to this I have presented over 50 talks of urban wildlife conservation to numerous organisations within the eThekwini Metropolitan Municipality including:

- The Durban Alumnus Association
- Kloof Conservancy
- Botanical Society of South Africa

ORGANISATIONS

I am a registered member of the following organisations:

- South African Council for Natural Scientific Professions (Membership No. 117852)
- South African Wetland Society (Membership No. KE9AJ0J4)
- Herpetological Association Of Africa (Membership No. AF 025)
- Zoological Society of Southern Africa (Membership No. 199)
- Field Guides Association of Southern Africa (Membership No. 22691).

WORK EXPERINCE

NAME OF COMPANY	POSITION OCCUPIED	PERIOD OF EMPLOYMENT	RESPONSIBILITIES
Malachite Ecological Services	Director and Ecologist	May 2016 - present	Conducting vegetation and faunal assessments within South Africa. Further to this, two detailed faunal assessments were conducted in the Republic of Cameroon (Aug 2016 and March 2017)
Afzelia Environmental Consultants c.c	Ecologist	March 2015- April 2016	Conducting faunal and avifaunal assessments across South Africa.
University of KwaZulu-Natal	Teachers Assistant	January 212-July 2012	Employed as the lecturer's assistant for Biology 213 Angiosperm diversity. Lecturer – Prof. Ashley Nicholas. Focused on leading and teaching of practical techniques for angiosperm identification.
University of KwaZulu-Natal	Field Assistant	December 2011	Conducted mammal, avian and reptile surveys in southern Madagascar under the supervision of Prof Steve Goodman and other members of the Vahatra Field School.

WORK RESPOSIBILITIES

Faunal Assessments

South Africa comprises a region of high biodiversity with high levels of endemism. According to the National Environmental Management: Biodiversity Act (NEMBA) (Act no.10 of 2004), biodiversity is defined as:

> *"the variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems"*

I have conducted a number of faunal assessments throughout my employment from March 2015 to my current position. These assessments are centred on the description of available faunal micro-habitats within the study area and the health and functionality of these habitats to support species of conservation concern. As the majority of faunal species are secretive, nocturnal and in the case of some amphibians and reptiles seasonal (due to their ectothermic physiological strategies), the availability and suitability of foraging and breeding habitats identified during site investigations are used in conjunction with distributional data to determine the likelihood of occurrence of species of conservation concern within the larger study area.

Snapshot of projects compiled with respect to my areas of qualifications

- Proposed Residential Development on Erf 209 Drummond within the eThekwini Metropolitan Municipality, KwaZulu-Natal: Vegetation Survey - GroundWater Consulting Services
- Proposed Khoto Residential Development, eThekwini Metropolitan Municipality, KwaZulu-Natal: Ecological Screening - Shah Consult
- Rezoning for Portion 204 (of 184) of the Farm Mt. Albert No. 2074 in Pennington, Umdoni Municipality: Ecological Screening – Adrienne Edgson
- Ayesha Avenue internal access road and residential parking lot development, eThekwini Metropolitan Municipality, KwaZulu-Natal: Faunal Assessment – ECA Consulting, Environmental & Carbon Assessments
- PeaceValley III Road Upgrade Project, uMsunduzi Local municipality: Faunal and Vegetation Assessment- ECA Consulting, Environmental & Carbon Assessments
- Proposed development of the Eskom Agulhas 400/132Kv 2x500 MVA Transmission Substation and loop-in loop-out lines, Swellendam Local Municipality, Western Cape Province: Avifaunal Assessment - Nsovo Environmental Consulting
- Proposed construction of the Tshipi Borwa substation (132/11kv 2x10mva) and 132Kv loop in loop out power line development adjacent to the Tshipi eBorwa Open Pit Mine, Northern Cape Province: Avifaunal and Faunal Assessment - Envirolution Consulting (Pty) Ltd
- Proposed upgrade and construction activities outside of the National Route 2 Wild Coast Toll Highway road reserve. Eastern Cape: Faunal Assessment – KSEMS Environmental Consulting

- Elandspruit Colliery Mining Pan Amendment Plan, Middleburg: Faunal Assessment - Ecology International
- Proposed construction of a dam and irrigation pipeline on the farm compensation, within the Matatiele Local Municipality, Eastern Cape: Ecological Impact Assessment- Green Door Environmental
- Aviemore-Hattingspruit 88kV powerline and associated substation project, KwaZulu-Natal: Vegetation Assessment: GSC Water and Environmental Consultants
- Proposed Lower Maguga hydropower project, Kingdom of Eswatini: Terrestrial Biodiversity Assessment - Knight Piésold
- Subdivision and Rezoning of Erf 15990, Ladysmith Township, KwaZulu-Natal. Ecological and Wetland Assessment – Ecology International
- Unlawful Establishment of a Dam Located on Farm South Downs no. 17934, Mooi River, KwaZulu-Natal. Biodiversity Assessment – Green Door Environmental
- Proposed Bhokwe Community Sanitation Project, Abaqulusi Local Municipality, KwaZulu-Natal: Biodiversity Assessment- 1World Consultants
- Ibisi Sewer Reticulation Project in the Umzimkhulu Local Municipality, KwaZulu-Natal: Vegetation Assessment- SAT Environmental Consultants
- Ubuhlebezwe Local Municipality Cemetery Project, KwaZulu-Natal: Wetland and Vegetation Assessment - Hanslab Environmental Consultants:

FURTHER STUDIES

I am a registered FGASA level 1 Field Guide and completed a track and signs course through African Nature Training (ANT) and was award a Level 2 tracking certificate.

OTHER

I am a confident, hardworking individual who is able to convey information in a concise and efficient way. I am also able to address large audiences. I have an absolute passion for South African Wildlife and will stop at nothing to achieve my goals.

REFERENCES

When looking at urban wildlife stories to cover for a new BBC Natural History Unit production, Craig was invaluable with his extensive knowledge of urban large-spotted genets. He was extremely helpful, and professional, providing solutions and plans for setting up potential filming and offering his expertise on genet movement and behaviour. He was very easy to work with and had clearly maintained good relationships with people in the area who'd previously reported genet movement. I would be really keen to work with Craig again.

Mary Melville (Mary.Melville@bbc.co.uk)

BBC Natural History

We would like to acknowledge with thanks Dr. Craig Widdows' significant contribution to the understanding of the Ecology of Suni-Ridge Sand Forest Park. Craig's professional assessment of the biodiversity of our Reserve, with special focus on the carnivores, has been an important and much appreciated analysis. Due to his experience in the wild environment, careful observations and astute tracking, Craig was able to identify the best possible positions for a number of camera traps that were set up to record movement of wildlife. Craig's passion for his work and his on-going interest in our Region has been a wonderful inspiration to us all. We are honoured to have him involved in the Elephant Coast Region.

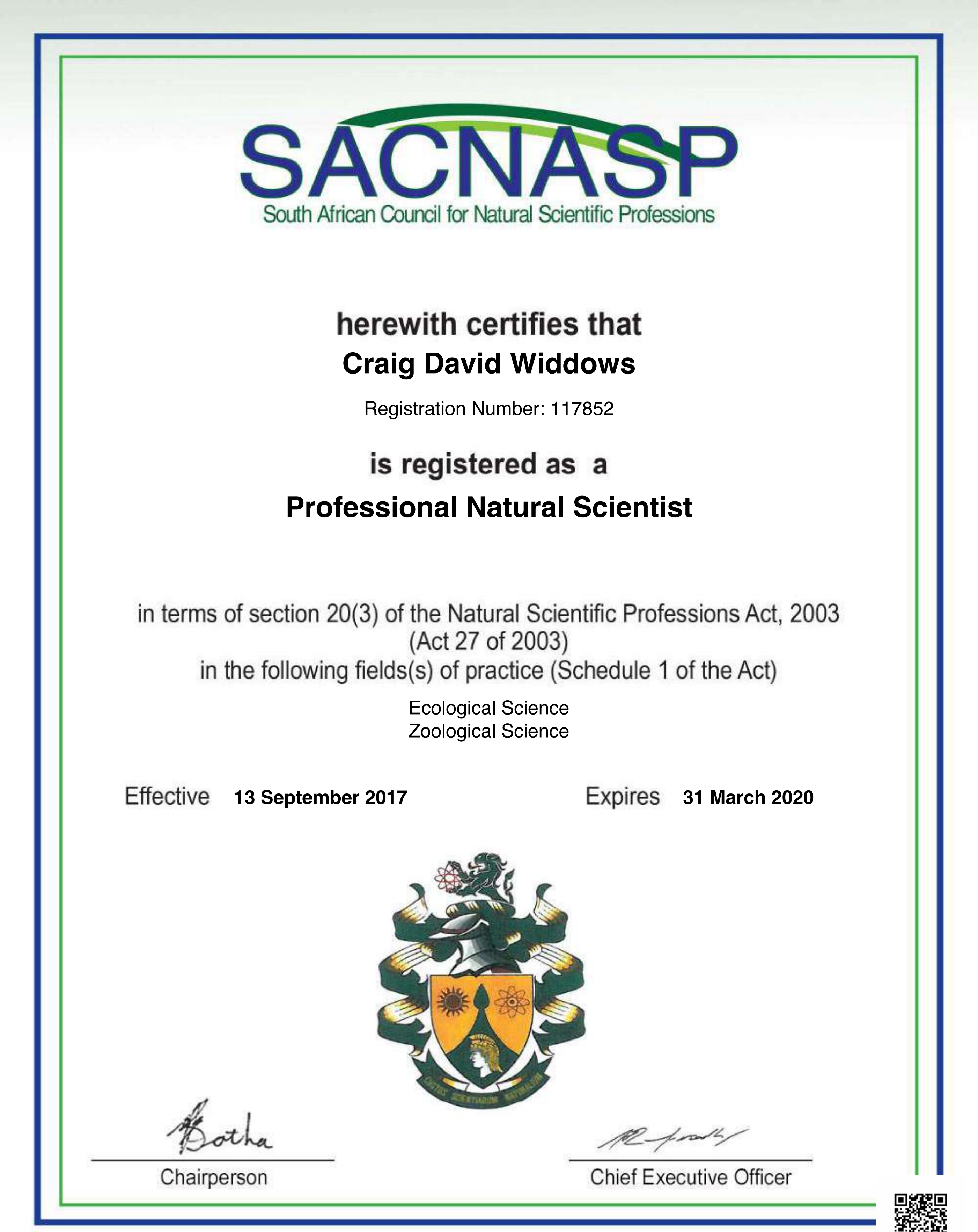
Janet Cuthbertson
Chair – Suni-Ridge Sand Forest Park

Suni-Ridge Sand Forest Park

Craig has been providing pro-bono support to the Kloof Conservancy in the form of research on the impact of disposable nappies on the environment. Craig's work has been thorough and professional and his work has been presented not only to the eThekwini Conservancies Forum but also to the National Department of Environmental Affairs who are also looking into the issue. Craig's willingness to assist the conservancies movement has been exemplary and highly reliable and demonstrates his commitment to giving back to the communities and the environment in which he operates.

Paolo Candotti (Chairman)

KLOOF
CONSERVANCY



SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Craig David Widdows

Registration Number: 117852

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 fields(s) of practice (Schedule 1 of the Act)

Ecological Science
Zoological Science

Effective **13 September 2017** Expires **31 March 2020**

Botha
Chairperson

Chief Executive Officer

Scan this code to view online version of this certificate

CURRICULUM VITAE JEAN LOIS BEATER

Nationality: **South African**

Qualifications & Membership with Professional societies:

Accredited Heritage Professional: Amafa aKwaZulu-Natali

Affiliate Member of the Association of Southern African Professional Archaeologists (ASAPA) (No. 349)

International Association of Impact Assessment (SA Branch) (Membership No. 1538)

Contact Details: 084 4041118 / jean.beater@gmail.com

EMPLOYMENT RECORD

April 2015 – present:	**JLB Consulting** Undertake Heritage Impact Assessments (HIAs) and Heritage Management Plans (HMPs) Environmental authorisation processes (Scoping & Environmental Impact Assessments, Basic Assessments); Water Use Licence Applications (WULAs); EMPRs, public participation process, et**c.**
March 2014 – March 2015:	**Senior Environmental Consultant: Nemai Consulting cc** Project management of various Basic Assessments and Scoping & EIAs; EMFs Undertake HIAs and WULAs for clients; Manage clients, appoint & manage specialists, undertake public participation process; compile and manage budgets for projects
March 2010 – February 2014:	**Environmental & Heritage Impact Consultant** Undertake Heritage Impact Assessments (HIAs) for various clients; Project management of environmental authorisation processes (S&EIRs, BARs); WULAs; EMPRs, public participation, etc
June 2005 – February 2010:	**Senior Environmental Specialist with PBA International (South Africa) Pty Ltd (now called Fourth Element)** Project management of various EIA studies (Basic Assessments and Scoping & Environmental Impact Assessments); Undertake HIAs for various clients; Manage clients, appoint & manage specialists, undertake public participation process; Compile and manage budgets for projects

POST-GRADUATE EDUCATION AND DEGREES

2002	University of the Witwatersrand	MA (Heritage Studies)
2016	University of the Free State	MSc (Environmental Management)

HERITAGE PROJECTS UNDERTAKEN INCLUDE:

- Cultural heritage survey of several farms in Northern and Eastern Cape for proposed solar power developments
- Heritage Impact Assessment for the Hammersdale water supply pipeline, eThekwini Municipality, KZN
- Heritage Impact Assessments for the Raw Water and Potable Water components of the uMkhomazi Water Supply Project, KZN.
- Heritage Management Plans for the Raw Water and Potable Water components of the uMkhomazi Water Supply Project, KZN
- Heritage Impact Assessment for Quha River Bridge, Umzumbe area
- Heritage Impact Assessment for Bloukrans and Qabango River crossings near Frere in Umtshezi Local Municipality (LM)
- Heritage Impact Assessment for the Burbreeze Water Infrastructure (pipeline and reservoir) Project, Tongaat
- Heritage Impact Assessment for the Ezimbokodweni *in-situ* housing project, Amanzimtoti
- Heritage Impact Assessment for the road determination project in the Greater Johannesburg area, Gauteng Province
- Heritage Impact Assessment for the Impendle Water Treatment Plant, KZN
- Heritage Impact Assessment for the Madrassa An-Noor Facility for the Blind near Cedara Agricultural College, Umngeni Municipality
- Heritage Impact Assessment for Ixopo CRU Housing development, Ubuhlebezwe LM
- Heritage Impact Assessment for Kokstad CRU Housing development, Greater Kokstad Municipality
- Walk down heritage survey of proposed construction of Neptune to Pembroke 400kV power lines, near East London, Eastern Cape Province
- Heritage Impact Assessments for the Northern (12) and Southern (5) borrow pits project within eThekwini Municipality
- HIA for the Queen’s substation and associated 132kV power line project, Hartzenbergfontein Agricultural Holdings, Walkerville, Gauteng Province
- HIA for the proposed Ezingadeni Low Level Bridge, Mondlo, Abaqulusi LM
- HIA for the upgrade of Jennings Road, Estcourt, Inkosi Langalibalele LM, KZN
- HIA for the irrigation projects at Isondlo Dairy Farm, Okhahlamba Local Municipality and KwaSobabili Cooperative, Imbabazane Local Municipality, KZN
- HIA for the Hartebeestpoort Housing Development, Tshwane, Gauteng Province
- HIA for the N3 Logistics Hub, Lesidi Local Municipality, Gauteng Province
- HIA for the Mgeni Adit, Zululand Anthracite Colliery near Ulundi, KZN
- HIA for the Mookadi-Mahikeng 400kV power line between Vryburg and Mahikeng, North-West Province
- HIA for the upgrade of Provincial Road P728, eThekwini Municipality
- HIA for Umshwati BWSS Phase 4, Ndwedwe Local Municipality, KZN
- HIA for Aviemore substation and 88kV power line project, Dundee, KZN
- Heritage screening for the R603 Adams Road settlement plan, eThekwini Municipality
- HIA for Area 8 Pit Extension, Somkhele Anthracite Mine near Mtubatuba, KZN
- Bhekuzulu Water Reticulation project, Wards 1-5 and portion of Ward 6, Inkosi Langalibalele Local Municipality, KZN
- KwaBhaca Mixed Land Use Development, Mount Frere, Eastern Cape Province
- Chansbury Layer Poultry Houses near Winterton, KZN
- Bhokwe Village Sanitation project near Vryheid, KZN
- Upgrade of D1867 Road near Phongola, KZN

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NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

1. This form is current as of **October 2019**. It is the responsibility of the Applicant / Environmental Assessment Practitioner ("EAP") to ascertain whether subsequent versions of the form have been released by the Department.

PROJECT TITLE

Bhokwe Village Water

DISTRICT MUNICIPALITY

Zululand District Municipality

1. SPECIALIST INFORMATION

Specialist name:	Prof Marion Bamford		
Contact person:	same		
Postal address:	PO Box 652, Wits		
Postal code:	2050	Cell:	082 555 6937
Telephone:	011 7176690	Fax:	011 717 6694
E-mail:	Marionbamford12@gmail.com		
Professional affiliation(s) (if any)	ASSAf, FRSSAf, PSSA, SASQUA, IOP		

Project Consultant / EAP:	1World Consultants (Pty) Ltd		
Contact person:	Hasan Mahomedy		
Postal address:	P O BOX 2311, Westville		
Postal code:	3630	Cell:	072 730 7866
Telephone:	031 262 8327	Fax:	086 726 3619
E-mail:	hasan@1wc.co.za		

2. DECLARATION BY THE SPECIALIST

I, **Marion Kathleen Bamford** lare that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, 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 with respect to 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 am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

MKBamford

Signature of the specialist:

Name of company: Marion Bamford t/a Marion Bamford Consulting

Date:

12 December 2019

edtea
Department :
Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

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Provincial Reference Number:	
NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

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PROJECT TITLE

Bhokwe Community Sanitation Project

DISTRICT MUNICIPALITY

Zululand District Municipality

1. SPECIALIST INFORMATION

Specialist name:	Lucinda Coelho		
Contact person:	Lucinda Coelho		
Postal address:	PO Box 259 Hillcrest		
Postal code:	3650	Cell:	082 780 3549
Telephone:	031 765 6670	Fax:	
E-mail:	luci@realconsulting.co.za		
Professional affiliation(s) (if any)			

Project Consultant / EAP:	1World Consultants (Pty) Ltd		
Contact person:	Hasan Mahomedy		
Postal address:	P O BOX 2311, Westville		
Postal code:	3630	Cell:	072 730 7866
Telephone:	031 262 8327	Fax:	086 726 3619
E-mail:	hasan@1wc.co.za		

2. DECLARATION BY THE SPECIALIST

I, **Lucinda Jane Coelho** lare that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
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- 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;
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ljcoelho

Signature of the specialist:

Real Consulting

Name of company:

04.12.2019

Date:

edtea
Department :
Economic Development, Tourism and
Environmental Affairs
PROVINCE OF KWAZULU-NATAL

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NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

KINDLY NOTE:

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PROJECT TITLE

Bhokwe reticulation and oxidation pond

DISTRICT MUNICIPALITY

Zululand District Municipality

1. SPECIALIST INFORMATION

Specialist name:	Wetland and Aquatic Ecology Specialist		
Contact person:	Andrew Husted		
Postal address:	18 Peridot Street, Jukskei Park		
Postal code:	2153	Cell:	0813191225
Telephone:		Fax:	
E-mail:	info@thebiodiversitycompany.com		
Professional affiliation(s) (if any)	SACNASP Pr Sci Nat 400213/11		

Project Consultant / EAP:	1World Consultants (Pty) Ltd		
Contact person:	Hasan Mahomedy		
Postal address:	P O BOX 2311, Westville		
Postal code:	3630	Cell:	072 730 7866
Telephone:	031 262 8327	Fax:	086 726 3619
E-mail:	hasan@1wc.co.za		

2. DECLARATION BY THE SPECIALIST

I, Andrew Husted lare that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
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Signature of the specialist:

The Biodiversity Company
Name of company:

3 February 2020
Date:

edtea
Department:
Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

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NEAS Reference Number:	KZN / EIA /
Waste Management Licence Number (if applicable):	
Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

Submitted in terms of section 24(2) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or for a waste management licence in terms of section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

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PROJECT TITLE

Proposed Bhokwe Community Sanitation Project

DISTRICT MUNICIPALITY

Zululand District Municipality

1. SPECIALIST INFORMATION

Specialist name:	Malachite Ecological Services		
Contact person:	Craig Widdows		
Postal address:	345 Peter Mokaba Road, Morningside, Durban.		
Postal code:	4001	Cell:	0837818725
Telephone:	0837818725	Fax:	-
E-mail:	craig@malachitesa.co.za		
Professional affiliation(s) (if any)	SACNASP 117852		

DECLARATION OF INTEREST BY SPECIALIST

Project Consultant / EAP:	1World Consultants (Pty) Ltd		
Contact person:	Hasan Mahomedy		
Postal address:	P O BOX 2311, Westville		
Postal code:	3630	Cell:	072 730 7866
Telephone:	031 262 8327	Fax:	086 726 3619
E-mail:	hasan@1wc.co.za		

2. DECLARATION BY THE SPECIALIST

I, **Craig Widdows** are that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, 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;
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Signature of the specialist:

Malachite Ecological Services

Name of company:

06 December 2019

Date:

edtea
Department: Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

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Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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PROJECT TITLE

Bhokwe Village Sanitation Project

DISTRICT MUNICIPALITY

Zululand District Municipality

1. SPECIALIST INFORMATION

Specialist name:	JLB Consulting		
Contact person:	Jean Beater		
Postal address:	19 Wager Avenue, Prestondale		
Postal code:	4319	Cell:	0844041118
Telephone:		Fax:	
E-mail:	jean.beater@gmail.com		
Professional affiliation(s) (if any)	ASAPA – No. 349 IAIAsa – No. 1538		

Project Consultant / EAP:	1World Consultants (Pty) Ltd		
Contact person:	Hasan Mahomedy		
Postal address:	P O BOX 2311, Westville		
Postal code:	3630	Cell:	072 730 7866
Telephone:	031 262 8327	Fax:	086 726 3619
E-mail:	hasan@1wc.co.za		

2. DECLARATION BY THE SPECIALIST

I, **Jean Lois Beater** ,, declare that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, 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 with respect to 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;
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Signature of the specialist:

JLB Consulting

Name of company:

04/12/2019

Date:

edtea
Department :
Economic Development, Tourism and Environmental Affairs
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Date Received by Department:	

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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KINDLY NOTE:

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PROJECT TITLE

PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, ABAQULUSI LOCAL MUNICIPALITY, KWAZULU-NATAL

DISTRICT MUNICIPALITY

Zululand District Municipality

1. SPECIALIST INFORMATION

Specialist name:	Malachite Ecological Services		
Contact person:	Rowena Harrison		
Postal address:	345 Peter Mokaba Road, Morningside, Durban		
Postal code:	4001	Cell:	078 023 0532
Telephone:		Fax:	
E-mail:	rowena@malachitesa.co.za		

Professional affiliation(s) (if any)	SACNASP IAIAsa		

Project Consultant / EAP:	1World Consultants (Pty) Ltd		
Contact person:	Hasan Mahomedy		
Postal address:	P O BOX 2311, Westville		
Postal code:	3630	Cell:	072 730 7866
Telephone:	031 262 8327	Fax:	086 726 3619
E-mail:	hasan@1wc.co.za		

2. DECLARATION BY THE SPECIALIST

I, **Rowena Harrison** lare that --

General declaration:

- I act as the independent specialist in this application;
- do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
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- 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;
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- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
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- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

Signature of the specialist:

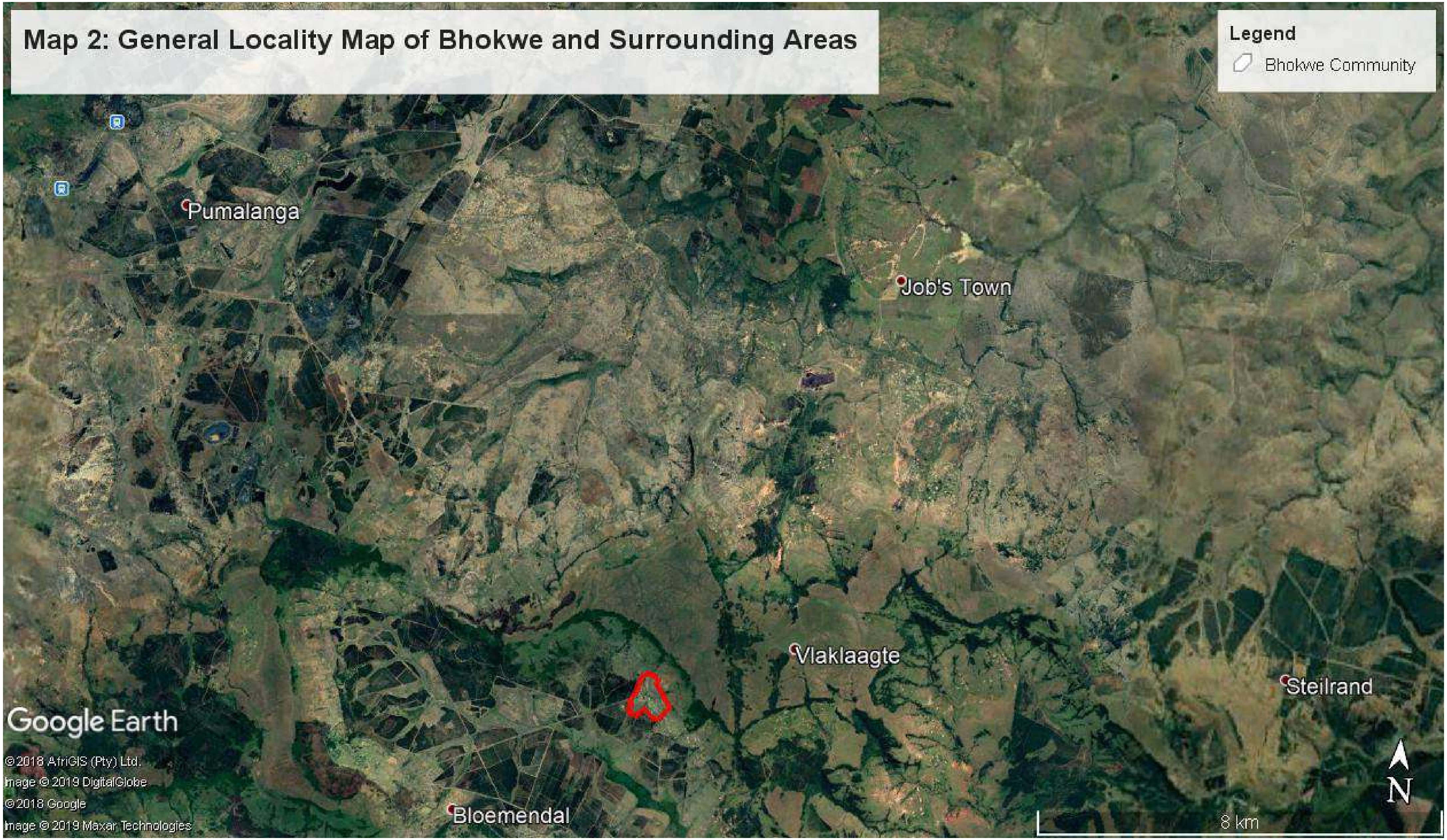
Malachite Ecological Services

Name of company:

05/12/2019

Date

Appendix C



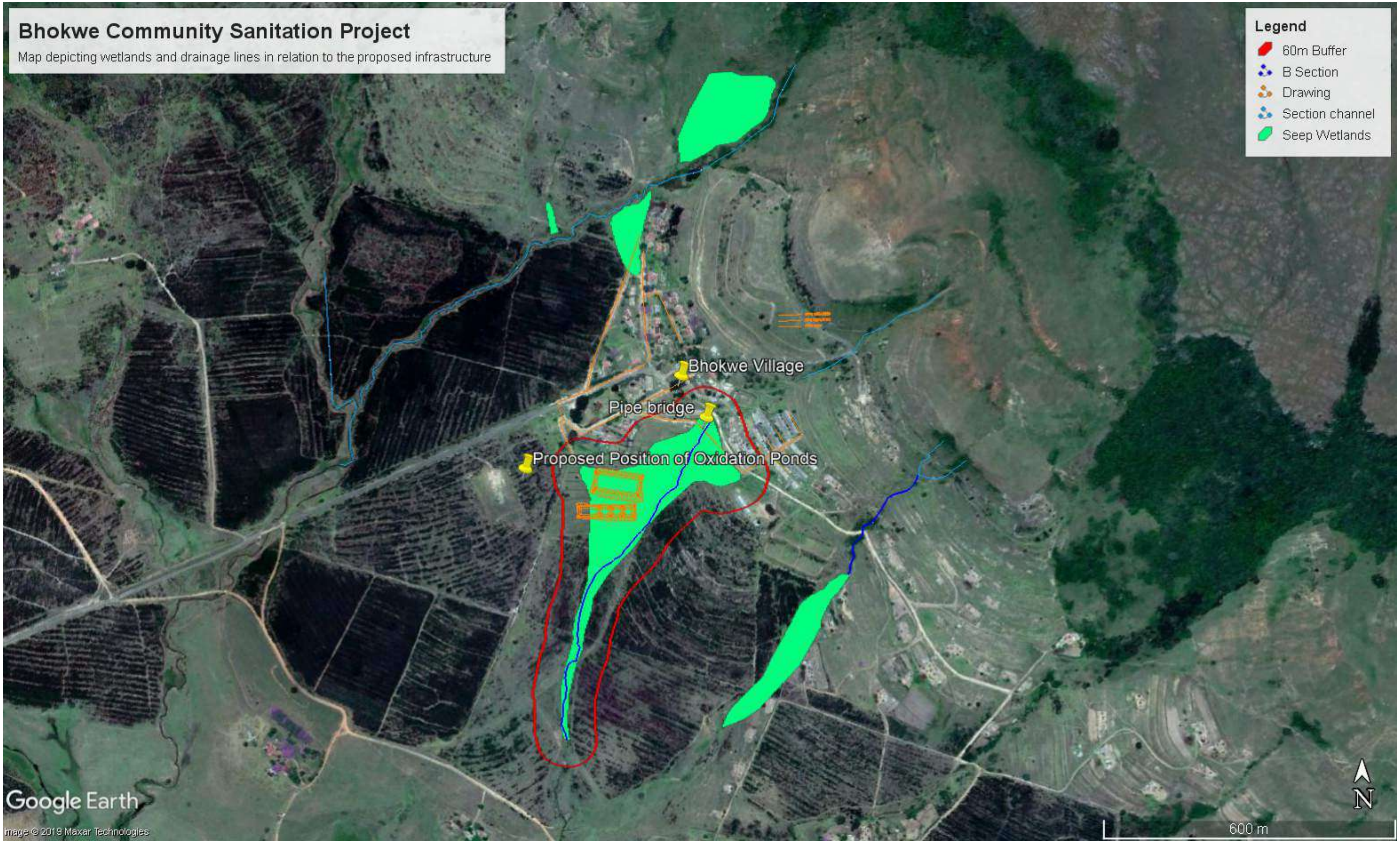
Map 2: General Locality Map of Bhokwe and Surrounding Areas

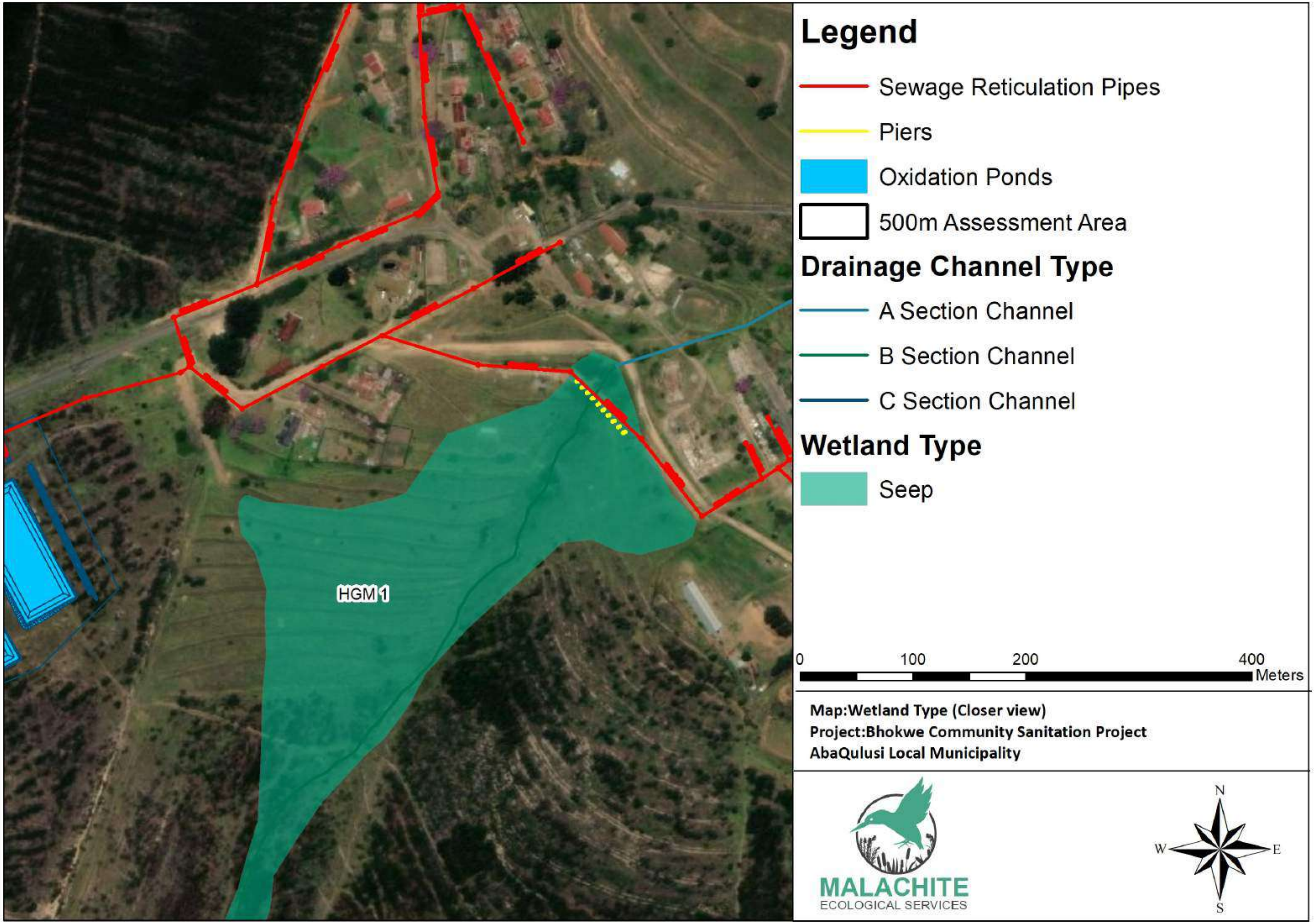
BHOKWE COMMUNITY SANITATION PROJECT

Layout detailing sewer reticulation, proposed camp site, wetland crossing, oxidation treatment plant and associated evapotranspiration ponds.

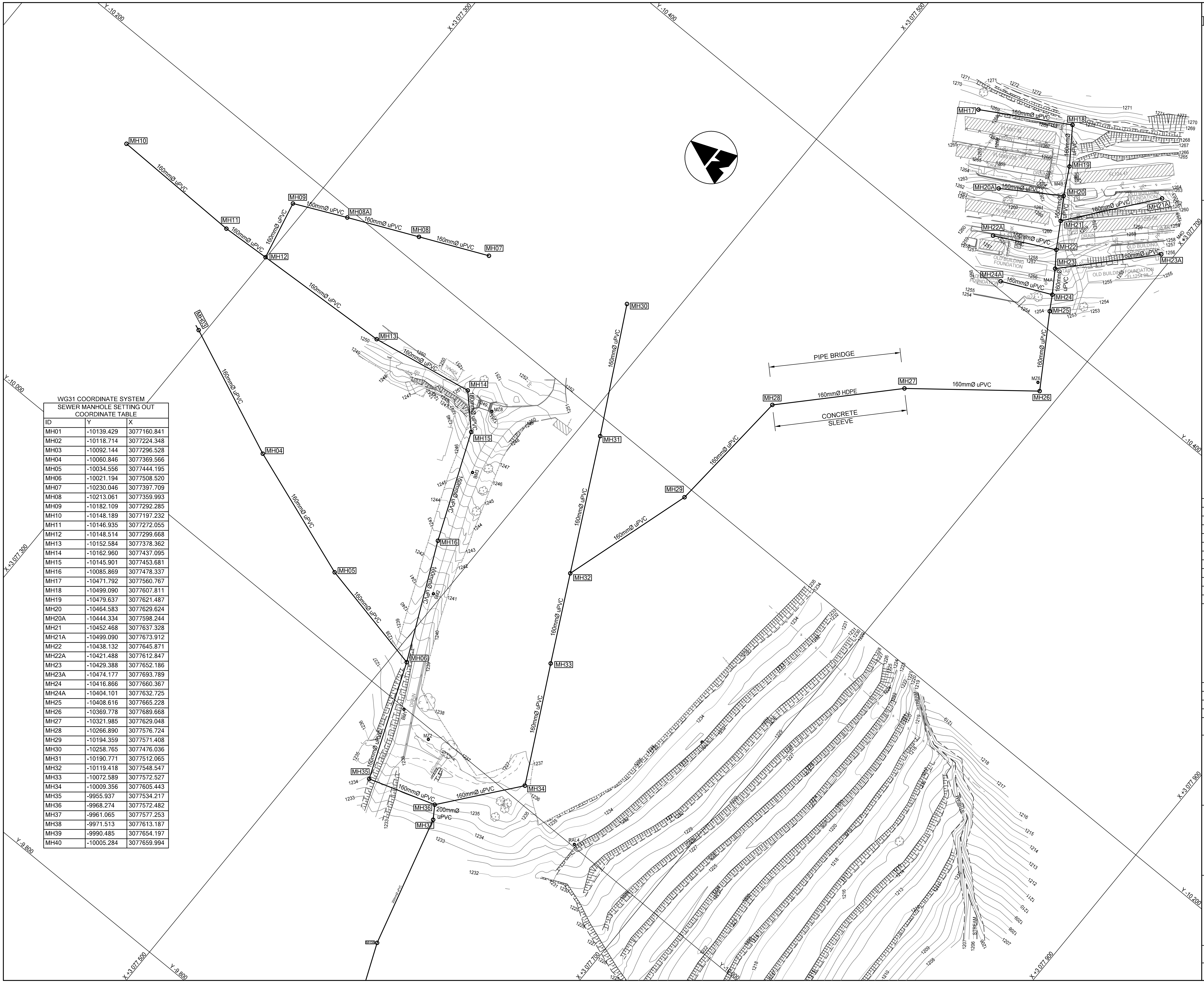
Bhokwe Community Sanitation Project

Map depicting wetlands and drainage lines in relation to the proposed infrastructure





Map:Wetland Type (Closer view)
Project:Bhokwe Community Sanitation Project
AbaQulusi Local Municipality



WG31 COORDINATE SYSTEM

SEWER MANHOLE SETTING OUT COORDINATE TABLE		
ID	Y	X
MH01	-10139.429	3077160.841
MH02	-10118.714	3077224.348
MH03	-10092.144	3077296.528
MH04	-10060.846	3077369.566
MH05	-10034.556	3077444.195
MH06	-10021.194	3077508.520
MH07	-10230.046	3077397.709
MH08	-10213.061	3077359.993
MH09	-10182.109	3077292.285
MH10	-10148.189	3077197.232
MH11	-10146.935	3077272.055
MH12	-10148.514	3077299.668
MH13	-10152.584	3077378.362
MH14	-10162.960	3077437.095
MH15	-10145.901	3077453.681
MH16	-10085.869	3077478.337
MH17	-10471.792	3077560.767
MH18	-10499.090	3077607.811
MH19	-10479.637	3077621.487
MH20	-10464.583	3077629.624
MH20A	-10444.334	3077598.244
MH21	-10452.468	3077637.328
MH21A	-10499.090	3077673.912
MH22	-10438.132	3077645.871
MH22A	-10421.488	3077612.847
MH23	-10429.388	3077652.186
MH23A	-10474.177	3077693.789
MH24	-10416.866	3077660.367
MH24A	-10404.101	3077632.725
MH25	-10408.616	3077665.228
MH26	-10369.778	3077689.668
MH27	-10321.985	3077629.048
MH28	-10266.890	3077576.724
MH29	-10194.359	3077571.408
MH30	-10258.765	3077476.036
MH31	-10190.771	3077512.065
MH32	-10119.418	3077548.547
MH33	-10072.589	3077572.527
MH34	-10009.356	3077605.443
MH35	-9955.937	3077534.217
MH36	-9968.274	3077572.482
MH37	-9961.065	3077577.253
MH38	-9971.513	3077613.187
MH39	-9990.485	3077654.197
MH40	-10005.284	3077659.994

cms

100mm ON ORIGINAL DRAWING

SEWER NOTES

1. PIPES TO BE HEAVY DUTY uPVC CLASS 34 TO SABS 791. DIAMETER AS INDICATED.
2. THIS DRAWING APPLIES TO THE MAIN EXTERNAL SEWERS ONLY. FOR DETAILS OF CONNECTIONS TO BUILDINGS REFER TO ARCHITECTS DRAWINGS.
3. ALL BEDDING TO BE BEDDING FOR FLEXIBLE PIPES, UNLESS OTHERWISE DIRECTED BY ENGINEER.
4. MANHOLE COVERS ARE HEAVY DUTY UNLESS OTHERWISE SHOWN.
5. REFER DRG. No. 19008/9020 FOR SEWER DETAILS.

BENCHMARKS WG31

ID	Y	X	Z
RAL1	-9944.104	3077783.546	1219.071
RAL3	-10092.700	3077667.763	1233.704
RAL4	-10001.315	3077648.435	1233.393
BM1	-9999.206	3077524.353	1237.330
BM2	-10060.836	3077495.533	1240.610
BM3	-10128.516	3077468.879	1246.150
M4A	-10419.499	3077653.521	1255.750
M4B	-10470.861	3077625.839	1264.260
M4C	-10429.993	3077626.414	1259.620
M4D	-10488.666	3077698.357	1259.100
MZ6	-10372.997	3077685.741	1248.870

Reference drawings:	Description:
-	-

D	21/11/2019	PIPE FROM MH01 TO MH 03 OMITTED	SAS
C	19/11/2019	SLEEVES ADDED	SAS
B	17/10/2019	MH37 - MH39 REPOSITIONED	SAS
A	02/07/2019	ISSUED FOR TENDER	SAS
Rev.	Date	Description	By

Consultant:

UKUZA CONSULTING (PTY) LTD

Designed:	Shaun Swanby	
Drawn:	Neil Naidoo	
Checked:	Shaun Swanby	
Member:	--	
Scale: 1:1000	Sheet size: A0	Date: 02/07/2019

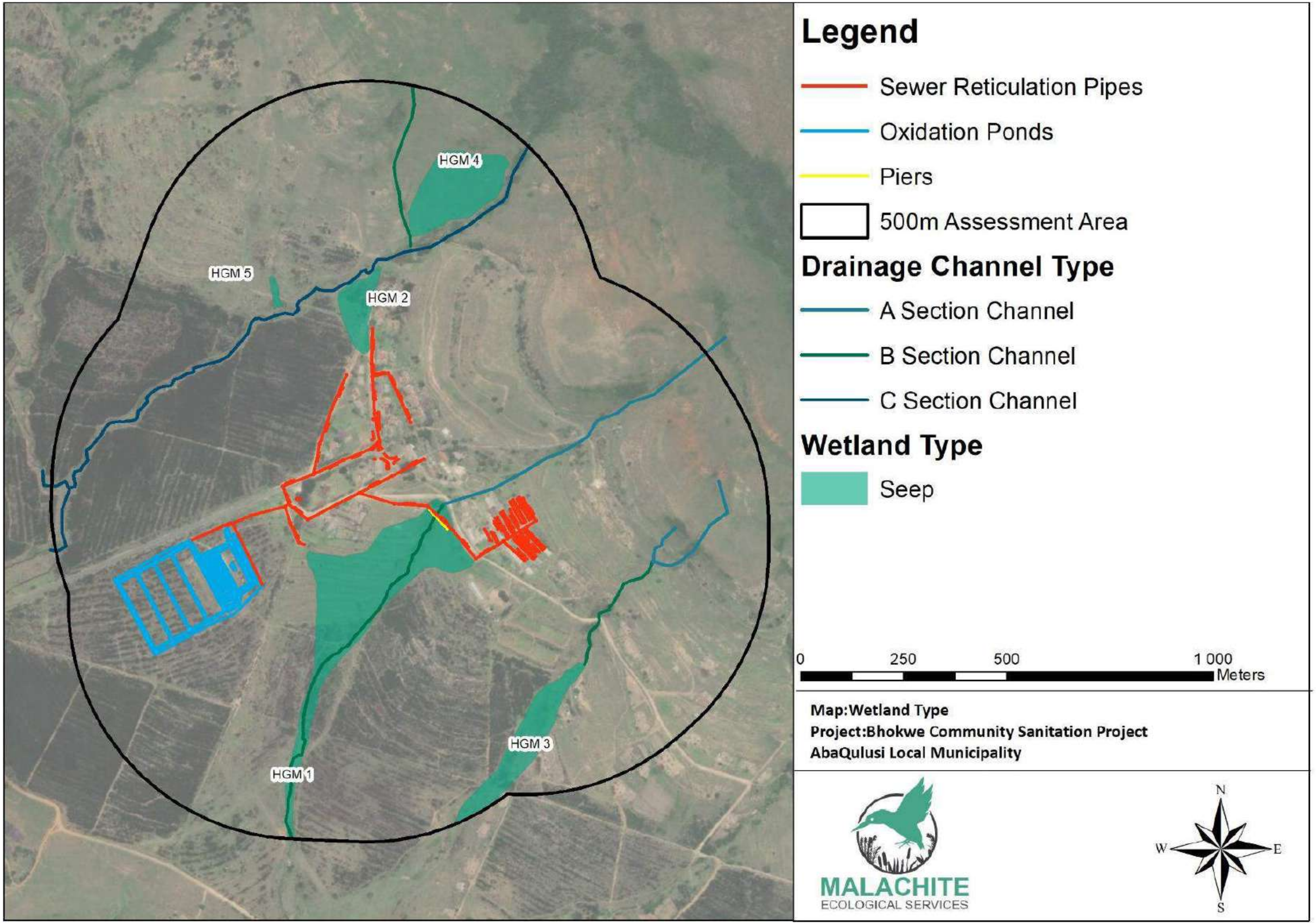
Client:

MISA
Municipal Infrastructure Support Agent
REPUBLIC OF SOUTH AFRICA

Project:
REHABILITATION OF SEWER AT BOKWE VILLAGE

Drawing Description:
SEWER RETICULATION PLAN

Project Number:	Drawing Number:	Revision Number:
19008	9001	D



Map:Wetland Type
Project:Bhokwe Community Sanitation Project
AbaQulusi Local Municipality

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT (MISA)

REHABILITATION OF SEWER RETICULATION AT BOKWE VILLAGE

Method Statement

October 2019

Revision B
2019-11-25

Contents

Annexure A :	Project Location
Annexure B:	Sewer reticulation Oxidation ponds

1. Background

Ward No. 5 of the Abaqulusi Local Municipality consists mainly of two areas; the Bhokwe and ENyathi Areas. Abaqulusi Local Municipality falls within the Zululand District Municipality in the KwaZulu-Natal Province. Bhokwe Settlement consists of No. 7 Village, Bhokwe Quarters, Bhokwe Hostels, Golozela Village, Mahowane Village, Mafuta Village and Mzimba Village.

In Bhokwe Settlement, there is Bhokwe primary school which caters for about 270 students

The existing waterborne sewer system in Bhokwe Quarters and the Hostels is old and dilapidated. It is characterised by frequent bursts, blockages and overflowing manholes . The ageing sewer infrastructure was provided by the Anglo American Coal mining company at least 50years ago. The system consists of flushing toilets connected to a shallow sewer reticulation system that discharges into a common conservancy tank which is meant to be maintained by the local municipality. Two conservancy tanks were observed, one that services Bhokwe Quarters and the other that services Bhokwe Hostels. The rest of the Villages under Bhokwe Settlement use VIP toilets.

This project proposes the replacement of the existing sewer reticulation with a new reticulation system and replacement the existing conservancy tanks with a new WWTW (oxidation pond system)

2 Project description

The project will comprise approximately 1860m of 160mmØ HD uPVC and 150m of 200mmØ HD uPVC sewer reticulation, 37No 1250Ø concrete manholes and an oxidation pond system consisting of a primary pond, a secondary pond, three tertiary ponds. The final effluent will cascade into four shallow evaporation ponds.

The reticulation crosses a seep wetland once. The pipe will be elevated on concrete piers.

3 Project location

The project is located approximately 28 km east of Vryheid in KwaZulu-Natal, 27°48'39.56"S 31° 6'13.58"E. Refer Annexure A
The project area covers approximately 16hectares including reticulation and oxidation ponds. Refer annexure B

4 Pipeline construction methodology

4.1 Materials

Reticulation
The house connections will be 110mm uPVC class 51.
The main reticulation will be 160mm and 200mm uPVC class 34 (HD)
The concrete rings will be 1250mm diameter with heavy duty concrete covers
The elevated pipe will be 150mm NB flanged steel epoxy coated and lined

4.2 Construction corridor and servitude

The village is not formally laid out except for the school. The position of the pipes will be dictated by the position of the existing fences and roads. No pipeline servitudes will be registered after construction.

The construction corridor where construction vehicles are permitted and outside of sensitive areas is to be 10m in total, 5m on either side of the proposed pipeline route.

4.3 Pipes laid below ground

Pipelines will be laid below ground by conventional open trench excavation except in the sensitive area where it will be elevated.

The depth of the various trenches varies according to location and topography of the existing ground level. Generally an average cover of 1m above the top of the pipe is adhered to. The trench widths will be in accordance with SANS 1200 - 300mm wider on either side of the pipeline. This allows for compaction with a motorised rammer.

Before laying, pipes will be visually checked for scratches, puncture, ovality, correct marking.

The pipes will be laid on flexible bedding as shown on Figure 1. The selected cradle and blanket is to be river sand.

More river sand is then placed on the sides of the pipe to 100mm above the crown of pipe (bedding cradle). This is then hand stamped to secure the position of the pipe. Suitable material from the trench excavation or river sand, if the sand taken from the trench has too many large particles, it is then placed a further 200mm on top of the pipe (bedding blanket) and then compacted. The trench will then be backfilled with normal backfill material or the material excavated from the trench till the existing ground level. This backfill is compacted in 300mm layers until the ground profile is reached.

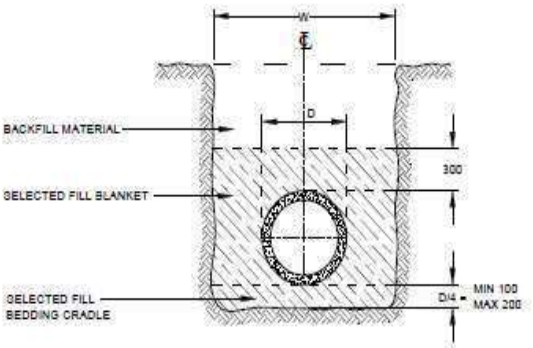


Figure 1: Proposed HDuPVC pipeline bedding

Construction activities may impact on water quality, animal habitat, and flow regime. Prevention and mitigation measures are presented in Table 1 below.

Table 1. Potential sources of pollution and mitigation measures

Potential source of pollution	Potential pollution	Mitigation measure
1.Construction Vehicles	a)Oil leaks	(i) Routine checking of machinery/plant and vehicles for oil leaks each day before construction activity begins shall be conducted. Areas in which oil is kept will be bunded.
	b)Access control	(i) No vehicle will be permitted to cross drainage lines, wetlands and floodplain areas during construction. (ii) Access routes shall be designed to limit the potential impact on the environment, bearing in mind steep banks and areas prone soil erosion. (iii) Existing access roads/tracks shall be used where possible.
2.Construction Workers	a)Washing and cleaning of construction equipment	(i) Washing and cleaning of construction shall not be undertaken within the drainage lines, watercourses and wetland areas.
	b)Littering	(i) Waste disposal facilities (bins) shall be provided and workers encouraged not to litter or dispose solid waste in the natural environment but to use available facilities.
	c)Sanitation	(i) Portable toilets shall be provided where construction is occurring. Workers shall be encouraged to use these facilities and not the natural environment.
3.Construction Activity	a) Hazardous substances	(i) Proper storage and handling of hazardous substances (e.g. chemicals) shall be administered. (ii) All employees handling fuels and other hazardous materials shall be trained properly. (iii) Spillage of hazardous substances shall be cleaned up immediately and contaminants properly drained and disposed to a suitable dump site. (iv) Any contaminated soil in the construction site shall be removed and rehabilitated timeously and appropriately.
	b)Stockpile material	(i) No stockpiling of any materials shall take place within any water course, including wetlands and rivers/drainage lines.
	c)Cement	(i) No cement batching activities shall take place near the water course and wetland areas. (ii) Cement batching boards shall be used and cement-based products/wash not be disposed into the natural environment.
	d) Managing the use of sand and water from the watercourse.	(i) Soil/sand required for construction purpose shall not be derived from watercourse. (ii) Water for use in construction or as a drinking supply shall not be taken directly from any wetlands or streams. Where there is an abstraction of water from wetlands or rivers for construction will be approved by the Department of Water and Sanitation. (iii) Excavated material/sediments/spoil from the construction (including any unsuitable materials) shall not be placed or stockpiled within any watercourse (drainage line).

4.4 Seep wetland Crossings

There is no significant water flow in the seep wetland. The pipe piers will be placed at 6m intervals on crushed stone approximately 1.8m x 1.8m in plan and 1m thick. The piers will be constructed in reinforced concrete.

The position of the pier foundations will be marked out. The existing vegetation will be carefully removed in manageable clumps to a stockpile area nearby. The stockpiled vegetation will be maintained during the construction of the piers. The pier foundations will be hand excavated to prevent excessive damage. Soil will be placed on plastic sheets so as not to contaminate the existing vegetation. The piers will be backfilled on completion and any plant damage in the construction zone repaired with the vegetation from stockpile.

4.5 Road Crossings

Where the pipeline crosses the road, conventional open cut trenching with traffic controls will be utilised followed by temporary reinstatement. Once all the pipelines have been completed, tested and accepted, formal reinstatement will proceed. The pipeline will be laid with a cover of 1200mm above the crown of the pipe.

5 Oxidation ponds construction methodology

5.1 Materials

The grit channel will be constructed from reinforced concrete and brickwork. The screens will be stainless steel.
The floor and banks of the ponds will be lined with a 1.5mm HDPE liner on top of a geosynthetic clay liner.
The pond berms will be capped with 150mm G5 gravel
The pond interconnecting structures will comprise brickwork with high alumina mortar and 200mm uPVC pipes.

5.1 Construction

Oxidation Ponds
The topsoil channel and berm will be constructed to prevent runoff inundating the works.
The area will be stripped of topsoil.
Steep areas will be benched at 1:20 sloping into the slope.
The fill will be compacted in layers to 95% mod AASHTO and then trimmed to line and level.
A 150mmm selected layer free of roots and stones will be place above the bulk earthworks.
The inlet, outlet and inter-pond structures will be installed prior to the installation of the liners
The ponds will be lined with a geosynthetic clay liner (GCL)and top of that a 1.5mm HDPE liner
The liners will be secured on the perimeter in an anchor trench
The 3m wide berms will be protected by a 150mm gravel capping
The external banks will be topsoiled and grassed with endemic grass sods sourced locally.

Evaporation Ponds
The methodology is the same as for the oxidation ponds except that the ponds will be shallower and the berms narrower.

Fence and gates
The permanent fence and gates will be installed.

6 Rehabilitation

6.1 Rehabilitation Non-Sensitive Areas

There are three rehabilitation options.

The options are:

- For gentle slopes (>1:10) and not in the path of high flows.

A product produced by Macafferri called Biomac will be installed, Biomac is a bio-degradable product used after reinstating banks and promotes vegetation growth. After the backfilling of the trench is complete the surrounding bank is then shaped and trimmed. A sheet of Biomac is then placed on this area and is anchored down by either steel or wooden pegs. Topsoil of about 20mm thick is then raked over and this area is then hydo-seeded.

- For steeper slopes (between 1:2 and 1:10) and where there is medium velocity flows

A product produced by Macafferri called Mac-mat will be installed. Mac-mat is a woven mesh application which can take a tensile force of up to 30kN (kilonewtons) and is used after reinstating banks and promotes vegetation growth. After the backfilling of the sewer trench is complete the surrounding bank is then shaped and trimmed. A sheet of Mac-mat is then placed on this area and is anchored down by either steel or wooden pegs. Topsoil of about 20mm thick is then raked over and this area is then hydro seeded.

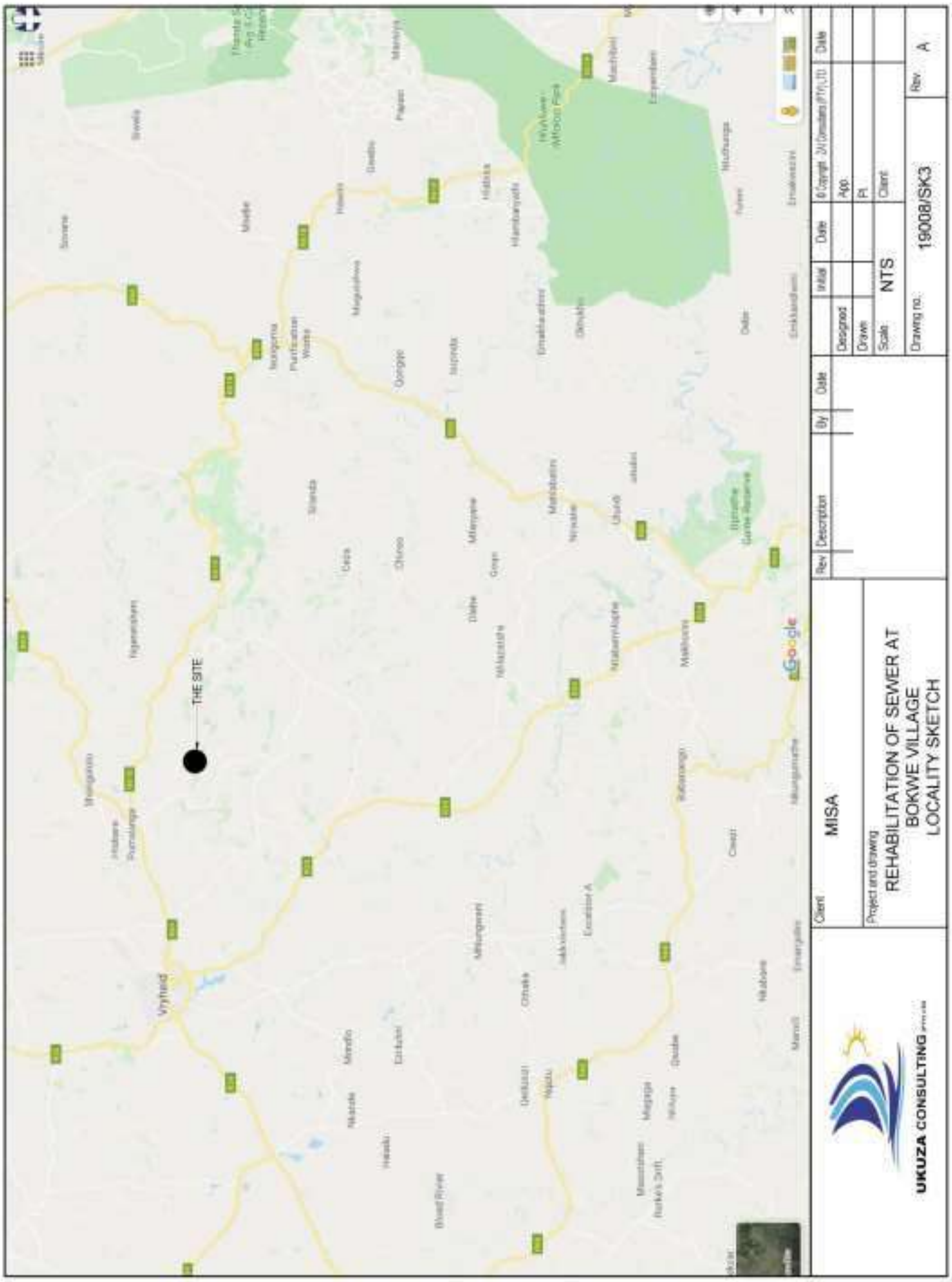
- For steeps banks ($> \mathbf{1:2}$) and in areas of high flows

A stepped terrace of gabion baskets will be installed along the banks width, if required, Reno mattress will be constructed on the river bed at its existing level. This is specially for areas which run through private property were not much care or inadequate river protection was placed and as a result of flooding has washed away some of the banks.

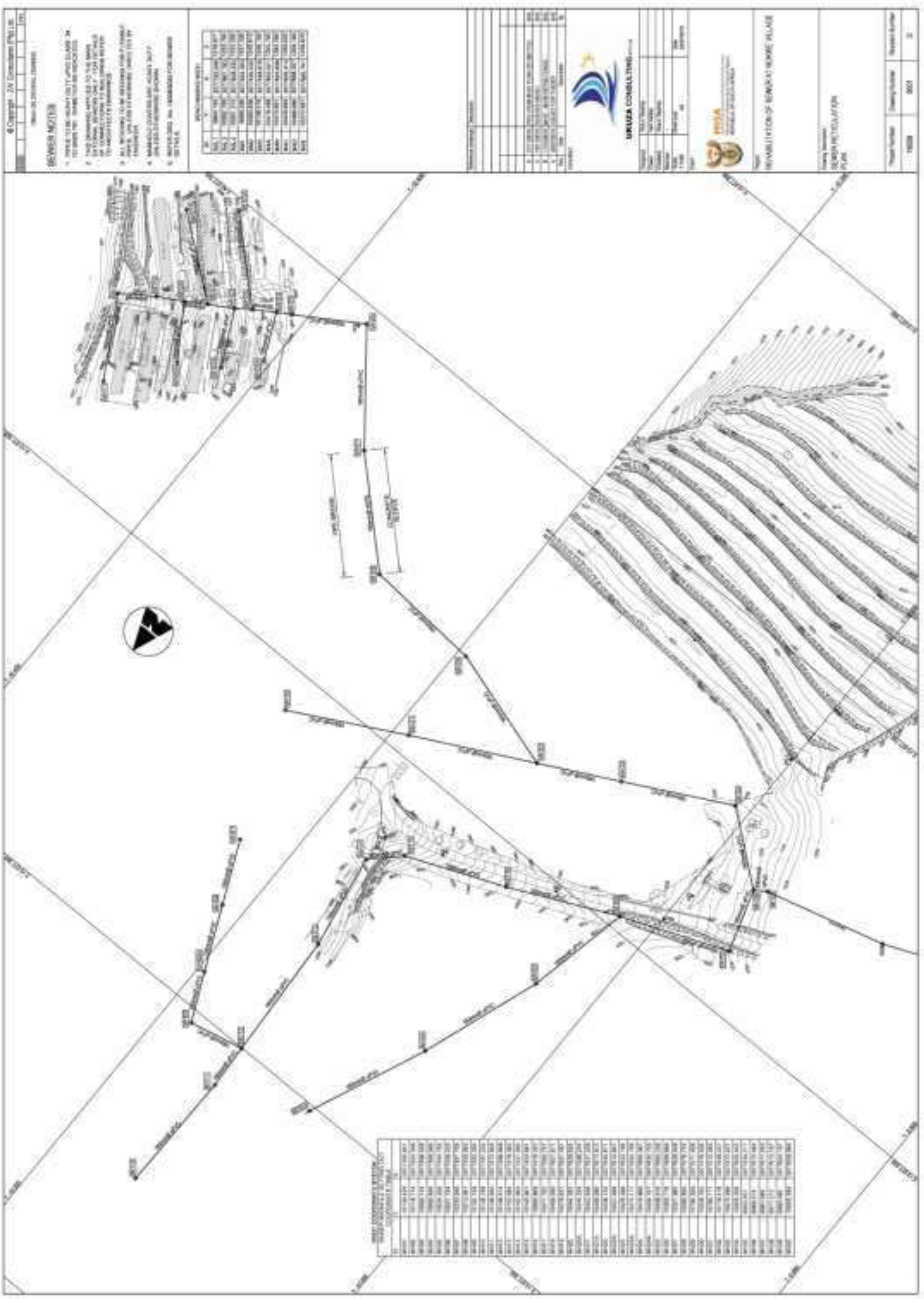
6.2 Rehabilitation-Seep wetland

Refer 4.4 above

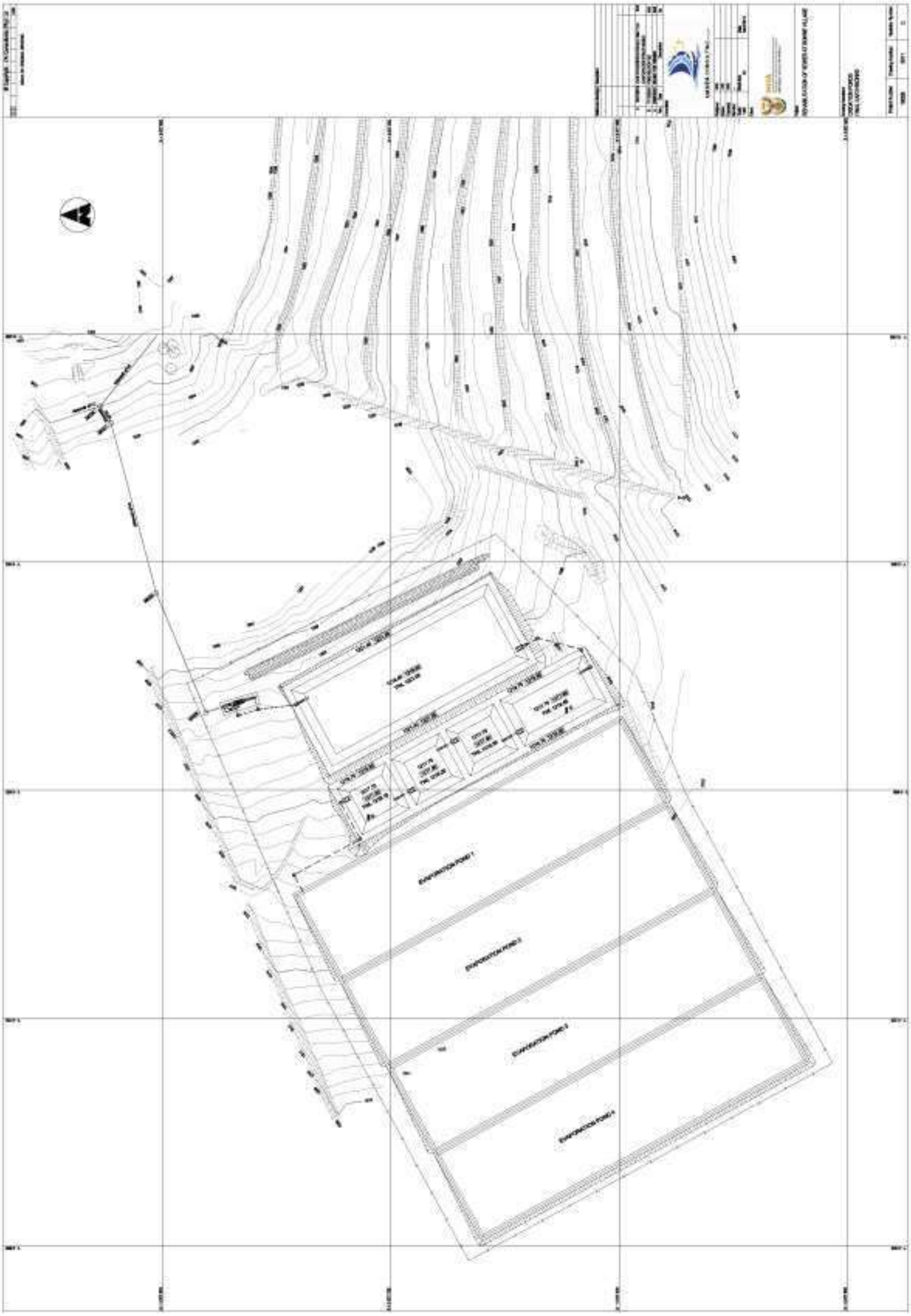
Annexure A: Project Location



Annexure B: Sewer Reticulation



Annexure B: Oxidation Ponds



MUNICIPAL INFRASTRUCTURE SUPPORT AGENT (MISA)

REHABILITATION OF SEWER RETICULATION AT BOKWE VILLAGE

Water Balance

October 2019

Revision B
2019-11-25

Contents

1. Background

Ward No. 5 of the Abaqulusi Local Municipality consists mainly of two areas; the Bhokwe and ENyathi Areas. Abaqulusi Local Municipality falls within the Zululand District Municipality in the KwaZulu-Natal Province. Bhokwe Settlement consists of No. 7 Village, Bhokwe Quarters, Bhokwe Hostels, Golozela Village, Mahowane Village, Mafuta Village and Mzimba Village.

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The project will comprise approximately 1860m of 160mmØ HD uPVC and 150m of 200mmØ HD uPVC sewer reticulation, 37No 1250Ø concrete manholes and an oxidation pond system consisting of a primary pond, a secondary pond, three tertiary ponds. The final effluent will cascade into four shallow evaporation ponds.

The reticulation crosses a seep wetland once. The pipe will be elevated on concrete piers.

3 Project location

The project is located approximately 28 km east of Vryheid in KwaZulu-Natal, 27°48'39.56"S 31° 6'13.58"E. Refer Annexure A
The project area covers approximately 16hectares including reticulation and oxidation ponds. Refer annexure B

4 Water Balance

4.1 Design Flows and Loading

86HH in Bhokwe Hostels were classified to be under the lower income group 26HH for Bhokwe Quarters were classified to be under the Middle income

86 lower income households with a demand of 500 l/day and 7 people /household
26 middle income households with a demand of 750 l/day and 7 people /household
Peak factor of 3.25
Stormwater infiltration of 15.%
Growth rate of 1% over 30 years (factor 1.348)
Organic loading 50g BOD/cap/d

Average dry weather flow (ADWF) = 86 x 500l/day + 26 x 750 l/day = 62500 l/day
62.5 kl/day (0.723 l/s)

Average wet weather flow (AWWF) = 62.5 x 1.15 =	71.9 kl/day
Peak wet weather flow (PWWF) = 71.9 x 3.25 =	233.6 kl/day (2.704 l/s)
Future ADWF = 62.5 x (1.0130) =	**84.2 kl/day** (0.975 l/s)
Future PWWF = 233.6 x (1.0130) =	314.9 kl/day (3.644 l/s)

The hydraulic pipes and structures are designed for the PWWF which will occur over a short period in the day and the treatment works is designed for the ADWF.

4.1 Water Balance

From records, the average annual rainfall is 778mm/year and the free surface evaporation rate is 1740mm/year. The nett evaporation is thus 962mm/year.

The area required for the evaporation of all the effluent is thus:-

$$\frac{84.2 \text{ m}^3\text{/day x 365 days}}{0.962\text{m}} = 31\ 947 \text{ m}^2$$

The surface area of the oxidation ponds is 5560 m² thus the evaporation pond surface area required is 31 947 m² – 5 560 m² = 26 387 m²

We shall provide four evaporation ponds with a floor area of 160m x 40m which will provide a surface area of 27 216 m²

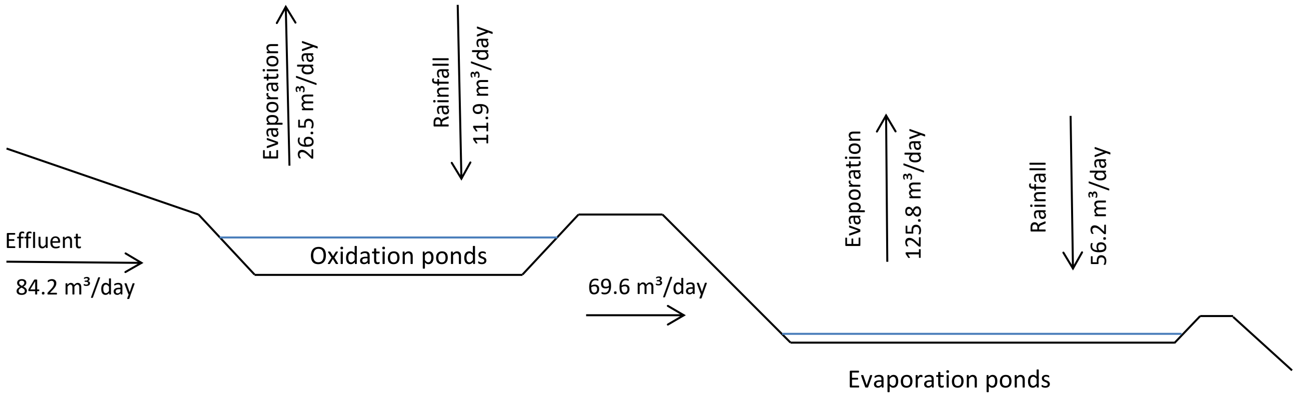
Oxidation Ponds

Description	Length (m)	Breadth (m)	Depth (m)	Volume (m³)	Detention Provided (days)	Detention Required (days)	Floor Area (m²)	Surface area (m²)
Primary	90	30	1.5	4617	54.8	52.3	2700	3456
Secondary	33	15	1.5	986	11.7	10	495	819
Tertiary 1	16	15	1.4	479	5.7	5	240	445
Tertiary 2	16	15	1.3	434	5.2	5	240	428
Tertiary 3	16	15	1.2	391	4.6	5	240	412
				6907	82.1	77.3		5560

Evaporation ponds

Description	Length (m)	Breadth (m)	Depth (m)	Volume (m³)	Detention Provided (days)	Detention Required (days)	Floor Area (m²)	Surface area (m²)
Evapo 1	160	40	0.5	3301			6400	6804
Evapo 2	160	40	0.5	3301			6400	6804
Evapo 3	160	40	0.5	3301			6400	6804
Evapo 4	160	40	0.5	3301			6400	6804
				13204				27216

Expressed daily pictorially thus:-



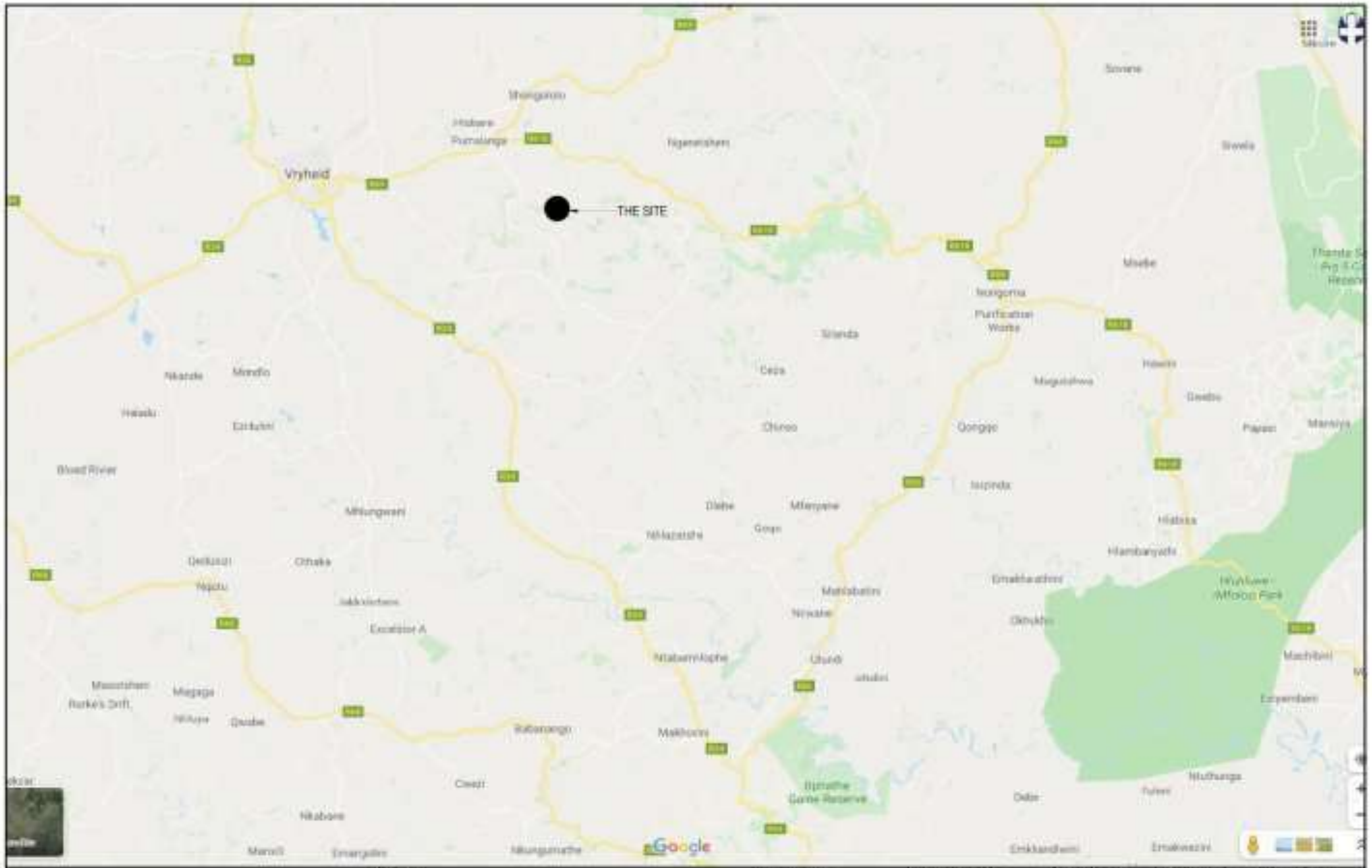
Check
Inputs 84.2 + 11.9 + 56.2 = 152.3 m^3/day
Outputs 26.5 + 125.8 = 152.3 m^3/day

Expressed monthly thus:-

	Average annual evaporation (mm)	Average annual rainfall (mm)
January	187	133
February	157	112
March	146	82
April	125	35
May	108	21
June	94	12
July	104	13
August	140	20
September	158	39
October	163	74
November	165	107
December	193	130
Year	1740	778

Month	Effluent from Reticulation (m^3)	Rainfall (m^3)	Evaporation (m^3)
January	2561	4249	5974
February	2561	3578	5016
March	2561	2620	4664
April	2561	1118	3993
May	2561	671	3450
June	2561	383	3003
July	2561	415	3322
August	2561	639	4473
September	2561	1246	5048
October	2561	2364	5207
November	2561	3418	5271
December	2561	4153	6166
m^3/year	30732	24854	55587
m^3/day	84.2	68.1	152.3

Annexure A: Project Location



UKUZA CONSULTING

Client
MISA

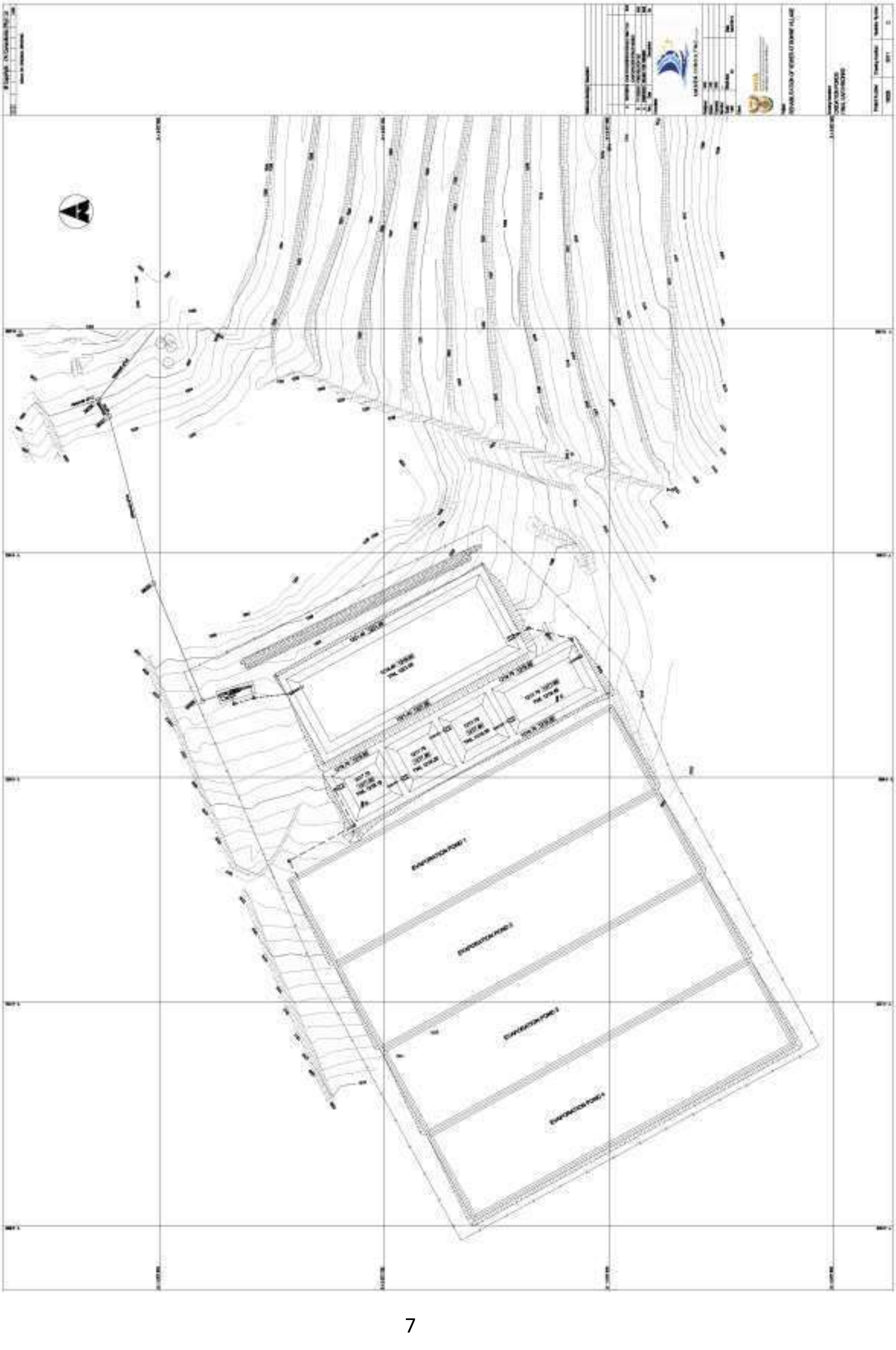
Project and drawing
REHABILITATION OF SEWER AT
BOKWE VILLAGE
LOCALITY SKETCH

Rev	Description	By	Date

	Initial	Date	© Copyright - ZA Consultants (PTY) LTD	Date
Designed			App.	
Drawn			Pl.	
Scale: NTS			Client	

Drawing no.: 19008/SK3
Rev. A

Annexure B: Oxidation Ponds



MUNICIPAL INFRASTRUCTURE SUPPORT AGENT (MISA)

REHABILITATION OF SEWER RETICULATION AT BOKWE VILLAGE

Design Report

November 2019

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Contents

1 INTRODUCTION

1.1 BACKGROUND

Ward No. 5 of the Abaqulusi Local Municipality consists mainly of two areas; the Bhokwe and ENyathi Areas. Abaqulusi Local Municipality falls within the Zululand District Municipality in the KwaZulu-Natal Province. Bhokwe Settlement consists of No. 7 Village, Bhokwe Quarters, Bhokwe Hostels, Golozela Village, Mahowane Village, Mafuta Village and Mzimba Village. (**see Locality Map in Annexure A**)

This report is restricted to the Bhokwe Village i.e. the Bhokwe Quarter and the Bhokwe Hostels

Table 1: Demographic Details

Place	Location			No. of HH*	Est. Population	Type & Patten of Settlement
	Southing	Easting	Elevation			
Bhokwe Settlement						
No. 7	27°49’02.665’’	31°05’05.687’’	1156			Rural: Linear
Bhokwe Quarters	**27°48’29.084’’**	**31°06’10.699’’**	**1264**	**26**	**182**	**Peri-Urban: Nucleated**
Bhokwe Hostels	**27°48’44.010’’**	**31°06’21.820’’**	**1267**	**86**	**602**	**Peri-Urban: Nucleated**
Golozela Village	27°49’20.030’’	31°06’09.190’’	1173			Rural: Dispersed
Mahowane Village	27°49’13.210’’	31°06’29.150’’	1213			Rural: Nucleated
Mafuta Village	27°48’56.650’’	31°06’32.950’’	1253			Rural: Nucleated
Mzimba Village	27°49’06.760’’	31°06’53.780’’	1267			Rural: Dispersed
			Total	**112**	**784**	

*The population estimation is based on an average number of 7 individuals per household.

In Bhokwe Village, there is Bhokwe primary school which caters for about 270 students.

1.2 EXISTING WATER & SANITATION INFRASTRUCTURE

Bhokwe Settlement: Existing Sewer

The existing waterborne sewer system in Bhokwe Quarters and the Hostels is old and dilapidated. It is characterised by frequent bursts, blockages and overflowing manholes **(Annexure B: Fig 1)**. The ageing sewer infrastructure was provided by the Anglo American Coal mining company at least 50years ago. The system consists of flushing toilets connected to a shallow sewer reticulation system that discharges into a common conservancy tank **(Annexure B: Fig 2)** which is meant to be maintained by the local municipality. Two conservancy tanks were observed, one that services Bhokwe Quarters and the other that services Bhokwe Hostels. The rest of the Villages under Bhokwe Settlement use VIP toilets.

Bhokwe Settlement: Existing Water

The water supply source for the settlement is a ground water system (borehole) that supplies the Mzimba Command Reservoir which then contributes water to a reticulation network that terminates into standpipes. Residents have highlighted that water supply is erratic and that pressure is always inadequate especially at peak periods. The water reticulation in Bhokwe Hostels and Bhokwe Quarters was observed to be of 50mm diameter galvanised lines and there were about 5 stand pipes that service Bhokwe Hostels and Bhokwe Quarters.

1.3 TOPOGRAPHY OF PROJECT AREA

The study area (Bhokwe Village) is generally steeply sloped with the northern side being higher than the southern side thus giving rise to south-easterly surface water drainage. Bhokwe Village is flanked by a mountain range to the north-west, the north and north-east. The mountain ranges significantly in elevation between 1300 on the north-west side to 1500 on the north-east side. The land use immediately outside Bhokwe Village on the southern-west and south-east side is dominated by Tree Plantations. (See **Annexure C**)

1.4 SCOPE AND PURPOSE OF THE REPORT

The report records and presents the sewer challenges in Bhokwe Village; namely in Bhokwe Quarters and Bhokwe Hostels. The main design criterion, estimation of wastewater flows and estimated construction costs for the proposed sewer replacement network and a proposed waste water treatment system will be outlined.

The report is intended to present to MISA and all the stakeholders (AbaQulusi Local Municipality, Zululand District Municipality & Community) the outputs of the detailed design, the expected performance of the proposed infrastructure and the envisaged construction schedule.

2 REAL OPTIONS ANALYSIS

2.1 SEWER RETICATION

Bhokwe Village; namely Bhokwe Quarters and Bhokwe Hostels was formerly serviced with flushing toilets connected to a shallow water borne sewer reticulation system that discharged into a common conservancy tank. The reticulation is dilapidated and requires significant maintenance. The conservancy tank requires frequent emptying.

On-site treatment for example VIP’s, VDIP’s and VV’s were considered. The middle income households have space for on-site treatment but because of high maintenance costs and because the previous system was flushing toilets, it was not considered appropriate for the middle income households. The low income hostels are too closely spaced for on-site treatment.

Therefore the dilapidated water borne sewer reticulation system will be replaced with functional water borne sewer borne sewer reticulation system.

2.3 LINKING BHOKWE WITH NEARBY BULK INFRASTRUCTURE

The nearest sewer system is situated in Enyathi Settlement. The Enyathi Waste Water Treatment Works **(27° 49’ 26.0832’’S; 31° 3’ 27.63’’E; 1225)** consist of two conservancy tanks and 4 lagoons in series and is approximately 5km away from the proposed Bhokwe Village. Due to the great distance between Bhokwe Village and the Enyathi Sewer system it is not viable to link the two systems from an operational and financial point of view.

2.3 WWTW options

Three Wastewater Treatment Works (WWTW) options were evaluated viz. Oxidation Pond System, Activated Sludge System, Rotating bio-contactors System. The Oxidation Pond System is the preferred WWTW option. Bhokwe climate can be considered typical of KZN, year-round mild to warm climates. Bhokwe Village also has large land area available. These environmental and spatial factors favour the use of such a system. It is robust - handles varying wastewater types (Industrial or Domestic). Lower maintenance and operating costs (generally periodic dredging). Low Technology solution i.e. self-sufficient treatment system hence reduction of operator responsibilities to manage treatment plant - a reduction in labour costs (require only part-time staff).

The complete report is included in **Annexure E.**

3 PROJECT DESIGN CRITERIA

This section presents the design criteria which were used for the detailed design of the Proposed Sewer Reticulation Network. The criteria were compiled using experience gained from similar sewer networks, Guidelines for Human Settlement Planning and Design Vol. 2 (Red Book) and international design best practices.

3.1 DESIGN HORIZON

A design Horizon of **30yrs** was adopted

3.2 FLOWS & INFLUENT LOADING

SEWER RETICATION (**Guidelines for Human Settlement Planning and Design Vol. 2** (Red Book))

Depth of Flow & Infiltration:
-The sewer reticulation was designed to flow 66% at the peak design flow.
-15% stormwater infiltration was included in the design for wet weather flow.

Average Dry Weather flow (ADWF):

-Discharge from day schools were not been taken into account because the flows do not peak at the same time as the main residential flow.

- This is the average daily flow emanating from each property within the project area during dry weather conditions and hence no rain water ingress.
-See Table 3.1 below for Average Dry Weather flow.

Table 3.1:

Average Dry Weather flows per single –family dwelling unit (du)			
Income Group	**Lower**	**Middle**	**Higher**
Litres per Unit	500	750	1000
Average total individuals per dwelling unit	7	7	5

Limiting Gradients:

Table 3.2:

Minimum Sewer Gradients	
Sewer Diameter (mm)	**Minimum Gradients**
110	1:120
160	1:200
200	1:300
250	1:400

Peak Design Flow:

-For single-family dwelling units; a peak factor “PF” of 2.5 was applied and adjusted with the attenuation curve in the Red Book Fig C1.

Hydraulic design:

-The Manning formulae { $V=(R_h^{2/3} x\ S^{1/2})/n$} was used:

- V= Cross sectional Average Velocity
- R_h= Hydraulic Radius
- S= Channel bed slope
- n=0.011 (manning coef)

Minimum Size of sewer:

-160mm for Reticulation

-110mm for House connections

Minimum Velocities:

At the head of a sewer, it is usually impossible to achieve this minimum velocity due to the low flows being generated. Under such circumstances, the minimum gradient for a 160mm diameter sewer shall be 1:100 which should be maintained until an ultimate design flow of 0.3 l/sec is achieved. This minimum gradient may be relaxed to 1:120 until the ultimate design flow increases to 1.0 l/sec after which a minimum velocity shall be 0.7 m/sec.

WASTE WATER TREATMENT PONDS

A proposal was completed based on the following assumptions:

- Nature of area and surrounds
- Availability of the required utility infrastructure (ie. Electricity supplies)
- Requirement for ease of operation and low maintenance requirements

- BOD influent loading based on accepted norms from the South African National Institute of Water Research (NIWR)
    - 50g BOD/cap.d
- Hydraulic loading based on an average of seven occupants per household (86HH for Bhokwe Hostels and 26HH for Bhokwe Quarters)
    - 784 residents
- Influent E.coli levels of 4*10^6 E.coli/100ml influent
- Effluent requirements of 1000 E.coli/100ml effluent

4 DESIGN FLOWS AND LOADING

SEWER RETICATION

86HH in Bhokwe Hostels were classified to be under the lower income
group 26HH for Bhokwe Quarters were classified to be under the Middle
income

86 lower income households with a demand of 500 l/day and 7 people /household
26 middle income households with a demand of 750 l/day and 7 people /household
Peak factor of 3.25
Stormwater infiltration of 15.%
Growth rate of 1% over 30 years $[(1.01)^{30} = 1.348]$
Organic loading 50g BOD/cap/d

Average dry weather flow (ADWF) = 86 x 500l/day + 26 x 750 l/day =	62500 l/day 62.5 kl/day (0.723 l/s)
Average wet weather flow (AWWF) = 62.5 x 1.15 =	71.9 kl/day
Peak wet weather flow (PWWF) = 71.9 x 3.25 =	233.6 kl/day (2.704 l/s)
Future **ADW**F = 62.5 x (1.348) =	**84.2 kl/day** (0.975 l/s)
Future **PWWF** = 233.6 x (1.348) =	**314.9 kl/day** (3.644 l/s)

The hydraulic pipes and structures are designed for the PWWF which will occur over a short period in the day and the treatment works is designed for the ADWF.

Table 3.1: Design Flows

MH No	No of HH	Income Group (l/d)	ADWF (l/s)	AWWF (l/s)	PWWF (l/s)	PWWF Future (l/s)
1	2	750	0.0174	0.0220	0.0649	0.0875
3	3	750	0.0260	0.0299	0.0973	0.1312
5	3	750	0.0260	0.0299	0.0973	0.1312
7	4	750	0.0347	0.0399	0.1298	0.1749
10	2	750	0.0174	0.0200	0.0649	0.0875
14	5	750	0.0434	0.0499	0.1622	0.2186
17	11	500	0.0637	0.0732	0.2379	0.3207
20A	11	500	0.0637	0.0732	0.2379	0.3207
21A	21	500	0.1215	0.1398	0.4542	0.6122
22A	11	500	0.0637	0.0732	0.2379	0.3207
23A	21	500	0.1215	0.1398	0.4542	0.6122
24A	11	500	0.0637	0.0732	0.2379	0.3207
30	2	750	0.0174	0.0200	0.0649	0.0875
32	1	750	0.0087	0.0100	0.0324	0.0437
33	3	750	0.0260	0.0299	0.0973	0.1312
34	1	750	0.0087	0.0100	0.0324	0.0437
TOTAL FLOW						**3.644 l/s**

WASTE WATER TREATMENT PO NDS

The pond hydraulic loading is 84.2 kl/day (m³/day)
The pond organic loading is 52.8 kg/day
The design population is 1056 (future population)
BOD Concentration of the influent is 627.2 mg/l
Assumed E.coli of influent 4*10^6 E.coli/100ml

5 DESIGN INFRASTRUCTURE

5.1 SEWER RETICATION

Sewer Pipes (SANS 791 & SANS 1200LD):

-Class 34 Heavy Duty uPVC Sewe r pipes (110mm for house connections, 160mm for Reticulation Network, and 200mm for Sewer outfall)

Sewer Manholes (SANS 1294 & SANS 1200LD):

All manholes rings shall be precast reinforced concrete rings
Minimum internal dimensions o f circular manhole Shaft = 750mm
Minimum internal dimensions of circular manhole Chamber = 1250mm -
The maximum height of manholes above ground shall be 150mm
Manhole covers not subject to traffic loads shall be heavy duty reinforced concrete.
Manhole cover subject to traffic loads shall type 2B to SANS 558.
Manholes will be placed at all junctions and all changes of grade and/ or direction
-Maximum spacing of manholes = 80m
-Minimum cover to the outside of pipe barrel in Servitudes = 600mm

-Minimum cover to the outside of pipe barrel in Road Reserves = 1200mm

The sewer reticulation network predominately spans along roads outside stand boundaries for easy access during maintenance. However; due to space limitations the sewer reticulation will have to intersect existing water lines, existing roads and storm water services as detailed in Section 6 in this report.

The sewer pipes, manholes and the waste water treatment ponds have been deliberately positioned to avoid pumping so that the system becomes self-sustaining as far as possible.

Sewer Pipe Trench (SANS 1200D B)

Excavations and backfill for pipe trenches in accordance with SANS 1200DB, pipe bedding in accordance with SANS 1200LB and design and construction of sewer lines in accordance with SANS 1200LD.

PRESSURE TEST of SEWER PIP ELINE – WATER TEST

The following operations will be undertaken to test the pipeline.

Once the pipeline is considered to be mechanically completed and accepted, a request for filling the pipe with water will be issued to the Engineer, and after the approval to proceed has been given by Engineer the section of pipeline to be tested can be filled up.

1 The section of the pipeline under test should be filled up with water such that the manhole chamber at the upper end shall be filled with water to such depth that every portion of the pipeline is subjected to a pressure of not less than 12Kpa and no more than 60Kpa.

2 During the test there shall be no discernible leakage of water.

3 An appropriate period which shall be at least 10min shall be allowed for initial absorption, and the loss of water over the next 30min shall be noted. The amount lost shall not exceed the applicable of the following rates per 100m of pipeline per hour.

Norminal Diameter of Pipe, mm	**Loss rate, litres per 100m per hour, Max**
100	6.0
150	9.0
200	12.0
225	13.5
250	15.0
300	18.0

4 Should any section of the pipeline fall pass the water test, a re-test will be permitted and, in such case acceptance or rejection of the section shall be determined on the result of the re-test

5 Each connecting sewer line shall be tested between its upper end and the junction at the main sewer (Lower end).

WATERTIGHTNESS TEST OF MANHOLE **(SANS 1200LD)**

Manholes shall be tested separately from the pipeline for water tightness.

5.2 OXIDATION PONDS

Pond systems provide a low cost means of handling domestic wastewater from small communities. Their function relies on the natural self-purification process that occurs in a body of water and is dependent on natural factors such as sunshine, temperature and wind action. Generally their size is limited to 5000 persons or 800 kl/day. The future population at is estimated to be 1056 and the ADWF 84.2 kl/day which is substantially less.

The pond system considers suitable for this application is the standard facultative and secondary ponds i.e. no anaerobic ponds and no recirculation.

The essential elements are :-
1 Grit channel
1 Facultative (Primary pond)
4 Secondary ponds (Secondary plus three tertiary)
4 Evaporation ponds bed

Refer **Annexure F** for process flow diagram.

Process Flow:

The effluent flows by gravity to the grit channel.

Grit Channel
The grit channel comprises three parts. The first part is manual screening. Large floating objects are trapped by the screen and raked to a draining platform by the operator. The second part is the grit channel. The grit channel is shaped to run at constant velocity to settle out the smaller grit particles. There are two grit channels to aid cleaning. The third part is the measuring flume.

From the grit channel the effluent flows into the Primary (facultative) pond.

Inlet and outlet structures
The pond inlets comprise a shallow open manhole on the berm and an inlet below water level. The pond outlet comprises a manhole that is open one end in the pond. The manhole has a brick scum board to prevent floating matter leaving the pond and a brick overflow weir to set the pond top water level. The interconnecting structures comprise an outlet and an inlet combined into one structure. The inlets and outlets are placed diagonally opposite each other to reduce short-circuiting.
The freeboard in the primary pond and the secondary pond is 500mm. The freeboard in the three tertiary ponds increase as the depth decreases to 800mm. The weirs may be lowered if the estimated influent volume is not achieved or raised to accommodate any unexpected population increase.

Primary Ponds:

The Facultative pond serves as a reactor where both aerobic and anaerobic mechanisms take place. The aerobic in the upper levels of the pond (due to photosynthesis resulting in algal growth) and anaerobic in the lower levels of the pond where bacteria metabolise organic material releasing carbon dioxide (used in the photosynthetic process mentioned above). This ensure the effective breakdown of organic matter within the pond resulting in a stabilised settled sludge and effluent with lower organic loadings. The primary pond should not be oversized which will result in excessive evaporation and increased COD values.

The floor and banks of the primary ponds will be lined with a 1.5mm HDPE liner on top of a geosynthetic clay liner (GCL). The floor of the pond will be protected (during future cleaning) by a 150mm cement stabilised selected soil layer.

Property	Value	Unit
Design Influent flow	84.2	m^3/day (kl/day)
Design Organic loading	52.8	kg BOD/d
Influent loading	627.2	mg/l BOD
Minimum detention time req.	52.3	days
Detention time provided	54.8	days
Pond depth (effluent)	1.5	m
Base Length	90	m
Base Width	30	m
Pond volume	4617	m^3

Secondary Ponds
The sizing of the secondary ponds is based principally on detention time. The ponds are arranged in series for efficient faecal reduction. Nitrogen removals improve with increased detention times. The floor and banks of the primary ponds will be lined with a 1.5mm HDPE liner on top of a geosynthetic clay liner (GCL).

Property	Value				Unit
Design Influent flow	84.2				m^3/day (kl/day)
Design Organic loading	4.6				kg BOD/d
Influent loading	54.8				mg/l BOD
Minimum detention time req.	10	5	5	5	days
Detention time provided	11.7	5.7	5.2	4.6	days
Pond depth (effluent)	1.5	1.4	1.3	1.2	m
Base Length	33	16	16	16	m
Base Width	15	15	15	15	m
Pond volume	986	479	434	391	m^3

Total (Primary plus secondary) detention time required is 77.3 days
Total (Primary plus secondary) detention time provided is 82.1 days

Evaporation ponds

The evaporation ponds are designed to maximise surface area. They are in four compartments each 160m x 40m giving a combined surface area of 27 200m and a total volume of 13200m³. The ponds are 1m deep with 0.5m freeboard i.e. 0.5m water depth. The earth banks will be sloped at 1:2 like the oxidation ponds. Water in the upper pond will cascade to the lower pond via 2No 2m wide concrete spillways. The final evaporation pond will have an emergency overflow to protect the pond banks against overtopping

The evaporation ponds will be lined with a 1.5mm HDPE liner on top of a geosynthetic clay liner (GCL)..

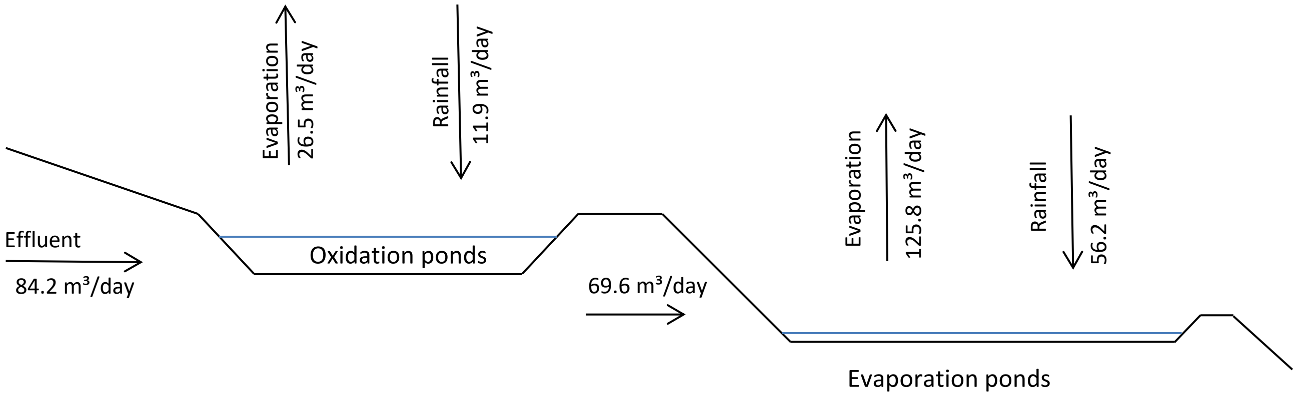
Water Balance

From records, the average annual rainfall is 778mm/year and the free surface evaporation rate is 1740mm/year. The nett evaporation is thus 962mm/year.

The area required for the evaporation of all the effluent is 31 947 m². The surface area of the oxidation ponds is 5560 m² thus the evaporation pond surface area required is = 26 387 m² We shall provide four evaporation ponds with a floor area of 160m x 40m which will provide a surface area of 27 216 m²

Description	Length (m)	Breadth (m)	Depth (m)	Volume (m³)	Detention Provided (days)	Detention Required (days)	Floor Area (m²)	Surface area (m²)
Evapo 1	160	40	0.5	3301			6400	6804
Evapo 2	160	40	0.5	3301			6400	6804
Evapo 3	160	40	0.5	3301			6400	6804
Evapo 4	160	40	0.5	3301			6400	6804
				13204				27216

Expressed daily thus:-



Expressed monthly thus:-

	Average annual evaporation (mm)	Average annual rainfall (mm)
January	187	133
February	157	112
March	146	82
April	125	35
May	108	21
June	94	12
July	104	13
August	140	20
September	158	39
October	163	74
November	165	107
December	193	130
Year	1740	778

Month	Effluent from Reticulation (m³)	Rainfall (m³)	Evaporation (m³)
January	2561	4249	5974
February	2561	3578	5016
March	2561	2620	4664
April	2561	1118	3993
May	2561	671	3450
June	2561	383	3003
July	2561	415	3322
August	2561	639	4473
September	2561	1246	5048
October	2561	2364	5207
November	2561	3418	5271
December	2561	4153	6166
m³/year	30732	24854	55587
m³/day	84.2	68.1	152.3

6 IMPACT OF PROPOSED WORKS ON EXISTING INFRASTRUCTURE

As per the detailed topographical survey on the study area; the proposed sewer reticulation will intersect existing services as detailed below:

- Water Lines: - MH10 to MH11; MH11 to MH12; MH23A to MH23 and MH30 to MH31
- Storm water culverts: - MH10 to MH11
- Road / Track / Paved Driveways:- MH10 to MH12, MH14 to MH15, MH30 to MH31, MH32 to MH33; MH35 to MH36, MH21A to MH21, MH23A to MH23, MH29 to MH32 and MH25 to MH26

The rest of the sewer reticulation runs parallel to the various services. Therefore care will be taken to ensure that the existing services will be proven prior to trenching and earthworks to ensure that they are protected.

The proposed site for the sewer ponds is predominately used for agricultural purposes and no services were observed during the detailed topographic survey.

7 STORMWATER MANAGEMENT PLAN

7.1 During Construction

Adherence to the Stormwater Management plan is the responsibility of the Contractor. The Clients Agent, the Clerk of Works or Resident Engineer, will exercise oversight. The Stormwater management Plan will be included in the tender documentation.

Sandbag berms must be placed at regular intervals on all steep slopes on the trench line before and after backfilling in order to minimize erosion and contaminate stormwater runoff into water courses.

Contamination of surface water and stormwater must be well controlled. This can be achieved by managing activities such as mixing concrete on wooden boards in a plastic lined and bunded area and by reducing spills of hazardous substances.

When the trench line runs across sloping ground, the topsoil excavated from the trench must be stored on the down-slope side of the trench and the sub-soil on the up-slope side. This is important for two reasons, firstly, the larger volume of soil is stored upslope of the trench so that if soil fines and silt are washed off the stockpile during rainfall events, these are washed into the trench and not into a water course, and secondly, it is important to separate the two so that the topsoil is placed on top of the subsoil when the trench is backfilled. This is essential to promote rapid growth of vegetation during the rehabilitation phase.

Newly excavated pipeline trenches on steep slopes should have sandbag berms placed on either side of the trench line radiating out from the soil stockpiles at 10 m intervals. The berms should point very slightly downhill to prevent storm water build up. These berms will greatly reduce the volume of storm water polluted with silt and soil fines which could impact on rivers and streams below the pipelines and will minimize erosion of bare areas. Silt and soil fines that build up on the inside of these berms should be removed and placed back on the soil stockpiles. Stone packs should be placed at the discharge points at the ends of these berms to prevent erosion if necessary.

Once the trenches have been backfilled and the soil compacted, sandbag berms should be placed across the trench lines at 10 m intervals. Berms should be angled just off 90º to the slope to prevent the build-up of storm water on the inside of the berm.

Surface water and stormwater must be minimised and not allowed to flow down cut or fill slopes or along pipeline routes without erosion protection measures, as previously discussed, being in place.

All overflow and scours channels shall be lined with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge must be at a point where there is dense natural grass cover.

Channels shall not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient.

All runoff shall be collected and channelled to discharge via surface spreaders into drainage lines.
Upon completion of backfilling, sandbag berms must be placed across the bare area created by the trench line. These berms must be angled just off 90º.

The intention is to have a minimum distance of open trench with stockpiled soils exposed to rainfall and storm water flow at any one time. It is essential that construction and rehabilitation is completed as quickly as is reasonably possible.

7.2 Post construction

The reticulation is hydraulically designed to accommodate 15% stormwater infiltration. This would only occur on days where there is rain. This is not desirable and is unlikely for a new installation but long term this may happen and so it allowed for. The berm above the ponds prevents surface water from entering the ponds.

The ponds are also hydraulically designed to accommodate the same 15% infiltration and will not affect the freeboard of the ponds. Any water falling on the ponds will increase the treatable volume slightly. The effluent will be more dilute and so although the treatable volume goes up the detention time comes down so the size of the primary ponds is the same and the effluent quality exiting the ponds is the same. The final evaporation pond has an emergency overflow to protect the pond banks against overtopping.

The ponds are 280m from and 9m above the nearest stream and above the 1:100 flood line.

8. BUDGET AND CASH FLOWS

Table 5: Cost Breakdown

Description	**Amount**
Construction of Works (Rehabilitation of Sewer Reticulation at Bhokwe Village) (Estimated)	R 5,700,000.00
EIA, Geotech and Survey	R 150,000.00
Sub- total for Construction	R 5,800,000.00
Engineering fees (11.5%)	R 655,510.00
Additional Duties (PTO's, Wayleaves, etc.)	R 50,000.00
ISD Consultants	R 75,000.00
Disbursements	R 25,000 00
Sub- total for Non- Construction	**R 855,510.00**
Sub- Total (1)	R 6,655,510.00
Add 14% VAT	R 931,771.40
Total Project Budget	**R 7,587,281.40**

Table 6: CASHFLOW

Phase	PIP & Detailed Design	Detailed Design & BOQ	Construction	Close Out & Release of Retention	**TOTAL**
Cash Flow:					
Sept 2016	R 381,248.49				R 381,248.49
Oct 2016		R 435,712.56			R 435,712.56
Nov 2016			R 756,733.01		R 756,733.01
Dec 2016			R 504,488.67		R 504,488.67
Jan 2017			R 882,855.18		R 882,855.18
Feb 2017			R 1,117,905.49		R 1,117,905.49
Mar 2017			R 1,891,832.53		R 1,891,832.53
Apr 2017			R 1,237,141.40		R 1,237,141.40
May 2017					
Jun 2017					
Jul 2017					
Aug 2017					
Sept 2017					
Oct 2017					
Nov 2017					
Dec 2017					
Jan 2018					
Feb 2018					
Mar 2018					
Apr 2018				R 379,364.07	**59,394.54**
TOTAL (Vat. Inc.)	**R 381,248.49**	**R 435,712.56**	**R 6,390,956.28**	**R 379,364.07**	**7 587 281.40**

9 PROPOSED PROGRAMME

See **Annexure D** : Gantt Chart

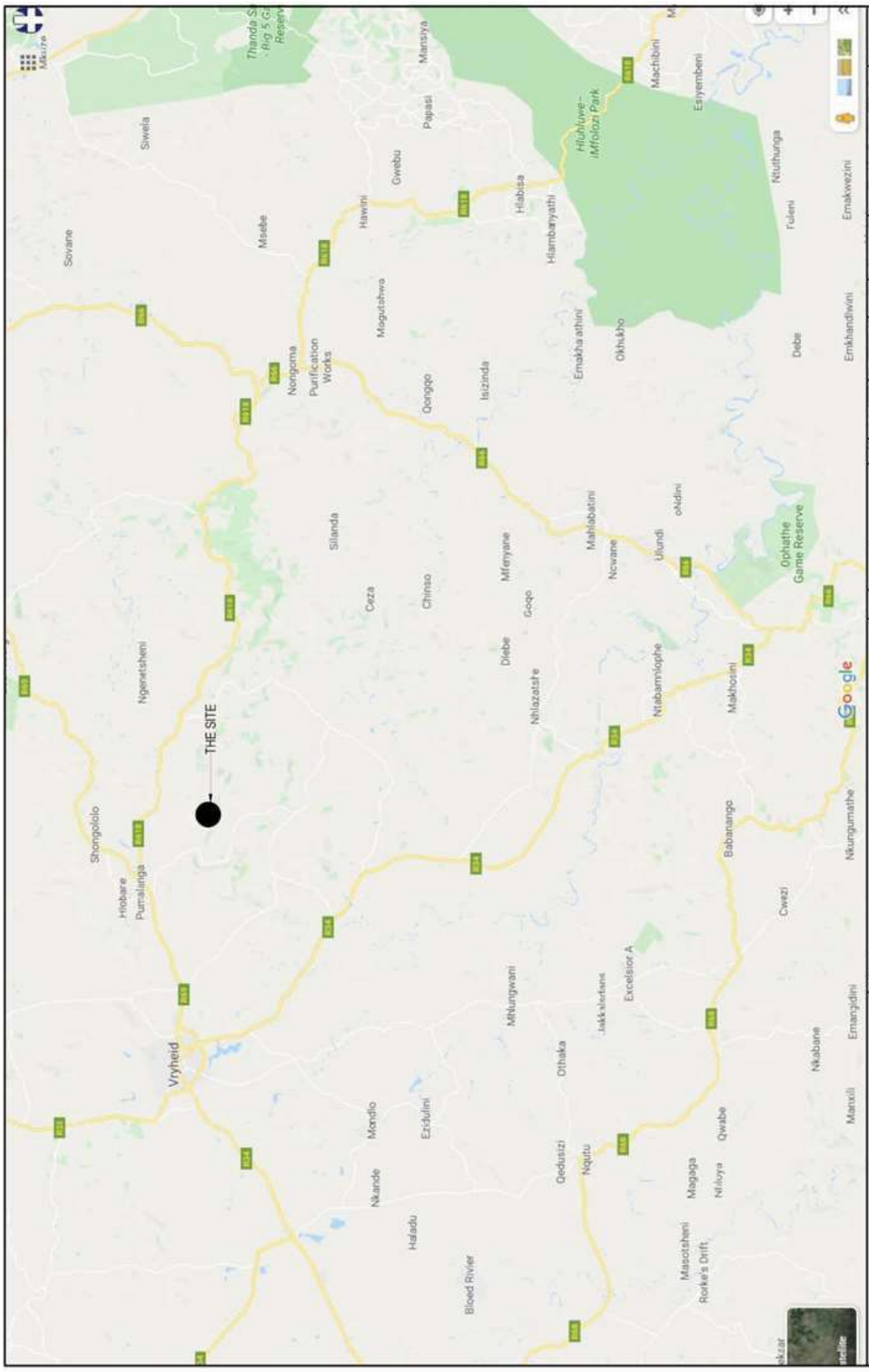
10 RECOMMENDATIONS & CONCLUSIONS

- Provide an updated water supply (by others) and house connection to the Bhokwe Hostels and Bhokwe Quarters
- Provide a sewer reticulation system to receive effluent from the Bhokwe Hostels and Bhokwe Quarters
- Construct a WWTW comprising a conventional oxidation pons system on land identified by the community. The Msiyane Traditional Council and IGalelo Trust will be officially engaged and a PTO for the site will need to be signed by all stakeholders and if necessary an application for a lease with the INgonyama Trust Board will also be submitted.
- Care should be taken during construction so that the existing sewer system is not further damaged

11 DETAILED DESIGN REPORT APPROVAL (FOR USE BY MISA)

Signature:	
Print Name:	
Title:	
Role:	
Date:	

Annexure A: Locality Map



UKUZA CONSULTING (PTY) LTD

Client: MISA

Project and drawing: REHABILITATION OF SEWER AT BOKWE VILLAGE LOCALITY SKETCH

Rev	Description	By	Date

	Initial	Date	© Copyright - ZAI Consultants (PTY) LTD	Date
Designed			App.	
Drawn			Pl.	
Scale	NTS		Client	

Drawing no. 19008/SK3

Rev. A

Annexure B: Photographic Facts

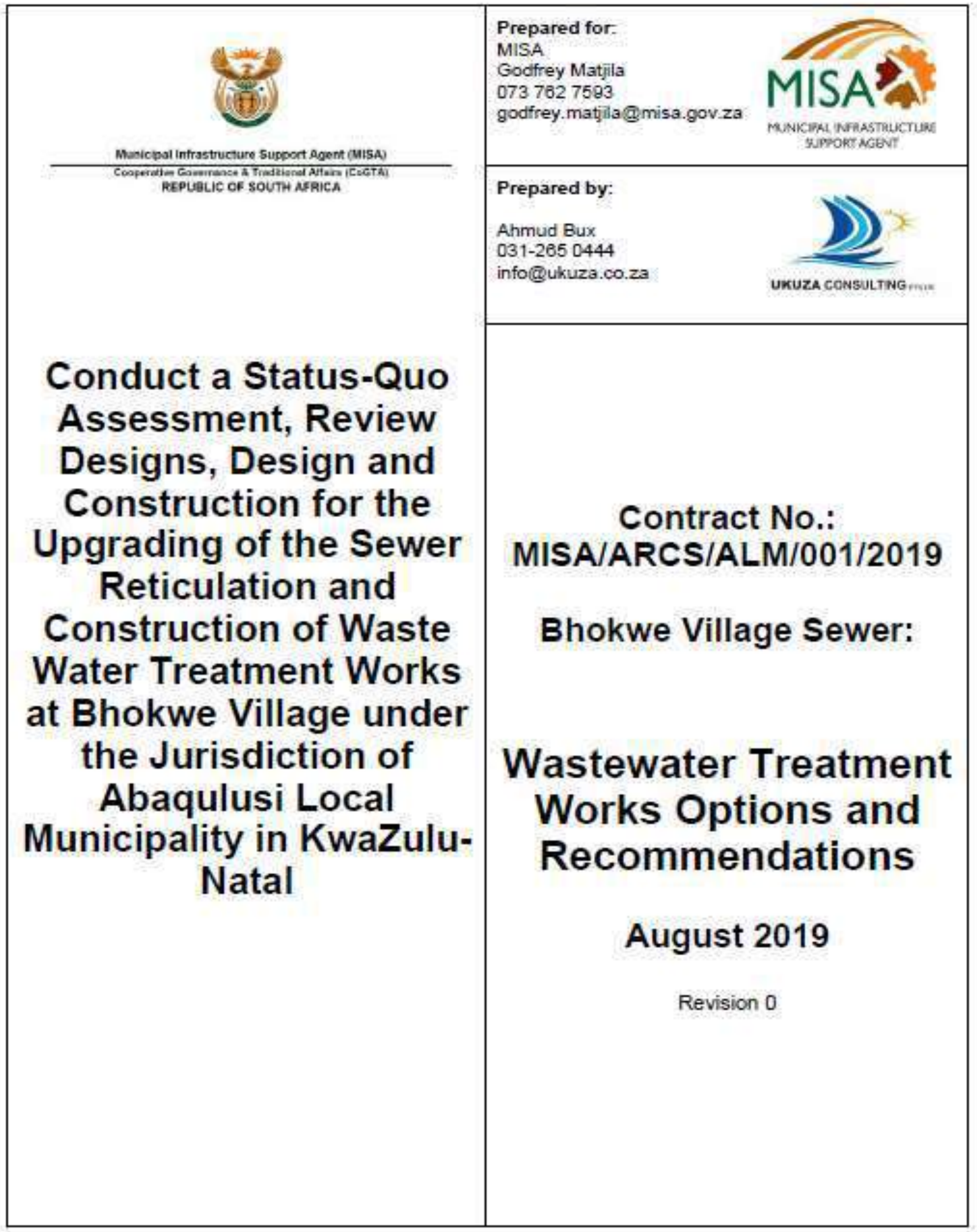
FIG 1:

FIG 2:

Annexure C: Oblique View of Surface Topography

Annexure D: Gantt Chart

Annexure E: WWTW Options Report



Municipal Infrastructure Support Agent (MISA)
Cooperative Governance & Traditional Affairs (CoGTA)
REPUBLIC OF SOUTH AFRICA

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Conduct a Status-Quo Assessment, Review Designs, Design and Construction for the Upgrading of the Sewer Reticulation and Construction of Waste Water Treatment Works at Bhokwe Village under the Jurisdiction of Abaqulusi Local Municipality in KwaZulu-Natal

Contract No.: MISA/ARCS/ALM/001/2019

Bhokwe Village Sewer:

Wastewater Treatment Works Options and Recommendations

August 2019

Revision 0

Project Client: Municipal Infrastructure Support Agent (MISA)

Project Title: Conduct a Status-Quo Assessment, Review Designs, Design and Construction for the Upgrading of the Sewer Reticulation and Construction of Waste Water Treatment Works at Bhokwe Village under the jurisdiction of Abaqulusi Local Municipality in KwaZulu Natal

Contract Number: MISA/ARCS/ALM/001/2019

Document Title: Bhokwe Sewer Wastewater Treatment Works Options and Recommendations

Document File Ref.:

Electronic File Ref.:

Rev.	**Date**	**Issued to**	**Prepared by**	**Checked by**	**Approved by**	**Comments**
0	Sep 2019	G. Matjila	N. Sissel / A. Bux	A. Bux	G. Payne	

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Ukuza Contact Person:

Mr. C. Govender
(Director)

September 2019
Date

BHOKWE SEWER WWTW OPTIONS AND RECOMMENDATIONS

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1. PURPOSE OF THIS DOCUMENT

The purpose of this document is:

- Investigate 3no. options for a proposed Wastewater Treatment Works (WWTW) for the Bhokwe Village
- Assess the technical advantages and dis-advantages of the WWTW options
- Assess the financial implications of the WWTW options : Initial Capital Cost & Life Cycle Cost
- Recommend the preferred WWTW option

2. EXECUTIVE SUMMARY

The Bhokwe Sanitation Project is located in Ward No. 5 of the Abaqulusi Local Municipality. The project involves the Upgrading of the existing Sewer Reticulation and construction of Wastewater Treatment Works. The Bhokwe Village consists of approximately 26 no. Middle income units and 86 no. Low income units which will be served by a proposed sewer reticulation and wastewater treatment works. Municipal Infrastructure Support Agent (MISA) appointed a service provider on a Turnkey basis (WINWATER Mechanical & Electrical Projects (Pty)) Ltd to design and rehabilitate sewer reticulation facilities in Bhokwe village, for a 12-month period from 20 June 2016. The contractor abandoned site during construction and MISA is at this stage, uncertain of the condition of the infrastructure installed, quality of materials on site and external factors such as, vandalism, theft, etc., which may have affected the completed works. In order to resuscitate and complete the project, MISA initiated a procurement process during April 2019 for the appointment of a new Service Provider. Ukuza Consulting (Pty) Ltd have since been appointed as the professional service provider.

The sewer collected by the proposed reticulation network and out-falling to the proposed wastewater treatment works (WWTW) is classified as domestic in composition. In general, the objective of treating this type of wastewater is the removal of suspended solids, reduction of COD, BOD, ammonia and other contaminants. Choice of the process most applicable are influenced by the proposed plant size, type of waste to be treated, degree and consistency of treatment, operations and maintenance required etc.

Three Wastewater Treatment Works (WWTW) options were evaluated viz. Oxidation Pond System, Activated Sludge System, Rotating bio-contactors System. The Oxidation Pond System is the preferred WWTW option. Bhokwe climate can be considered typical of KZN, year-round mild to warm climates. Bhokwe Village also has large land area available. These environmental and spatial factors favour the use of such a system. It is robust - handles varying wastewater types (Industrial or Domestic). Final Effluent does not require disinfection. Completes sludge treatment. Lower maintenance and operating costs (generally periodic dredging). Low Technology solution ie. self-sufficient treatment system hence reduction of operator responsibilities to manage treatment plant - a reduction in labor costs (require only part-time staff).

3. PROJECT LOCATION

Abaqulusi Local Municipality in Northern KZN falls under Zululand District Municipality (ZDM) which is the Water Services Provider (WSP) within the project area.

GPS Co-Ordinates:

27.811543 , 31.103350

Fig A1: Project Location with GPS Co-ordinates

4. WWTW SITE LOCATION

GPS Co-Ordinates:

27°48'47.33"S

31° 6'7.93"E

Fig A2: WWTW Site Location with GPS Co-ordinates

5. SEWAGE EFFLUENT CHARACTERISTICS

The Sewage Effluent emanating from the Bhokwe Village is domestic in composition. The following are the main sewer characteristics which can be divided into four categories:

> i. the concentration of oxidisable organic material, or substrate - normally expressed as an oxygen demand and is a measure of the strength of the sewage.
>
> ii. the concentration of nutrients present - generally refer to nitrogen and phosphorus present, and is a measure of the propensity for the treated effluent to give rise to eutrophication (algal growth) downstream from the works.
>
> iii. the solids concentration - an indicator of the relative amount of sludge likely to be produced.
>
> iv. the pH and alkalinity value - needs to be adequate to sustain full nitrification (oxidation of ammonia to nitrate).

6. WWTW DESIGN GUIDELINES, CRITERIA & CONSTRAINTS

6.1 WWTW Design Guidelines

The following design guidelines were used to benchmark the applicable design criteria.

- City of Durban Design Manual Part 1. 1985. Guidelines for the Design of Foul Water Sewers
- CSIR. 2005. Guidelines for the Human settlement Planning and Design. Volume 2, Chapter 10. Sanitation
- Manual on the Design of Small Sewage Works. 1988. Water Institute of South Africa.
- South African National Standards. 1982. Standardized Specification for Civil Engineering Construction, LD Sewers. SANS 1200 LD.

6.2 WWTW Design Constraints

Environmental :

The treated final effluent cannot be discharged directly into the watercourse downstream of the site. Effluent to be passed through a reed bed system or irrigated on the vacant land below the ponds - non-edible grasses (not for human consumption) and not directly to the river.

Geotechnical :

The WWTW site is underlain by between 0.45 m and 0.95 m of colluvial soils comprising slightly moist, dark brown to orange brown, medium dense to dense, intact, silty sands. These are generally underlain by residual shale soils comprising slightly moist, orange brown mottled reddish brown, soft to firm, intact, silty sandy clay, which grades into highly weathered, dark brown stained yellow and orange, fine grained, very closely jointed, thinly bedded, fissile, soft to medium hard rock shale bedrock.

The colluvial soils is unsuitable for a pond system without a suitable lining. Ponds should be as shallow as possible. In general, it is recommended that cut slopes and fill embankments have a maximum slope of 1 vertical to 2 horizontal to promote stability.

6.3 WWTW Base Design Criteria

From the guidelines, the following design criteria is derived:

- 86 lower income households with a demand of 500 l/day and 7 people /household
- 26 middle income households with a demand of 750 l/day and 7 people /household
- Population Growth rate of 1% over 30 years (factor 1.348)
- Average dry weather flow (ADWF) = 86 x 500l/day + 26 x 750 l/day = 62500 l/day = 62.5 kl/day
- Future ADWF = 62.5 x (1.01^{30}) = 84.2 kl/day (0.975 l/s)
- Sewer composition : domestic
- Organic loading of 50g BOD/cap/d
- The pond hydraulic loading is 84.2 kl/day
- The future design population is 1056 persons
- The pond organic loading is 52.8 kg/day
- BOD Concentration of the influent (mg/l) is 627.2 mg/l

7. WWTW OPTIONS - Technical Assessment

Three (3no.) Wastewater Treatment Works (WWTW) options are evaluated technically henceforth viz. Oxidation Pond System, Activated Sludge System, Rotating bio-contactors System.

7.1 Option 1 WWTW : Oxidation Pond System

Oxidation ponds are large, shallow ponds designed to treat wastewater through the interaction of sunlight, bacteria, and algae. Algae grow using energy from the sun and carbon dioxide and inorganic compounds released by bacteria in water. During the process of photosynthesis, the algae release oxygen needed by aerobic bacteria. The figure following illustrates the oxidation pond process.

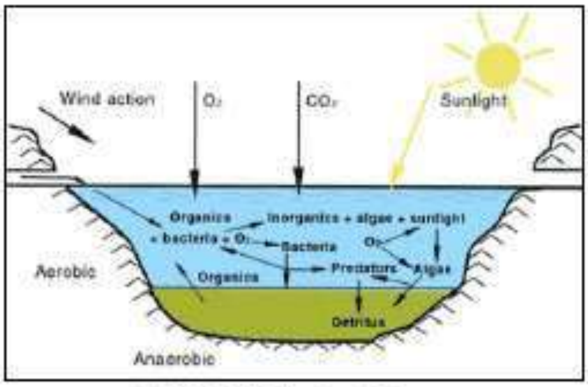
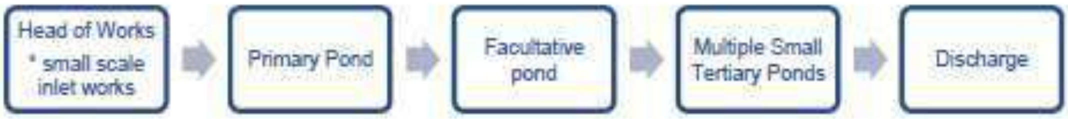


Fig A3: Oxidation Pond Process

Type

Aerobic pond with Facultative and Tertiary/Maturation ponds.

System



Sizing

Pond Treatment Stage	Length (m)	Breadth (m)	Max Depth (m)	Volume (m^3)	Detention time required (days)	Detention time provided (days)
Primary	90	30	1.5	4617	52.3	54.8
Secondary	33	15	1.5	986	10	11.7
Tertiary 1	16	15	1.4	479	5	5.7
Tertiary 2	16	15	1.3	434	5	5.2
Tertiary 3	16	15	1.2	391	5	4.6
					77.3	**82.1**

Table B1: Oxidation Pond Sizing

Advantages	Disadvantages
Easy to construct	Requires a large land area
Reduction of operator responsibilities to manage treatment hence a reduction in labor costs (require only part-time staff)	Odour can become a nuisance during algal blooms
BOD, fecal coliform, and helminth removal is higher than by other treatment methods such as activated sludge, biological filters, and rotational biological contactors	Unmaintained lagoons can provide a breeding area for mosquitoes and other insects
Handles varying wastewater types (Industrial or Domestic)	High BOD and TSS with algae concentrations
Final Effluent does not require disinfection	
Ideal for small communities and mild to warm climates	
Completes sludge treatment	
Low Technology - self-sufficient treatment system	
Does not require electricity to operate	
Low maintenance costs (generally periodic dredging)	

Table B2: Oxidation Ponds - Pros & Cons

Discharge - Options to be considered for the final discharge from the treatment plant are:

- ✓ Irrigated on the vacant grasslands below the ponds
- ✓ Use of sub-surface irrigation distribution lines/soakaways
- ✓ Use of a reedbed system

Operation And Maintenance

Low tech hence reduced operator responsibilities. Generally periodic dredging. Surface cleaning of weeds, non biological solids etc which could block out sunlight. No Electrical and mechanical equipment maintenance.

7.2 Option 2 WWTW : Package Treatment Plant - Activated Sludge System

The activated sludge treatment system consists of a pre-treatment step(eg. septic tank), an aeration tank followed by a secondary clarifier. Settled sewage, mixed with fresh sludge that is recirculated from the secondary clarifier, is introduced into the aeration tank.

Compressed air is then injected into the mixture through porous diffusers located at the bottom of the tank. As it bubbles to the surface, the diffused air provides oxygen and a rapid mixing action. Under such oxygenated conditions, microorganisms thrive, forming an active, healthy suspension of biological solids—mostly bacteria—called activated sludge.

Type - Not a Single Batch Reactor - hydraulic retention times to be a minimum of 3 days, If the final effluent is only required for irrigation purposes, the disinfection step could be omitted.

System

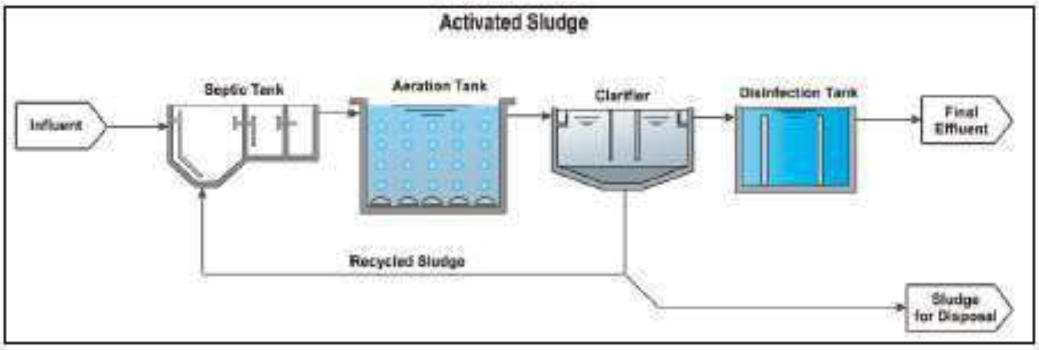


Fig A4: Typical Activated Sludge System

Sizing

Balancing tank/Septic Tank : 7 day storage capacity = 590m³ : 20m x 30m x 1m

Package units : eg. "Ampac 90" : 16m x 9m x 2m : Power = 5.5kW

Advantages	Disadvantages
Compact and space efficient	Specialist installation
Odours are generally contained	Requires power supply with backup system
Ideal for small communities	Sludge disposal location, costs
Sewer is not exposed hence fewer mosquitoes and other insects	Not robust to handle varying wastewater types (Industrial or Domestic)
	Final Effluent requires disinfection
	High technical capabilities of operator
	High maintenance costs

Table B3: Activated Sludge Package Plant - Pros & Cons

Operation And Maintenance

Operation and Maintenance plans and manuals required. Skilled/Trained personnel required. Maintenance of several electrical and mechanical components (screening, valves, pumps, motors etc). Maintenance must be periodic. Higher OM budgets required.

Discharge - Options to be considered for the final discharge from the treatment plant are:

- ✓ Irrigated on the vacant grasslands below the ponds
- ✓ Use of sub-surface irrigation distribution lines/soakaways
- ✓ Use of a reedbed system

7.3 Option 3 WWTW : Package Treatment Plant - Rotating bio-contactors System

Rotating bio-contactors (RBCs) consist of a series of discs attached to a horizontal shaft. These systems are modular and additional shafts and discs can be added in series. The pre-treatment step is generally a septic tank.

System

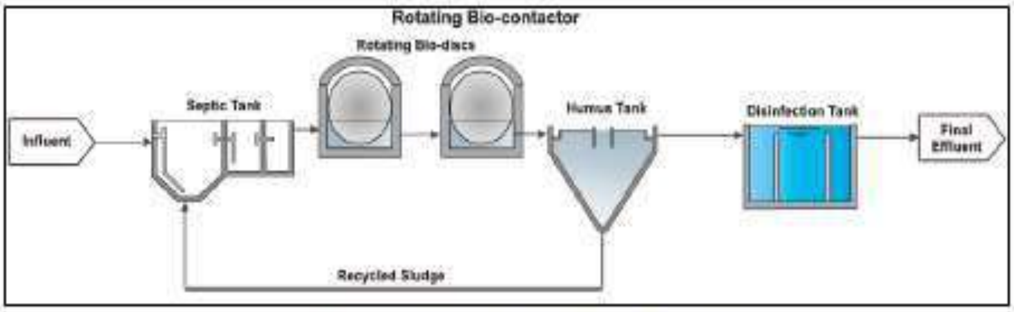


Fig A5: Typical Rotating bio-contactor System

RBCs are generally housed in a concrete or carbon steel tank, such that 40% of the disc surface area is submersed in the wastewater. The shafts (upto 9m long) rotate by either a mechanical or compressed air drive at a rate of between 1 and 4 revolutions a minute. The biomass is aerated whilst exposed to air above the wastewater. Variable rotational speeds should be provided to control media growth.

The bio-discs must however, not be exposed to sunlight and are therefore covered with a fibre glass cover with air vents. The biomass attaches to these discs and drops off into the wastewater as the biofilm becomes too thick.

The next step in the process is a humus tank, in which the solids and liquid phases are separated. The effluent flows into a disinfection chamber, whilst the settled solids are returned to the septic tank. The septic tank will need to be desludged regularly.

Sizing

Balancing tank/Septic Tank : 7 day storage capacity = $590m^3$: 20m x 30m x 1m

Operation And Maintenance

Easy access to the bearings, discs and mechanical drives is required for maintenance. Operation and Maintenance plans and manuals required. Skilled/Trained personnel required. Maintenance of several electrical and mechanical components (screening, valves, pumps, motors etc). Maintenance must be periodic. Higher OM budgets require

Advantages	Disadvantages
Compact and space efficient	Specialist installation
Odours are generally contained	Uneven media growth can lead to an unbalanced RBC, which increases torque loads on the shaft
Sewer is not exposed hence fewer mosquitoes and other insects	Requires power supply with backup system
	Septic Tank Sludge disposal location, costs
	Final Effluent requires disinfection
	High technical capabilities of operator
	High maintenance costs

Table B4: Rotating bio-contactors Package Plant - Pros & Cons

Discharge - Options to be considered for the final discharge from the treatment plant are:

- ✓ Irrigated on the vacant grasslands below the ponds
- ✓ Use of sub-surface irrigation distribution lines/soakaways
- ✓ Use of a reedbed system

8. WWTW OPTIONS - Financial Assessment

Three (3no.) Wastewater Treatment Works (WWTW) options are evaluated financially henceforth with respect to Estimated Initial Capital Cost & Estimated 30 year Life Cycle Maintenance and Operation Cost viz. Oxidation Pond System, Activated Sludge System, Rotating bio-contactors System.

8.1 Option 1 WWTW : Oxidation Pond System

Description	Amount
Estimated Capital Cost	R 13,171,000
Estimated 30 year Life Cycle Maintenance and Operation Cost	R 9,800,000
Total (Ex. VAT)	**R 22,971,000**

Table B5: Oxidation Pond System - Estimated Costs

8.2 Option 2 WWTW : Package Treatment Plant - Activated Sludge System

Description	Amount
Estimated Capital Cost	R 9,300,000
Estimated 30 year Life Cycle Maintenance and Operation Cost	R 21,900,000
Total (Ex. VAT)	**R 31,200,000**

Table B6: Activated Sludge Package Plant - Estimated Costs

8.3 Option 3 WWTW : Package Treatment Plant - Rotating bio-contactors System

Description	Amount
Estimated Capital Cost	R 10,800,000
Estimated 30 year Life Cycle Maintenance and Operation Cost	R 19,200,000
Total (Ex. VAT)	**R 30,000,000**

Table B7: Rotating bio-contactors Package Plant - Estimated Costs

9. RECOMMENDATION

The **Oxidation Pond System** is the preferred WWTW option. Bhokwe climate can be considered typical of KZN, year-round mild to warm climates. Bhokwe Village also has large land area available. These environmental and spatial factors favour the use of such a system.

Further, It is robust - handles varying wastewater types (Industrial or Domestic). Final Effluent does not require disinfection. The system completes the sludge treatment. Comparatively it has lower maintenance and operating costs (generally periodic dredging). Low Technology solution ie. self-sufficient treatment system hence reduction of operator responsibilities to manage treatment plant - a reduction in labor costs (require only part-time staff).

10. REPORT APPROVAL

THE WWTW OPTIONS REPORT DATED SEPTEMBER 2019 IS APPROVED AND CONFIRMED HEREUNDER:

UKUZA CONSULTING (PTY) LTD

Administered by:

Signature:	:	
Print Name	:	Nathan O'Niel Sissel
Title	:	Project Manager
Role:	:	Project Administrator
Date	:	

Reviewed by:

Signature:	:	
Print Name	:	Ahmud Bux
Title	:	Professional Engineer
Role:	:	Civil / Structural Engineer
Date	:	

Approved by:

Signature:	:	
Print Name	:	Graham Payne
Title	:	Senior Professional Engineer
Role:	:	Lead Civil / Structural Engineer
Date	:	

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

Approved by:

Signature:	:	
Print Name	:	Godfrey Matjila
Title	:	Project Manager: KZN
Role:	:	MISA Representative
Date	:	

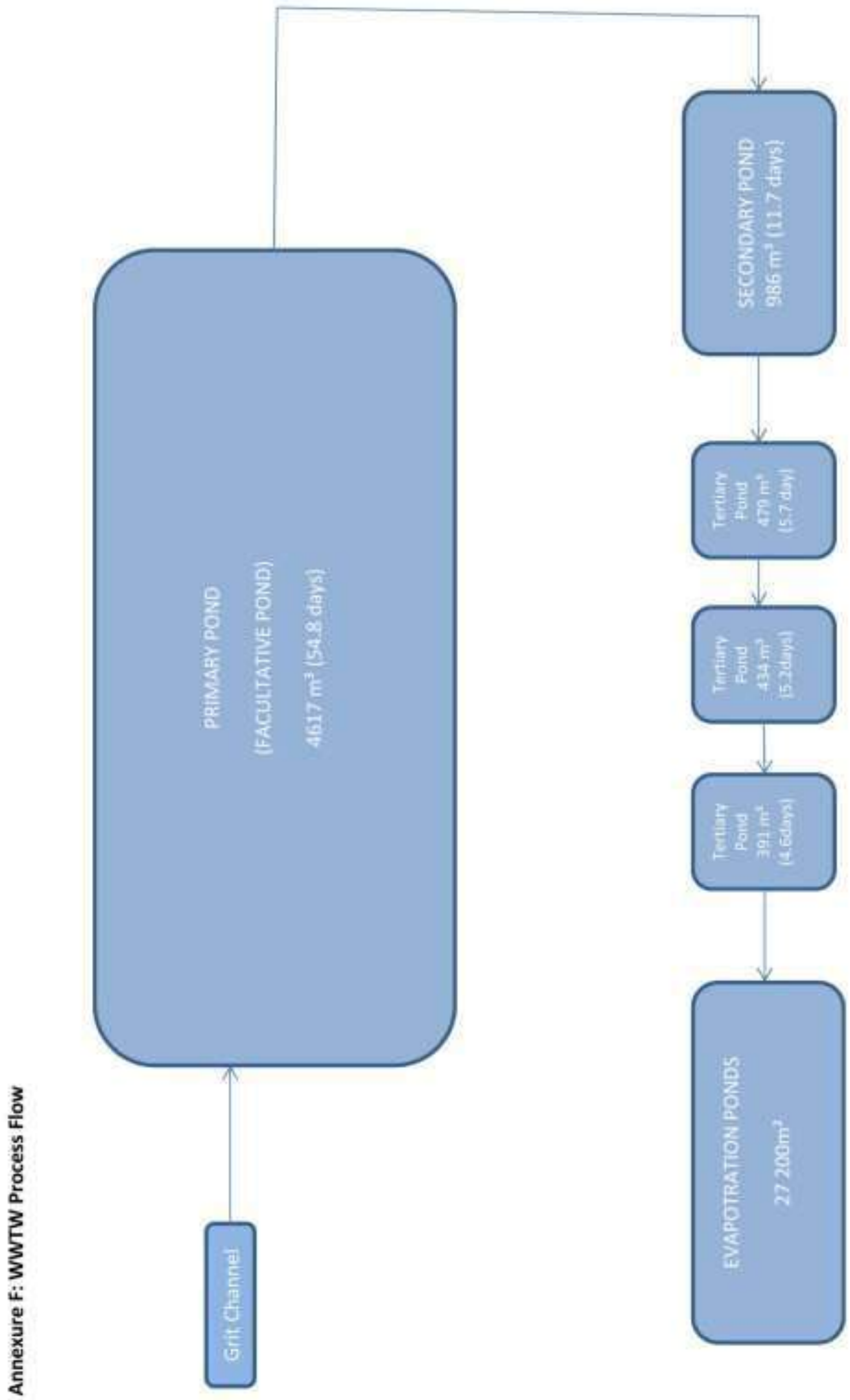
Approved by:

Signature:	:	
Print Name	:	
Title	:	Provincial Manager: KZN
Role:	:	MISA Representative
Date	:	

Approved by:

Signature:	:	
Print Name	:	
Title	:	Chief Director: IDMSC
Role:	:	MISA Representative
Date	:	

Annexure F: WWTW Process Flow



Annexure G: Network Analysis

Design Parameters

File Name: F:\PROJECTS\2019\19008 - Bokwe Village Sewer\5 Drawings\5.2 Civil Drawings\Civdes\2019-06-28_Sewer.se8

Inflow Calculation Method = Unit Flow
Manhole Conditions = Invert
Minimum Velocity = 0.700 m/s
Maximum Velocity = 2.500 m/s
Minimum Cover = 0.800 m
Freeboard = 0.000 m

Node Data

Node Name	Overflow Node Name	Inlet Condition	Cover Level m	Cover Level Lock	Freeboard m	Fixed Invert Level m	Minimum Cover m	Y Coordinate	X Coordinate	Maximum Inflow l/s	Maximum Storage m³	Manhole Type
MH01		Invert	1249.950	No	0.000	1248.600	0.800	-10139.429	3077160.841	0.000	0	None
MH02		Invert	1249.340	No	0.000	1246.400	0.800	-10118.714	3077224.348	0.000	0	None
MH03		Invert	1246.170	No	0.000	1242.270	0.800	-10092.144	3077296.528	0.000	0	None
MH04		Invert	1238.920	No	0.000	1236.310	0.800	-10060.846	3077369.566	0.000	0	None
MH05		Invert	1236.800	No	0.000	1234.690	0.800	-10034.556	3077444.195	0.000	0	None
MH06		Invert	1237.957	No	0.000	1233.920	0.800	-10021.007	3077508.574	0.000	0	None
MH07		Invert	1260.910	No	0.000	1259.010	0.800	-10230.046	3077397.709	0.000	0	None
MH08		Invert	1260.570	No	0.000	1258.400	0.800	-10213.061	3077359.993	0.000	0	None
MH09		Invert	1258.050	No	0.000	1256.200	0.800	-10182.109	3077292.285	0.000	0	None
MH10		Invert	1251.690	No	0.000	0.000	0.800	-10148.189	3077197.232	0.000	0	None
MH11		Invert	1252.630	No	0.000	0.000	0.800	-10146.935	3077272.055	0.000	0	None
MH12		Invert	1252.800	No	0.000	1249.450	0.800	-10148.514	3077299.668	0.000	0	None
MH13		Invert	1251.020	No	0.000	1248.270	0.800	-10152.584	3077378.362	0.000	0	None
MH14		Invert	1251.048	No	0.000	0.000	0.800	-10162.960	3077437.095	0.000	0	None
MH15		Invert	1247.435	No	0.000	0.000	1.400	-10145.901	3077453.681	0.000	0	None
MH16		Invert	1242.715	No	0.000	0.000	1.400	-10085.869	3077478.337	0.000	0	None
MH17		Invert	1268.717	No	0.000	0.000	1.400	-10471.792	3077560.767	0.000	0	None
MH18		Invert	1269.548	No	0.000	0.000	1.400	-10499.090	3077607.811	0.000	0	None
MH19		Invert	1265.481	No	0.000	0.000	1.400	-10479.637	3077621.487	0.000	0	None
MH20		Invert	1263.191	No	0.000	0.000	1.400	-10464.583	3077629.624	0.000	0	None
MH21		Invert	1260.909	No	0.000	1258.090	1.400	-10452.468	3077637.328	0.000	0	None
MH22		Invert	1258.431	No	0.000	0.000	1.400	-10438.132	3077645.871	0.000	0	None
MH23		Invert	1256.624	No	0.000	1254.870	1.400	-10429.388	3077652.186	0.000	0	None
MH24		Invert	1255.237	No	0.000	1253.520	1.400	-10416.880	3077660.356	0.000	0	None
MH25		Invert	1254.440	No	0.000	1252.290	0.800	-10408.616	3077665.228	0.000	0	None
MH26		Invert	1248.610	No	0.000	1246.530	0.800	-10369.778	3077689.668	0.000	0	None
MH27		Invert	1246.263	No	0.000	1245.255	1.400	-10321.985	3077629.048	0.000	0	None
MH28		Invert	1246.845	No	0.000	1244.409	1.400	-10266.890	3077576.724	0.000	0	None
MH29		Invert	1245.980	No	0.000	1243.600	1.400	-10194.359	3077571.408	0.000	0	None
MH30		Invert	1258.430	No	0.000	1256.550	1.400	-10258.765	3077476.036	0.000	0	None
MH31		Invert	1249.560	No	0.000	1247.670	1.400	-10190.771	3077512.065	0.000	0	None
MH32		Invert	1243.820	No	0.000	1241.850	1.400	-10119.418	3077548.547	0.000	0	None
MH33		Invert	1240.260	No	0.000	1238.290	1.400	-10072.589	3077572.527	0.000	0	None
MH34		Invert	1236.417	No	0.000	0.000	1.400	-10009.356	3077605.443	0.000	0	None

Node Name	Overflow Node Name	Inlet Condition	Cover Level m	Cover Level Lock	Freeboard m	Fixed Invert Level m	Minimum Cover m	Y Coordinate	X Coordinate	Maximum Inflow l/s	Maximum Storage m³	Manhole Type
MH35		Invert	1234.000	No	0.000	0.000	1.400	-9955.937	3077534.217	0.000	0	None
MH36		0.040	1234.993	No	0.000	0.000	1.400	-9968.274	3077572.482	0.000	0	None
MH37		Invert	1234.116	No	0.000	0.000	1.400	-9961.065	3077577.253	0.000	0	None
MH20A		Invert	1261.931	No	0.000	0.000	1.400	-10444.334	3077598.244	0.000	0	None
MH21A		Invert	1261.413	No	0.000	0.000	1.400	-10499.090	3077673.912	0.000	0	None
MH22A		Invert	1257.867	No	0.000	0.000	1.400	-10421.488	3077612.847	0.000	0	None
MH23A		Invert	1256.741	No	0.000	1255.233	0.400	-10474.177	3077693.789	0.000	0	None
MH24A		Invert	1256.067	No	0.000	0.000	1.400	-10404.101	3077632.725	0.000	0	None
MH08A		Invert	1259.540	No	0.000	1257.660	0.800	-10195.637	3077321.383	0.000	0	None
MH38		Invert	1227.797	No	0.000	0.000	0.800	-9886.477	3077597.087	0.000	0	None
MH39		Invert	1222.290	No	0.000	1221.558	0.800	-9819.604	3077624.910	0.000	0	None

Link Data

Link Name	Node Name	Next Node Name	Subnet	Branch	Link	Number of Links	Link Type	Fixed Size	Bedding Class	Length m	Fixed Slope %	Fixed Ratio Slope (1:x)	Maximum Flow l/s
LMH01	MH01	MH02	1	1	1	1	PVC-U	160 mm	Flexible	66.800	0.000000	0.000000	0.000
LMH02	MH02	MH03	1	1	2	1	PVC-U	160 mm	Flexible	76.915	0.000000	0.000000	0.000
LMH03	MH03	MH04	1	1	3	1	PVC-U	160 mm	Flexible	79.461	0.000000	0.000000	0.000
LMH04	MH04	MH05	1	1	4	1	PVC-U	160 mm	Flexible	79.124	0.000000	0.000000	0.000
LMH05	MH05	MH06	1	1	5	1	PVC-U	160 mm	Flexible	65.789	0.000000	0.000000	0.000
LMH07	MH07	MH08	1	2	1	1	PVC-U	160 mm	Flexible	41.364	0.000000	0.000000	0.000
LMH10	MH10	MH11	1	3	1	1	PVC-U	160 mm	Flexible	74.834	0.000000	0.000000	0.000
LMH11	MH11	MH12	1	3	2	1	PVC-U	160 mm	Flexible	27.658	0.000000	0.000000	0.000
LMH12	MH12	MH13	1	2	5	1	PVC-U	160 mm	Flexible	78.799	0.000000	0.000000	0.000
LMH14	MH14	MH15	1	2	7	1	PVC-U	160 mm	Flexible	23.793	0.000000	0.000000	0.000
LMH15	MH15	MH16	1	2	8	1	PVC-U	160 mm	Flexible	64.898	0.000000	0.000000	0.000
LMH16	MH16	MH06	1	2	9	1	PVC-U	160 mm	Flexible	71.564	0.000000	0.000000	0.000
LMH17	MH17	MH18	1	4	1	1	PVC-U	160 mm	Flexible	54.390	1.667000	59.988002	0.000
LMH18	MH18	MH19	1	4	2	1	PVC-U	160 mm	Flexible	23.779	8.000000	12.500000	0.000
LMH19	MH19	MH20	1	4	3	1	PVC-U	160 mm	Flexible	17.112	0.000000	0.000000	0.000
LMH20	MH20	MH21	1	4	4	1	PVC-U	160 mm	Flexible	14.357	0.000000	0.000000	0.000
LMH21	MH21	MH22	1	4	5	1	PVC-U	160 mm	Flexible	16.688	0.000000	0.000000	0.000
LMH22	MH22	MH23	1	4	6	1	PVC-U	160 mm	Flexible	10.786	0.000000	0.000000	0.000
LMH23	MH23	MH24	1	4	7	1	PVC-U	160 mm	Flexible	14.940	0.000000	0.000000	0.000
LMH24	MH24	MH25	1	4	8	1	PVC-U	160 mm	Flexible	9.593	0.000000	0.000000	0.000
LMH25	MH25	MH26	1	4	9	1	PVC-U	160 mm	Flexible	45.888	0.000000	0.000000	0.000
LMH27	MH27	MH28	1	4	11	1	PVC-U	160 mm	Flexible	75.982	0.000000	0.000000	0.000
LMH28	MH28	MH29	1	4	12	1	PVC-U	160 mm	Flexible	72.726	0.000000	0.000000	0.000
LMH30	MH30	MH31	1	10	1	1	PVC-U	160 mm	Flexible	76.950	0.000000	0.000000	0.000
LMH31	MH31	MH32	1	10	2	1	PVC-U	160 mm	Flexible	80.139	0.000000	0.000000	0.000
LMH32	MH32	MH33	1	4	14	1	PVC-U	160 mm	Flexible	52.612	0.000000	0.000000	0.000
LMH33	MH33	MH34	1	4	15	1	PVC-U	160 mm	Flexible	71.287	0.000000	0.000000	0.000
LMH35	MH35	MH36	1	1	7	1	PVC-U	160 mm	Flexible	40.205	0.000000	0.000000	0.000
LMH36	MH36	MH37	1	1	8	1	PVC-U	200 mm	Flexible	8.645	0.000000	0.000000	0.000
LMH34	MH34	MH36	1	4	16	1	PVC-U	160 mm	Flexible	52.670	0.000000	0.000000	0.000
LMH20A	MH20A	MH20	1	5	1	1	PVC-U	160 mm	Flexible	37.346	0.000000	0.000000	0.000
LMH21A	MH21A	MH21	1	6	1	1	PVC-U	160 mm	Flexible	59.262	0.000000	0.000000	0.000
LMH22A	MH22A	MH22	1	7	1	1	PVC-U	160 mm	Flexible	36.981	0.000000	0.000000	0.000
LMH23A	MH23A	MH23	1	8	1	1	PVC-U	160 mm	Flexible	61.130	0.000000	0.000000	0.000
LMH24A	MH24A	MH24	1	9	1	1	PVC-U	160 mm	Flexible	30.443	0.000000	0.000000	0.000
LMH06	MH06	MH35	1	1	6	1	PVC-U	160 mm	Flexible	69.940	0.000000	0.000000	0.000
LMH26	MH26	MH27	1	4	10	1	PVC-U	160 mm	Flexible	77.194	0.000000	0.000000	0.000
LMH29	MH29	MH32	1	4	13	1	PVC-U	160 mm	Flexible	78.350	0.000000	0.000000	0.000
LMH09	MH09	MH12	1	2	4	1	PVC-U	160 mm	Flexible	34.397	0.000000	0.000000	0.000
LMH13	MH13	MH14	1	2	6	1	PVC-U	160 mm	Flexible	59.642	0.000000	0.000000	0.000
LMH08	MH08	MH08A	1	2	2	1	PVC-U	160 mm	Flexible	42.378	0.000000	0.000000	0.000
LMH08A	MH08A	MH09	1	2	3	1	PVC-U	160 mm	Flexible	32.071	0.000000	0.000000	0.000
LMH38	MH38	MH39	1	1	10	1	PVC-U	200 mm	Flexible	72.430	0.000000	0.000000	0.000
LMH37	MH37	MH38	1	1	9	1	PVC-U	200 mm	Flexible	77.180	0.000000	0.000000	0.000

Inflow Data

Node Name	Point Class	Point Inflow l/s	Inflow 1	Inflow 2	Inflow 3	Inflow 4	Inflow 5
MH01		0.087					
MH02		0.000					
MH03		0.131					
MH04		0.000					
MH05		0.131					
MH06		0.000					
MH07		0.175					
MH08		0.000					
MH09		0.000					
MH10		0.087					
MH11		0.000					
MH12		0.000					
MH13		0.000					
MH14		0.218					
MH15		0.000					
MH16		0.000					
MH17		0.321					
MH18		0.000					
MH19		0.000					
MH20		0.000					
MH21		0.000					
MH22		0.000					
MH23		0.000					
MH24		0.000					
MH25		0.000					
MH26		0.000					
MH27		0.000					
MH28		0.000					
MH29		0.000					
MH30		0.087					
MH31		0.000					
MH32		0.044					
MH33		0.131					
MH34		0.044					
MH35		0.000					
MH36		0.000					
MH37		0.000					
MH20A		0.321					
MH21A		0.612					
MH22A		0.321					
MH23A		0.612					
MH24A		0.321					
MH08A		0.000					
MH38		0.000					
MH39		0.000					

File Name: F:\PROJECTS\2019\19008 - Bokwe Village Sewer\5 Drawings\5.2 Civil Drawings\Civdes\2019-06-28_Sewer.se8

Inflow Calculation Method = Unit Flow

Inflow Type = Peak Wet Weather Flow

Peak Factor (excl Pnt Src) = 6.000

Infiltration (excl Pnt Src)= 15 %

Proportional Flow Depth = 66 %

Number of Nodes analyzed = 44

Subnetwork 1

Outfall Node = MH39

Outlet Level = 1229.760 m

Design Flow = 3.641 l/s

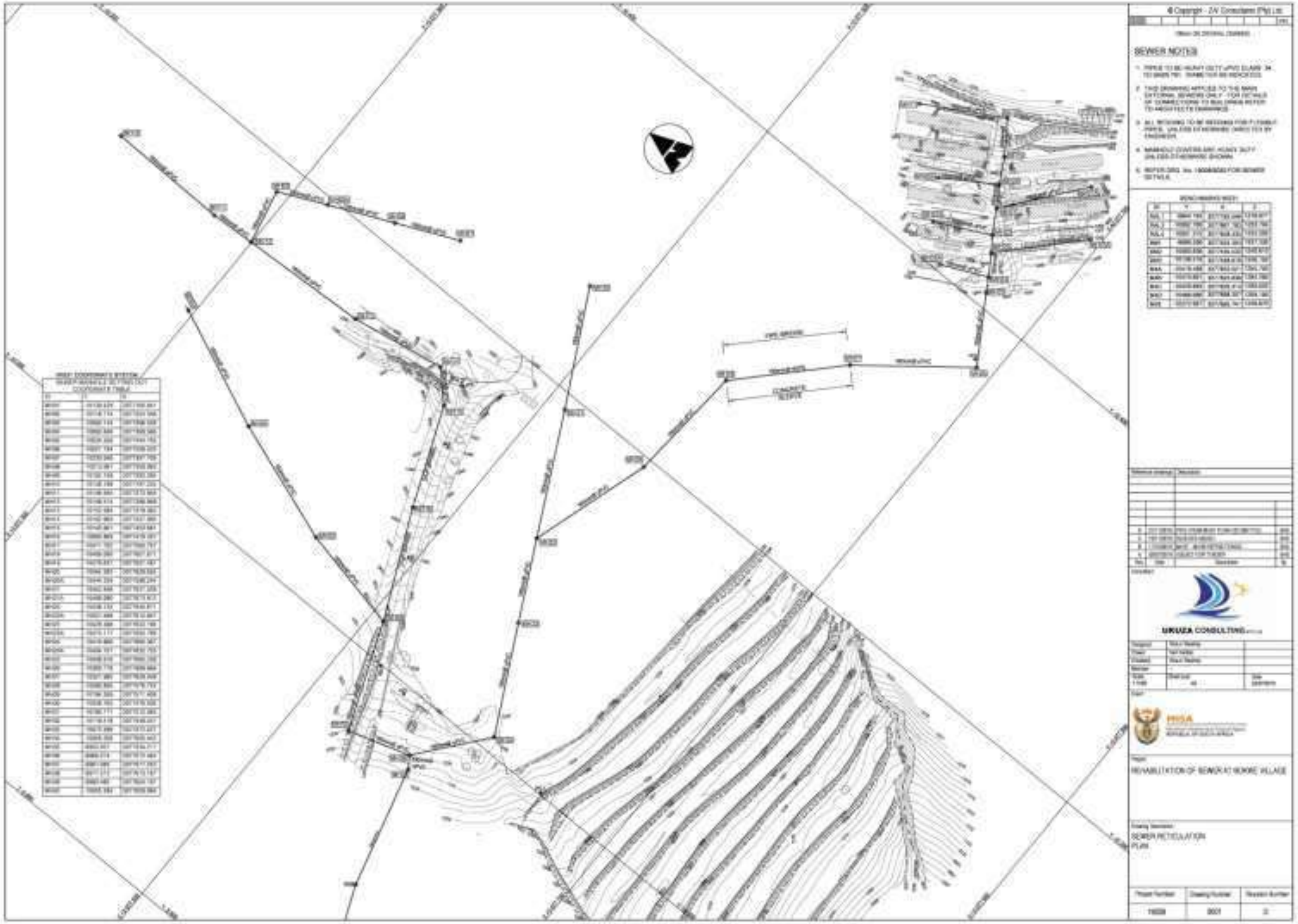
Total Point Inflow = 3.641 l/s

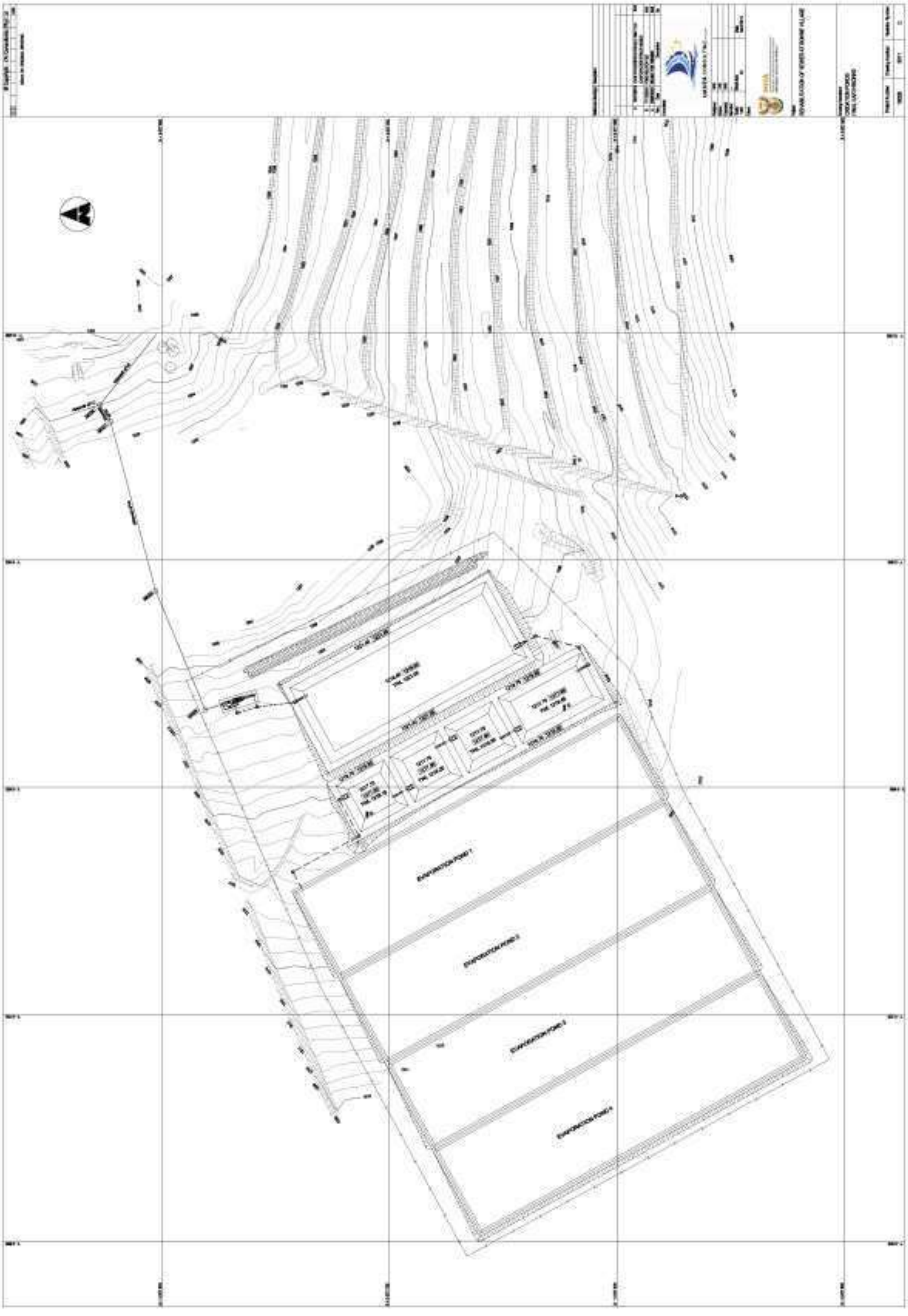
Total Inflow = 3.641 l/s

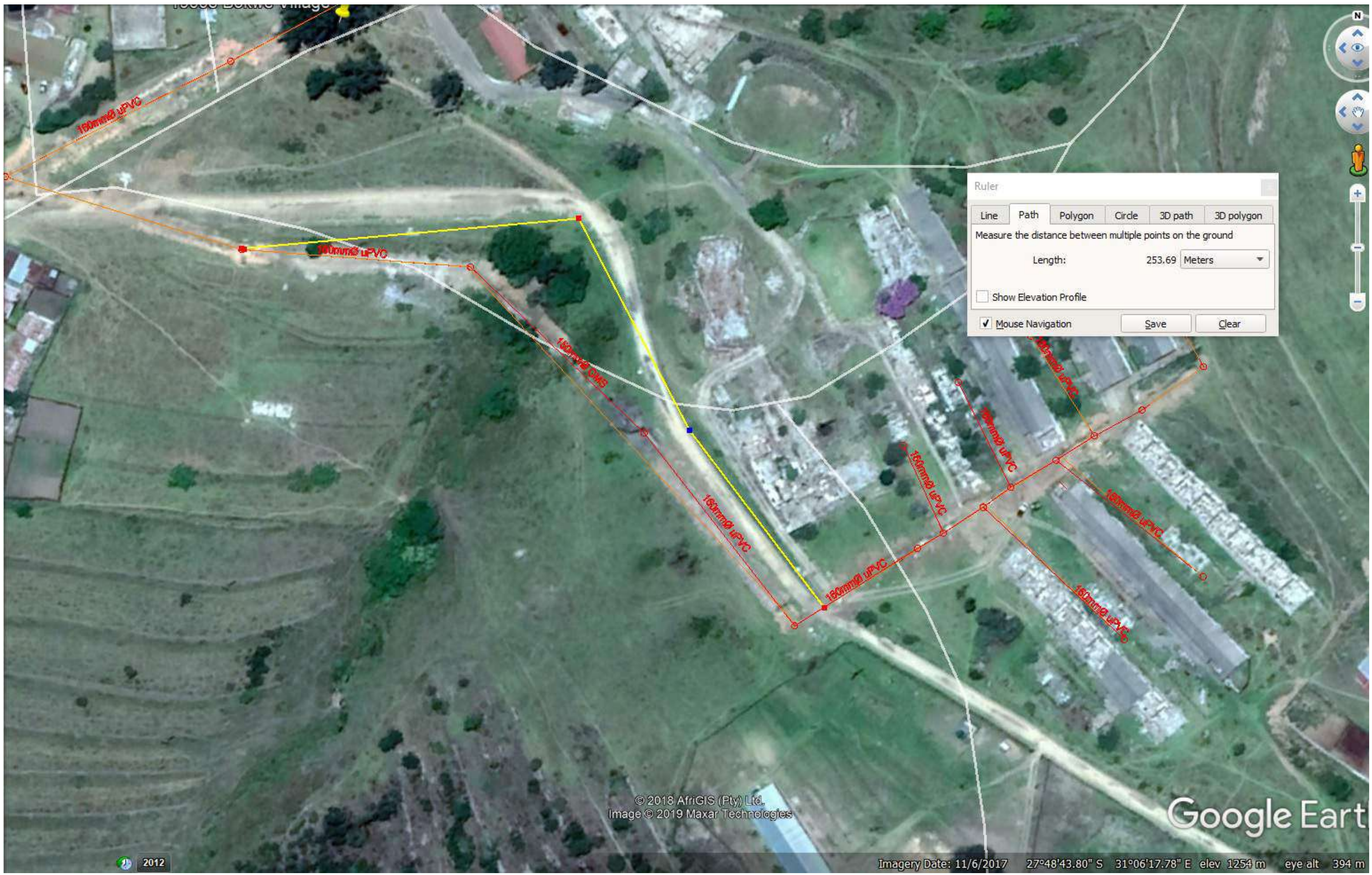
Peak Factor = 3.25

Equivalent Population = 0

Annexure H: Design Drawings




EVAPORATION POND 1
EVAPORATION POND 2
EVAPORATION POND 3
EVAPORATION POND 4



Ruler

Line | Path | Polygon | Circle | 3D path | 3D polygon

Measure the distance between multiple points on the ground

Length: 253.69 Meters

☐ Show Elevation Profile

☑ Mouse Navigation

Save Clear

Imagery Date: 11/6/2017 27°48'43.80" S 31°06'17.78" E elev 1254 m eye alt 394 m

Appendix D

I&AP REGISTER/DATABASE - DISTRIBUTION LIST

ORGANISATION	CONTACT PERSON	PHONE NUMBER	CONTACT DETAILS	COPY OF THE BID SENT	COPY OF THE DRAFT BAR SENT
KZN Department of Transport	Judy Reddy	033 355 8600	KwaZulu-Natal Department of Transport 224 Prince Alfred Street Pietermaritzburg **Judy.Reddy@Kzntransport.gov.za**	Yes (electronic copy)	
Ezemvelo KZN Wildlife	Dominic Wieners	033 845 1346	Ezemvelo KZN Wildlife P.O.Box 13053 Cascades 3202 **data@kznwildlife.com** **Dominic.Wieners@kznwildlife.com**	Yes (electronic copy)	
Department of Water and Sanitation	Siyabonga Buthelezi	031 336 2700	Department of Water and Sanitation 88 Joe Slovo Street Durban 4001 **ButheleziS2@dws.gov.za**	Yes (electronic copy)	
AMAFA	Bernadet Pawandiwa	033 394 6543	bernadetp@amafapmb.co.za	Yes (electronic copy)	
KZN Corporate Governance and Traditional Affairs	Vishnu Govender	031 204 1711	KwaZulu-Natal: Corporate Governance and Traditional Affairs 7 Buro Crescent Mayville Durban 4091 **vishnu.govender@kzncogta.gov.za**	Yes (electronic copy)	
Ward Councillor, Ward 05	Bongumusa Ntombela	034 982 2133	information@abaqulusi.gov.za	Yes (electronic copy)	
Municipal Manager AbaQulusi Municipality	Bonga Ntanzi	034 982 2133	municipalmanager@abaqulusi.gov.za	Yes (electronic copy)	
Community Representative and Trustees	Thomas Ntombela (Mnyathi Trust) Pheneas Mtshali (Igalelo Trust)	082 403 3329 076 391 6213	qalindaban@gmail.com pmmtshali1@gmail.com	Yes (electronic copy)	

Commission on Restitution of Land Rights	Lynn Boucher	033 341 2600	Commission on Restitution of Land Rights Private Bag X9120 Pietermaritzburg 3200 **lynn.boucher@drdlr.gov.za**	Yes (electronic copy)	
eThekwini Municipality	Crystal Naidoo/Pam Ramnarain	031 322 4303/031 3117471	eThekwini Municipality Environmental Planning & Climate Protection Department 166 K.E. Masinga Road Durban 4001 **crystal.naidoo@durban.gov.za** **pam.ramnarain@durban.gov.za**	Yes (electronic copy)	
KZN Department of Economic Development, Tourism and Environmental Affairs	Sbusiso Ndwandwe	035 870 9383	KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs King Dinizulu Highway Legislative Assembly Building / Offices Second Floor; Suite 229 Ulundi 3838 **sbusisozz57@gmail.com**	Yes (electronic copy)	
MISA	Godfrey Matjila	073 762 7597	Municipal Infrastructure Support Agent godfrey.matjila@misa.gov.za	Yes (electronic copy)	
Zulualnd District Municipality	Zamokwakhe Mcineke	078 804 2806	ZDM Municipality zmcineka@zululand.org.za	Yes (electronic copy)	
MISA	Tenisia Chidzurira	082 381 2091	Municipal Infrastructure Support Agent tenisia.chidzurira@misa.gov.za	Yes (electronic copy)	

Purpose of a Background Information Document (BID)

The purpose of this Background Information Document (BID) is to provide Interested and Affected Parties (I&AP's) with background information on the proposed project and introduce the Environmental Basic Assessment (BA) process to be followed. It also aims to (i) inform I&AP's on how to participate in the BA, (ii) encourage responses to documents that will be distributed for review and (iii) encourage I&AP's to attend any public meetings.

1World Consultants have been appointed as the independent Environmental Assessment Practitioner (EAP), to undertake the Basic Assessment Process for the Environmental Authorisation for the Proposed Bhokwe Community Sanitation Project.

Nature and Location of Activity

Ukuza Consultants proposes the construction of 2.2 km of 160mmØ uPVC sewer reticulation, 90 m of 250mmØ uPVC sewer reticulation, an oxidation sewer pond and numerous 1000mmØ precast concrete ring manholes, in Bhokwe Community, Ward 05, AbaQulusi Municipality, KwaZulu-Natal.

The project will require water, electricity and waste disposal during the construction phase only. This will be provided by the Contractor.

The Bhokwe communities within this region require rehabilitation of the sanitation systems in this settlement, which are characterized by frequent bursts, blockages and overflowing resulting in a health hazard to the community.

Municipal Infrastructure Support Agent (MISA) was requested by the Bhokwe communities to assist with rehabilitation of the water and sanitation systems in these settlements. MISA appointed a service provider on a Turnkey basis to design and rehabilitate sewer reticulation facilities in 20 June 2016. The contractor abandoned site approximately eighteen months ago and MISA is at this stage, uncertain of the condition of the infrastructure installed and quality of materials on site and external factors such as weather, vandalism, theft, etc., which may have affected the completed works. The previous service provider has since been liquidated resulting in the abandonment of the site. In order to resuscitate and complete the project, MISA initiated a procurement process during April 2019 for the appointment of a new Service Provider. Ukuza Consulting (Pty) Ltd have since been appointed as the professional service provider. In this regard, the proposed reticulation and completion of existing works will be continued.

Environmental Impact

In terms of the Environmental Impact Assessment (EIA) Regulations (2017) promulgated under the National Environmental Management Act (Act No. 107 of 1998) (as amended), a Basic Assessment Study will be required. The proposed development triggers the following listed activity, as per Listing Notice 1:

Activity 19:

The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.

Activity 27:

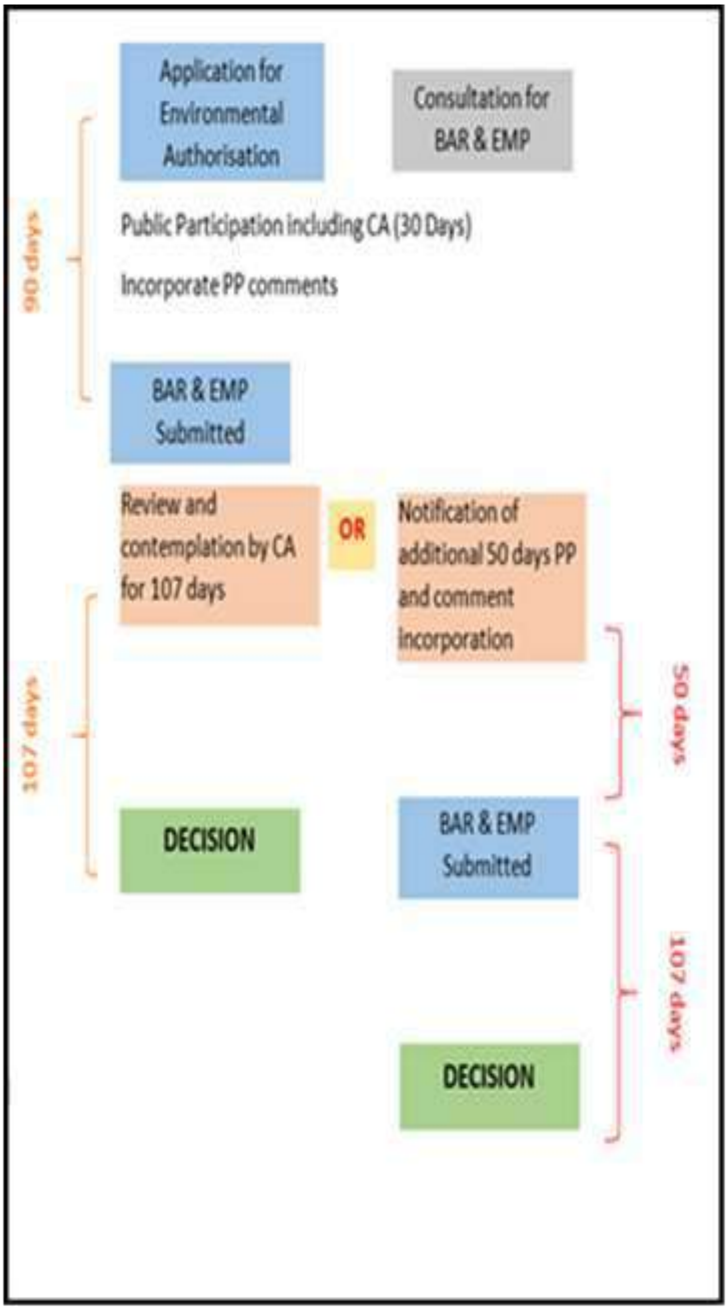
The **clearance of an area** of 1 hectares or more, but less than 20 hectares of **indigenous vegetation**.

The Basic Assessment Process and Public Participation Process (PPP)

The primary aim of the Basic Assessment is to ensure that any potential environmental impacts that may occur, due to the construction and/or operation of the proposed development, are mitigated.

The main aspects of a Basic Assessment are:

- Investigate and gather information on the area,
- Describe the environment and how the development would fit in,
- Identify and involve potential I&AP's and stakeholders,
- Identify potential impacts,
- Investigate alternatives to the proposed development,
- Recommend mitigation measures and compile an Environmental Management Plan (EMPr) for the construction and operational phases.



Mitigation Measures

There are several risks associated with construction activities. Initial mitigation measures include a minimal working footprint, site demarcation, demarcation of no-go areas, designated and demarcated site access routes, sediment control measures, spillage control measures, dust control measures, general construction control, staff training and site rehabilitation post construction. A monitoring and auditing plan for the construction phase of the development, will be formulated to ensure that the mitigation measures, detailed in the Environmental Management Plan (EMPr) are followed.

Elements of the Public Participation Process (PPP)

The public is invited to register as an I&AP and take part in the PPP via the following methods:

- Media Notices placed in newspapers.
- Distribution of this Background Information Document (BID)
- Site notice boards
- Stakeholder meetings
- Public meeting (if necessary)
- Submission of comments on the media notices, BID, and Draft Basic Assessment Report.

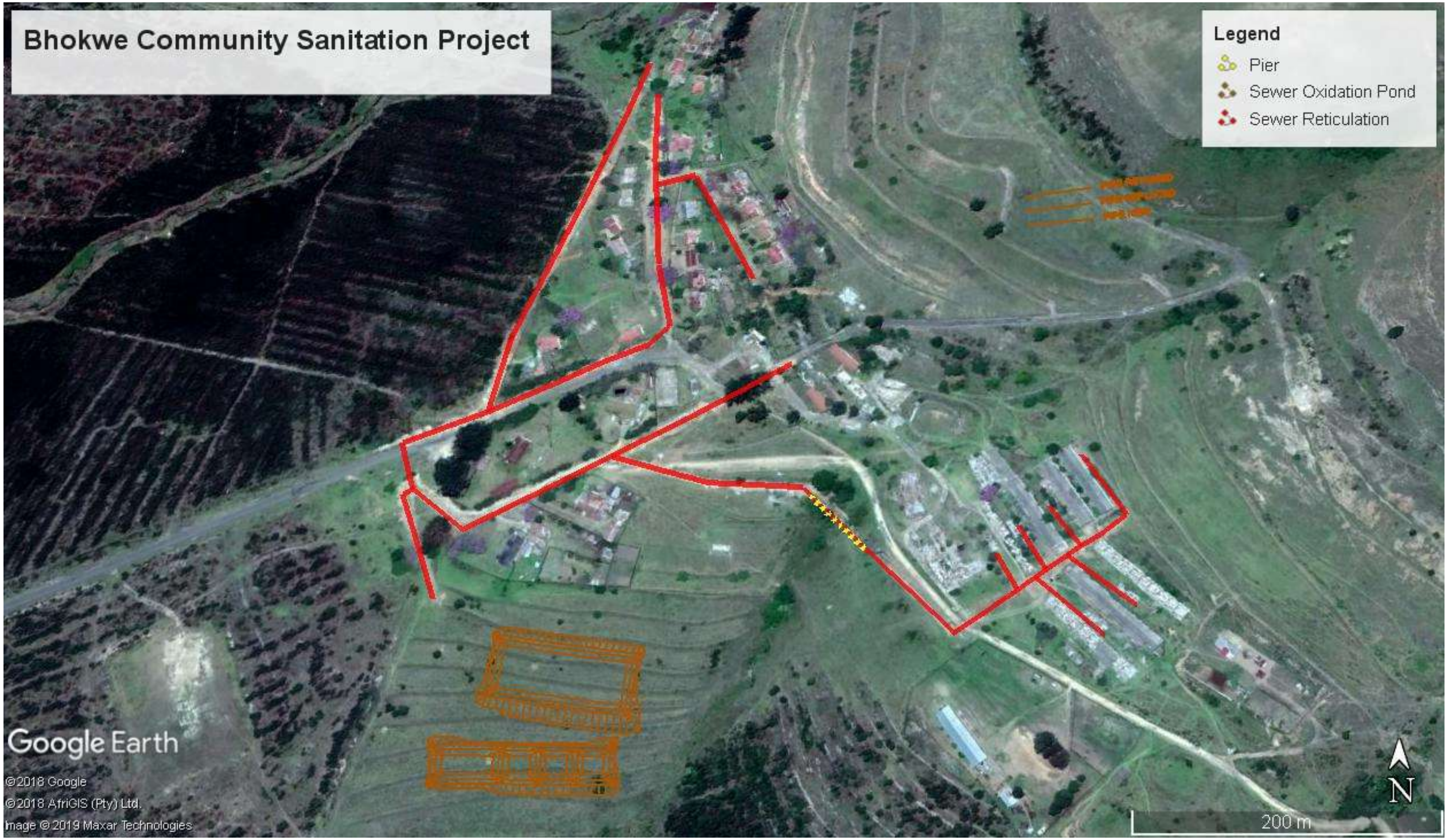
Note: All information is available on request.

How to Participate?

All Interested and Affected Parties (I&AP's) are invited to register, on the database managed by 1World Consultants (Pty) Ltd by email or fax using the details provided.

Comments and recommendations regarding the proposed development are welcome and may be addressed to:

Hasan Mahomedy B.Sc.
Tel: 031 262 8327
Fax: 086 726 3619
Postal: PO Box 2311, Westville, 3630
Email: hasan@1wc.co.za


Bhokwe Community Sanitation Project
Legend
Pier
Sewer Oxidation Pond
Sewer Reticulation
Google Earth
©2018 Google
©2018 AfriGIS (Pty) Ltd.
Image © 2019 Maxar Technologies
N
200 m

From: Crystal Naidoo <Crystal.Naidoo@durban.gov.za>
Sent: Thursday, July 11, 2019 10:33 AM
To: hasan@1wc.co.za
Subject: RE: Bhokwe Project BID

Received

From: hasan@1wc.co.za [mailto:hasan@1wc.co.za]
Sent: Tuesday, 09 July 2019 14:31
Cc: adila@1wc.co.za
Subject: Bhokwe Project BID

Good day,

I trust that this email finds you well.

The ***Proposed Bhokwe Community Sanitation Project***, located in Ward 05, AbaQulusi Municipality, refers.

1World Consultants (Pty) Ltd have been appointed as the independent Environmental Assessment Practitioner (EAP) for this project.

You have been identified as a possible Interested and Affected Party (I&AP) or stakeholder for the EIA process.

Attached, please find the Background Information Document (BID) for your review. You are hereby invited to register on the database of I&AP's.

1World utilises email as our primary communication tool. Should you have any queries and/or comments please provide it via email.

We look forward to liaising with you.

N.B: Kindly acknowledge receipt of this email and one attachment.

Thank you

Kind regards,

Hasan Mahomedy, BSc (Hons)
Environmental Assessment Practitioner
Cell: 072 730 7866

1world consultants
Tel: 031 262 8327 **Fax:** 086 726 3616 **Email:** hasan@1wc.co.za
P O Box 2311, Westville, 3630

From:	hasan@1wc.co.za
Sent:	Tuesday, July 9, 2019 2:31 PM
Cc:	'adila@1wc.co.za'
Subject:	Bhokwe Project BID
Attachments:	1WC_Final_Bokwe_BID_May2019.pdf

Good day,

I trust that this email finds you well.

The ***Proposed Bhokwe Community Sanitation Project***, located in Ward 05, AbaQulusi Municipality, refers.

1World Consultants (Pty) Ltd have been appointed as the independent Environmental Assessment Practitioner (EAP) for this project.

You have been identified as a possible Interested and Affected Party (I&AP) or stakeholder for the EIA process.

Attached, please find the Background Information Document (BID) for your review. You are hereby invited to register on the database of I&AP's.

1World utilises email as our primary communication tool. Should you have any queries and/or comments please provide it via email.

We look forward to liaising with you.

N.B: Kindly acknowledge receipt of this email and one attachment.

Thank you

Kind regards,

Hasan Mahomedy, BSc (Hons)
Environmental Assessment Practitioner
Cell: 072 730 7866

1world consultants
Tel: 031 262 8327 **Fax:** 086 726 3616 **Email:** hasan@1wc.co.za
P O Box 2311, Westville, 3630

From:	hasan@1wc.co.za
Sent:	Tuesday, July 9, 2019 2:12 PM
To:	'Sbusiso Ndwandwe'
Cc:	'adila@1wc.co.za'
Subject:	RE: Bhokwe Pipeline Project
Attachments:	1WC_Final_Bokwe_BID_May2019.pdf

Good day Sbusiso

I hope you are well.

As discussed previously, Please find attached BID for the proposed Bhokwe Community Sanitation Project.

I have two queries regarding the project:

1. When can we set up a pre-application meeting?
2. I would like to query if I have to have the EDTEA reference number on the adverts and notices for the PP Process? I.e. Can I send out these notices without a reference number?

Please do not hesitate to contact me should you require any further information.

Thank you

Kind regards,

Hasan Mahomedy, BSc (Hons)
Environmental Assessment Practitioner
Cell: 072 730 7866

1world consultants
Tel: 031 262 8327 **Fax:** 086 726 3616 **Email:** hasan@1wc.co.za
P O Box 2311, Westville, 3630

From: Sbusiso Ndwandwe <sbusisozz57@gmail.com>
Sent: Tuesday, July 2, 2019 12:26 PM
To: hasan@1wc.co.za
Subject: Re: Bhokwe Pipeline Project

Hasan
Thank you for the update.

On Tue, Jul 2, 2019 at 11:53 AM <hasan@1wc.co.za> wrote:

> Good day
>
> I hope you are well.
>
> I have made contact with you yesterday telephonically regarding an Environmental Application for Bhokwe Community Sanitation Project (Ward 05, AmaQulusi Municipality).
>
> I am currently preparing the BID. I will forward it during the week.
>
> Thank you for your assistance.
>
> **Kind regards,**
>
> **Hasan Mahomedy, BSc (Hons)**
>
> ***Environmental Assessment Practitioner***
>
> **Cell: 072 730 7866**
>
> 1world consultants
>
> **Tel:** 031 262 8327 **Fax:** 086 726 3616 **Email:** hasan@1wc.co.za
>
> P O Box 2311, Westville, 3630

--
Mr. B. S. Ndwandwe
Assistant Director: Environmental Impact Assessment

Environmental Services
KZN Department of Economic Development; Tourism and Environmental Affairs
King Dinizulu Highway
Legislative Assembly Building / Offices
Second Floor; Suite 229
Ulundi 3838
Tel: 035 - 870 9383
Fax: 035 - 870 9390
Cell: 082 719 9883
E Mail Address: sbusisozz57@gmail.com

agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

F 033 342 8783
T 033 392 7721
ThembalakheS@daff.gov.za

DAFF
Forestry Regulations & Support
P/Bag X9029
Pietermaritzburg, 3204091

Mr. T. Sibozana
29 July 2019

1World Consultants
P.O Box 2311
Westville
3630

Attention: Mr. Hasan Mahomedy

BACKGROUND INFORMATION DOCUMENT (BID) FOR THE PROPOSED BHOKWE COMMUNITY SANITATION WARD 05, ABAQULUSI MUNICIPALITY, KWAZULU-NATAL.

The Department of Agriculture, Forestry and Fisheries appreciates the opportunity to register as an interested and affected party for the above-mentioned project. DAFF through the sub-directorate Forestry Regulations and Support is the authority mandated to implement the National Forests Act No. 84 of 1998 by regulating the use of natural forests and protected trees species in terms of the said Act.

With regards to the BID received on 10/07/2019, the proposed project will trigger vegetation clearing of 1 hectares of indigenous vegetation. It is recommended that a vegetation specialist report or ecological report should be conducted to determine how natural forests and protected trees will be impacted upon by the proposed development. Therefore the Department will not be able to provide comments at this stage however comments will be made upon the receipts of a Draft Basic Assessment Report including Environmental Management Plan.

This letter does not exempt you from considering other environmental legislations. Should any further information be required, please do not hesitate to contact this office.

Yours faithfully
Mr. T. Sibozana

Senior Forester: KZN Forestry Management
Forestry Regulations and Support

agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

F📠: 033 342 8783	🖱 DAFF	✉ Mr. T. Sibozana
T☎: 033 392 7721	Forestry Regulations & Support	10 July 2019
✉ThembalakheS@daff.gov.za	P/Bag X9029	
	Pietermaritzburg	
	3200	

P.O Box 2311
Westville
3630

Attention: Hasan Mahomedy

BACKGROUND INFORMATION DOCUMENT (BID) FOR THE PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, WARD 5, ABAQULUSI LOCAL MUICIPALITY, KWAZULU-NATAL.

This letter serves as a notice of receipt for the above document received on the 10th July 2019. Kindly note that the document will be processed within 30 days from the date of receival, provided that all requested information is submitted to the department timeously. Should any further information be required, please do not hesitate to contact this office.

Yours faithfully
Mr. T. Sibozana

……………………………………………
Forestry Regulations & Support
KwaZulu-Natal Forestry Management

KWAZULU-NATAL
AMAFA AND RESEARCH INSTITUTE

ISIKHUNGO SAMAFA NOCWANINGO
SAKWAZULU-NATALI

KWAZULU-NATAL
AMAFA- EN NAVORSINGSINSTITUUT

195 Langalibalele Street
PO Box 2685
Pietermaritzburg 3200

☎Tel: 033 394 6543
Fax: 033 394 6552

www.heritagekzn.co.za

Bhokwe Community Sanitation Project

Our Ref: SAH19/14255

Enquiries: Bernadet Pawandiwa
Tel: 033 394 6543
Email: bernadetp@amafapmb.co.za
CaseID: 14255

Date: Wednesday September 11, 2019
Page No: 1

Final Comment

IN TERMS OF SECTION 38(8) OF THE NATIONAL HERITAGE RESOURCES ACT (ACT 25 OF 1999) AND SECTION 41 OF THE KWAZULU-NATAL AMAFA AND RESEARCH INSTITUTE ACT (ACT 05 OF 2018)

Attention: 1World Consultants (Pty) Ltd

181 Winchester Drive,
Reservoir Hills,
Durban,
4091

The sewer system in Bhokwe consists of flushing toilets connected to a shallow sewer reticulation system that discharges into a common conservancy tank. There are two conservancy tanks in the ward, one servicing Bhokwe quarters and the other servicing Bhokwe hostels. The rest of the villages under Bhokwe settlements use VIP toilets. The municipal staff and community that are close to the wastewater treatment plant are exposed to health hazards due to the condition of the plant. The Bhokwe community requires the rehabilitation of the sanitation system in the settlement, as it is characterized by frequent bursts, blockages and overflows resulting in a health hazard to the community

The application for comment with regards to the above development proposal has been considered. Section 8 and 9 of the Heritage Impact Study conducted by Jean Beater and Section 8 of the Palaeontological Study by Professor Marion Bamford Section provide suitable recommendations and mitigation measures to ensure that the development does not compromise heritage resources. The developer should therefore ensure that the activities relating to this project do not in any way compromise heritage resources by complying with the stipulated recommendations and mitigation measures.

The KwaZulu Natal Amafa and Research Institute, (Formerly Amafa aKwaZulu Natal, Heritage KwaZulu Natal, Erfernis KwaZulu Natal), therefore has no objection to the proposed development within limits of the stipulated conditions and mitigation measures.

You are also required to adhere to the below-mentioned standard conditions:

Conditions:

KWAZULU-NATAL
AMAFA AND RESEARCH INSTITUTE

ISIKHUNGO SAMAFA NOCWANINGO
SAKWAZULU-NATALI

KWAZULU-NATAL
AMAFA- EN NAVORSINGSINSTITUUT

195 Langalibalele Street
PO Box 2685
Pietermaritzburg 3200

☎Tel: 033 394 6543
Fax: 033 394 6552

www.heritagekzn.co.za

Bhokwe Community Sanitation Project

Our Ref: SAH19/14255

Enquiries: Bernadet Pawandiwa
Tel: 033 394 6543
Email: bernadetp@amafapmb.co.za
CaseID: 14255

Date: Wednesday September 11, 2019

1. The KwaZulu Natal Amafa and Research Institute should be contacted if any heritage objects are identified during earth-moving activities and all development should cease until further notice.

2. No structures older than sixty years or parts thereof are allowed to be demolished altered or extended without a permit from the KwaZulu Natal and Amafa Research Institute.

3. Under no circumstances may any heritage material be destroyed or removed from site unless under direction of the KwaZulu Natal and Amafa Research Institute and a heritage specialist.

4. Should any remains be found on site that is potentially human remains, the South African Police Service (SAPS) should also be contacted. No SAPS official may disturb or exhume such remains, without the necessary permission from the KwaZulu Natal and Amafa Research Institute.

5. No activities are allowed within 50m of a site, which contains rock art.

6. Sources of all natural materials (including topsoil, sands, natural gravels, crushed stone, asphalt, etc.) must be obtained in a sustainable manner and in compliance with the heritage legislation.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully

Bernadet Pawandiwa
Senior Heritage Officer
KwaZulu-Natal Amafa and Research Institute

Bhokwe Community Sanitation Project

Our Ref: SAH19/14255

Enquiries: Bernadet Pawandiwa
Tel: 033 394 6543
Email: bernadetp@amafapmb.co.za
CaseID: 14255

Date: Wednesday September 11, 2019
Page No: 3

ADMIN:
Direct URL to case: https://sahris.sahra.org.za/node/527813
(, Ref:)

Terms & Conditions:

1. This approval does not exonerate the applicant from obtaining local authority approval or any other necessary approval for proposed work.
2. If any heritage resources, including graves or human remains, are encountered they must be reported to the Institute immediately.
3. The Institute reserves the right to request additional information as required.

ZO CLASSIFIEDS

www.zululandobserver.co.za

Phone our friendly Classifieds Consultants on 035 799 0500
or email yolande@zob.co.za

EMERGENCY NUMBERS

STOP GENDER VIOLENCE HELPLINE	0800 150 150/ 035 789 9111
AIDS TOLL-FREE LINE	0800 012 322
AMBULANCE	10177
BAY HOSPITAL	035 780 6111
CHILDLINE	0800 055 555
EMPANGENI HOSPITAL	035 902 8500
ESKOM	086 020 4560
FARM WATCH	035 792 0070
FIRE RESCUE	035 797 3911
LIFE EMPANGENI PRIVATE HOSPITAL	035 902 8000
LIFE LINE	035 789 7788
MELOMED	035 791 5300
NETCARE 911 (AMBULANCE)	0800 333 444
NGWELEZANA HOSPITAL	035 901 7000
RAPE CRISIS CENTRE	035 902 8517
SAP EMPANGENI	035 901 5800
SAP RICHARDS BAY	035 901 2475/ 035 901 2478
SEA RESCUE	035 753 1991/ 082 990 5949
SNAKE-CATCHER	083 661 1232 066 243 3377 061 335 8014
SPCA EMPANGENI	071 174 4746
EMERGENCY ONLY	083 482 3866
SPCA RICHARDS BAY	035 753 2086
EMERGENCY ONLY	073 551 4564
TRAVEL CLINIC	035 789 8309

SERVICES

0301	Arts & Crafts
0302	Accounting
0303	Beauty & Health
0304	Airconditioning
0306	Bridal
0309	Building Consultants/ Designs/Plans
0312	Catering
0315	Cellular Telephones
0318	Child Care
0321	Cleaning
0324	Computer
0327	Curtaining & Blinds
0330	Dressmaking
0333	Driving Schools
0336	Entertainment/ Party Planning
0339	Financial/Loans
0342	For Hire
0345	Furniture Restoration
0348	General Repairs
0351	Home Industry
0354	House Sitters
0357	Locksmiths
0360	Miscellaneous
0363	Personal
0366	Pest Control
0369	Pets/ Accommodation
0372	Photographic
0375	Professional & Business
0378	Removals & Storage
0381	Security
0384	Transport/ Taxis/Couriers
0387	Tuition/ Education
0390	TV & Video Rentals
0393	TV/Video/ Aerials
0396	Typing/ Secretarial
0399	Upholstery

0300
SERVICES

0330
DRESSMAKING

High quality

Seamstress

• Curtains • Duvet covers • Throw overs • Fitted sheets • Night Frills • Scatter cushions • Table cloths • Alterations etc

ALDA

Cell: 072 302 7341
A/H: 035 792 5783
1 Alumina Gardens, Rex Henderson Rd, Empangeni

sm000933-20©

0339
FINANCIAL/ LOANS

BRIDGING Cash

While waiting for pension/package payout (lump sum only).

Pcm/SMS
074 137 3355
/ 033 342 1260

sm000932-20©

0366
PEST CONTROL

ERADICATION OF PESTS
INSPECTION OF BUILDINGS
ZULULAND PEST CONTROL
50 YEARS IN ZULULAND
HYGIENE SERVICES

Tel: 035 772 4091
Nevill: 082 381 7540
Email: zpc@worldonline.co.za
www.zululandpestcontrol.com

sm000934-20©

PROPERTY TO LET

0501	Estates Agencies
0505	Accommodation/ Rooms to let
0507	Commercial Premises to let
0510	Farms & Plots
0515	Flats/Units
0520	Garden Flats/ Cottages
0525	Houses
0530	Industrial Premises
0535	Offices & Shops
0540	Retirement Accommodation/ Villages
0545	Storage/Parking Facilities
0550	Townhouses/ Cluster Homes
0555	Wanted To Rent

0500
PROPERTY TO LET

0505
ACCOMMODATION/ ROOMS TO LET

ROOM TO LET
KILDARE
EMPANGENI

Use of swimming pool included. Cleaning by domestic included. Water and lights included. Free Wi-fi included. R1 900pm. Has own shower and basin
Phone: 060 529 5128

SR006101

0515
FLATS/ UNITS TO LET

RENTAL PROPERTY
61 MONTEREY
2 BED FLAT, AIRCONS, BALCONY, CARPORT, WASHING M/C AS NEW, RENT R6 250, DEP. REQ.
TEL: 082 570 4552

NW000868

You are the eyes and ears of the police

STOP CRIME

To report a crime phone Crime Stop 08600 10 111

MOTORING

0702	Bakkies & 4x4s
0705	Boats & Caravans & Trailers
0710	Commercial Vehicles
0715	Farm Equipment
0720	Motorcycles
0725	New Car Sales
0730	Rental and Leasing
0735	Spares/ Accessories
0740	Used Cars
0745	Vehicle Maintenance/ Services
0750	Wanted

0700
MOTORING

0740
USED CARS

CARS FROM R1 500pm

Finance problems? We can try to assist

whatsapp

Call: 072 188 7959

sm000935-20©

VACANCIES

0803	Accounting
0806	Banking/ Insurance
0809	Business
0812	Business Opportunities
0815	Computers
0818	CVs
0821	Drivers & Messengers
0824	Employment Wanted
0827	General
0830	Hairdressing & Beauty
0833	Hotel & Catering
0836	Legal
0839	Management
0841	Medical
0844	Part Times/ Temps
0847	Personnel/HR
0850	Professional
0853	Reception/ Switchboard
0856	Sales/ Marketing
0859	Security
0862	Secretary/PA
0865	Senior Citizens
0868	Technical
0871	Trade
0874	Training
0877	Domestic Employment/ Accom
0880	Domestic Employment Agencies

Child HELPLINE

08000 55 555

0800
VACANCIES

0868
TECHNICAL

WE ARE LOOKING FOR A QUALIFIED AIRCONDITIONING TECHNICIAN WITH INSTALLATIONS AND BREAKDOWN EXPERIENCE IN R /BAY AREA

- Must have drivers licence

Please send CV to - amandavdl @gmail.com

SR006095

0877
DOMESTIC EMPLOYMENT/ ACCOM.

BONGIWE
Seeks F/P/T, S/I/O, Eng, Cook, Kids, Refs
Tel: 072 341 9272

RA000120

EDWINA
Seeks F/T, S/O, Eng, Kids, Cooks, Refs
Tel: 071 889 2099

RA000126

NOBUHLE
Seeks F/P/T, S/O, Eng, Cooks, Kids, Refs
Tel: 066 200 8018

RA000121

NOMSA
Seeks F/T, S/I, Eng, Cooks, Kids, Refs
Tel: 063 932 9893/ 060 576 8691

RA000128

NOMUSA
Seeks F/T, S/I, Eng, Kids, Cooks, Refs
Tel: 073 798 3169

NW000860

NTOKOZO
Seeks F/T, S/O, Eng, Cooks, Kids, Refs
Tel: 079 486 0640

RA000132

NTOMBI
Seeks F/T, S/O, Eng, Kids, Cooks, Refs
Tel: 073 250 1115

NW000866

SIZAKELE
Seeks F/T, S/O, Eng, Cooks, Kids, Refs
Tel: 081 840 5847

NW000865

ZANDILE
Seeks F/T, S/O, Eng, Cooks, Kids, Refs
Tel: 072 549 5468

RA000129

ZONKE
Seeks F/T, S/O, Eng, Cooks, Kids, Refs
Tel: 079 970 0625

NW000844

LEGALS

0905	Auctioneers
0910	Public/Legal Notices
0915	Sale In Execution
0920	Tenders

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 Deed of Transfer Number T58069 /2006 passed by Willem Francois Kroukamp Kruger (Identity Number: 451211 5017 08 9) in respect of certain Erf 185 Mthunzini Estate, Registration Division GU, Province of KwaZulu Natal, which has been lost or destroyed and cannot be located. All interested persons having objections to the issue of such copy are hereby required to lodge the same in writing with the Registrar of Deeds at Pietermaritzburg within 2 (two) weeks from the date of publication of this notice. Dated at Empangeni this 4th day of February 2020.

Applicants : Willem Francois Kroukamp Kruger C/o : Kloppers Empangeni Inc
Address : Unit F2 The Park, Pearce Crescent, Empangeni,
3880.
Email Address : zania@kloppersinc.co.za
Contact Number : 035 772 2700

10-02-2020

SR006091

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 DEED OF GRANT TG 1919/1986 KZ Registered in the name of: ALPHEUS MPILO ZOBOLO in respect of certain ERF 865 ESIKHAWINI J which has been lost or destroyed. All interested persons having objection to the issue of such copy are hereby required to lodge the same in writing with the Registrar of Deeds at PIETERMARITZBURG within two weeks from the date of the publication of this notice.
Dated at Empangeni this 20th day of January 2020.

Applicant
CHRISTINE WADE & CO
Suite 9, Union Chambers
4 Union Street
EMPANGENI
3880
Email: convey1 @cwade.co.za
Tel: 035 7721244

10-02-2020

MA020015

FORM KKK
LOST OR DESTROYED BOND

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 Mortgage Bond Number B70668 /2006 passed by Willem Francois Kroukamp Kruger (Identitty Number: 451211 5017 08 9) in favour of ABSA Bank Limited (Registration Number: 1986/004794/06) for a capital amount of R468 000.00 (Four Hundred and Sixty Eight Thousand Rand) in respect of certain Erf 185 Mthunzini Estate, Registration Division GU, Province of KwaZulu Natal, which has been lost or destroyed and cannot be located. All interested persons having objections to the issue of such copy are hereby required to lodge the same in writing with the Registrar of Deeds at Pietermaritzburg within 2 (two) weeks from the date of publication of this notice. Dated at Empangeni this 4th day of February 2020.

Applicants : ABSA Bank Limited C/o : Kloppers Empangeni Inc
Address : Unit F2 The Park, Pearce Crescent, Empangeni,
3880.
Email Address : zania@kloppersinc.co.za
Contact Number : 035 772 2700

10-02-2020

SR006090

PUBLIC PARTICIPATION PROCESS

NOTICE TO UNDERTAKE A BASIC ASSESSMENT FOR THE PROPOSED BHOKWE COMMUNITY SANITATION INFRASTRUCTURE PROJECT IN BHOKWE, WARD 05 WITHIN THE ABAQULUSI MUNICIPALITY, KWAZULU- NATAL

EIA REFERENCE NUMBER: DC26/0001 /2020

Notice is hereby given in terms of the National Environmental Management Act (NEMA), (Act No. 107 of 1998) as amended in GNR 326 (07 April 2017) for the following initiative by Ukuza Consultants:

Project Outline: Ukuza Consultants proposes to undertake the Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 150 metres of 200 mm diameter HD uPVC piping, 110 mm diameter uPVC housing connections, an oxidation sewer treatment plant with associated evapotranspiration ponds, and approximately 37 precast, 1250 mm diameter, ring manhole covers, serving close to 112 households.
1World Consultants primary task is to conduct the environmental authorisation process. The Draft BAR will be available on request from 1World Consultants (Pty) Ltd.

PROCESS FOR INCLUSION IN THE PUBLIC PARTICIPATION PROCESS

1World Consultants (Pty) Ltd, the independent Environmental Assessment Practitioner (EAP) have been appointed by Ukuza Consultants, to undertake the required Basic Assessment and associated Public Participation Process for the proposed project.
`Interested and Affected Parties are invited to register via e-mail or fax by submitting their name, contact information and interest in the project to the environmental consultant within 30 days of this advertisement publication, for inclusion in the Participation Process.
`Copies of all documents and reports are available for review and comment, upon request from the EAP.

EAP Details: Hasan Mahomedy (B.Sc. Environmental Science)
Postal: P.O Box 2311, Westville, 3630
Email:hasan@1wc.co.za
Tel: 031 262 8327
Fax: 086 726 3619

10-02-2020

MA020035

UHLELO LOKUQHAWULA UMPHAKATHI ISAZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUHLELWA KOKUHLELWA KOMPHAKATHI WEZOBUNGAZI KOMPHAKATHI E-BHOKWE, WARD 05 NGEKHAYA LOMASIPALA WE-BAQULUSI, KWAZULU- NATAL

I-EIA INOMBOLO YEREFERENSI: DC26 /0001/2020

Ngaleso sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa Kwemvelo (i-NEMA), (uMthetho Nombolo 107 ka-1998) njengoba kuchitshiyelwe ku-GNR 326 (07 Ephreli 2017) ngaleli hlelo elilandelwa ngabacebisi be-Ukuza:

Uhlaka Lephrojekthi: Abakwa-Ukuza Abacebisi bahlongoza ukwenza i-Bhokwe Community Sanitation Project; ngokwakhiwa okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, amamitha ayi-150 ububanzi we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC izindlu, isizinda sokwelapha i-oxidation se-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye ne-precast engama-3750, 1250 mm. ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.
Umsebenzi wokuqala we-1World Consultants ukwenza inqubo yokugunyazwa kwezemvelo. I-Draft BAR izotholakala ngesicelo kwabakwa-1World Consultants (Pty) Ltd.

ISIQINISEKISO SOKUXHUMANISA UHLELO LOKUQHAWULA KOMPHAKATHI

Abakwa-1World Consultants (Pty) Ltd, oqokwe ozimele Wokuhlola Imvelo (i-EAP) baqokwe ngabakwa-Ukuza Abacebisi, ukuze benze uHlelo Lokuhlola Okuyisisekelo oludingekayo kanye nenqubo yokubamba iqhaza komphakathi ehlobene nayo.
` Izinhlaka ezithintekayo nezithintekayo ziyamenywa ukuba zibhalise nge-imeyili noma ngefeksi ngokuthumela igama lazo, imininingwane yokuxhumana nentshisekelo yephrojekthi kumeluleki wezemvelo kungakapheli izinsuku ezingama-30 kushicilelwe lesi sikhangiso, ukuze kufakwe inqubo yokuBamba iqhaza.
` Amakhophi ayo yonke imibhalo nemibiko ayatholakala ukuthi abukezwe futhi aphawulwe, uma kucelwa kwa-EAP.

EAP Details:
Hasan Mahomedy (B.Sc. Environmental Science)
Postal: P.O Box 2311, Westville, 3630
Email:hasan@1wc.co.za
Tel: 031 262 8327
Fax: 086 726 3619

10-02-2020

MA020036

www.autodealer.co.za

Hyundai Venue a happy place to be

Val van der Walt

Hyundai recently gave hatchback owners another reason to get out of their old cars and into a crossover, this time in the B-segment.

The new Venue slots in below the Hyundai's popular Tucson and Creta, and is closely related to the i20 because the two cars share a platform.

Five models are available starting with the base- Motion manual derivative at R274 900 and topping out with the Glide DCT version which is priced at R369 900.

Autodealer drove the range topper, courtesy of Tangawizi Hyundai, so here's what you can expect from this fresh Korean car:

Sweet gearbox

One engine does duty across the range, a modern turbo-charged three-cylinder 1.0-litre petrol unit which has been tuned to deliver 88kW and 172Nm.

Here, it's worth noting that power output is quite high because most manufacturers making use of pressurized 1.0-litres, stick to the lower and mid 80s.

The Venue is compact and light, so that 88kW is more than enough to ensure satisfactory results in all road scenarios like overtaking on a highway.

Even from 120km/h, the Venue Autodealer tested had no qualms when asked to speed up to 140 in order to execute a safe and swift overtaking manoeuvre.

Having driven manual and auto versions - the latter equipped with Hyundai's 'DCT' transmission - it has to be said that the automatic is the clear winner because it's just the sweetest little box.

Essentially the DCT is the same as VW's famed and much loved DSG transmission and behaves similarly with super fast, accurate and seamless shifts.

Inside, the Venue is a very neat little car with the range topping Glide DCT sporting sturdy bucket seats, an eight-inch touchscreen high-up in the centre of the dash and even a start/stop button.

The seats, especially, are the best Autodealer have seen in a long time; made up from a mix of durable canvas-feel material and leather panels.

They are comfortable too, and offer a high vantage point which makes for comfortable driving in traffic and easier parking.

Interior space is a tad on the tight side because the Venue is not a big car, but the boot is deep and will be able to cope with a family of three's luggage without you having to be the Tetris world champion. Overall interior execution is good with decent materials used throughout the cabin and a pleasant mix of different styles and textures.

On the higher spec'ed models the air-con temperature dial is also a digital display and shows you what's blowing - a nice touch!

Verdict

The Venue is another good passenger car from the company that is busy carving out a good name for itself in the passenger car market. Whether it's the drivetrain or the interior fit and finish, the compact crossover's build-quality cannot be faulted and it looks good, too.

On the highway it gets pushed around somewhat by crosswinds but that's to be expected from a small, lightweight vehicle with such a high profile.

As for safety equipment, the Venue is well kitted out with ABS, EBD, ESP and even Hill Start Assists standard across the range. Luxury and convenience features are also ample, especially from the mid-spec Fluid models upwards.

So, if a Creta is what you want but it's out of your budget, its little brother is worth looking at.

NEW VEHICLE SPECIALS

MITSUBISHI MOTORS
Drive your Ambition

Vehicle	Listed retail price	Discount	Special Price	Estimated Instalment 0% Deposit
ASX 2.0 ES Manual	R364 995	R20 000	R344 995	R5 848
ASX 2.0 ES CVT	R384 995	R25 000	R359 995	R6 099
Eclipse Cross 2.0 CVT	R409 995	R25 000	R384 995	R6 516
Eclipse Cross 2.0 CVT AWD	R449 995	R40 000	R409 995	R6 933
Outlander 2.4 Exceed CVT	R559 995	R35 000	R524 995	R8 852
Pajero Sport 2.4 4x2 A/T	R589 995	R40 000	R549 995	R9 269
Pajero Sport 2.4 4x4 A/T	R639 995	R40 000	R599 995	R10 103
Triton 2.4 4x2 Manual	R519 995	R35 000	R484 995	R8 184
Triton 2.4 4x2 A/T	R539 995	R40 000	R499 995	R8 601
Triton 2.4 4x4 A/T	R599 995	R40 000	R559 995	R9 436

'NEW ASX COMING SOON'

Estimated instalments calculated as follows: 72 months, 12% interest rate, 30% residual. Trade-ins welcome. Prices exclude admin fee of R6500 and bank initiation fee of R68

*Offer valid while stocks last. Terms and conditions apply.

MCCARTHY INYANGA EMPANGENI 035 901 7500

Thulani Sibiya 082 218 4229 • Julz Appel 071 181 1355 • 1 John Ross Highway, Empangeni

ZR204108-20©E

KING CETSHWAYO

WITHDRAWAL NOTICE

TENDER REFERENCE: KCDM/42/2019

TENDER FOR THE MOTORISED WATER TANKER SERVICES WITHIN KING CETSHWAYO DISTRICT MUNICIPALITY AREA OF JURISDICTION FOR THE PERIOD ENDING JUNE 2022

The King Cetshwayo District Municipality wishes to extend a public notice for the official withdrawal of the above-mentioned tender, advertised on the **27th of January 2020**, due to unforeseen circumstances.

All enquiries must be directed to **Xolani Mthembu, tel. 035 799 2521.**

The Municipal Council apologises for any inconvenience caused in this regard.

SAFCOL
OUR FORESTS. OUR FUTURE.

ROUND LOGS FOR SALE FOR THE REMAINING PERIOD OF THE 2019/2020 FINANCIAL YEAR

A total volume of ±270 000m³ (all log classes) has become available for sale from February 2020 to 31 March 2020. The volume is being offered for the remaining period of the current financial year (2019/2020) at a discount.

The volume is on offer from Komatiland Forests plantations in KwaZulu-Natal, Mpumalanga and Limpopo.

Clients will be required to make payment as per KLF's normal terms and conditions of trade.

Interested parties should contact **Noko Rammutla** and **Elsina Mahlase** at the Log Marketing and Sales Office on:

Noko: tel. 013 754 2849 / email: **noko.rammutla@safcol.co.za**

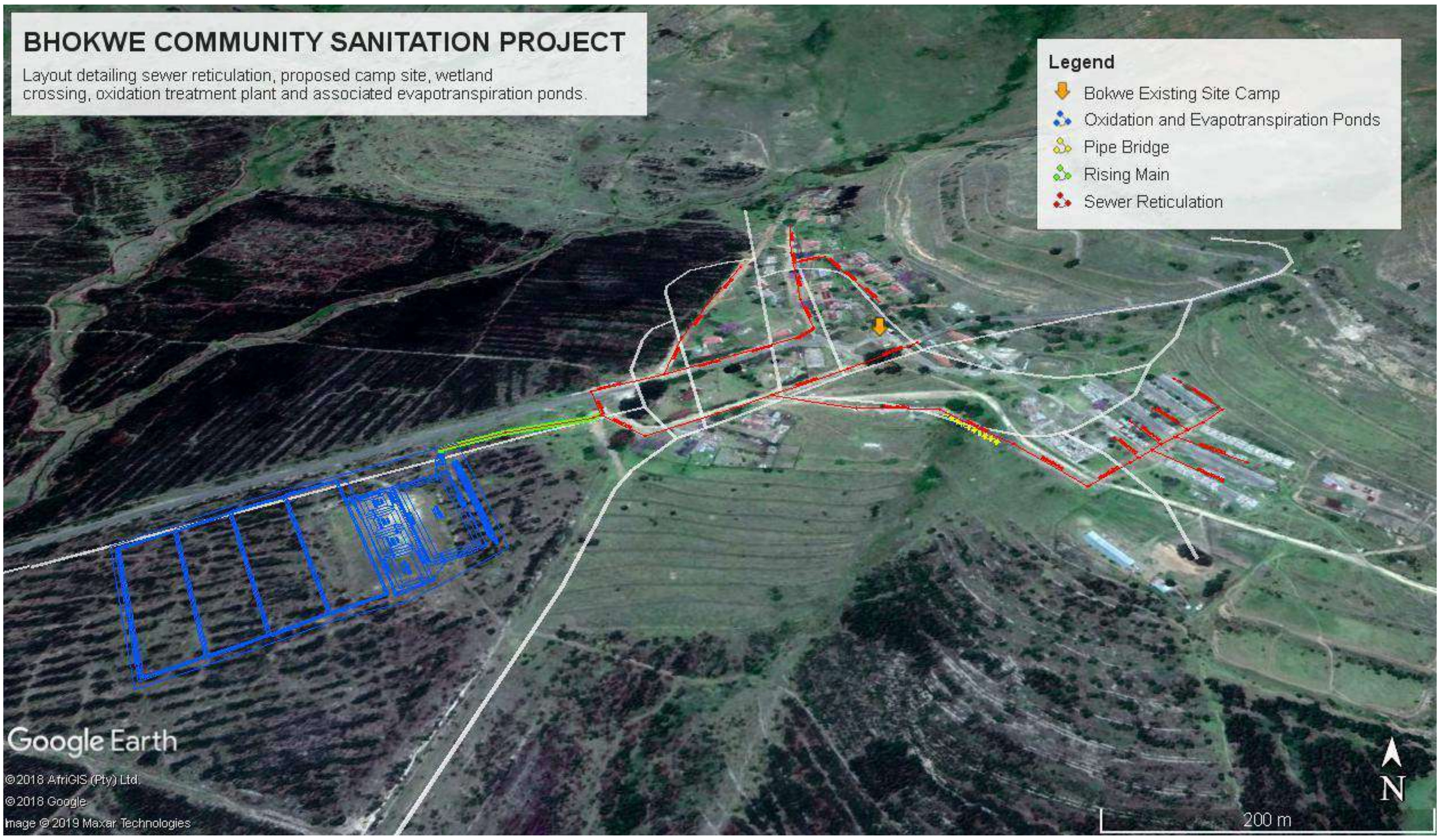
Elsina: cell: 083 809 1339 / email: **elsina@safcol.co.za**

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

NOTICE TO UNDERTAKE A BASIC ASSESSMENT FOR THE PROPOSED NEW SEWAGE RETICULATION IN BHOKWE COMMUNITY, ABAQULUSI MUNICIPALITY, KWAZULU-NATAL

Notice is hereby given in terms of the National Environmental Management Act (NEMA), (Act No 107 of 1998) published in GN 326 (07 April 2017), of intent to carry out a Basic Assessment Report for the installation of a new sewage reticulation to service Ward 05, Bhokwe, to eliminate the use of conservancy tanks and pit latrines.

EIA REFERENCE NUMBER: DC26/0001/2020



<u>Project Details:</u> Ukuza Consultants proposes to undertake the Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 150 meters of 200 mm diameter HD uPVC piping, 110 mm diameter uPVC housing connections, an oxidation sewer treatment plant with associated evapotranspiration ponds, and approximately 37 precast, 1250 mm diameter, ring manhole covers, serving close to 112 households.

1World Consultants (Pty) Ltd who is the independent Environmental Assessment Practitioner (EAP) has been appointed by Ukuza Consultants, to undertake the required Environmental Assessment process and the associated public participation process for the proposed project. Interested and Affected Parties (I&APs) must register via email by submitting their name, contact information and interest in the project using the contact details below.

Hasan Mahomedy *(Environmental Assessment Practitioner)*
Postal: P.O. Box 2311, Westville, 3630
Email: hasan@1wc.co.za
Tel: 031 262 8327
Fax: 086 726 3619

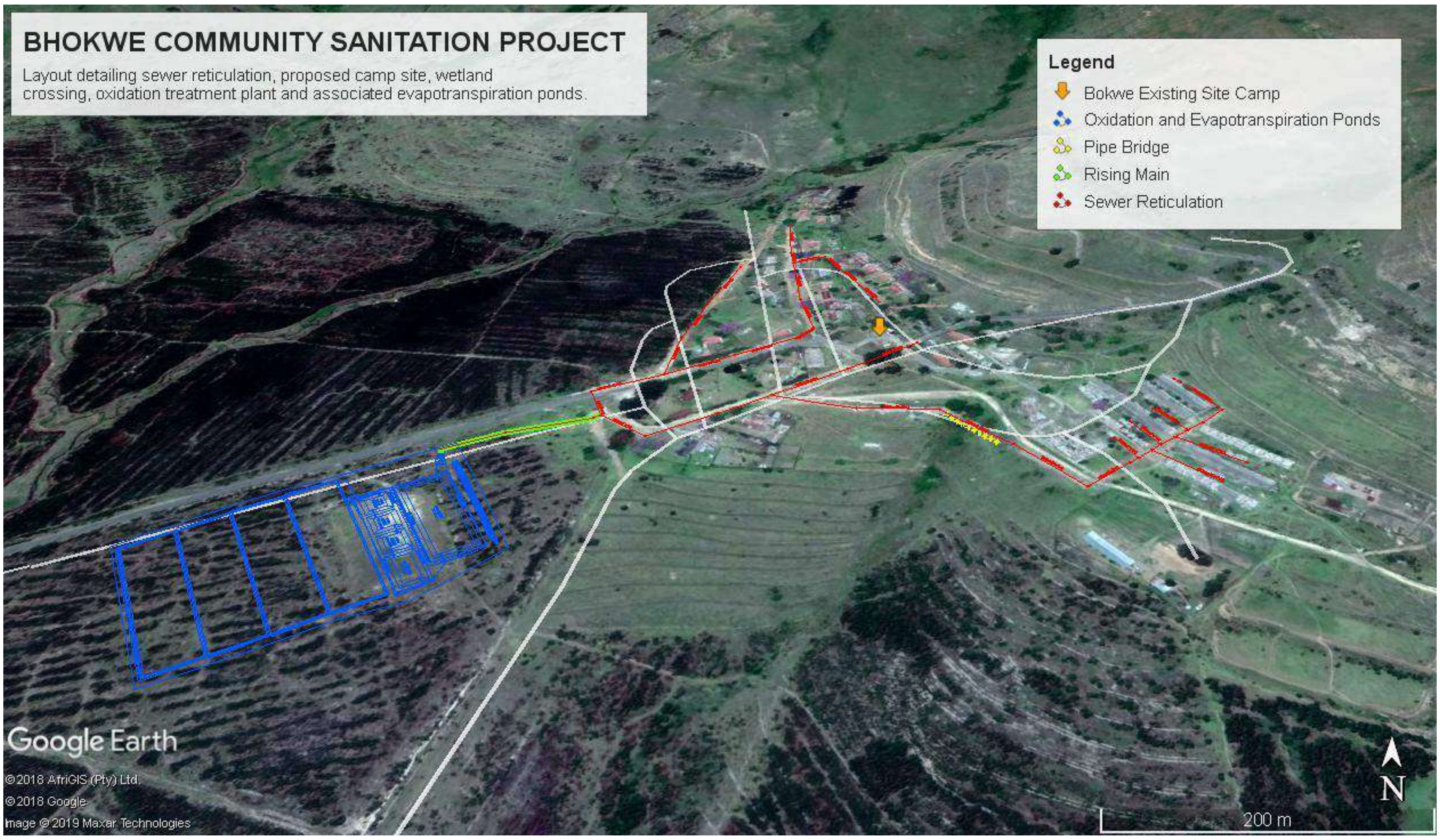
Date of this Notice: 06 February 2020

ISIQINISEKISO SOKUQINISEKISA IMEYA

ISAZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUTHENGWA KOMNYANGO OMUSHA WOKUXHUMANYWA KOMNYANGO WEBHOKWE, UMASIPALA we-BAQULUSI, KWAZULU-NATAL

Ngaleso sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa Kwezemvelo (i-NEMA), (uMthetho Nomb. 107 ka-1998) oshicilelwe ku-GN 326 (07 Ephreli 2017), ngenhloso yokufeza uMbiko Wokuhlola Okuyisisekelo ukufakwa komshini omusha wokugcwala kwendle ukusebenza ku-Ward 05, Bhokwe, ukuqeda ukusetshenziswa kwamathangi okulondolozwa kanye nemithambo yokumba imigodi.

IMINININGWANE YOKUZEZA EIA: DC26/0001/2020



Imininingwane Yephrojekthi: Abacebisi be-Ukuza bahlongoza ukwenza i-Bhokwe Community Sanitation Project; ngokwakhiwa okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, amamitha ayi-150 ububanzi we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC izindlu, isizinda sokwelapha i-oxidation se-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye ne-precast engama-3750, 1250 mm. ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.

Abakwa-1World Consultants (Pty) Ltd obesebenza ngokuzimeleyo kwi-Environmental Practitioner (EAP) baqokwe ngabakwa-Ukuza Abacebisi, ukuthi benze inqubo edingekayo yokuHlolwa kweMvelo kanye nenqubo yokubamba iqhaza yomphakathi ehlobene nayo. Amaqembu Anentshisekelo Nathintekayo (I & APs) kufanele abhalise nge-imeyili ngokuthumela igama lawo, imininingwane yokuxhumana nentshisekelo yephrojekthi esebenzisa imininingwane yokuxhumana engezansi.

Hasan Mahomedy *(UmSebenzisi Wokuhlola Imvelo)*
Iposi: P.O. Box 2311, Westville, 3630
i-imeyili: hasan@1wc.co.za
Ngocingo: 031 262 8327
Ifeksi: 086 726 3619

Usuku lwesaziso: 06 February 2020

ISIQINISEKISO SOKUQINISEKISA [illegible]

ISAZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUTHE[illegible] OMUSHA WOKUXHUMANYWA KOMNYANGO WEBHOKWE, [illegible] BAQULUSI, KWAZULU-NATAL

Ngalesi sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa [illegible] Nomb. 107 ka-1998) oshicilelwe ku-GN 326 (07 Ephreli 2017), ngenhloso yokufeza [illegible] ukufakwa komshini omusha wokugcwala kwendle ukusebenza ku-Ward 05, Bhokwe, [illegible] kwamabhangi okulondolozwa kanye nemithambo yokumba imigodi.

IMININGWANE YOKUZEZA EIA: DC26/0001/202[illegible]

[illegible] Yephrojekthi: Abacebisi be-Ukuza bahlongoza ukwenza i-Bhokwe Community [illegible] okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, [illegible] we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC [illegible] we-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye [illegible] ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.

[illegible] World Consultants (Pty) Ltd obesebenza ngokuzimeleyo kwi-Environmental [illegible] Ukuza Abacebisi, ukuthi benze inqubo edingekayo yokuHlolwa kweMvelo [illegible] ehlobene nayo. Amaqembu Anentshisekelo Nathintekayo (I & APs) [illegible] igama lawo, imininingwane yokuxhumana nentshisekelo yephrojekthi [illegible] engezansi.

[illegible] (UmSebenzisi Wokuhlola Imvelo)
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[illegible]@1wc.co.za
[illegible] 262 8327
[illegible] 726 3619

Usuku [illegible] 2020

ENVIRONMENTAL IMPACT ASSESSMENT PROCES

NOTICE TO UNDERTAKE A BASIC ASSESSMENT FOR THE PROPOSE
SEWAGE RETICULATION IN BHOKWE COMMUNITY, ABAQULUSI MUN
KWAZULU-NATAL

Notice is hereby given in terms of the National Environmental Management Act (NEMA), (Act published in GN 326 (07 April 2017), of intent to carry out a Basic Assessment Report for the sewage reticulation to service Ward 05, Bhokwe, to eliminate the use of conservancy tanks and pit

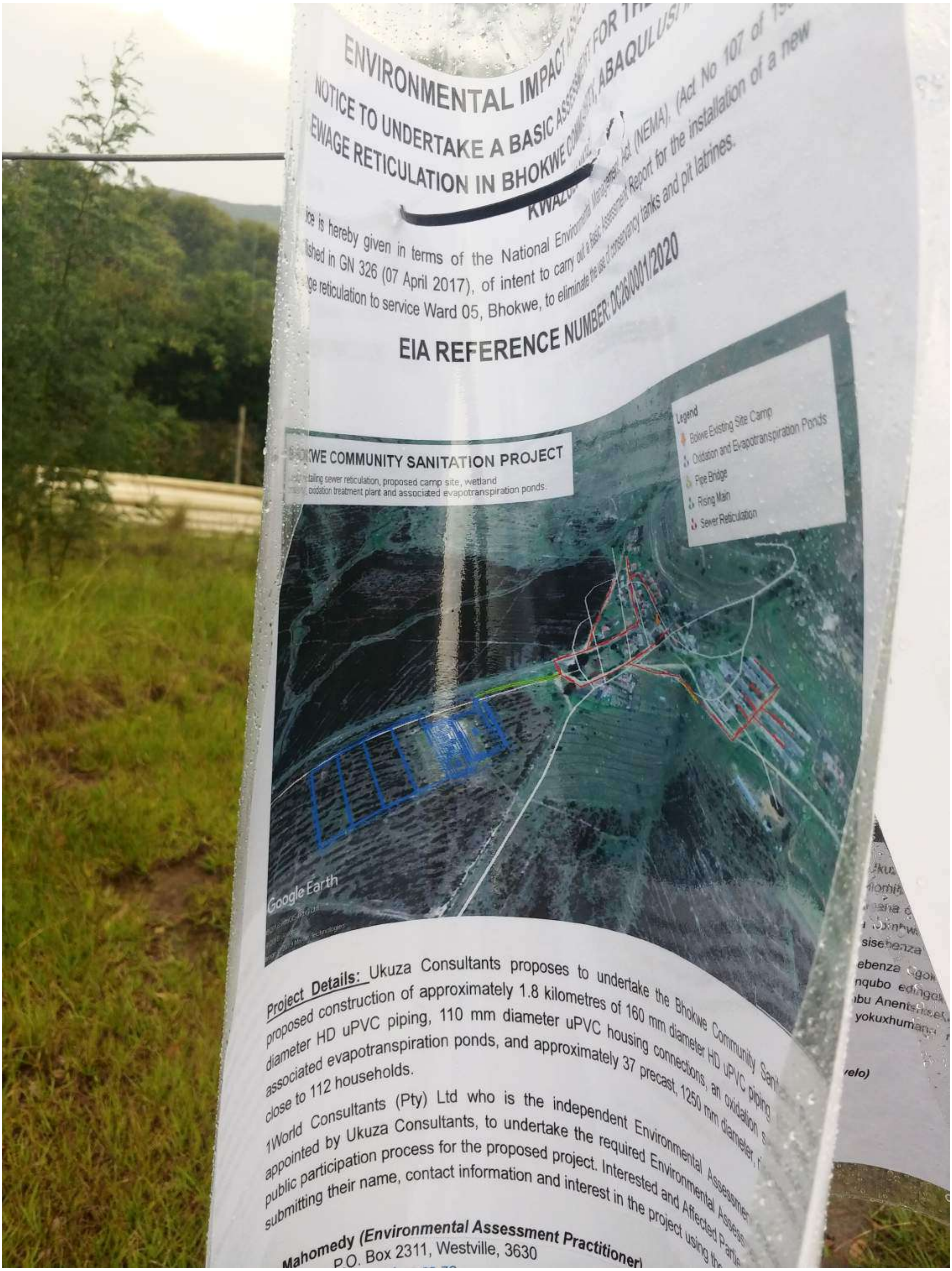
EIA REFERENCE NUMBER: DC26/0001/2020

Project Details: Ukuza Consultants proposes to undertake the Bhokwe Community Sanitation proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 50 diameter HD uPVC piping, 110 mm diameter uPVC housing connections, an oxidation sewer associated evapotranspiration ponds, and approximately 37 precast, 1250 mm diameter ring close to 112 households.

1World Consultants (Pty) Ltd who is the independent Environmental Assessment Practitioner appointed by Ukuza Consultants, to undertake the required Environmental Assessment process public participation process for the proposed project. Interested and Affected Parties (I&APs) submitting their name, contact information and interest in the project using the contact details below

Hasan Mahomedy (*Environmental Assessment Practitioner*)
Postal: P.O. Box 2311, Westville, 3630
Email: hasan@1wc.co.za
Tel: 031 262 8327
Fax: 086 726 3619

Date of this Notice



ENVIRONMENTAL IMPACT ASS FOR TH

NOTICE TO UNDERTAKE A BASIC ASSESSMENT FOR THE BHOKWE COMMUNITY, ABAQULUSI

EWAGE RETICULATION IN BHOKWE COMMUNITY, ABAQULUSI

KWAZ

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ge reticulation to service Ward 05, Bhokwe, to eliminate the use of conservancy tanks and pit latrines.

EIA REFERENCE NUMBER: DC26/0001/2020

KWE COMMUNITY SANITATION PROJECT

tailing sewer reticulation, proposed camp site, wetland

oxidation treatment plant and associated evapotranspiration ponds.

Legend
- Bokwe Existing Site Camp
- Oxidation and Evapotranspiration Ponds
- Pipe Bridge
- Rising Main
- Sewer Reticulation

Google Earth

Project Details: Ukuza Consultants proposes to undertake the Bhokwe Community Sani
proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping
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associated evapotranspiration ponds, and approximately 37 precast, 1250 mm diameter,
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Mahomedy (*Environmental Assessment* Practitioner)
P.O. Box 2311, Westville, 3630

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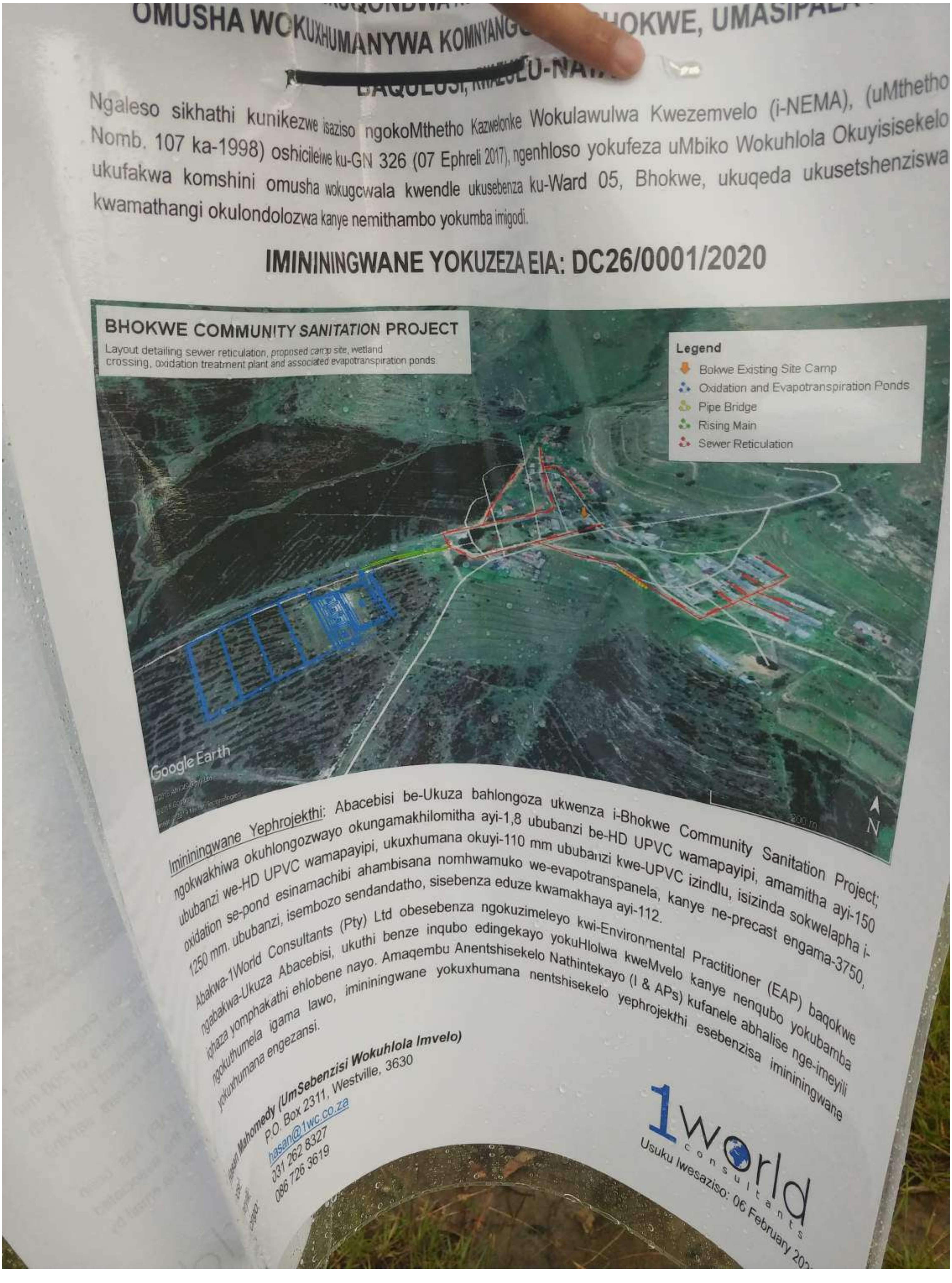

OMUSHA WOKUXHUMANYWA KOMNYANG HOKWE, UMASIPALA

[redacted] BAQULUSI, ZULU-NAT

Ngaleso sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa Kwezemvelo (i-NEMA), (uMthetho Nomb. 107 ka-1998) oshicileiwe ku-GN 326 (07 Ephreli 2017), ngenhloso yokufeza uMbiko Wokuhlola Okuyisisekelo ukufakwa komshini omusha wokugcwala kwendle ukusebenza ku-Ward 05, Bhokwe, ukuqeda ukusetshenziswa kwamathangi okulondolozwa kanye nemithambo yokumba imigodi.

IMINININGWANE YOKUZEZA EIA: DC26/0001/2020

BHOKWE COMMUNITY *SANITATION* PROJECT

Layout detailing sewer reticulation, proposed camp site, wetland crossing, oxidation treatment plant and associated evapotranspiration ponds.

Legend

- Bokwe Existing Site Camp
- Oxidation and Evapotranspiration Ponds
- Pipe Bridge
- Rising Main
- Sewer Reticulation

Imininingwane Yephrojekthi: Abacebisi be-Ukuza bahlongoza ukwenza i-Bhokwe Community Sanitation Project; ngokwakhiwa okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, amamitha ayi-150 ububanzi we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC izindlu, isizinda sokwelapha i-oxidation se-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye ne-precast engama-3750, 1250 mm. ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.

Abakwa-1World Consultants (Pty) Ltd obesebenza ngokuzimeleyo kwi-Environmental Practitioner (EAP) baqokwe ngababakwa-Ukuza Abacebisi, ukuthi benze inqubo edingekayo yokuHlolwa kweMvelo kanye nenqubo yokubamba iqhaza yomphakathi ehlobene nayo. Amaqembu Anentshisekelo Nathintekayo (I & APs) kufanele abhalise nge-imeyili ngokuthumela igama lawo, imininingwane yokuxhumana nentshisekelo yephrojekthi esebenzisa imininingwane yokuxhumana engezansi.

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1World consultants

Usuku lwesaziso: 06 February 20

ISIQINISEKISO SOKUQINISEKISA IMEYA

ISAZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUTHENGWA KOMN
OMUSHA WOKUXHUMANYWA KOMNYANGO WEBHOKWE, UMASIPALA
BAQULUSI, KWAZULU-NATAL

Ngaleso sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa Kwezemvelo (I-NEM
Nomb. 107 ka-1998) oshicilelwe ku-GN 326 (07 Ephreli 2017), ngenhloso yokufeza uMbiko Wokuhlola
ukufakwa komshini omusha wokugcwala kwendle ukusebenza ku-Ward 05, Bhokwe, ukuqeda uk
kwamathangi okulondolozwa kanye nemithambo yokumba imigodi.

IMININININGWANE YOKUZEZA EIA: DC26/0001/2020

<u>Imininingwane Yephrojekthi</u>: Abacebisi be-Ukuza bahlongoza ukwenza i-Bhokwe Community Sanitation Proje
ngokwakhiwa okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, amamitha ayi-1
ububanzi we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC izindlu, isizinda sokwelapha
oxidation se-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye ne-precast engama-375
1250 mm ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.

Abakwa-1World Consultants (Pty) Ltd obesebenza ngokuzimeleyo kwi-Environmental Practitioner (EAP) baqokwe
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ngokuthumela igama lawo, imininingwane yokuxhumana nentshisekelo yephrojekthi esebenzisa imininingwane
yokuxhumana engezansi.

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Usuku lwesaziso: 06 February 2020

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

NOTICE TO UNDERTAKE A BASIC ASSESSMENT FOR THE PROPOSED NEW SEWAGE RETICULATION IN BHOKWE COMMUNITY, ABAQULUSI MUNICIPALITY, KWAZULU-NATAL

Notice is hereby given in terms of the National Environmental Management Act (NEMA), (Act No 107 of 1998) published in GN 326 (07 April 2017), of intent to carry out a Basic Assessment Report for the installation of a new sewage reticulation to service Ward 05, Bhokwe, to eliminate the use of conservancy tanks and pit latrines.

EIA REFERENCE NUMBER: DC26/0001/2020

BHOKWE COMMUNITY SANITATION PROJECT

Layout detailing sewer reticulation, proposed camp site, wetland crossing, oxidation treatment plant and associated evapotranspiration ponds

Project Details: Ukuza Consultants proposes to undertake the Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 150 meters of 200 mm diameter HD uPVC piping, 110 mm diameter uPVC housing connections, an oxidation sewer treatment plant with associated evapotranspiration ponds, and approximately 37 precast, 1250 mm diameter, ring manhole covers, serving close to 112 households.

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1world consultants

Date of this Notice: 06 February 2020

Hasan Mahomedy *(Environmental Assessment Practitioner)*
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031 262 8327
06 3619


ENVIRONMENTAL IMPACT A ENT PROCESS
UNDERTAKE A BASIC ASSES THE PROPOSED NEW
RETICULATION IN BHOKWE COMM ABAQULUSI MUNICIPALITY,
KWAZULU
EIA REFERENCE NUM /2020
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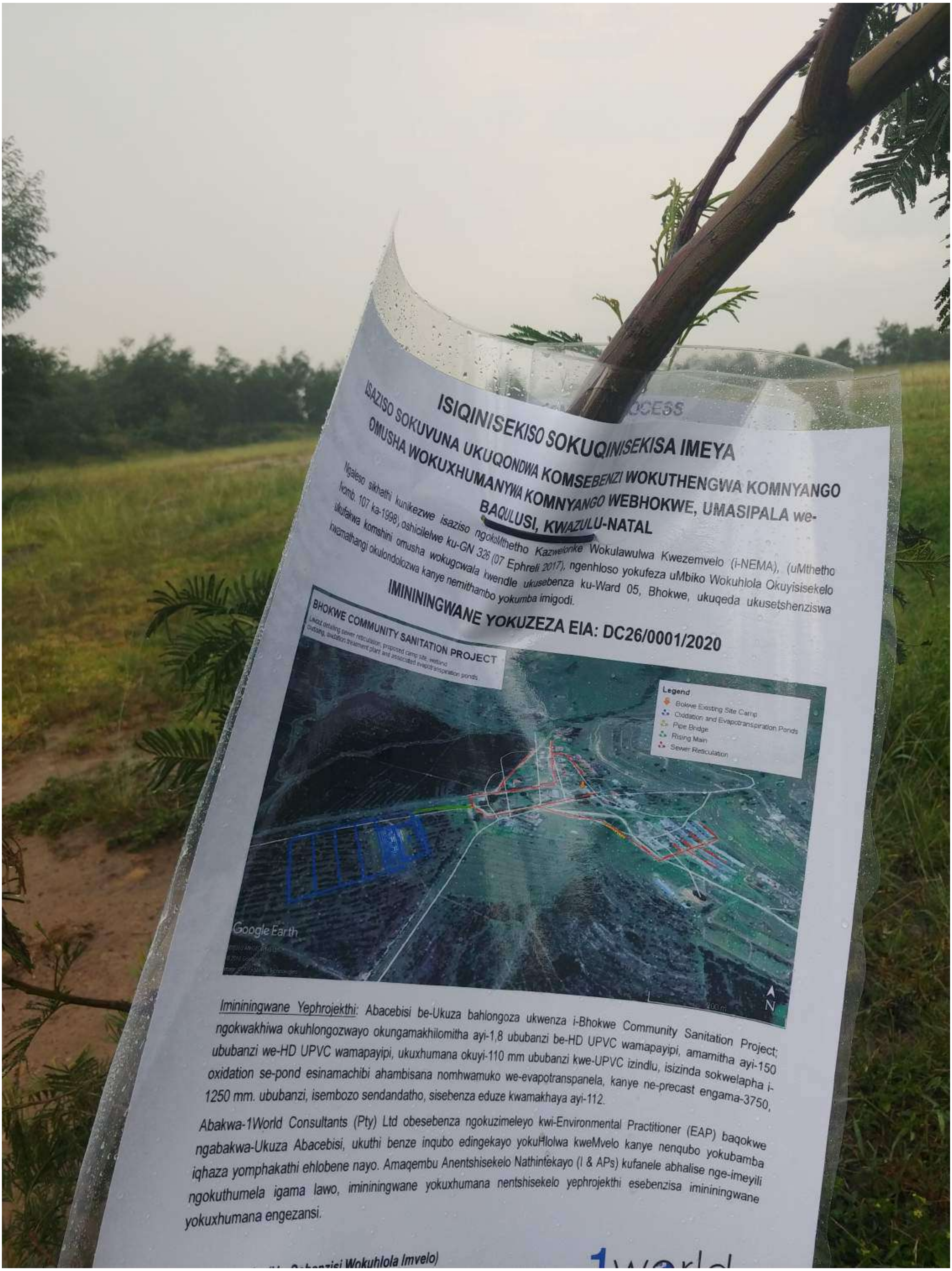

ISIQINISEKISO SOKUQINISEKISA IMEYA

ISAZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUTHENGWA KOMNYANGO OMUSHA WOKUXHUMANYWA KOMNYANGO WEBHOKWE, UMASIPALA we-BAQULUSI, KWAZULU-NATAL

Ngaleso sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa Kwezemvelo (i-NEMA), (uMthetho Nomb. 107 ka-1998), oshicilelwe ku-GN 326 (07 Ephreli 2017), ngenhloso yokufeza uMbiko Wokuhlola Okuyisisekelo ukufakwa komshini omusha wokugcwala kwendle ukusebenza ku-Ward 05, Bhokwe, ukuqeda ukusetshenziswa kwamathangi okulondolozwa kanye nemithambo yokumba imigodi.

IMININGWANE YOKUZEZA EIA: DC26/0001/2020

Imininingwane Yephrojekthi: Abacebisi be-Ukuza bahlongoza ukwenza i-Bhokwe Community Sanitation Project; ngokwakhiwa okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, amamitha ayi-150 ububanzi we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC izindlu, isizinda sokwelapha i-oxidation se-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye ne-precast engama-3750, 1250 mm. ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.

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Wokuhlola Imvelo)

ISIQINISEKISO SOKUQINISEKISA IMEYA

ZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUTHENGWA KOMNYANGO OMUSHA WOKUXHUMANYWA KOMNYANGO WEBHOKWE, UMASIPALA we-BAQULUSI, KWAZULU-NATAL

sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa Kwezemvelo (i-NEMA), (uMthetho 107 ka-1998) ochicilelwe ku-GN 326 (07 Ephreli 2017), ngenhloso yokufeza uMbiko Wokuhlola Okuyisisekelo komshini omusha wokugcwala kwendle ukusebenza ku-Ward 05, Bhokwe, ukuqeda ukusetshenziswa okulondolozwa kanye nemithambo yokumba imigodi.

IMININGWANE YOKUZEZA EIA: DC26/0001/2020

<ins>Imininingwane Yephrojekthi</ins>: Abacebisi be-Ukuza bahlongoza ukwenza i-Bhokwe Community Sanitation Project; ngokwakhiwa okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, amamitha ayi-150 ububanzi we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC izindlu, isizinda sokwelapha i-oxidation se-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye ne-precast engama-3750, 1250 mm. ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.

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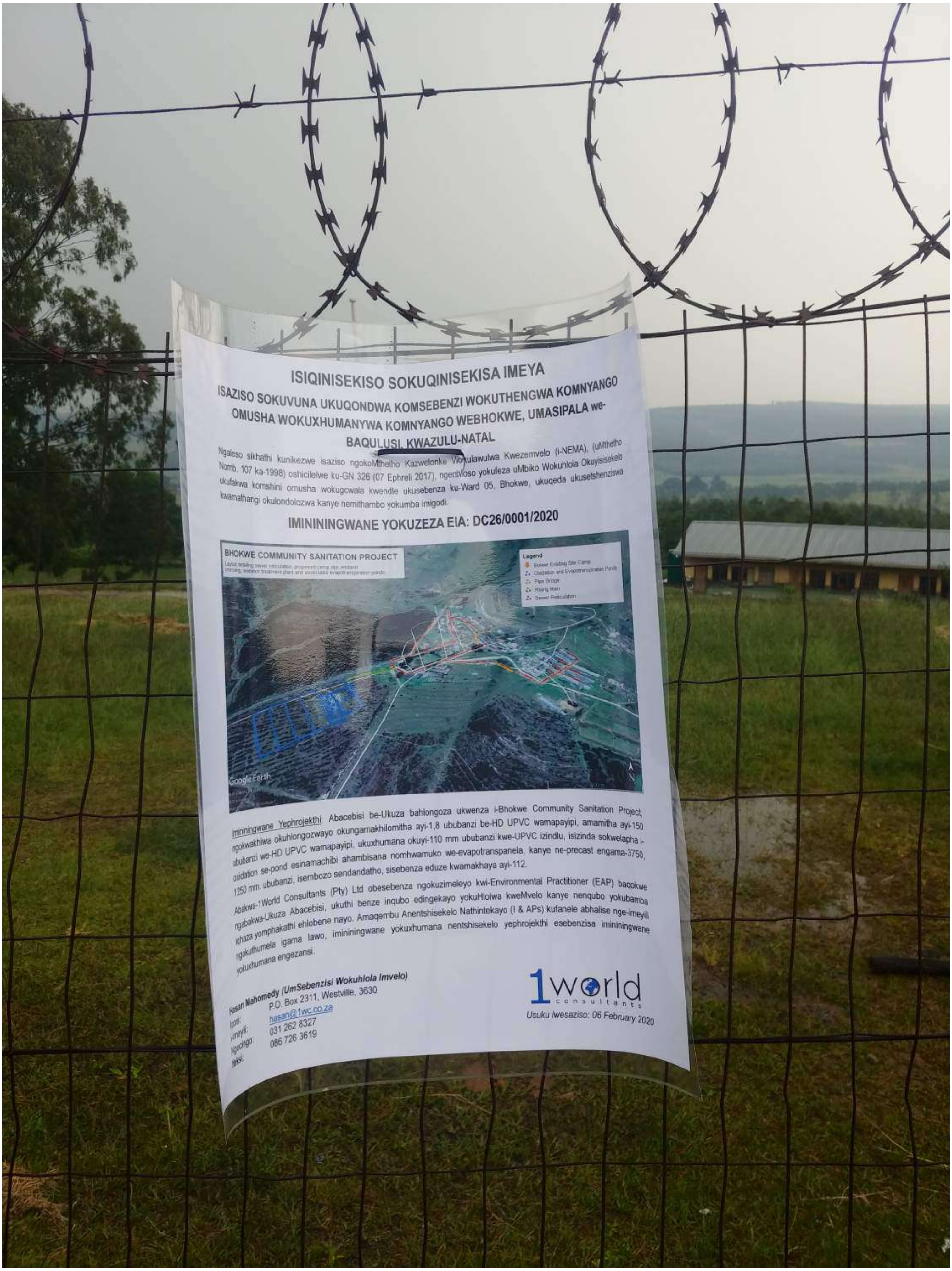

ISIQINISEKISO SOKUQINISEKISA IMEYA

ISAZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUTHENGWA KOMNYANGO OMUSHA WOKUXHUMANYWA KOMNYANGO WEBHOKWE, UMASIPALA we-BAQULUSI, KWAZULU-NATAL

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Hasan Mahomedy *(UmSebenzisi Wokuhlola Imvelo)*
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Ifeksi: 086 726 3619

1world consultants

Usuku lwesaziso: 06 February 2020

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

NOTICE TO UNDERTAKE A BASIC ASSESSMENT FOR THE PROPOSED NEW SEWAGE RETICULATION IN BHOKWE COMMUNITY, ABAQULUSI MUNICIPALITY, KWAZULU-NATAL

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EIA REFERENCE NUMBER: DC26/0001/2020

Project Details: Ukuza Consultants proposes to undertake the Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 150 meters of 200 mm diameter HD uPVC piping, 110 mm diameter uPVC housing connections, an oxidation sewer treatment plant with associated evapotranspiration ponds, and approximately 37 precast, 1250 mm diameter, ring manhole covers, serving close to 112 households.

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Postal: P.O. Box 2311, Westville, 3630
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Date of this Notice: 06 February 2020

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

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Date of this Notice: 06 February 2020


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YOKUZEZA EIA: DC

RONMENTAL IMPACT ASSESSMENT

UNDERTAKE A BASIC ASSESSMENT

TICULATION IN BHOKWE COMMUNITY, AL

KWAZULU-NATAL

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A REFERENCE NUMBER: DC26/0001/20

ISIQINISEKISO SOKUQINISEKISA IMEYA

ISAZISO SOKUVUNA UKUQONDWA KOMSEBENZI WOKUTHENGWA KOMNYANGO OMUSHA WOKUXHUMANYWA KOMNYANGO WEBHOKWE, UMASIPALA we-BAQULUSI, KWAZULU-NATAL

[redacted]

Ngaleso sikhathi kunikezwe isaziso ngokoMthetho Kazwelonke Wokulawulwa Kwezemvelo (i-NEMA), (uMthetho Nomb. 107 ka-1998) oshicilelwe ku-GN 326 (07 Ephreli 2017), ngenhloso yokufeza uMbiko Wokuhlola Okuyisisekelo ukufakwa komshini omusha wokugcwala kwendle ukusebenza ku-Ward 05, Bhokwe, ukuqeda ukusetshenziswa kwamathangi okulondolozwa kanye nemithambo yokumba imigodi.

IMININININGWANE YOKUZEZA EIA: DC26/0001/2020

Imininingwane Yephrojekthi: Abacebisi be-Ukuza bahlongoza ukwenza i-Bhokwe Community Sanitation Project; ngokwakhiwa okuhlongozwayo okungamakhilomitha ayi-1,8 ububanzi be-HD UPVC wamapayipi, amamitha ayi-150 ububanzi we-HD UPVC wamapayipi, ukuxhumana okuyi-110 mm ububanzi kwe-UPVC izindlu, isizinda sokwelapha i-oxidation se-pond esinamachibi ahambisana nomhwamuko we-evapotranspanela, kanye ne-precast engama-3750, 1250 mm. ububanzi, isembozo sendandatho, sisebenza eduze kwamakhaya ayi-112.

Abakwa-1World Consultants (Pty) Ltd obesebenza ngokuzimeleyo kwi-Environmental Practitioner (EAP) baqokwe ngabakwa-Ukuza Abacebisi, ukuthi benze inqubo edingekayo yokuHlolwa kweMvelo kanye nenqubo yokubamba iqhaza yomphakathi ehlobene nayo. Amaqembu Anentshisekelo Nathintekayo (I & APs) kufanele abhalise nge-imeyili ngokuthumela igama lawo, imininingwane yokuxhumana nentshisekelo yephrojekthi esebenzisa imininingwane yokuxhumana engezansi.

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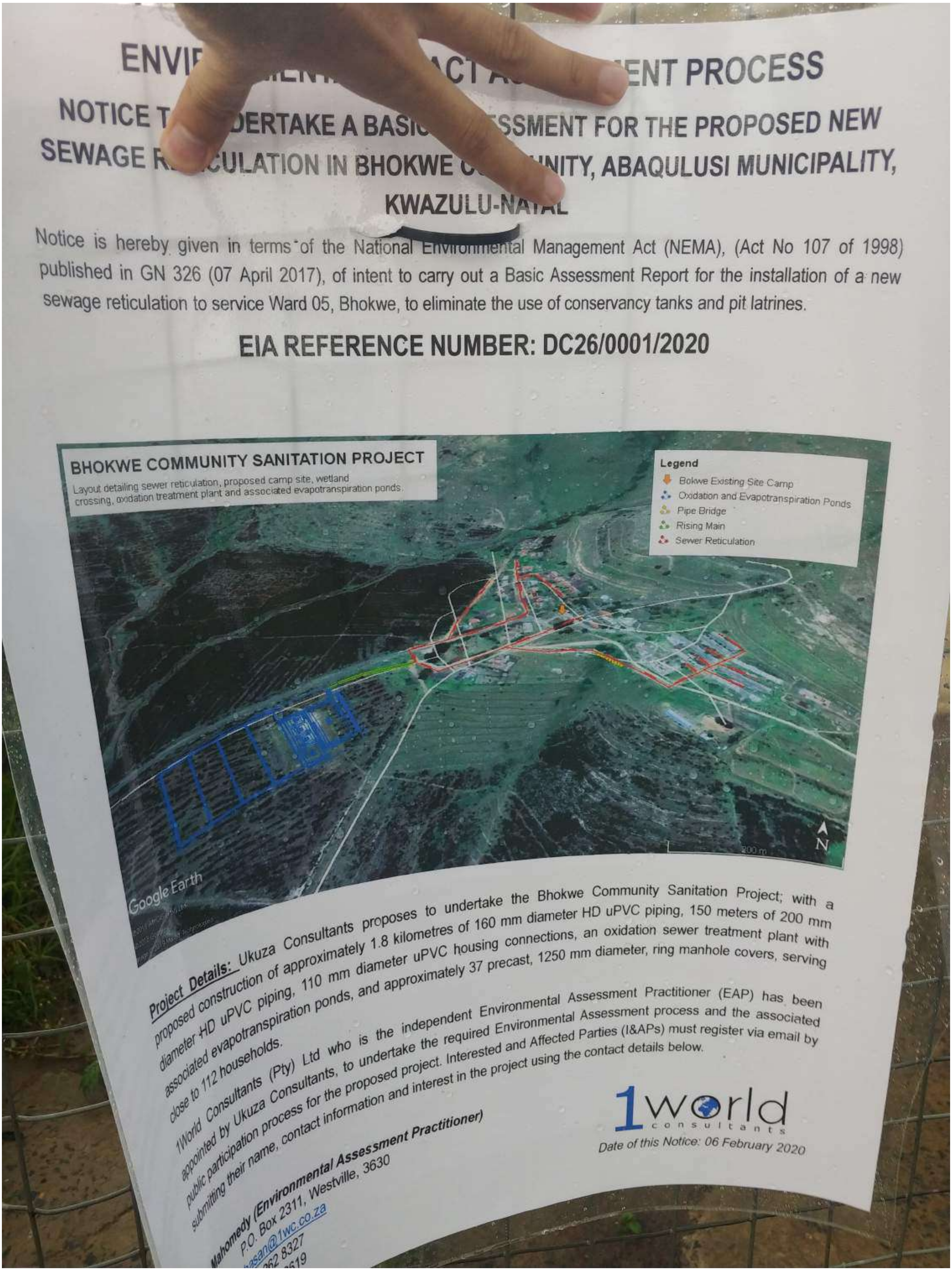
1world consultants
Usuku lwesaziso: 06 February 2020



ENVI[illegible] ACT A[illegible]ENT PROCESS

NOTICE T[illegible] DERTAKE A BASI[illegible] SSMENT FOR THE PROPOSED NEW SEWAGE R[illegible] CULATION IN BHOKWE C[illegible] NITY, ABAQULUSI MUNICIPALITY, KWAZULU-NATAL

Notice is hereby given in terms of the National Environmental Management Act (NEMA), (Act No 107 of 1998) published in GN 326 (07 April 2017), of intent to carry out a Basic Assessment Report for the installation of a new sewage reticulation to service Ward 05, Bhokwe, to eliminate the use of conservancy tanks and pit latrines.

EIA REFERENCE NUMBER: DC26/0001/2020

Project Details: Ukuza Consultants proposes to undertake the Bhokwe Community Sanitation Project; with a proposed construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 150 meters of 200 mm diameter HD uPVC piping, 110 mm diameter uPVC housing connections, an oxidation sewer treatment plant with associated evapotranspiration ponds, and approximately 37 precast, 1250 mm diameter, ring manhole covers, serving close to 112 households.

1World Consultants (Pty) Ltd who is the independent Environmental Assessment Practitioner (EAP) has been appointed by Ukuza Consultants, to undertake the required Environmental Assessment process and the associated public participation process for the proposed project. Interested and Affected Parties (I&APs) must register via email by submitting their name, contact information and interest in the project using the contact details below.

Mahomedy (Environmental Assessment Practitioner)
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1world consultants

Date of this Notice: 06 February 2020

Appendix E

WETLAND IMPACT ASSESSMENT

PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, ABAQULUSI LOCAL MUNICIPALITY, KWAZULU-NATAL

Prepared for:

1World Consultants

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Prepared by:

Morningside,
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Tel: 078 023 0532
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Final Version
December 2019

Declaration of Independence by Specialist

I, Rowena Harrison in my capacity as specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Have and will not have vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- Based on information provided to me by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional ability.

RHarrison

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Rowena Harrison

SACNASP Reg. No. 400715/15

Date: 2nd December 2019

EXECUTIVE SUMMARY

Malachite Ecological Services was appointed by 1World Consultants to undertake a Wetland Impact Assessment for the proposed Bhokwe Community Sanitation Project. This project involves the construction of 2.2km of 160mmØ uPVC sewer reticulation, 110 mmØ uPVC housing connections, 165 m of 200mmØ uPVC sewer reticulation, oxidation sewer ponds and numerous 1250mmØ precast concrete ring manholes. The oxidation sewer ponds will be lined by HDPE lining and the evapotranspiration bed lined. This is to ensure that there is zero discharge from the ponds.

The terms of reference for the current study were as follows:

- Identify and delineate any wetland and/or watercourse systems within the defined study site as well as within a 500m assessment area according to the Department of Water Affairs and Forestry[1] "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Classify the identified wetland habitats and/or watercourses in accordance with the latest approach; 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).
- Determine the Present Ecological State score (PES) and Functional Integrity of any identified wetlands using the WET-Health and Wet-EcoServices approach.
- Determine the Ecological Importance and Sensitivity (EIS) of the identified wetlands.
- Identify current and possible negative impacts on any identified wetlands/watercourses. Recommend mitigation measures to lessen these impacts on wetlands or watercourses delineated within the study site and the implementation of suitable rehabilitation measures.

Based on the current identification of the four wetland indicators, five HGM units were delineated within the 500m assessment area. These were all classified as seep systems. The seep systems are associated with drainage channels which flow in a generally southern direction toward the valley bottom associated with the Black Mfolozi River, situated 1.2km south of the study site. Furthermore, three A Section channels, three B Section channels and one C Section channel were identified within the assessment area. A Section channels are temporary watercourses that convey stormwater runoff immediately after a rain event and are not saturated often enough to be associated with a riparian zone. They are not hydrologically sensitive systems. B Section channels are in contact with the zone of saturation often enough to have vegetation associated with saturated conditions as well as gleyed soil within the channel confine. They are therefore described as non-perennial. C Section channels

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[1] Department of Water Affairs and Forestry (DWAF) is now named the Department of Water and Sanitation (DWS).

are constantly in contact with the zone of saturation and have vegetation associated with saturated conditions as well as gleyed soil within the channel confines. They are considered to be perennial in nature. Both the B Section and C Section channels are considered hydrologically sensitive as they are associated with a riparian habitat.

HGM units 1 and 2 will be impacted by the proposed project layout. HGM units 3, 4 and 5 are situated within the 500m assessment area, however their locations are either upslope of the proposed project (HGM 4), located within a separate catchment (HGM 5) or situated approximately 200m to the east of the project (HGM 3) and will therefore not be affected. Only HGM 1 and HGM 2 were therefore assessed further in this report.

HGM units 1 and 2 were assessed with regards to the health according to the Wet-Health methodology. HGM unit 1 is classified as Seriously Modified (PES Category E), while HGM 2 is classified as Largely Modified (PES Category D). Modifications to both HGM units stem from the use of the area for agricultural activities. These include *Acacia mearnsii* plantations and terracing of the area for historic cultivation. Furthermore, both systems are utilised extensively for livestock grazing, reducing the basal cover of vegetation associated with the systems. A reduction in basal cover over an extended period will lead to the formation of further erosion gullies. Invasive alien vegetation was noted within both systems and in particular along the associated drainage channels.

Ecosystem goods and services were calculated for both HGM units. Both HGM units received low to moderate scores with regards to ecosystem services. Both seeps provide ecosystem services related to streamflow regulation (as both seep systems are linked to drainage channels), sediment trapping, filtration (in the form of nitrate, phosphate and toxicant trapping), and erosion control, carbon storage, the provision of natural resources and the cultivation of food. The use of these wetlands (particularly HGM 1) for cultivation has had a negative impact on the health of these systems.

An Ecological Importance and Sensitivity (EIS) assessment was undertaken to rank the water resources in terms of provision of goods and services or valuable ecosystem functions which benefit people; biodiversity support and ecological value as well as the reliance of subsistence users (especially basic human needs uses). The EIS scores received for the HGM units were Low. Both systems are situated within a largely disturbed area, within the Bhokwe village, and this limits their abilities to provide suitable habitat for faunal and floral species. However, the drainage channel associated with HGM 1 does provide habitat for provincially protected species. HGM 2, situated on the western side of Bhokwe has been less disturbed by cultivation. The drainage channel associated with the system also provides habitat for aquatic and semi aquatic species. No species of conservation concern were noted within the wetland system.

Wetland and watercourse buffers are areas that surround these water resources and reduce adverse impacts to their functions and values from adjacent development. The buffer tool (Macfarlane & Bredin, 2016) which aims to provide a method for determining appropriate buffer widths for developments associated with wetlands, rivers or estuaries was utilised. A 60m buffer has been calculated for the protection of the wetland systems from the proposed construction of the oxidation ponds. The buffer tool takes into account a number of different factors in determining the buffer width including the impact of the proposed activity on the water resource, climatic factors, the sensitivity of the wetlands and topographical factors. The closest wetland to the oxidation ponds is HGM 1. This HGM unit is situated outside of the recommended 60m buffer at a distance of approximately 124m. The sewer reticulation pipes will cross HGM unit 1. The pipeline will furthermore be laid within approximately 8m-10m from HGM 2 but will not cross this system.

Impacts associated with pipelines are generally related to the reduced depth of refusal and soil moisture inside the pipeline corridor. Further to this, the installation of pipelines has the potential to damage soil and vegetation associated with wetlands through the compaction of hydric soils, altering the hydrology of systems, reduction in plant diversity and facilitating encroachment of invasive alien species. The proposed project will only have a direct impact on HGM unit 1 as it will be crossed by the sewer reticulation pipes. Common impacts associated with pipeline projects include erosion and sedimentation of impacted wetlands, reduction in hydrophytic vegetation where the pipeline will be laid, pollution of the wetlands, and the encroachment of alien invasive species as a result of the disturbance.

The Risk Assessment for the proposed project was undertaken in accordance with the General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21 (c) and (i) (Notice 509 of 2016). Impacts associated with the sanitation project received Low Risk Scores with impacts to the water resources and resource quality being small and easily mitigated. This is due to the disturbed nature of the wetlands along the pipeline route as a result of a previous contractor which dug the trenches but did not complete the job. Low risk scores are provided all mitigation measures recommended in this report form part of the Environmental Management Programme for the project. The installation of the reticulation pipes provides an opportunity for the rehabilitation of the area disturbed by the previous contractor and it is the author’s recommendation that the proposed project is approved.

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1. INTRODUCTION AND BACKGROUND

1.1. PROJECT BACKGROUND AND LOCALITY

Malachite Ecological Services was appointed by 1World Consultants to undertake a Wetland Impact Assessment for the proposed Bhokwe Community Sanitation Project. This project involves the construction of 2.2km of 160mmØ uPVC sewer reticulation, 110 mmØ uPVC housing connections, 165m of 200mmØ uPVC sewer reticulation, oxidation sewer ponds and numerous 1250mmØ precast concrete ring manholes. The oxidation sewer ponds will be lined by HDPE lining and the evapotranspiration bed lined. This is to ensure that there is zero discharge from the ponds. A previous contractor was appointed to implement this project in June 2016 however, the site was abandoned with some aspects of the project including certain pipelines and manholes already constructed. Subsequently, Ukuza Consulting will be completing the sanitation project.

The project area lies within Ward 5 of the Bhokwe Community, which is located within the AbaQulusi Local Municipality, KwaZulu-Natal (Figure 1). The sewer reticulation pipes will for the most part be laid within existing road reserves associated with the Bhokwe village, while the oxidation ponds are proposed to be constructed within an area to the south-west of the village (Figure 2).

The Wetland Impact Assessment forms part of the environmental requirements in the Basic Assessment and Water Use License applications. These are undertaken in compliance with the National Environmental Management Act (Act 107 of 1998) and the Environmental Impact Assessment (EIA) Regulations, 2017, GN R. 327, R.325 and R. 324; as well as the Water Use Licence Application (WULA) in terms of the National Water Act (Act 36 of 1998).

The primary aim of the study is to provide a description of the current ecological integrity and impacts pertaining to any water resources occurring within the assessment area as well as providing appropriate management recommendations to reduce any identified impacts on the delineated systems.

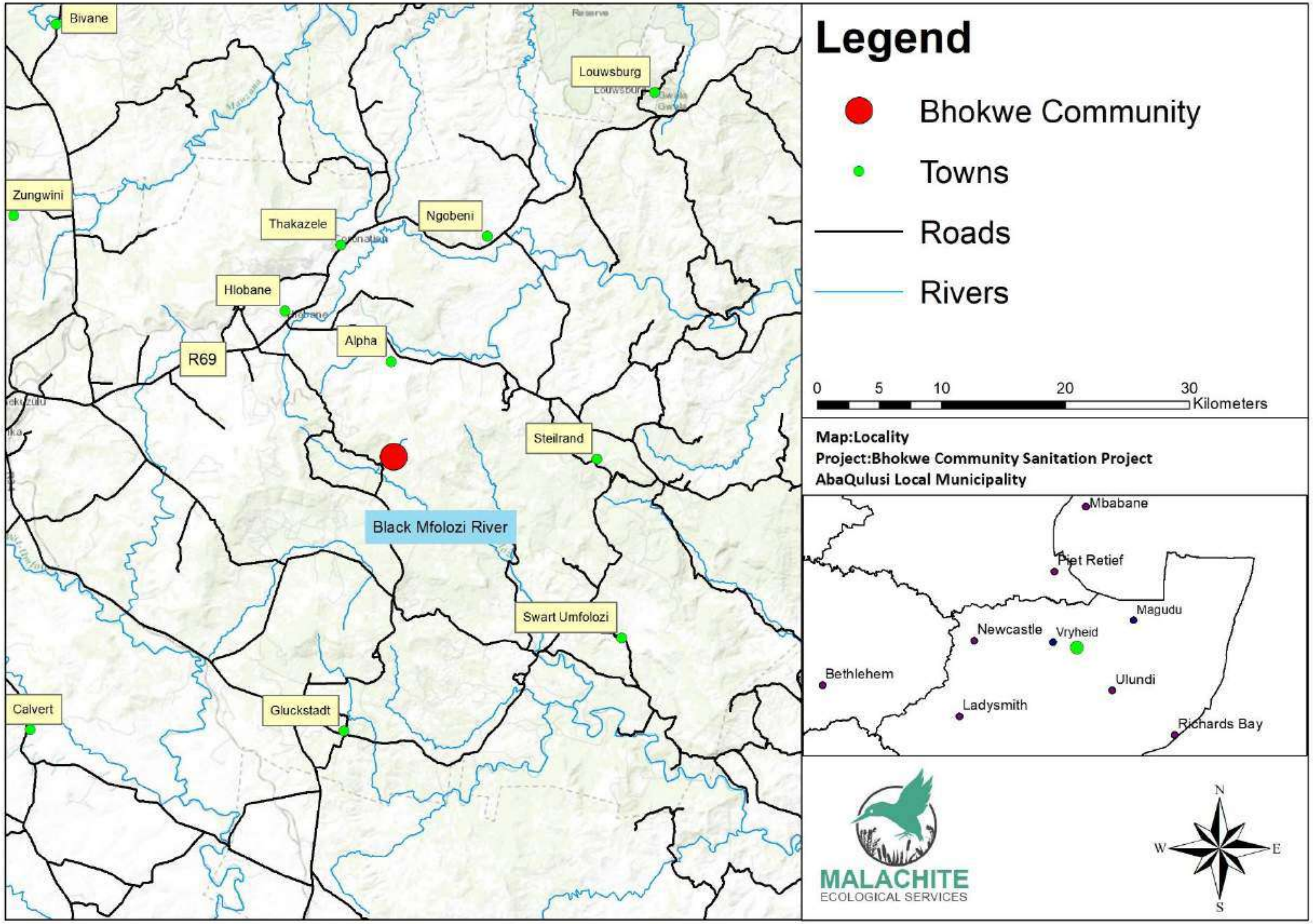

Figure 1: Site locality

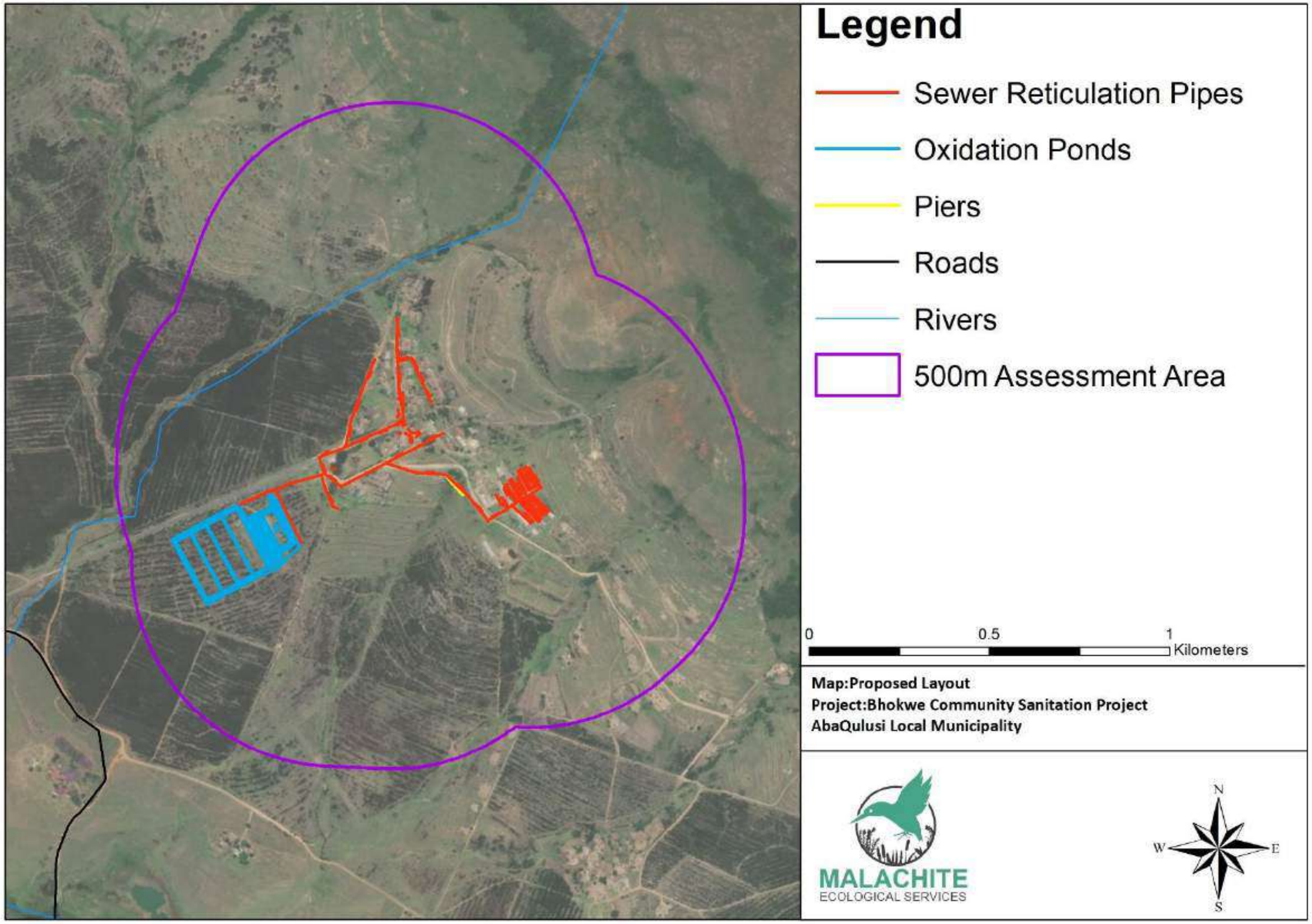

Figure 2: Proposed Sanitation Project Layout

1.2. SCOPE OF THE ASSESSMENT

The terms of reference for the current study were as follows:

- Identify and delineate any wetland and/or watercourse systems within the defined study site as well as within a 500m assessment area according to the Department of Water Affairs and Forestry[2] "Practical field procedure for the identification and delineation of wetlands and riparian areas".
- Classify the identified wetland habitats and/or watercourses in accordance with the latest approach; 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).
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- Determine the Ecological Importance and Sensitivity (EIS) of the identified wetlands.
- Identify current and possible negative impacts on any identified wetlands/watercourses. Recommend mitigation measures to lessen these impacts on wetlands or watercourses delineated within the study site and the implementation of suitable rehabilitation measures.

Typically, surface water attributed to wetland systems, rivers and riparian habitats comprise an important component of natural landscapes. These systems are often characterised by high levels of biodiversity and fulfil various ecosystems functions. As a result, these systems are protected under various pieces of legislation including; the National Water Act, 1998 (Act No. 36 of 1998) and the National Environmental Management Act, 1998 (Act No. 107 of 1998).

1.3. ASSUMPTIONS AND LIMITATIONS

It is difficult to apply pure scientific methods within a natural environment without limitations or assumptions. The following apply to this study:

i. The findings, results, observations, conclusions and recommendations provided in this report are based on the author's best scientific and professional knowledge as well as available information regarding the perceived impacts on the water resources. The author, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document
ii. In order to obtain definitive data regarding the biodiversity, hydrology and functioning of rivers and wetlands, studies should ideally be conducted over a number of seasons and over a number of years. This study took place during a single site visit conducted on the 18th September 2019.
iii. Water resource boundaries are essentially based on GPS coordinate waypoints taken onsite of indicator features. The accuracy of the GPS device therefore affects the

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[2] Department of Water Affairs and Forestry (DWAF) is now named the Department of Water and Sanitation (DWS).

accuracy of the maps produced. A hand-held Garmin eTrex 30x was used to delineate the water resources and this has an accuracy of 3-6m.

iv. The assessment of the wetlands' Present Ecological State (PES), Functional Integrity (Wet-Ecoservices) and Ecological Importance and Sensitivity (EIS) was based on a single day field investigation. Once-off assessments such as this may potentially miss certain ecological information, thus limiting accuracy, detail and confidence.

1.4. REPORTING CONDITIONS

The findings and recommendations provided in this report are based on the authors' best scientific and professional knowledge as well as information available at the time of compilation. No form of this report may be amended without the prior written consent of the author.

2. METHODOLOGY

2.1. ASSESSMENT TECHNIQUES AND TOOLS

The techniques and tools utilised for this assessment can be divided into baseline data and field investigations. Baseline data was utilised during the desktop component to determine the biophysical context of the site as well as National and Provincial legislation that governs the proposed activity.

2.2. BASELINE DATA

The desktop study involved the examination of aerial photography and Geographical Information System (GIS) databases. The study made use of the following data sources:

- Google Earth™ satellite imagery was used at the desktop level.
- Relief dataset from the Surveyor General was used to calculate slope and the desktop mapping of water resources.
- The National Freshwater Ecosystem Priority Areas were used in determining any priority wetlands.
- The South African Inventory of Inland Aquatic Ecosystems (van Deventer et al, 2018) was utilised at a desktop level to determine the probability of wetland systems and streams (watercourses) within the study area.
- Vegetation type dataset from Mucina & Rutherford (2006) with amendments by Scott Shaw & Escott (2012), and amendments by SANBI (2018) were used in determining the vegetation type and conservation status of the study area.
- Background Information Document compiled by 1World Consultants (2019).

2.3. SITE INVESTIGATION

In field data collection was taken on the 18th September 2019. This included the delineation exercise, topographical setting, soil sampling techniques, identification of current land use and the identification of existing impacts and dominant vegetation units present.

2.4. WETLAND DEFINITION & DELINEATION TECHNIQUE

South Africa has a strong legislative framework enforcing the country's obligations to numerous international conservation agreements for the protection of freshwater/wetland resources. These frameworks include several Acts, Ordinances and treaties.

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act 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."*

Furthermore, the Ramsar Convention[3] defines wetlands as:

> *"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6m"*

These habitats are found where the topography and geological parameters impede the flow of water through the catchment, resulting in the soil profiles of these habitats becoming temporarily, seasonally or permanently wet. Further to this, wetlands occur in areas where groundwater or surface water discharges to the surface forming seeps and springs. Soil wetness and vegetation indicators change as the gradient of wetness changes (Figure 3).

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[3] The Ramsar Convention is legally named the Convention on Wetlands of International Importance Especially as Waterfowl Habitat and was adopted by the International Conference on the Wetlands and Waterfowl at Ramsar, Iran, 2 February 197 I in order to recognise amongst others that wetlands constitute a resource of great economic, cultural, scientific and recreational value, the loss of which would be irreparable.

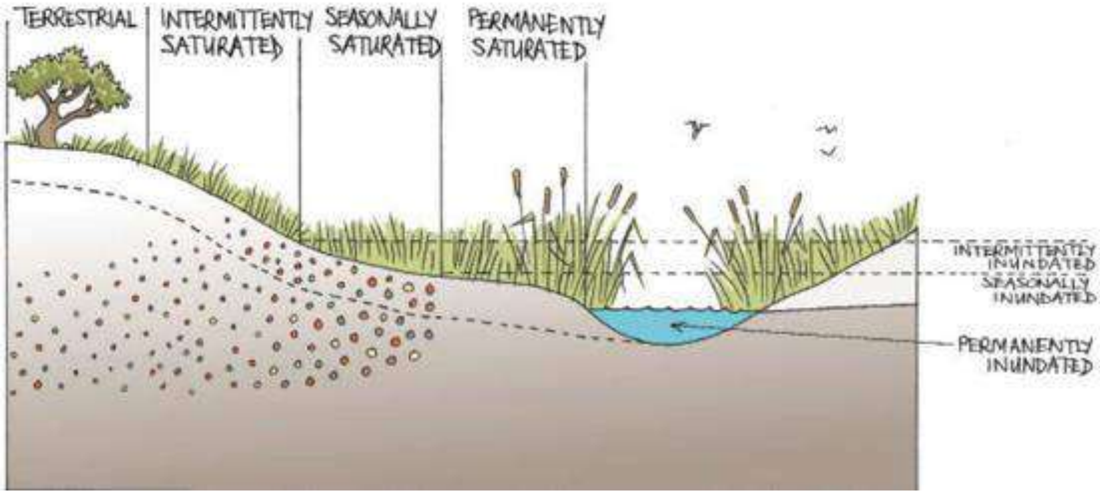


Figure 3: Increasing soil wetness zones identified within various wetland systems

Based on definition presented in the National Water Act, three vital concepts govern the presence of a wetland namely:

i. Hydrology- Land inundated by water or displays saturated soils when these soils are biologically active (the growth season).
ii. Hydric soils- Soils that have been depleted of oxygen through reduction resulting in the presence of redoximorphic features.
iii. Hydrophytic vegetation- Plant species that are adapted to growing in saturated soils and subsequent anaerobic conditions (hydrophytes).

The conservation of wetland systems is vital as these habitats provide numerous functions that benefit not only biodiversity but provide an array of ecosystem services. These services are further divided into direct and indirect and are detailed in Table 1. These transitional habitats also provide refugia for a variety of terrestrial and semi-aquatic fauna, plants and invertebrates.

Table 1: Direct and indirect benefits of wetland systems (Kotze et al. 2005)

Wetland Goods and Services	
Direct	**Indirect**
Hydrological Water purification Flood reduction Erosion control Groundwater discharge	*Socio-economic* Socio-cultural significance Tourism and recreation Education and Research
Biodiversity conservation	Water supply
Chemical cycling	Provision of harvestable resources

The study site was assessed with regards to the determination of the presence of wetland and watercourse areas according to the procedure described in ‘A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas –Edition 1’ (DWAF, 2005). The WET-Health model was utilised to facilitate the rapid assessment of the integrity of wetland systems while WET-Ecosystems model measures the ecosystem goods and services provided the wetland system/s in question.

2.5. WETLAND HEALTH AND FUNCTIONAL INTEGRITY ASSESSMENT TECHNIQUES

A Wet-Health Assessment to determine the Present Ecological State was undertaken. The draft 2018 version of Wet-Health (Ollis et al. 2018) was utilised for the Present Ecological State of each HGM unit. The 2018 version is currently at a draft stage and will be refined before being published. It takes into account impacts on the hydrology, geomorphology, vegetation and water quality of both the individual HGM unit as well as each HGM unit’s catchment. A level 2 assessment (detailed) was undertaken on the units delineated.

A Level 2 Wet-EcoServices Assessment to determine the Functional Integrity of the identified wetland units, was carried out. Further to this, the Ecological Importance and Sensitivity of each delineated wetland unit was ascertained.

Detailed methodology for the wetland delineation, health, provision of ecosystem goods and services (functional integrity), ecological importance and sensitivity is given in Appendix A.

3. BASELINE BIOPHYSICAL DESCRIPTION

3.1. LOCAL CLIMATIC CONDITIONS

The municipal area is characterised by a summer rainfall pattern with sporadic rainfall events in the winter months. The mean annual precipitation is approximately 870mm. The wettest time of the year is between December and January with an average of 141mm and the driest is June with 12mm (Table 2). The seasonality of precipitation is a driving factor behind the hydrological cycles of rivers and drainage lines within the area. Typically, rivers and drainage lines have a higher flow rate during the summer months. Maximum temperatures range from 25.3^{0}C in January to 18.5 ^{0}C in June (Table 3). The altitude of the project area ranges from approximately 1288 meters above sea level to approximately 1185 meters above sea level.

Table 2: Mean Annual Rainfall

	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
MEAN ANNUAL RAINFALL	141	124	73	61	26	12	19	23	56	102	111	122

Table 3: Temperatures and Evaporation for the area

	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
MEAN TEMP (°C)	20.1	20.0	19.3	16.9	14.9	12.6	12.8	14.3	16.4	16.9	18.0	19.4
MAX TEMP (°C)	25.3	25.1	24.6	22.2	20.6	18.5	18.9	20.6	22.6	22.4	23.2	24.6
MIN TEMP (°C)	14.9	14.9	14.1	11.6	9.2	6.8	6.8	8.0	10.1	11.4	12.7	14.2

3.2. GEOLOGY AND TOPOGRAPHY

Water resources in South Africa are the products of erosional and depositional processes, as well as the presence of geological influences controlled by the variable environment across the country. South Africa is a semi-arid country with differences in rainfall patterns, topography and geology. The geological characteristics of an area influences the topography, soil types and textures, vegetation communities and faunal assemblages present. These all determine the types and locations of wetland and watercourse systems within the landscape.

The geology of the area is dominated by sandstones and shales of the Volksrust and Madzaringwe Formation (Ecca Group of the Karoo Supergroup) supporting shallow, duplex soils and soils of moderate to poor drainage, which present an erosion hazard if not managed correctly (Mucina and Rutherford, 2006; Camp, 1999). The Volksrust Formation Sandstone underlies the project area and comprises of arkosic, quartz arenite Sandstone typically overlain by upper dark brown silty sand to moderately clayey colluvial sand (Davies, Lynne & Partners, 2017).

3.3. REGIONAL VEGETATION STRUCTURE AND COMPOSITION

The study site is situated within the Grassland Biome and the vegetation units identified within the project area include the Paulpietersburg Moist Grassland and the Northern Zululand Mistbelt Grassland (Figure 4). Each vegetation unit is discussed in more detail below based on the Vegetation Map of South Africa (Mucina & Rutherford, 2006).

Paulpietersburg Moist Grassland

This vegetation unit is distributed within the KwaZulu-Natal and Mpumalanga provinces as well as within the upper catchments of the Phongolo River. Paulpietersburg Moist Grassland is characterised by tall closed grasslands dominated by *Tristachya leucothrix*, *Themeda triandra* and *Hyparrhenia hirta*. These grassland systems have a high concentration of forb species, with evergreen woody vegetation prominent on rocky outcrops (Mucina & Rutherford, 2006). The vegetation unit is classified as Vulnerable with a small percentage conserved within Witbad, Vryheid Mountain, Paardeplaats and Phongola Bush Nature Reserves. It is estimated that approximately 30% has been transformed by plantations and cultivated land. Further impacts include livestock overgrazing, inappropriate burning regimes and the encroachment of invasive alien species (*Acacia*, *Eucalyptus* and *Pinus* spp).

Northern Zululand Mistbelt Grassland

This vegetation unit is distributed within the KwaZulu-Natal province at altitudes ranging from 780 – 1540m ASL. The Northern Zululand Mistbelt Grassland is characterised by tall Sourveld, *Themeda triandra* grasslands with a high diversity of forb species. This largely occurs on gentle-steep slopes of mountains formed by dolerite dykes (Mucina & Rutherford, 2006). This vegetation unit is classified as Vulnerable with a small percentage conserved within the Ithala Nature Reserve and in the Ntendeka Wilderness Area. It is estimated that approximately 20% has been transformed by plantations and cultivated land. Further impacts include livestock overgrazing, extensive annual burning techniques and the encroachment of invasive alien species.

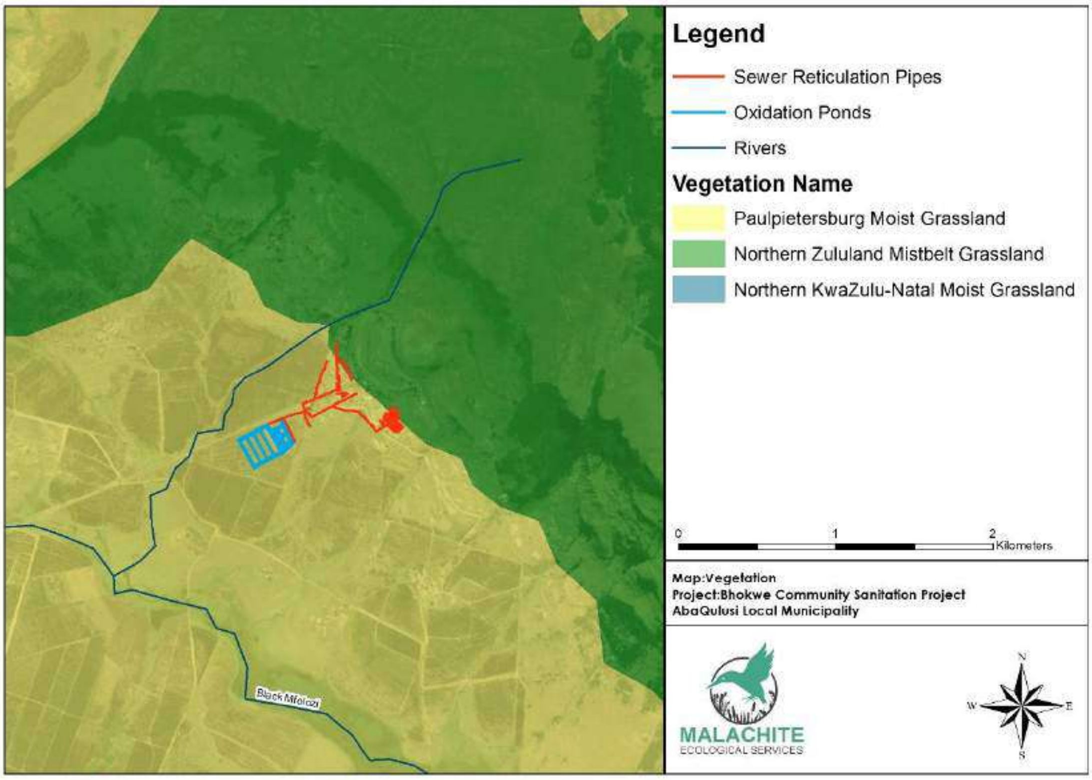


Figure 4: Regional Vegetation associated with the study site

3.4. CATCHMENT CHARACTERISTICS AND WATERCOURSES

The study area is located within the Pongola-Mtamvuna Water Management Area (WMA). The major rivers include the Pongola, Mhlatuze, Mfolozi, Mkuze, Thukela, Mvoti, Umgeni, Umkomazi, Umzimkulu and Mtamvuna rivers. These rivers experience significant levels of high-water demand related stress, particularly during drought seasons. Many of these surrounding communities rely on fresh water from these rivers throughout the year and supply adequate water for domestic, stock and irrigation.

More specifically, the project area is situated within the W22A Quaternary Catchment (Figure 5). The Black Mfolozi River and Mgobhozi River are the primary drainage systems within the quaternary catchment. The Black Mfolozi River flows approximately 1.2km south of the assessment area. A number of non-perennial drainage channels flow through the assessment area toward the Black Mfolozi River.

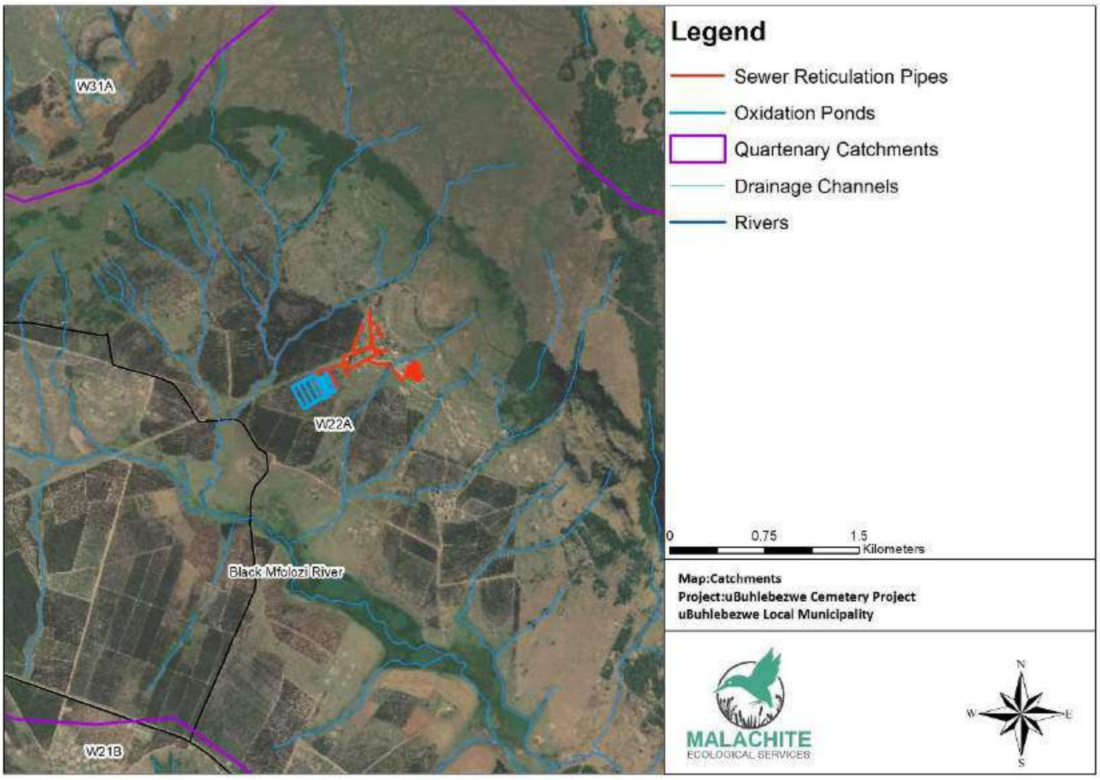


Figure 5: Quaternary catchment location and river systems

The dominant land use surrounding the project area comprises low density villages as well as *Eucalyptus* sp. and *Acacia mearnsii* plantations interspersed with patches of natural veld systems, often characterised by wetland/riparian areas (Figure 6). The removal of natural grassland and riparian systems due to plantations not only alters the vegetation communities (and subsequent ecological services these systems provide) but also influences water levels within the soil profile. Further impacts include the spread and colonisation of invasive alien species due to anthropogenic disturbances, conversion and over utilisation of natural vegetation and degradation of water resources. The transformation of biophysical characteristics exacerbates impacts such as sedimentation and reduced water quality within the catchment.

Figure 6: Land use surrounding the project area. Note the plantations to the west of Bhokwe village

3.5. NATIONAL FRESHWATER ECOSYSTEM PRIORITY AREAS (NFEPA) AND THE SOUTH AFRICAN INVENTORY OF INLAND AQUATIC ECOSYSTEMS (SAIIAE)

The National Freshwater Ecosystem Priority Areas (NFEPA) project represents a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), Department of Water Affairs (DWA; now Department of Water and Sanitation, or DWS), Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). More specifically, the NFEPA project aims to:

- Identify Freshwater Ecosystem Priority Areas (hereafter referred to as 'FEPAs') to meet national biodiversity goals for freshwater ecosystems; and
- Develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers.

The South African Inventory of Inland Aquatic Ecosystems (van Deventer et al, 2018) provides a collection of data layers pertaining to ecosystem types and pressures for both rivers and inland wetlands. One of the layers of this dataset displays the probability of wetland systems and streams (watercourses) within a particular area. This can be used at a desktop level to identify potential wetland and watercourse systems within the study site.

Based on current outputs of the NFEPA project (Nel et al., 2011), no FEPA wetlands were identified within the Bhokwe village or within the 500m assessment area. Only the Black Mfolozi River which is situated approximately 1.2km south of the assessment area was identified as a FEPA wetland (Figure 7). The proposed project will not have an impact on this river system.

According to the SAIIAE database (2018), a number of ‘stream’ systems were identified flowing through the assessment area (Figure 7). These systems were investigated further in this assessment.

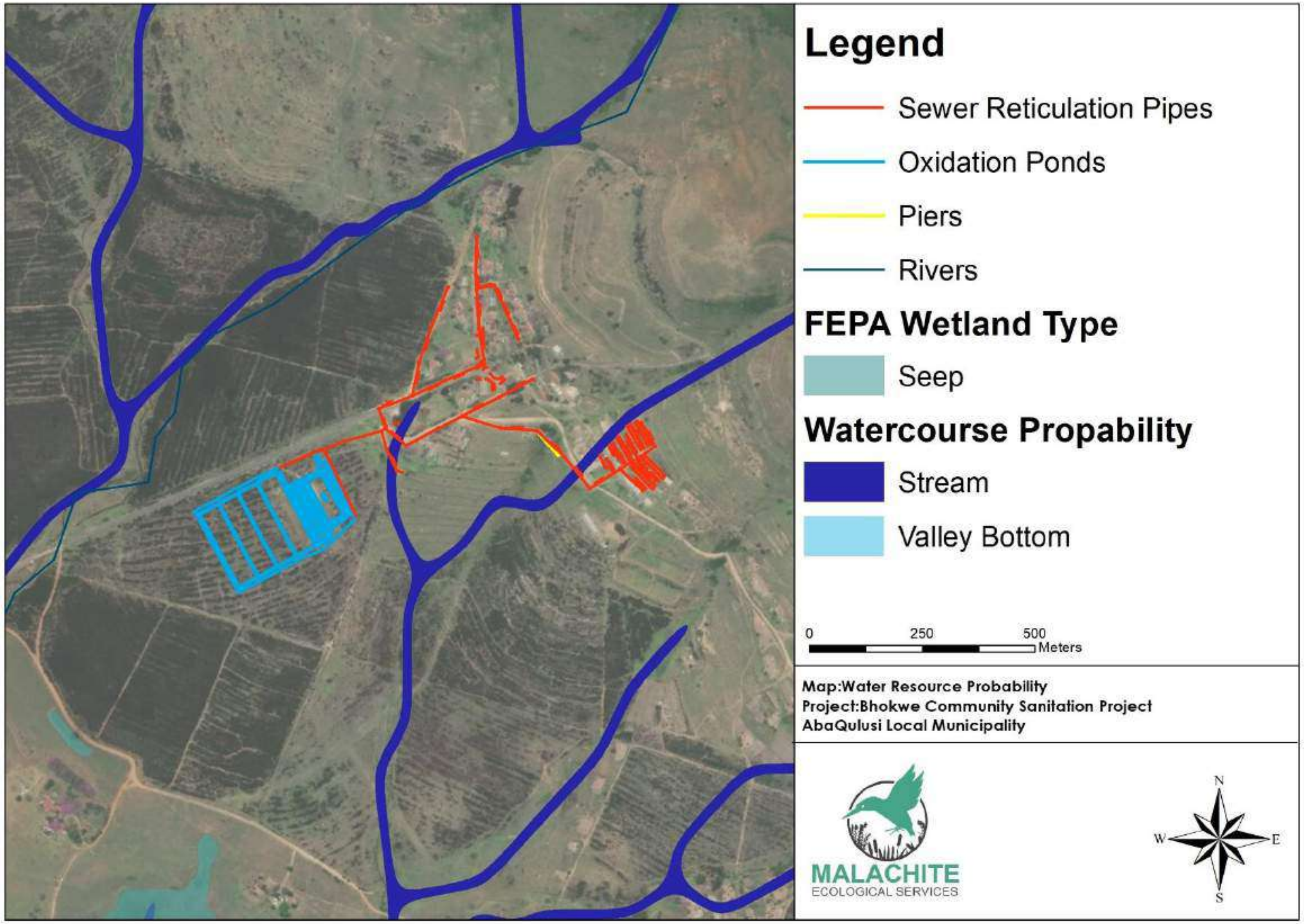


Figure 7: Predicted water resource systems within the assessment area

4. ASSESSMENT RESULTS

4.1. WETLAND DELINEATION

The South African classification system categorises wetland systems based on the characteristics of different Hydrogeomorphic (HGM) Units. An HGM unit is a recognisable physiographic wetland-unit based on the geomorphic setting, water source of the wetland and the water flow patterns (Macfarlane et al., 2008). There are five broad recognised wetland systems based on the abovementioned system and these are depicted in Figure 8. The classification of these wetlands is then further refined as per the 'Classification System for Wetlands and other Aquatic Ecosystems in South Africa' (Ollis et al., 2013).

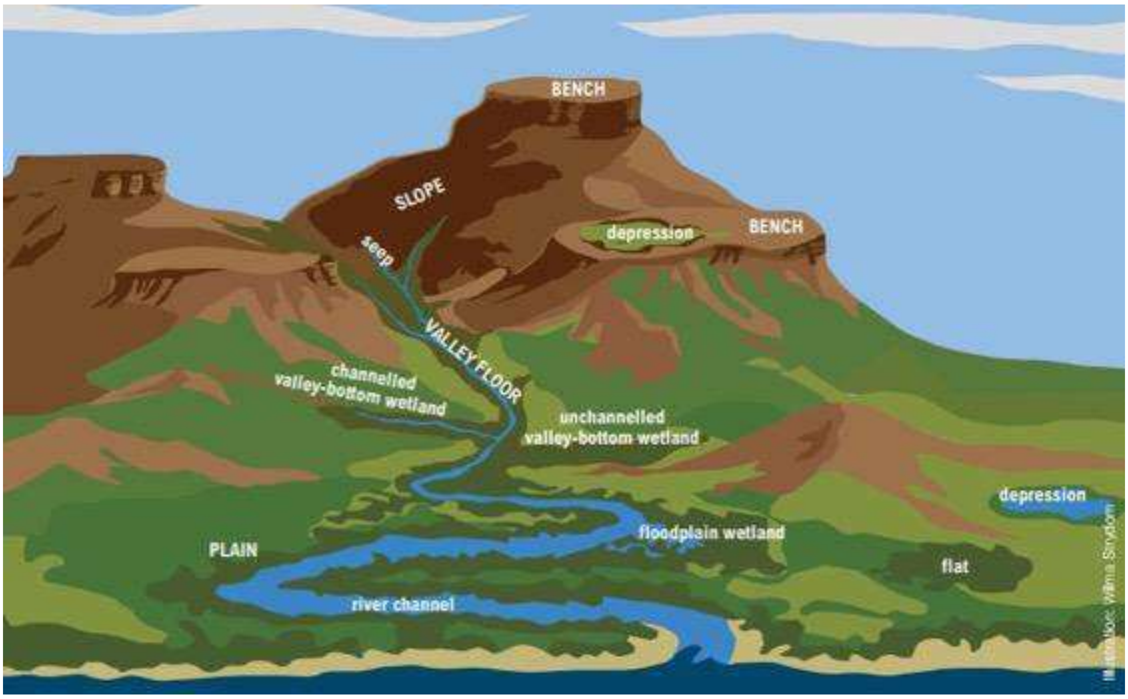
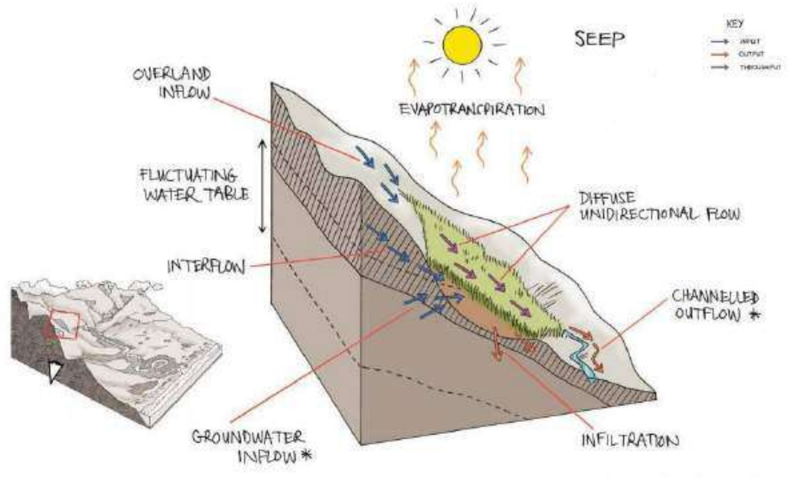


Figure 8: Diagrammatic representation of common wetland systems identified in Southern Africa

Based on the current identification of the four wetland indicators, five HGM units were delineated within the 500m assessment area. These were all classified as seep systems. These seep systems are depicted in Figure 11, with the flow directions depicted in Figure 12. A closer view of the crossing position of HGM 1 is depicted in Figure 13 and the position of the pipeline in relation to HGM 2 depicted in Figure 14.

The seep systems were associated with drainage channels which flow in a generally southern direction toward the valley bottom associated with the Black Mfolozi River, situated 1.2km south of the study site.

Seepage wetlands are characterised by their association with topographic positions that either cause groundwater to discharge to the land surface or rain-derived water to seep down-slope as subsurface interflow. Water movement through the seep is primarily attributed to interflow, with diffuse overland flow often being significant during and after rainfall events (Kotze et al., 2008; Ollis et al., 2013). Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.



The wetland delineation exercise was conducted based on the dominant indicators, including soil type (i.e. soil form and the presence of hydric characteristics); vegetation; and topographic position within a landscape. These are discussed in more detail in the following sections.

As depicted in Figure 11, only HGM 1 will be crossed by the pipeline and the pipeline will be laid in close proximity to HGM 2. HGM units 3, 4 and 5 are situated within the 500m assessment area, however their locations are either upslope of the proposed project (HGM 4), located within a separate catchment (HGM 5) or situated approximately 200m to the east of the project (HGM 3) and will therefore not be affected. Only HGM 1 and HGM 2 were therefore assessed further in this report.

4.2. WATERCOURSE CLASSIFICATION

Watercourse systems were identified flowing within the 500m assessment area. These were delineated based on based on topographic setting, vegetative indicators as well as the presence or absence of alluvial soils as described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005) requirements. This manual separates the classification of watercourses into three (3) separate types of channels or sections defined by their position relative to the zone of saturation in the riparian area (Figure 9). The classification system separates channels into:

- Those that do not have baseflow (A Section).
- Those that sometimes have baseflow (B Section) or non-perennial.
- Those that always have baseflow (C Section) or perennial.

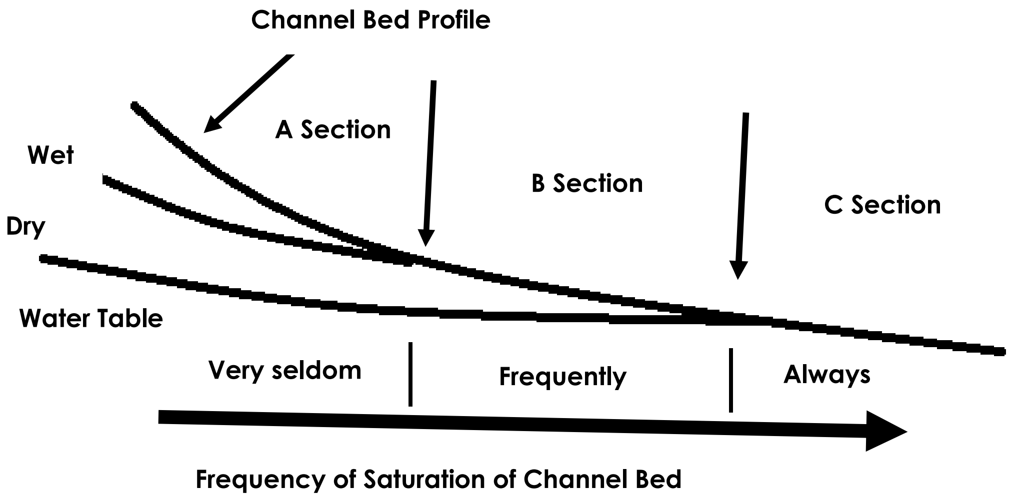


Figure 9: Diagram showing the change of saturation depending on the type of channel

Three A Section channels, three B Section channels and one C Section channel were identified within the assessment area (Figure 11). A Section channels are temporary watercourses that convey stormwater runoff immediately after a rain event and are not saturated often enough to be associated with a riparian zone. They are not hydrologically sensitive systems.

B Section channels are in contact with the zone of saturation often enough to have vegetation associated with saturated conditions as well as gleyed soil within the channel confine. They are therefore described as non-perennial. C Section channels are constantly in contact with the zone of saturation and have vegetation associated with saturated conditions as well as gleyed soil within the channel confines. They are considered to be perennial in nature. Both the B Section and C Section channels are considered hydrologically sensitive as they are associated with a riparian habitat.

The National Water Act (Act 36 of 1998), defines a riparian habitat as:

> *"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 zone or riparian area of a river is the portion of land directly adjacent to the active channel (i.e. on the banks of the river), which is influenced by river-induced or river-related processes. These areas are commonly characterised by alluvial soils and by vegetation that is distinct from that of adjacent land areas in terms of its composition and physical structure. The riparian zone of a river is typically located between the outside edge of the active channel and the outside edge of the macro-channel (Ollis et al., 2013).

Riparian areas perform numerous vital functions (Figure 10) including the protection and enhancement of water resources through the following:

- Aiding in the storage of water and flood prevention.
- Stabilising stream banks.
- Improving water quality by trapping sediment and nutrients.
- Maintaining natural water temperatures for aquatic species.
- Providing foraging and roosting habitats for birds and other animals.
- Providing corridors for dispersal and migration of different species.
- Serving as a buffer between aquatic ecosystems and adjacent land uses.

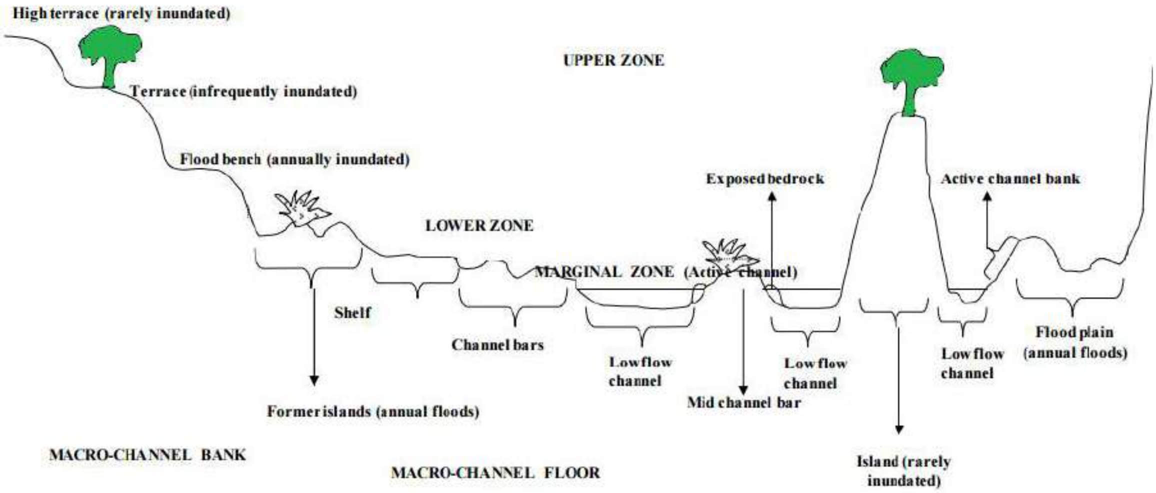


Figure 10: Diagrammatic representation the zones (lower, marginal and upper) associated with riparian habitats (extracted from river eco-classification manual for ecostatus determination, 2007)

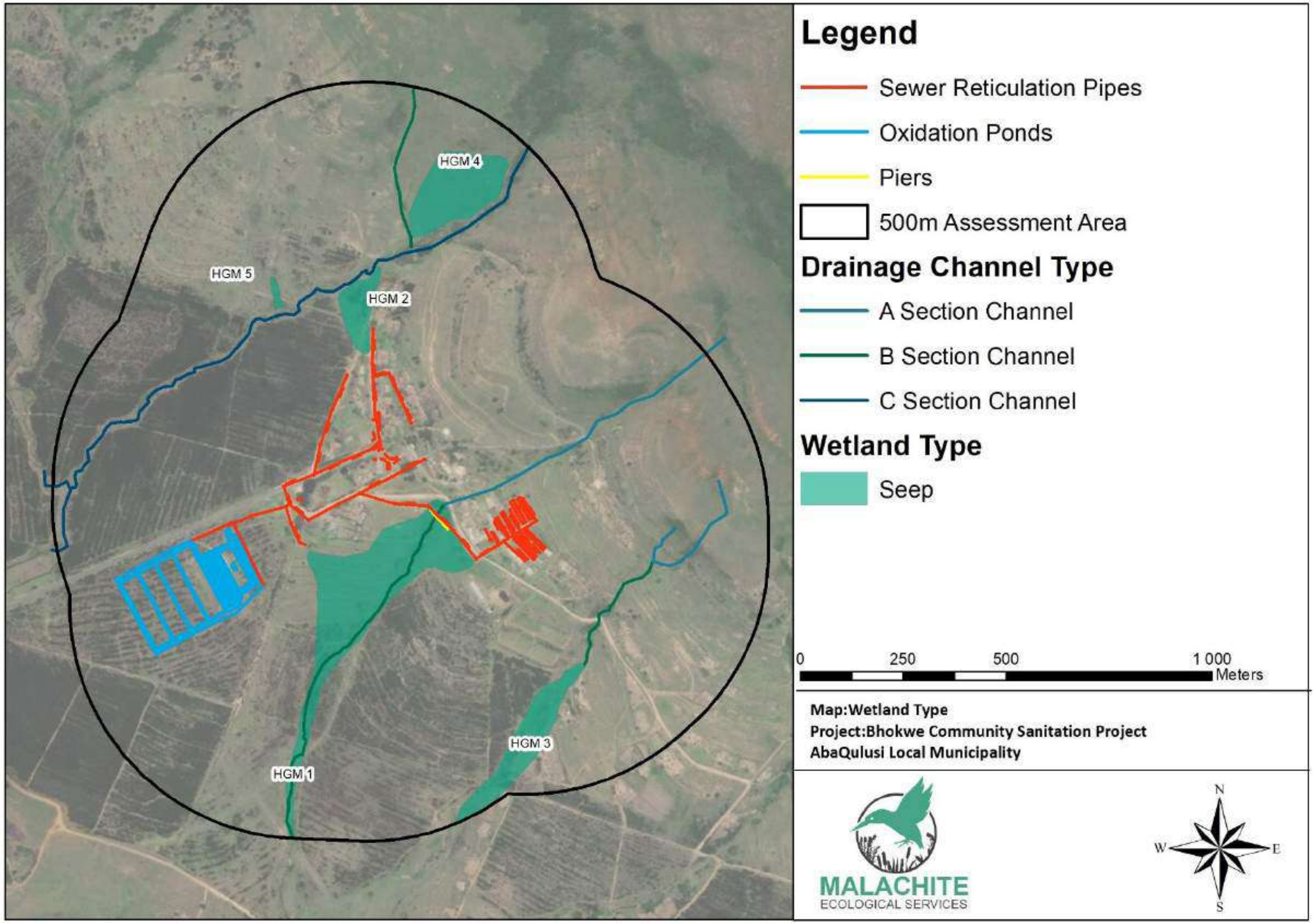


Figure 11: Delineation of the wetland units identified within the assessment area

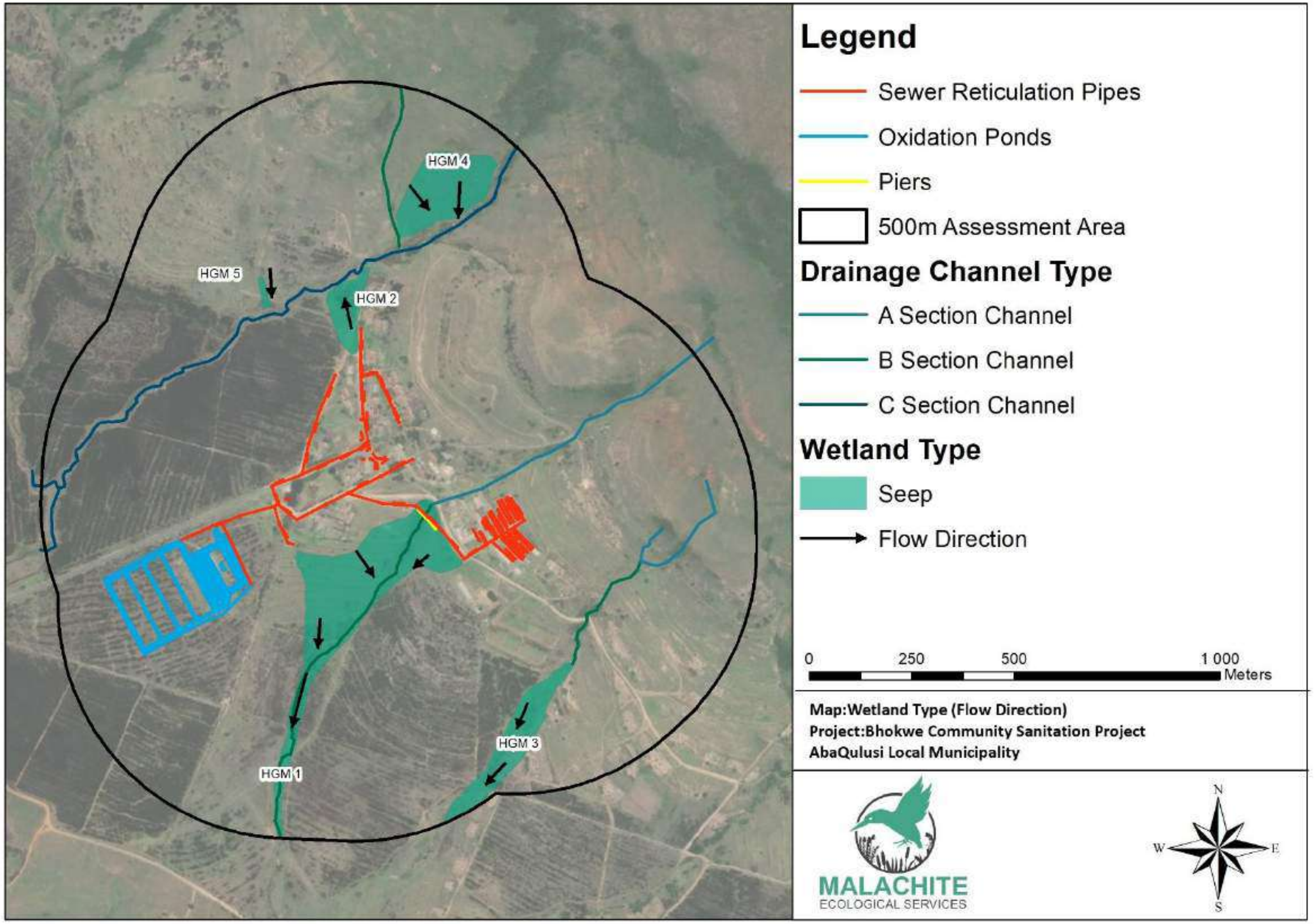


Figure 12: Delineation of wetlands, showing the direction of flow

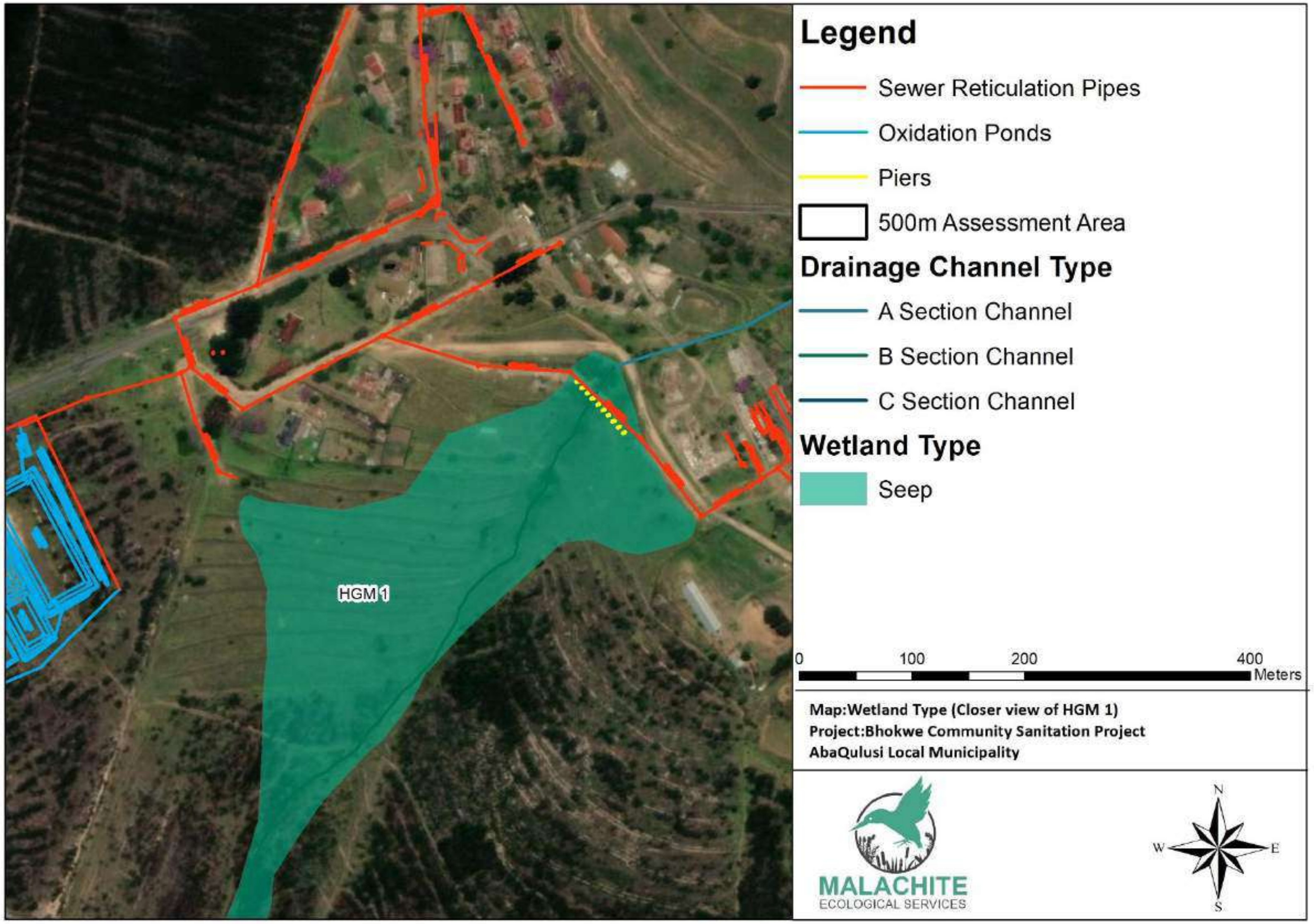


Figure 13: Closer view of where the pipeline crosses HGM 1

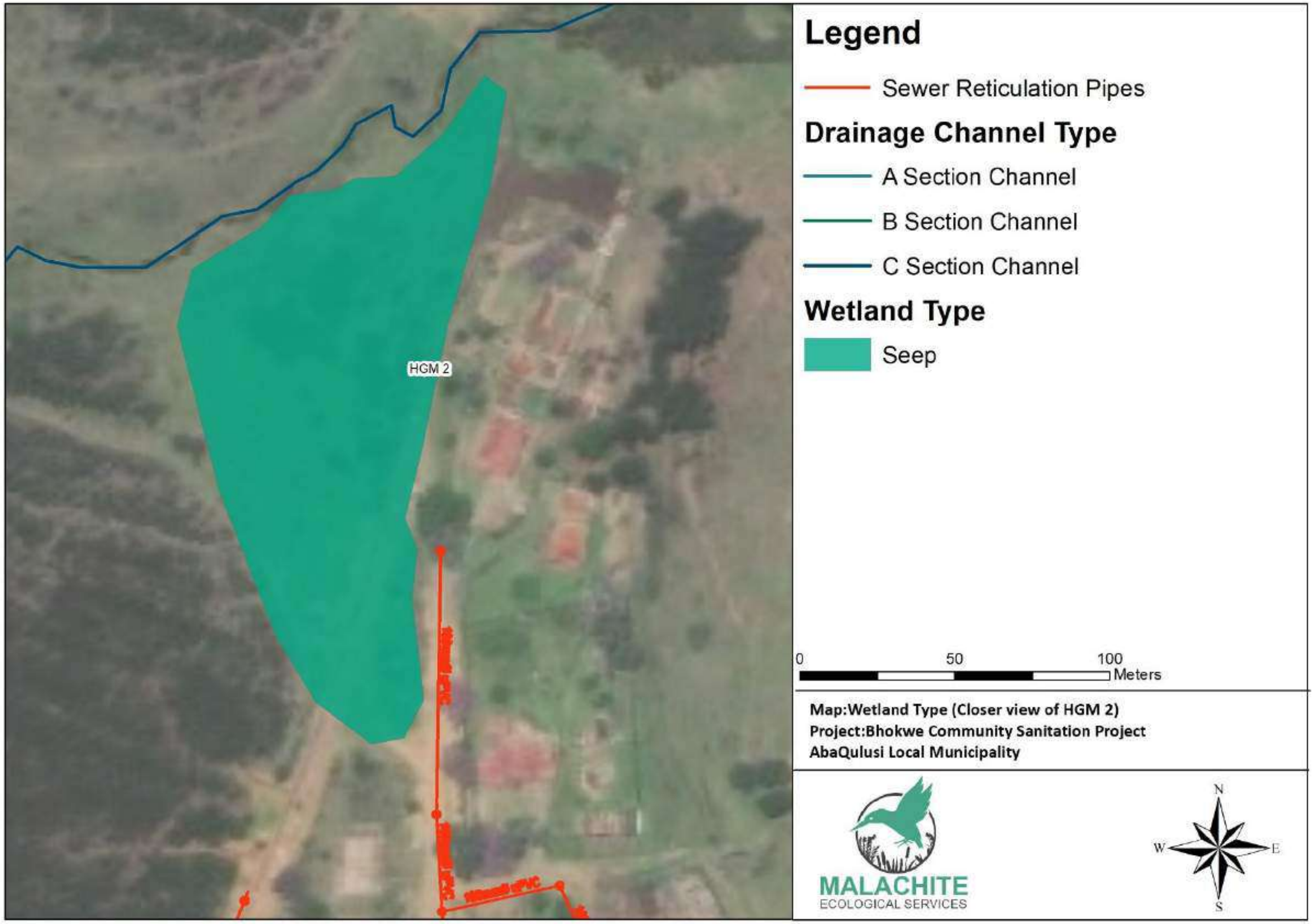


Figure 14: Closer view of where the pipeline will be laid in close proximity to HGM 2

4.3. SOIL WETNESS AND SOIL FORM INDICATOR

Soil samples were taken within the study site during the wetland delineation exercise. Auger points were examined for the presence of hydric (wetland) properties. Hydric soils are defined as those that typically show characteristics resulting from prolonged and repeated saturation. These characteristics are called redoximorphic features and include the presence of mottling (i.e. bright insoluble iron compounds); a gleyed matrix; and/or Manganese (Mn)/Iron (Fe) concretions (Figure 15).

The presence of redoximorphic features are the most important indicator of wetland occurrence, as these soil wetness indicators remain in wetland soils, even if they are degraded or desiccated (DWAF, 2005). It is important to note that the presence or absence of redoximorphic features within the upper 500mm of the soil profile alone is sufficient to identify the soil as being hydric, or non-hydric and that a soil horizon does not have to be 100% saturated for this reduction reaction to begin and to show within the profile as either mottling, a gleyed matrix or a concretion. A hydric soil will therefore not necessarily contain all the diagnostic horizons associated with redoximorphic features; however, all hydric soils will contain at least one of these features within the upper 500mm of the soil profile (Collins, 2005).

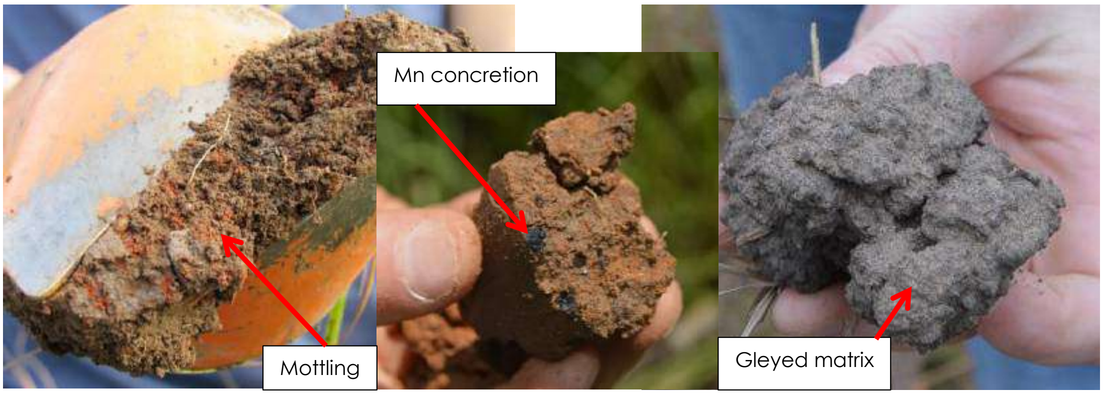


Figure 15: Examples of hydric characteristics used as indicators for wetland conditions

Further to the identification of hydric properties, it is important to consider the soil form. The type of soil (or the soil form) has a significant influence on the formation and functioning of a wetland system and its location within a catchment. This includes the way in which water enters and flows through a wetland (Ollis et al., 2013). Soil forms are not randomly distributed in a landscape and therefore hydrological soil types typically occupy specific positions in the hillslope. This means that certain soils play more of a releasing or receiving role related to water movement within a hillslope or topographic position. This has important implications in landscape hydrology (van Tol, et al., 2013).

Anthropogenic development within the Bhokwe village has had an impact on the original soil profiles of the area. These include residential development, road networks, existing pipe networks as well as cultivation for crops. The Bhokwe area has been cultivated both historically and currently and this agricultural activity has led to the creation of terraces which have caused soil mixing. This was particularly evident in HGM 1 in which the topsoil has been lost through terracing, and the hydric horizons displayed at the surface of the profile.

Hydric soils were classified as the Katspruit, Tukulu, Pinedene and Bloemdal forms, while terrestrial soils were noted outside of the wetland systems and were dominated by the Clovelly, Griffin, Oakleaf and Mispah soil forms. Alluvial deposits were also noted within watercourses associated with the area. Alluvial soils are considered young soils, which are deposited within the riverbed by hydrological flow and flood events. They are structureless and do not show the typical characteristics of wetland system.

Characteristics of the soils identified within the assessment area are displayed in Table 4.

Table 4: Soils identified within the sampling area

Soil Form and Defining Horizons		Defining Soil colour	Soil Texture	Zone of wetness	Observations	Photograph
Hydric Soils						
Katspruit	Orthic A	10YR 2/1	Silty-Clay	Permanent to Seasonal	Identified in the permanent zones.	
	Gley	10YR 5/2				
Pinedene	Orthic A	10YR4/3	Silty-Clay Loam	Seasonal and Temporary	Identified in the more seasonal and temporary zone of saturation of the wetland units.	
	Yellow Brown Apedal	10YR 5/8				
	Gleyic	7.5YR 4/1				

SOIL FORM AND DEFINING HORIZONS		DEFINING SOIL COLOUR	SOIL TEXTURE	ZONE OF WETNESS	OBSERVATIONS	PHOTOGRAPH
Bloemdal	Orthic A	5Yr 4/2	Silty-Clay Loam	Seasonal to Temporary	Identified in the cultivated area associated with HGM 1. Topsoil lost to cultivation and terracing. Gleyed horizon showed signs of mottling and a gleyed matrix.	
	Red Apedal B	5YR 4/4				
	Gleyic	5YR 5/1				
Tukulu	Orthic A	10YR 3/1	Sandy-Loam	Seasonal/ Temporary	Identified within the seasonal and temporary zones of the wetlands. Hydric properties dominated by large scale mottling.	
	Neocutanic B	10YR 3/2				
	Gleyic	10YR 6/2				

<table>
<tr><th colspan="2">Soil Form and Defining Horizons</th><th>Defining Soil colour</th><th>Soil Texture</th><th>Zone of wetness</th><th>Observations</th><th>Photograph</th></tr>
<tr><td colspan="2">Alluvial soil deposits</td><td>10YR 4/1</td><td>Sandy</td><td>Watercourses and Riparian</td><td>Identified within and adjacent to the watercourses associated with the area.</td><td></td></tr>
<tr><td colspan="7">Terrestrial Soils</td></tr>
<tr><td rowspan="3">Griffin</td><td>Orthic A</td><td>5YR 3/2</td><td rowspan="3">Silty-Loam</td><td rowspan="3">Terrestrial/None</td><td rowspan="3">Identified outside of the wetland areas adjacent to HGM 1 on the gentler slopes. No hydric properties identified within the soil profiles.</td><td rowspan="3"></td></tr>
<tr><td>Red Apedal B</td><td>5YR 5/8</td></tr>
<tr><td>Yellow-Brown Apedal B</td><td>7.5YR 4/6</td></tr>
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SOIL FORM AND DEFINING HORIZONS		**DEFINING SOIL COLOUR**	**SOIL TEXTURE**	**ZONE OF WETNESS**	**OBSERVATIONS**	**PHOTOGRAPH**
Clovelly	Orthic A	10YR 3/2	Silty-Loam	Terrestrial/None	Identified outside of the wetland areas on the gentler slopes associated with the area	
	Yellow-Brown Apedal B	10YR 4/6				
Mispah	Orthic A	10YR 3/2	Sandy	Terrestrial/None	Identified outside of the wetland areas on the steeper slopes associated with the area. Shallow in nature and rocky.	
	Hard Rock					

4.4. VEGETATION INDICATOR

According to DWAF (2005), vegetation is regarded as a key component to be used in the delineation procedure for wetlands as distinct changes in vegetation assemblages can be noted when moving through wetland systems, from the permanent zone to the temporary zone. Vegetation also forms a central part of the wetland definition in the National Water Act (Act 36 of 1998).

Hydrophytic vegetation are plant species that are adapted to growing in permanently or temporarily water-logged conditions (elevated water conditions in wetland soils). This is further subdivided into species that are obligate and facultative wetland species (Table 5). The composition of a plant community is determined by the complex interactions between climate, soil type, position in the landscape and competition between plant species.

Wetland plant species perform a variety of functions including:

- Maintaining water quality by filtering out nutrients and sediments.
- Providing food, shelter and breeding habitat for both aquatic and terrestrial fauna.
- Preventing erosion.

Table 5: The classification of plants according to occurrence in wetlands (DWAF, 2008)

Vegetation Components	Description
Obligate wetland species	Almost always grow in wetlands (> 99% of occurrences)
Facultative wetland species	Usually grow in wetlands (67-99% of occurrences) but occasionally are found in non-wetland areas
Facultative species	Are equally likely to grow in wetlands and non-wetland areas (34-66% of occurrences)
Facultative dry-land species	Usually grow in non-wetland areas but sometimes grow in wetlands (1- 34% of occurrences)

These wetland "indicator" species assist in the identification of wetland systems and associated boundaries. However, using vegetation as a primary wetland indicator requires undisturbed conditions (DWAF, 2005). The alteration of habitat and associated floral communities has a detrimental impact on the ability to confidently rely on vegetation as wetland indicators. In these instances, it makes scientific sense to utilise a combination of terrain and soil characteristics in determining wetland boundaries around transformed areas.

Vegetation within the majority of the assessment area has been impacted through the development of Bhokwe village as well as through agricultural cultivation practices. Impacts include the dumping of anthropogenic waste, the historic clearing and terracing of the area. These impacts have facilitated the encroachment of invasive species, through the alteration of habitats and the creation of novel habitats. Invasive species are pioneers and able to quickly colonise these novel habitats. Prominent species recorded within the site included *Solanum* *mauritianum, Verbena bonariensis*, *Cirsium vulgare*, *Bidens pilosa*, *Lantana camara*, *Tagetes minuta* and *Ricinus communis*. Stands of woody *Acacia mearnsii* formed part of the riparian vegetation in many identified drainage channels.

Pioneer and invasive species formed a mosaic with indigenous woody and herbaceous species. Graminoid species recorded included *Imperata cylindrica*, *Andropogon eucomus*, *Melinis repens, Hyparrhenia hirta* and *Sporobulus pyramidalis*.

The wetland and riparian vegetation were identified within the project area. Prominent growth forms identified within these systems were dominated by sedges, rushes and graminoid species associated with areas of elevated soil moisture conditions. Species included *Pycreus polystachyos, Cyperus longus, Juncus effusus and Typha capensis. Gomphocarpus physocarpus* and several *Helichrysum* species including *Helichrysum aureonitens* were also noted within the seepages wetland systems.

Photograph 1: Disturbed vegetation associated with HGM 1. Note the second picture shows the drainage channel associated with this seep

Photograph 2: Disturbed vegetation within Bhokwe village associated with residential development

Photograph 3: Vegetation associated with HGM 2. This seep system is situated adjacent to an Acacia mearnsii plantation

4.5. TERRAIN INDICATOR

The topography of an area is generally a good practical indicator for identifying those parts in the landscape where wetlands/watercourses are likely to occur. Generally, these occur as valley bottom units however, wetlands can also occur on steep to mid slopes where groundwater or surface water discharge is taking place through seeps (DWAF, 2005). In order to classify a wetland system and/or a watercourse the localised landscape setting must be taken into consideration through ground-truthing of the study site after initial desktop investigations (Ollis et al., 2014).

Bhokwe village is situated on moderate to steep slopes which range in altitude from 1214m to 1273m above sea level (Figure 16). The larger mountain range which surrounds Bhokwe has a number of springs which release water perennially into the village. These springs are the source of water for a number of wetlands and watercourses within the study area and the higher percentage of seep wetlands.

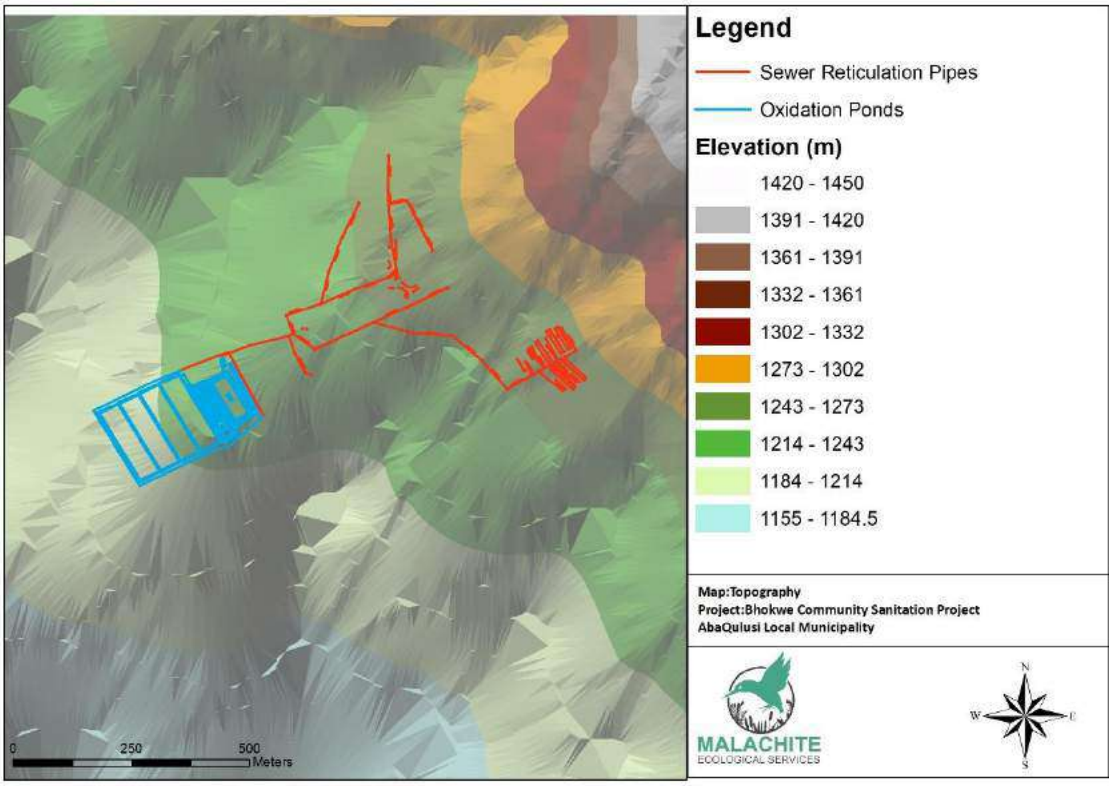

Figure 16: Topography of the study area. Note the hillshade display a moderate to steep sloping topographic position

5. WETLAND HEALTH AND FUNCTIONAL ASSESSMENT

5.1. PRESENT ECOLOGICAL STATE (PES)

HGM units 1 and 2 were assessed with regards to the health according to the Wet-Health methodology [4]. HGM unit 1 is classified as Seriously Modified (PES Category E), while HGM 2 is classified as Largely Modified (PES Category D).

Modifications to both HGM units stem from the use of the area for agricultural activities. These include *Acacia mearnsii* plantations and terracing of the area for historic cultivation. The majority of HGM 1 has been completely terraced and cultivated and this has impacted the flow dynamics of the seep causing erosion of the drainage channel associated with the seep system (Photograph 4). Erosion gully formation negatively alters the hydrological flow of water through the system thus reducing the ability of the system to attenuate water within the landscape.

HGM 2 has been impacted by *Acacia mearnsii* plantations as well as the development of residential housing and associated infrastructure (Photograph 5). Furthermore, both systems are utilised extensively for livestock grazing, reducing the basal cover of vegetation associated with the systems. A reduction in basal cover over an extended period will lead to the formation of further erosion gullies. Vegetation acts as a barrier to surface runoff, reducing the velocity of water as it flows over the wetland surface. This reduction in velocity allows for the infiltration of water into the soil profile and creates the interflow that sustains seep systems. A reduction in basal cover removes this barrier to water movement, therefore increasing its velocity over the surface of the soil and creating erosion gullies along preferential flow paths.

Invasive alien vegetation was noted within both systems and in particular along the associated drainage channels.

A summary of the PES scores obtained for the field-based delineated systems following application of the Wet-Health approach during the present assessment is provided in Table 6.

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[4] The current size of the delineated wetlands was recorded. It must be noted that this is not the entire size of the wetland but rather the portion of the system delineated within the assessment area.

Table 6: Summary of PES score

HGM Unit	Extent Delineated (Ha)	Hydrology	Geomorphology	Water Quality	Vegetation	PES Score (Category)
HGM 1	8.02	6.6	5.6	5.0	6.7	E (6.2)
HGM 2	2.58	6.5	4.5	4.5	4.4	D (5.5)

Photograph 4: Terraced and cultivated portion of HGM 1. Note the lack of basal cover within the seep system

PHOTOGRAPH 5:PORTION OF HGM 2, AS WELL AS THE ACACIA MEARNSII PLANTATION ADJACENT TO THE SEEP

5.2. FUNCTIONAL ASSESSMENT (ECOSYSTEM GOODS AND SERVICES)

Ecosystem goods and services were calculated for the HGM units. Both HGM units received low to moderate scores with regards to ecosystem services (Figure 17). Both seeps provide ecosystem services related to streamflow regulation (as both seep systems are linked to drainage channels), sediment trapping, filtration (in the form of nitrate, phosphate and toxicant trapping), and erosion control, carbon storage, the provision of natural resources and the cultivation of food. The use of these wetlands (particularly HGM 1) for cultivation has had a negative impact on the health of these systems.

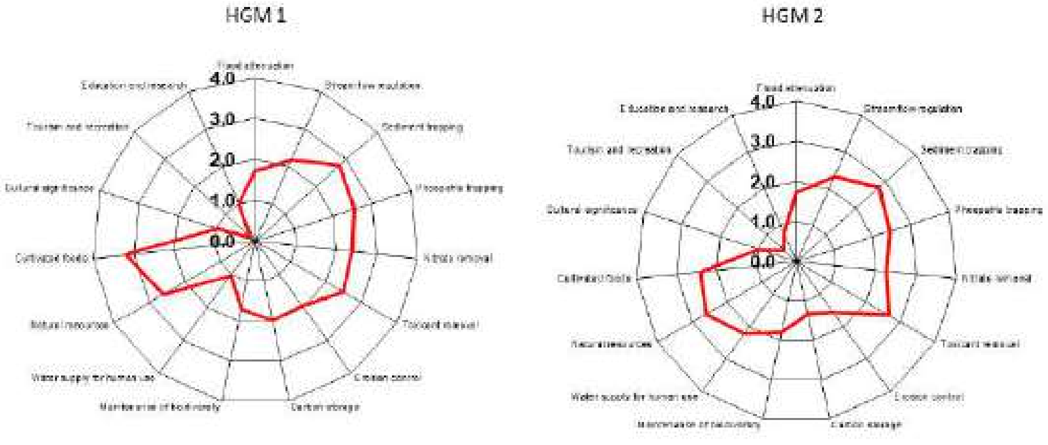

Figure 17: General WET-EcoServices results for the Wetland Systems

5.3. ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The EIS scores received for the HGM units is Low[5] (Table 7). Both systems are situated within a largely disturbed area, within the Bhokwe village, and this limits their abilities to provide suitable habitat for faunal and floral species. Furthermore, the basal cover within HGM 1 has been diminished through cultivation activities. However, the drainage channel associated with HGM 1 does provide habitat for provincially protected species including *Cyrtanthus tuckii* (Green-tipped Fire Lily), *Zantedeschia aethiopica* (Arum lily) and *Alsophila dregei* (Tree Fern) as well as aquatic and semi-aquatic species, particularly during the higher rainfall period in the summer months.

HGM 2, situated on the western side of Bhokwe has been less disturbed by cultivation. The drainage channel associated with the system also provides habitat for aquatic and semi aquatic species. No species of conservation concern were noted within the wetland system. The presence of a large *Acacia mearnsii* plantation adjacent to the seep has facilitated the encroachment of alien invasive species.

The Hydrological Functional Importance of HGM 1and HGM 2 is recorded as Low due largely to the degraded state of these wetland systems. Both systems are used for agricultural production and this has had a negative impact on the state of the wetland systems. Socio-economic importance of this wetlands is associated with agricultural use.

Table 7: Summary of the Ecological Importance and Sensitivity

HGM UNIT	EIS	SCORE (0-4)	CONFIDENCE (0-5)	CATEGORY
HGM 1	Ecological Importance and Sensitivity	1.13	4.00	Low
	Hydrological Functional Importance	1.90	4.00	Low
	Direct Human Benefits	1.67	4.00	Low
HGM 2	Ecological Importance and Sensitivity	1.20	4.00	Low
	Hydrological Functional Importance	1.70	4.00	Low

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[5] A low score indicates that features about the wetland are regarded as somewhat ecologically important and sensitive at a local scale. The functioning and/or biodiversity features have low-medium sensitivity to anthropogenic disturbances. They typically play a very small role in providing ecological services at the local scale.

HGM UNIT	EIS	SCORE (0-4)	CONFIDENCE (0-5)	CATEGORY
	Direct Human Benefits	1.50	4.00	Low

6. BUFFER REQUIREMENTS

Wetland buffers are areas that surround a wetland and reduce adverse impacts to wetland functions and values from adjacent development. Buffer zones outside the boundary of wetlands are required to ensure that the ecotones between aquatic and terrestrial environments are effectively managed and conserved. These ecotones have a high ecological significance and have been shown to perform a wide range of functions, and on this basis, have been proposed as a standard measure to protect water resources and associated biodiversity (Macfarlane & Bredin, 2016). Literature indicates that buffers reduce wetland impacts by moderating the effects of stormwater runoff including stabilising soil to prevent erosion; filtering suspended solids, nutrients, and harmful or toxic substances; and moderating water level fluctuations (Castelie et al., 1992).

Buffers also provide essential foraging, roosting, refugia and breeding habitat for wetland-associated species. Finally, buffers reduce the adverse impacts of human disturbance on wetland habitats including blocking noise and glare; reducing sedimentation and nutrient input; reducing direct human disturbance from dumped debris, cut vegetation and providing visual separation.

The buffer tool (Macfarlane & Bredin, 2016) which aims to provide a method for determining appropriate buffer widths for developments associated with wetlands, rivers or estuaries was utilised to calculate the appropriate buffer width for the protection of the ecosystem services provided by the HGM units. A 60m buffer has been calculated for the protection of the wetland systems from the proposed construction of the oxidation ponds.

The buffer tool considers a number of different factors in determining the buffer width including the impact of the proposed activity on the water resource, climatic factors, soil forms, vegetative basal cover during the construction and operational phases, topographical factors and the sensitivity of the water resource. It is recommended that the buffer zones be vegetated with indigenous grasses and maintained.

The closest wetland to the oxidation ponds is HGM 1. This HGM unit is situated outside of the recommended 60m buffer (Figure 18) at a distance of approximately 124m. The sewer reticulation pipe was installed by the previous contractor and crosses HGM 1. The pipeline will furthermore be laid within approximately 8m-10m from HGM 2 but will not cross this system.

Due to the previous contractor clearing the pipeline route across HGM1 and installing the pipeline, the selection of this route provides an opportunity to rehabilitate area.

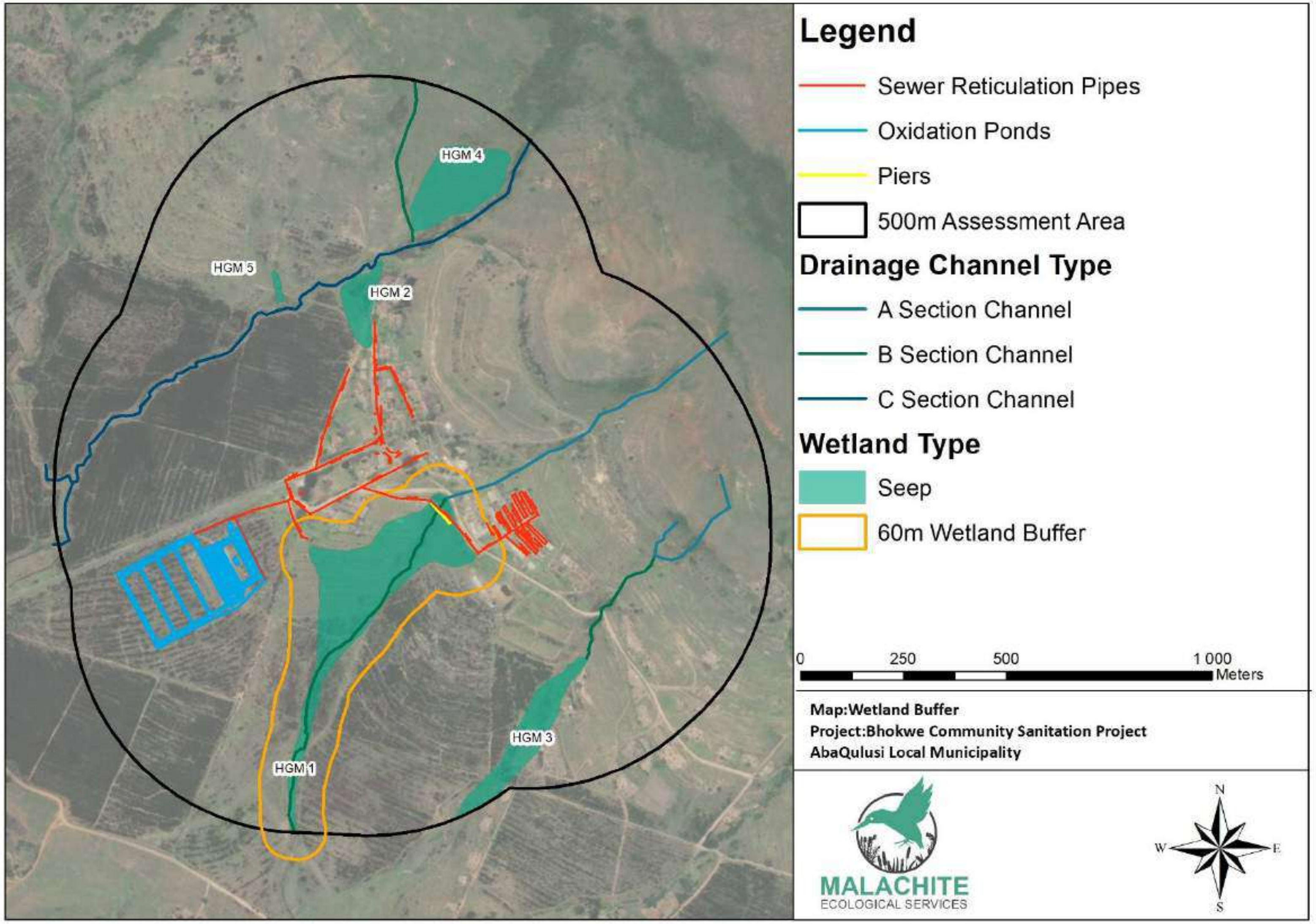

Figure 18: 60m Recommended Buffer for the Protection of the Seep Wetlands from the Oxidation Ponds

7. IMPACT ASSESSMENT

Any development activity in a natural system will have an impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of the impacts caused by the proposed Bhokwe sanitation project on the delineated and assessed wetland systems and to provide a description of the mitigation required so as to limit the identified negative impacts on the receiving environment.

Impacts associated with pipelines are generally related to the reduced depth of refusal and soil moisture inside the pipeline corridor. Further to this, the installation of pipelines has the potential to damage soil and vegetation associated with wetlands through the compaction of hydric soils, altering the hydrology of systems, reduction in plant diversity and facilitating encroachment of invasive alien species. In a study conducted by Olsona and Dohertyd (2012) soils within pipeline servitude had a 63% higher bulk density, 13% lower depth to refusal and 19% lower soil moisture than sites outside the pipeline servitude.

A previous contractor (Municipal Infrastructure Support Agent) was appointed to implement this project in June 2016 however, the site was abandoned with some aspects of the project including certain pipelines and manholes already constructed. Subsequently, Ukuza Consulting will be completing the sanitation project.

The proposed project will only have a direct impact on HGM unit 1. The previous contractors cleared a section through HGM 1 and installed the pipeline (Table 8). It is understood that this area will be utilised as the pipeline crossing area.

*TABLE 8: DESCRIPTORS AND SCORING FOR THE **EXTENT** OF AN IMPACT*

No.	Water Resource	Start Coordinate	End Coordinate	Length of Water Resource affected
1	HGM 1	27°48'42.04"S; 31° 6'15.13"E	27°48'43.75"S 31° 6'17.13"E	75.8m

Common impacts associated with pipeline projects include:

Construction Phase:

- Erosion and increased sediment movement into and within wetlands due to disturbance.
- Decline in functionality of wetland habitats and knock on effects for floral and faunal communities.
- Decline in water quality due to construction activities and spills.
- Disturbance to hydrological flow patterns due resulting from interception and diversion of flows.
- Colonisation of invasive alien vegetation and pioneer species.

Operational Phase:

- Spills/leaks into wetland systems due to pipe failure.
- Continued erosion and sedimentation due to ineffective rehabilitation of the route.

7.1. METHODOLOGY

Potential impacts of the proposed activity on the wetland systems were assessed in terms of a formalised method, whereby a typical risk assessment process was undertaken in order to determine the significance of the potential impacts without the application of mitigation/management measures (WOMM). Once the significance of the impacts without the application of mitigation/management measures was known, the impacts were then re-evaluated, taking cognisance of proposed mitigation/management measures provided in order to reduce the impact (WMM), thus enabling an understanding of the overall impact after the implementation of mitigation/management measures. The process that was undertaken is described in the section below.

The **EXTENT** refers to the impact footprint. What that means is that if a species were to be lost then the extent would be global because that species would be lost to the world. If human health is threatened, then the impact is likely to be no more than local and possibly (in the case of a nuclear power station) regional.

*TABLE 9: DESCRIPTORS AND SCORING FOR THE **EXTENT** OF AN IMPACT*

Descriptors	Definitions	Score
Site only	The impact remains within the footprint or cadastral boundary of the site.	1
Local	The impact extends beyond the footprint or cadastral boundary of the site, to include the immediately adjacent and surrounding areas.	2
Regional	The impact includes the greater surrounding area within which the site is located.	3
National	The scale/extent of the impact is applicable to the Republic of South Africa.	4
Global	The scale /extent of the impact is global (i.e. world-wide).	5

The **DURATION** is the period of time for which the impact would be manifest. Importantly, the concept of reversibility is taken into consideration in the scoring. In other words, the longer the impact endures, the less likely is the reversibility of the impact.

TABLE 10: DESCRIPTORS AND SCORING FOR THE DURATION OF AN IMPACT

Descriptors	Definitions	Score
Temporary	The impact endures for only a short period of time (0-1 years).	1
Short term	The impact continues to manifest for a period of between 1-5 years.	2
Medium term	The impact continues to manifest for a period of 5-15 years.	3
Long term	The impact will cease after the operational life of the activity.	4
Permanent	The impact will continue indefinitely.	5

The **MAGNITUDE** is the measure of the potential severity of the impact on the associated environment. As with duration, the concept of reversibility should be taken into account when considering the magnitude of the potential impact.

TABLE 11: DESCRIPTORS AND SCORING FOR THE MAGNITUDE OF AN IMPACT

Descriptors	Definitions	Score
Negligible	The ecosystem pattern, process and functioning are not affected, although there is a small negative impact on quality of the ecosystem.	1
Minor	Minor impact - a minor impact on the environment and processes will occur.	2
Low	Low impact - slight impact on ecosystem pattern, process and functioning.	4
Moderate	Valued, important, sensitive or vulnerable systems or communities are negatively affected, but ecosystem pattern, process and functions can continue albeit in a slightly modified way.	6
High	The environment is affected to the extent that the ecosystem pattern, process and functions are altered and may even temporarily cease. Valued, important, sensitive or vulnerable systems or communities are substantially affected.	8
Very High	The environment is affected to the extent that the ecosystem pattern, process and functions are completely destroyed and may permanently cease.	10

The **PROBABILITY** is the likelihood of the impact manifesting. Although likelihood and probability may be considered interchangeable, the term likelihood is preferred as probability has a very specific mathematical and/ or statistical connotation. As such the expectation created by the term probability is that there will be an accurate empirically or mathematically defined expression of risk, which is not necessarily required.

TABLE 12: DESCRIPTORS AND SCORING FOR THE PROBABILITY OF AN IMPACT

Descriptors	**Definitions**	**Score**
Very improbable / Rare	Where it is highly unlikely that the impact will occur, either because of design or because of historic experience	1
Unlikely	Improbable – where the impact is unlikely to occur (some possibility), either because of design or historic experience.	2
Probable	there is a distinct probability that the impact will occur (< 50% chance of occurring)	3
Highly Probable	Most likely that the impact will occur (50 – 90% chance of occurring)	4
Definite	The impact will occur regardless of any prevention or mitigating measures (>90% chance of occurring).	5

The **SIGNIFICANCE** of impacts will be derived through a synthesis of ratings of all criteria in the following calculation:

(Magnitude+ Duration + Extent) x Probability = Significance

TABLE 13: IMPACT SIGNIFICANCE RATINGS

Descriptors	**Definitions**	**Score**
Low	The perceived impact will not have a noticeable negative influence on the environment and is unlikely to require management intervention that would incur significant cost.	0 – 19
Low to Moderate	The perceived impact is considered acceptable, and application of recommended mitigation measures recommended.	20 – 39
Moderate	The perceived impact is likely to have a negative effect on the receiving ecosystem and is likely to influence the decision to approve the activity. Implementation of mitigation measures is required, as is routine monitoring to ensure effectiveness of recommended mitigation measures.	40 – 59
Moderate to High	The perceived impact will have a significant impact on the receiving ecosystem and will likely to have an influence on the decision-making process. Strict implementation of mitigation measures as provided is required, and strict monitoring and high levels of compliance and enforcement in respect of the impact in question are required.	60 – 79
High	The impact on the receiving ecosystem is considered of high significant and likely to be irreversible, and therefore highly likely to result in a fatal flaw for the project. Alternatives to the proposed activity are to be investigated as impact will have an influence on the decision-making process.	80 - 100

The significance of an impact gives one an indication of the level of mitigation measures required in order to minimise negative impacts and reduce environmental damage during the construction, operational and decommissioning / closure phases. Suitable and appropriate mitigation measures were identified for each of the potential impacts.

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7.2. SOIL EROSION AND SEDIMENTATION WITHIN THE WETLAND SYSTEMS

IMPACTS ASSOCIATED WITH SOIL EROSION, SEDIMENTATION AND DEGRADATION OF THE WETLANDS										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	With out	With	With out	With	With out	With		
CONSTRUCTION PHASE										
Soil erosion and sedimentation	4	3	1	1	2	1	8	4	**44 (Moderate)**	**18 (Low)**
OPERATIONAL PHASE										
Continued erosion and sedimentation of wetlands	3	2	5	5	2	1	8	4	**45 (Moderate)**	**20 (Low to Moderate)**

<u>Description of impact</u>

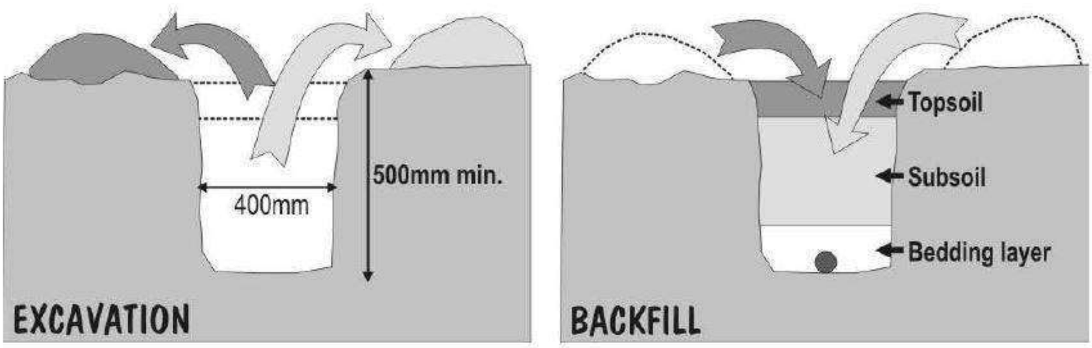
Construction activities (i.e. excavations and vegetation clearing) within the site will expose soil to environmental factors including rainfall and wind. Furthermore, compaction of soil that will experience heavy vehicle traffic, within the construction footprint will occur. The exposure of soil, the increase in soil bulk density, reduction in the porosity and the hydraulic conductivity, and the impedance of hydrological flow within the pipeline servitude can lead to the formation of erosion gullies. This will lead to sediment deposition in both HGM 1 and HGM 2.

Sedimentation of the deposited soil within the wetlands poses a risk to the geomorphological/functional integrity of these systems. It can also result in unstable watercourse substrate, particularly within the drainage channels associated with the seeps which will lead to further erosion.

The direct impacts related to the installation of a reticulation pipe across HGM 1 are associated with the removal of hydric soils and hydrophytic vegetation for the creation of the pipeline trench. If the topsoil and subsoil are not correctly separated and placed back into the trench in the correct order, i.e. an inverted or mixed soil profile the soil pH, organic matter content and nitrogen content will be altered. This will have further effects on the ecology (floral and faunal species) of the seeps leading to the further decline in the health of the wetland systems. However, given the disturbed nature of the crossing area as a result of previous work in the area, the use of this area, also provides the opportunity to rehabilitate the wetland system.

Mitigation Options

- The pipeline must not interfere with surface water movement leading to erosion. This is particularly so where the pipeline will cross HGM 1. It is understood that a series of piers will be constructed within HGM 1 and the pipeline will cross this seep above ground. This is the preferred crossing method in order to protect the integrity of the seep at this point and allow for rehabilitation.
- Use existing tracks and roads to gain access to the work servitude as much as possible.
- When soil is excavated for the pipeline trench, the topsoil and subsoil must be separated.
- In the event of infilling, replacement of subsoil must precede the topsoil replacement, and all material must be well compacted.



- No stockpiling of any materials may take place within or directly adjacent to the wetland systems.
- Erosion control measures must be implemented in areas sensitive to erosion such as near water supply points, edges of slopes, etc. These measures include but are not limited to - sand bags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes.
- Install sediment barriers across the entire construction right of way, particularly when working in close proximity to HGM 1 and HGM 2. This will help to prevent sediment flow into the wetlands.
- Do not dig the pipeline trench during a storm event and install the pipeline within the wetland during a dry period. This will reduce sediment movement and allow for quicker rehabilitation of the area.
- Disturbed sites must be rehabilitated as soon as construction in an area is complete or near complete and not left until the end of the project to be rehabilitated.
- Vegetation clearing must be kept as limited as possible to prevent excess sediment movement during rainfall.

7.3. REDUCTION IN HYDROPHILIC VEGETATION

IMPACTS ASSOCIATED WITH SOIL EROSION, SEDIMENTATION AND DEGRADATION OF THE WETLANDS										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	With out	With	With out	With	With out	With		
CONSTRUCTION PHASE										
Reduction in hydrophytic vegetation	5	5	1	1	2	1	6	4	45 (Moderate)	30 (Low to Moderate)
OPERATIONAL PHASE										
Reduction in hydrophytic vegetation	2	1	5	5	2	1	6	4	26 (Low to Moderate)	10 (Low)

Description of impact

The removal of existing wetland vegetation for the crossing of HGM 1 will have negative impacts on the functionality of the vegetation community within this area. The disturbance will make the wetland susceptible to further encroachment by invasive species. This is particularly so in this study site as the wetland is already disturbed by livestock overgrazing, encroachment of commercial plantations, historic terracing and further anthropogenic activities. If this occurs, then potentially re-establishment and re-development of former communities may either be hindered or may not occur, resulting in changes to the ecological structure and species composition of the wetland area along the pipeline route.

Mitigation options

- Prior to any construction activity, the boundary the crossing point of HGM 1 by the proposed pipeline must be demarcated.
- Existing disturbed corridors exist in HGM 1 where the original contractor dug the pipeline trench. These disturbed areas must be utilised.
- Construction camps must be located outside of wetland and watercourse systems.
- Protect as much indigenous vegetation as possible. Remove invasive alien species where construction activities occur and replace with indigenous vegetation. The pipeline route must be rehabilitated with appropriate indigenous species.
- Keep the work servitude as narrow as possible, especially at the crossing point and this must be clearly demarcated. Movement by workers and machinery outside of this servitude must be prohibited. The reduction of disturbance within the wetland systems will increase the likelihood of success of the rehabilitation phase.
- If any vegetation is present within disturbed areas, a rescue and storage operation of hydrophytic vegetation prior to construction must occur. This vegetation must be stored during the construction phase and replaced after construction in this area is completed. This must be conducted with input from a suitably qualified wetland ecologist or ECO.

- Rehabilitation must be aimed at improving the status and function of the ecosystem, i.e. through the removal of invasive alien species and the planting of indigenous species, as well as increasing the basal cover.

  Site preparation:
  - Utilise erosion and sediment control techniques where needed.
  - Loosen the soil by hand.
  - Should the re-vegetation with existing vegetation be unsuccessful, seeding and planting with appropriate species must occur. This must be done in consultation with a qualified wetland ecologist and supervised by the ECO.
  - Plant when the weather will permit e.g. suitable temperatures and moisture for plant growth. Spring plantings give the best results.
  - On unstable soils use a soil saver such as fibre netting or a fibre mat or geotextiles such as soil cells. The sloped area must then be seeded, and the mat placed on top to protect the bare soil.
  - The recovery of vegetation along the pipeline route must be monitored and where re-vegetation is observed to not be occurring, then further remedial measures must be implemented.

7.4. POLLUTION OF WATER RESOURCES AND SOIL

IMPACTS ASSOCIATED WITH THE POLLUTION										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	With out	With	With out	With	With out	With	With out	With		
CONSTRUCTION PHASE										
Pollution of wetlands	4	2	1	1	2	1	6	4	**36 (Low to Moderate)**	**12 (Low)**
OPERATIONAL PHASE										
Pollution of wetlands	4	2	5	5	2	1	8	6	**60 (Moderate)**	**24 (Low to Moderate)**

Description of the impact

Sediment releases (particularly contaminated sediments) from a construction site into the downstream aquatic environment is one of the most common forms of waterborne pollution. Furthermore, mismanagement of waste and pollutants including hydrocarbons, construction waste and other hazardous chemicals will result in these substances entering and polluting the wetland systems either directly through surface runoff during rainfall events, or subsurface water movement.

Further to this, the linked nature of the wetland systems to downstream water resources, will result in pollutants being carried downstream from the construction site having consequences on further downstream users.

During the operational phase, any leakage from the reticulation pipes and oxidation ponds will result in wastewater pollution entering into the wetland systems. This will have an impact on the water quality of the systems leading to a loss of faunal species and having an impact on downstream users.

Mitigation Options

- All waste generated during construction is to be disposed of as per an Environmental Management Programme (EMPr) and washing of containers, wheelbarrows, spades, picks or any other equipment that has been contaminated with cement or chemicals in the wetland systems.
- Proper management and disposal of construction waste must occur during the construction of the development.
- No release of any substance i.e. cements, oil, or any other substance that could be toxic to fauna or faunal habitats within the wetland systems.
- Spillages of fuels, oils and other potentially harmful chemicals must be contained and cleaned up immediately. Contaminants must be properly drained and disposed of using proper solid/hazardous waste facilities (never to be disposed of within the natural environment). Any contaminated soil must be removed, and the affected area rehabilitated immediately.
- Monitoring of the reticulation pipes and oxidation ponds will be required to ensure that leakages are prevented during the operational phase.

7.5. INVASIVE ALIEN SPECIES ENCROACHMENT

IMPACTS ASSOCIATED WITH THE ENCROACHMENT OF ALIEN INVASIVE SPECIES										
Potential impact	Probability		Duration		Extent		Magnitude		Significance scoring without mitigation	Significance scoring with mitigation
	Without	With	Without	With	Without	With	Without	With		
CONSTRUCTION PHASE										
Alien invasive species encroachment	3	2	1	1	2	1	6	4	**27 (Low to Moderate)**	**12 (Low)**
OPERATIONAL PHASE										
Alien invasive species encroachment	3	2	5	5	2	1	6	4	**39 (Low to Moderate)**	**20 (Low to Moderate)**

Description of the impact

Any removal of vegetation will lead to a disturbance within the area having a negative impact on the functionality of the vegetation community. Invasive alien species occur within the area, and these will further encroach into disturbed areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches (Bromilow, 2010). Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity (both abundance and diversity of species), change nutrient cycling and productivity, and modify food webs (Zedler, 2004).

Mitigation Options

- Construction staff and vehicles must stick to the construction area and not be allowed to access sensitive areas.
- Monitor all sites disturbed by construction activities for colonisation by exotics or invasive plants and control these as they emerge. This requirement is in fulfilment of the terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004). Areas which have been disturbed will be quickly colonised by invasive alien plant species.

8. RISK MATRIX

The Risk Assessment for the proposed Bhokwe sanitation project was undertaken in accordance with the General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21 (c) and (i) (Notice 509 of 2016). The risk assessment involves the analysis of the risk matrix provided in appendix 1 of this notice and involves the evaluation of the severity of impacts to the flow regime, water quality, habitat, and biota of the water resource. Based on the outcome of the Risk Assessment Matrix, low risk activities will be generally authorised with conditions, while moderate to high risk activities will be required to go through a Water Use Licence Application Process. Water use activities that are authorised in terms of the General authorisations will still need to be registered with the DWS.

It must be borne in mind that when assessing the impact significance following the DWS Risk Assessment Matrix, determination of the significance of the impact assumes that mitigation measures as listed within this report as well as within an Environmental Management Programme for the construction and operational phase of the sanitation project are feasible and will be implemented, and as such does not take into consideration significance before implementation of mitigation measures.

The risk assessment is provided in Appendix B. Impacts associated with the proposed installation of the Bhokwe sanitation project, particularly the installation of reticulation pipelines within HGM 1 received Low risk scores. This is due to the disturbed nature of the wetlands along the pipeline route as a result of a previous contractor which dug the trenches but did not complete the job. The installation of the reticulation pipes provides an opportunity for the rehabilitation of the area disturbed by the previous contractor.

Low risk scores are provided all mitigation measures recommended in this report form part of the Environmental Management Programme for the project.

9. CONCLUSION

Based on the current identification of the four wetland indicators, five HGM units were delineated within the 500m assessment area. Only HGM units 1 and 2 were assessed in this report as they will be impacted by the proposed project.

The reticulation pipelines will cross HGM 1 and be laid in close proximity to HGM 2, however the oxidation ponds are situated outside of any wetlands systems and the recommended 60m buffer.

HGM units 1 and 2 were assessed with regards to the health according to the Wet-Health methodology. HGM unit 1 is classified as Seriously Modified (PES Category E), while HGM 2 is classified as Largely Modified (PES Category D). Ecosystem goods and services were calculated for both HGM units. Both HGM units received low to moderate scores with regards to ecosystem services. The Ecological Importance and Sensitivity scores received for the HGM units is Low.

Common impacts associated with pipeline projects include erosion and sedimentation of impacted wetlands, reduction in hydrophytic vegetation where the pipeline will be laid, pollution of the wetlands, and the encroachment of alien invasive species as a result of the disturbance.

The Risk Assessment for the proposed project was undertaken in accordance with the General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21 (c) and (i) (Notice 509 of 2016). Impacts associated with the sanitation project received Low Risk Scores with impacts to the water resources and resource quality being small and easily mitigated. This is due to the disturbed nature of the wetlands along the pipeline route as a result of a previous contractor which dug the trenches but did not complete the job. Low risk scores are provided all mitigation measures recommended in this report form part of the Environmental Management Programme for the project. The installation of the reticulation pipes provides an opportunity for the rehabilitation of the area disturbed by the previous contractor and it is the author’s recommendation that the proposed project is approved.

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11. APPENDICES

11.1. APPENDIX A – WETLAND DELINEATION AND ASSESSMENT METHODOLOGY

WETLAND DELINEATION TECHNIQUE

For the purpose of this assessment, wetlands are considered as those ecosystems defined by the National Water Act 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 study site was assessed with regards to the determination of the presence of wetland areas according to the procedure described in 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (DWAF, 2005). This methodology requires the delineator to give consideration to the following four indicators in order to identify wetland areas; to find the outer edge of the wetland zone; and identify the different zones of saturation within the wetland systems identified:

i. **Terrain Unit Indicator:** helps to identify those parts of the landscape where wetlands are more likely to occur.
ii. **Soil Form Indicator:** identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
iii. **Soil Wetness Indicator:** identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation. Signs of wetness are characterised by a variety of aspects including marked variations in the colour of various soil components, known as mottling; a gleyed soil matrix; or the presence of Fe/Mn concretions. It should be noted that the presence of signs of wetness within a soil profile is sufficient to classify an area as a wetland area despite the lack of other indicators.
iv. **Vegetation Indicator:** identifies hydrophilic vegetation associated with frequently saturated soils.

In assessing whether an area is a wetland, the boundary of a wetland should be considered as the point where the above indicators are no longer present. An understanding of the hydrological processes active within the area is also considered important when undertaking a wetland assessment. Indicators should be 'combined' to determine whether an area is a wetland, to delineate the boundary of that wetland and to assess its level of functionality and health.

RIPARIAN ZONE DELINEATION TECHNIQUE

Riparian delineations were undertaken according to 'A Practical Field Procedure for Identification and Delineation of Wetland and Riparian Areas – Edition 1' (Department of Water Affairs, 2005), which requires the following to be taken into account:

i. **Topography associated with the watercourse.** This assesses changes in topography associated with the watercourse and is used in identifying the outer bank of the macro channel;

ii. **Vegetation.** This is the main indicator of a riparian area and is associated with changes in species composition between the channel, the riparian area adjacent to the channel and the terrestrial areas;

iii. **Alluvial soils and deposited material**. Riparian areas often have recent deposits of sand, silt or clay, set down by flowing water. This is not always used as a primary indicator to accurately delineate riparian areas but can be used to confirm topographical and vegetation indicators.

ASSESSMENT OF THE WETLAND'S FUNCTIONAL INTEGRITY

Wetlands within the study area serve to improve habitat within and potentially downstream of the study area through the provision of various ecosystem services. These ecosystem services relate to:

- Flood attenuation.
- Streamflow regulation.
- Water purification (including sediment trapping and the assimilation of phosphates, nitrates and toxicants).
- Carbon storage.
- Maintenance of biodiversity.
- Provision of water for human and agricultural use.
- Cultural benefits (including tourism, recreation and cultural heritage).

Wetlands therefore affect the quantity and quality of water within a catchment (Mitsch & Gosselink, 1993). The importance of wetland conservation and sustainable management is directly related to the value of the functions provided by a wetland. An indication of the functions and ecosystem services provided by wetlands is assessed through the WET-EcoServices manual (Kotze et al., 2008) and is based on a number of characteristics that are relevant to the particular benefit provided by the wetland. The tool uses biophysical characteristics of the wetland and the level of disturbance within the wetland and its catchment to estimate the level of supply of ecosystem goods and services. A Level 2 WET-EcoServices assessment was undertaken for the wetlands identified along the power line corridor. A Level 2 assessment is the highest WET-EcoServices assessment that can be undertaken and involves an on-site assessment as well as desktop work.

ASSESSMENT OF THE WETLAND'S PRESENT ECOLOGICAL STATE (PES)

The Present Ecological State (PES) for wetlands which is defined as '*a measure of the extent to which human impacts have caused the wetland to differ from the natural reference condition'* is also an indication of each wetland's ability to contribute to ecosystem services within the study area. This was assessed according to the methods contained in the Level 2 WET-Health: *A technique for rapidly assessing wetland health* (Macfarlane et al., 2009).

This document assesses the health status of a wetland through evaluation of three main factors -

- **Hydrology:** defined as the distribution and movement of water through a wetland and its soils.
- **Geomorphology:** defined as the distribution and retention patterns of sediment within the wetland.
- **Vegetation***: defined as the vegetation structural and compositional state.*

The WET-Health tool evaluates the extent to which anthropogenic changes have impacted upon the functional integrity or health of a wetland through assessment of the above-mentioned three factors. The deviation from the natural condition is given a rating based on a score of 0-10 with 0 indicating no impact and 10 indicating modifications have reached a critical level. Since hydrology, geomorphology and vegetation are interlinked their scores are then aggregated to obtain an overall PES health score These scores are then used to place the wetland into one of six health classes (A – F; with A representing completely unmodified/natural and F representing severe/complete deviation from natural as depicted in Table 14.

TABLE 14: HEALTH CATEGORIES USED BY WET-HEALTH FOR DESCRIBING THE INTEGRITY OF WETLANDS

DESCRIPTION	IMPACT SCORE	HEALTH CATEGORY
Unmodified, natural.	0 - 1.0	A
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 - 2.0	B
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2.1 - 4.0	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4.1 - 6.0	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable	6.1 - 8.0	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota	8.1 - 10.0	F

Due to differences in the pattern of water flow through various hydro-geomorphic (HGM) types, the tool requires that the wetland is divided into distinct HGM units at the outset. Ecosystem services for each HGM unit are then assessed separately.

ASSESSMENT OF ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The Ecological Importance and Sensitivity (EIS) assessment was determined by utilising a rapid scoring system. The system has been developed to assess the 'Ecological Importance and Sensitivity' of the wetland within the larger landscape; the 'Hydrological Functional Importance' of the wetland; and the 'Direct Human Benefits' obtained from the wetland through either subsistence or cultural practices. The scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze et al. (2008) on the assessment of wetland ecological goods and services from the WET-EcoServices tool. The scores obtained were placed into a category of very low; low; medium; high; and very high as shown:

- Very low: 0 – 1.0
- Low: 1.1 – 2.0
- Medium: 2.1 – 3.0
- High: 3.1 – 4.0
- Very High 4.1 – 5.0

11.2. APPENDIX B– RISK MATRIX

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

NAME and REGISTRATION No of SACNASP Professional member: Rowena Harrison Reg. no. 400715/15

Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

					Severity																		
No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph + Vegetatio	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes	PES AND EIS OF WATER RESOURCE
1	Construction Phase	Bhokwe reticulation pipe installation, construction of the oxidation ponds- Soil Erosion leading to sedimentation	Exposure of soil from construction activities leading to it being washed away, particularly on the steeper slopes and deposited into HGM 1 and HGM 2	Disturbances to the hydrological flow of wetlands; continued formation of erosion gullies.	2	2	1	1	1.5	1	1	3.5	4	3	5	1	13	45.5	L	80	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low
2	Construction Phase	Bhokwe reticulation pipe installation, construction of the oxidation ponds- Reduction in Hydrophilic Vegetation	Removal of hydrophytic vegetation, compaction of soils	Disturbances to the vegetation communities associated with HGM 1 making them more susceptible to alien invasive encroachment	1	1	2	2	1.5	1	1	3.5	5	4	5	1	15	52.5	L	80	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low

	Construction Phase	Bhokwe reticulation pipe installation, construction of the oxidation ponds - Pollution of wetlands and soil	Sediment deposition into HGM 1 and HGM 2, release of hydrocarbons and other pollutants during construction	Deterioration in water quality affecting aquatic and terrestrial species that utilise these systems	**1**		**2**		**1**		**1**		**1.25**	**1**	**1**		**3.25**		**4**	**3**	**5**	**1**		**13**	**42.25**	L	**80**	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low
3	Construction phase	Bhokwe reticulation pipe installation, construction of the oxidation ponds - Encroachment of alien invasive species	Removal of vegetation along the pipeline routes, leads to disturbances and the encroachment of alien invasive species	Further deterioration in vegetation communities associated with the wetland systems	**1**		**1**		**2**		**1**		**1.25**	**1**	**1**		**3.25**		**4**	**3**	**5**	**1**		**13**	**42.25**	L	**80**	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low
4	Operational phase	Bhokwe Sanitation Project -Soil erosion and sedimentation	Long-term sediment movement as a result of a lack of rehabilitation of the pipeline routes leads to formation of erosion gullies, particularly in HGM 1 and HGM 2	Excessive erosion in sensitive environments	**1**		**1**		**1**		**1**		**1**	**1**	**2**		**4**		**4**	**2**	**5**	**2**		**13**	**52**	L	60	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low
5	Operational phase	Bhokwe Sanitation Project - Reduction in Hydrophilic Vegetation	Long-term changes the vegetation communities associated with HGM 1, lack of monitoring and rehabilitation of pipeline routes.	A further decline in the health of these systems as alien invasive species encroach disturbed areas	**1**		**1**		**2**		**2**		**1.5**	**1**	**2**		**4.5**		**4**	**2**	**5**	**1**		**12**	**54**	L	60	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low

5	Operational phase	Bhokwe Sanitation Project - Pollution of the wetlands	Leakage of sewer pipes leads to pollution of wetlands	Long-term deterioration in water quality of wetland systems.	**1**		**1**		**1**		**1**		**1**	**1**	**2**		**4**		**4**	**2**	**5**	**2**		**13**	**52**	L	60	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low
6	Operational phase	Bhokwe Sanitation Project - Encroachment of alien invasive species	Encroachment of alien invasive species within disturbed areas as a result of a lack of monitoring	Deterioration in the vegetation communities of the wetlands	**1**		**1**		**1**		**1**		**1**	**1**	**2**		**4**		**4**	**1**	**5**	**2**		**12**	**48**	L	60	As per Section 7 of the report		HGM 1 (Seep) PES - E EIS – Low; HGM 2 (Seep) PES - D, EIS - Low

BHOKWE COMMUNITY SANITATION PROJECT
ABAQULUSI LOCAL MUNICIPALITY
KWAZULU-NATAL

Phase 1 Heritage Impact Assessment

11 July 2019
Updated 08 November 2019

FOR: **1World Consultants**
Hasan Mahomedy

AUTHOR: JLB Consulting
Jean Beater

EXECUTIVE SUMMARY

The sewer system in Bhokwe consists of flushing toilets connected to a shallow sewer reticulation system that discharges into a common conservancy tank. There are two conservancy tanks in the ward, one servicing Bhokwe quarters and the other servicing Bhokwe hostels. The rest of the villages under Bhokwe settlements use VIP toilets. The municipal staff and community that are close to the wastewater treatment plant (WWTP) are exposed to health hazards due to the condition of the WWTP. The Bhokwe community requires the rehabilitation of the sanitation systems in the settlement, which is characterized by frequent bursts, blockages and overflows resulting in a health hazard to the community.

The project consists of the construction of 2.2 km of 160mmØ uPVC sewer reticulation, 110mmØ uPVC housing connections, 165 m of 200mmØ uPVC sewer reticulation, an oxidation sewer pond and numerous 1000mmØ precast concrete ring manholes.

The length of the pipeline is 2.2 km in length hence it triggers section 41 (1)(a) of the KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No 5 of 2018) which refers to the construction of a road, wall, power line, <u>pipeline</u>, canal or other similar form of linear development or barrier <u>exceeding 300 m</u> in length. In addition, the pond/s comprising the waste water treatment system are 11 812m^2 in size hence triggering section 41 (1)(c)(i) of the same Act that refers to any development or other activity which will change the character of a site exceeding 5 000m^2.

Bhokwe village is situated very close to the Natal Anthracite Mine which was situated at the base of the Ngwibi / Bhokwe Mountain that looms above the village. It is surrounded by various other mines including the now defunct Enyati Anthracite Mine and is situated approximately 38 km south east of the town of Vryheid in KwaZulu-Natal.

An inspection of the project area was undertaken on 02 July 2019. Visibility was good and the specialist spoke to several residents in terms of the presence of heritage resources.

The pipeline and components of the water treatment system were inspected on foot. Many buildings within the village have been dismantled with only the foundations and some walls remaining. Some of the existing buildings could be older than 60 years but will not be impacted by the proposed development. The areas where the pipeline has been laid and is to be laid is disturbed by roads and residential activity.

Residents told the specialist that the Municipality did not want burials within the village and the residents use a cemetery situated some distance from the village to bury their dead.

The section of pipeline that has already been laid was inspected. The associated infrastructure for the sanitation and water project were clearly visible and much of the pipeline runs along the road before entering properties. No heritage resources were to be impacted along the sections of laid pipeline.

The elevated section of steel pipe was inspected and the remains of structures were found. However, no heritage resources were found along this section.

Many of the structures located above the elevated pipeline against the mountain have been demolished. These were the compounds or hostels in which workers lived and in which some people currently live. There are seven hostels consisting of up to 20 rooms or more in each hostel. Some of the roofs have been removed as well as windows and in others some of the rooms have been left intact. The age of the hostels could not be ascertained. Although the mine was acquired by Anglo-American in the early seventies, the mine may have been in operation prior to this. The pipeline alignment is situated between the hostels and should not impact on the buildings.

The area where the conventional pond system for wastewater treatment has been moved west due to concerns raised by residents and the Department of Water and Sanitation. The new location is disturbed and is currently used as a soccer field by local residents according to Mr. Mdititi Ntombela, the Councillor of the area. According to Mr. Ntombela, there are no graves on the proposed site. The ponds are also situated on a tree planation where the possibility of finding heritage resources is low to negligible.

According to the South African fossil sensitivity map, the proposed Bhokwe sanitation project falls within an area of very high fossil sensitivity. An area of very high fossil sensitivity requires a field assessment; however, because the area is disturbed by residential and mining activity as well as the laying of infrastructure, it is recommended that a desktop palaeontological study is undertaken to assess the significance of impact of the sanitation project on fossil resources in the area and to recommend the way forward.

The desktop palaeontological study revealed that the proposed site lies on the non-fossiliferous dolerite dykes of Jurassic age (higher altitude), and the shales of the early Permian Vryheid Formation (Ecca Group). The latter could potentially contain fossil plant impressions of the Glossopteris flora, but only below ground and not in the village or the soils of the ploughed field (site for sewer oxidation tanks) Since there is a small chance that fossils could be discovered once excavations commence, a Fossil Chance Find Protocol should be added to the

Environmental Management Programme and no site visit is required by a palaeontologist unless fossils are found during the project.

Some of the pipelines could run close to structures that could be older than 60 years. Structures over 60 years are protected by section 37 (1)(a) of the Amafa and Research Institute Act (2018), which states that no structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without prior written approval of the Institute having been obtained. It is therefore recommended that the pipelines avoid impacting on structures.

If the recommendations and mitigation measures provided in this report are implemented and adhered to, then the construction of the Bhokwe community sanitation project may proceed from a heritage perspective.

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I, **Jean Lois Beater**, act as an independent specialist for this project and I do not have any vested interest either business, financial, personal or other, in the proposed activity other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014.

SPECIALIST DETAILS

Name	Qualification	Professional Registration
Jean Beater	MA (Heritage Studies) MSc (Environmental Management)	Member of Association of South African Professional Archaeologists (No. 349) Member of IAIAsa (No. 1538)

1. INTRODUCTION

The sewer system in Bhokwe consists of flushing toilets connected to a shallow sewer reticulation system that discharges into a common conservancy tank. There are two conservancy tanks in the ward, one servicing Bhokwe quarters and the other servicing Bhokwe hostels. The rest of the villages under Bhokwe settlements use VIP toilets. The municipal staff and community that are close to the wastewater treatment plant (WWTP) are exposed to health hazards due to the condition of the WWTP. The Bhokwe community requires the rehabilitation of the sanitation system in the settlement, as it is characterized by frequent bursts, blockages and overflows resulting in a health hazard to the community (1World Consultants 2019:1).

Ukuza Consultants (on behalf of the Municipal Infrastructure Support Agent – MISA) proposes the construction of 2.2 km of 160mmØ uPVC sewer reticulation, 110 mmØ uPVC housing connections, 165 m of 200mmØ uPVC sewer reticulation, an oxidation sewer pond and numerous 1000mmØ precast concrete ring manholes, in Bhokwe community, Ward 05 of the AbaQulusi Municipality, KwaZulu-Natal (KZN) (1World Consultants 2019:1).

The footprint of the oxidation sewer pond from edge of bank to edge of bank is 11 812m² or 1.18 ha. In order to cross the valley, an elevated section of steel pipe will be constructed that will be about 70m long. It should be noted that approximately 1.6m of the pipeline has already been laid; however, the specialist was requested to inspect the laid pipeline to ensure that no heritage resources had been impacted.

This is the Phase 1 Heritage Impact Assessment (HIA) report for the proposed Bhokwe community sanitation project.

2. LEGISLATIVE BACKGROUND

The length of the pipeline is 2.2 km in length hence it triggers section 41 (1)(a) of the KwaZulu-Natal Amafa and Research Institute Act, 2018 (Act No 5 of 2018) which lists developments or activities that may require an HIA. The relevant section of the Act refers to the following development: *"the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length"*.

In addition, the ponds comprising the waste water treatment system are 11 812m² in size hence triggering section 41 (1)(c)(i) of the same Act that refers to *any development or other activity which will change the character of a site* *exceeding 5 000m²*.

In addition, the proposed project may impact on graves, structures, archaeological and palaeontological resources that are protected in terms of sections 37, 38, 39, and 40 of the KwaZulu-Natal Amafa and Research Institute Act, 2018.

In terms of section 3 of the NHRA, heritage resources are:
(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 natural features of cultural significance;
(e) geological sites of scientific or cultural importance;
(f) archaeological and paleontological sites;
(g) graves and burial grounds, including—
    (i) ancestral graves;
    (ii) royal graves and graves of traditional leaders;
    (iii) graves of victims of conflict;
    (iv) graves of individuals designated by the Minister by notice in the *Gazette*;
    (v) historical graves and cemeteries; and
    (vi) other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);
(h) of significance relating to the history of slavery in South Africa;
(i) movable objects, including:
(i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
(ii) objects to which oral traditions are attached or which are associated with living heritage;
(iii) ethnographic art and objects;
(iv) military objects;
(v) objects of decorative or fine art;
(vi) objects of scientific or technological interest; and
(vii) books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings, excluding those that are public records as defined in section 1(xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996).

3. LOCATION

Bhokwe village is situated very close to the Natal Anthracite Mine which was situated at the base of the Ngwibi / Bhokwe Mountain that looms above the village. It is surrounded by various other mines including the now defunct Enyati Anthracite Mine as depicted on a segment of the 1:50 000 map (2731CC) in **Figure 1**. It is situated approximately 38 km south east of the town of Vryheid (see **Figure 2** below).

~~The proposed layout of the Bhokwe community sanitation project (outlined in orange) is provided in **Figure 3**.~~In October 2019, the original position of the oxidation ponds was moved due to objections by the community. The new position of the ponds is directly west of the original position. In November 2019, due to concerns raised by the Department of Water and Sanitation (DWS), the reticulation and oxidation ponds have been slightly revised. See **Figure 3** below.

4. TERMS OF REFERENCE

Undertake a Phase 1 Heritage Impact Assessment in order to determine the possible existence of heritage resources, as listed above, that could be impacted by the proposed sanitation project. Provide mitigation measures to limit or avoid the impact of the proposed project on heritage resources (if any).

Submit the HIA report to the provincial heritage resources authority, namely the KwaZulu-Natal Amafa and Research Institute (hereafter, referred to as the Institute), for the Institute's assessment and comment.

5. METHODOLOGY

A survey of literature, including other heritage impact assessment reports completed for the larger area, was undertaken in order to ascertain the history of the area and what type of heritage resources have or may be found in the area of development.

An inspection of the project area was undertaken on 02 July 2019. Visibility was good and the specialist spoke to several residents in terms of the presence of heritage resources.

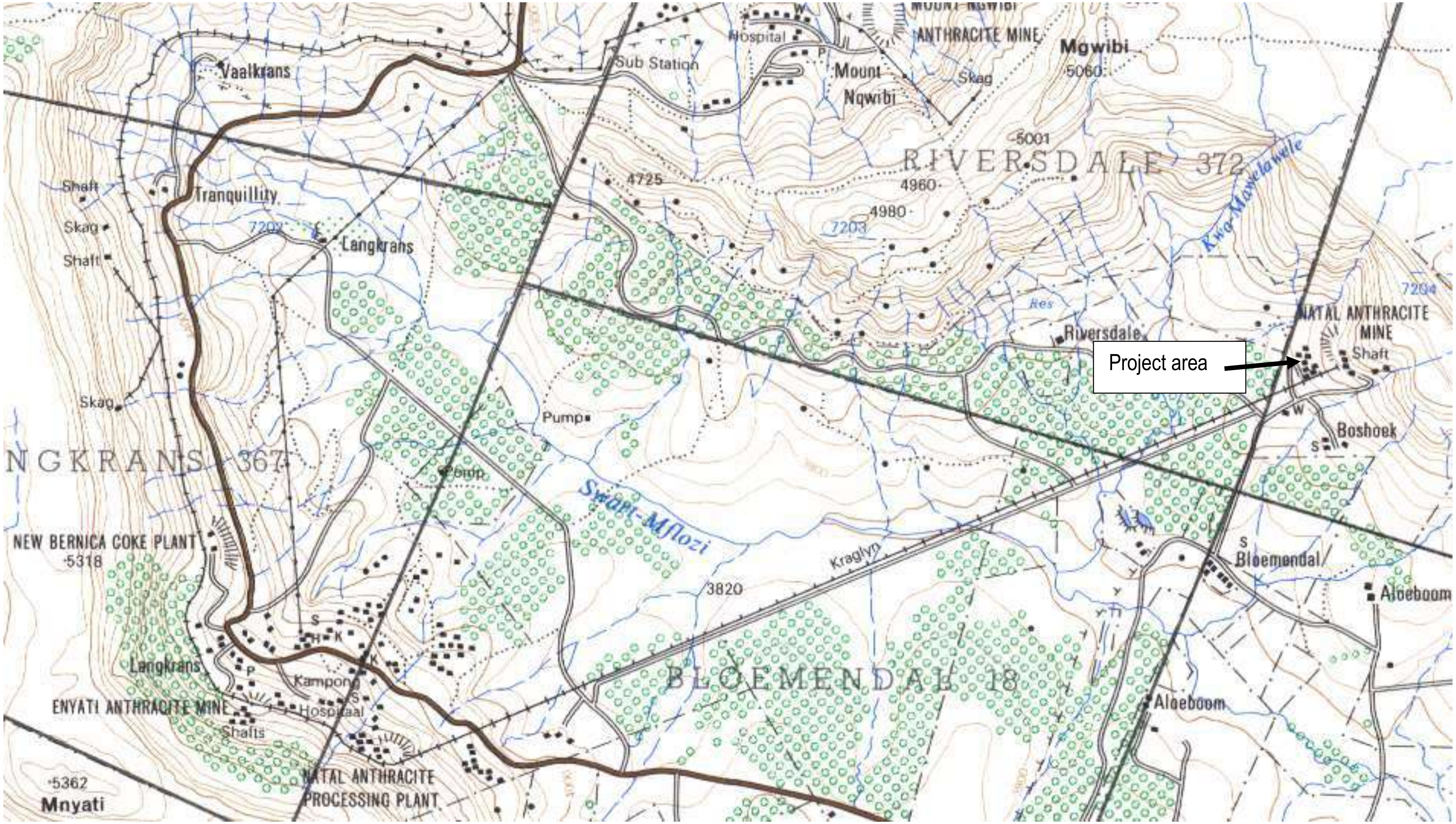


Figure 1: Project area surrounded by mines

Figure 2: Location of project area in relation to surrounding area

Figure 3: Project layout indicated in orange with oxidation ponds in foreground

6. HISTORICAL BACKGROUND OF AREA

Portions of the greater Vryheid and Nqutu areas have been systematically surveyed for archaeological in the past. Sixty archaeological sites are recorded that include fourteen Early Stone Age sites, eight Middle Stone Age sites, ten Later Stone Age sites, three rock painting sites, and forty Later Iron Age sites. The majority of the Early Stone Age sites occur in open air context in large dongas. Middle and Later Stone Age sites occur in context in four rock shelters. The majority of the known Later Iron Age sites are situated to the south east of Nqutu some distance from the project area. Around 800 years ago, Bantu-speaking farmers settled in the greater Vryheid area and with the expansion of the Zulu kingdom of King Shaka in the early 1820’s the wider area became incorporated into his kingdom (Active Heritage 2014:2-3).

During the Anglo-Zulu War of 1879, the surrounding area saw action with the battle of Hlobane taking place on 28 March 1879 during which the British were defeated by the Zulu army. During the Anglo-Boer War of 1899-1902, the immediate project area saw action on Bhokwe mountain. In March 1901, it was held by the Vryheid Boer commando and during the Boers second invasion of Natal, Commandant-General Louis Botha concentrated his forces on the mountain in October 1901 and rested for there for three days before leaving on 5 October 1901 (Jones and Jones 1999:27).

Hancox and Gotz (2014:86) have indicated that whilst never being the largest producers by tonnage, the coalfields of KZN have historically played an important role in the coal industry of South Africa for the high quality of the coals produced. Historically the Vryheid Coalfield was an important producer of high-quality coking coal and anthracite, producing the highest quality anthracite in South Africa. The coalfield has been extensively mined. The earliest recorded commercial exploitation in the Vryheid Coalfield was in 1898, with coal being mined from the Hlobane and Zuinguin mountains. The rail line only reached Vryheid in 1906 and it took the creation of a branch line in 1908 to open up the development of the Hlobane coal mining sector.

In the early seventies, the Anglo-American Corporation acquired the Enyati and Natal Anthracite Collieries, which were located in the Enyati and Ngwibi mountains in the Vryheid district. Since then most of the production came from Natal Anthracite Colliery until it ceased production at the end of March 1992. Natal Anthracite provided direct employment for up to a 1000 people over a period of 50 years.

7. RESULT OF SITE INSPECTION

The pipeline and components of the water treatment system were inspected on foot. Many buildings within the village have been dismantled with only the foundations and some walls remaining. A resident told the specialist that when the mine ceased production, the owner, Anglo-American, dismantled the buildings and took useful building material with them. Some of the existing buildings could be older than 60 years but will not be impacted by the proposed development. The areas where the pipeline has been laid and is to be laid is disturbed by roads and residential activity.

Two residents told the specialist that the Municipality did not want burials within the village and the residents use a cemetery situated a distance from the village to bury their dead.

The section of pipeline that has already been laid was inspected as well as trenches that had already been dug but not used as yet. The associated infrastructure for the sanitation and water project were clearly visible including yellow markers indicating the alignment of pipelines. Much of the pipeline runs along the road before entering properties. No impacted heritage resources were found along the sections of laid pipeline.

Figure 4: Section of laid pipeline with infrastructure in background

Figure 5: Dug section entering property from road

Figure 6: Remains of structure

There will be an elevated section of steel pipe about 70m long where a gravity sewer pipeline will cross a valley. This area was inspected and the remains of structures were found. The area is very wet either due to a spring or wetland. No heritage resources were found along this section.

Most of the structures located above the elevated pipeline section against the mountain have been demolished. These were the compounds or hostels in which workers lived and in which some people currently live. There are seven hostels consisting of up to 20 rooms or more in each hostel. Some of the roofs have been removed as well as windows and in others some of the rooms have been left intact (see **Figures 7 - 10** below).

The age of the hostels could not be ascertained. Although the mine was acquired by Anglo-American in the early seventies (see **Chapter 6** above), it may have been in operation prior to this. The pipeline alignment is situated between the buildings and should not impact on them.

According to Guest (1988, 50), housing provided for black labourers, who always constituted the majority of the work-force on mines, was primitive. Apart from the family accommodation which married employees were encouraged to construct for themselves with whatever materials were available, Natal's collieries were characterized by grim compounds for the migrant males who considerably outnumbered the married men living more or less permanently on mine properties.

Figure 7: Closer view of elevated section and compounds

Figure 8: Remains of compound

Figure 9: Section of intact compound and remains of demolished section

Figure 10: Interior of room within compound

Figure 11: View of pipeline route showing new man-holes

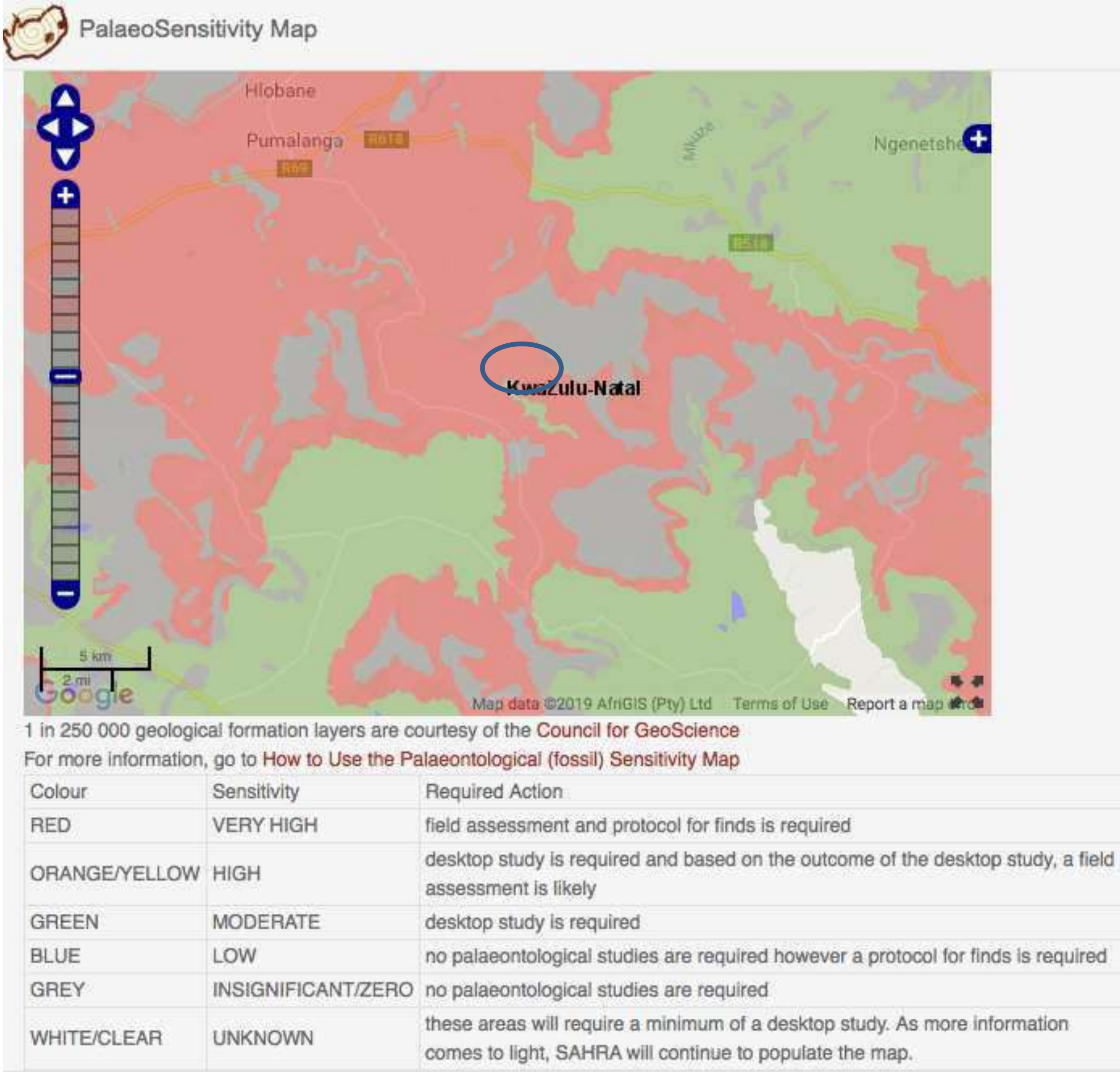
The area where the conventional pond system for wastewater treatment has been moved west due to concerns raised by residents and the DWS. The new location is disturbed. Part of it is currently used as a soccer field by local residents according to Mr. Mdititi Ntombela, the Councillor of the area. According to Mr. Ntombela, there are no graves on the proposed site. The ponds are also situated on a ~~It also falls into a~~ tree planation (see **Figure 3**) where the possibility of finding heritage resources is low to negligible.

Figure 12: View across area identified for waste water treatment system

Figure 13: View looking across waste water treatment system

According to the South African fossil sensitivity map, the proposed Bhokwe sanitation project falls within an area of very high fossil sensitivity as indicated by the red colour in **Figure 14** below. This is unsurprising as coal is fossilised plant material.

An area of very high fossil sensitivity requires a field assessment; however, because the area is disturbed by residential and mining activity as well as the laying of infrastructure, it is recommended that a desktop palaeontological study is undertaken to assess the significance of impact of the sanitation project on fossil resources in the area and to recommend the way forward.



1 in 250 000 geological formation layers are courtesy of the Council for GeoScience

For more information, go to How to Use the Palaeontological (fossil) Sensitivity Map

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 14: Fossil sensitivity of project area indicated by blue oval

The desktop palaeontological study revealed that the proposed site lies on the non-fossiliferous dolerite dykes of Jurassic age (higher altitude), and the shales of the early Permian Vryheid Formation (Ecca Group). The latter could potentially contain fossil plant impressions of the

Glossopteris flora, but only below ground and not in the village or the soils of the ploughed field (site for sewer oxidation tanks) Since there is a small chance that fossils could be discovered once excavations commence, a Fossil Chance Find Protocol should be added to the Environmental Management Programme (EMPr) and no site visit is required by a palaeontologist unless the geologist or responsible person discovers fossils.

8. RECOMMENDATIONS AND CONCLUSION

Some alignments of the pipelines that comprise the sanitation project could run close to structures that could be older than 60 years. Structures over 60 years are protected by section 37 (1)(a) of the Amafa and Research Institute Act (2018), which states that no structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without prior written approval of the Institute having been obtained on written application to the Institute. It is therefore recommended that the pipeline alignments avoid impacting on structures.

A Fossil Chance Find Protocol, as included in Chapter 8 of the desktop palaeontological study, must be added to the (EMPr).

If the recommendations and mitigation measures provided in this report and that of the desktop palaeontological study are implemented and adhered to, then the construction of the Bhokwe sanitation project may proceed from a heritage perspective.

9. ADDITIONAL MITIGATION MEASURES

- Workers should be made aware of the types of heritage resources, such as protected structures, that could be impacted by the construction of the sanitation project.
- For any chance heritage finds (graves, etc.), all work must cease in the area affected and the Contractor must immediately inform the Project Manager. A registered heritage specialist must be called to site to inspect the finding/s. The relevant heritage resource agency (the Institute) must be informed about the finding/s.
- The heritage specialist will assess the significance of the resource and provide guidance on the way forward.
- Permits must be obtained from the Institute if heritage resources are to be removed, destroyed or altered.
- Under no circumstances may any heritage material be destroyed or removed from the project site unless under direction of a heritage specialist.

- Should any recent remains be found on site that could potentially be human remains, the South African Police Service as well as the Institute must be contacted. No SAPS official may remove remains (recent or not) until the correct permit/s have been obtained.

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BIODIVERSITY ASSESSMENT

PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, ABAQULUSI LOCAL MUNICIPALITY, KWAZULU-NATAL

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Draft Version For Client Review and Comment
December 2019

Declaration of Independence by Specialist

I, **Craig Widdows**, in my capacity as a specialist consultant, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Have and will not have vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- Based on information provided to me by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional ability; and
- Undertake to have my work peer reviewed on a regular basis by a competent specialist in the field of study for which we are registered.

Dr. Craig Widdows
Ecologist
SACNASP Reg. No. 117852

EXECUTIVE SUMMARY

Malachite Ecological Services was appointed by 1World Consultants to conduct a biodiversity assessment for the proposed Bhokwe Community Sanitation Project. The project is located within the Bhokwe Community, Ward 05 of the Abaqulusi Local Municipality, KwaZulu-Natal. A previous contractor (Municipal Infrastructure Support Agent) was appointed to implement this project in June 2016 however, abandoned the site with some aspects of the project such as certain pipelines and manholes constructed. Broad-scale vegetation within the project area is associated with Paulpietersburg Moist Grassland (Gm15) and Northern Zululand Mistbelt Grassland (Gs1). Although not within the project area, the northern boundary is classified an Irreplaceable Critical Biodiversity Area and extends into an Ecological Support Area (KZN: BSP).

The majority of the sanitation project occurs within the Bhokwe village and as such large portions have been transformed through housing, gardens, internal roads, verges, dumping of waste, compaction of soils, spread of invasive alien vegetation and continued disturbance. The vegetation communities within the village have been completely transformed. *Acacia mearnsii* plantations have replaced large portions of grasslands extending southwards of the project area. Remaining grassland systems were isolated and degraded to some extent. Invasive alien vegetation was noted throughout the project area, with high densities occurring within areas largely associated with anthropogenic disturbances such as road reserves, erosion gullies, infrastructure developments where rehabilitation measures have not been successful and historically cultivated lands.

Taking into consideration the nature of the proposed sanitation project, impacts are likely associated with the degradation of habitats surrounding the pipeline route and further encroachment of invasive alien vegetation. However, as represented in this assessment large portions of habitats within the project area are associated with the Bhokwe village whilst adjacent habitats have experienced a high degree of transformation through edge effects. Furthermore, the previous contractor cleared the pipeline routes. Therefore, given the nature and location of the project coupled with the site specific impacts and proposed mitigation opportunities, the specialist is of the opinion that impacts arising can be mitigated to an acceptably low level.

This is based on the assumption that mitigation measures specified within the impact assessment are adhered to as well as the following provisos:

- Disturbed areas must be rehabilitated as soon as the construction is completed. Emphasis must be placed on the drainage channel crossing, where the pipeline has already been put in place.
- Implementation of an invasive alien management plan and removal of invasive species within the pipeline servitude. This plan must form part of the approved environmental management plan.
- Implementation of recommendations provided by the wetland assessment (Malachite Ecological Services, 2019).

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ACRONYMS

BGIS	Biodiversity Geographic Information System
BODATSA	Botanical Database of southern Africa
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DD	Data Deficient
DEA	Department of Environmental Affairs
ECO	Environmental Control Officers
EMP	Environmental Management Programme
EN	Endangered
ESA	Ecosystem Support Area
IAPs	Invasive Alien Plants
IBA	Important Bird and Biodiversity Areas
IUCN	International Union for Conservation of Nature
LC	Least Concern
NFA	National Forest Act 1998 (Act No. 84 of 1998)
NT	Near Threatened
NEMA	National Environmental Management Act (No. 107 of 1998)
SABAP	South African Bird Atlas Project
SAFAP	South African Frog Atlas Project
SARCA	South African Retile Conservation Assessment
NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
VU	Vulnerable

1. INTRODUCTION

1.1 Project Description and Locality

1World Consultants were appointed to conduct the necessary environmental authorisation processes for the proposed Bhokwe Community Sanitation Project. Subsequently, Malachite Ecological Services (Pty) Ltd was appointed to conduct a biodiversity assessment. The current sanitation within the Bhokwe community is prone to frequent bursts and blockages. Therefore the project aims to upgrade the deficient system to remove the potential health hazard to the Bhokwe community. A previous contractor (Municipal Infrastructure Support Agent) was appointed to implement this project in June 2016 however, the site was abandoned with some aspects of the project including certain pipelines and manholes already constructed. Subsequently, Ukuza Consulting will be completing the sanitation project.

The Sanitation Project will involve the construction of 2.2km of 160mmØ uPVC sewer reticulation, 110 mmØ uPVC housing connections, 165 meters of 200 mmØ uPVC sewer fed piping, an oxidation sewer pond and numerous 1250mmØ precast concrete ring manholes (1World Consultants, 2019). These will be constructed within the Bhokwe Community, Ward 05 of the Abaqulusi Local Municipality, KwaZulu-Natal (Figure 1). The site falls within the 2731CC quarter degree square and surrounding land use is comprised of *Acacia mearnsii* plantations (southwards) and tracts of moist grasslands and drainage lines (northwards) associated with the escarpment (Figure 2).

The primary aim of this investigation is to assess vegetation communities present within the project area through a site investigation and impact assessment. Further to this, an assessment of faunal communities associated with the project area was also conducted. The findings of this assessment must be used in conjunction with other specialist assessments to ensure the project has a limited impact on the receiving environment.

1.2 Scope of the Assessment

The vegetation encompassed the following scope of work:

- Initial desktop review and mapping exercise based on available datasets and spatial information to gather contextual information on the project area and the modelled conservation importance of vegetation associated with the project area.
- Consultation of the Botanical Database of Southern Africa, Animal Demographic Unit, Virtual Museum and other appropriate literature sources, to determine species likely to be present within the project area, including species of conservation concern.
- Field survey identifying vegetation habitats/communities present within a defined project area as well as the associated ecological sensitivity.
- Assessment of the significance of impacts arising from the proposed project (based on layouts and specifications provided by 1World Consultants) and suggest relevant measures to avoid and/or mitigate anticipated negative impacts.
- Provide ecological recommendations.

1.3 Assumptions and Limitations

It is difficult to apply pure scientific methods within a natural environment without limitations or assumptions. During the present study, the following limitations were experienced:

- The findings, results, observations, conclusions and recommendations provided in this report are based on the author's best scientific and professional knowledge. The author, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document
- The current assessment focuses on a defined project area (as defined by 1World Consultants) and vegetation communities outside this area were not assessed.
- Modelled biodiversity databases have accuracy limitations and as a result, must be ground-truthed for verification.
- In order to obtain a comprehensive understanding of the dynamics and diversity of the biota on a site, including species of conservation concern, studies should include investigations through the different seasons of the year.
- A hand-held Garmin eTrex 30x was used to delineate the vegetation communities and record protected species and this has an accuracy of 3-6m.

1.4 Reporting Conditions

The findings and recommendations provided in this report are based on the authors' best scientific and professional knowledge as well as information available at the time of compilation. No form of this report may be amended without the prior written consent of the author/s.

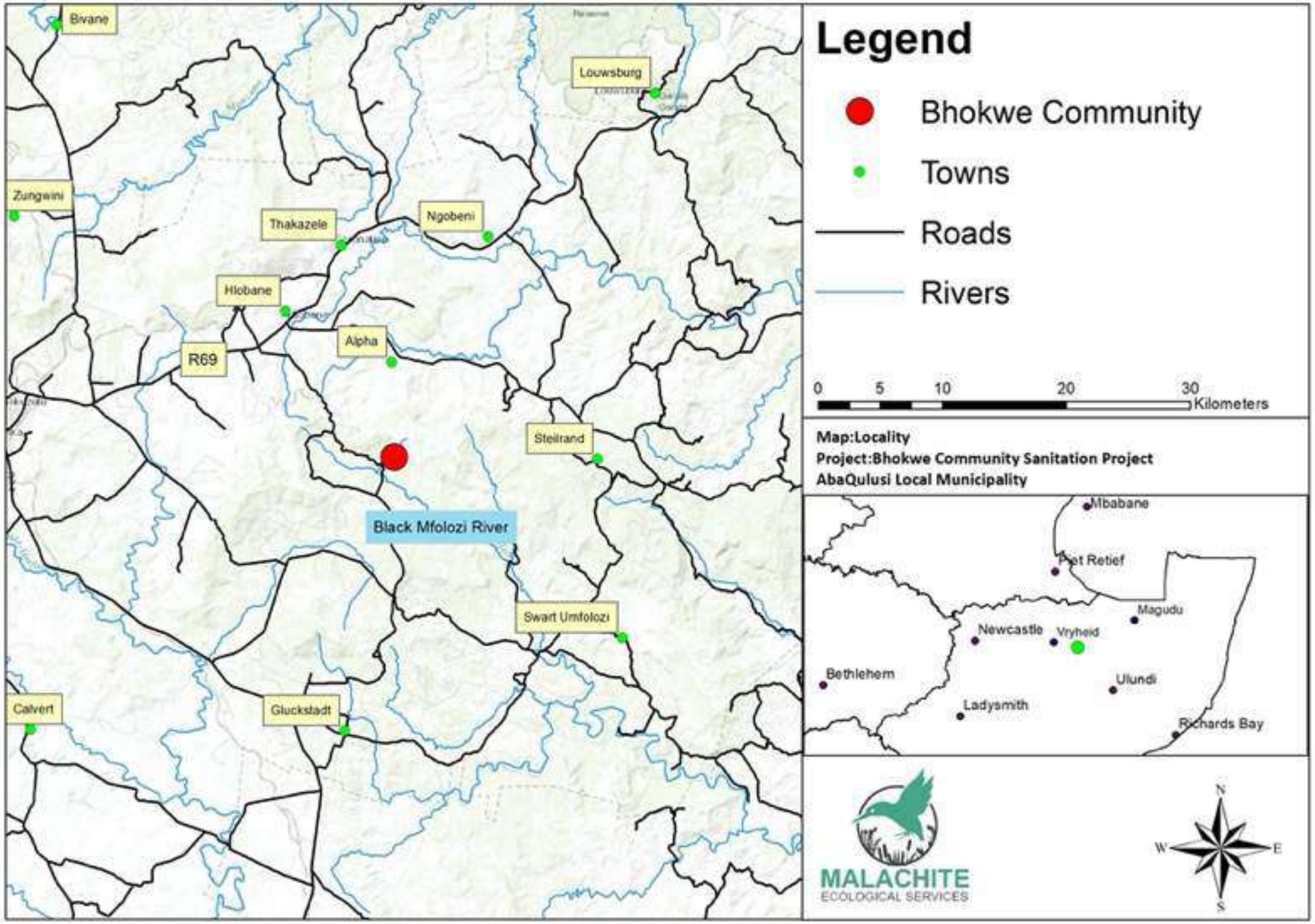

Figure 1: Locality of the study area

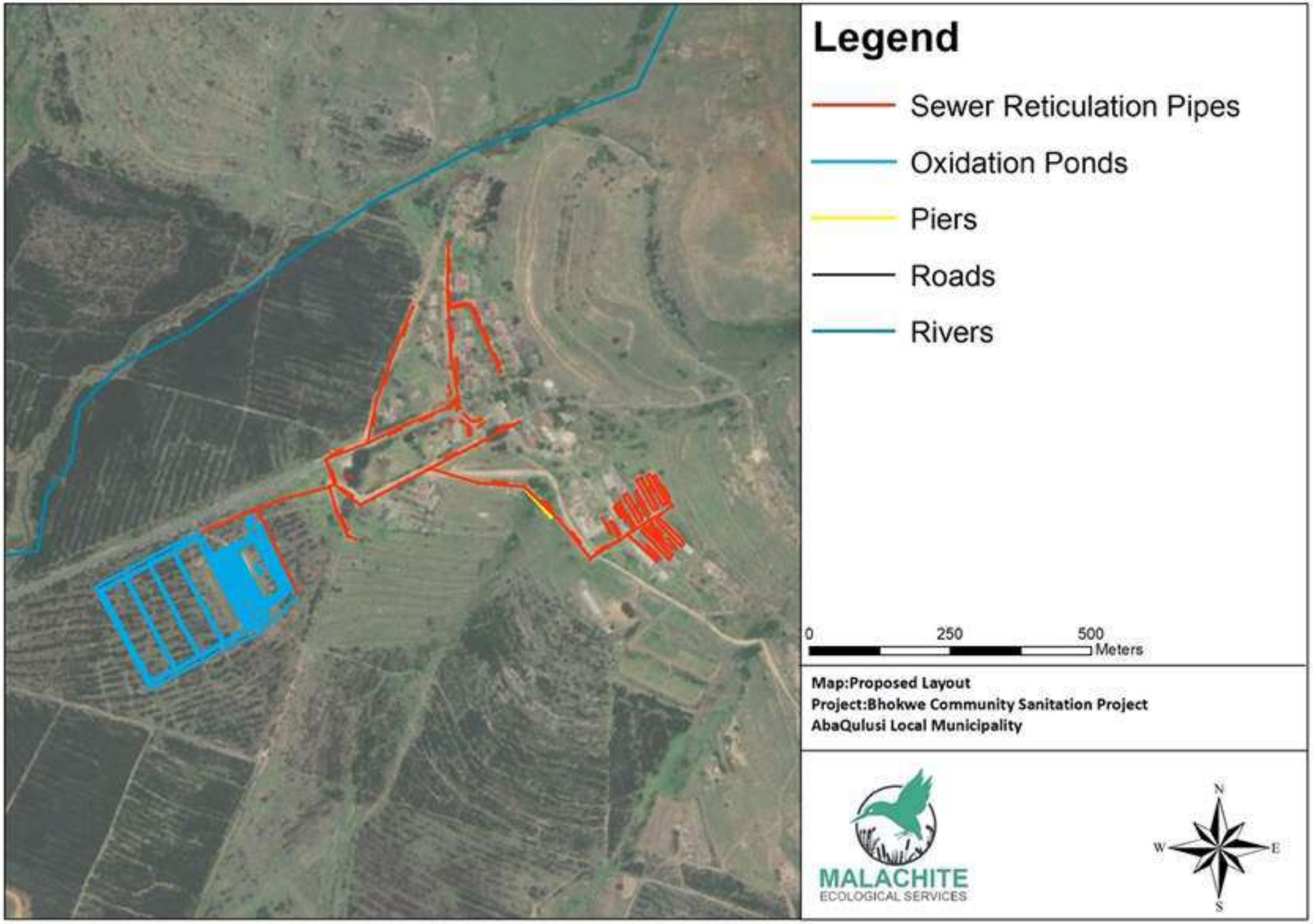

Figure 2: Project layout

2. BIOPHYSICAL CHARACTERISTICS

2.1 Climate

The study area is characterised by summer rainfall patterns with sporadic rainfall events during the winter months. The mean annual precipitation is approximately 870mm, with the bulk of the rainfall occurring between October and February. The wettest time of the year is January with an average of 141mm and the driest is June with 12mm (Table 1). The seasonality of precipitation is a driving factor behind the hydrological cycles of water resources within the area. Typically, watercourses have a higher flow rate during the summer months. Temperatures vary with mean temperatures ranging from 20.1^{0}C in January to 12.6^{0}C in June (Camp., 1995).

Table 1: Mean Annual Rainfall and temperature for the area (Xc2 – Uitkomst)

	Annual	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Mean Rainfall (mm)	870	141	124	73	61	26	12	19	23	56	102	111	122
Mean Temperature (^{O}C)	16.8	20.1	20.0	19.3	16.9	14.9	12.6	12.8	14.3	16.4	16.9	18.0	19.4

2.2 Geology and Topography

South Africa is a semi-arid country with differences in rainfall patterns, topography and geology. The geological characteristics of an area influences the topography, vegetation communities present and subsequent faunal assemblages. The project area is underlain by sandstones and shales of the Volksrust and Madzaringwe Formation (Ecca Group of the Karoo Supergroup) supporting shallow, duplex soils and soils of moderate to poor drainage, which present an erosion hazard if not managed correctly (Camp, 1999; www.stec.ukzn.ac.za).

The topographical setting is a defining characteristic that influences the biodiversity associated with the area. Increased topographical heterogeneity associated with geomorphologically diverse habitats results in elevated, often site specific biodiversity attributes. Bhokwe village is situated on moderate to steep slopes which range in altitude from 1214m to 1273m above sea level. The larger mountain range which surrounds Bhokwe has a number of springs which release water perennially into the village.

2.3 Regional Vegetation Structure and Composition

The project area is located within the Grassland Biome (Mucina & Rutherford, 2006). According to the delineation of vegetation types as described and mapped for South Africa (Mucina & Rutherford, 2006; updated 2018 on BGIS), the study area and surrounds are associated with the Paulpietersburg Moist Grassland (Gm15), for the most part, and Northern Zululand Mistbelt Grassland (Gs1) (Figure 5) as well as within Bioresource Group 11 (BRG subgroup 11. 4) defined as Moist Transitional Tall

Grassveld. This is discussed in more detail below based on *The Vegetation Map of South Africa*[1] (Mucina & Rutherford, 2006; Scott-Shaw & Escott, 2011).

Gm15 Paulpietersburg Moist Grassland

This vegetation unit is characterised by tall closed grasslands with a high forb diversity and dominated by *Tristachya leucothrix*, *Themeda triandra* and *Hyparrhenia hirta*. It often occurs in undulating and moderately steep slopes. Evergreen woody vegetation is characteristic on rocky outcrops.

Important Taxa **Graminoids**: *Alloteropsis semialata subsp. eckloniana, Andropogon schirensis, Brachiaria serrata, Ctenium concinnum, Cymbopogon caesius, Digitaria tricholaenoides, Eragrostis racemosa, Harpochloa falx, Heteropogon contortus, Hyparrhenia hirta, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Rendlia altera, Setaria nigrirostris, Themeda triandra, Tristachya leucothrix, Andropogon appendiculatus, Cynodon hirsutus, Diheteropogon amplectens, D. filifolius, Elionurus muticus, Eragrostis chloromelas, E. curvula, E. plana, Festuca scabra, Melinis nerviglumis, Panicum ecklonii, P. natalense, Trachypogon spicatus, Urelytrum agropyroides.* **Herbs:** *Argyrolobium speciosum, Cissus diversilobata, Dicoma zeyheri, Eriosema kraussianum, Geranium wakkerstroomianum, Helichrysum nudifolium var. nudifolium, Ipomoea oblongata, Pelargonium luridum, Acalypha glandulifolia, A. peduncularis, Acanthospermum australe, Aster bakerianus, Becium filamentosum, Berkheya setifera, Dicoma anomala, Euryops laxus, E. transvaalensis subsp. setilobus, E. transvaalensis subsp. transvaalensis, Helichrysum rugulosum, H. simillimum, Indigofera hilaris var. hilaris, I. velutina, Kohautia amatymbica, Pearsonia grandifolia, Pentanisia prunelloides subsp. latifolia, Senecio bupleuroides, S. coronatus, S. inornatus, S. isatideus, S. latifolius, Sonchus nanus, Thunbergia atriplicifolia, Vernonia capensis, V. natalensis, Xerophyta retinervis.* ***Herbaceous Climber****: Rhynchosia totta.* ***Geophytic Herbs****: Chlorophytum haygarthii, Gladiolus aurantiacus, Agapanthus inapertus subsp. intermedius, Asclepias aurea, Cheilanthes hirta, Cyrtanthus tuckii var. transvaalensis, Hypoxis colchicifolia, H. costata, H. rigidula var. pilosissima, Moraea brevistyla, Pteridium aquilinum, Watsonia latifolia, Zantedeschia rehmannii.* **Succulent Herbs:** *Aloe ecklonis, A. maculata, Lopholaena segmentata.* ***Small Trees****: Canthium ciliatum, Dombeya rotundifolia, Vangueria infausta.* ***Succulent Tree****: Aloe marlothii subsp. marlothii.* **Tall Shrubs:** *Calpurnia sericea, Rhus rehmanniana, Diospyros lycioides subsp. guerkei, Euclea crispa subsp. crispa.* **Low Shrubs:** *Rhus discolor, Anthospermum rigidum subsp. pumilum, A. rigidum subsp. rigidum, Clutia monticola, Diospyros galpinii, Erica oatesii, E. woodii, Hermannia geniculata, Indigofera arrecta, Otholobium wilmsii, Polygala uncinata, Pseudarthria hookeri, Rubus rigidus.* **Succulent Shrub***: Euphorbia pulvinata.*

This vegetation unit is classified as Vulnerable with an estimated 33% of the area transformed, largely due to cultivation and plantations. Livestock overgrazing and altered fire regimes have greatly reduced the area of grasslands. It is statutorily conserved in Witbad, Vryheid Mountain, Paardeplaats and Phongola Bush Nature Reserves. According to Jewitt et al. (2018), the remaining natural habitat has been reduced by 48% (120957ha natural area remaining).

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[1] The National Vegetation Map is a spatial model of the historical extent of South Africa's vegetation types and is a surrogate data set for the terrestrial ecosystem types (Dayaraman et al., 2019).

Gs1 Northern Zululand Mistbelt Grassland

This vegetation unit occupies gentle to steep upper slopes of mountains formed by hard dolerite dykes around Ngome Mountain range, Louwsburg and several smaller mountain areas in northern KwaZulu-Natal. It is dominated by relatively forb-rich, tall sour *Themeda triandra* grasslands.

***Important Taxa* Graminoids**: *Themeda triandra*, *Tristachya leucothrix*, *Alloteropsis semialata* subsp. *eckloniana*, *Andropogon schirensis*, *Aristida monticola*, *Brachiaria serrata*, *Cymbopogon nardus*, *Cyperus albostriatus*, *Ehrharta erecta var. erecta*, *Elionurus muticus*, *Eragrostis plana*, *E. racemosa*, *Hyparrhenia hirta, Loudetia simplex*, *Microchloa caffra*, *Monocymbium ceresiiforme*, *Panicum deustum, Paspalum scrobiculatum*, *Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Sporobolus africanus, Trachypogon spicatus.* **Herbs:** *Aeschynomene micrantha, Conostomium natalense, Helichrysum chionosphaerum, H. nanum, H. nudifolium var. oxyphyllum, H. nudifolium var. pilosellum, H. umbraculigerum, Hermannia grandistipula.* **Geophytic Herbs:** *Cheilanthes hirta, Oxalis smithiana, Watsonia latifolia*. **Small Tree:** *Apodytes dimidiata subsp. dimidiata*. **Low Shrubs:** *Asparagus virgatus, Clutia pulchella*. **Succulent Shrub:** *Aloe arborescens*.

This vegetation unit is classified as Vulnerable with an estimated 33% of the area transformed, largely due to cultivation and plantations. Heavy livestock grazing and altered fire regimes have greatly reduced the area of grasslands and invasive alien species such as *Acacia mearnsii* and *Eucalyptus* species threatened remaining patches.

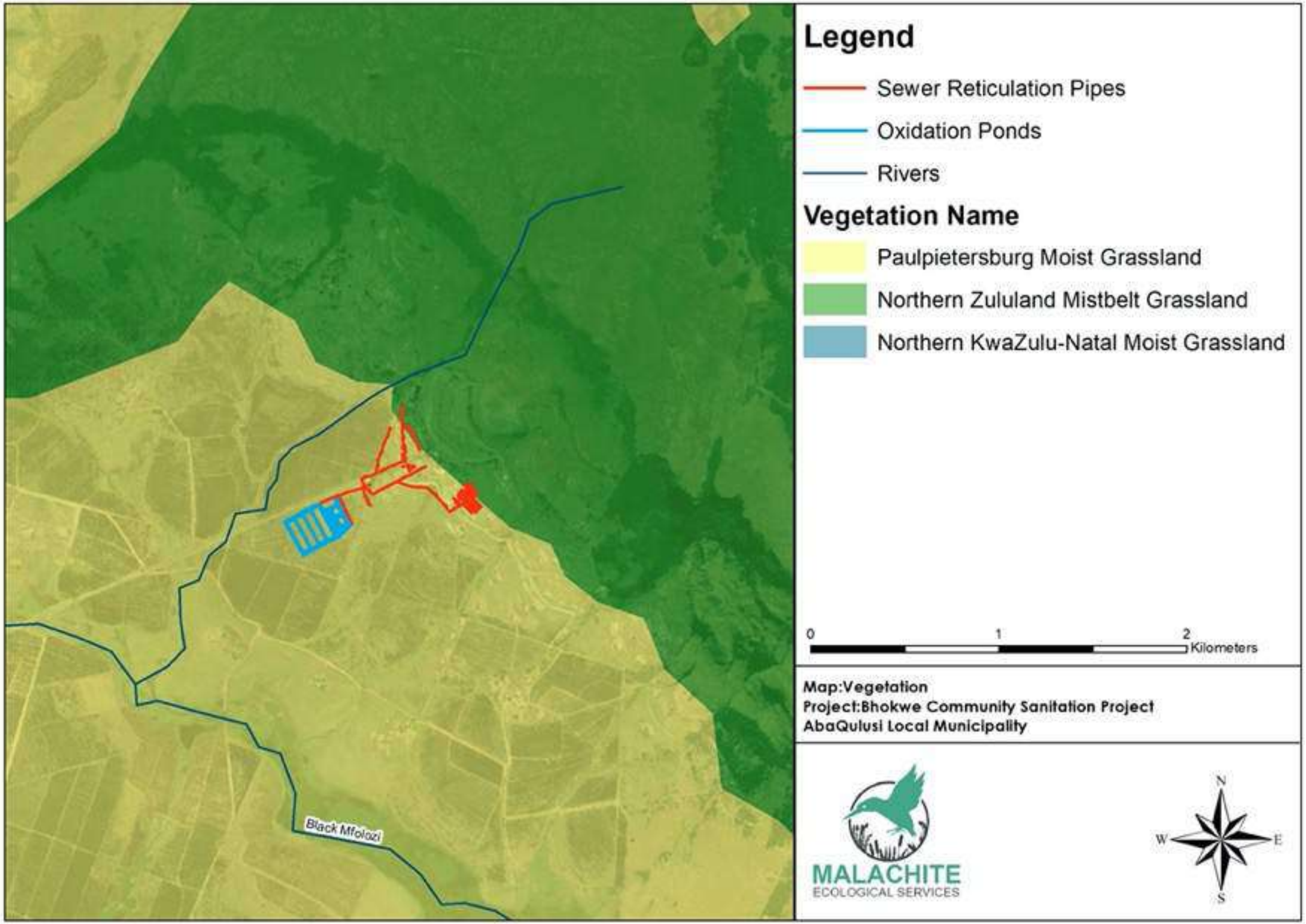

Figure 3: Regional vegetation

3. CONSERVATION PLANNING

Systematic conservation planning is a globally recognised practice which identifies priorities for biodiversity conservation and informs legislation to facilitate the long-term conversion of identified biodiversity (Jewitt, 2018). The biodiversity sector is centred on a data-driven approach and is continually refining the outputs by improving input data (Dayaram et al., 2019).

3.1 National Conservation Level

The National Environmental Management: Biodiversity Act (Act 10 of 2004) lists Threatened or Protected ecosystems, in one of four categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Protected. The main purpose of listing Threatened Ecosystems is to reduce the rate of ecosystem and species extinction and includes the prevention of further degradation and loss of structure, function and composition of Threatened ecosystems.

Threatened terrestrial ecosystems have been delineated based on the following:

- The South African Vegetation Map.
- Priority areas identified in a provincial systematic biodiversity plan.
- High irreplaceability forest patches and clusters.

There are four main types of implications of listed ecosystems on development:

- Planning related implications, linked to the requirement in NEMBA for listed ecosystems to be taken into account in municipal IDPs and SDFs.
- Environmental authorisation implications, especially in terms of NEMA and EIA regulations.
- Proactive management implications, in terms of NEMBA.
- Monitoring and reporting implications, in terms of NEMBA.

According to the ‘Schedule of Threatened Terrestrial Ecosystems in South Africa’ (promulgated under NEMBA, Government Notice 1002 of 2011), the northern boundary of the project area is located within the Ngome Mistbelt Grassland and Forest (KZN 31) and classified as Endangered (Figure 4).

3.2 Provincial Level

Loss of biodiversity results in ecosystem degradation and subsequent loss of important ecological services. Anthropogenic developments are a driving force that exerts pressure on the natural habitat and biological diversity.

Sensitivity of the area was assessed through the interrogation of biodiversity databases. The Provincial Biodiversity Sector Plan is a conservation plan introduced and implemented by Ezemvelo KZN Wildlife. The primary aim of this conservation plan is to ensure that representative biodiversity samples are conserved to ensure that subsequent conservation targets are achieved. Areas are categorised based on the sites ecological sensitivity, biological functioning and conservation significance.

Interrogation of the KZN Biodiversity Sector Plan indicated that the northern boundary of the project area is classified an Irreplaceable Critical Biodiversity Area. These area areas that are critical for meeting conservation targets and thresholds and are required to ensure the persistence of viable populations of species and the functionality of ecosystems. Therefore, the site has an irreplaceable conservation value with no alternative sites available. This CBA follows a similar delineation as the Terrestrial Threatened Ecosystem. Furthermore, the northern escarpment is classified as an Ecological Support Area (Figure 4).

3.3 NFEPA and Water Resources

South Africa's freshwater ecosystems are diverse and these ecosystems refer to all inland water bodies (fresh or saline) including rivers, lakes, wetlands, sub-surface waters and estuaries (Driver et al., 2011). More than half of the country's freshwater ecosystems are considered threatened with the taxa associated with these habitats also displaying high levels of threat (fishes, molluscs, dragonflies, crabs and vascular plants). These statistics emphasise the need to protect and conserve the remaining freshwater ecosystems.

The National Freshwater Ecosystem Priorities Area (NFEPA) project was developed to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs (Driver et al., 2011). NFEPA further supports the implementation of the National Water Act, the Biodiversity Act and the Protected Areas Act. The project area lies within the W22A quaternary catchment within the Pongola-Mtamvuna Water Management Area. The Black Mfolozi River is the primary drainage system within the quaternary catchment.

As discussed in the regional vegetation component, vegetation in South Africa has been categorised into special units based on biotic factors, physical features and assemblages. In a similar way the NFEPA wetland vegetation groups have further categorised vegetation units associated with water resources. These vegetation groups were derived from grouping the 438 vegetation units into 133 wetland vegetation groups. The site is situated within the Sub-Escarpment Grassland Group 4 wetland type. This ecosystem type is listed as Endangered.

Based on current outputs of the NFEPA project (Nel et al., 2011), No FEPA wetlands were identified within and surrounding the project area.

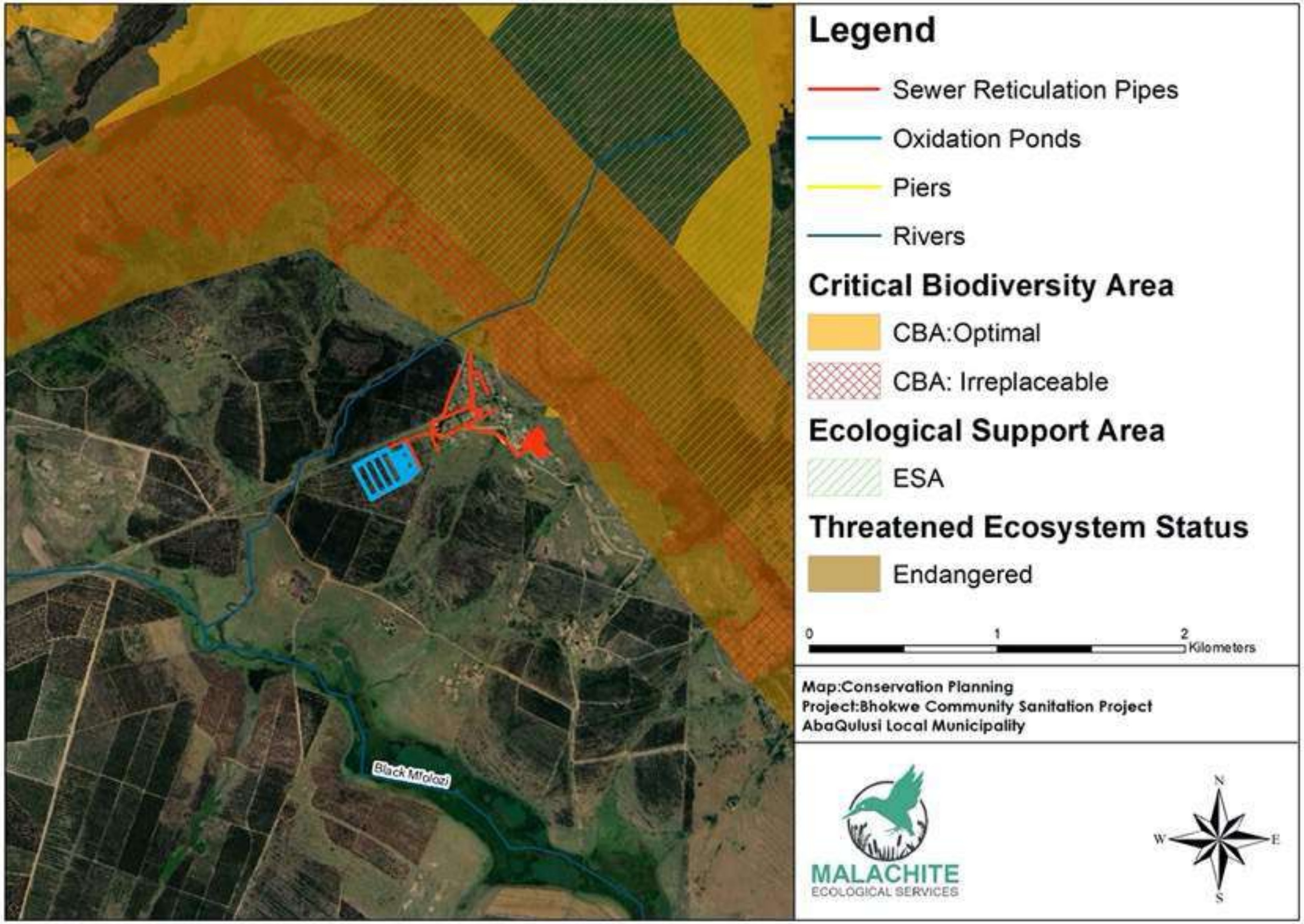

Figure 4: KwaZulu-Natal Biodiversity Sector Plan and National Threatened Ecosystem

3.4 Important Bird and Biodiversity Areas

Due to South Africa's high levels of habitat diversity, the country contains more than 840 avian species, encompassing approximately 7% of the world's avifauna (Fishpool & Evans, 2001). Various sites within the country have been identified as important for maintaining viable populations of endemic, range restricted and Threatened species. The primary aim of the Important Bird Areas program is to ensure the long-term conservation of important avifaunal habitats. Through the conservation of IBAs, the ecosystem goods and services provided by these areas are in turn protected. According to BirdLife South Africa, one-third of the 112 IBAs located within South Africa are under threat by invasive alien vegetation, habitat modification/degradation and agricultural expansion (Marnewick et al., 2015). Further to this, 52% of IBAs fall outside formally Protected Areas, further complicating avian habitat conservation. Based on the current delineation of IBAs in South Africa, the present study area is not associated with or in close proximity to any IBAs

4. ASSESSMENT RESULTS

4.1 SANBI Dataset

The South African National Biodiversity Institute (SANBI) Botanical Database of Southern Africa (BODATSA) was utilised to ascertain possible species of conservation concern within the project area and surrounding habitats (Figure 5).

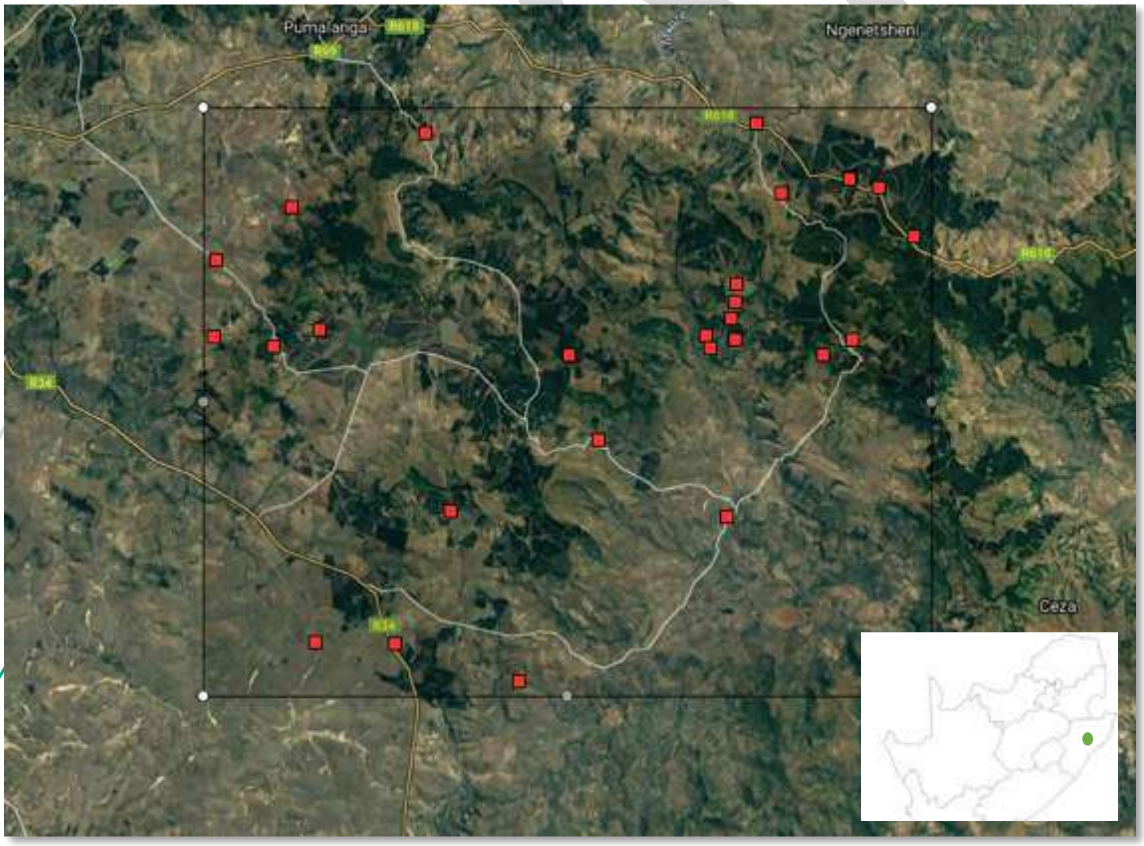

Figure 5: Projected area based on BODATSA-POSA, 2016

The below mentioned species of conservation concern that have been reported by BODATSA-POSA, 2016.

- ***Brachystelma gerrardii*** is a member of the Apocynaceae family and occupies grassland habitats. *B. gerrardii* is rare within its range with subpopulations only consisting of 10 mature individuals. It is threatened by habitat loss (urban and rural housing development) livestock overgrazing and improper burning regimes (Styles & von Staden. 2007). It is classified as Endangered.
- ***Helichrysum ingomense*** is an Endangered member of the Asteraceae family restricted to the Ngome Forest. It favours edges of dolerite rock sheets facilitating a high water table. No subpopulations outside of Ngome have been identified however, some are predicted to exist. Population decline is attributed to loss of habitat due to crop cultivation and afforestation. Overgrazing declines the functionality of remaining habitats (Scott-Shaw et al., 2009).
- ***Hermannia sandersonii*** is a member of the Malvaceae family and occupies grassland habitats often on steep slopes. *H. sandersonii* is rare within its range and known from less than 10 known locations (EOO 640m^2). On a national scale it is threatened by habitat loss (commercial forestry plantations and crop cultivation), degradation (invasive alien colonisation) and livestock overgrazing (Raimondo, 2006). It is classified as Vulnerable.

There is a low likelihood of occurrence of the abovementioned species within the project area due to the impacted nature of the project area coupled with the habitat requirements and known distributions (particularly *Helichrysum ingomense*) of these species.

4.2 Vegetation Communities

4.2.1 Bhokwe Village

The sewer reticulation component of the sanitation project occurs for the most part within the Bhokwe village where vegetation has been altered by existing houses, derelict infrastructure, gardens, internal roads and transformed verges. The floristic composition of these habitats has been altered significantly and does not reflect the reference state (as per Mucina & Rutherford, 2012). Species noted were comprised of ornamental (*Banksia serrata, Callistemon viminalis, Plumeria c.f rubra*) garden species[2], invasive alien vegetation with scattered indigenous trees/shrubs. As with any settlement area, various edge effects were noted extending into adjacent habitats including the dumping of anthropogenic waste, inadequate stormwater control resulting in erosion and expansion of invasive alien vegetation. Invasive alien vegetation noted included species associated with gardens (*Melia azedarach*, *Psidium guajava*, *Jacaranda mimosifolia*, *Eucalyptus sp.* and *Callistemon viminalis*) and those associated with road verges (*Datura stramonium*, *Solanum sisymbriifolium*, *Solanum mauritianum*, *Agave* sp., *Cirsium vulgare* and *Tagetes minuta*).

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[2] A detailed list of garden plants and ornamental species did not form part of this assessment

Photograph 1: Transformed vegetation within the Bhokwe Village

4.2.2 Acacia mearnsii Plantations

Acacia mearnsii plantations have replaced large portions of grasslands extending southwards of the project area. *A. mearnsii* produces large quantities of long-lived seeds and together with its rapid growth rates have encroached into grassland systems within KwaZulu-Natal. *A. mearnsii* has negative effects on biodiversity through excessive shading, water stress and allelopathy (Fatunbi et al., 2009). Allelopathy is the growth suppression of one plant species by another due to the release of toxic compounds (Bhdoria, 2011). The leaf litter under *A. mearnsii* stands is often thick and prevents the establishment of seeds of other species around these areas and diminishes the grass layer (Fatunbi et al., 2009). As such vegetation communities within and surrounding these plantations has been transformed. *A. mearnsii* is cultivated as a commercial source of tannin, pulpwood or a source of fire wood for local communities. Harvesting by community members was noted during the 2019 assessment.

4.2.3 Grassland Communities

A degraded grassland community was classified within the 50m assessment buffer of the project area. It is likely that alteration to species diversity has already occurred due to surrounding anthropogenic impacts with the eastern grassland surrounded by settlements and *A. mearnsii* plantations. Furthermore, portions of the grasslands surrounding Bhokwe have been historically cleared and terraced and exist presently as fallow land. Livestock grazing was also evident. Most grass species noted were resistant species commonly associated with overutilized veld. The indigenous herbaceous layer was poorly developed and comprised largely of pioneer or ruderal species. Commonly reported species included *Senecio decurrens, S. madagascariensis, Plantago major, Tagetes minuta*, *Becium obovatum* and *Helichrysum nudifolium var. nudifolium*. Invasive species have colonised erosion gullies, cleared and disturbed areas. Dominant species included *Solanum mauritianum, Solanum sisymbriifolium* and *Lantana camara.*

Figure 6: Degraded grassland community: Note terracing (Aerial imagery from 2012)

Photograph 2: Historically terraced area surrounded by Acacia mearnsii plantations

A drainage system was noted on the north eastern boundary of the project area extending southwards into the *A. mearnsii* plantation. This ecotone and grasslands surrounding the channel supported more functional systems than degraded grasslands. These ecotones generally display a zonation of species relative to their tolerance to frequency, magnitude and duration of sediment deposition and saturated conditions (Webb & Erskine, 2003). Species composition within the upper reaches of the channel was more skewed towards woody species. Common woody species noted included *Clausena anisata var. anisata, Erythrina lysistemon, Ficus sur, Maesa lanceolata, Combretum kraussii* and shrubs *Buddleja salviifolia, Cassinopsis ilicifolia, Dovyalis caffra and Diospyros lycioides. Zantedeschia aethiopica, Gunnera perpensa, Juncus effusus* and facultative wetland grass species such as *Miscanthus cf. capensis, Andropogon eucomus, Setaria sphacealata var sphacealata* and *Paspalum* sp occupied areas within increased soil moisture. Scattered *Alsophila dregei* were noted on the banks of the channel. Encroachment of invasive alien vegetation surrounding the upper reaches of the channel (where disturbances have occurred) was noted and dominated by *Solanum mauritianum* and *Lantana camara*. The pipeline has already been constructed by the previous contractor across the channel and rehabilitations must be implemented to address current erosion and encroachment of invasive alien species.

Photograph 3: Drainage channel noted on the north eastern boundary. Note the pipeline already traversing the channel from the previous contractor.

4.3 Invasive Alien Plant Species

Invasive Alien Plants (IAPs) have been a long term, significant environmental issue, affecting South Africa's freshwater and terrestrial ecosystems. Invasive alien vegetation can be loosely defined as species not indigenous to an area, or region which has been introduced either intentionally or accidentally. They have the propensity to invade and their presence threatens habitats, ecosystems or species. Grassland systems in KwaZulu-Natal display a high representation of species of conservation concern species and threatened ecosystems. Grasslands are threatened by colonisation of invasive species, more than other habitats such as savanna or forests (Goodall and Zacharias, 2002). Invasive alien species are often associated with the following:

- Typically grow more rapidly than indigenous counterparts.
- Are prevalent in areas where disturbances to the landscape have occurred as they are colonisers. This is owed to their highly competitive growth and colonising strategies.
- Alter the structure of biomass, which in turn impacts carbon, nutrient dynamics and the intensity of fires.
- Result in a loss of biodiversity and ecosystem services.

Invasive alien vegetation was noted throughout the project area. High densities occurred within areas largely associated with anthropogenic disturbances such as road reserves, derelict buildings, erosion gullies and historic infrastructure developments where rehabilitation measures have not been successful. The majority of IAPs noted on site are classified as Category 1b requiring control as part of an invasive species management programme and their management and control must be in terms of an approved invasive species management plan.

Table 2: Invasive alien vegetation noted during the September 2019 field survey

Scientific Name	Common Name	Category
Acacia mearnsii	Black Wattle	2
Agave americana	American Agave/ Century Plant	1b (T)
Agave sisalana	Sisal	2
Callistemon viminalis	Weeping Bottlebrush	1b
Cereus jamacaru	Queen of the Night	1b
Cirsium vulgare	Spear Thistle	1b
Datura stramonium	Common Thorn Apple	1b
Eucalyptus sp.	-	1b
Jacaranda mimosifolia	Jacaranda	1b
Opuntia ficus-indica	Sweet Prickly Pear	1b
Lantana camara	Tick-berry	1b
Melia azedarach	Syringa	1b
Psidium guajava	Guava	2
Rubus cuneifolius	American Bramble	1b
Senna didymobotrya	Peanut Butter Cassia	1b
Solanum mauritianum	Bugweed	1b
Solanum sisymbriifolium	Dense-thorned bitter apple	1b
Tagetes minuta	Khakibos	-
Verbena bonariensis	Tall Verbena	1b

Various projects are currently under way within the Bhokwe village. As such disturbances to habitats have occurred and invasive alien species were noted and will likely continue to colonise these habitats. This is of particular concern of the northern portion of the village extending towards the Critical Biodiversity Areas. Therefore, the sanitation project provides an opportunity to assist in the control invasive vegetation.

The implementation of an IAPs management plan is recommended to prevent the spread of current invasive species, particularly those situated adjacent to sensitive drainage channel. This management plan must be a dynamic, working document which must be amended should new, pertinent information pertaining to recommended remediation be discovered. This plan must form part of the environmental management programme for the project. This process is also a requirement listed within the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R864 of 2016.

4.4 Noteworthy Species

The identification of species of conservation concern was based on a single site investigation conducted in early spring. It was evident that alterations to species composition due to current and historic disturbances have taken place within the assessment area. During the site investigation several provincially protected species were identified including *Zantedeschia aethiopica*, *Alsophila dregei* and *Cyrtanthus tuckii*. These species were recorded within the eastern drainage channel and adjacent grassland community. These species are protected under the KZN Nature Conservation Management Amendment Act, 1999 (Act No. 5 of 1999). No disturbance, destruction or relocation of these species is permitted without permits. It must be noted that these records occur outside the pipeline servitude and oxidation pond site. As such these species are unlikely to be impacted by the proposed project given the nature and size of reticulation network.

Photograph 4: Provincially protected Cyrtanthus tuckii and Alsophila dregei

Dietes grandiflora, Aloe arboresence and *Agapanthus* sp. were noted within gardens of the Bhokwe village. Although these species are provincially protected the need for a permit for the relocation of these species (should they be impacted by the reticulation network which is unlikely as the route traverse internal road reserves) could be wavered as:

- These species were likely planted by previous occupants of the houses.
- There is no specific species level protection within the act but rather the entire families (Amaryllidaceae and Liliaceae).
- Both species are nationally listed as Least Concern.

However, consultation with Ezemvelo KZNW will be required to confirm this.

5. FAUNAL DIVERSITY

5.1 Mammals

According to MammalMap (Animal Demographic Unit) a total of 24 species have been recorded within the 2731CC quarter degree square (QDS). This is dominated by small mammals from the Rodentia and Eulipotyphla families. Five species of conservation concern have been previously reported within the QDS (Table 3). The sanitation project is unlikely to affect any fauna of conservation concern due to the altered nature of the project area and specialist habitat requirements of these species.

Table 3: Red Listed mammals reported within the 2731CC QDS

Scientific Name	Common Name	Status	Habitat
Ourebia ourebi	Oribi	EN	• Open grassland in good condition containing a mosaic of both short grass and long grass
Panthera pardus	Leopard	VU	• Densely wooded and rocky areas within woodland, grassland savannah and mountain habitats
Otomys auratus	Southern African Vlei Rat	NT	• Mesic grasslands and wetlands within alpine, montane and sub-montane regions
Myosorex sclateri	Sclater's Mouse Shrew	VU	• Grassland, wetland and reedbed habitats. In some instances close to grassland/forest ecotones
Myosorex cafer	Dark-footed Forest Shrew	VU	• Restricted to moist, densely vegetated forests and grasslands

Species likely to be present within the project area are common within southern Africa and have a wide geographic distribution. These are predicted to be dominated by small-medium sized mammals that display some degree of ecological, behavioural and demographic plasticity and high reproductive and survival rates. These species include Southern African Pygmy Mouse (*Mus minutoides*) Tete Veld Rat (*Aethomys ineptus*), Water Mongoose (*Atilax paludinosus*), Large Spotted Genet (*Genetta tigrina*), Xeric Four-striped Mouse (*Rhabdomys pumilio*) and Natal Multimammate Mouse (*Mastomys natalensis*).

5.2 Herpetofauna

Herpetofauna are secretive, and robust lists require intensive field surveys over numerous seasons. Reptiles have adapted to a wide variety of habitats with their occurrence largely related to broad scale micro-habitats including terrestrial and aquatic habitats (Alexander & Marais, 2007).

Based on data extrapolated from the Animal Demographic Unit, the larger area falls within the distributional range of 19 amphibian species, with only 7 species confirmed to occur within the 2731CC QDS. None of the recorded species are of conservation concern. Species reported have wide distributions and generalist habitat requirements. Suitable environmental conditions, particularly breeding sites, are critical for amphibians, as species are often located within specific habitats. The

Bhokwe village is not associated with any important amphibian habitats and is unlikely to support any noteworthy populations. Drainage channels and moist grasslands towards the escarpment would provide important habitats however, these will not be impacted by the proposed project.

The project area is located on the edge of the know range of Plain Stream Frog (*Strongylopus wageri*). This cryptic member of the Pyxicephalidae family is associated with rocky streams and pools embedded within mistbelt forests and montane grasslands. The current known distribution of *S. wageri* is disjunct with isolated populations within KwaZulu-Natal (the closest known location to the study area is the Ngome Forest Reserve, 2731CD). It is classified as Near Threatened largely due to loss of indigenous forests and upland grassland systems, afforestation of invasive alien trees), decline is habitat quality due to chemical pollution associated with silviculture and the introduction of trout into streams (Minter et al., 2004). Given the unique habitat requirements *of S. wageri*, there is a low likelihood of occurrence within the project area.

Based on the findings of ReptileMAP and Southern African Reptile Conservation Assessment (SARCA) 13 species were recorded within the 2731CC QDS. It is predicted that alterations to the original reptilian composition have already occurred to some degree within the project area due to anthropogenic disturbances within and surrounding these habitats. For example snakes are often indiscriminately killed around settlements while certain gecko/skink species readily adapt to human settlements. The Near Threatened Striped Harlequin Snake (*Homoroselaps dorsalis*) is a regional endemic whose distribution overlaps with the project area. *H. dorsalis* occupies mesic highveld and sub-escarpment grassland habitats and the semi-fossorial nature of *H. dorsalis* as well as propensity to use moribund termitaria often result in this species being overlooked. Threats are associated with loss/degradation of grassland habitats as well as the fragmentation of remaining patches. Improper veld management (livestock overgrazing and frequent burning) within remaining grasslands depletes available optimal habitats as well as prey abundance. There is a low likelihood of occurrence within the project area.

Several endemic species were reported with the QDS by SARCA and are detailed below (Table 4)

Table 4: Endemic and Near Endemic reptile species reported within the 2731CC QDS

Scientific Name	**Common Name**	**Likelihood of Occurrence**	**Habitat**
**Duberria lutrix lutrix*	South African Slug-eater	Moderate	• Damp localities in grasslands, moist savanna and lowland forests
-Lamprophis guttatus	Spotted Rock Snake	Low	• Rocky habitats where it shelters under rocks or in crevices
**Scelotes mirus*	Montane Dwarf Burrowing Skink	Low	• Rocky montane grasslands and scrub
-Pachydactylus vansoni	Van Son's Gecko	Low	• Rocky outcrops in grassland, or often under dead *Aloes*

* Endemic - Near Endemic

5.3 Avifauna

A total of 76 avian species have previously been recorded within the 2745_3105 pentad[3] based on the South African Bird Atlas Project 2. The low species count is likely attributed to a lack of sampling effort as opposed to low diversity within the area. This assumption was corroborated by expanding the search to surrounding pentads where a further 40-50 species were reported.

The majority of species are associated with grassland habitats such as insectivores and granivores (Cisticolas, Waxbills, Pipits and Longclaws). Of the species reported by the atlas project, the White-bellied Korhaan (*Eupodotis senegalensis*) was the only species of conservation concern (classified as Vulnerable). *E. senegalensis* favours open, tall grasslands (taller grasslands than other bustards) and will generally avoid overgrazed and recently burnt areas (Taylor et al., 2015).

It is important to consider the nature of the proposed project in relation to the possible impacts on biodiversity. Although species such as the Secretarybird (*Sagittarius serpentarius*), African Marsh Harrier (*Circus ranivorus*) and Grey Crowned Crane (*Balearica regulorum*) are likely to use the larger project area as part of their foraging range or through transient movements, the proposed project will not have a negative impact on local populations. This is largely due to their breeding and nesting strategies coupled with the nature and location of the sanitation project.

Table 5: Avian SCC and the probability of these species occurring within the project area and surrounds

Scientific Name	Common Name	Conservation Status	Habitat	Likelihood of Occurrence
Circus ranivorus	African Marsh Harrier	EN	Permanent wetlands and marshes	Moderate-Low
Sagittarius serpentarius	Secretarybird	VU	Open grassland and scrub, with sufficient scattered trees	Moderate-Low
Eupodotis senegalensis	White-bellied Korhaan	VU	Tall grasslands but will use more areas during winter	Low
Anthropoides paradiseus	Blue Crane	NT	Open grasslands as well as agricultural landscapes	Low
Balearica regulorum	Grey Crowned Crane	EN	Wetland-grassland mosaics	Low

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

Due to the nature of the proposed reticulation project, coupled with the location within the Bhokwe village and immediate surrounds, the project is unlikely to impact any fauna of conservation concern, with species utilising the area being characterised by wide distributions and generalist habitat requirements.

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[3] A pentad is a 5 minute x 5 minute coordinate grid super-imposed over the continent for spatial reference

6. ECOLOGICAL SENSITIVITY ASSESSMENT

Important ecological habitats play an integral role within a landscape providing various ecosystem goods and services. The delineation of sensitive communities facilitates the implementation of ecosystem and landscape-level conservation strategies. These site sensitivities are presented in *Figure 7* and discussed in more detail below. It must be noted that the sensitivity of the project area is based on the findings of a short period survey and the Precautionary Principle must be utilised in an attempt to offset the incomplete understanding of the study area. This principle is based on the following:

> *'When the information available to an evaluator is uncertain as to whether or not the impact of a proposed development on the environment will be adverse, the evaluator must accept as a matter of precaution, that the impact will be detrimental. It is a test to determine the acceptability of a proposed development. It enables the evaluator to determine whether enough information is available to ensure that a reliable decision can be made.'*

The majority of the project area occurs within the village of Bhokwe and is associated with anthropogenically modified habitats. Vegetation communities have been impacted significantly and these habitats provide limited to no conservation value. As such these areas are associated with a low ecological sensitivity. The primary drivers of habitat degradation surrounding the village include invasive alien vegetation, varying degrees of vegetation clearing, erosion and dumping of anthropogenic waste. *Acacia mearnsii* plantations were noted extending from the southern edge of Bhokwe. These plantations have altered the natural grassland habitats through shading and allelopathy.

The eastern drainage system (through which the previously authorised pipeline crosses) is associated with more functional vegetation communities supporting several provincially protected species. Furthermore, drainage channels act as ecological corridors. This system was classified with a high ecological sensitivity. Impacts such as erosion and encroachment of invasive alien vegetation was noted surrounding this channel and these impacts should be remediated along the pipeline route to maintain its ecological properties.

The proposed reticulation pipeline route will for the most part, traverse adjacent to the existing access roads within Bhokwe village. Inspection of the aerial imagery from 2017 shows that the majority of the pipeline route was cleared and trenches were excavated. Despite some of these trenches being infilled, disturbance to the majority of the route has taken place. The selection of these cleared routes not only localises the historic impacts but also provides an opportunity to rehabilitate the servitude where it crosses the drainage channel with respect to erosion control and invasive alien control. The proposed oxidation pond site is located adjacent to a previously cleared area within an *Acacia mearnsii* plantation and attributed with a low ecological sensitivity.

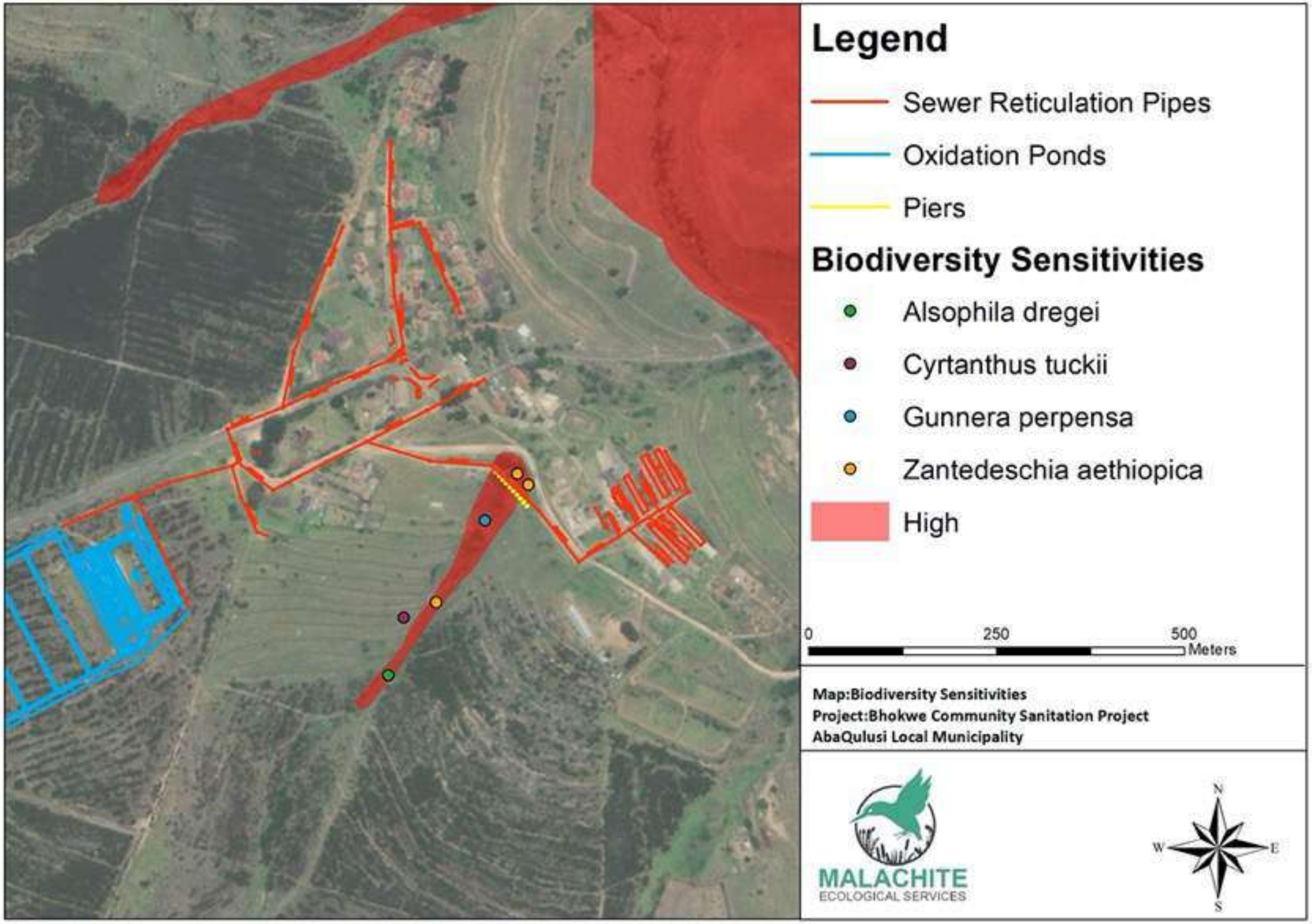

Figure 7: Biodiversity Features

6.1 Existing impacts within the project area

In South Africa many habitats are under severe pressure with large tracts already replaced due to anthropogenic activities (cultivation, forestry and urban development) with adjacent intact habitats susceptible to edge effects. Alterations of natural habitats often hinder the ability of these systems to provide ecosystem services (Kermen, 2005). Globally anthropogenic impacts have resulted in habitat destruction, biotic homogenization, increased species invasions and accelerated extinction rates (Le Roux et al., 2019).

Anthropogenic influences have altered the land use of the study site through the transformation and displacement of natural habitats. Fragmentation due to development reduces natural habitat and extends edge habitat, resulting in a shift in species composition and ecosystem functioning (Perlman & Milder, 2005). During the site investigations, various existing impacts were noted within identified communities. These drivers of habitat degradation are outlined below:

- Bhokwe village and associated infrastructure has transformed the vegetation communities associated with this area. Portions of the village are comprised of derelict buildings. Edge effects such as dumping of anthropogenic waste into adjacent habitats, inadequate storm water control and subsequent erosion were noted.
- Clearing of the pipeline routes during the initial stages of the project (2017).
- Surrounding *Acacia mearnsii* plantations have completely transformed natural habitats.
- Portions of the grasslands associated with the project area have been impacted by historic clearing and improper veld management. Overgrazing ultimately results in the deterioration of vegetation structure and associated biodiversity value (Leisher et al., 2011).
- Erosion were noted. Erosion alters soil functions such as regulation of water flow and infiltration rates. Furthermore, due to the continued loss of topsoil, areas surrounding eroded areas are often sub-optimal dominated by hardy ruderal species (often invasive in nature).
- Invasive alien vegetation was largely associated with anthropogenic disturbances such as Bhokwe village, road reserves, erosion gullies and surrounding *A. mearnsii* plantations.

7. IMPACT ASSESSMENT

Any activities associated with a natural system, whether historic, current, or proposed, will impact on the surrounding environment, usually in a negative way. In order to minimise these impacts development planning should be based on ecological principles that promote sustainable development. The purpose of this phase of the study was to identify and assess the significance of the potential impacts and to provide a description of the mitigation required to limit the perceived impacts on the natural environment.

Grasslands within KwaZulu-Natal have been impacted through inappropriate veld management (frequent/infrequent burning or heavily grazed), anthropogenic development and urban sprawl, soil erosion and unsustainable agricultural expansion and afforestation. (SANBI, 2013). Neke & Du Plessis (2004) analysed National Land Cover data for grasslands within South Africa and predicted that at least 35.8% of the biome has been transformed or degraded. Therefore, the early identification and quantification of impacts will facilitate the implementation of appropriate measures to reduce direct, indirect and cumulative risks to biodiversity (SANBI, 2013).

The Sanitation Project will involve the construction of 2.2km of 160mmØ uPVC sewer reticulation, 90 m of 250mmØ uPVC sewer reticulation, an oxidation sewer pond and numerous 1000mmØ precast concrete ring manholes (1World Consultants, 2019). As mentioned previously, various aspects of this project have taken place, but subsequently abandoned by the previous contractor (Figure 8). Taking into consideration the nature of the proposed sanitation project, impacts are likely associated with the degradation of habitats surrounding the reticulation route and further encroachment of invasive alien vegetation. Some degree of disturbance has likely taken place on faunal communities.

Figure 8: Note the cleared pipeline servitude as at 11/06/2017 aerial imagery.

Impact Assessment Criteria

Potential impacts of the proposed activity on the environment were assessed in terms a formalised method, whereby a typical risk assessment process was undertaken in order to determine the significance of the potential impacts without the application of mitigation/management measures (WOMM). Once the significance of the impacts without the application of mitigation/management measures was known, the impacts were then re-evaluated, taking cognisance of the application of proposed mitigation/management measures provided in order to reduce the impact (WMM), thus enabling an understanding of the overall impact after the implementation of mitigation/management measures. The process that was undertaken is described in the section below. It should be noted that, due to the nature of the proposed activity (i.e. township development), no closure/decommissioning phase was envisaged, and thus not assessed.

The **NATURE** of an impact refers to a description of the activity, inherent features, characteristics and/or qualities of the impact. Thus, each impact will be comprehensively detailed and contextualised prior to being assessed.

The **EXTENT** refers to the impact footprint. What that means is that if a species were to be lost then the extent would be global because that species would be lost to the world. If human health is threatened, then the impact is likely to be no more than local and possibly (in the case of a nuclear power station) regional.

Table 6: Descriptors and scoring for the Extent of an impact

Descriptors	Definitions	Score
Site only	The impact remains within the footprint or cadastral boundary of the site.	1
Local	The impact extends beyond the footprint or cadastral boundary of the site, to include the immediately adjacent and surrounding areas.	2
Regional	The impact includes the greater surrounding area within which the site is located.	3
National	The scale/extent of the impact is applicable to the Republic of South Africa.	4
Global	The scale /extent of the impact is global (i.e. world-wide).	5

The **DURATION** is the period of time for which the impact would be manifest. Importantly, the concept of reversibility is taken into consideration in the scoring. In other words, the longer the impact endures, the less likely is the reversibility of the impact.

Table 7: Descriptors and scoring for the Duration of an impact

Descriptors	Definitions	Score
Temporary	The impact endures for only a short period of time (0-1 years).	1
Short term	The impact continues to manifest for a period of between 1-5 years.	2
Medium term	The impact continues to manifest for a period of 5-15 years.	3
Long term	The impact will cease after the operational life of the activity.	4
Permanent	The impact will continue indefinitely.	5

The **MAGNITUDE** is the measure of the potential severity of the impact on the associated environment. As with duration, the concept of reversibility should is taken into account when considering the magnitude of the potential impact.

Table 8: Descriptors and scoring for the Magnitude of an impact

Descriptors	Definitions	Score
Negligible	The ecosystem pattern, process and functioning are not affected, although there is a small negative impact on quality of the ecosystem.	1
Minor	Minor impact – a minor impact on the environment and processes will occur.	2
Low	Low impact – slight impact on ecosystem pattern, process and functioning.	4
Moderate	Valued, important, sensitive or vulnerable systems or communities are negatively affected, but ecosystem pattern, process and functions can continue albeit in a slightly modified way.	6
High	The environment is affected to the extent that the ecosystem pattern, process and functions are altered and may even temporarily cease. Valued, important, sensitive or vulnerable systems or communities are substantially affected.	8
Very High	The environment is affected to the extent that the ecosystem pattern, process and functions are completely destroyed and may permanently cease.	10

The **LIKELIHOOD** is the likelihood of the impact manifesting. Although likelihood and probability may be considered interchangeable, the term likelihood is preferred as probability has a very specific mathematical and/ or statistical connotation. As such the expectation created by the term probability is that there will be an accurate empirically or mathematically defined expression of risk, which is not necessarily required.

The **SIGNIFICANCE** of impacts will be derived through a synthesis of ratings of all criteria in the following calculation:

(Extent + Duration + Magnitude) x Likelihood = Significance

Table 9: Descriptors and scoring for the Likelihood of an impact

Descriptors	Definitions	Score
Very improbable / Rare	Where it is highly unlikely that the impact will occur, either because of design or because of historic experience	1
Unlikely	Improbable – where the impact is unlikely to occur (some possibility), either because of design or historic experience.	2
Probable	there is a distinct probability that the impact will occur (< 50% chance of occurring)	3
Highly Probable	Most likely that the impact will occur (50 – 90% chance of occurring)	4
Definite	The impact will occur regardless of any prevention or mitigating measures (>90% chance of occurring).	5

Table 10: Descriptors for the significance score of an impact

Descriptors	Definitions	Score
Low	The perceived impact will not have a noticeable negative influence on the environment and is unlikely to require management intervention that would incur significant cost.	**0 – 19**
Low to Moderate	The perceived impact is considered acceptable, and application of recommended mitigation measures recommended.	**20 – 39**
Moderate	The perceived impact is likely to have a negative effect on the receiving ecosystem, and is likely to influence the decision to approve the activity. Implementation of mitigation measures is required, as is routine monitoring to ensure effectiveness of recommended mitigation measures.	**40 – 59**
Moderate to High	The perceived impact will have a significant impact on the receiving ecosystem, and will likely to have an influence on the decision-making process. Strict implementation of mitigation measures as provided is required, and strict monitoring and high levels of compliance and enforcement in respect of the impact in question are required.	**60 – 79**
High	The impact on the receiving ecosystem is considered of high significant and likely to be irreversible, and therefore highly likely to result in a fatal flaw for the project. Alternatives to the proposed activity are to be investigated as impact will have an influence on the decision-making process.	**80 – 100**

Recommended Mitigation Measures

The effectiveness of ecological mitigations either derived from assessments or in response to legal requirements has recently come under question. Recommendations presented are in most instances incorporated into planning conditions or become conditions of Protected species licences, but these recommendations are implemented to varying degrees. Often follow-up monitoring and assessment of the mitigation with sufficient scientific rigour is lacking to effectively determine whether the mitigation measures prescribed have been successful. The issue is further compounded as when monitoring work is implemented the results are not published (Hill & Arnold, 2012). Therefore, the mitigation measures presented in this report must be fully implemented and monitored to determine their success/failure.

7.1 Loss of indigenous vegetation and diversity

	Extent	Duration	Magnitude	Likelihood	Significance
Construction Phase					
WOMM	Site only (1)	Temporary (1)	Low (4)	Definite (5)	**Low to Moderate (30)**
WMM	Site only (1)	Temporary (1)	Minor (2)	Definite (5)	**Low to Moderate (20)**

It is predicted that impacts pertaining to 7.1 will be associated with:

- Loss of indigenous vegetation through the creation of the pipeline servitude, heavy machinery activity and increased construction personnel to the area.
- Altered soil processes through the removal and/or compaction of soils. This can result in a decline in water infiltration and an increase in surface water run-off.
- Decline in adjacent habitat quality and possible edge effects. These include a decrease in basal cover, an increase in erosion potential and spread of invasive alien vegetation.
- Possible spillages of pollutants.

Mitigation

- All construction activities must be carried out according to the generally accepted environmental best practice and the spatial footprint must be kept to a minimum.
- Retain as much natural vegetation as possible, removing it immediately ahead of construction activities. This will assist in the maintenance of groundcover and reduce erosion potential surrounding the working servitude.
- Where practical, existing roads must be used and driving ‘off-road’ in sensitive habitats (ie. Wetlands buffers) is prohibited.
- Avoid impacts to sensitive wetland systems (including the prescribed buffer zones). No dumping of waste into adjacent drainage systems.
- No further clearing of indigenous woody vegetation must occur within the drainage channel. The existing pipeline route must be utilised.
- Erosion control measures must be put in place during the construction phase in areas prone to erosion. These include slopes adjacent to the servitude, trenches and areas of exposed soils.
- Prevent spillages and should these occur they must be contained and treated immediately in accordance with the approved EMPr.
- Construction personnel, contractors etc must be informed of the following through an induction process:
  - Harvesting of species of conservation concern is prohibited
  - Areas where no vegetation clearing can take place
- Construction camps must be set up in areas of low ecological sensitivity (already disturbed habitats), taking into consideration buffers prescribed within this report and other specialist studies. There appears to be an existing construction camp within the village (set up by previous contractors) and this should be selected for the continuation of the project.

- Once the construction phase has been completed, disturbed areas must be rehabilitated and all waste materials, equipment must be removed. This includes the re-vegetation and seeding of the servitude with appropriate, locally sourced grass species to not only stabilize the soils but also to facilitate the recovery of vegetation.

Minimal further loss of vegetation within the pipeline servitude will occur during the operational phase. The primary operational impact would be associated with edge effects i.e. spread of invasive alien species as these species proliferate in disturbed areas. Effective rehabilitation measures and monitoring will reduce these impacts to an acceptably low level. Furthermore, a spill contingency plan must be implemented for the pipeline crossing the drainage system.

7.2 Spread of invasive alien vegetation

	Extent	Duration	Magnitude	Likelihood	Significance
Construction Phase					
WOMM	Local (2)	Temporary (1)	Moderate (6)	Highly Probable (4)	**Low to Moderate (36)**
WMM	Site only (1)	Temporary (1)	Low (4)	Probable (3)	**Low (18)**
Operational Phase					
WOMM	Local (2)	Long Term (4)	Moderate (6)	Probable (3)	**Low Moderate (36)**
WMM	Site only (1)	Long term (4)	Low (4)	Unlikely (2)	**Low (18)**

It is predicted that impacts pertaining to 7.2 will be associated with:

- Continued growth and spread of invasive alien vegetation.
- Introduction of alien invasive reproductive materials from contaminated soils used for rehabilitation.
- Ineffective clearing of invasive species facilitating continued growth and expansion.

Mitigation

- The implementation of an invasive alien management plan in terms of the National Environmental Management: Biodiversity Act. This plan must form part of an approved environmental management plan and should take into consideration:
    - Type and density of IAPs on site.
    - Control methods to be implemented ie. Hand pulling, ring-barking, foliar spraying etc.
    - Post removal follow up and rehabilitation
    - Monitoring to determine success/failure. The pipeline servitude must be monitored and should new invasive species be noted, these must be removed immediately.

- Topsoil and overburden stockpiles must be created. Top soils which are colonised by invasive alien vegetation must not be used during the rehabilitation of pipeline corridors/surrounding the oxidation pond site as the existing seed bed within the soil will facilitate continued invasive alien growth.
- Construction equipment must be cleaned on a regular basis.
- The spatial footprint of the project must be kept to a minimum (especially where the route traverses the drainage system). This can be achieved through the demarcation of the project footprint (including construction camps) as well as sensitive areas.

7.3 Clearing of *Acacia mearnsii* within the oxidation pond footprint

The oxidation pond site is located within an *Acacia mearnsii* plantation. Therefore, the selection of this site will result in the removal of invasive alien *A. mearnsii* within the footprint. This is a positive impact and the following measures are recommended:

- Construction machinery must be cleaned before use outside of this area.
- The clearing *of A. mearnsii* must follow the approved invasive alien management plan. This must include continued monitoring to prevent coppicing of felled trees.
- The topsoil from this area must not be used for any rehabilitation due to the existing *A. mearnsii* seed bed.
- Areas surrounding the oxidation ponds must be rehabilitated and revegetated with locally available grass species such as *Cynodon dactylon*, *Eragrostis curvula* and *Hyparrhenia hirta*.

7.4 Loss of faunal species and disturbance

	Extent	Duration	Magnitude	Likelihood	Significance
Construction Phase					
WOMM	Site only (1)	Temporary (1)	Low (4)	Definite (5)	**Low to Moderate (30)**
WMM	Site only (1)	Temporary (1)	Minor (2)	Definite (5)	**Low to Moderate (20)**

It is predicted that impacts pertaining to 7.4 will be associated with:

- Inadvertent burial or mortalities (fossorial species) during construction activities (creation of trenches etc) and mortalities through vegetation clearing.
- An increase in construction workers, personnel and vehicle activity and associated noise pollution.

<u>Mitigation</u>

- No wild animals may under any circumstance be handled, removed or be interfered with by construction workers or any personnel.
- The implementation of an environmental awareness programme for all construction personnel.
- The hunting or collection of fauna is prohibited.

- Disturbance should be contained within the project footprint and unnecessary disturbance to adjacent habitats must be avoided.
- Any faunal species located on the site during the construction phase, that are unable to evade construction (e.g. fossorial species), must be moved to a suitable location with optimal habitat. This should be undertaken by a suitable qualified ecologist/faunal specialist.

Minimal further impacts on faunal habitat will occur during the operational phase, as the affected habitat will have been transformed by the pipeline. Furthermore, as majority of the sanitation project is located within the Bhokwe village, disturbance to faunal communities through this settlement has likely already occurred, with species utilising the area common to the region.

8. CONCLUSION AND RECOMMENDATIONS

Taking into consideration the nature of the proposed sanitation project, impacts are likely associated with the degradation of habitats surrounding the reticulation route and further encroachment of invasive alien vegetation. However, as represented in this assessment large portions of habitats within the project area are associated with the Bhokwe village whilst adjacent habitats have experienced a high degree of transformation through edge effects. Therefore, given the nature and location of the project coupled with the site specific impacts and proposed mitigation opportunities, the specialist is of the opinion that impacts arising can be mitigated to an acceptably low level.

This is based on the assumption that mitigation measures specified within the impact assessment are adhered to as well as the following provisos:

- Disturbed areas must be rehabilitated as soon as the construction is completed. Emphasis must be placed on the drainage channel crossing which has already taken place.
- Implementation of an invasive alien management plan and removal of invasive species within the pipeline servitude. This plan must form part of the approved environmental management plan.
- Implementation of recommendations provided by the wetland assessment (Malachite Ecological Services, 2019).

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10. APPENDICES

APPENDIX A: METHODOLOGY

Desktop Assessment

A desktop study was carried out to document the biodiversity characteristics of the study area. This included the use of various literature resources, databases and terrestrial conservation planning information. The study made use of the following data sources:

- Google Earth^{TM} satellite imagery and geospatial information data was used to identify important habitats, conditions of habitats, vegetation types, features of concern, sensitive habitats and ecological corridors.
- The evaluation of the modelled conservation importance of the study area in terms of the KwaZulu-Natal Biodiversity Plan.
- National Vegetation Map of Southern Africa (Mucina & Rutherford, 2006) with amendments by Scott Shaw & Escott (2011). These resources were consulted to identify broad scale vegetation types that occur within the study area and associated conservation status.
- Terrestrial Threatened Ecosystems (Government Notice 1002 (gazetted on 9 December 2011).
- The South African National Biodiversity Institute (SANBI) Botanical Database of Southern Africa (BODATSA), to determine species likely to be present within the project area (http://newposa.sanbi.org).
- The faunal component made use of the following data sources in order to determine the geographical ranges of faunal species:
- Mammals:
  - Stuart's Field Guide to Mammals of Southern Africa (Stuart & Stuart, 2015).
  - Distributional patterns and conservation status of mammals of Swaziland, southern Africa (Monadjem, 1998).
- Avifauna:
  - The Southern African Bird Atlas Project (SABAP2) was used to provide a detailed list of avian species occurring within the larger project area.
  - The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor et al., 2015).
- Herpetofauna:
  - South African Frog Atlas Project.
  - A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009).
  - ReptileMAP (SARCA).
  - Atlas and Red list of Reptiles of South Africa, Lesotho and Swaziland (Bates et al., 2014).
  - A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007).

Site Investigation

The desktop findings were ground-truthed during a survey conducted on the 18th September 2019. The primary aim of this survey was the identification of vegetation communities, presence of sensitive micro-habitats and current impacts within the project area. The project area is defined as pipeline route (and 50m buffer surrounding this route) as well as the proposed oxidation pond site.

Ecological Sensitivity Mapping

The vegetation sensitivity mapping exercise was conducted by assessing the current ecological condition of identified habitats, associated biodiversity value, phytosociological characters and site-specific attributes. This process facilitates the identification and delineation of sensitive vegetation communities. This analysis makes use of the following categories:

- **High:** Vegetation communities comprised of indigenous species, a high ecological integrity and contain specific habitats (and associated species) and/or high faunal niche diversity. The preservation of these habitats will ensure the protection of species of conservation concern.

- **Medium:** Vegetation communities which have been historically impacted, to some extent, by anthropogenic disturbances but these habitats still retain ecological functioning (as per broad-scale units identified by Mucina & Rutherford, 2006). These comprise of areas that need to remain intact to ensure the functioning of ecological corridors and adjacent habitats.

- **Low:** These are habitats that have been degraded and disturbed with limited ecological integrity and are unlikely to contribute to achieving conservation targets.

APPENDIX B: PLANT SPECIES RECORDED

SPECIES	STATUS	GROWTH FORM
Acacia mearnsii	*Invasive Alien*	*Tree*
Agave americana	*Invasive Alien*	*Succulent*
Agave sisalana	*Invasive Alien*	*Succulent*
Aloe arborescens	*Indigenous*	*Succulent*
Alsophila dregei	*Indigenous*	*Tree-fern*
Ambrosia artemisiifolia	*Exotic*	*Herb*
Andropogon eucomus	*Indigenous*	*Grass*
Aristida junciformis	*Indigenous*	*Grass*
Asparagus virgatus	*Indigenous*	*Low Shrub*
Banksia serrata	*Exotic*	*Tree*
Becium obovatum	*Indigenous*	*Herb*
Berkheya	*Indigenous*	*Herb*
Buddleja salviifolia	*Indigenous*	*Shrub/Tree*
Callistemon viminalis	*Invasive Alien*	*Tree*
Cassinopsis ilicifolia	*Indigenous*	*Shrub/Tree*
Chamaecyparis lawsoniana	*Exotic*	*Tree*
Cheilanthes cf. hirta	*Indigenous*	*Fern*
Cereus jamacaru	*Invasive Alien*	*Succulent*
Cirsium vulgare	*Invasive Alien*	*Herb*
Clausena anisate var. anisata	*Indigenous*	*Shrub/Tree*
Clutia monticola	*Indigenous*	*Herb*
Combretum kraussii	*Indigenous*	*Tree*
Conyza canadensis	*Exotic*	*Herb*
Cussonia spicata	*Indigenous*	*Tree*
Cynodon dactylon	*Indigenous*	*Grass*
Cyrtanthus tuckii	*Indigenous*	*Geophyte*
Datura stramonium	*Invasive Alien*	*Herb*
Digitaria eriantha	*Indigenous*	*Grass*
Dietes grandiflora	*Indigenous*	*Herb*
Diospyros lycioides	*Indigenous*	*Shrub/Tree*
Dovyalis rhamnoides	*Indigenous*	*Shrub*
Eragrostis chloromelas	*Indigenous*	*Grass*
Eragrostis curvula	*Indigenous*	*Grass*
Eragrostis superba	*Indigenous*	*Grass*
Erythrina lysistemon	*Indigenous*	*Deciduous Tree*
Eucalyptus sp.	*Invasive Alien*	*Tree*
Euclea natalensis subsp. natalensis	*Indigenous*	*Shrub/tree*
Euphorbia pulcherrima	*Exotic*	*Shrub*
Ficus sur	*Indigenous*	*Tree*
Gazania krebsiana	*Indigenous*	*Herb*

Gomphocarpus physocarpus	*Indigenous*	*Herb*
Greyia c.f radlkoferi	*Indigenous*	*Tree*
Gunnera perpensa	*Indigenous*	*Herb*
Gymnosporia buxifolia	*Indigenous*	*Shrub/Tree*
Helichrysum nudifolium var. nudifolium	*Indigenous*	*Herb*
Hypoxis acuminata	*Indigenous*	*Geophyte*
Hyparrhenia hirta	*Indigenous*	*Grass*
Hyperthelia dissoluta	*Indigenous*	*Grass*
Jacaranda mimosifolia	*Invasive Alien*	*Tree*
Juncus effusus	*Indigenous*	*Rush*
Lantana camara	*Invasive Alien*	*Woody/Shrub*
Ledebouria revoluta	*Indigenous*	*Geophyte*
Leonotis cf intermedia	*Indigenous*	*Herb*
Maesa lanceolate	*Indigenous*	*Small Tree*
Melia azedarach	*Invasive Alien*	*Woody*
Melinis repens	*Indigenous*	*Grass*
Miscanthus cf. capensis	*Indigenous*	*Grass*
Opuntia ficus-indica	*Invasive Alien*	*Succulent*
Phytolacca dioica	*Invasive Alien*	*Tree*
Plantago major	*Exotic*	*Herb*
Plectranthus sp.	*Indigenous*	*Shrub*
Plumeria rubra	*Exotic*	*Succulent Shrub*
Populus x canescens	*Invasive Alien*	*Tree*
Psidium guajava	*Invasive Alien*	*Tree*
Senecio sp.	*Indigenous*	*Herb*
Senna didymobotrya	*Invasive Alien*	*Shrub*
Solanum mauritianum	*Invasive Alien*	*Shrub/Tree*
Solanum sisymbriifolium	*Invasive Alien*	*Shrub*
Sporobulus africanus	*Indigenous*	*Grass*
Sporobolus pyramidalis	*Indigenous*	*Grass*
Tagetes minuta	*Invasive Alien*	*Herb*
Themeda triandra	*Indigenous*	*Grass*
Vachellia natalitia	*Indigenous*	*Tree*
Verbena bonariensis	*Invasive Alien*	*Herb*
Zantedeschia aethiopica	*Indigenous*	*Herb*

ANNEXURE C – LIST OF FAUNAL SPECIES

Mammalian Species Recorded within the 2731BC QDS (Animal Demographic Unit, 2019)

Scientific Name	Common Name	Conservation Status	Habitat
Sylvicapra grimmia	Common Duiker	LC	Widespread, scrub, savanna and bush-covered areas
Ourebia ourebi	Oribi	EN	Savannah woodlands, floodplains and other open grasslands
Amblysomus hottentotus	Hottentot's Golden Mole	LC	Broad range of habitats
Graphiurus murinus	Woodland Dormouse	LC	Woodland, savannah, grassland and rocky areas
Mus minutoides	Pygmy Mouse	LC	Habitat generalist preferring grasslands also found in savannah, fynbos and rocky habitats
Rhabdomys sp.	Four-striped Grass Mouse	LC	Wide habitat tolerance, and are commensal species occasionally found in agricultural lands
Otomys angoniensis	Angoni Vlei Rat	LC	Well-watered savannah grassland, seasonally flooded grassland and wetlands
Thallomys paedulcus	Tree Rat	LC	Arboreal, associated with established woodlands, particularly Acacia bushland.
Crocidura cyanea	Reddish-grey Musk Shrew	LC	Broad habitat tolerance, associated with moist habitats with dense matted vegetation
Crocidura hirta	Lesser Red Musk Shrew	LC	In KZN reedbeds, fig-dominated forests, woodland, grassland, fallow agricultural fields
Myosorex cafer	Dark-footed Forest Shrew	VU	KwaZulu-Natal it occurs in Afromontane (mistbelt), scarp and coastal forests
Myosorex sclateri	Sclater's Forest Shrew	VU	Near water in subtropical swamps, coastal forests, grassland and wetlands (reedbeds)
Suncus infinitesimus	Least Dwarf Shrew	LC	Broad habitat tolerance, occurring in forest, montane grassland, subtropical grasslands savannah, bushveld and suburban gardens
Suncus lixus	Greater Dwarf Shrew	LC	Savannah and dry woodland habitats as well as riverine forest, open dry scrub, open grassland, coastal lowland forest
Otomys auratus	Vlei Rat	NT	Mesic grasslands and wetlands within alpine, montane and sub-montane regions

Scientific Name	**Common Name**	**Conservation Status**	**Habitat**
Mastomys natalensis	Multimammate Mouse	LC	Wide distribution across the savannahs, grasslands and agricultural landscapes
Herpestes sanguineus	Slender Mongoose	LC	Forest to open Savanna, as long as there is suitable cover. Can persist in urban areas
Aethomys ineptus	Tete Veld Rat	LC	Savanna habitats with abundant ground cover of grass, rocks, or debris
Caracal caracal	Caracal	LC (CITES II)	Variety of habitats
Panthera pardus	Leopard	VU (TOPS, CITES I)	Wide habitat tolerance ie. woodland, grassland savannah, mountain habitats, and coastal

Amphibian Species Recorded within the 2731CC QDS (Animal Demographic Unit, 2019)

Scientific Name	Common Name	Conservation Status	Habitat
		Southern Africa	
Sclerophrys gutturalis	Guttural Toad	LC	Open pools, dams, vleis and other semi-permanent or permanent water bodies in grasslands and savannah
Amietia delalandii	Common River Frog	LC	Banks of slow-moving streams or other permanent bodies as well as wetland habitats
Kassina senegalensis	Bubbling Kassina	LC	Grassland around vleis and pans. Breeds in temporary and permanent water bodies
Tomopterna natalensis	Natal Sand Frog	LC	Variety of habitats in savanna and grassland
Phrynobatrachus natalensis	Snoring Puddle Frog	LC	Margins of permanent and temporary water bodies including shallow marshes, lakes, rivers, streams and pools
Hyperolius marmoratus	Painted Reed Frog	LC	Reeds and vegetation at the edge of waterbodies in savanna, grassland and forest habitats
Ptychadena anchietae	Plain Grass Frog	LC	Wide distribution in savanna, grasslands, agricultural and urban areas, sheltering in vegetation
Schismaderma carens	Red Toad	LC	Savanna and woodland, readily adapting to human habitation
Ptychadena oxyrhynchus	Sharp-nosed Grass Frog	LC	Moist open savannah and woodland habitat.

Reptile Species Recorded within the 2731CC QDS (Animal Demographic Unit, 2019)

Scientific Name	Common Name	Conservation Status	Habitat (Bates et al., 2014)
Acanthocercus atricollis	Southern Tree Agama	LC	Associated with large trees, sometimes found among rocks
Crotaphopeltis hotamboeia	Red-lipped Snake	LC	Damp areas, commonly found sheltering under rocks and in old termitaria
Leptotyphlops scutifrons scutifrons	Peters' Thread Snake	LC	Subterranean, feeding on ant eggs and their larvae
Psammophis brevirostris	Short-snouted Grass Snake	LC	Grassland and savanna, shelters in holes, under rocks and in old termitaria
Dasypeltis scabra	Rhombic Egg-eater	LC	Variety of habitats, often found in termitaria, under rocks, in rock crevices
Duberria lutrix lutrix	South African Slug-Eater	LC Endemic	Favours damp localities in grassland, moist savanna, lowland forests and fynbos
Lamprophis guttatus	Spotted Rock Snake	LC Near Endemic	Rocky habitats where it shelters under rocks or in crevices
Pseudaspis cana	Mole Snake	LC	Variety of habitats, spends time underground in deserted animal burrows
Scelotes mirus	Montane Dwarf Burrowing Skink	LC Endemic	Rocky montane grasslands and scrub
Lygodactylus capensis capensis	Common Dwarf Gecko	LC	Arboreal in savanna habitats but adapts readily to urban environments
Pachydactylus vansoni	Van Son's Gecko	LC Near Endemic	Rocky outcrops in grassland, or often under dead *Aloes*
Cordylus vittifer	Common Girdled Lizard	LC Near Endemic	Rock outcrops in grassland and savanna habitat
Dispholidus typus typus	Boomslang	LC	Arboreal utilising variety of habitats in moist savanna and lowland forests but also fynbos
Philothamnus semivariegatus	Spotted Bush Snake	LC	Moist savanna, lowland forest and riverbanks and shrubby vegetation
Thelotornis capensis capensis	Southern Twig Snake	LC	Trees and shrubs in coastal thicket, forest fringes and savanna
Pachydactylus maculatus	Spotted Gecko	LC Near-endemic	Broad range of habitat types (mesic areas). Rocks, old termitaria, logs or debris used as refuge sites

Scientific Name	Common Name	Conservation Status	Habitat (Bates et al., 2014)
Hemidactylus mabouia	Common Tropical House Gecko	LC	Scansorial and found in varied habitats, often associated with urban landscapes
Atractaspis bibronii	Bibron's Stiletto Snake	LC	Fossorial, found in termitaria or on soil under logs or rocks
Nucras ornata	Ornate Sandveld Lizard	LC	Grass tussocks and leaf litter in montane grasslands and mesic savanna
Trachylepis varia	Variable Skink	LC	Open rocky habitats in montane grasslands, savannah and coastal scrub
Panaspis wahlbergi	Wahlberg's Snake-eyed Skink	LC	Variety of habitats usually under suitable cover or in leaf litter
Bitis arietans arietans	Puff Adder	LC	Wide habitat preference. Absent from alpine habitats, dense forests and true deserts
Boaedon capensis	Brown House Snake	LC	Wide range of habitats and appears tolerant to considerable habitat transformation
Dendroaspis polylepis	Black Mamba	LC	Variety of habitats especially rocky hillsides and outcrops
Naja mossambica	Mozambique Spitting Cobra	LC	Lowland forests, moist savanna. Shelters in holes in the ground and rock crevices
Acontias plumbeus	Giant Legless Skink	LC	Mesic microhabitats under leaf litter in forests, partly wooded habitats, grasslands and alluvial sands
Lycophidion capense capense	Cape Wolf Snake	LC	Under rocks and logs or in old termitaria
Varanus niloticus	Water Monitor	LC	Close to, or in, water, but may be found some distance away when foraging
Afrotyphlops bibronii	Bibron's Blind Snake	LC Near Endemic	Fossorial, found in old termitaria, and in or on soil under rocks and rotting logs

MUNICIPAL INFRASTRUCTURE SUPPORT AGENT (MISA)

REHABILITATION OF SEWER RETICULATION AT BOKWE VILLAGE

Stormwater management plan

October 2019

Revision B
2019-11-25

Contents

Annexure A : Project Location

Annexure B: Sewer reticulation
Oxidation ponds

1. Background

Ward No. 5 of the Abaqulusi Local Municipality consists mainly of two areas; the Bhokwe and ENyathi Areas. Abaqulusi Local Municipality falls within the Zululand District Municipality in the KwaZulu-Natal Province. Bhokwe Settlement consists of No. 7 Village, Bhokwe Quarters, Bhokwe Hostels, Golozela Village, Mahowane Village, Mafuta Village and Mzimba Village.

In Bhokwe Settlement, there is Bhokwe primary school which caters for about 270 students

The existing waterborne sewer system in Bhokwe Quarters and the Hostels is old and dilapidated. It is characterised by frequent bursts, blockages and overflowing manholes . The ageing sewer infrastructure was provided by the Anglo American Coal mining company at least 50years ago. The system consists of flushing toilets connected to a shallow sewer reticulation system that discharges into a common conservancy tank which is meant to be maintained by the local municipality. Two conservancy tanks were observed, one that services Bhokwe Quarters and the other that services Bhokwe Hostels. The rest of the Villages under Bhokwe Settlement use VIP toilets.

This project proposes the replacement of the existing sewer reticulation with a new reticulation system and replacement the existing conservancy tanks with a new WWTW (oxidation pond system)

2 Project description

The project will comprise approximately 1860m of 160mmØ HD uPVC and 150m of 200mmØ HD uPVC sewer reticulation, 37No 1250Ø concrete manholes and an oxidation pond system consisting of a primary pond, a secondary pond, three tertiary ponds. The final effluent will cascade into four shallow evaporation ponds.

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The reticulation crosses a seep wetland once. The pipe will be elevated on concrete piers.

3 Project location

The project is located approximately 28 km east of Vryheid in KwaZulu-Natal, 27°48'39.56"S 31° 6'13.58"E. Refer Annexure A
The project area covers approximately 16hectares including reticulation and oxidation ponds. Refer annexure B

4 Stormwater management plan

4.1 During Construction

Adherence to the Stormwater Management plan is the responsibility of the Contractor. The Clients Agent, the Clerk of Works or Resident Engineer, will exercise oversight. The Stormwater management Plan will be included in the tender documentation.

Sandbag berms must be placed at regular intervals on all steep slopes on the trench line before and after backfilling in order to minimize erosion and contaminate stormwater runoff into water courses.

Contamination of surface water and stormwater must be well controlled. This can be achieved by managing activities such as mixing concrete on wooden boards in a plastic lined and bunded area and by reducing spills of hazardous substances.

When the trench line runs across sloping ground, the topsoil excavated from the trench must be stored on the down-slope side of the trench and the sub-soil on the up-slope side. This is important for two reasons, firstly, the larger volume of soil is stored upslope of the trench so that if soil fines and silt are washed off the stockpile during rainfall events, these are washed into the trench and not into a water course, and secondly, it is important to separate the two so that the topsoil is placed on top of the subsoil when the trench is backfilled. This is essential to promote rapid growth of vegetation during the rehabilitation phase.

Newly excavated pipeline trenches on steep slopes should have sandbag berms placed on either side of the trench line radiating out from the soil stockpiles at 10 m intervals. The berms should point very slightly downhill to prevent storm water build up. These berms will greatly reduce the volume of storm water polluted with silt and soil fines which could impact on rivers and streams below the pipelines and will minimize erosion of bare areas. Silt and soil fines that build up on the inside of these berms should be removed and placed back on the soil stockpiles. Stone packs should be placed at the discharge points at the ends of these berms to prevent erosion if necessary.

Once the trenches have been backfilled and the soil compacted, sandbag berms should be placed across the trench lines at 10 m intervals. Berms should be angled just off 90º to the slope to prevent the build up of storm water on the inside of the berm.

Surface water and stormwater must be minimised and not allowed to flow down cut or fill slopes or along pipeline routes without erosion protection measures, as previously discussed, being in place.

All overflow and scours channels shall be lined with stone pitching along their length and at their points of discharge to prevent soil erosion. The point of discharge must be at a point where there is dense natural grass cover.

Channels shall not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient.

All runoff shall be collected and channelled to discharge via surface spreaders into drainage lines. Upon completion of backfilling, sandbag berms must be placed across the bare area created by the trench line. These berms must be angled just off 90º.

The intention is to have a minimum distance of open trench with stockpiled soils exposed to rainfall and storm water flow at any one time. It is essential that construction and rehabilitation is completed as quickly as is reasonably possible.

4.2 Post construction

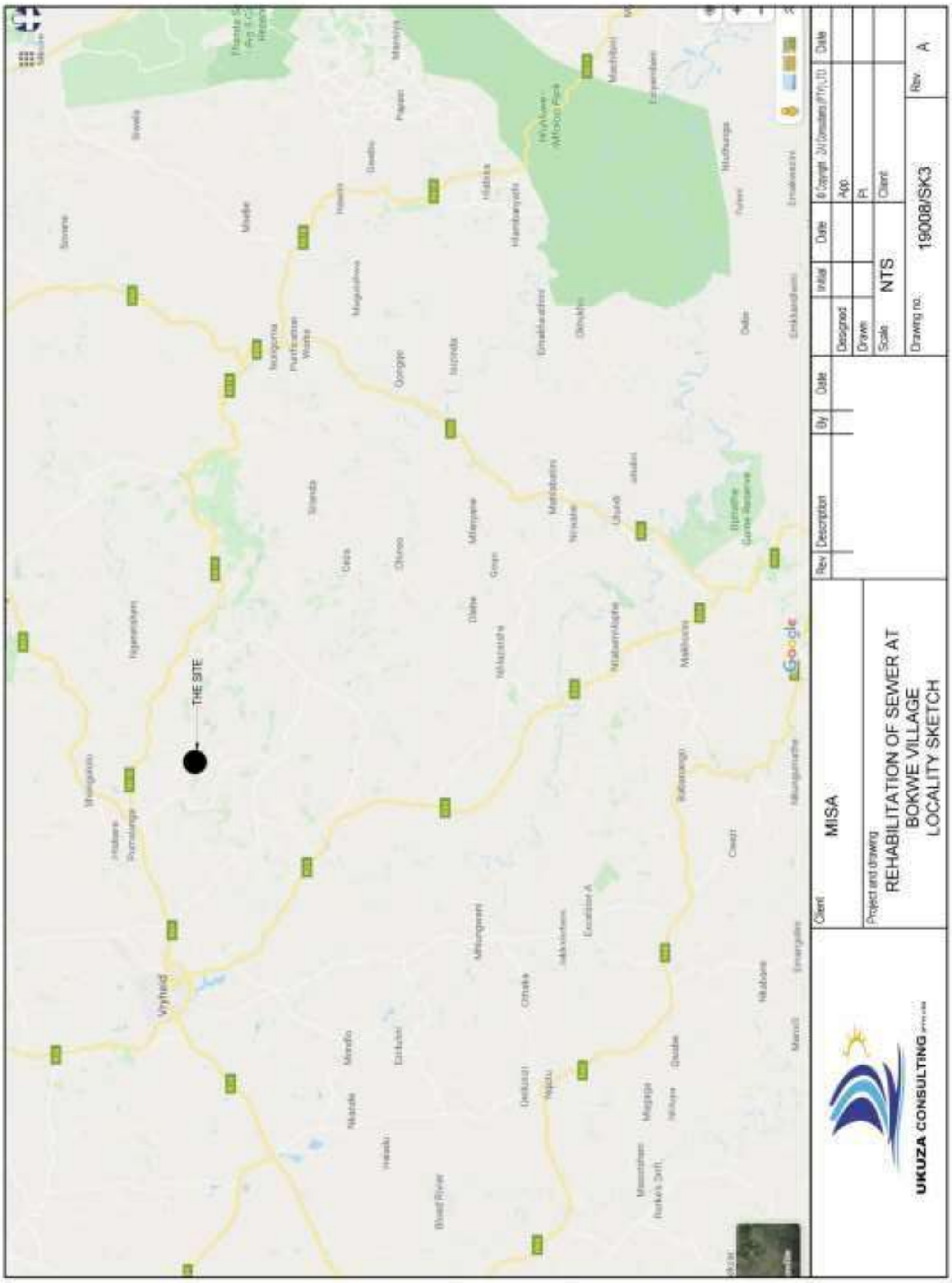
The reticulation is hydraulically designed to accommodate 15% stormwater infiltration. This would only occur on days where there is rain. This is not desirable and is unlikely for a new installation but long term this may happen and so it allowed for.

The berm above the ponds prevents surface water from entering the ponds.

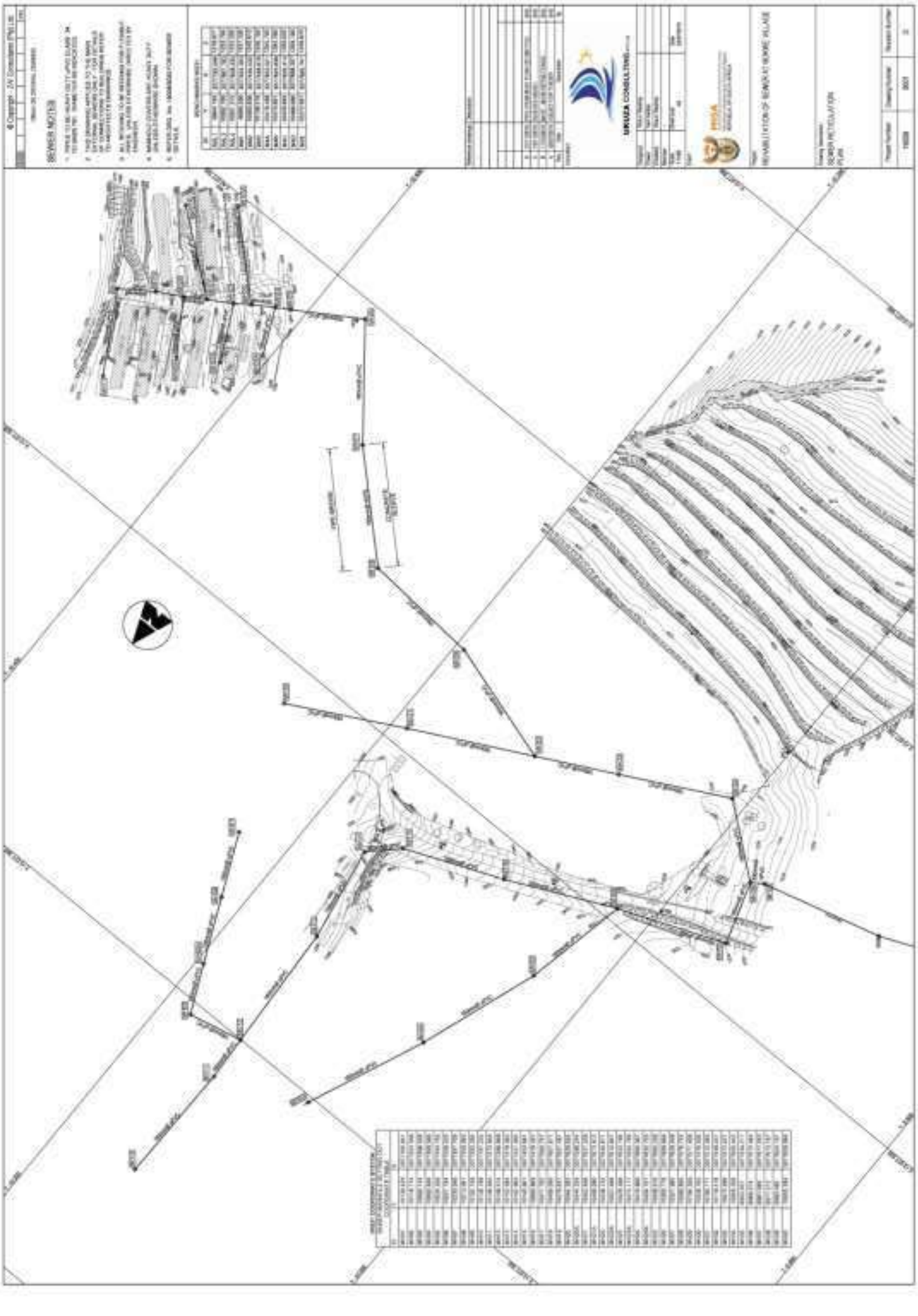
The ponds are also hydraulically designed to accommodate the same 15% infiltration and will not affect the freeboard of the ponds. Any water falling on the ponds will increase the treatable volume slightly. The effluent will be more dilute and so although the treatable volume goes up the detention time comes down so the size of the primary ponds is the same and the effluent quality exiting the ponds is the same. The final evaporation pond has an emergency overflow to protect the pond banks against overtopping.

The ponds are 280m from and 9m above the nearest stream and above the 1:100 flood line.

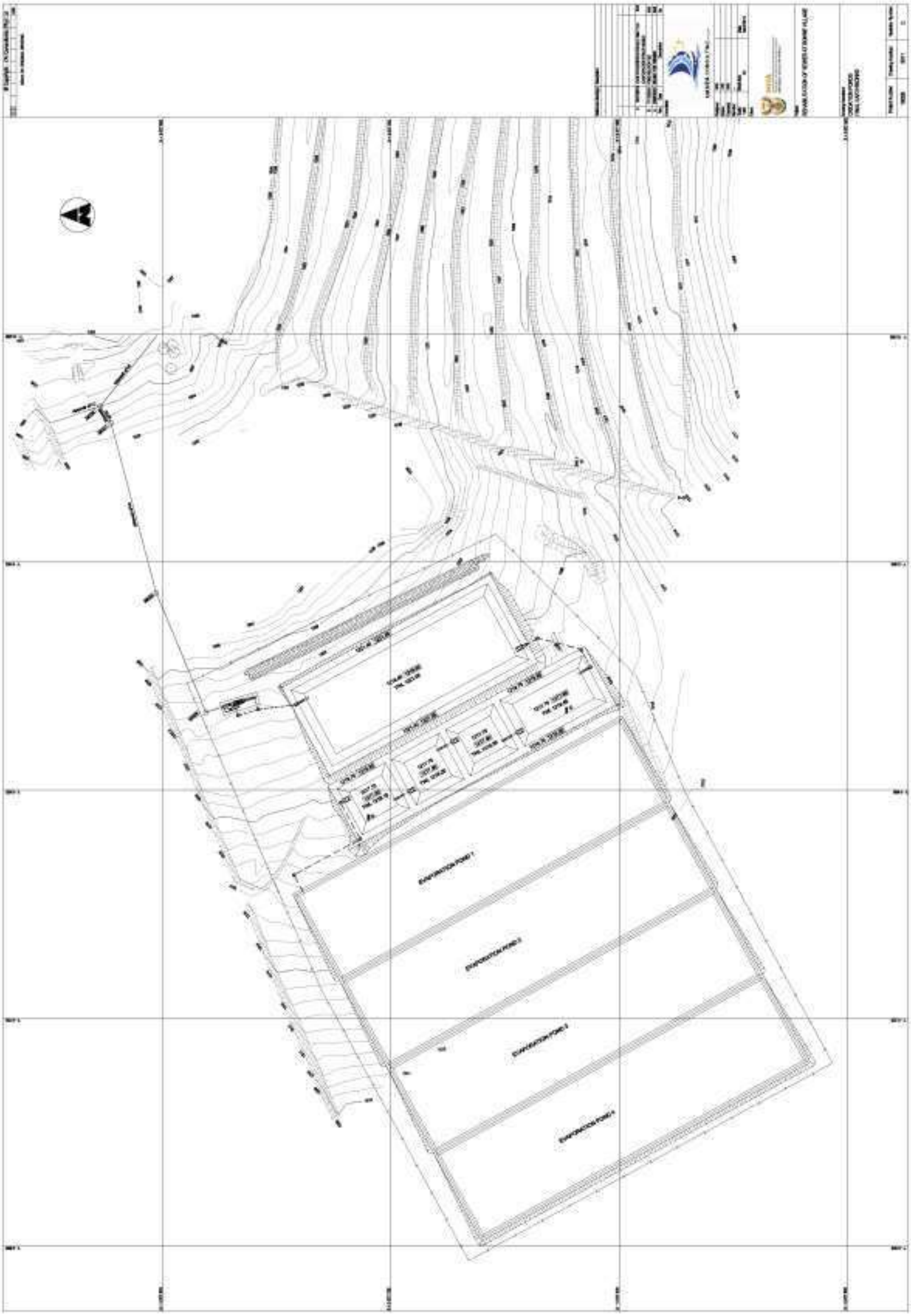
Annexure A: Project Location



Annexure B: Sewer Reticulation



Annexure B: Oxidation Ponds



GEOTEHNICAL INVESTIGATION REPORT FOR THE PROPOSED RETICULATION AND SEWAGE TREATMENT PONDS AT BHOKWE VILLAGE

MARCH 2017

WINWATER
Driven, Inspired, Passionate

Client Name: WINWATER

Location: Abaqulusi Municipality

DRAFT GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED RETICULATION AND SEWAGE TREATMENT PONDS AT BHOKWE VILLAGE

March 2017

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Bhokwe Village Reticulation

1. INTRODUCTION

iLZ Consulting was appointed by Mr B Mhindu of WINWATER Mechanical and Electrical Projects to undertake geotechnical investigation for the proposed reticulation and sewage treatment at Bhokwe Village, northern kwaZulu-Natal.

The objective of the investigation was to complete a geotechnical investigation of the site giving:-

- The soil/rock profiles.
- The engineering properties of the near surface soils.
- An assessment of the near surface soils for their use as bedding and backfill material.
- Bearing capacity of the soil/rock;
- Design parameters for embankments; and
- Comments on any perceived geotechnical problems that may affect either the design or construction of the proposed structures.

This draft report presents the results of the geotechnical investigation undertaken for the proposed reticulation and sewage treatment ponds. Recommendations are given for:

- Ground stability;
- Earthworks; and
- Materials usage

It must be noted that the recommendations and conclusions made in this report are based on results and information obtained at specific investigation points.

The assessment of the overall geotechnical conditions for the proposed development has been inferred by professional judgement made from the interpolation and extrapolation of the point information gained from trial pits and dynamic probing light (DPL) tests, as well as visual assessments of surface features.

Although considered unlikely, should significant variations from the inferred conditions become apparent during construction, the advice of a geotechnical professional must be sought.

2. INFORMATION SUPPLIED

Information made available to iLZ at the time of investigation comprised the following:-

- Survey drawings showing the layout of the site with the proposed

development.
- Google earth image of the site.
- 1: 250 000 Scale, 2730 Vryheid Geological Map.
- 1: 50 000 Scale, 2731CC Gluckstadt Topographical Map

3. SITE DESCRIPTION

The site for the proposed development is located within a small former mining village, Bhokwe, which is about 42km east of Vryheid northern KwaZulu Natal.

The proposed reticulation system traverses along village internal roads with the sewage treatment plant located south of the village next to the gum tree plantation.

Access to the site is through a tar road which detours from an unnamed road going to Enyathi. **Figure 1** below shows site layout plan with trial pit extracted from Google Earth

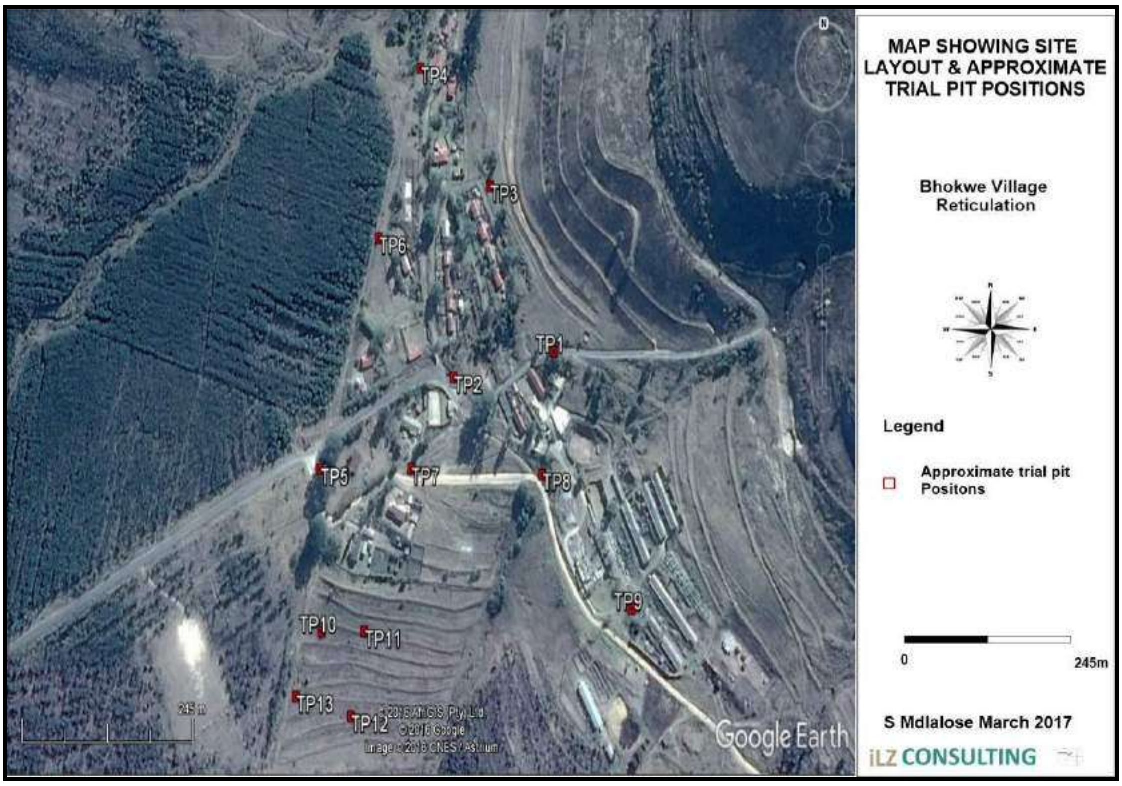


Figure 1 Site layout plan showing approximate trial pit positions

Topographically, the site has a gentle slope in general. Such slope dips towards the south west with elevations ranging from 1219 to 1269 mamsl (metres above mean sea level). The site coordinates in Longitude and Latitude, Datum WGS84 are 27°48'42.50"S and 31° 6'10.55"E. **Figure 2** below shows a topography of Bhokwe Village extracted from **2731CC Gluckstadt Topographic Map** at scale of **1:50 000**

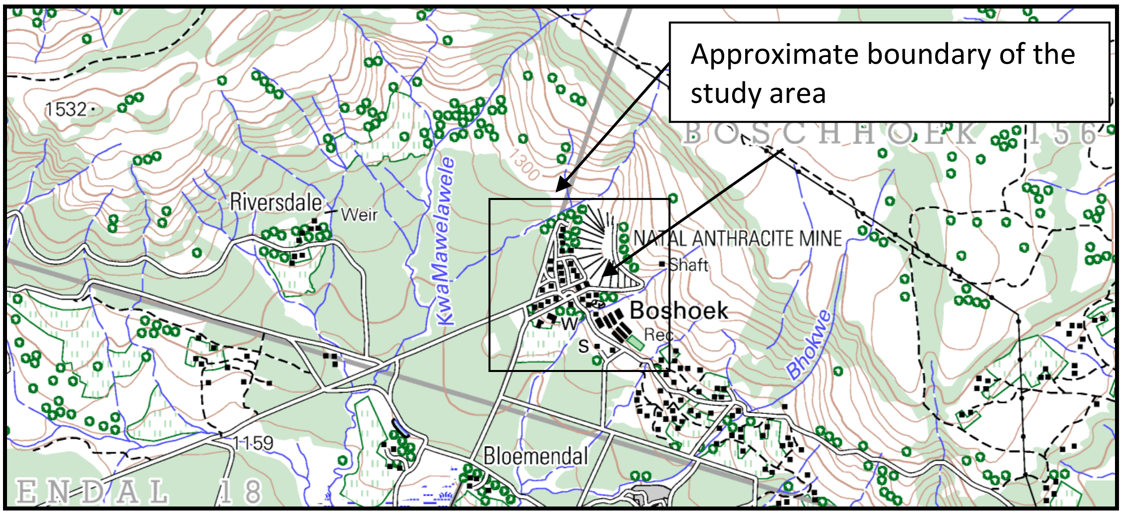


Figure 2 Topographical map showing site boundary at a scale 1:50 000

The site for the proposed sewage treatment ponds appears to have been used for contour ploughing of different crops. It also dips towards the south west, has thick grass cover and scattered trees as shown in **Figure 3** below.

Figure 3 Picture showing general site topography

4. METHODOLOGY

The geotechnical study was carried out in separate stages: The first stage was a **desktop study** that commenced a day before the field work**.** The second stage was **field work** and it entailed excavation of trial pit using a Tractor-Loader-Backhoe (TLB) machine, profiling of trial pits as well as conducting Dynamic Probe Light (DPL) tests.

Field work took place on the 7th and 8th of February 2017.

The excavated subsoils were profiled immediately by a Geologist in accordance with the Geoterminology (2002)[1]. All trial pits were then loosely backfilled. Each inspection pit was set out in the field using a hand held Garmin eTrex GPS, and their locations are indicated on the site plan that appears in **Figure 1** above. The profile descriptions are presented in **Appendix A** of this report.

Figure 4 Picture showing trial pit excavation on site

During this field work, soil samples were taken to a SANAS accredited soil testing laboratory (SOILCO in Vryheid) for testing.

The DPL penetration rates were used for the evaluation of subsoil consistency and the empirical derivation of the estimated allowable safe bearing pressure (EASBP) and in-situ CBR, according to the methods of Terzaghi & Peck, modified by Meyerhof (Craig, 1997) and Draft TMH 6 (1984) respectively.

The DPL test results are presented in **Appendix B**.

4.1 Reticulation system

4.1.1 Trial pits

TP1 through to TP9 were excavated at 300m intervals along the proposed pipeline route. Trial pits were extended to 2.5m (average pipe invert level) below existing ground level. Shallow refusals on weathered sandstone at depths of 1.9m and 2.3m below ground level were experienced on TP1 and TP7 respectively.

---

[1] Geoterminology Workshop (2002) – Guidelines for Soil and Rock Logging SAIEG-AEG-SAICE (Geotech Div) pp47

Figure 5 Picture showing typical trial pit along the reticulation pipe network

4.2 Sewage treatment ponds

4.2.1 Trial pits

Four trial pits designated TP10 through to TP13 were excavated where the sewage treatment plant will be constructed. The trial pits were extended to 3.2m below existing ground level. Shallow weathered sandstone refusal was encountered at depths ranging between 1.0 and 1.5m below existing ground level at TP10 and TP13 respectively.

Figure 6 Picture showing shallow sandstone refusal at TP10

4.2.2 Dynamic Cone Penetrometer Tests

Five penetrometer tests (DPL) tests designated DPL 1 through to DPL 5 were advanced from surface adjacent to the trial pits to refusal depths ranging from 0.6 to 2.7m below existing ground level.

Figure 7 Picture showing penetrometer tests conducted on site

4.3 Sampling and Laboratory Testing

Representative disturbed samples were retrieved from the trial pits for laboratory testing. The following tests were conducted

- 3 x Atterberg limits;
- 1 x Hydrometer;
- 4 x chemical
- 4 x MOD-CBR; and
- 1 x Shear box

5. BRIEF GEOLOGY

According to the 2730 Vryheid, 1:250 000 Geological Series, the site is underlain by sandstone, shale and grit with coal and oil-shale beds of the Vryheid Formation which is Permian in age.

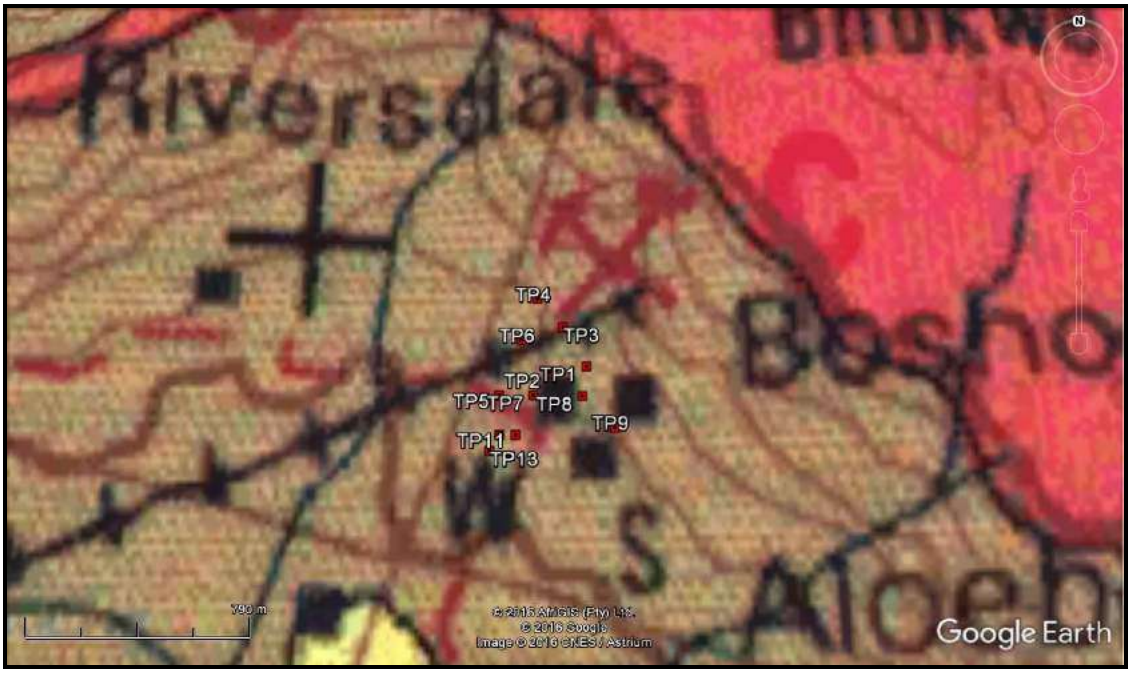


Figure 8 Map showing geology of the study area at 1:250 000

Field investigation showed a continuous mantle of transported soils that are in a form of colluvium. Underlying transported soils were residual soils which overlie weathered sandstone bedrock (see geological profiles in **Appendix A**).

5.1 Transported Soils

Colluvial soils are soils that have been transported prior to deposition. A consistent layer of these soils with varying thickness was encountered from surface to a maximum depth of 1.7m below existing ground level. They were described as dry to slightly moist, dark grey to black, loose, intact, fine sand.

5.2 Residual Soils

Residual soils are derived from complete weathering of parent rock.

Residual sandstone was described as slightly moist, reddish brown to yellowish brown speckled orange, loose to medium dense, intact, fine sands and sandy clays.

5.3 Weathered bedrock

Weathered sandstone was encountered in most of the trial pits put down during investigation. It was described as yellowish brown to white, light brown to grey mottled orange and red, completely to slightly weathered, highly to moderately fractured, fine to medium grained, very soft to medium hard rock.

6. GROUNDWATER OCCURRENCE

No groundwater seepage was encountered in any of the trial pits put down during investigation. However, during periods of prolonged rainfall, particularly the summer season, a marked increase in the occurrence and magnitude of groundwater seepage flow can be anticipated. Perched groundwater flows at the soil / rock interface are likely to become more prolific in these rainy months.

7. LABORATORY TEST RESULTS

For more accurate determination and classification purposes, particle size distribution, Atterberg Limits, MOD AASHTO and CBR tests were carried out on representative samples of soil retrieved from trial pits.

The results are displayed in **Appendix C** and are summarized in **Table 1**. It should be noted that results for pH, conductivity and shear box tests were not available at the time of preparation of this report.

Table 1 Summary of Results of Particle Size Distribution Analysis, Atterberg Limit Determinations, MOD AASHTO and CBR Tests

Pit No	Depth (m)	Material Description	Particle Size %			Atterberg Limits %			GM	Modified AASHTO		CBR Values (%) Compaction MDD (%)				Classification and Activity
			Clay and Silt	Fine Sand	Course Sand	LL	PI	LS		MDD (kgm3)	OMC %	90	93	95	100	
TP1	1.4-1.9	Brown mottled orange, sandstone	37	45	18	24	4	1.8	1.73	1800	12.6	8	14	19	44	A-1b(0), G8
TP2	0.0-1.6	Dark brown, sand	33	49	19	20	5	2.6	0.98							A-2-4(0)
TP4	0.0-2.3	Dark brown, sand	33	51	14	18	4	2.0	0.82							A-2-4(0)
TP5	1.1-2.5	Yellowish brown sandstone	18	25	57	22	7	3.3	1.43	1778	8.5	5	8	10	19	A-1b(0), G9
TP7	1.2-2.3	Yellowish brown speckled orange, sand	33	54	14	CBD	S/P	1.1	1.91							

Pit No	Depth (m)	Material Description	Particle Size %			Atterberg Limits %			GM	Modified AASHTO		CBR Values (%) Compaction MDD (%)				Classification and Activity
			Clay and Silt	Fine Sand	Course Sand	LL	PI	LS		MDD (kgm3)	OMC %	90	93	95	100	
TP9	1.1-2.3	Reddish brown sand	53	34	14	34	15	7.5	0.69	1697	17.7	0	1	2	8	A-6(16), Spoil
TP10	0.5-1.0	Grey, sandstone	26	47	27	CBD	S/P	0.8	1.83	1909	9.4	5	9	13	35	G9
TP11	0.0-2.7	Reddish brown sandy clay	49	41	9	33	14	7.0	0.63							A-6(16), LOW

LL- Liquid Limit
LS - Linear Shrinkage
PI - Plasticity Index

MDD – Maximum Dry Density
OMC – Maximum Moisture Content
GM– Grading Modulus

Classification in terms of AASHTO TRH14 (1985)

8. RECOMMENDATIONS

8.1 Excavation requirements

The trenchability of the materials underlying the proposed pipeline has been assessed according to the criteria published by SANS1200D.

The majority of the site is underlain by loose to medium dense sands (residual sandstone) overlying soft to medium hard sandstone. As a result, conditions over much of the site should be categorized as Soft to Intermediate Excavation.

If excavations are carried out over rainy periods, groundwater seepage may be encountered, and problems related to collapse of trench sidewalls may occur.

8.2 Bedding Material

In terms of the SANS 1200 LB (1983) concerning bedding requirements, buried pipelines require two types of selected material. Those selected materials are termed “Selected Granular Material” and “Selected Fill Material”.

In general, the “Selected Granular Material “is used as bedding material to support the pipe, while the “Selected Back Fill Material” is used as blanket material over the crown of the pipe. General Backfill material, which is placed above the blanket materials, up to ground level.

From visual inspection of the materials encountered in the trial pits as well as the laboratory results, the following comments and recommendations regarding the suitability and use of these materials can be made:

- Materials from the soil part of the inspection pit profiles vary in composition from sandy clays to medium sands .
- The rock materials beneath the soil mantle ranges in composition from completely to slightly weathered sandstone. However, encounter of the shale, dolerite as well as coal beds may not be excluded along the pipeline chainage. These materials are generally excavated as rock fragments ranging in size from fine gravel through to large boulders.
- The following conclusions can be made regarding the suitability of the insitu materials for use in the construction of the bedding layers of the pipeline according to the requirements of SABS1200LB:
    - **None** of the insitu materials sampled meet the grading requirements for “Selected Granular Material” laid down in SABS 1200 LB (1983). Selected granular material is defined as *“granular, non-cohesive and singularly graded between 0.6mm and 19mm. The material must be free draining and have a compactability factor not exceeding 0.4”*. Therefore, all selected granular bedding material will need to be imported to the site.

- The majority of materials identified will not be suitable for "Selected Fill" purposes. Selected fill is defined as *"a material with a Plasticity Index (PI) not exceeding 6, free from lumps, vegetation and stones of a diameter exceeding 30mm"*. Therefore, most of the selected fill materials will also need to be imported to the site.
- All soil materials excavated from trenches may be used as general backfill over the bedding layers.
- Caution may be taken that, gravel and boulders consisting of excavated shale bedrock will disintegrate or exfoliate over time and will result in loss of backfill volume. It is recommended that where shale gravel/boulders are used for backfill, the general backfill profile to the pipe be overbuilt to compensate for this.

8.3 Backfill and Erosion

The trench line can also become a route for continued erosive activity, and with time could develop into a donga feature with resultant failure of the pipeline. It will be important to vegetate the trench outline as soon as possible after backfill is complete.

Compaction of the general backfill soils over the bedding layer should be carried out in layers maximum loose thickness 150mm and compacted to minimum 93% MAASHTO density. This is critical to ensure that settlement over pipes and within trench outlines is limited, particularly where they cross underneath roads or paved areas.

Settlement of trench backfill beneath roads and paved areas can be limited by stabilising backfill materials with cement stabiliser beneath areas of anticipated high wheel loads.

8.4 Trench Stability

In general it is anticipated that vertical sidewall of trench excavations will be stable over the short term. The sidewalls of the trial pits put down for investigation were stable while the investigation was in progress. It is considered that in general trenches not exceeding 1.5 metre depth can remain open for periods of up to 2 days without significant collapse provided **no rainfall and/or seepage of any form of water** occurs during that period. If saturation of the trench occurs, sidewalls of trenches deeper than 1m should either be battered to a safe angle of 1V:2H (cohesion less) or **supported laterally**. In this respect it is recommended that the length of trenches likely to be left open for any sustained period be limited to prevent deterioration in the trench stability.

Excavations in rock will require careful evaluation particularly where deep trenches are envisaged. The shales are known for their tendency to slide along bedding planes particularly when clayey gouge and groundwater occur within the bedrock. This is known to occur even where the shales dip at relatively low dip angles. Deep, vertically sided excavations will therefore require full height support where unfavourable dip angles are evident. Likewise, closely jointed dolerite may also display localised instability such as wedge and slide failures. For this reason it will critical for an experienced g engineering geologist to conduct inspections of the trenches during construction so that potential instability problems can be identified at the earliest opportunity.

8.5 Precautionary Measures

8.5.1 Bedding

- Bedding material for pipe placement shall be non-frost susceptible material
- Before placing any bedding material the bottom of the trench shall be hand raked ahead of the pipe laying operation to remove stones and lumps which will interfere with smooth and complete bedding of the pipe.
- The specified bedding material shall then be placed in layer(s) the full width of the trench, each layer not exceeding eight inches in thickness loose measure, and compacted to 95% of maximum density as determined by AASHTO T 180 D, until the elevation of the plan grade for the pipe invert is attained.
- After the pipe has been laid and approved for covering, the specified bedding material shall be placed evenly on both sides of the pipe for the full width of the trench.

8.5.2 Backfill

- After backfilling of the trench is completed, any excess material from trench excavation shall be hauled to a CONTRACTOR furnished disposal site off of the Project.

8.5.3 Trench Safety

It is important to ensure that soil removed from the trench is placed no closer than 1.5m from the edge of the trench. It is generally required that trenches deeper than 1.5m must be adequately shored where there is a possibility of collapse. With pipeline trenches in particular there is a tendency to open the trench over large lengths thereby increasing the risk of sidewall collapse. In any event there must be provision for safe access not more than every 50m along the trench length.

Key issues regarding the stability of trench sidewalls are;-

- Soft wet soil conditions
- Surcharge loading at edges of trenches
- Groundwater seepage
- Rainwater runoff

Of these both surcharge loading and control of rainwater runoff can be managed. Surcharge in the form of stockpiling of backfill, or trenching machinery (pipe laying rigs), must be placed well away from the edge of the trench.

9. CONCLUSIONS

This report presents results of the geotechnical investigation carried out for the proposed sewage reticulation at Bhokwe Village east of Vryheid, northern KwaZulu Natal.

The investigation undertaken has concluded that the site is suitable for the proposed development, provided that the recommendations provided in this report are adhered to.

Since laboratory test results for shear box test were still outstanding at the time of compilation of this report, comments on design parameters for embankments will be added as Appendices to this report once results have been received from the laboratory.

Finally, it must be noted that the interpretation of the overall subsurface conditions across the site is inferred, using professional judgment, from the interpolation and extrapolation of point information assimilated from the various test positions. Geotechnical conditions at intermediate positions have been inferred by professional judgment. In the unlikely event of significant variations from the inferred conditions becoming apparent during subsequent phases of the project then these must be referred to a geotechnical professional for verification.

10. REFERENCES

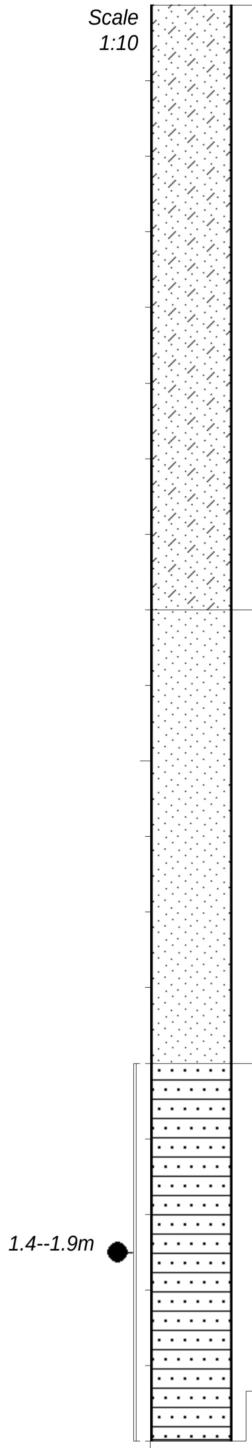
- Brink, ABA and Bruin, RMH.Guidelines for Soil and Rock Logging in South Africa. Proceedings of the Geoterminology Workshop (2002).Sponsored by AEG, SAICE and SAIEG.
- Draft TMH 6. Special Methods. Method ST6. Measurement of the In Situ Strength of Soils by the Dynamic Cone Penetrometer (DCP), (1984).
- 1: 250 000 ***Scale Geological Map. Sheet* 2730 Vryheid**. Published by South African Council for Geoscience.
- 1:50 000 ***Scale Topography Map. Sheet* 2731CC Gluckstadt**. Published by Surveys and Mapping
- SANS 1200 D. Standardised Specification for Civil Engineering Construction, Section D: Earthworks. South African National Standards, (1988).
- SANS 1200 LB (1988). Standardised Specifications for Civil Engineering Construction: Earthworks.
- SECTION 0223-TRENCHING (2003). Standard Specifications for Civil Engineering Projects and Subdivision Improvements.

11. APPENDIX A: GEOLOGICAL PROFILES

WINWATER
Bhokwe Village Reticulation

HOLE No: TP1
Sheet 1 of 1

JOB NUMBER: iLZ_70118



0.00	Dry, dark brown, loose, intact, fine grained slightly clayey sand. Colluvium
0.80	Slightly moist, reddish brown, loose to medium dense, intact, fine grained sand. Residual Sandstone
1.40	Brown, mottled orange, highly weathered, highly fractured, very fine grained, soft to medium hard Sandstone. Vryheid Formation
1.90	

NOTES

1) TLB refusal on sandstone at 1.9m

2) No groundwater seepage

3) No sidewall collapse

4) Disturbed sample between 1.4--1.9m

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Y-COORD : 31° 6’17.20"E

HOLE No: TP1

dotPLOT 7019

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WINWATER
Bhokwe Village Reticulation

HOLE No: TP2
Sheet 1 of 1

JOB NUMBER: iLZ_70118

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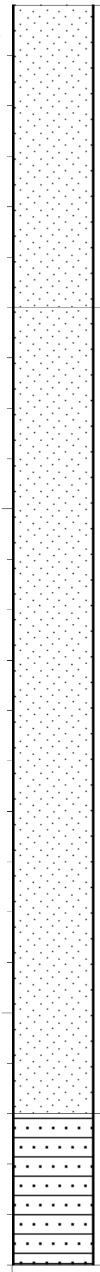

0.00	Slightly moist, dark brown, loose, intact, fine grained sand. Colluvium
0.60	Slightly moist, reddish brown, loose to medium dense, intact, fine grained sand. Residual Sandstone
2.20	Brown, mottled orange, highly weathered, highly fractured, very fine grained, soft Sandstone. Vryheid Formation
2.50	

NOTES

1) End of Hole at 2.5m
2) No groundwater seepage
3) No sidewall collapse
4) Disturbed sample between 0--1.6m

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Y-COORD : 31° 6’12.10"E

HOLE No: TP2

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WINWATER
Bhokwe Village Reticulation

HOLE No: TP3
Sheet 1 of 1

JOB NUMBER: iLZ_70118

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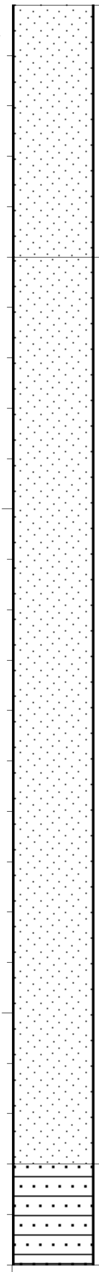

0.00	Slightly moist, black, loose, intact, fine grained sand. Colluvium
0.50	Slightly moist, reddish brown speckled orange and grey, loose to medium
2.30	Brown, mottled orange, highly weathered, highly fractured, very fine grained, soft Sandstone. Vryheid Formation
2.50	

NOTES

1) End of hole at 2.5m
2) No groundwater eepage
3) No sidewall collapse

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DIAM :
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DATE : 02/02/2017
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Y-COORD : 31° 6’14.00"E

HOLE No: TP3

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WINWATER
Bhokwe Village Reticulation

HOLE No: TP4
Sheet 1 of 1

JOB NUMBER: iLZ_70118

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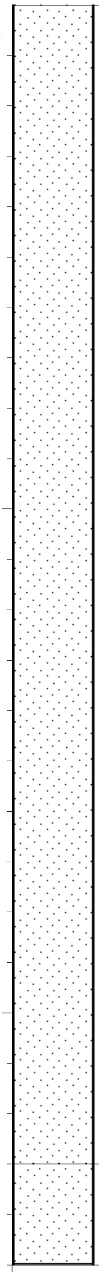

0.00

Slightly moist, black, loose, intact, fine grained sand. Colluvium

2.30

Slightly moist, reddish brown speckled orange and grey, loose to medium dense, intact, fine grained sand. Residual Sandstone

2.50

NOTES

1) End of hole at 2.5m

2) No groundwater seepage

3) No sidewall collapse

4) Disturbed sample between 0--2.3m

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PROFILED BY : S Mdlalose
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DIAM :
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HOLE No: TP4

dotPLOT 7019

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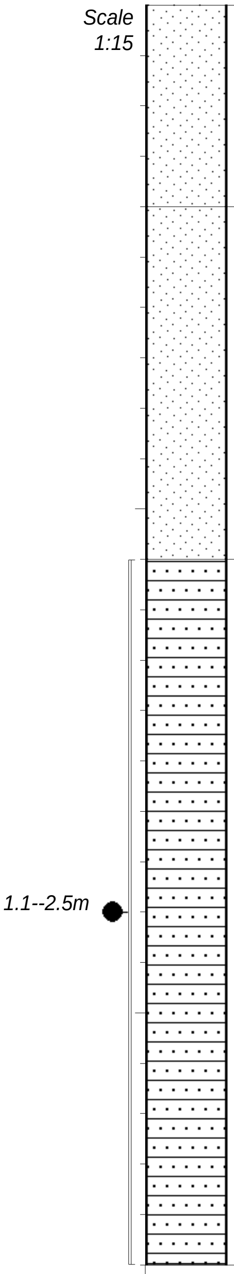
Geotechnical & Geohydrological Consultants

WINWATER
Bhokwe Village Reticulation

HOLE No: TP5
Sheet 1 of 1

JOB NUMBER: iLZ_70118



0.00	Slightly moist, dark grey, loose, intact, fine grained sand. Colluvium
0.40	Slightly moist, light brown, loose, intact, fine grained sand. Residual Sandstone
1.10	Yellowish brown to white, highly to moderately weathered, highly fractured, medium grained, very soft to medium hard Sandstone. Vryheid Formation
2.50	

NOTES

1) End of Hole at 2.5m
2) No groundwater seepage
3) No sidewall collapse
4) Disturbed sample between 1.1--2.5m

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Y-COORD : 31° 6’5.20"E

HOLE No: TP5

dotPLOT 7019

WINWATER
Bhokwe Village Reticulation

HOLE No: TP6
Sheet 1 of 1

JOB NUMBER: iLZ_70118

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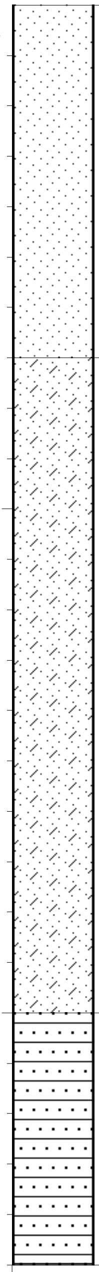


0.00	Slightly moist, black, loose, intact, fine grained sand. Colluvium
0.70	Slightly moist, reddish brown, loose, intact, fine grained clayey sand. Residual Sandstone
2.00	Light brown, completely weathered to highly weathered, very fine grained, very soft to soft Sandstone. Vryheid Formation
2.50	

NOTES

1) End of Hole at 2.5m
2) No groundwater seepage
3) No sidewall collapse

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : S Mdlalose
TYPE SET BY : Standard
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 02/02/2017
DATE : 08/03/2017 13:03
TEXT : ..nwater\bhokwevillage.txt

ELEVATION : 1246m
X-COORD : 27°48’34.20"S
Y-COORD : 31° 6’8.20"E

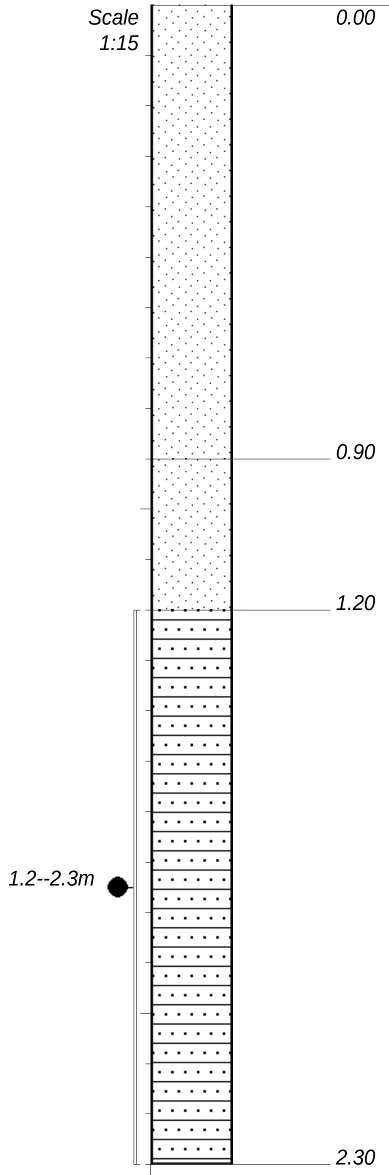
HOLE No: TP6

iLZ CONSULTING
GEOTECHNICAL & GEOHYDROLOGICAL CONSULTANTS

WINWATER
Bhokwe Village Reticulation

HOLE No: TP7
Sheet 1 of 1

JOB NUMBER: iLZ_70118



Slightly moist, black, loose, intact, fine grained sand. Colluvium

Slightly moist, yellowish brown speckled orange, loose, fine grained sand. Residual Sandstone

Light brown, completely weathered to highly weathered, very fine grained, very soft to medium hard Sandstone. Vryheid Formation

NOTES

1) Refusal on Sandstone at 2.3m
2) No groundwater eepage
3) No sidewall collapse
4) Disturbed sample between 1.2--2.3m

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : S Mdlalose

INCLINATION :
DIAM :
DATE :
DATE : 02/02/2017

ELEVATION : 1248m
X-COORD : 27°48’41.20"S
Y-COORD : 31° 6’9.90"E

HOLE No: TP7

TYPE SET BY : Standard
SETUP FILE : STANDARD.SET

DATE : 08/03/2017 13:03
TEXT : ..nwater\bhokwevillage.txt

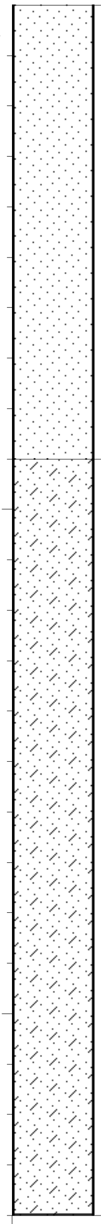
iLZ CONSULTING
GEOTECHNICAL & GEOHYDROLOGICAL CONSULTANTS

WINWATER
Bhokwe Village Reticulation

HOLE No: TP8
Sheet 1 of 1

JOB NUMBER: iLZ_70118

Scale
1:15



0.00

Slightly moist, black to grey, loose, intact, fine grained sand. Colluvium

0.90

Slightly moist, yellowish brown speckled orange, loose, fine grained clayey sand. Residual Sandstone

2.40

NOTES

1) End of Hole at 2.4m
2) No groundwater seepage
3) No sidewall collapse

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : S Mdlalose
TYPE SET BY : *Standard*
SETUP FILE : *STANDARD.SET*

INCLINATION :
DIAM :
DATE :
DATE : 02/02/2017
DATE : *08/03/2017 13:03*
TEXT : *..nwater\bhokwevillage.txt*

ELEVATION : 1251m
X-COORD : 27°48’41.40"S
Y-COORD : 31° 6’16.60"E

HOLE No: TP8

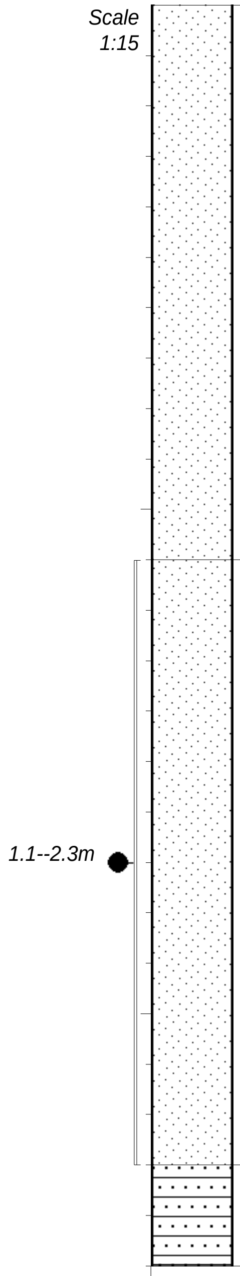
dotPLOT 7019

iLZ CONSULTING
GEOTECHNICAL & GEOHYDROLOGICAL CONSULTANTS

WINWATER
Bhokwe Village Reticulation

HOLE No: TP9
Sheet 1 of 1

JOB NUMBER: iLZ_70118



0.00 Slightly moist, black, loose, intact, fine grained sand. Colluvium

1.10 Slightly moist, reddish brown, loose to medium dense, intact, fine to medium grained sand. Residual Sandstone

2.30 Yellowish brown, highly weathered, highly fractured, medium grained very soft sandstone. Vryheid Formation

2.50

NOTES

1) TLB on at 2.5m

2) No groundwater seepage

3) No sidewall collapse

4) Disturbed sample between 1.1--2.3m

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : S Mdlalose
TYPE SET BY : *Standard*
SETUP FILE : *STANDARD.SET*

INCLINATION :
DIAM :
DATE :
DATE : 02/02/2017
DATE : *08/03/2017 13:03*
TEXT : *..nwater\bhokwevillage.txt*

ELEVATION : 1260m
X-COORD : 27°48’45.30"S
Y-COORD : 31° 6’21.00"E

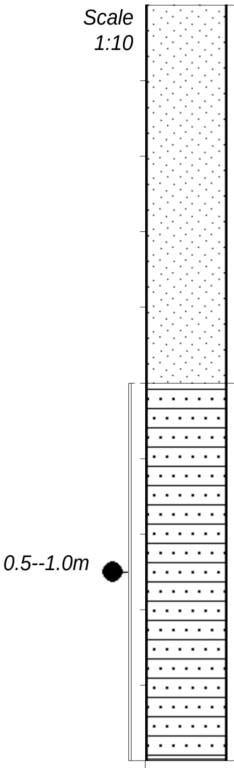
HOLE No: TP9

iLZ CONSULTING
GEOTECHNICAL & GEOHYDROLOGICAL CONSULTANTS

WINWATER
Bhokwe Village Reticulation

HOLE No: TP10
Sheet 1 of 1

JOB NUMBER: iLZ_70118



0.00

Slightly moist, brown, loose, intact, fine grained sand. Colluvium

0.50

Grey, highly to slighly weathered, highly fractured, medium grained very soft sandstone. Vryheid Formation

1.00

NOTES

1) TLB refusal at 1.0m
2) No groundwater seepage
3) No sidewall collapse
4) Sampled between 0.5--1.0m

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : S Mdlalose
TYPE SET BY : Standard
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 02/02/2017
DATE : 08/03/2017 13:02
TEXT : ..nwater\bhokwevillage.txt

ELEVATION : 1229m
X-COORD : 27°48’46.00"S
Y-COORD : 31° 6’5.30"E

HOLE No: TP10

dotPLOT 7019

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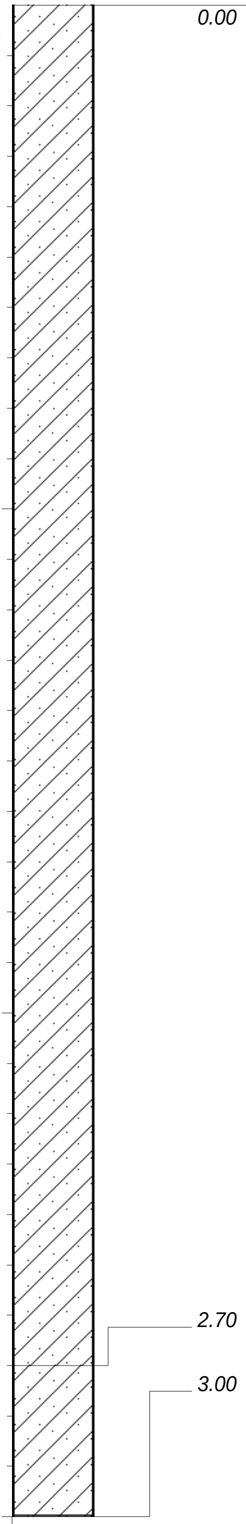
GEOTECHNICAL & GEOHYDROLOGICAL CONSULTANTS

WINWATER
Bhokwe Village Reticulation

HOLE No: TP11
Sheet 1 of 1

JOB NUMBER: iLZ_70118

Scale
1:15



Slightly moist, reddish brown, soft to firm, intact, fine grained sandy clay. Residual Sandstone

Slightly moist, grey, soft to firm, intact, fine sandy clay. Residual Sandstone

NOTES
1) End of Hole at 3.0m

2) No groundwater seepage

3) No sidewall collapse

4) Disturbed sample between 0--2.7m

CONTRACTOR :		*INCLINATION :*		*ELEVATION :*	1227m
MACHINE :		*DIAM :*		*X-COORD :*	27°48’46.00"S
DRILLED BY :		*DATE :*		*Y-COORD :*	31° 6’7.50"E
PROFILED BY :	S Mdlalose	*DATE :*	02/02/2017		
TYPE SET BY :	*Standard*	*DATE :*	*08/03/2017 13:02*		
SETUP FILE :	*STANDARD.SET*	*TEXT :*	*..nwater\bhokwevillage.txt*		

HOLE No: TP11

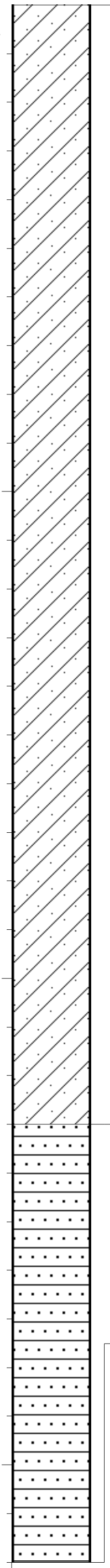
iLZ CONSULTING
GEOTECHNICAL & GEOHYDROLOGICAL CONSULTANTS

WINWATER
Bhokwe Village Reticulation

HOLE No: TP12
Sheet 1 of 1

JOB NUMBER: iLZ_70118

Scale
1:15



0.00	Slightly moist, reddish brown, soft, intact, fine to medium sandy clay. Residual
2.30	Grey mottled orange and red, completely weathered, completely fractured, medium grained, very soft Sandstone. Vryheid Formation
3.20	NOTES

NOTES

1) End of hole at 3.2m
2) No groundwater seepage
3) No sidewall collapse
4) Disturbed sample between 0--3.2m

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : S Mdlalose
TYPE SET BY : Standard
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE :
DATE : 02/02/2017
DATE : 08/03/2017 13:02
TEXT : ..nwater\bhokwevillage.txt

ELEVATION : 1219m
X-COORD : 27°48’48.50"S
Y-COORD : 31° 6’6.80"E

HOLE No: TP12

dotPLOT 7019

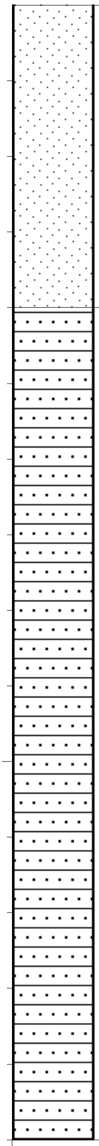
iLZ CONSULTING
GEOTECHNICAL & GEOHYDROLOGICAL CONSULTANTS

WINWATER
Bhokwe Village Reticulation

HOLE No: TP13
Sheet 1 of 1

JOB NUMBER: iLZ_70118

Scale
1:10



0.00	Slightly moist, brown, loose, intact, fine sand. Colluvium
0.40	Grey, highly to slighly weathered, highly fractured, medium grained very soft sandstone. Vryheid Formation
1.50	

NOTES

1) TLB refusal at 1.50m

2) No groundwater seepage

3) No side wall collapse

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : S Mdlalose
TYPE SET BY : *Standard*
SETUP FILE : *STANDARD.SET*

INCLINATION :
DIAM :
DATE :
DATE : 02/02/2017
DATE : *08/03/2017 13:02*
TEXT : *..nwater\bhokwevillage.txt*

ELEVATION : 1220m
X-COORD : 27°48’47.90"S
Y-COORD : 31° 6’4.00"E

HOLE No: TP13

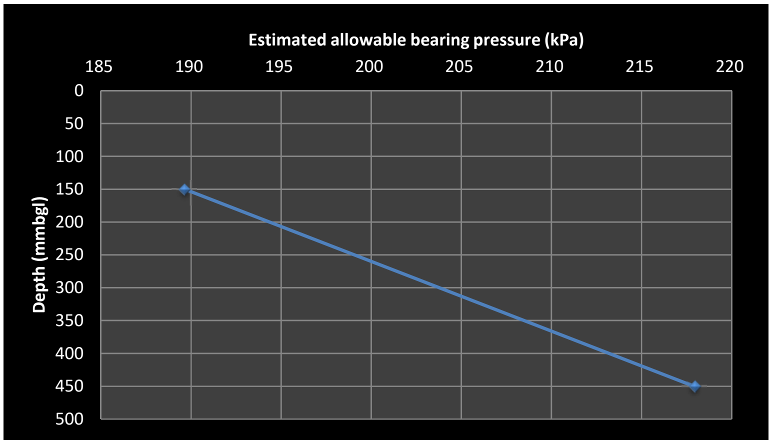
dotPLOT 7019

12. APPENDIX B: INSITU DYNAMIC CONE PENETRATION TEST

ANALYSES OF DPL TEST RESULTS

Project Name **Bhokwe Village Reticulation**
Date 08-02-17
DPL No. 1
Note on refusal DPL bouncing with no penetration
Depth of hole in which DCP was taken : 0 mm below NGL
Applied Factor : 1 times Terzaghi's value

iLZ CONSULTING



Penetration Guide		
SPT mm/blow	DCP DN	Consistency
75-100	132-210	Very Dense
30-75	78-132	Dense
10-30	25-78	Med Dense
4-10	10 25	Loose
<4	<10	Very Loose

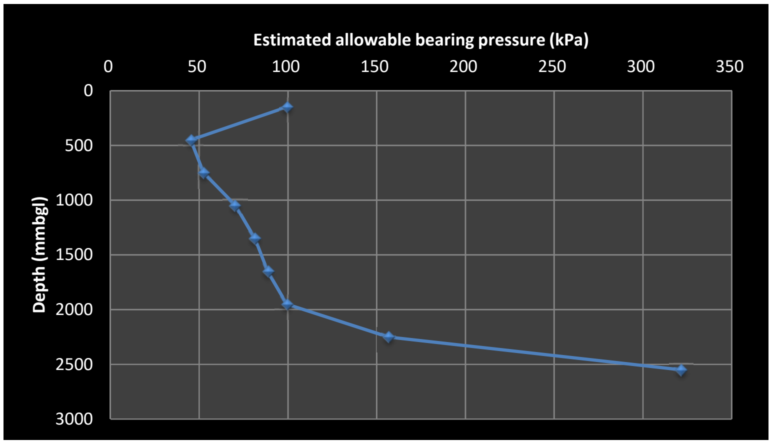
NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN lows/300m	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	300	150	36	150	8	14	29	190
2	300	600	450	42	450	7	16	35	218

ANALYSES OF DPL TEST RESULTS

Project Name **Bhokwe Village Reticulation**
Date 08-02-17
DPL No. 2
Note on refusal DPL bouncing with no penetration
Depth of hole in which DCP was taken : 0 mm below NGL
Applied Factor : 1 times Terzaghi's value

iLZ CONSULTING



Penetration Guide

SPT mm/blow	DCP DN	Consistency
75-100	132-210	Very Dense
30-75	78-132	Dense
10-30	25-78	Med Dense
4-10	10 25	Loose
<4	<10	Very Loose

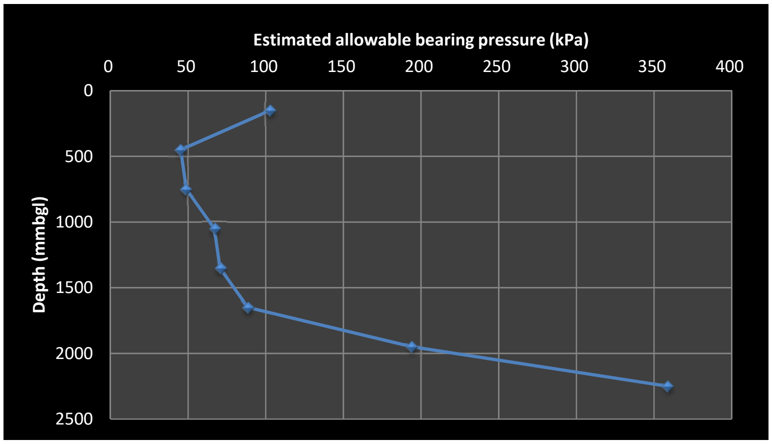
NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN lows/300m	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	300	150	22	150	14	8	15	99
2	300	600	450	7	450	43	3	3	45
3	600	900	750	9	750	33	3	5	52
4	900	1200	1050	14	1050	21	5	8	71
5	1200	1500	1350	17	1350	18	6	11	81
6	1500	1800	1650	19	1650	16	7	13	89
7	1800	2100	1950	22	1950	14	8	15	99
8	2100	2400	2250	29	2250	10	11	22	157
9	2400	2700	2550	64	2550	5	24	61	322

ANALYSES OF DPL TEST RESULTS

Project Name **Bhokwe Village Reticulation**
Date 08-02-17
DPL No. 3
Note on refusal DPL bouncing with no penetration
Depth of hole in which DCP was taken : 0 mm below NGL
Applied Factor : 1 times Terzaghi's value

iLZ CONSULTING



Penetration Guide		
SPT mm/blow	DCP DN	Consistency
75-100	132-210	Very Dense
30-75	78-132	Dense
10-30	25-78	Med Dense
4-10	10 25	Loose
<4	<10	Very Loose

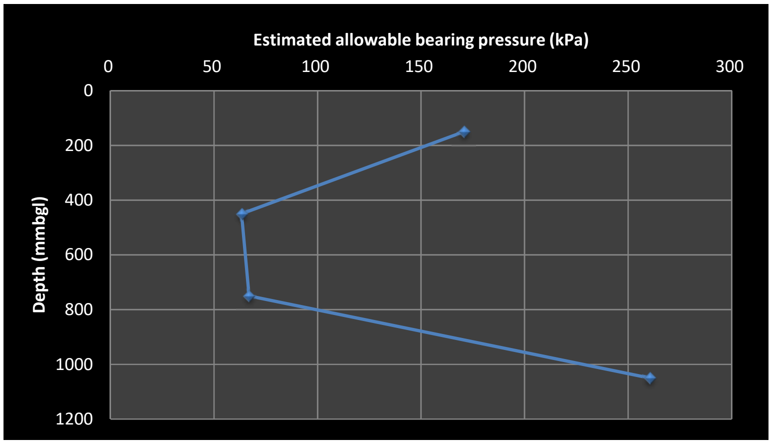
NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN lows/300m	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	300	150	23	150	13	9	16	103
2	300	600	450	7	450	43	3	3	45
3	600	900	750	8	750	38	3	4	49
4	900	1200	1050	13	1050	23	5	8	67
5	1200	1500	1350	14	1350	21	5	8	71
6	1500	1800	1650	19	1650	16	7	13	89
7	1800	2100	1950	37	1950	8	14	30	194
8	2100	2400	2250	72	2250	4	27	72	359

ANALYSES OF DPL TEST RESULTS

Project Name **Bhokwe Village Reticulation**
Date 08-02-17
DPL No. 2
Note on refusal DPL bouncing with no penetration
Depth of hole in which DCP was taken : 0 mm below NGL
Applied Factor : 1 times Terzaghi's value

iLZ CONSULTING



Penetration Guide		
SPT mm/blow	DCP DN	Consistency
75-100	132-210	Very Dense
30-75	78-132	Dense
10-30	25-78	Med Dense
4-10	10 25	Loose
<4	<10	Very Loose

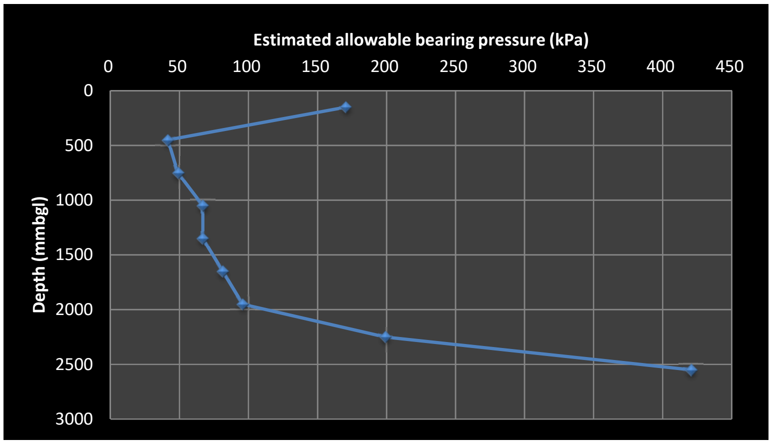
NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN lows/300mı	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	300	150	32	150	9	12	25	171
2	300	600	450	12	450	25	5	7	63
3	600	900	750	13	750	23	5	8	67
4	900	1200	1050	51	1050	6	19	46	260

ANALYSES OF DPL TEST RESULTS

Project Name **Bhokwe Village Reticulation**
Date 08-02-17
DPL No. 2
Note on refusal DPL bouncing with no penetration
Depth of hole in which DCP was taken : 0 mm below NGL
Applied Factor : 1 times Terzaghi's value

iLZ CONSULTING



Penetration Guide		
SPT mm/blow	DCP DN	Consistency
75-100	132-210	Very Dense
30-75	78-132	Dense
10-30	25-78	Med Dense
4-10	10 25	Loose
<4	<10	Very Loose

NOTE :
Stated consistencies do not apply to cohesive materials. Describe using "stiff or firm or soft".

Reading No.	Layer From	Layer To	Average Layer Depth	DCP DN lows/300m	Level Below NGL mm	DCP penetration mm/blow	Equiv. SPT N Value	Approx In-situ CBR	Approx EASBP kPa
1	0	300	150	32	150	9	12	25	171
2	300	600	450	6	450	50	2	3	42
3	600	900	750	8	750	38	3	4	49
4	900	1200	1050	13	1050	23	5	8	67
5	1200	1500	1350	13	1350	23	5	8	67
6	1500	1800	1650	17	1650	18	6	11	81
7	1800	2100	1950	21	1950	14	8	14	96
8	2100	2400	2250	38	2250	8	14	31	199
9	2400	2700	2550	85	2550	4	32	89	421

APPENDIX C : LABORATORY TEST RESULTS

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

SOILCO

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07

NOOITGEDAGHT FARM - LOUWSBURG ROAD - P.O.BOX 761 - VRYHEID - 3100 - KWAZULU - NATAL
TELEPHONE : 034 9826012 TELEFAX : 034 9826013 email : soilco@vhd.dorea.co.za

Customer : Winwater Mechanical & Electrical Projects

Project : Bhokwe Village

Sampling Process : Samples Delivered by Customer

Job Card No. : 212649

Date Received : 07-02-2017

Date Tested : 02-07-2017 to 14-02-2017

Date Reported : 02-03-2017

MATERIALS TEST REPORT

Laboratory Number	V362	V363	V364	V365	V366
Field Number					
Position in field	Test Pit 1	Test Pit 2	Test Pit 4	Test Pit 5	Test Pit 7
Depth (mm)	1.4 to 1.9m	0 - 1.6m	0 - 2.3m	1.1 - 2.5m	1.2 - 2.3m
Sample Description	Pale to Dark Brown Mudstone	Dark Brown Gravelly Silty Sand	Dark Brown Silty Sand	Light Yellowish Orange Sandstone	Light to Pale Red Sandstone
Stabilising Agent	Natural	Natural	Natural	Natural	Natural

Sieve Analysis (Wet Preparation) SANS 3001 - GR 1

100.0	mm	Percentage Passing					
75.0	mm						
63.0	mm						
50.0	mm						
37.5	mm						100
28.0	mm		100				96
20.0	mm		99	100			88
14.0	mm		92	99		100	74
5.0	mm		70	97		99	58
2.0	mm		58	94	100	97	50
0.425	mm		48	77	85	42	43
0.075	mm		22	31	33	18	16
Grading Modulus		SANS 3001 - PR 5	1.73	0.98	0.82	1.43	1.91

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand	(%)	18	19	14	57	14
Coarse - Fine Sand	(%)	6	18	16	9	6
Medium - Fine Sand	(%)	12	17	20	9	27
Fine - Fine Sand	(%)	27	14	15	7	21
Silt and Clay	(%)	37	33	33	18	33

Atterberg Limits - SANS 3001 - GR 10 - GR 12

Liquid Limit	(%)	24	20	18	22	CBD
Plasticity Index	(%)	4	5	4	7	S/P
Linear Shrinkage	(%)	1.8	2.6	2.0	3.3	1.1
Classification Group Index						
COLTO Classification	#					
TRH 14 Classification (1985)	#	G8			G9	

Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30

Optimum Moisture Content	(%)	1800			1778	
Maximum Dry Density	(kg/m^3)	12.6			8.5	

California Bearing Ratio - SANS 3001 - GR 40

CBR	@	100 %	Compaction	44			19	
CBR	@	98 %	Compaction	32			14	
CBR	@	95 %	Compaction	19			10	
CBR	@	93 %	Compaction	14			8	
CBR	@	90 %	Compaction	8			5	
Swell	@	100 %	Compaction	0.44			0.01	

The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Soilco Materials Investigations (Pty) Ltd.

Opinions and Interpretations expressed herein are Outside the Scope of SANAS Accreditation.

Remarks : - The Colto / TRH 14 Classifications are only based on the above results. Further testing might be required.

For Soilco : - (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

SOILCO

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965 / 009585 / 07
NOOITGEDAGHT FARM - LOUWSBURG ROAD - P.O.BOX 761 - VRYHEID - 3100 - KWAZULU - NATAL
TELEPHONE : 034 9826012 TELEFAX : 034 9826013 email : soilco@vhd.dorea.co.za

Customer : Winwater Mechanical & Electrical Projects
Project : Bhokwe Village

Sampling Process : Samples Delivered by Customer

Job Card No. : 212549
Date Received : 07-02-2017
Date Tested : 02-07-2017 to 14-02-2017
Date Reported : 02-03-2017

MATERIALS TEST REPORT

Laboratory Number	V367	V368	V369		
Field Number					
Position in field	Test Pit 9	Test Pit 10	Test Pit 11		
Depth (mm)	1.1 - 2.3m	0.5 + 1.0m	0 - 2.7m		
Sample Description	Orange Brown Silty Clay	Dark Brown Sandstone	Orange Brown Silty Clay		
Stabilising Agent	Natural	Natural	Natural		

Sieve Analysis (Wet Preparation) SANS 3001 - GR 1

100.0	mm	Percentage Passing					
75.0	mm						
63.0	mm						
50.0	mm						
37.5	mm			100			
28.0	mm			97			
20.0	mm		100	93			
14.0	mm		99	84			
5.0	mm		98	66	100		
2.0	mm		97	58	99		
0.425	mm		83	43	90		
0.075	mm		51	15	49		
Grading Modulus		SANS 3001 - PR 5	0.69	1.83	0.62		

Mechanical Analysis - SANS 3001 - GR 1

Coarse Sand	(%)	14	27	9		
Coarse - Fine Sand	(%)	11	10	11		
Medium - Fine Sand	(%)	12	17	13		
Fine - Fine Sand	(%)	11	20	17		
Silt and Clay	(%)	53	26	49		

Atterberg Limits - SANS 3001 - GR 10 - GR 12

Liquid Limit	(%)	34	CBD	33		
Plasticity Index	(%)	15	S/P	14		
Linear Shrinkage	(%)	7.5	0.8	7.0		
Classification Group Index						
COLTO Classification	#					
TRH 14 Classification (1985)	#	SPOIL	G9			

Maximum Dry Density and Optimum Moisture Content - SANS 3001 - GR 30

Optimum Moisture Content	(%)	1697	1909			
Maximum Dry Density	(kg/m^3)	17.7	9.4			

California Bearing Ratio - SANS 3001 - GR 40

CBR	@	100 %	Compaction	8	35				
CBR	@	98 %	Compaction	4	24				
CBR	@	95 %	Compaction	2	13				
CBR	@	93 %	Compaction	1	9				
CBR	@	90 %	Compaction	0	5				
Swell	@	100 %	Compaction	0.72	0.34				

Opinions and Interpretations expressed herein are Outside the Scope of SANAS Accreditation.

Remarks : - The Colto / TRH 14 Classifications are only based on the above results. Further testing might be required.

For Soilco : - (Technical Signatory)

SOILCO MATERIALS INVESTIGATIONS (PTY) LTD

CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965/09585/07

NOOITGEDAGHT FARM - LOUWSBURG ROAD - P.O. Box 761 - VRYHEID - 3100 - KWA-ZULU NATAL

TEL : 034 982 6012 FAX : 034 982 6013 email : soilco@vhd.dorea.co.za

Client : Winwater Mechanical & Electrical Projects
Project : Bhokwe Village
Sample By : **Client**

Job Card No : 212549
Date Received : 07-02-2017
Date Tested : 15-02-2017
Date Reported : 02-03-2017

HYDROMETER ANALYSIS TEST REPORT

Laboratory No.	V369				
Field No.					
Position in Field	Test Pit 11				
Depth (mm)	0 - 2.7m				
Material Description	Orange Brown Silty Clay				
Stabilising Agent	Natural				

Sieve Analysis (Wet Preparation) SANS 3001 - GR 1

Sieve Aperture	**75.0**	**mm**					
	63.0	**mm**					
	50.0	**mm**					
	37.5	**mm**					
	28.0	**mm**					
	20.0	**mm**					
	14.0	**mm**					
	5.00	**mm**	100				
	2.00	**mm**	99				
	0.425	**mm**	90				
	0.075	**mm**	49				
	Grading Modulus		0.62				

Hydrometer Analysis (ASTM - D422)

Sieve Aperture	**0.060**	**mm**	45				
	0.050	**mm**	43				
	0.026	**mm**	42				
	0.015	**mm**	40				
	0.010	**mm**	38				
	0.0074	**mm**	36				
	0.005	**mm**	34				
	0.0036	**mm**	34				
	0.0020	**mm**	32				
	0.0015	**mm**	32				

Soil Mortar Analysis

Coarse Sand	**%**	9				
Fine Sand	**%**	45				
Silt	**%**	13				
Clay	**%**	33				

Atterberg Limits TMH 1 - Methods A2, A3, A4

Liquid Limit	**%**	33				
Plasticity Index	**%**	14				
Linear Shrinkage	**%**	7				
Equivalent PI	**%**	13				
Classification (Group Index)						

The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the the prior consent of Soilco Materials Investigations (Pty) Ltd. Material descriptions as per FAA Textural classification of soils (Figure 6)

For Soilco :

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CIVIL ENGINEERING MATERIALS TESTING LABORATORY

Reg. No. : 1965/09585/07

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TEL : 034 982 6012 FAX : 034 982 6013 email : soilco@vhd.dorea.co.za

---

Client : Winwater Mechanical & Electrical Projects

Project : Bhokwe Village

Sample Delivered by : Client

Job Card No. : 212549

Date Received : 07-02-2017

Date Tested : 15-02-2017

Date Reported : 02-03-2017

Sample Number : V369

Position in field : Test Pit 11

Sample Description : Orange Brown Silty Clay

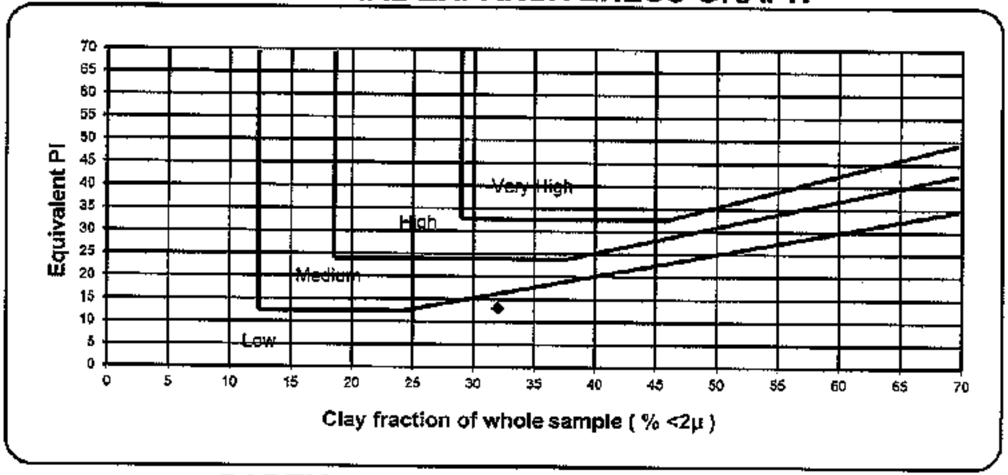
Field or Pit Number : 0

Depth (mm) : 0 - 2.7m

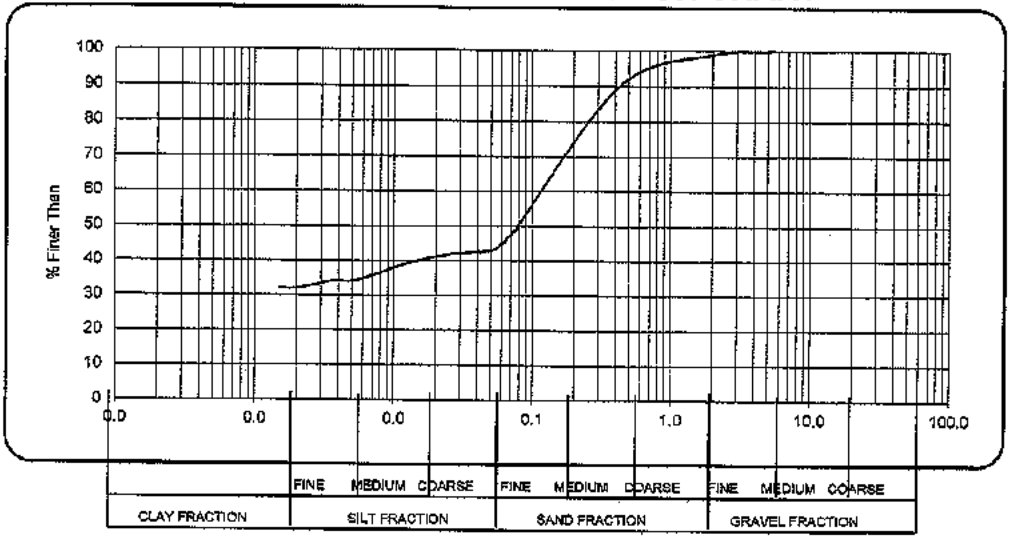
Equivalent PI : 13

Clay fraction of whole sample (% <2μ) : 32

POTENTIAL EXPANSIVENESS GRAPH



PARTICLE SIZE DISTRIBUTION CHART



For Soilco:

Client :Winwater Mechanical & Electrical Projects
Project :Bhokwe Village

Sampling Process : Sampled By :- Client

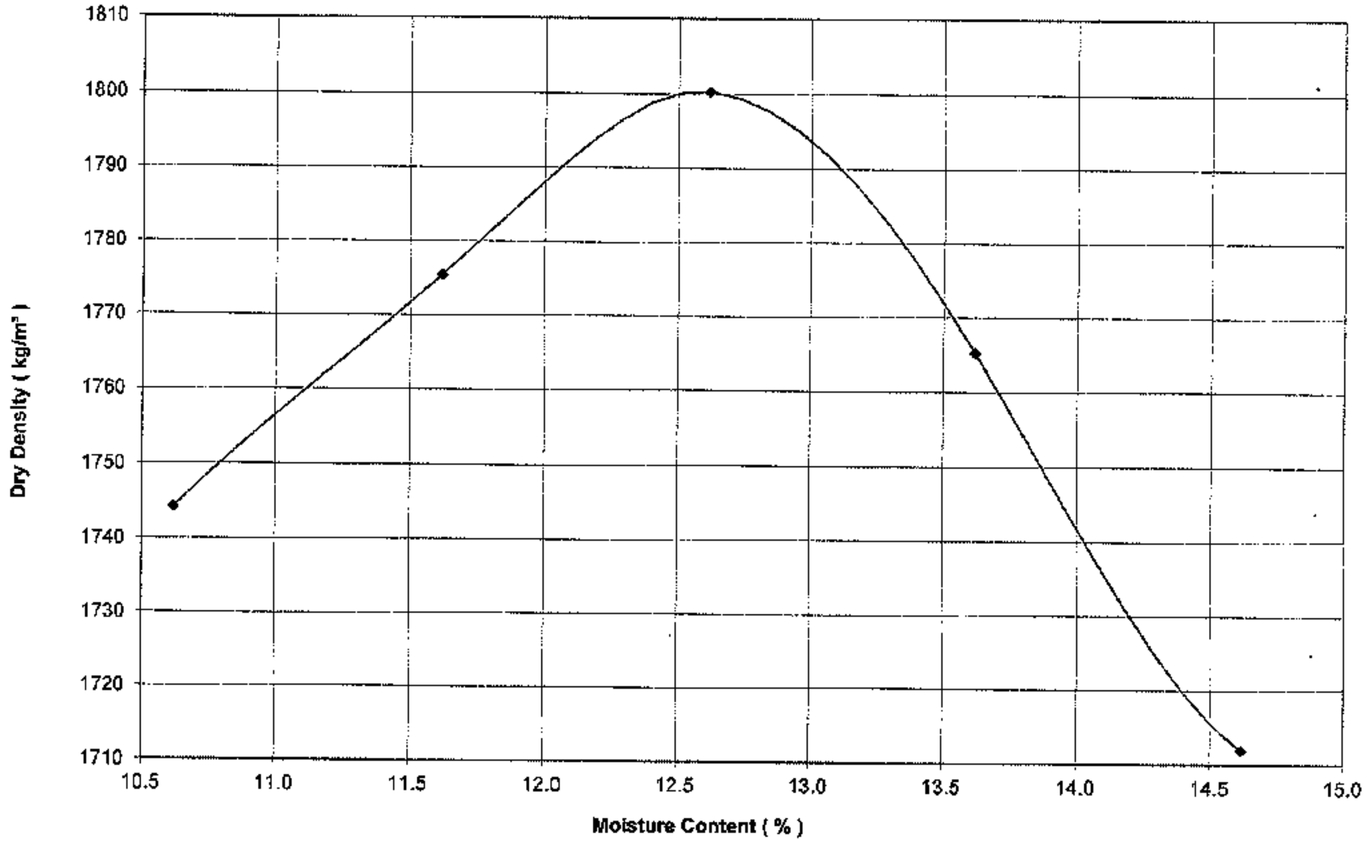
Job Card No. : 212549
Date Received : 2017-02-07
Date Tested : 2017-02-08
Date Reported : 2017-02-09

Laboratory Number : V362
Position in field : Test Pit 1
Material Description : Pale to Dark Brown Mudstone

Field Reference No. :
Depth (mm) : 1.4-1.9m

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR30

Moisture Content; (%)	10.6	11.6	12.6	13.6	14.6	Maximum Dry Density	1800 kg/m^3
Dry Density (kg/m^3)	1744	1775	1800	1765	1712	Optimum Moisture Content	12.6 %



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Remarks :

Method of Preparation : Scalping Process

For Soilco :

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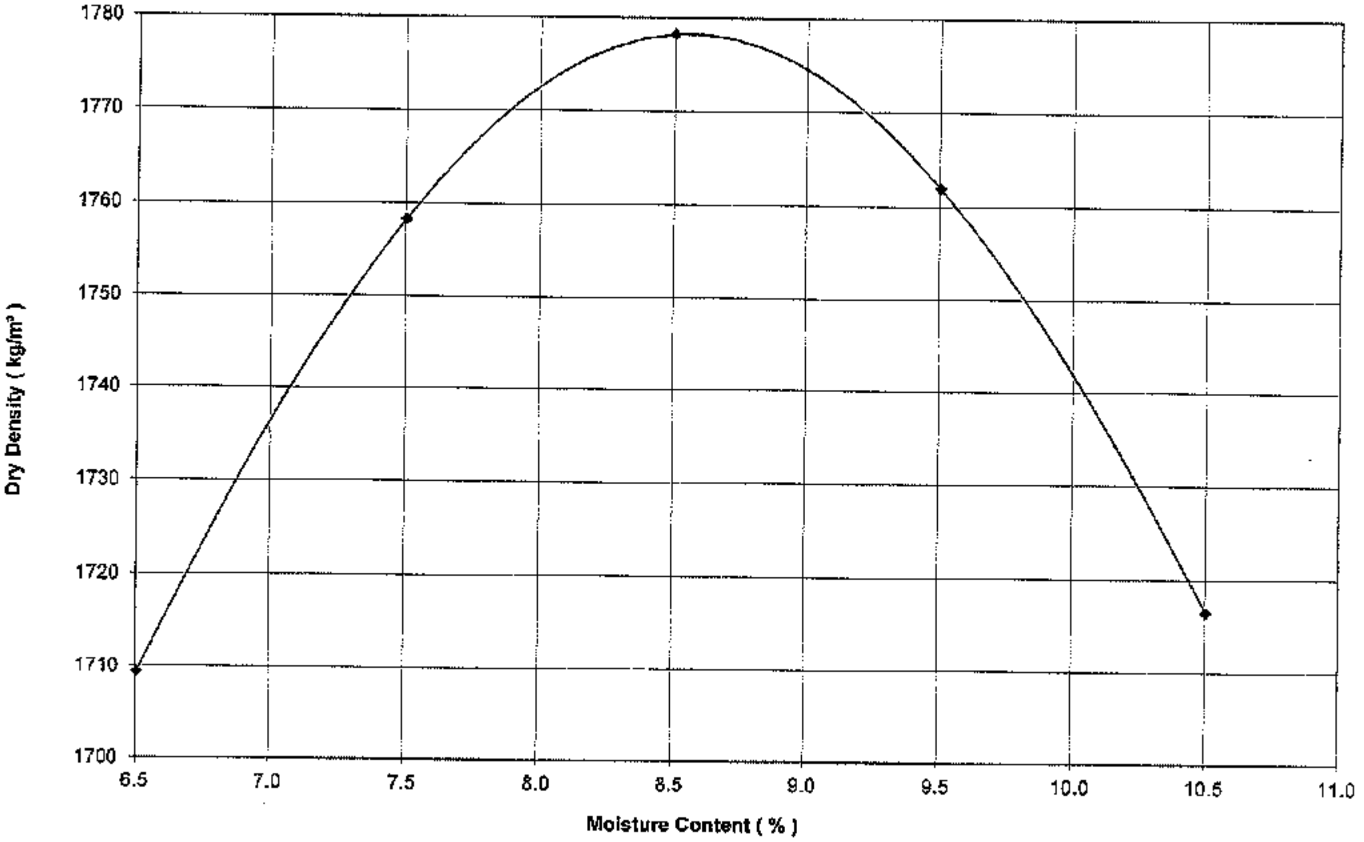
Client :Winwater Mechanical & Electrical Projects
Project :Bhokwe Village
Sampling Process : **Sampled By :- Client**

Job Card No. : 212549
Date Received : 2017-02-07
Date Tested : 2017-02-08
Date Reported : 2017-02-09

Laboratory Number : V365
Field Reference No. :
Position in field : Test Pit 5
Depth (mm) : 1.1-2.5m
Material Description : Light Yellowish Orange Sandstone

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR30

Moisture Content; (%)	6.5	7.5	8.5	9.5	10.5	Maximum Dry Density	**1778 kg/m^3**
Dry Density (kg/m^3)	1709	1758	1778	1762	1716	Optimum Moisture Content	**8.5 %**



Remarks :

Method of Preparation : Scalping Process

For Soilco :

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Reg. No. : 1965/09585/07
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TELEPHONE : 034 - 9826012 : TELEFAX 034 - 9826013 - email : soilco@vhd.dorea.co.za

Client :Winwater Mechanical & Electrical Projects
Project :Bhokwe Village

Sampling Process : Sampled By :- Client

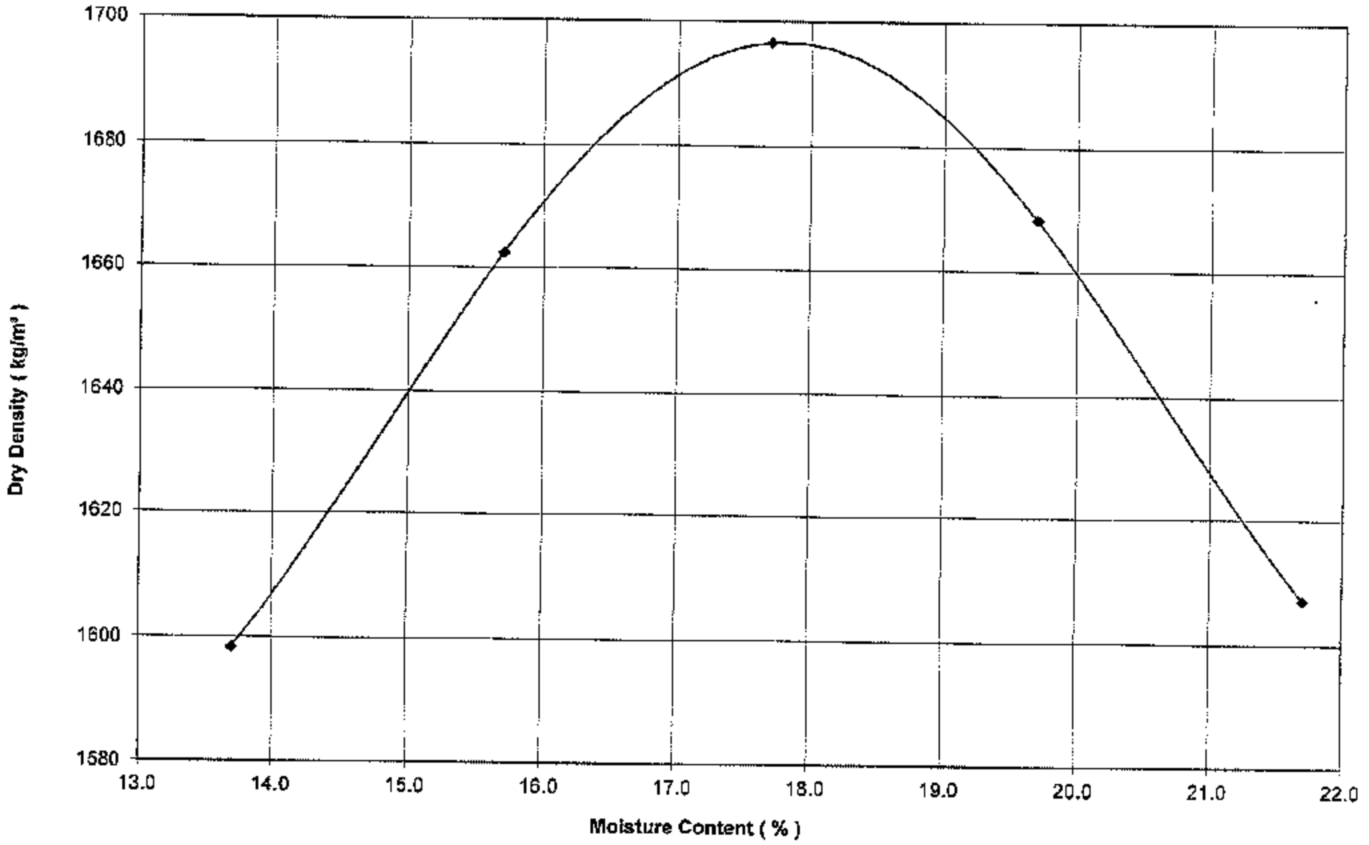
Job Card No. : 212549
Date Received : 2017-02-07
Date Tested : 2017-02-08
Date Reported : 2017-02-09

Laboratory Number : V367
Position in field : Test Pit 9
Material Description : Orange Brown Silty Clay

Field Reference No. :
Depth (mm) : 1.1-2.5m

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR30

Moisture Content; (%)	13.7	15.7	17.7	19.7	21.7	Maximum Dry Density	1697 kg/m³
Dry Density (kg/m³)	1598	1662	1697	1668	1607	Optimum Moisture Content	17.7 %



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Remarks :

For Soilco :

Method of Preparation : Scalping Process

Client :Winwater Mechanical & Electrical Projects
Project :Bhokwe Village

Sampling Process : Sampled By :- Client

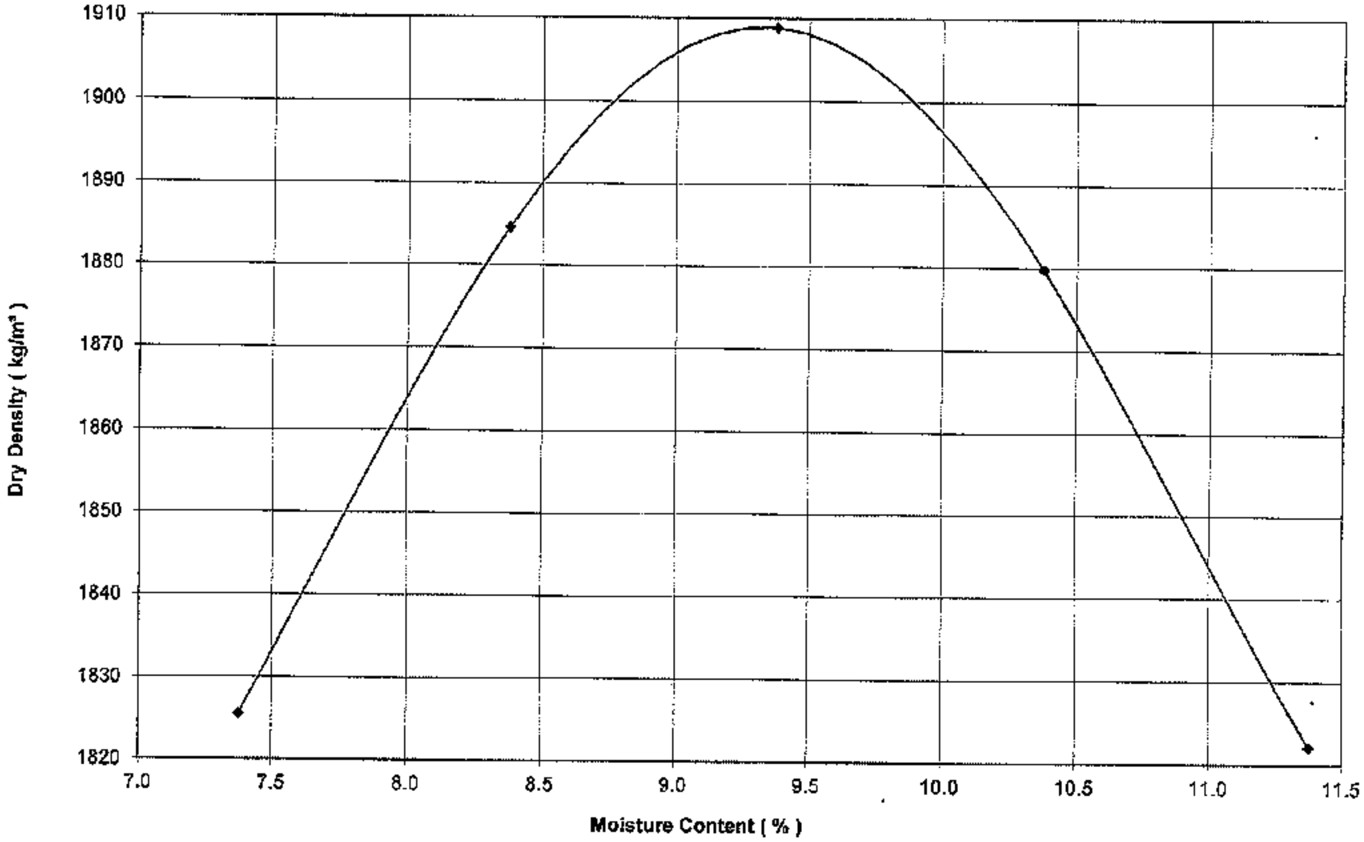
Job Card No. : 212549
Date Received : 2017-02-07
Date Tested : 2017-02-08
Date Reported : 2017-02-09

Laboratory Number : V368
Position in field : Test Pit 10
Material Description : Dark Brown Sandstone

Field Reference No. :
Depth (mm) : 0.5-1.0m

MOISTURE / DENSITY RELATIONSHIP - SANS 3001 - GR30

Moisture Content; (%)	7.4	8.4	9.4	10.4	11.4	Maximum Dry Density	**1909 kg/m^3**
Dry Density (kg/m^3)	1826	1885	1909	1880	1822	Optimum Moisture Content	**9.4 %**



The above test results are pertinent only to the samples received and tested at the laboratory. This report shall not be reproduced, except in full, without the prior consent of Soilco Materials Investigations (Pty) Ltd.

Remarks :

Method of Preparation : Scalping Process

For Soilco :

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Client :Winwater Mechanical & Electrical Projects
Project :Bhokwe Village

Sampling Process : **Sampled By :- Client**

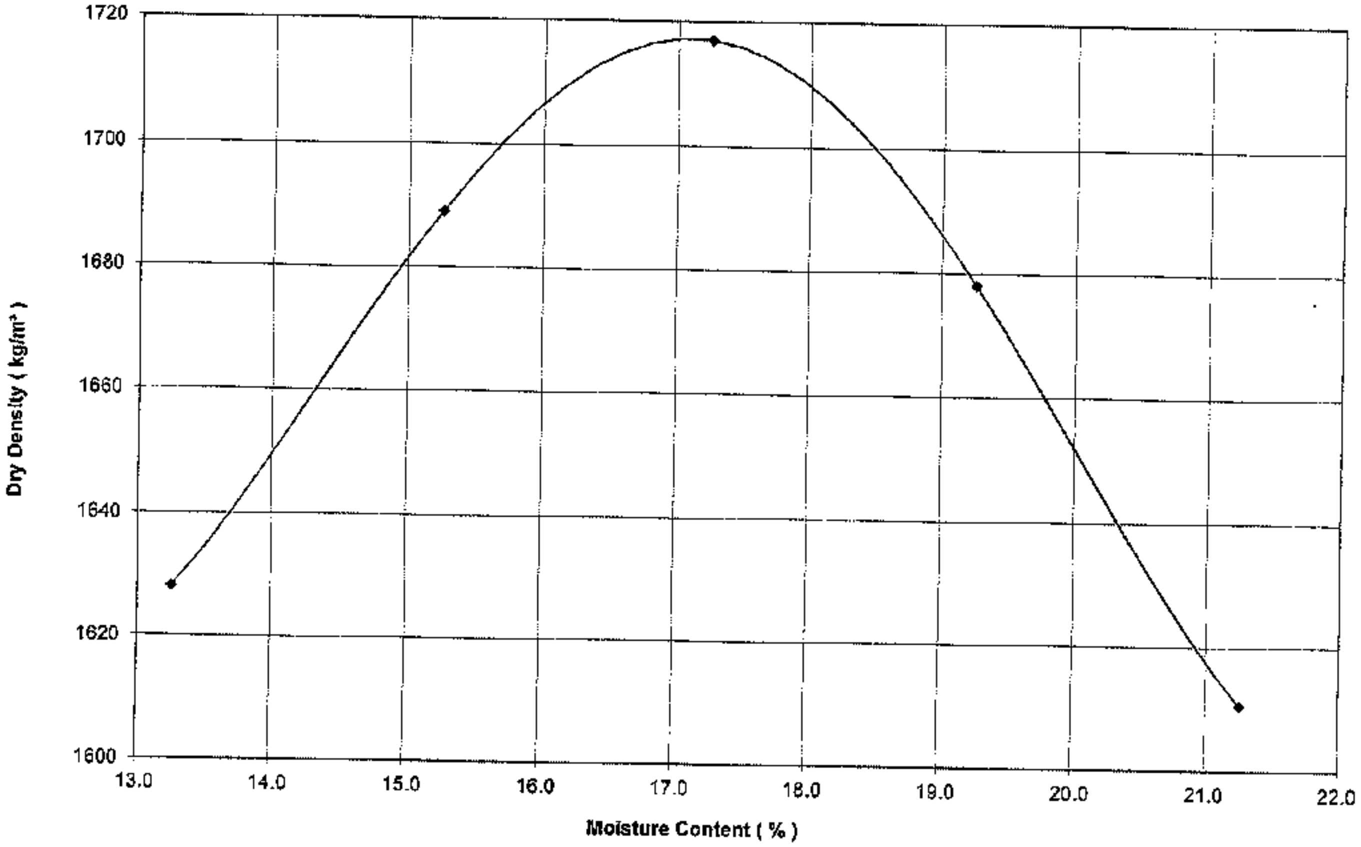
Job Card No. : 212549
Date Received : 2017-02-07
Date Tested : 2017-02-28
Date Reported : 2017-03-01

Laboratory Number : V370
Position in field : TP 12
Material Description : Orange Reddish Brown Silty Clay

Field Reference No. :
Depth (mm) : 0-2.3m

MOISTURE / DENSITY RELATIONSHIP PROCTOR EFFORT - SANS 3001 - GR30

Moisture Content; (%)	13.3	15.3	17.3	19.3	21.3	Maximum Dry Density	**1717 kg/m^3**
Dry Density (kg/m^3)	1628	1689	1717	1678	1610	Optimum Moisture Content	**17.0 %**



Remarks :

Method of Preparation : Scalping Process

For Soilco :

REF. NO.: 2019/241 **DATE: 12TH SEPTEMBER 2019**

FINAL REPORT ON THE DESKTOP STUDY AND GEOHYDROLOGICAL INVESTIGATION UNDERTAKEN FOR THE PROPOSED BHOKWE VILLAGE WASTEWATER TREATMENT WORKS AND SEWER LINE COMPLETION – VRYHEID AREA – ZULULAND DISTRICT MUNICIPALITY

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GEOMEASURE GROUP
Groundwater, Environmental & Geotechnical Consultants

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FINAL REPORT ON THE DESKTOP STUDY AND GEOHYDROLOGICAL INVESTIGATION UNDERTAKEN FOR THE PROPOSED BHOKWE VILLAGE WASTEWATER TREATMENT WORKS AND SEWER LINE COMPLETION – VRYHEID AREA – ZULULAND DISTRICT MUNICIPALITY

1. INTRODUCTION, TERMS OF REFERENCE AND SCOPE OF WORK

After the submission of a requested scope of work and budget proposal, Geomeasure Group (Pty) Ltd. were appointed to undertake a geohydrological investigation to determine the status of the groundwater prior to development of the proposed Bhokwe Village Wastewater Treatment Works and Sewer Line in the Vryheid area in Zululand District Municipality. An initial desktop study report was submitted, and the final geohydrological report has been added onto the initial desktop report in the report. This was done so that the complete geohydrological study could be submitted in one (1) report.

The scope of work as part of this investigation is detailed hereafter:

Phase A – Initial Desktop Assessment

- Identification and delineation of all surface water sources / bodies in proximity to the site
- Assessment of any applicable existing reports / information pertaining to the project, should they be available
- Desktop study of, and collation of information pertaining to, the geology and geohydrology of the area
- Undertaking of a desktop hydrocensus within a 5 km radius of the site, utilising the Department of Water and Sanitation (DWS) KwaZulu-Natal Groundwater Resource Information Database (GRIP), the DWS National Groundwater Archives (NGA) and our in-house (Geom) borehole database
- Assessment of DWS-mapped structures in proximity to the site, in accordance with the regional geological map
- Assessment of other relevant GIS data and mapping information pertaining to the site and this project

Phase B – Hydrocensus Investigation

- Site walkover inspection and reconnaissance of the receiving environment to identify surface and subsurface migration pathways as well as potential receptors located in the ward.
- Performance of a hydrocensus with the aim of identifying functional and abandoned groundwater, spring and surface water sources within the ward and gathering the following information, where possible
    - borehole ages, depths, construction types, water strikes, static water levels, equipment and volumes of water currently being abstracted

  - groundwater and surface water physical parameters, including temperature, pH, electrical conductivity (EC) levels and total dissolved solids (TDS) concentrations

- Collection of up to six (6) water samples from boreholes / springs and possibly surface water sources located within the ward for submission to a SANAS-accredited laboratory for analysis according to the abbreviated SANS 241: 2015 suite of determinants with the addition of ammonia (NH_3), free and saline ammonia and ammonium (NH_4), to allow for the assessment of baseline water quality on-site / within the study area.

- Identification and delineation of existing point-source pollution sources within the study area, should any be in evidence

Phase C – Data Evaluation and Reporting

- Preparation of a geohydrological investigation report, where the following will be included:

  - field investigation methodologies and applicable principles

  - results of the hydrocensus, including the position of, and distance to, identified groundwater sources as well as the gathered pertinent groundwater field characteristics

  - inferred geology and geohydrology of the area, through the inclusion of gathered field data, laboratory data and the available desktop information

  - possible impacts of this project on the downstream environment and groundwater resources in its vicinity, and any existing geohydrological constraints

  - compilation of detailed maps showing water sources and pollution sources

  - interpretation of the water quality results from the selected water sources within the ward

  - interpretation of field and desktop data to give estimated anticipated water table levels

  - identification of the geohydrological risks

  - recommendations for potentially significant impacts

2. PROJECT LOCATION & DESCRIPTION

The site is located in the greater Vryheid area at the co-ordinates 27° 48’ 39.07” S and 31° 06’ 12.73” E within the Zululand District Municipality. The site is located approximately 31 km (as the crow flies) south east of the town of Vryheid (see attached Locality Plan - Dwg No. 2019/241 Figure 1). The site is accessed by a series of roads accessed via the R69 between Vryheid and Louwsburg.

The development will comprise a WWTW and sewer line. At the WWTW there will reportedly be no discharge directly into a watercourse, as a reed bed will be located south of the oxidation pond which the treated water will be “irrigated” onto.

3. TOPOGRAPHY AND DRAINAGE

The proposed WWTW site and surrounding area where the reticulation is to be completed is situated at an elevation of between 1200 and 1300 meters above mean sea level (m AMSL). The topography of the surrounding area can be described as mildly to steeply undulating. Natural drainage at the proposed WWTW is in a southerly direction towards the Bhokwe River and tributaries thereof. Drainage in the surrounding areas where reticulation is to be completed is likely to be in a southerly to south westerly direction towards the Bhokwe River and other tributaries (see attached Area Plans – Dwg No. 2019/241 Figures 2a and 2b). The Bhokwe River flows into the Swart Mfolozi River approximately 1.2 km south south-west of the WWTW.

4. GEOLOGY & GEOHYDROLOGY

4.1 GEOLOGY

The geology of the area is depicted on the 1: 250 000 scale published Geological Map of Vryheid (Map No. 2730), which shows that the proposed WWTW and surrounding village is underlain by sandstones of the Vryheid Formation, which forms part of the Karoo Supergroup, which have been extensively intruded by Jurassic age dolerites (see attached Geological Plan - Dwg No. 2019/241 Figure 3).

The Vryheid Formation is comprised chiefly of various sandstone units that are beige-grey in colour. However, grain size, sorting, facies type and bedding structures typically vary considerably and are dependent upon the area in which the sandstones were formed in relation to delta fronts. These units are, however, commonly interfingered by dark grey, muddy siltstones and black shale that testify to the deltaic origin of this formation.

These formations have been subjected to faulting and fracturing associated with the break-up of the ancient Gondwana super-continent and have been intruded by younger Jurassic age dolerites, in the form of sub-horizontal sills and sub-vertical dolerite dykes.

4.2 GEOHYDROLOGY

The Karoo Supergroup sedimentary units are essentially secondary or fractured rock aquifers with negligible primary storage and permeability. Groundwater storage and movement is generally confined to geological structures, such as fractures, joints and bedding planes within the rock mass. However, the indurated contact zones with dolerite intrusions are often highly fractured and these discrete zones offer preferential groundwater flow paths.

According to the "*Characterisation and Mapping of the Groundwater Resources KwaZulu-Natal Province Mapping Unit 5*" April 1995, the sediments of the Vryheid Formation are reported to form a moderate potential aquifer with a median borehole yield of 0.5 l/sec. However, boreholes sited and drilled to intersect the indurated mudstone / shale and intruded dolerite contacts may produce borehole yields in excess of 26.0 l/sec.

The extensive dolerite and diabase sills in the area form their own hydrogeological unit which can be described as poor / low aquifers with yields ranging between 0.1 and 0.5 l/s. As mentioned above, higher yields can be expected when intercepting the contact zone between the dolerite and diabase intrusions and the country rock.

The ambient groundwater quality in the Vryheid Formation is reportedly moderate to poor as the groundwater ranges from fresh water through to saline chloride water. pH ranges from

7.60 to 8.50. Groundwater from the Vryheid Formation is characterised by a wide range in electrical conductivity (EC). The EC ranges from 32.2 mS/m to 636 mS/m. The average total dissolved solids is 2187 mg/l. The chloride content ranges between 12.3 % and 45.9 % of the total solids.

The typical chemical character of the groundwater in the Vryheid Formation is Ca/Mg-HCO_3. The mean average rainfall (MAR) for the region is 600 mm to 800 mm.

5. GEOHYDROLOGICAL SITE INVESTIGATION

5.1. INITIAL DESKTOP ASSESSMENT

A desktop study of the area was conducted using the DWS KZN GRIP database, the DWS NGA borehole database, as well as our own in-house database (Geom BH Data), which typically represent the most up to date and complete data sets for the study area.

The results of this exercise indicated that twelve (12) borehole records and nineteen (19) spring records occur within a 5 km radius of the Bhokwe village and proposed WWTW (see attached Area Plan – Dwg No. 2019/241 Figure 2). The desktop study borehole data has been presented in Tables 1 and 2 of Appendix A. It must be noted that some of these borehole records may be duplicated.

Available details of the borehole records are summarised as follows:

Borehole Depth:	21.94 – 150.00 m bgl *
Static Water Level	12.80– 21.95 m bgl
Blowyields:	0.35 – 4.04 l/sec
Water Strike Depths:	19.81 – 150.00 m bgl
Borehole Use:	Domestic, Agricultural and Stock Watering

** m bgl: metres below ground level.*

5.2. FIELD ASSESSMENT AND HYDROCENSUS

A site visit was conducted on the 18th and 19th June 2019. This included a site walkover, hydrocensus and a spring sampling event. A hydrocensus was undertaken within the area deemed geohydrologically sensitive by an on-site assessment of the study area.

During the hydrocensus, the proposed site and neighbouring properties were investigated in order to identify groundwater users, especially users immediately down-gradient of the site. The results of this investigation are detailed below in Table 1, whilst the locations of the identified drinking water sources and hydrocensus points are shown on the attached Hydrocensus Area Plan – Dwg No. 2019/241 Figure 4. Furthermore, a photographic report has been included in Appendix B. A total of two (2) boreholes were located in the study area – one was inaccessible as it was located in the Bhokwe School property which was locked up for the school holidays and the other was a non-functional handpump. The drinking water sources in the study area were identified to be springs and streams, all of which were located up-gradient of the proposed WWTW.

The detailed tabulated hydrocensus data is included in Table 3 in Appendix B.

Unfortunately, no groundwater samples from boreholes could be attained during the hydrocensus. However, three (3) spring / stream samples were attained and springs are defined as surface expressions of groundwater.

Table 1: Bhokwe Village Hydrocensus Information

Borehole Number	Purpose	Latitude	Longitude	Borehole Age (years)	Borehole Depth (m)	SWL^2 (m bgl)	Abstraction Rate / Amount (l/sec)
Bhokwe School BH	Domestic	27° 48’ 46.97’’ S	31° 06’ 21.62’’ E				Unknown
Stream 1	Domestic	27° 49’ 03.53’’ S	31° 06’ 40.62’’ E	-	-	-	Unknown
Handpump 1	Domestic	27° 49’ 16.00’’ S	31° 06’ 29.53’’ E				Not functional
Spring 1	Domestic	27° 49’ 06.36’’ S	31° 06’ 58.59’’ E	-	-	-	Unknown
Spring 2	Domestic	27° 48’ 24.00’’ S	31° 06’ 16.97’’ E	-	-	-	Unknown

[1] bgl – below ground level [2] SWL – static water level

Data / information could not be attained in the field as detailed above

From Table 1 above, the following can be deduced:

- As mentioned previously, many of the intrinsic borehole details (age, depth, water strikes and SWL) could not be attained. From the information that was obtained, it was determined that:
  - Two (2) boreholes were located – only one was functional but could not be sampled
  - The functional borehole is used for supplying Bhokwe School
  - No abstraction rate is known for the borehole
  - Springs and streams are the primary drinking water source in the area
- The investigation confirms that groundwater springs are generally a reliable source of water in this region.

5.3. GROUNDWATER AND SURFACE WATER SAMPLING

Three (3) water samples were taken from the springs and stream in the area namely, Spring 1, Spring 2 and Stream 1.

The samples were submitted to the SANAS-accredited Talbot Laboratories for analysis according to the abbreviated SANS 241: 2015 suite of determinants with the addition of ammonia, such that the current water quality in the area could be determined prior to the completion of the sewer line and the development of the WWTW.

The tabulated results are contained in Table 4 included in Appendix C, where the groundwater quality results are compared to the SANS 241: 2015 Standards for Drinking Water as all groundwater should conform to potable standards. The laboratory certificates of analysis are included in Appendix D. Whilst Stream 1 is technically a surface water stream, the results have been compared to Drinking Water Standards as this stream is used primarily as a Drinking Water Source.

5.3.1. Groundwater Quality Results

The results of the laboratory analysis on the three (3) above-mentioned water quality samples indicate that the water quality is generally good to moderate. However, the *E.Coli*, total coliforms and standard plate count are elevated in all three (3) samples. The elevated levels are likely attributed to environmental sources or livestock. The elevated manganese in Spring

2 is also likely attributed to environmental / geological sources. The elevated turbidity in the Spring samples is attributed to the sediments at the spring collection points.

The water requires treatment prior to drinking.

Table 2: Elevated Determinants – SANS 241: 2015 Drinking Water Standards

Determinant	Risk	Units	Standard Limit	**Sample** Stream 1 18/06/2019	**Sample** Spring 1 18/06/2019	**Sample** Spring 2 18/06/2019
Micro-chemical – Determinants						
Manganese	Chronic Health	ug/l	≤ 400.0	37.00	7.03	***1026.00***
Microbiological – Determinants						
E.Coli	Acute Health	Count / 100ml	0	***300.00***	***73.00***	***20.00***
Total Coliforms	Operational	Count / 100ml	≤ 10.0	***7500.00***	***95.00***	***27.00***
Standard Plate Count	Operational	Count / ml	≤ 1000.0	***>10000.00***	***2380.00***	***5760.00***

6. EXISTING POINT-SOURCE POLLUTION SOURCE ASSESSMENT

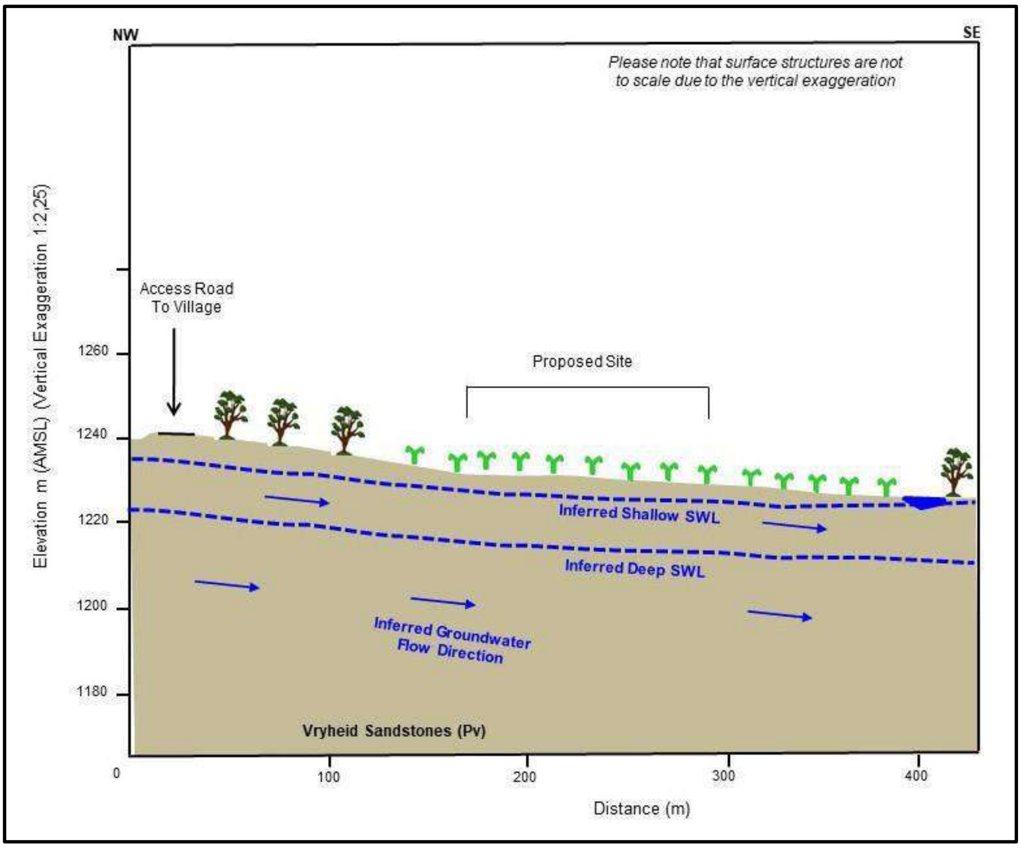
During the site visit, an existing point-source pollution source assessment was undertaken within the area deemed geohydrologically sensitive by an on-site assessment of the study area.

The only possible point-source pollution sources identified were the few VIP toilets in the area.

7. CONCEPTUAL SITE MODEL

From the limited information gathered, a basic conceptual site model was compiled, as shown overleaf. The CSM line has been shown on the attached Site Plan – Dwg No. 2019/241 Figure 5.

The conceptual site model indicates that groundwater flow direction is in a south easterly direction towards the tributary to the south east to the site.



8. AQUIFER CLASSIFICATION

The aquifer was classified according to the methodology contained in the published report entitled ”*South African Aquifer System Management Classification’; WRC Report No: KV 77/95”* (12 January 1993) by Mr. R. Parsons.

Although this methodology is not promulgated, it allows for the classification of aquifers for management purposes and attempts to ensure preservation of our aquifers, using a quantitative approach. Input into this methodology was provided by Department of Water and Sanitation (then Department of Water and Forestry (DWAF))) and is an accepted way of classifying aquifers.

Through the undertaking of the investigation it was determined that the aquifers in this area are Minor Aquifer Systems.

This type of aquifer can be fractured or potentially fractured which does not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying base flow for rivers.

9. ASSESSMENT OF IMPACTS FROM THE PROPOSED WWTW AND SEWER LINE

The Impact Assessment Methodology involves a scoring process which allows for the determination of an Impact Assessment Significance Rating. It must be noted that the assessment has been undertaken and criteria have been scored in the view of a potential failure of the system occurring and the environment being impacted.

Detailed below in Table 3 are the Impact Assessment Criteria and descriptions as provided by the client:

Table 3: Impact Assessment Criteria

CRITERIA	DESCRIPTION
NATURE	Includes a description of what causes the effect, what will be affected and how it will be affected.
EXTENT	Physical and spatial scale of the impact.
DURATION	Lifetime of the impact is measured in relation to the lifetime of the project.
INTENSITY	Examining whether the impact is negligible, low / potential harmful, medium / slightly harmful, high / harmful, very high / disastrous
SEVERITY	Extent + Duration + Intensity
FREQUENCY	Provides a description of any repetitive, continuous or time-lined characteristics of the impact
PROBABILITY	A description of the chance that the consequences of that selected level of severity could occur during the exposure
INCIDENCE	Frequency + Probability
RISK	Severity (Extent + Duration + Intensity) x Incidence (Frequency + Probability)

Detailed below in Table 4 is the Description of the Nature Criteria.

Table 4: Nature Criteria of the Impact Assessment

CRITERIA	DESCRIPTION	SCORE
NATURE	Cause of the effects could include poor construction and failure / accidental release from the WWTW and sewer pipeline. What could be affected would be the groundwater environment and the tributary located down-gradient of the WWTW. An accidental release from the sewer pipeline could affect the streams / springs which the community are totally reliant on. How the environment would be affected would include the impacts of liquids containing nitrates and inorganics, heavy metals, organics and microbials.	N/A

Detailed below in Table 5 is the Explanation of the Extent Criteria and its score.

Table 5: Extent Criteria of Assessment

CRITERIA	DESCRIPTION	SCORE
EXTENT	**AREA**: Impact could affect the area within 5km of the site	2

Detailed below in Table 6 is the Explanation of the Duration Criteria and its score.

Table 6: Duration Criteria of the Impact Assessment

CRITERIA	DESCRIPTION	SCORE
DURATION	**MEDIUM TERM:** 1 – 5 years. If an accidental failure had to occur which was fixed relatively quickly the affects could last 1 – 5 years.	3

Detailed below in Table 7 is the Explanation of the Intensity Criteria and its score.

Table 7: Intensity Criteria of the Impact Assessment

CRITERIA	DESCRIPTION	SCORE
INTENSITY	**MEDIUM:** Affected environment is altered, but functions and processes continue, albeit in a modified way.	3

Severity = (extent + duration + intensity)

Severity = 2 + 3 + 3 = 8

Detailed below in Table 8 is the Explanation of the Frequency Criteria and its score.

Table 8: Frequency Criteria of the Impact Assessment

CRITERIA	DESCRIPTION	SCORE
FREQUENCY	**RARE:** Occurring from time to time 1 in 5 years or 1 in 10 years	2

Detailed below in Table 9 is the Explanation of the Probability Criteria.

Table 8: Probability Criteria of the Impact Assessment

CRITERIA	DESCRIPTION	SCORE
PROBABILITY	**IMPROBABLE:** The probability of the impact occurring is highly unlikely due to its design and or historic experience, provided the WWTW and sewer line are designed and installed by experienced qualified personnel	2

Incidence = frequency + probability

Incidence = 2 + 2 = 4

Risk = Severity x Incidence

Risk = 8 x 4 = 32

Table 9: Risk of Impact

RISK	SCORE
LOW RISK	0 - 50
MEDIUM RISK	51 - 100
HIGH RISK	101 - 150

The risks from the impacts of a potential accidental spillage from the WWTW and sewer line are determined to be LOW.

Mitigation measures to reduce impacts would involve the following:

- design of the chosen treatment facility by a competent engineer
- construction of the facilities under the supervision of a competent engineer and through the use of competent contractors
- provision of training to the site supervisors and staff to ensure the efficient management of the site once the site is developed
- regular groundwater monitoring (as recommended hereafter) to identify any impacts, so that they can be remediated as soon as possible.

10. RECOMMENDED WATER QUALITY MONITORING PLAN

10.1 SURFACE WATER MONITORING

The recommended surface water monitoring plan for the Bhokwe WWTW should comprise the following:

- Weekly monitoring and recording of volumes of effluent received, treated and discharged to the reedbed.

- Monthly grab sampling of the raw and final effluent for submission to an accredited laboratory for the analysis as per the General Limits stipulated under the General Authorisation.

- The following determinants should be analysed for during the sampling events:

  - Faecal Coliforms (per 100ml)
  - *E.Coli* (per 100ml)
  - Chemical Oxygen Demand (mg/l)
  - pH
  - Ammonia as Nitrogen (mg/l)
  - Nitrate as Nitrogen
  - Chlorine as Free Chlorine
  - Suspended Solids (mg/l)
  - Electrical Conductivity (mS/m)
  - Ortho-phosphate as Phosphorous (mg/l)

- Six-monthly grab sampling of the designated up-stream and down-stream sampling points along the tributary that is located to the east of the site, analysed for the above determinants.

- Sampling of any springs down-gradient of the pipeline should also be included in the sampling regime and should also be analysed for the above determinants.

10.2 GROUNDWATER MONITORING

It is recommended that four (4) monitoring wells be installed on site at locations up and down gradient of the WWTW and reedbeds. These monitoring boreholes should be installed as soon as construction on site has been completed, prior to operation of the site.

The recommended groundwater monitoring plan for the Bhokwe WWTW should comprise the following:

- The quarterly purging and sampling of the monitoring boreholes and submission of the samples to an accredited laboratory for analysis.

- The following determinants at least should be analysed for during the sampling events:

  - Faecal Coliforms (per 100ml)
  - E.Coli (per 100ml)
  - Chemical Oxygen Demand (mg/l)
  - pH
  - Ammonia as Nitrogen (mg/l)
  - Nitrate as Nitrogen
  - Chlorine as Free Chlorine
  - Suspended Solids (mg/l)
  - Electrical Conductivity (mS/m)
  - Ortho-phosphate as Phosphorous (mg/l)
  - Potassium (mg/l)
  - Sulphates (mg/l)
  - Iron (mg/l)
  - Chromium (total Cr) (mg/l)
  - Fluoride (mg/l)
  - Nickel (ug/l)
  - Mercury (ug/l)
  - Zinc (ug/l)
  - Lead (ug/l)

- The results of the surface water and groundwater monitoring should be compiled into reports and submitted to the Department of Water and Sanitation.

11. CONCLUSIONS

Based upon the above report, the following can be concluded:

- Geomeasure Group has undertaken a geohydrological investigation for the proposed Bhokwe Village WWTW and sewer line in the Vryheid area in the Zululand District Municipality.

- The development will comprise a WWTW and sewer line. No discharge will occur directly into a water course as treated water will “irrigated” onto red beds on site.

- The site is underlain by consolidated Vryheid sandstones. Median borehole yields of 0.5 l/sec are typically expected in this formation.
- The ambient groundwater quality in the Vryheid Formation is reportedly moderate to poor as the groundwater ranges from fresh water through to saline chloride water. pH ranges from 7.60 to 8.50. Groundwater from the Vryheid Formation is characterised by a wide range in electrical conductivity (EC).

- A total of twelve (12) borehole records and nineteen (19) spring records occur within a 5 km radius of the Bhokwe village at a desktop level, and although the various data sets are not entirely complete, they do provide some valuable information.

- A field hydrocensus identified two (2) boreholes, one (1) stream and two (2) springs in the area deemed geohydrologically sensitive by an on-site assessment, with neither of the identified boreholes likely registered on the various available databases.

- During the field hydrocensus, it was discovered that only (1) borehole was functional and this supplied the Bhokwe School. It was discovered that the community are totally reliant on streams and springs for their potable water supply.

- A total of three (3) water quality samples were taken from the springs and stream in the area. All samples presented elevated levels of E.Coli, total coliforms and standard plate count. Spring 2 sample showed highly elevated manganese and the two 92) springs showed elevated turbidity levels. These elevated concentrations are likely attributed to environmental sources and not anthropogenic sources.

- The point-pollution sources identified were the few residential VIP toilets.

- The aquifer underlying the site is classified as a minor aquifer.

- The provided scoring system indicates that the risk from an accidental release from the WWTW or sewer line is low, and impacts can be further mitigated if the recommendations provided are adhered to.

12. RECOMMENDATIONS

- The following need to be adhered to, when considering the construction of the WWTW and installation of the sewer line:

  - design of the chosen treatment facility by a competent engineer
  - construction of the facilities under the supervision of a competent engineer and through the use of competent contractors
  - regular groundwater monitoring (as recommended hereafter) to identify any impacts, so that they can be remediated as soon as possible.

- Monitoring boreholes are recommended to be installed up-gradient and down-gradient of the WWTW and reed beds to allow for the monitoring of the groundwater so that detection of any impacts can be identified timeously.

- Surface water and groundwater monitoring should be conducted as per the recommendations contained in Section 10 of this report.

We trust that this report meets your immediate requirements in this matter. Please do not hesitate to contact the undersigned if you require any further information.

Yours faithfully,

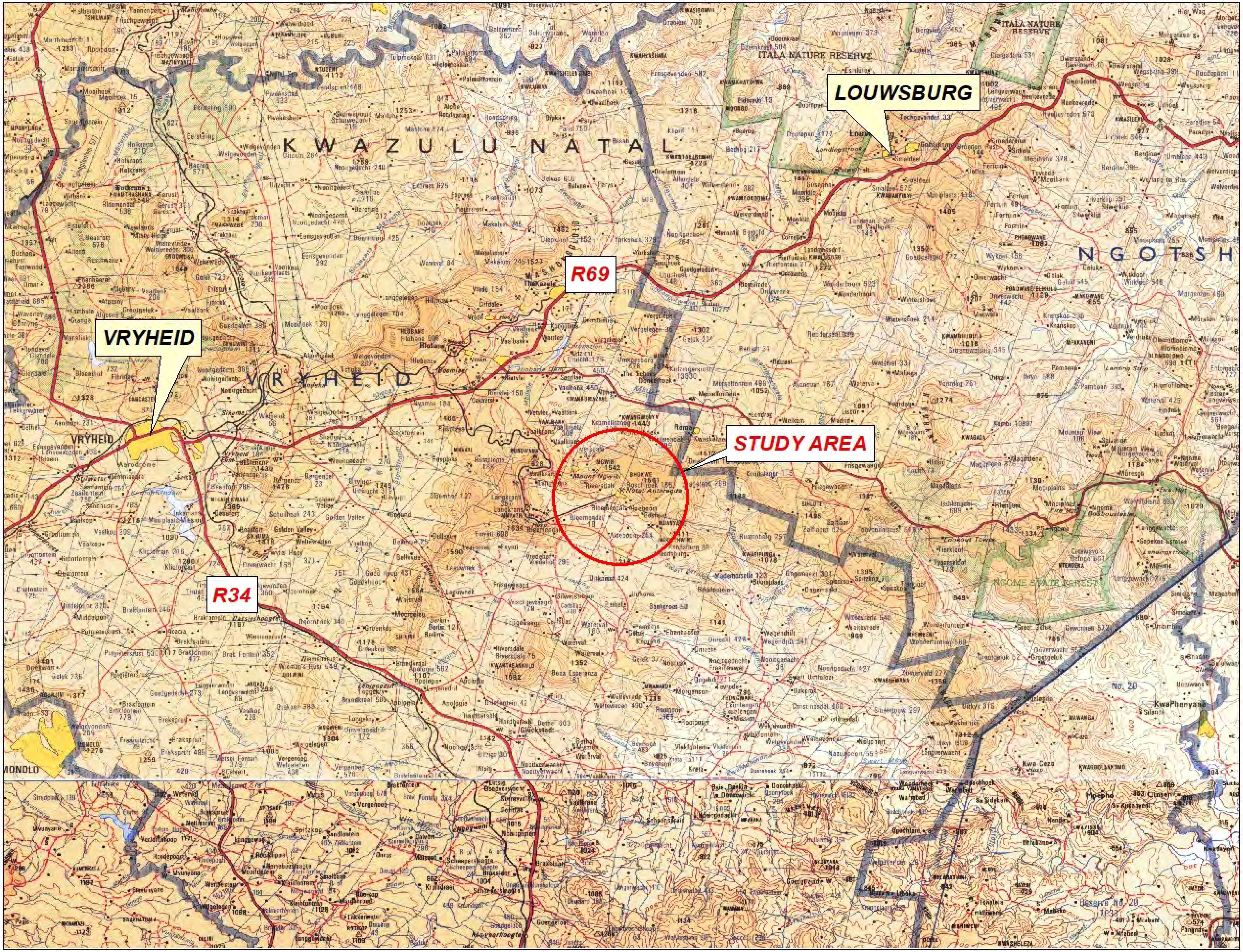
Swales

Taryn Swales
Senior Geohydrologist

Lynn Fitschen
Principal Engineering Geologist

GEOMEASURE GROUP (Pty) Ltd

FIGURES

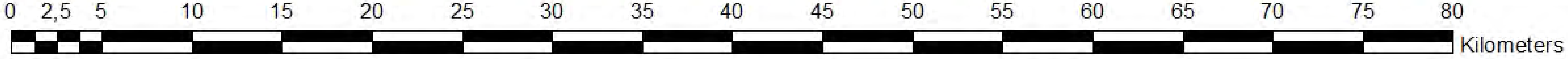


Legend:

GEOMEASURE GROUP

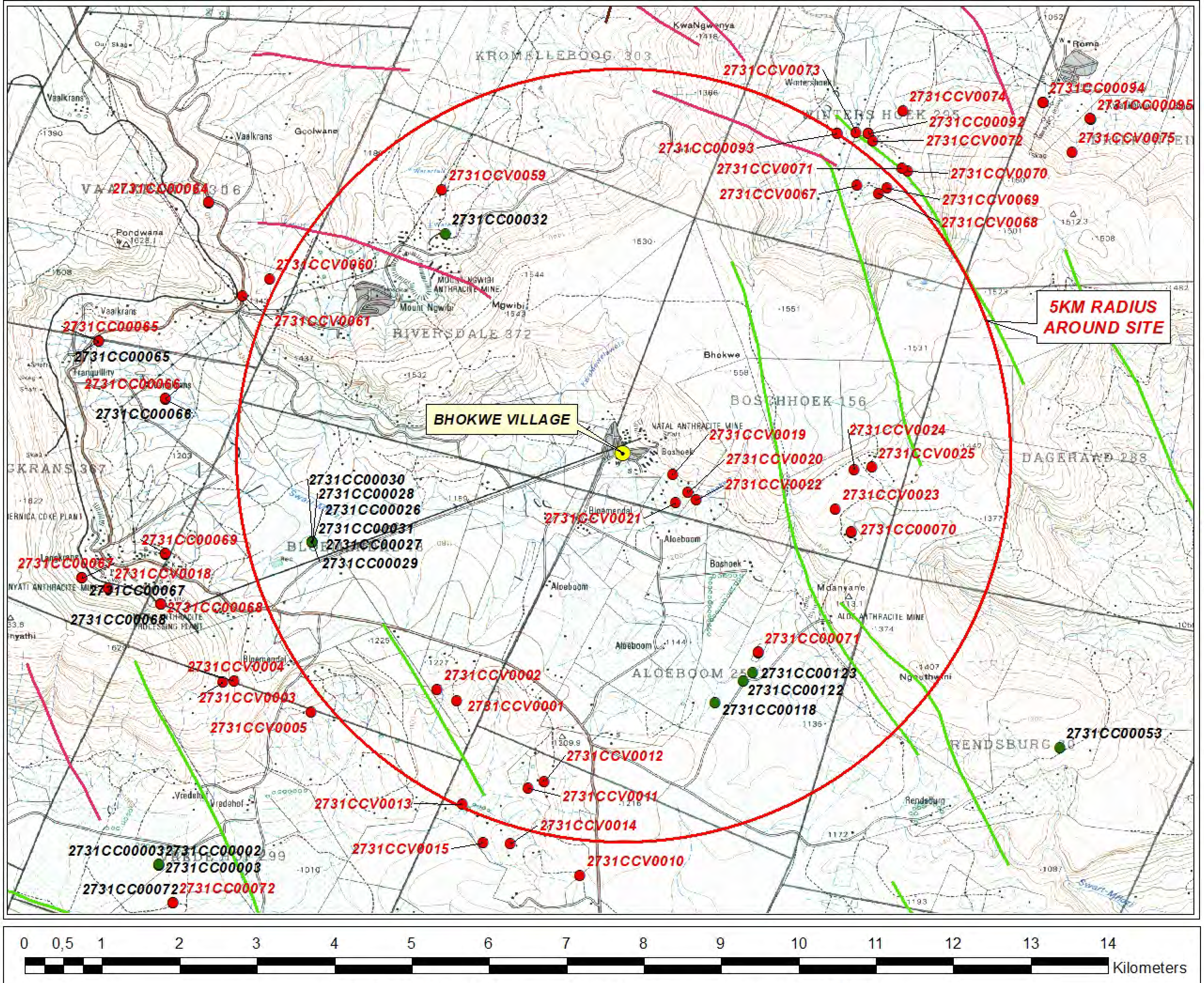
BHOKWE VILLAGE GEOHYDROLOGICAL INVESTIGATION

LOCALITY PLAN



1 : 250 000 Digital Coverage from Chief Directorate: Surveys and Mapping

DWG NO. 2019/241
FIGURE 1



1 : 50 000 Digital Coverage from Chief Director: Surveys and Mapping

Legend:

N

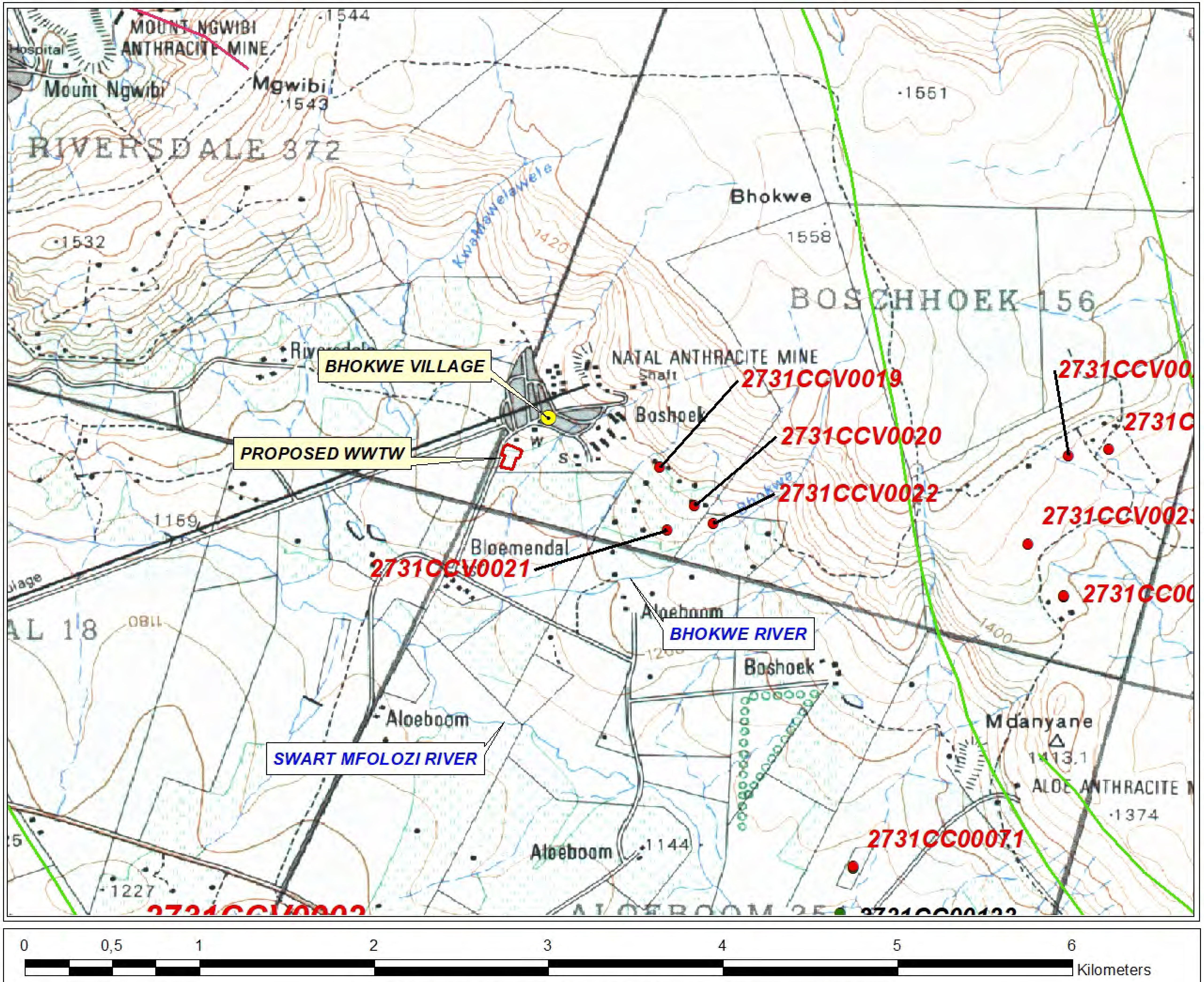
- ● Bhokwe Village
- ● KZN GRIP BH Data
- ● NGA BH Data
- ● Geom BH Data
- — Dolerite Dykes
- — Geological Faults
- — Lineaments

GEOMEASURE GROUP

BHOKWE VILLAGE GEOHYDROLOGICAL INVESTIGATION

AREA PLAN SHOWING GEOLOGICAL STRUCTURES & AVAILABLE DESKTOP HYDROCENSUS DATA

DWG NO. 2019/241
FIGURE 2A



1 : 50 000 Digital Coverage from Chief Director: Surveys and Mapping

Legend:

N

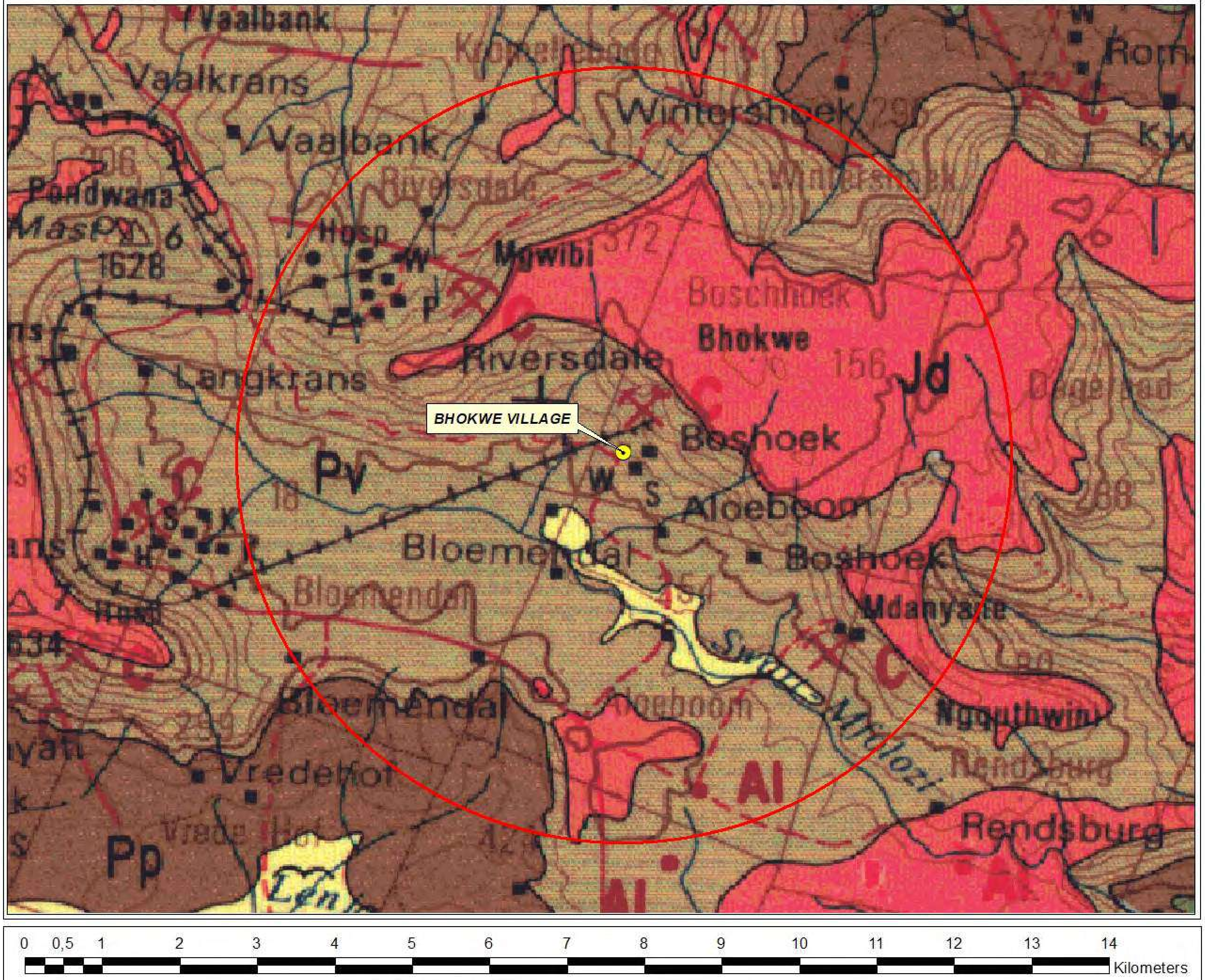
- ● Bhokwe Village
- ● KZN GRIP BH Data
- ● NGA BH Data
- ● Geom BH Data
- — WWTW
- — Dolerite Dykes
- — Geological Faults
- — Lineaments

GEOMEASURE GROUP

BHOKWE VILLAGE GEOHYDROLOGICAL INVESTIGATION

ZOOMED AREA PLAN SHOWING GEOLOGICAL STRUCTURES & AVAILABLE DESKTOP HYDROCENSUS DATA

DWG NO. 2019/241
FIGURE 2B



1 : 250 000 Digital Coverage from Council of Geoscience

Legend:

N

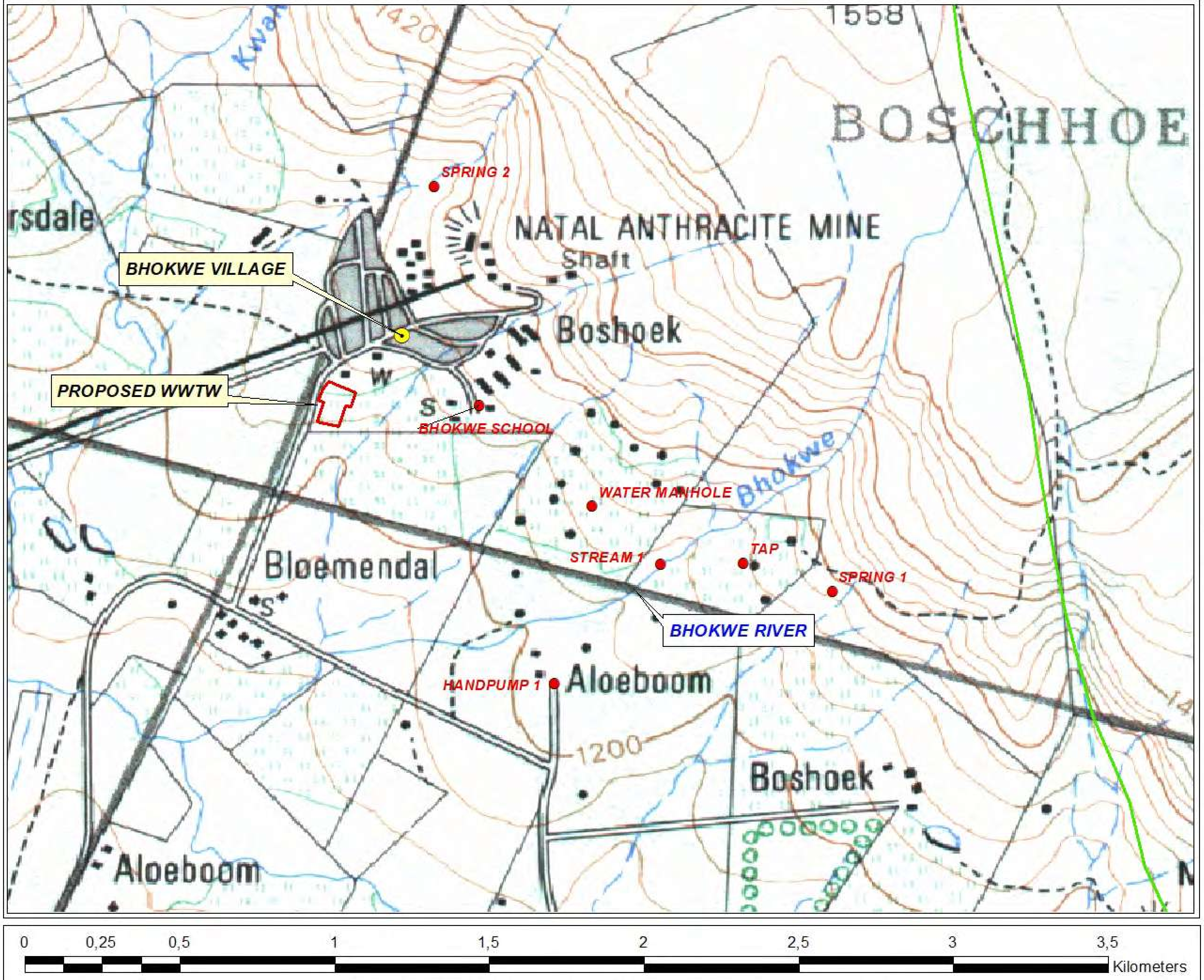
- ● Bhokwe Village
- Alluvium
- Jd Jurassic Dolerite
- Pv Vryheid Sandstone
- Pp Pietermaritzburg Shale

GEOMEASURE GROUP

BHOKWE VILLAGE GEOHYDROLOGICAL INVESTIGATION

GEOLOGICAL PLAN

DWG NO. 2019/241
FIGURE 3



1 : 50 000 Digital Coverage from Chief Director: Surveys and Mapping

Legend:

N

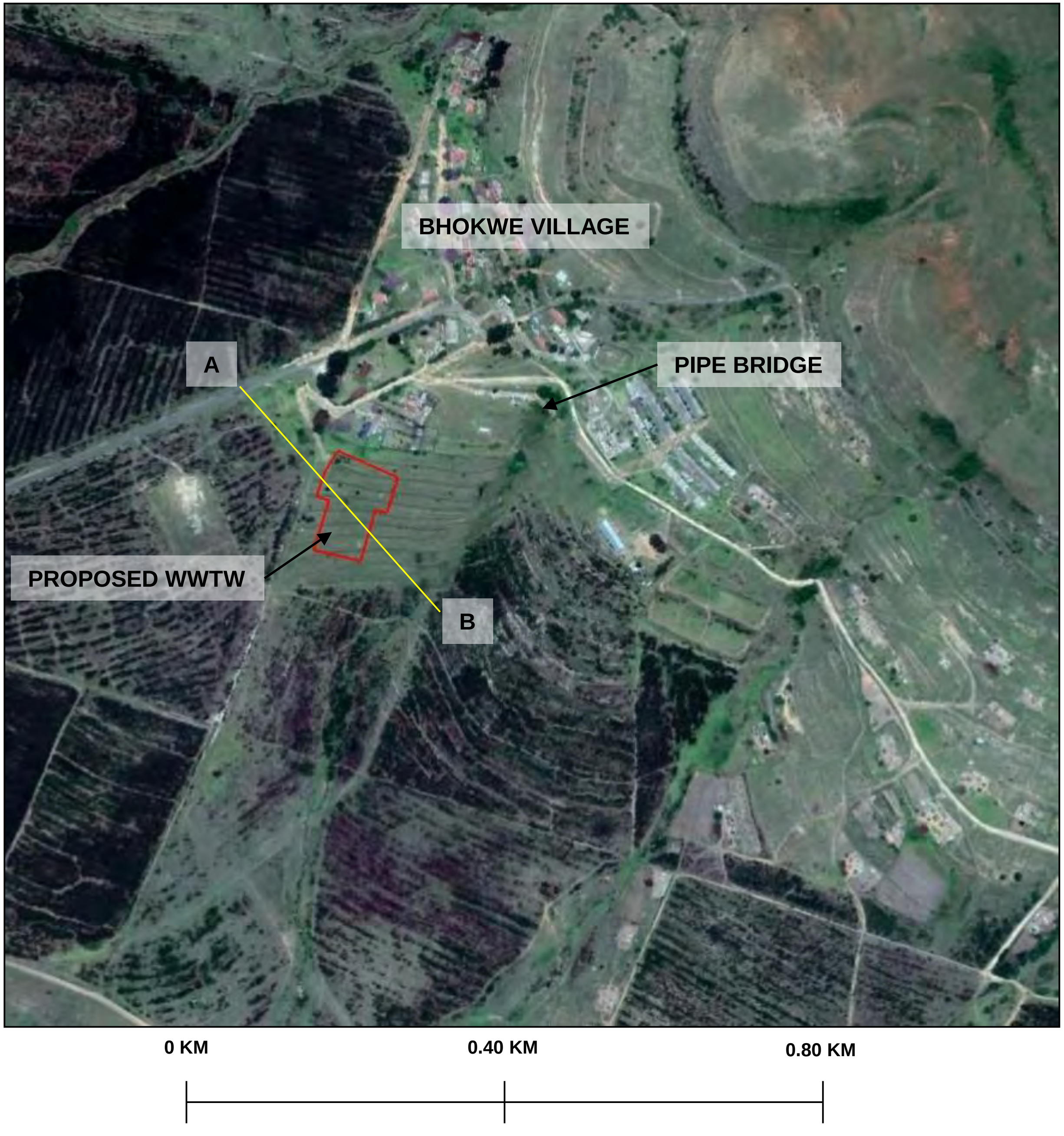
● Hydrocensus_Points
⊙ Bhokwe Village
— WWTW
— Dolerite Dykes
— Geological Faults
— Lineaments

GEOMEASURE GROUP

BHOKWE VILLAGE GEOHYDROLOGICAL INVESTIGATION

AREA PLAN SHOWING GEOLOGICAL STRUCTURES & FIELD HYDROCENSUS DATA

DWG NO. 2019/241
FIGURE 4



Imagery from Google Earth 2019

Legend

- 🟥 Proposed WWTW
- 🟨 CSM Line

GEOMEASURE GROUP
Groundwater, Environmental & Geotechnical Consultants

BHOKWE VILLAGE GEOHYDROLOGICAL INVESTIGATION

AERIAL PLAN

DWG NO: 2019/241
FIGURE 5

APPENDIX A

DESKTOP HYDROCENSUS DATA

TABLE 1 : KZN GRIP GROUNDWATER / BOREHOLE DATA WITHIN 5KM RADIUS OF SITE

site_id	SITE_TYPE	Latitude	Longitude	site_name	EQUIPMENT	SITE_STATU	USE_APPLIC	PH	EC	TDS	CA	MG	NA	K	SI	N_AMONIA
2731CC00070	Spring	-27,820184	31,130303	ALOEBOOM GED. ALOE ANTHR. MINE	None	In Use	Domestic	6,67	5,40	45,00	4,20	1,90	3,00	0,10	4,00	0.19
2731CC00071	Borehole	-27,834133	31,119463	ALOEBOOM GED. SWART UNFOLOZI	None	In Use										
2731CC00093	Spring	-27,773797	31,128633	WINTERS HOEK	None	In Use	Domestic									
2731CCV0001	Spring	-27,839780	31,084440	BLOEMENDAL PTN. MASANGWENI	None	In Use	Agric & Domestic									
2731CCV0002	Spring	-27,838470	31,082140	BLOEMENDAL PTN. MASANGWENI	None	In Use	Agric & Domestic									
2731CCV0011	Spring	-27,850000	31,092720	UITKOMST PTN. UKUKHANYA DISTRICT	None	In Use	Agric & Domestic									
2731CCV0012	Spring	-27,849140	31,094530	UITKOMST PTN. UKUKHANYA DISTRICT	None	In Use	Agric & Domestic									
2731CCV0013	Spring	-27,851860	31,085030	UITKOMST PTN. UKUKHANYA DISTRICT	None	In Use	Agric & Domestic									
2731CCV0019	Spring	-27,813530	31,109530	BOSCHHOEK	None	In Use	Agric & Domestic									
2731CCV0020	Spring	-27,815500	31,111280	BOSCHHOEK	None	In Use	Agric & Domestic									
2731CCV0021	Spring	-27,816780	31,109890	BOSCHHOEK	None	In Use	Agric & Domestic									
2731CCV0022	Spring	-27,816440	31,112250	BOSCHHOEK	None	In Use	Agric & Domestic									
2731CCV0023	Spring	-27,817500	31,128470	BOSCHHOEK PTN. MGOBHOZI	None	In Use	Agric & Domestic									
2731CCV0024	Spring	-27,812940	31,130580	BOSCHHOEK PTN. MGOBHOZI	None	In Use	Agric & Domestic									
2731CCV0025	Spring	-27,812640	31,132640	BOSCHHOEK PTN. MGOBHOZI	Other	In Use	Agric & Domestic									
2731CCV0059	Spring	-27,780390	31,082690	RIVERSDALE PTN. MOUNT GWIBI	None	In Use	Agric & Domestic									
2731CCV0067	Spring	-27,779810	31,130920	WINTERSHOEK PTN. KWAKWELVLEI	None	In Use	Stock Watering									
2731CCV0068	Spring	-27,780830	31,133420	WINTERSHOEK PTN. KWAKWELVLEI	None	In Use	Stock Watering									
2731CCV0069	Spring	-27,780220	31,134420	WINTERSHOEK PTN. KWAKWELVLEI	None	In Use	Stock Watering									

TABLE 2 : NGA GROUNDWATER / BOREHOLE DATA WITHIN 5KM RADIUS OF SITE

Geositel_1	Geositel_2	Geositel_3	Geositel_4	WaterLevel	DepthDiame	WaterStrik	WaterStr_1	WaterStr_2
2731CC00118	Borehole	-27,839960	31,114500		86.00			
2731CC00122	Borehole	-27,837520	31,117780		132.00	132.00		
2731CC00123	Borehole	-27,836520	31,118780		150.00	150.00		
2731CC00071	Borehole	-27,834190	31,119500					
2731CC00030	Borehole	-27,821380	31,067560	18.00	88.00	75.00		4.0400
2731CC00028	Borehole	-27,821370	31,067560		31.39			
2731CC00026	Borehole	-27,821360	31,067560	12.80	44.20	32.92		0.3500
2731CC00027	Borehole	-27,821360	31,067570		21.94			
2731CC00029	Borehole	-27,821360	31,067580	12.80	39.93	19.81		2.5600
2731CC00031	Borehole	-27,821360	31,067590		34.14			
2731CC00070	Spring	-27,820240	31,130340					
2731CC00032	Borehole	-27,785520	31,083110	21.95	42.37	28.96		2.5600
2731CC00093	Borehole	-27,773850	31,128670		80.00			

APPENDIX B

PHOTOGRAPHIC REPORT AND TABULATED FIELD HYDROCENSUS DATA

TABLE 3 : FIELD HYDROCENSUS DATA

REF	**LATITUDE**	**LONGITUDE**	**COMMENT**
BHOKWE SCHOOL	-27,813046	31,106006	No details and couldnt be sampled as school locked for holidays
WATER MANHOLE	-27,815972	31,109307	Some water infrastructure including taps evident in the area
STREAM 1	-27,817646	31,111282	Drinking water source - **SAMPLED**
HANDPUMP 1	-27,821110	31,108203	Existing handpump - not functional
TAP	-27,817613	31,113690	One of the taps identified in the area - not functional
SPRING 1	-27,818434	31,116275	Drinking water source - **SAMPLED**
SPRING 2	-27,806667	31,104714	Drinking water source - **SAMPLED**

PHOTO REPORT
BHOKWE VILLAGE

Plate 1 – View of WWTW Site

Plate 2 – View of Bhokwe School BH

Plate 3 – View of Water Manhole

Plate 4 – View of Stream 1

Plate 5 – View of Stream 1

Plate 6 – View of Handpump 1

Plate 7 – View of Existing Tap

Plate 8 – View of Spring 1

Plate 9 – View of Spring 2

Plate 10 – View of Spring 2

APPENDIX C

TABULATED WATER QUALITY RESULTS

TABLE 4: ANALYTICAL ANALYSIS IN ACCORDANCE WITH SANS 241: 2015 DRINKING WATER STANDARDS

PROJECT: BHOKWE VILLAGE GEOHYDRO - 1 WORLD

DETERMINANT	**Risk**	**Units**	**Standard Limit**	**STREAM 1 18/06/2019**	**SPRING 1 18/06/2019**	**SPRING 2 18/06/2019**
PHYSICAL - WATER QUALITY						
pH	Operational	pH units	≥ 5.0 to ≤ 9.7	7,70	7,40	7,20
Conductivity	Aesthetic	mS/m	≤ 170	17,00	20,00	54,00
Colour	Aesthetic	mg/L Pt-Co	≤ 15	<1,00	1,00	<1,00
Turbidity	Aesthetic	NTU	≤ 5	1,80	***5,40***	***10,00***
MACRO CHEMICAL - DETERMINANDS						
Total Alkalinity		mg/l	ns	16,30	79,00	92,00
Ammonia as N	Aesthetic	mg/l	≤ 1.5	<0,11	<0,11	0,16
Ammonium as N	Aesthetic	mg/l	ns	0,11	0,11	0,16
Ammonia-Free		mg/l	ns	<0,11	<0,11	<0,11
Ammonia-Saline		mg/l	ns	<0,11	<0,11	0,16
Calcium as Ca		mg/l	ns	11,50	22,00	36,00
Chloride as Cl	Aesthetic	mg/l	≤ 300	9,13	4,35	2,60
Free Chlorine as Cl	Chronic Health	mg/l	≤ 5,0	<0,10	<0,10	<0,10
Fluoride as F	Chronic Health	mg/l	≤ 1,5	0,15	0,12	0,24
Magnesium as Mg		mg/l	ns	4,61	5,63	5,45
Nitrate as N	Acute Health - 1	mg/l	≤ 11	0,20	2,47	0,12
Nitrite as N	Acute Health - 1	mg/l	<0,9	<0,01	<0,01	<0,01
Combined Nitrate plus Nitrite	Acute Health - 1		≤ 1	<0,12	0,24	<0,12
Sodium as Na	Aesthetic	mg/l	≤ 200	13,50	12,10	74,00
Sulphate as SO4	Acute Health - 1	mg/l	≤ 500	41,20	22,20	174,00
MICRO CHEMICAL - DETERMINANDS						
Copper as Cu	Chronic Health	ug/l	≤ 2000	<0,12	0,17	0,80
Iron as Fe	Chronic Health	ug/l	≤ 2000	73,00	33,00	839,00
Lead as Pb	Chronic Health	ug/l	≤ 10	<0,29	<0,29	<0,29
Manganese as Mn	Chronic Health	ug/l	≤ 400	37,00	7,03	***1026,00***
MICROBIOLOGICAL - DETERMINANDS						
E. Coli	Acute Health - 1	Count / 100 ml	0	***300,00***	***73,00***	***20,00***
Total Coliforms	Operational	Count / 100 ml	≤ 10	***7500,00***	***95,00***	***27,00***
Standard Plate Count	Operational	Count / ml	≤ 1000	***>10000,00***	***2380,00***	***5760,00***

Black - Within Standard Limits

Red - Exceeds Standard Limits

ns - not stated

APPENDIX D

LABORATORY CERTIFICATES

T0122

Talbot Laboratories (Pty) Ltd ● Company Registration Number: 2016/334237/07

20 Pentrich Road, P.O Box 22598, Pietermaritzburg, 3200, KwaZulu-Natal

2019/07/12

ANALYTICAL REPORT

OUR REF:	**004271/19**
COMPANY NAME:	**GEOMEASURE GROUP**
CONTACT ADDRESS:	**P O BOX 1194, HILLCREST, 3650**
CONTACT PERSON:	**ELZET BOWKER**
ORDER NUMBER:	**GMG 02371**
DELIVERY:	**GILLITTS DEPOT**
SAMPLE TYPE:	**SURFACE WATER SAMPLES**
DATE SUBMITTED:	**2019-06-24**

Determinand	**Units**	**Method No**	**SANS 241-1:2015 RECOMMENDED LIMITS**	**Results**	
				010843/19	010844/19
				BHOKWE VILLAGE GEOHYDRO - 1 WORLD: STREAM 1 18.06.19 (2019/241)	BHOKWE VILLAGE GEOHYDRO - 1 WORLD: SPRING 1 18.06.19 (2019/241)
Ammonia	mg N/ℓ	64G	≤1.5	<0.11	<0.11
Ammonium*	mg N/ℓ	-	Not specified	0.11	0.11
Chloride	mg Cl/ℓ	16G	≤ 300	9.13	4.35
Colour*	mg Pt-Co/ℓ	48	≤15	<1	1
Copper	µg Cu/ℓ	83	≤2000 µg/ℓ (≤2 mg/ℓ)	<0.12	0.17
Dissolved Calcium	mg Ca/ℓ	85	Not specified	11.5	22
Dissolved Magnesium	mg Mg/ℓ	85	Not specified	4.61	5.63
E.coli	colonies per 100mℓ	31	0	**300**	**73**
Electrical Conductivity at 25°C	mS/m	2A	≤170	17	20
Fluoride	mg F/ℓ	18G	≤1500 µg/ℓ (≤1.5 mg/ℓ)	0.15	0.12
Free Ammonia*	mg N/ℓ	Calc.	Not specified	<0.11	<0.11
Saline Ammonia*	mg N/ℓ	Calc.	Not specified	<0.11	<0.11
Free Chlorine*	mg Cl_2/ℓ	-	≤5	<0.1	<0.1
Iron	µg Fe/ℓ	83	Chronic: ≤ 2000 µg/ℓ (≤2 mg/ℓ) Aesthetic: ≤ 300 µg/ℓ (≤0.3 mg/ℓ)	73	33
Lead	µg Pb/ℓ	83	≤10 µg/ℓ (≤0.01 mg/ℓ)	<0.29	<0.29
Manganese	µg Mn/ℓ	83	Chronic: ≤ 400 µg/ℓ (≤0.4 mg/ℓ) Aesthetic: ≤100 µg/ℓ (≤0.1 mg/ℓ)	37	7.03
Nitrate	mg N/ℓ	65Gc	≤11	0.20	2.47
Nitrite	mg N/ℓ	65Gb	≤0.9	<0.01	<0.01
Combined Nitrate + Nitrite (sum of Ratios)*	-	-	≤1	<0.12	0.24
pH at 25°C	pH units	1A	5.0 - 9.7	7.7	7.4
Sodium	mg Na/ℓ	84	≤200	13.5	12.1
Standard Plate Count	colonies per mℓ	31	≤1000	**>10 000**	**2 380**
Sulphate	mg SO_4/ℓ	67G	Acute: ≤ 500 Aesthetic: ≤ 250	41.2	22.2
Total Alkalinity	mg $CaCO_3$/ℓ	10G	Not specified	16.3	79
Total Coliforms	colonies per 100mℓ	31	≤10	**7 500**	**95**
Total Hardness*	mg $CaCO_3$/ℓ	Calc.	Not specified	48	79
Turbidity	NTU	4	Operational ≤1 Aesthetic ≤5	1.8	**5.4**

Determinand	**Units**	**Method No**	**SANS 241-1:2015 RECOMMENDED LIMITS**	**Results**
				010845/19
				BHOKWE VILLAGE GEOHYDRO - 1 WORLD: SPRING 2 18.06.19 (2019/241)
Ammonia	mg N/ℓ	64G	≤1.5	0.16
Ammonium*	mg N/ℓ	-	Not specified	0.16
Chloride	mg Cl/ℓ	16G	≤ 300	2.60
Colour*	mg Pt-Co/ℓ	48	≤15	<1
Copper	µg Cu/ℓ	83	≤2000 µg/ℓ (≤2 mg/ℓ)	0.80
Dissolved Calcium	mg Ca/ℓ	85	Not specified	36
Dissolved Magnesium	mg Mg/ℓ	85	Not specified	5.45
E.coli	colonies per 100mℓ	31	0	**20**
Electrical Conductivity at 25°C	mS/m	2A	≤170	54
Fluoride	mg F/ℓ	18G	≤1500 µg/ℓ (≤1.5 mg/ℓ)	0.24
Free Ammonia*	mg N/ℓ	Calc.	Not specified	<0.11
Saline Ammonia*	mg N/ℓ	Calc.	Not specified	0.16
Free Chlorine*	mg Cl_2/ℓ	-	≤5	<0.1
Iron	µg Fe/ℓ	83	Chronic: ≤ 2000 µg/ℓ (≤2 mg/ℓ) Aesthetic: ≤ 300 µg/ℓ (≤0.3 mg/ℓ)	839
Lead	µg Pb/ℓ	83	≤10 µg/ℓ (≤0.01 mg/ℓ)	<0.29
Manganese	µg Mn/ℓ	83	Chronic: ≤ 400 µg/ℓ (≤0.4 mg/ℓ) Aesthetic: ≤100 µg/ℓ (≤0.1 mg/ℓ)	**1 026**
Nitrate	mg N/ℓ	65Gc	≤11	0.12
Nitrite	mg N/ℓ	65Gb	≤0.9	<0.01
Combined Nitrate + Nitrite (sum of Ratios)*	-	-	≤1	<0.12
pH at 25°C	pH units	1A	5.0 - 9.7	7.2
Sodium	mg Na/ℓ	84	≤200	74
Standard Plate Count	colonies per mℓ	31	≤1000	**5 760**
Sulphate	mg SO_4/ℓ	67G	Acute: ≤ 500 Aesthetic: ≤ 250	174
Total Alkalinity	mg $CaCO_3$/ℓ	10G	Not specified	92
Total Coliforms	colonies per 100mℓ	31	≤10	**27**
Total Hardness*	mg $CaCO_3$/ℓ	Calc.	Not specified	111
Turbidity	NTU	4	Operational ≤1 Aesthetic ≤5	**10**

Comment: Results that appear in bold do not meet specification limits.

Technical Signatory:

- This report shall not be reproduced, except in full, without the written approval of the General Manager of **TALBOT LABORATORIES.**
- Tests marked with an asterisk (*) are not SANAS accredited and are not included in the Schedule of Accreditation for T0122.
- Results marked with a ($^{\#}$) have been sub-contracted to a peer laboratory.
- Uncertainty of Measurement (UoM)
    - UoM values apply to tests analysed at T0122 and are identified in the attached Appendix.
    - UoM values for T0122 microbiological results are available upon request.
    - UoM values for subcontracted tests are available on request.
    - UoM values for ICP elements applies to total, dissolved and acid soluble metals.
    - UoM is calculated as a percentage and should be applied to the respective results.
- Results relate to the samples as taken and in the condition received by the laboratory.
- Opinions and interpretations expressed herein are outside the scope of SANAS accreditation and shall be solely used at the discretion of the customer.
- Sample preparation may require filtration, dilution, digestion or similar. Final results will be reported accordingly.

APPENDIX
UNCERTAINTY OF MEASUREMENT

Determinand	Method No	Uncertainty of Measurement (%)	Determinand	Method No	Uncertainty of Measurement (%)
Alkalinity (Total)	10	± 3.49	Magnesium (OES)	85	± 5.38
Alkalinity (Total)	10G	± 4.39	Mercury (ICP-MS)	83A	± 16.32
Ammonia	64G	± 6.29	Mercury (ICP-OES)	86	± 10.54
Aluminium (ICP-MS)	83A	± 20.62	Molybdenum (ICP-MS)	83A	± 11.08
Aluminium (ICP-OES)	87	± 8.09	Molybdenum (ICP-OES)	87	± 15.20
Antimony (ICP-MS)	83A	± 17.73	Nickel (ICP-MS)	83A	± 10.00
Antimony (ICP-OES)	87	± 30.16	Nickel (ICP-OES)	87	± 8.06
Arsenic (ICP-MS)	83A	± 12.04	Nitrate/Nitrite	65Ga	± 12.55
Arsenic (ICP-OES)	87	± 20.17	Nitrite	65Gb	± 12.83
Barium (ICP-MS)	83A	± 12.29	Nitrate	65Gc	± 12.55
Barium (ICP-OES)	87	± 10.25	Oxygen Absorbed	39	± 6.37
Beryllium (ICP-MS)	83A	± 23.10	Potassium (ICP-OES)	85	± 15.20
Beryllium (ICP-OES)	87	± 7.96	Orthophosphate	66G	± 11.76
Boron (ICP-MS)	83A	± 24.83	Phosphate (Total)	90	± 9.16
Boron (ICP-OES)	87	± 17.33	pH Value 25°C	1A	± 1.22
Cadmium (ICP-MS)	83A	± 9.59	Selenium (ICP-MS)	83A	± 21.40
Cadmium (ICP-OES)	87	± 7.69	Selenium (ICP-OES)	88	± 31.56
Calcium (ICP-OES)	85	± 5.09	Silver (ICP-MS)	83A	± 11.35
Chromium (ICP-MS)	83A	± 8.45	Sodium (ICP-OES)	84	± 8.99
Chromium (ICP-OES)	87	± 8.13	Strontium (ICP-MS)	83A	± 10.55
Cobalt (ICP-MS)	83A	± 8.39	Strontium (ICP-OES)	87	± 8.29
Cobalt (ICP-OES)	87	± 7.83	Sulphate	67G	± 6.96
Copper (ICP-MS)	83A	± 8.36	Suspended Solids	5	± 3.72
Copper (ICP-OES)	87	± 7.77	Thallium (ICP-MS)	83A	± 12.51
Chemical Oxygen Demand	3	± 16.04	Thallium (ICP-OES)	87	± 8.57
Chloride	16G	± 3.56	Tin (ICP-MS)	83A	± 12.17
Electrical Conductivity	2A	± 2.87	Tin (ICP-OES)	87	± 12.39
Fluoride	18G	± 17.67	Titanium (ICP-OES)	87	± 7.20
Hexavalent Chromium	68G	± 5.36	Total Dissolved Solids	41	± 1.29
Iron (ICP-MS)	83A	± 14.03	Total Solids at 105°C	59	± 0.59
Iron (ICP-OES)	87	± 7.83	Turbidity	4	± 4.60
Lead (ICP-MS)	83A	± 10.64	Uranium (ICP-MS)	83A	± 12.13
Lead (ICP-OES)	87	± 8.18	Uranium (ICP-OES)	87	± 7.26
Lithium (ICP-MS)	83A	± 20.65	Vanadium (ICP-MS)	83A	± 10.17
Lithium (ICP-OES)	87	± 6.79	Vanadium (ICP-OES)	87	± 7.18
Manganese (ICP-MS)	83A	± 10.71	Zinc (ICP-MS)	83A	± 22.86
Manganese (ICP-OES)	87	± 8.01	Zinc (ICP-OES)	87	± 7.41

APPENDIX UNCERTAINTY OF MEASUREMENT CONTINUED

Determinand	Method No	Uncertainty of Measurement (%)	Determinand	Method No	Uncertainty of Measurement (%)
Total Hydrocarbons	101	± 22.76	Tetrachloroethylene	100	± 17.04
Vinyl Chloride	100	± 23.42	1,1,1,2-Tetrachloroethene	100	± 21.13
Bromomethane	100	± 22.89	Chlorobenzene	100	± 16.08
Ethyl Chloride	100	± 23.25	Ethylbenzene (BTEX)	100	± 20.59
1,1-Dichloroethene	100	± 20.00	m,p-Xylene (BTEX)	100	± 24.59
Trans1,2-Dichlororethene	100	± 19.22	Styrene	100	± 18.91
Tert-Butylmethyl Ether (MTBE)	100	± 22.90	Bromoform (THM)	100	± 19.74
1,1-Dichloroethane	100	± 17.24	1,1,2,2-Tetrachloroethane	100	± 24.71
Cis-1,2-Dichloroethene	100	± 22.06	o-Xylene (BTEX)	100	± 23.70
Chloroform (THM)	100	± 18.67	1,2,3-Trichloropropane	100	± 22.64
2,2-Dichloropropane	100	± 19.27	Isopropylbenzene	100	± 21.01
1,2-Dichloroethane	100	± 15.27	Bromobenzene	100	± 19.61
1,1,1-Trichloroethane	100	± 21.72	n-Propylbenzene	100	± 24.17
1,1-Dichloropropene	100	± 20.33	2-Chlorotoluene	100	± 22.92
Carbon Tetrachloride	100	± 19.86	4-Chlorotoluene	100	± 22.11
Benzene (BTEX)	100	± 22.33	1,3,5-Trimethylbenzene	100	± 18.19
Dibromomethane	100	± 18.63	Tert-Butylbenzene	100	± 18.74
1,2-Dichloropropane	100	± 18.26	1,2,4-Trimethylbenzene	100	± 24.08
Trichloroethylene	100	± 21.76	Sec-Butylbenzene	100	± 20.11
Bromodichloromethane (THM)	100	± 15.31	1,3-Dichlorobenzene	100	± 24.31
Trans-1,3-Dichloropropene	100	± 14.50	1,4-Dichlorobenzene	100	± 24.31
Cis-1,3-Dichloropropene	100	± 15.77	1,2-Dichlorobenzene	100	± 20.31
1,1,2-Trichloroethane	100	± 16.46	n-Butylbenzene	100	± 14.50
Toluene (BTEX)	100	± 24.36	1,2,4-Trichlorobenzene	100	± 18.90
1,3-Dichloropropane	100	± 15.78	Naphthalene	100	± 23.66
Dibromochloromethane (THM)	100	± 18.00	Hexachlorobutadiene	100	± 18.39
1,2-Dibromoethane	100	± 14.72	1,2,3-Trichlorobenzene	100	± 24.70

Note: The Uncertainty of Measurement is calculated as a percentage and should be applied to the respective results.

For ICP elements, the UoM applies to total, dissolved and acid soluble metals.

Estimates of Uncertainty of Measurement for microbiological analyses can be provided on request.

** End of Report **

APPENDIX E

IMPACT ASSESSMENT METHODOLOGY

Assessment criteria for the rating of Impacts

The impacts of the proposed development should be quantified, as far as possible, according to the following criteria:

Status of the impact: A statement of whether the impact is positive (a benefit), negative (a cost), or neutral.

Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not **manifest** immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Nature – the evaluation of the nature is impact specific. Most negative impacts will remain negative, however, after mitigation, significance should reduce:

- **Positive.**
- **Negative.**

Extent: A description of whether the impact would occur on a scale limited to within the study area (local), limited to within 5 km of the study area (area); on a regional scale i.e. Mthonjaneni Local Municipality & KwaZulu-Natal (region); or would occur at a national or international scale.

Local	1
Area	2
Region	3
National	4
International	5

Duration: A prediction of whether the duration of the impact would be Immediate and once-off (less than one month), more than once, but short term (less than one year), regular, medium term (1 to 5 years), Long term (6 to 15 years), Project life/permanent (> 15 years, with the impact ceasing after the operational life of the development, or should be considered as permanent).

Immediate	1
Short term	2
Medium term	3
Long term	4
Project life/permanent	5

Severity (extent +duration + intensity)

Intensity: This provides an order of magnitude of whether or not the intensity (magnitude/size/frequency) of the impact would be negligible, low, medium, high or very high. This is based on the following aspects:

- an assessment of the reversibility of the impact (permanent loss of resources, or impact is reversible after project life);
- whether or not the aspect is controversial;
- an assessment of the irreplaceability of the resource loss caused by the activity (whether the project will destroy the resources which are easily replaceable, or the project will destroy resources which are irreplaceable and cannot be replaced);
- the level of alteration to the natural systems, processes or systems.

Negligible	The impact does not affect physical, biophysical or socio-economic functions and processes.	1
Low/potential harmful	The impact has limited impacts on physical, biophysical or socio-economic functions and processes.	2
Medium/slightly harmful	The impact has an effect on physical, biophysical and socio economic functions and processes, but in such a way that these processes can still continue to function albeit in a modified fashion.	3
High/Harmful	Where the physical, bio-physical and socio economic functions and processes are impacted on in such a way as to cause them to temporarily or permanently cease.	4
Very high/Disastrous	Where the physical, bio-physical and socio economic functions and processes are highly impacted on in such a way as to cause them to permanently cease.	5

Incidence (frequency + probability)

Frequency: This provides a description of any repetitive, continuous or time-linked characteristics of the impact: Once Off (occurring any time during construction or operation); Intermittent (occurring from time to time, without specific periodicity); Periodic (occurring at more or less regular intervals); Continuous (without interruption).

Once Off	Once	1
Rare	1/5 to 1/10 years	2
Frequent	Once a year	3
Very frequent	Once a month	4
Continuous	≥ Once a day/ per shift	5

Probability of occurrence: A description of the chance that consequences of that selected level of severity could occur during the exposure.

Highly unlikely	The probability of the impact occurring is highly unlikely due to its design or historic experience.	1
Improbable	The probability of the impact occurring is low due to its design or historic experience.	2
Probable	There is a distinct probability of the impact occurring	3
Almost certain	It is most likely that the impact will occur	4
Definite	The impact will occur regardless of any prevention measures	5

RATINGS

The risk rating is calculated based on input from the above assessments. The incidence of occurrence is calculated by adding the Extent of the impact to the duration of the impact. The Severity of the impact is calculated based on input from the extent of the impact, the duration and the intensity.

Risk = Severity (extent +duration + intensity) x Incidence (frequency + probability)

Significance: The significance of the risk based on the identified impacts has been expressed qualitatively as follows:

- **low** – the impact is of little importance/insignificant, but may/may not require minimal management
- **medium** - the impact is important, management is required to reduce negative impacts to acceptable levels.
- **high** - the impact is of great importance, negative impacts could render development options or the entire project unacceptable if they cannot be reduced to acceptable levels and/or if they are not balanced by significant positive impacts, management of negative impacts is essential.

Low risk	0 – 50
Medium risk	51 – 100
High risk	101 - 150

Level 2 Hydropedological Assessment for the proposed Waste Water Treatment Works (WWTW)

Bhokwe, KwaZulu-Natal

November 2019

CLIENT

Prepared by:
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www.thebiodiversitycompanycom

Report Name	**Level 2 Hydropedological Assessment for the proposed Waste Water Treatment Works (WWTW)**
Submitted to	**1 World Consultants**
Fieldwork and Report Writing	**Ivan Baker**

Ivan Baker is Cand. Sci Nat registered (119315) in environmental science and geological science. Ivan is a wetland and ecosystem service specialist, a hydropedologist and pedologist that has completed numerous specialist studies ranging from basic assessments to EIAs. Ivan has carried out various international studies following FC standards. Ivan completed training in Tools for Wetland Assessments with a certificate of competence and completed his MSc in environmental science and hydropedology at the North-West University of Potchefstroom.

Review	**Andrew Husted**

Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.

Declaration

The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Ecological Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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Declaration

I, Ivan Baker declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, 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 with respect to 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 71 and is punishable in terms of Section 24F of the Act.

Ivan Baker

Soil Specialist

The Biodiversity Company

November 2019

1 Introduction

The Biodiversity Company was commissioned to conduct a specialist hydropedological level two (2) assessment to meet the requirements of a Water Use Licence Application (WULA) for the proposed Waste Water Treatment Works (WWTW) and associated pipeline infrastructure in Bhokwe, KwaZulu-Natal. No hydropedological site assessment has been conducted, ultimately emphasising the importance of desktop data for this assessment.

This report should be interpreted after taking into consideration the findings and recommendations provided by the specialist herein. Further, this report should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.1 Project Area

The project is located in the town of Bhokwe, in the KwaZulu-Natal Province, South Africa. The project area is located within the Phongolo to Mtamvuna Water Management Area (WMA) in the W22A quaternary catchment. The nearest Sub Quaternary Reach (SQR) to the project is the W22A-2596 which is a reach of the upper Black Mfolozi River system. The proposed project is situated approximately 4 km south-west of Vlaklaagte and 4 km north-east of Bloemendal (see Figure 1). A detailed layout of the proposed WWTW is illustrated in Figure 2.

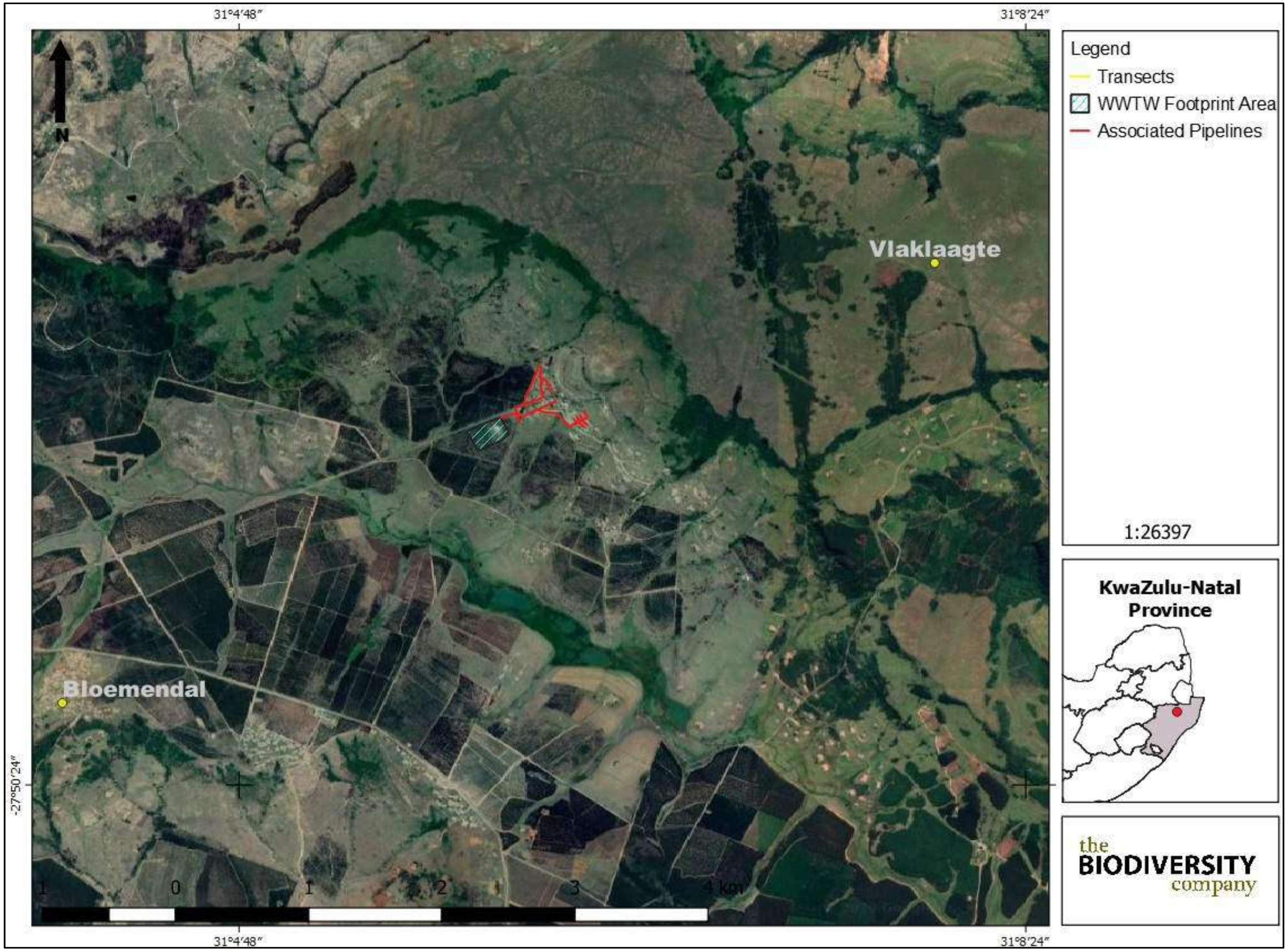

Figure 1: Spatial context of the proposed development

Figure 2: Detailed layout of WWTW

1.1.1 Climate

The region is characterised by summer rainfall with the majority of precipitation occurring between October and March with an overall Mean Annual Precipitation (MAP) of 750 mm. A large volume of the annual rainfall is accompanied with thunderstorms and hail with a Mean Annual Temperature (MAT) of 17℃ and a mean annual evaporation 1 845 mm. Also see Figure 3.

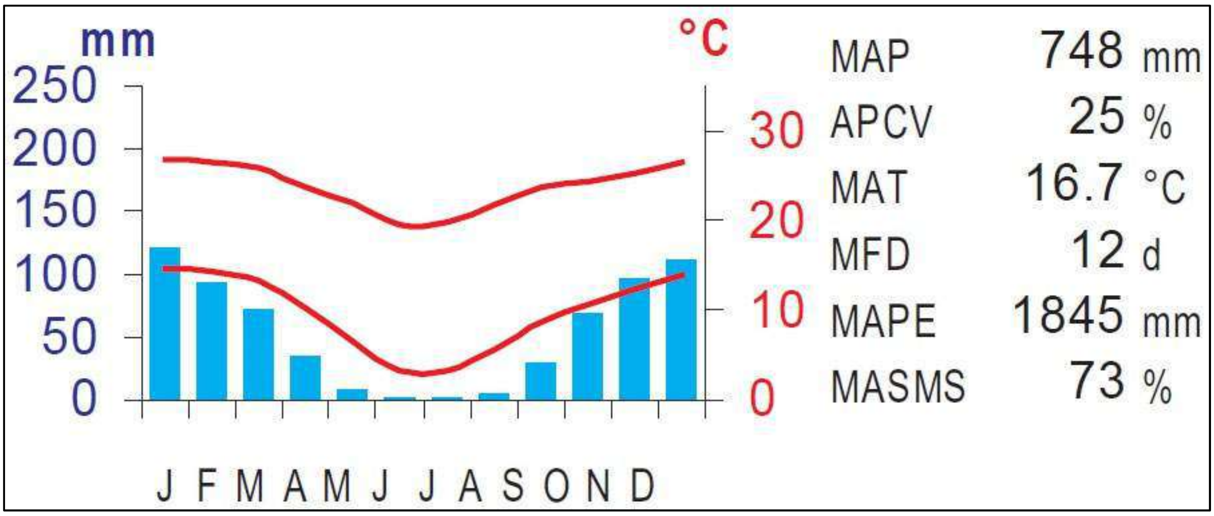

Figure 3: Climate for the project area (Mucina & Rutherford, 2006)

1.1.2 Vegetation

The Income Sandy Grassland (Gs 7) vegetation type is distributed throughout the KwaZulu-Natal Province in a large triangle between Vryheid, Newcastle and Dundee as well as in the Wasbank area in Northern KwaZulu-Natal. This vegetation type is located at in altitude of 880 to 1 340 Metres Above Sea Level (MASL) (Mucina & Rutherford, 2006).

This vegetation type is characterised by extensive flat areas with shallow, poorly drained soil which support low, tussock dominated sourveld supporting *A. Karroo, A. caffra, A. nilotica* and *Diospyros lycioides*. *A. sieberiana* var. *woodii* covers disturbed areas with *Aristida congesta, Michrochloa* and *Cynodon dactylon* distributed throughout shallow soils (Mucina & Rutherford, 2006).

This vegetation type is vulnerable with a target percentage of 23. No conservation areas are located within this vegetation type with approximately 27% being transformed by plantations, cultivation and urban sprawl. This vegetation type isn’t characterised by any serious invasion of alien plant species due to the low nutrient status of the soils. Erosion within this vegetation type ranges from low to high (Mucina & Rutherford, 2006).

2 Scope of Work

A hydropedology assessment on a local scale, a hillslope scale or a catchment scale must be completed in cases where the infiltration or sub-surface hydrology is expected to be affected by a proposed activity. A wide variety of services must be provided (i.e. modelling, classification of soil, hydropedological soil types and hillslope hydrology), depending on the intensity of the proposed activity. The following terms of reference has been identified to meet the criteria of such a hydropedology assessment:

- Conduct field work to acquire information regarding soil physical properties and morphology of soils;
- Construct conceptual models of hydrological response for each of the transects based on hydropedological interpretations;
- Assess dominant hydropedological flow paths through the dominant soil forms/associations;
- Determine (conceptually) the extent of disturbance to the natural hydropedological model; and
- Compile a report which includes recommendations and conclusions regarding the proposed activity to ultimately inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making.

3 Limitations

The following aspects were considered as limitations;

- Only the slopes affected by the proposed development have been assessed;
- No site visit has been conducted, only worst-case desktop data has been taken into consideration; and
- It has been assumed that the extent of the development area provided by the responsible party is accurate.

4 Literature Review

4.1 Hydropedological Flow Paths

Given that hydropedology is a relatively new field, a short literature review has been added on this interdisciplinary research field. This literature is an excerpt from van Tol *et al.,* (2017).

Soil physical properties and hydrology play significant roles in the fundamentals of hydropedology. Physical properties including porosity, hydraulic conductivity, infiltration etc. determine micro preferential flow paths through a soil profile. The hydrology in turn is responsible for the formation of various morphological processes in soil, including mottling, colouration and the accumulation of carbonate.

These processes are used to construct models illustrating sub-surface flow paths, storage and interconnection between these flow paths. Hydropedology can therefore be used for a variety of functions. These functions include process-based modelling, digital soil mapping, pollution control management, impact of land use change on water resources, wetland protection, characterising ground and sub-surface flows as well as wetland protection and rehabilitation, of which the latter will be the main focus during this report (see Figure 4). The latter mentioned enables effective water resource management regarding wetlands and sub-surface flows in general.

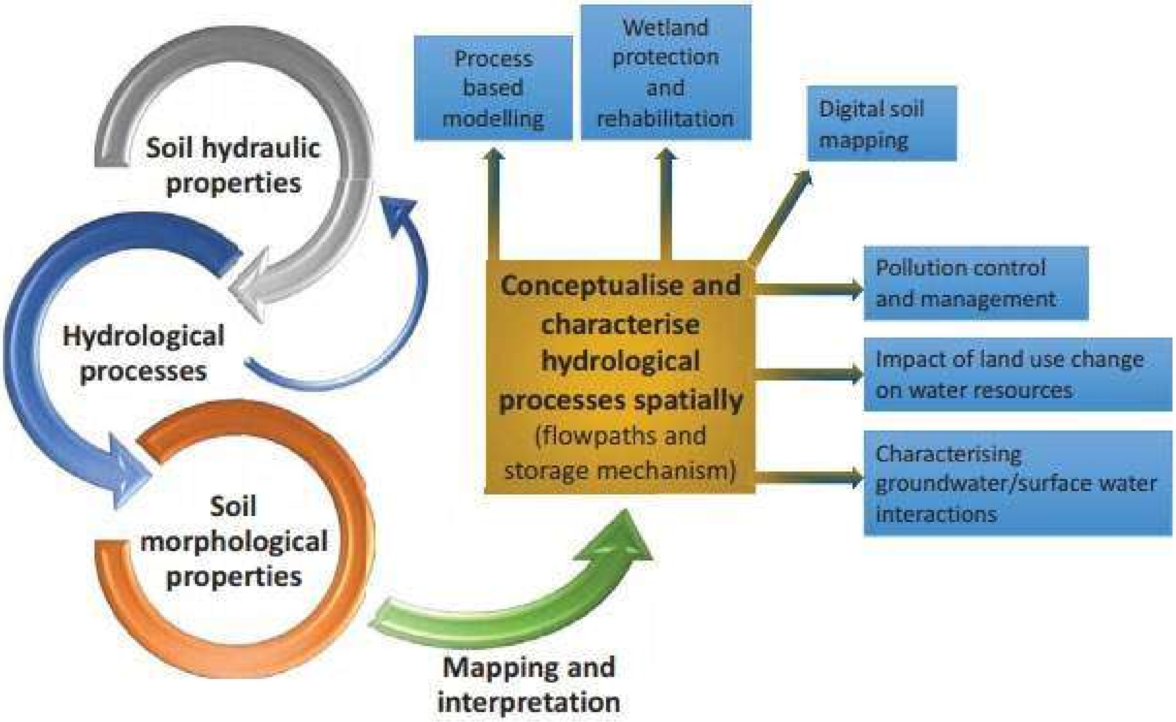

Figure 4: Illustration of the interactive nature of hydropedology and its potential applications (van Tol et al., 2017)

As can be seen in Figure 5, the hydropedological behaviour of soil types can differ significantly. Figure 5 (a) illustrates a typical red coloured soil (top- and sub-soil. This soil type will typically have a vertical flow path throughput the soil profile. Water will therefore infiltrate the top-soil and freely drain into the profile to such an extent that the water rapidly reaches the bedrock. After reaching this layer, water will penetrate the ground water source or be transported horizontally towards lower laying areas. This soil type is known as a recharge soil, given its ability to recharge ground and surface water sources.

Figure 5 (b) illustrates interflow soils. Lateral flows are dominant in this soil type and occurs due to differences in the hydraulic conductivity of soil horizons. The “sp” soil horizon restricts vertical movement and promotes lateral flows at the A/B interface. The lighter colour in this profile indicates leaching which is caused by lateral flows which often occurs on top of a bedrock layer due to the impermeable nature thereof. Mottles often occurs above this impermeable layer due to fluctuating water levels, see the magnified illustration in Figure 5 (b-i).

Figure 5 (c) illustrates responsive soils. This hydropedological soil type is characterised (in this case) by a dark top-soil and a grey coloured sub-soil. Other indicators include mottling and gleying. These soil types are saturated for very long periods. Therefore, rainfall is unlikely to infiltrate this layer and would likely be carried off via overland flow and are mostly fed by lateral sub-surface flows. Shallow soils are equally responsive in the sense that the soil profile will rapidly be saturated during precipitation, after which rainfall will be carried off by means of overland flows.

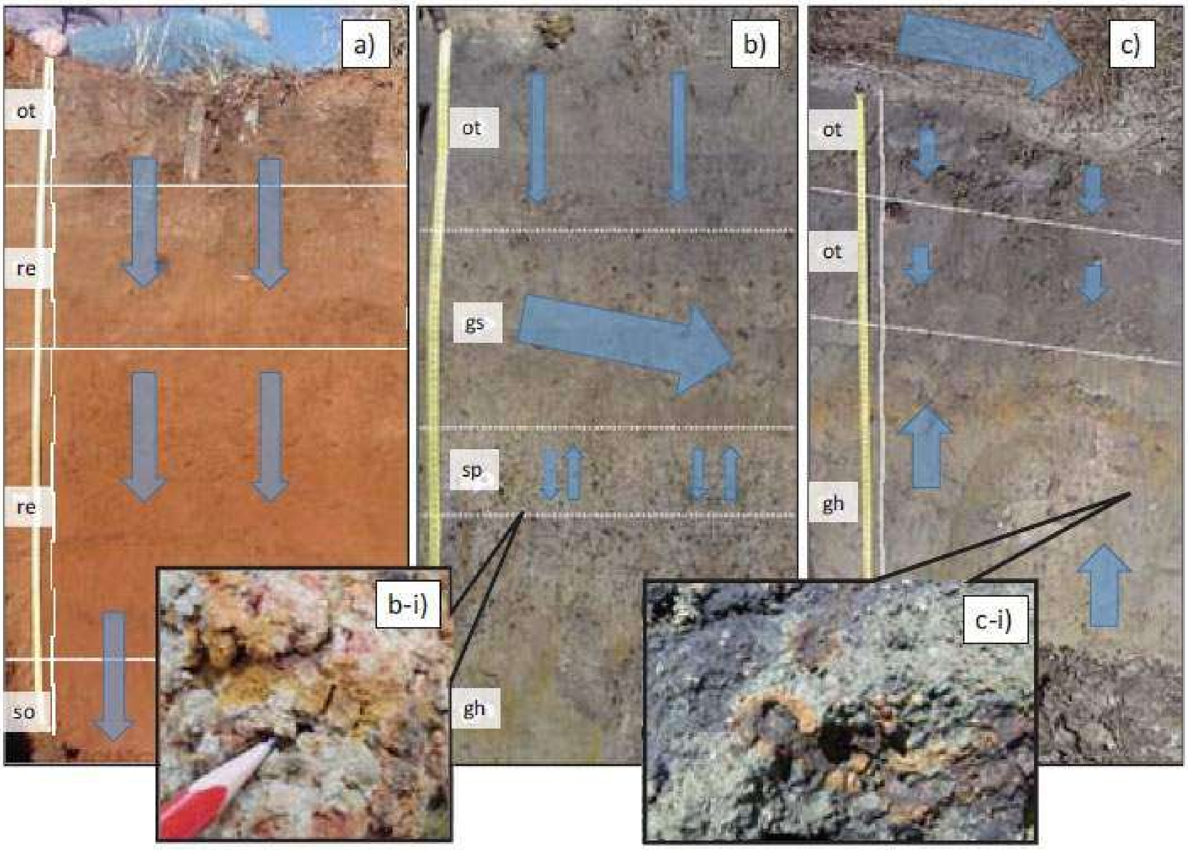

Figure 5: Illustration of different hydropedological soil types (van Tol et al., 2017)

A typical example of the hydropedological processes through a hillslope is illustrated in Figure 6. In this example, a recharge soil type is located at the upper reaches of the slope. Rainfall infiltrates this soil type and percolates vertically towards the bedrock. Water then, infiltrates into this bedrock given the permeability thereof and could now recharge groundwater or return to the soil in lower lying positions. The second soil type (the interflow zone) indicates lateral flows at the A/B interface and again at the soil/bedrock interface which feeds the responsive zone. The responsive zone is then simultaneously fed by lateral sub-surface flows and ground water recharge.

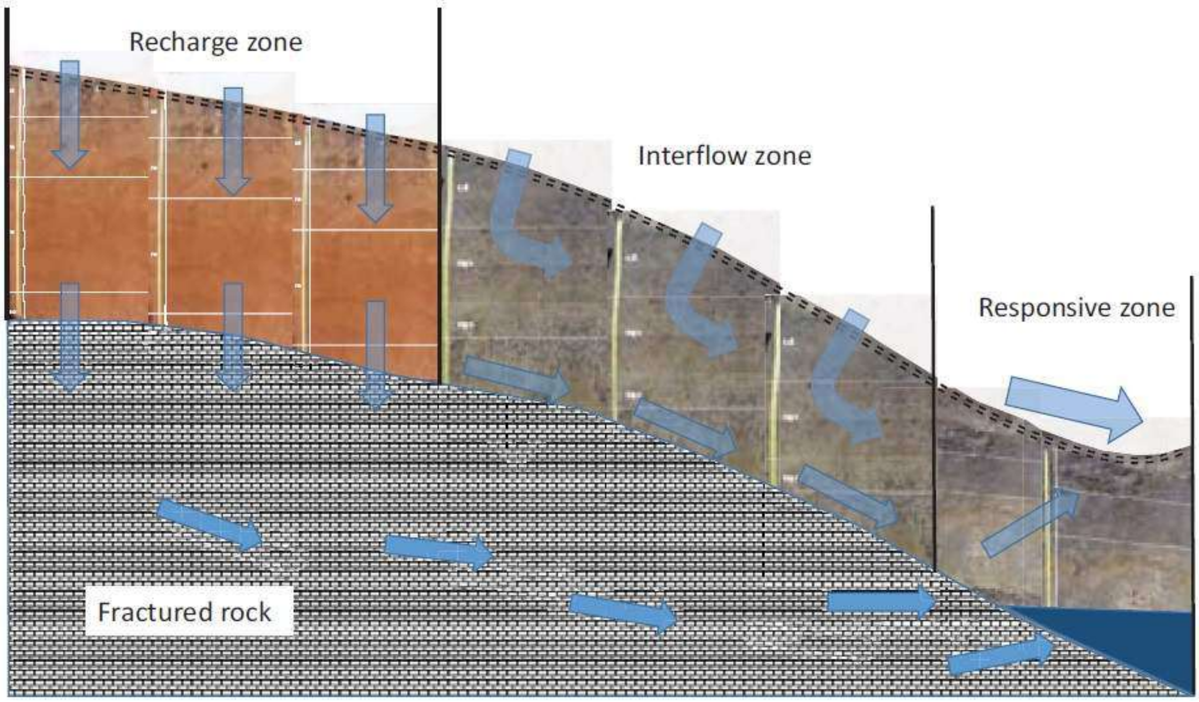

Figure 6: Theoretical example of various sub-surface flow paths (van Tol et al., 2017)

The methodology of van Tol *et al.,* (2017) has since been updated to include a "stagnant" hydropedological type. According to van *Tol et al.,* (2019), four different hydropedological types exist, namely Recharge, Interflow, Responsive and Stagnating hydropedological types. These soil types are divided into seven subgroups depending on the morphology of the relevant soil form. The latest addition to this methodology, as mentioned, is known as a stagnating hydropedological type.

This soil type is characterised by restrictive movement of water through profiles (both laterally and vertically) and is dominated by evapotranspiration. The A- and B-horizon of such a soil type usually has a high permeability with morphological indicators indicating very little movement through the profile. Lime and iron concretions as well as cementation of silica are typical indicators of such a soil form.

5 Methodology

5.1 Desktop Assessment

The following information sources were considered for the desktop assessment;

- Aerial imagery (Google Earth Pro);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- Topographical river line data;
- Contour data (5 m); and
- Mucina & Rutherford (2006).

The slopes within the project area have been assessed during the desktop assessment to identify possible transects that will represent typical terrain and soil distribution patterns. Two transects were identified to represent the hillslopes that will be affected by the proposed development (see Figure 7).

Given the size of the pipes and the fact that the proposed pipeline will mostly be located within disturbed areas (i.e. roads), very little to no impacts are expected towards the hillslope hydrology. Therefore, the only component assessed is that of the WWTW footprint area.

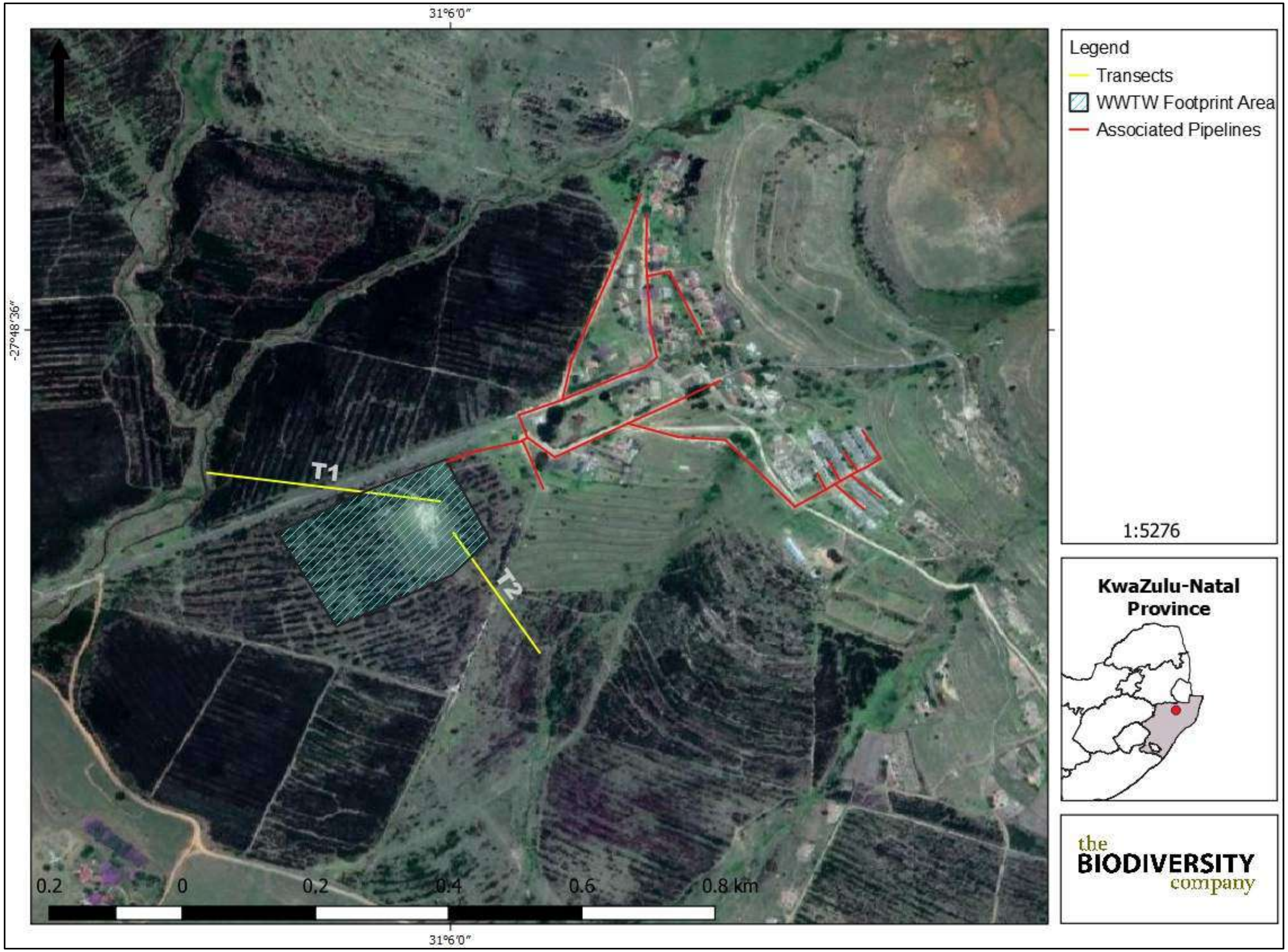

Figure 7: Transect relevant to the proposed development

5.1.1 Identification of Soil Types and Hydrological Soil Types

Soil types have been identified according to the South African soil classification system (Soil Classification Working Group, 1991) after which the link between soil forms and hydropedological response were established (van Tol & Le Roux, 2019), and the soils regrouped into various hydropedological soil types as shown in Table 1.

Table 1: Hydrological soil types of the studied hillslopes (van Tol et al., 2019).

Hydrological soil type	Description	Subgroup	Symbol
Recharge	Soils without any morphological indication of saturation. Vertical flow through and out the profile into the underlying bedrock is the dominant flow direction. These soils can either be shallow on fractured rock with limited contribution to evapotranspiration or deep freely drained soils with significant contribution to evapotranspiration.	Shallow	🟥
		Deep	🟪
Interflow (a/b)	Duplex soils where the textural discontinuity facilitates build-up of water in the topsoil. Duration of drainable water depends on rate of ET, position in the hillslope (lateral addition/release) and slope (discharge in a predominantly lateral direction).	A/B	🟧
Interflow (soil/bedrock)	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.	Soil/Bedrock	🟨
Responsive (shallow)	Shallow soils overlying relatively impermeable bedrock. Limited storage capacity results in the generation of overland flow after rain events.	Shallow	🟩
Responsive (saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation excess.	Saturated	🟩
Stagnating	In these soils outflow of water is limited or restricted. The A and/or B horizons are permeable but morphological indicators suggest that recharge and interflow are not dominant. These includes soils with carbonate accumulations in the subsoil, accumulation and cementation by silica, and precipitation of iron as concretions and layers. These soils are frequently observed in climate regions with a very high evapotranspiration demand. Although infiltration occurs readily, the dominant hydrological flow path in the soil is upward, driven by evapotranspiration.		🟪

6 Results and Discussions

6.1 Desktop Background Findings

6.1.1 Geology & Soils

Shale and Sandstone of the Karoo Supergroup’s Madzaringwe Formation which supports poorly drained sandy soils from the Glenrosa soil form is distributed throughout the project area. Dominant land types include the Fb, Bb and Ca land types (Mucina & Rutherford, 2006)

According to the land type database (Land Type Survey Staff, 1972 - 2006) the transect relevant to the project is located in the Ac 127 land type. The Ac land type is characterised by freely drained Red- and Yellow-Brown Apedal soils which are mesotrophic or dystrophic.

Figure 8 illustrates the respective terrain units relevant to the Ac 127 land type with the expected soils illustrated in Table 2. The Digital Elevation Model (DEM) for the site indicates a slope percentage between 0 and 2% (see Figure 9 and Figure 10), which emphasises the potential significance of evapotranspiration. Evapotranspiration tends to be higher for flatter regions due to the low gravitational forces inducing percolation.

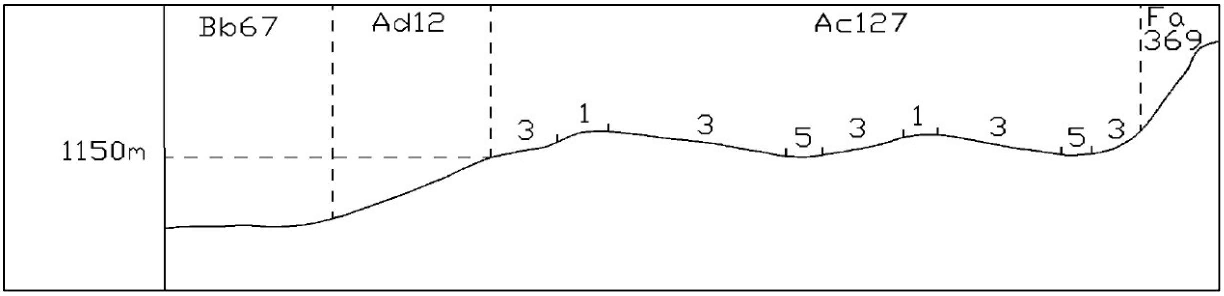

Figure 8: Illustration of land type Ac 127 terrain unit (Land Type Survey Staff, 1972 - 2006)

Table 2: Soils expected at the respective terrain units within the Ac 127 land type (Land Type Survey Staff, 1972 - 2006)

TERRAIN UNITS					
1 (15%)		3 (80%)		4 (5%)	
Griffin	34	Clovelly	45	Katspruit	30
Clovelly	28	Griffin	18	Streambeds	30
Cartref	14	Cartref	13	Dundee	20
Hutton	12	Hutton	13	Cartref	13
Mispah	5	Kroonstad	6	Kroonstad	7
rock	5	Mispah	5	Glencoe	5
		Rock	5		

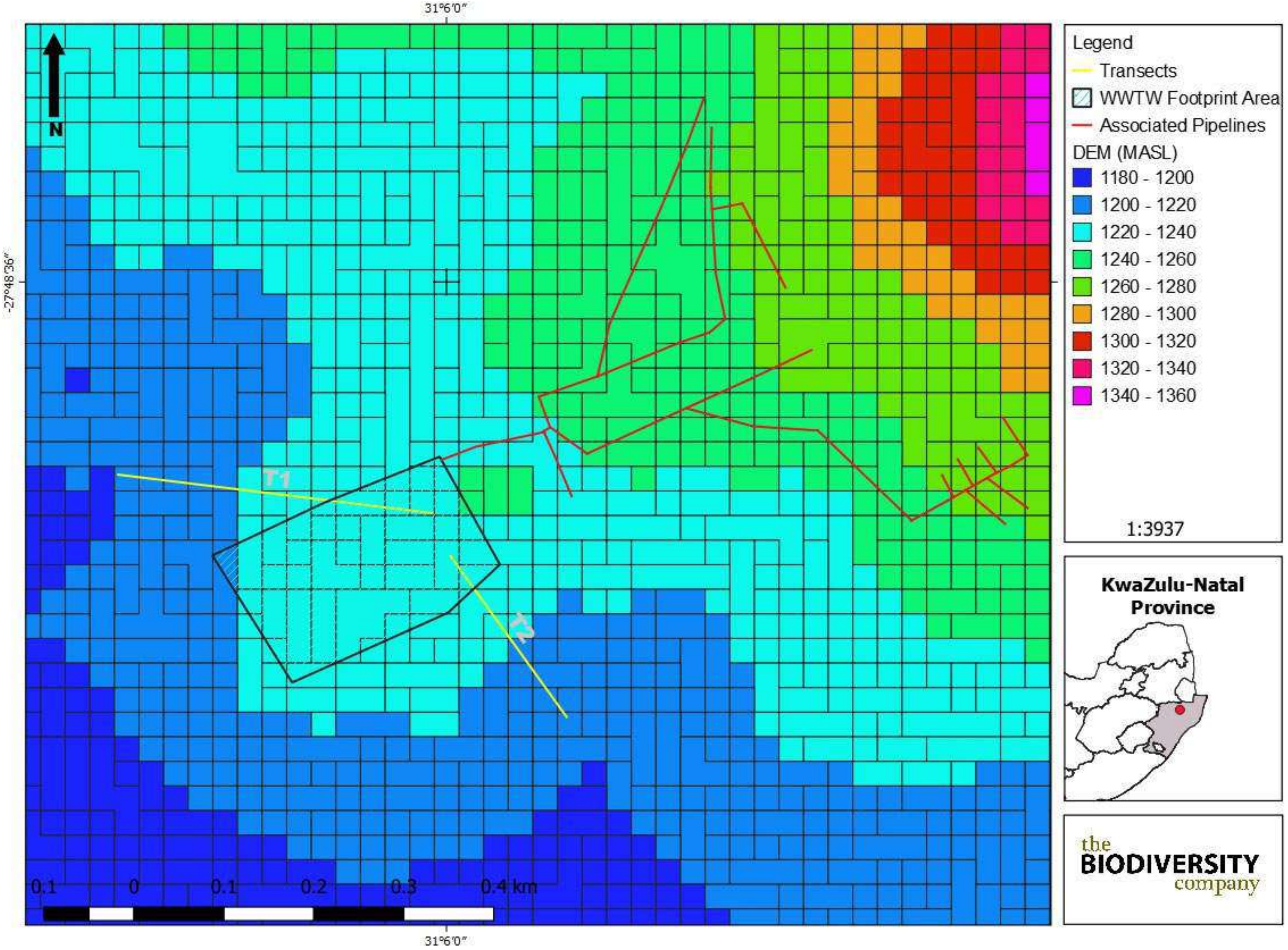

Figure 9: DEM for the proposed project area and its surroundings

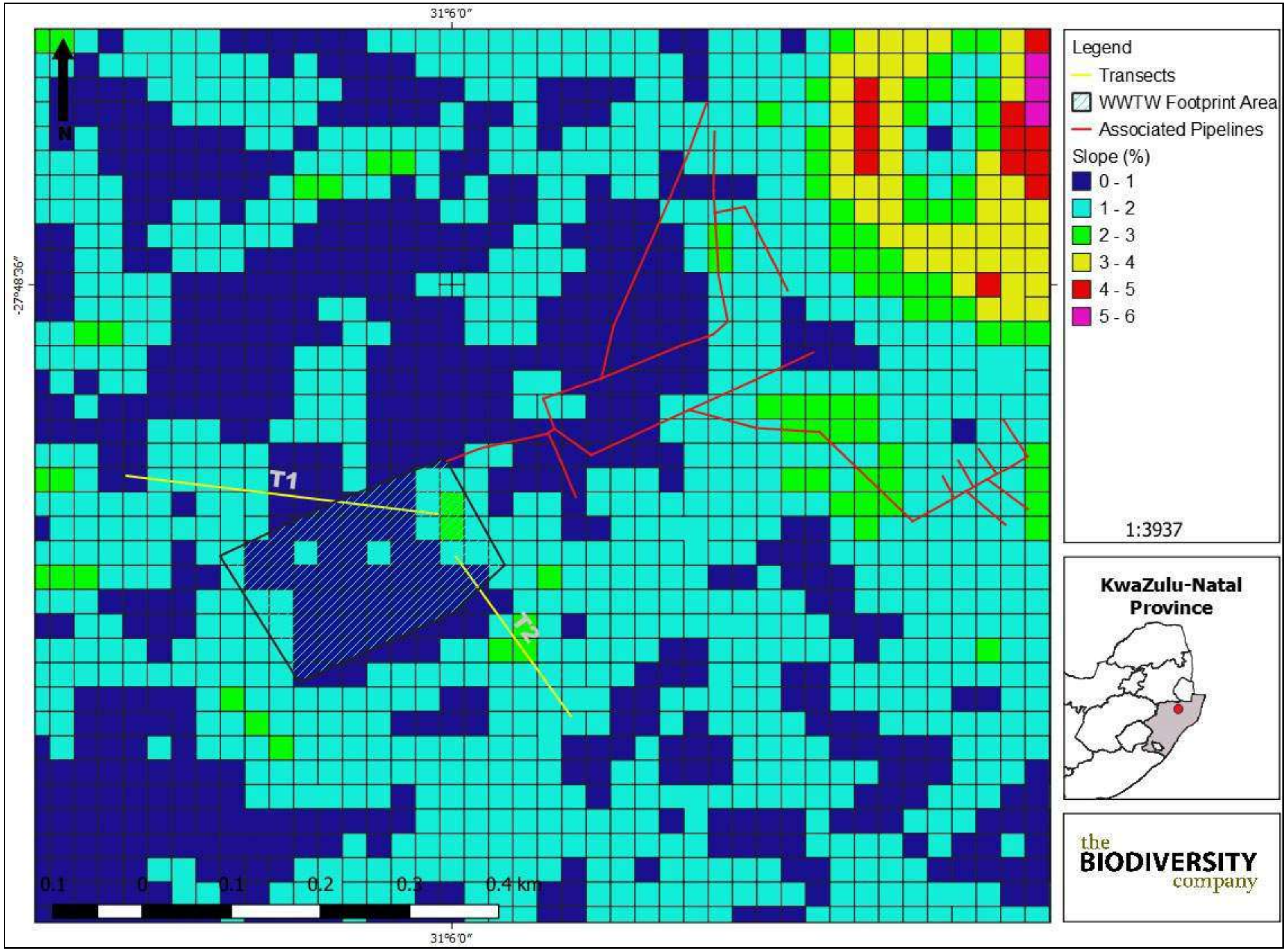

Figure 10: Slope percentage of the proposed project area

6.2 Expected Soil Forms

The following soil forms are expected on-site;

- Griffin (Orthic topsoil on a Yellow-Brown Apedal horizon on top of a Red Apedal horizon);
- Clovelly (Orthic topsoil on a Yellow-Brown Apedal horizon on top of a Lithic horizon);
- Cartref (Orthic topsoil on top of a Albic horizon, which in turn is underlain by a Lithic horizon);
- Hutton (Orthic topsoil on top of a thick Red Apedal horizon); and
- Katspruit (Orthic topsoil on top of a Gleyic horizon).

Orthic A topsoils are mineral horizons that have been exposed to biological activities and varying intensities of mineral weathering. The climatic conditions and parent material ensure a wide range of properties differing from one Orthic A topsoil to another (i.e. colouration, structure etc) (Soil Classification Working Group, 2018).

The Yellow-Brown Apedal horizon is similar to that of the Red Apedal horizon in all aspects except for the colour and the iron-oxide processes involved with the colouration thereof. This diagnostic soil horizon rarely occurs in parent rock high in iron-oxides and will rather be associated with Quartzite, Sandstone, Shale and Granites (Soil Classification Working Group, 1991).

The Red Apedal diagnostic soil horizon has no well-formed peds, but rather small porous aggregates. The poor structure associated with this diagnostic profile is a result of weathering processes under well drained oxidising conditions. Iron-oxide precipitations form on the outside of soil particles (hence the red colour) and non-swelling clays dominate the clay particles. This diagnostic soil horizon is widely spread across South Africa and can be associated with any parent material (Soil Classification Working Group, 1991).

The Albic horizon is characterised by a leached colour and lacks the colour from the topsoil and/or the soil horizon underneath the Albic horizon. The Albic horizon’s iron oxides and organic material has been leached out by lateral sub-surface flows, hence the grey colour. Rusty marks (mottles) are common in Albic horizons and indicate a temporary to seasonally saturated soil (Soil Classification Working Group, 1991).

Gley horizons that are well developed and have homogenous dark to light grey colours with smooth transitions. Stagnant and reduced water over long periods is the main factor responsible for the formation of a Gley horizon and could be characterised by green or blue tinges due to the presence of a mineral called Fougerite which includes sulphate and carbonate complexes. Even though grey colours are dominant, yellow and/or red striations can be noticed throughout a Gley horizon. The structure of a Gley horizon mostly is characterised as strong pedal, with low hydraulic conductivities and a clay texture, although sandy Gley horizons are known to occur. The Gley soil form commonly occurs at the toe of hillslopes (or benches) where lateral water inputs (sub-surface) is dominant and the underlaying geology is characterised by a low hydraulic conductivity. The Gley horizon usually is second in diagnostic sequence in shallow profiles yet is known to be lower down in sequence and at greater depths (Soil Classification Working Group, 2018).

For the Lithocutanic horizon, i*n situ* weathering of rock underneath a topsoil results in a well-mixed soil-rock layer. The colour, structure and consistency of this material must be directly related to the parent material of the weathered rock. The Lithocutanic horizon is usually followed by a massive rock layer at shallow depths. Hard rock, permeable rock and horizontally layered shale usually is not associated with the weathering processes involved with the formation of this diagnostic horizon (Soil Classification Working Group, 1991).

6.3 Hillslope Hydrology

The desktop survey was conducted to obtain information regarding the soil morphology and hydropedological flow paths relevant to the hillslope by means of two transects. Given the fact that the proposed development only includes the construction of a WWTW plant characterised by a foundation dug between 0,5 and 1 m into the soil profile, the only impact towards the hillslope hydrology will be restricting infiltration. Therefore, the most sensitive hydropedological soil type would be that of a recharge hydropedological type. The land type data suggests that all soil form from the lower foothills towards the crest is expected to be recharge soil forms. Therefore, worst-case scenario assumptions have been made that the entire slope up to the valley bottom comprises of recharge soils.

The hydropedological behaviour of the relevant transects are illustrated in a conceptual hydrological response model (see Figure 11). The processes involved within this slope is described according to the number assigned to the relevant hydrological response. It is worth noting that both transects are similar in morphology and topography, and has therefore been assessed as a conceptual example.

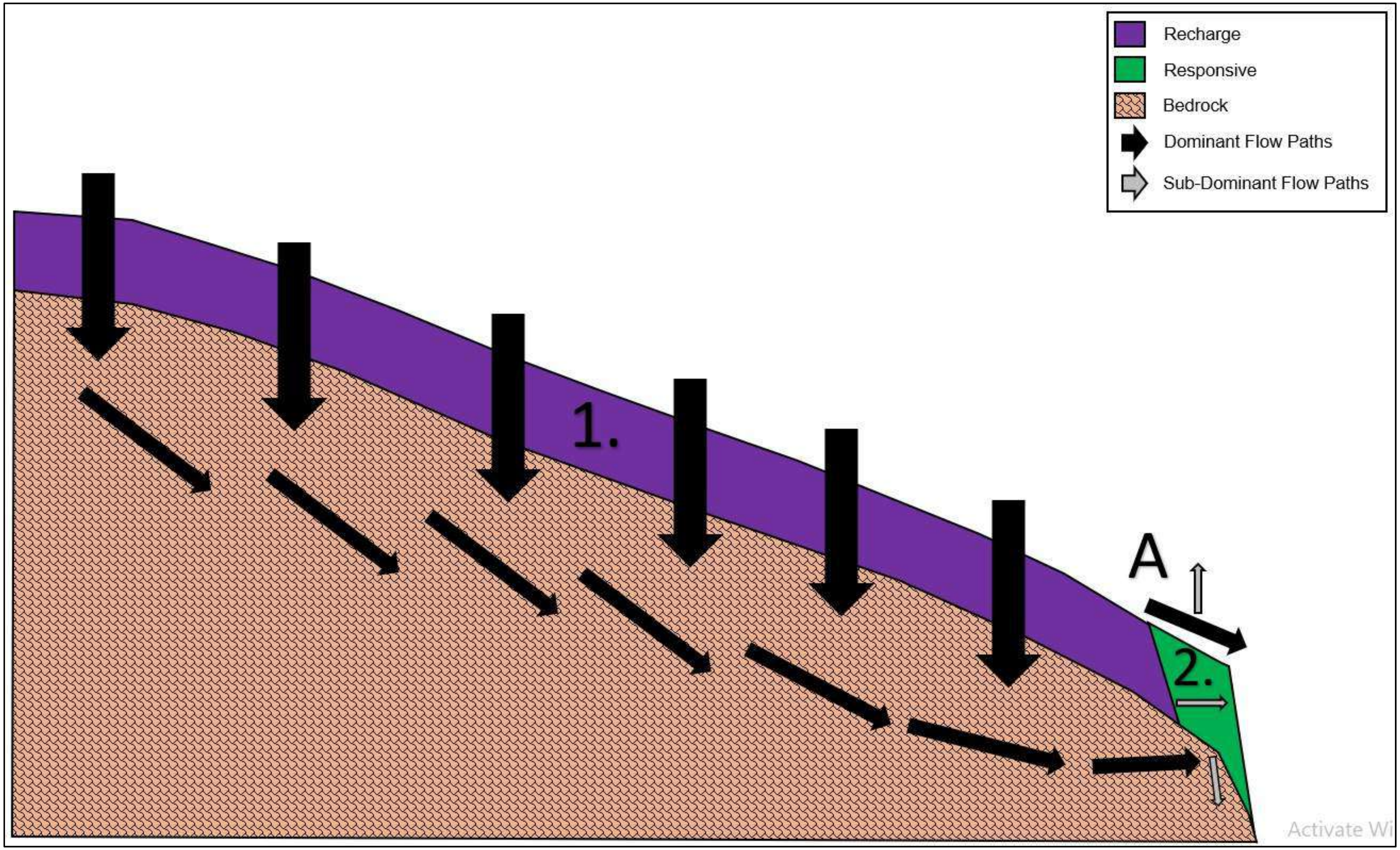

Figure 11: Conceptual hydropedological response model of the relevant transect (in current state)

6.3.1 Hydropedological Type #1

The majority of the hillslope (from the crest to the lower sections of the hillslope) is characterised by recharge hydropedological types. This phenomenon indicates rapid infiltration into the bedrock, with no interflow through the soil profile.

6.3.2 Hydropedological Type #2

The lower laying regions of the hillslope has been identified as a responsive hydropedological type. This soil form has a high level of saturation and promotes overland flow during rainfall events given the increased moisture levels and the level of saturation. After rainfall events, evapotranspiration increases with small fractions of water interflowing into the relevant water course and infiltrates bedrock.

6.3.3 Transition “A”

Transition “A” resembles the transition between the recharge and the responsive hydropedological types. Recharge feeds the responsive regions from below, ultimately resulting in prolonged periods of saturation.

7 Conceptual Impact Predictions

The only expected impact towards hillslope hydrology is the decreased infiltration of precipitation into the soil profile at the proposed footprint area. Precipitation will be restricted to artificial surfaces and be channelled along stormwater systems as opposed to infiltrating the topsoil. Impacts are expected to be low given the fact that only a small fraction of the hillslope will be covered by artificial surfaces (see Figure 12). Regardless, some mitigation measures have been prescribed to ensure the conservation of sub-surface flow paths.

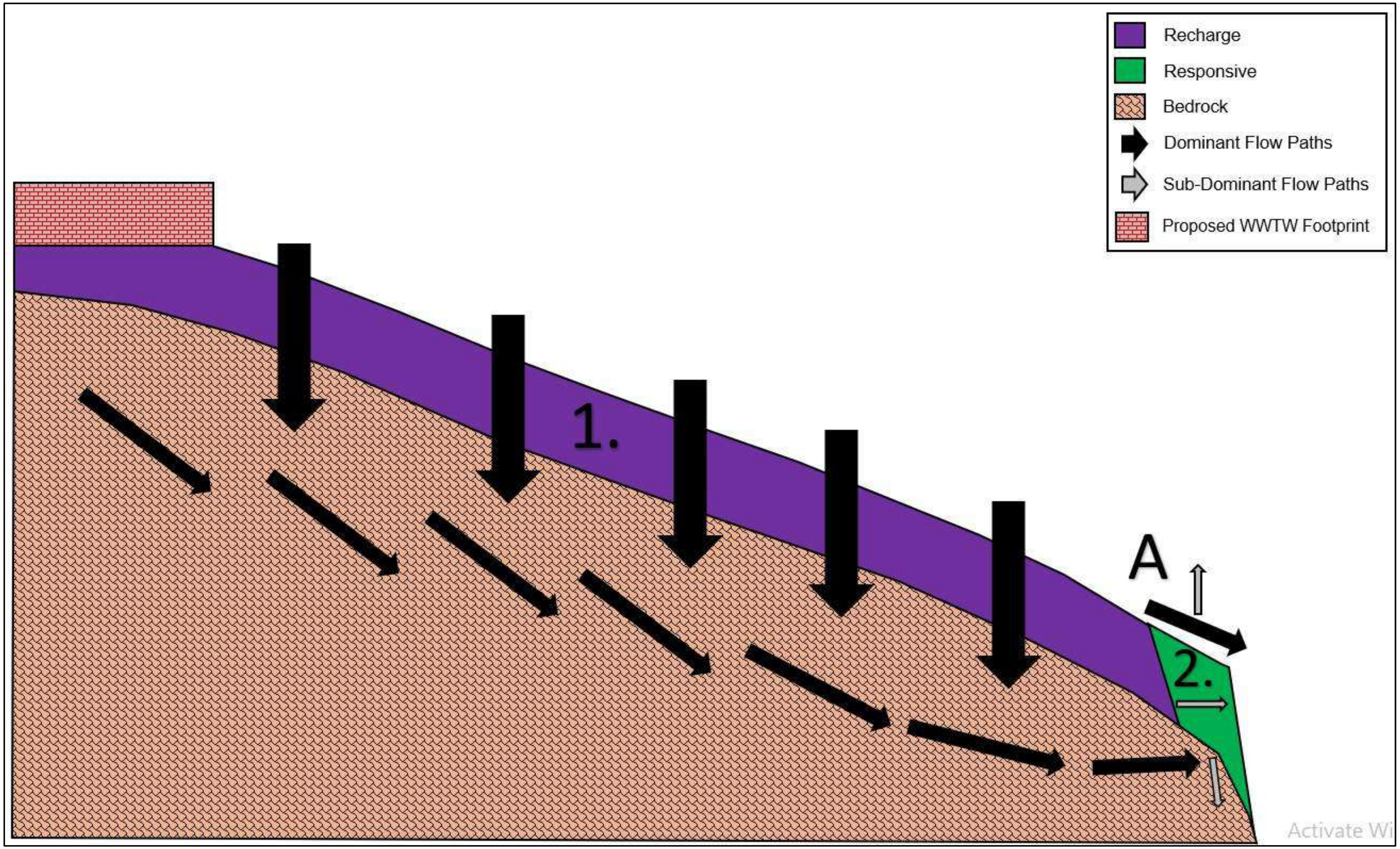

Figure 12: Conceptual hydropedological response model of the relevant transect (in proposed state)

7.1 Recommendations

The following mitigations have been assigned to minimise threats to sensitive receptors;

- Artificial surfaces must be constructed with material that allow infiltration (where possible);
- 50 cm^3 holes must be excavated into the ground underneath rain gutter outlets and be fitted with rocks to avoid erosion, increase infiltration as well as recharge (see Figure 13). These “gutters” must be cleaned monthly to ensure that pores do not block by means of sediment and vegetation inputs; and
- In the event that an attenuation pond will be installed to accommodate the Stormwater Management Plan (SWMP), water from the attenuation pond must be reintroduced into the watercourse by means of its natural hydropedological flow path, which in this case is recharge. This must be done by irrigating lawns and flower beds anywhere on the slope. The wetland areas must be demarcated to avoid irrigation on these areas. During the dry season, or any time the attenuation pond does not have enough water to supply sprinklers, manual labourers must make use of buckets to remove water from the attenuation ponds and irrigate the project area to avoid loss to evaporation, especially after rainfall events.

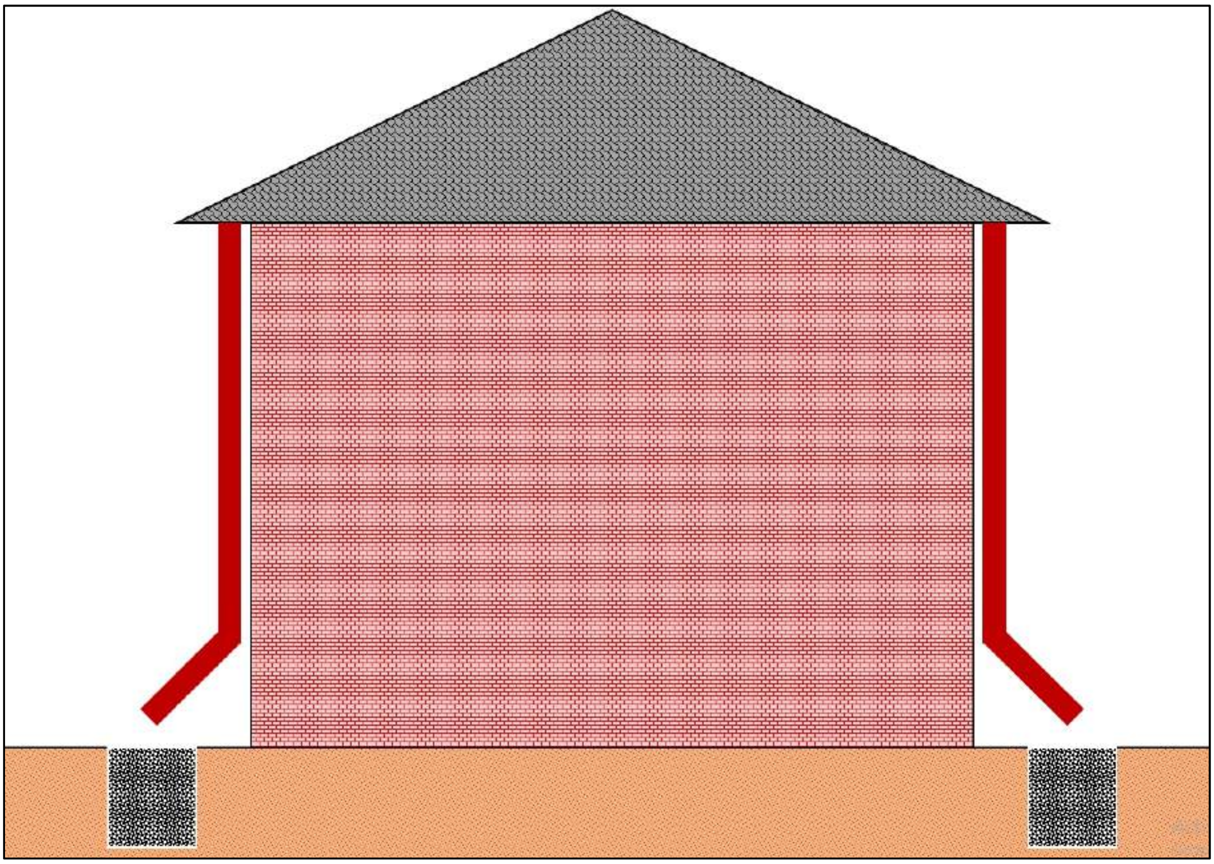

Figure 13: Conceptual example of pits underneath rain gutter outlets

8 Conclusions

Two hydropedological types were identified within the slope relevant to the proposed activities, namely recharge and responsive. The proposed construction will take place on top of the recharge zones, which limits impacts to the hillslope hydrology. The proposed activities are expected to have very little impact towards the hillslope hydrology. Nevertheless, recommendations have been made to ensure a low level of risk to the hillslope hydrology and vadose zone processes.

It is the specialist's opinion that the proposed activities should proceed as has been planned given the low level of risks associated with the proposed activities towards the vadose zone, on the condition that all of the recommendations made within this report be strictly adhered to.

9 References

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Palaeontological Impact Assessment for the proposed upgrading of sanitation for Bhokwe Village, about 22km east of Vryheid, KwaZulu Natal Province

Desktop Study

For

Jean Beater Consulting

29 August 2019

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Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 22 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Jean Beater Consulting, Durban, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: MKBamford

Executive Summary

A palaeontological Impact Assessment was requested for the proposed upgrading of the sanitation system in Bhokwe Village, AbaQulusi Municipality, KwaZulu Natal. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project area.

The proposed site lies on the non-fossiliferous dolerite dykes of Jurassic age (higher altitude, and the shales of the early Permian Vryheid Formation (Ecca Group). The latter could potentially contain fossil plant impressions of the Glossopteris flora, but only below ground and not in the village or the soils of the ploughed field (site for sewer oxidation tanks). Since there is a small chance that fossils could be discovered once excavations commence a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless the geologist or responsible person discovers fossils.

Table of Contents

1. Background

Ukuza Consultants proposes the construction of 2.2 km of 160mmØ uPVC sewer reticulation, 90 m of 250mmØ uPVC sewer reticulation, an oxidation sewer pond and numerous 1000mmØ precast concrete ring manholes, in Bhokwe Community, Ward 05, AbaQulusi Municipality, KwaZulu-Natal.

The project will require water, electricity and waste disposal during the construction phase only. This will be provided by the Contractor. The Bhokwe communities within this region require rehabilitation of the sanitation systems in this settlement, which are characterized by frequent bursts, blockages and overflowing resulting in a health hazard to the community. Municipal Infrastructure Support Agent (MISA) was requested by the Bhokwe communities to assist with rehabilitation of the water and sanitation systems in these settlements. MISA appointed a service provider on a Turnkey basis to design and rehabilitate sewer reticulation facilities in 20 June 2016. The contractor abandoned site approximately eighteen months ago and MISA is at this stage, uncertain of the condition of the infrastructure installed and quality of materials on site and external factors such as weather, vandalism, theft, etc., which may have affected the completed works. The previous service provider has since been liquidated resulting in the abandonment of the site. In order to resuscitate and complete the project, MISA initiated a procurement process during April 2019 for the appointment of a new Service Provider. Ukuza Consulting (Pty) Ltd have since been appointed as the professional service provider. In this regard, the proposed reticulation and completion of existing works will be continued.

Two activities are of relevance to the palaeontological impact assessment:
Activity 19: The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.
Activity 27: The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.

A Palaeontological Impact Assessment was requested for the project in order to comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development and is presented here.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page 1

c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4
g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

Figure 1: Google Earth map of the proposed upgrading of the sanitation system in Bhokwe Village, Bhokwe Community, Ward 05, AbaQulusi Municipality. The red lines indicate the sewer reticulation and the sewer oxidation ponds.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

The site lies in the central-eastern part of the Main Karoo Basin and comprises rocks of the lower Karoo Supergroup, in particular the basal Pietermaritzburg Formation and overlying Vryheid Formation (Ecca Group). There are large intrusions of dolerite dykes that were emplaced during the Jurassic and are associated with the massive basalt outpouring of the Drakensberg Mountains. The dykes do not preserve fossils because they are igneous in origin and, furthermore, tend to destroy fossils in their immediate vicinity. They will not be considered further.

The early Permian Pietermaritzburg Formation dark grey shales were deposited in deep water environments as the Karoo inland sea filled with meltwater from the receding glaciers from the mountainous region to the south. Shales, mudstones and sandstones make up the Vryheid Formation, together with coal seams, formed when the climate warmed and the vegetation flourished.

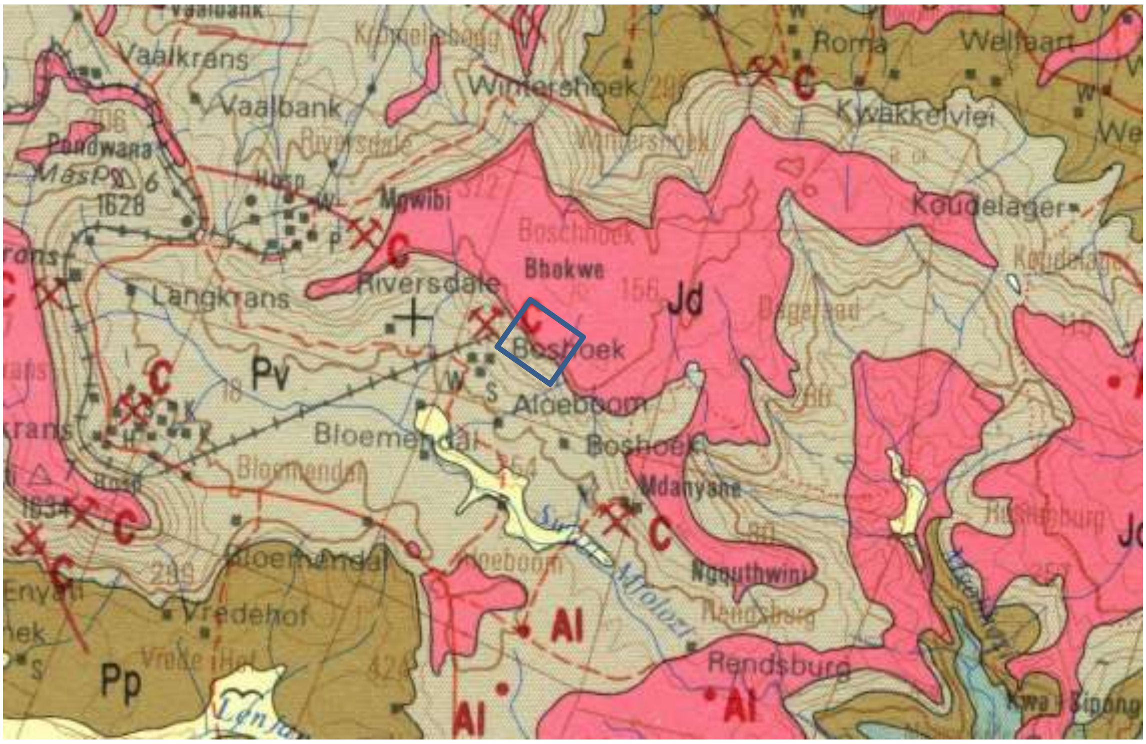


Figure 2: Geological map of the area around the Bhokwe Village, AbaQulusi District. The location of the proposed project is indicated within the blue rectangle. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2730 Vryheid.

Table 2: Explanation of symbols for the geological map and approximate ages (Johnson et al., 2006). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Neogene, ca 25 Ma to present
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Pv	Vryheid Fm	Shales, sandstone, coal	Lower Permian, Middle Ecca
Pp	Pietermaritzburg Fm, Ecca Group, Karoo SG.	Shales, mudstones, sandstones, coal	Early Permian, ca 290 Ma

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3. The site for development is in the Jurassic dolerite that forms the steep hillside and the Vryheid Formation shales and sandstones that are present in the lower slopes. Dolerite does not preserve fossils. They Vryheid Formation potentially can preserve fossils of the *Glossopteris* flora, such as leaves, reproductive structures, root impressions, and other plant groups such as lycopods, sphenophytes and ferns (Plumstead, 1969; Anderson and Anderson, 1985). While coal seams were formed from compressed and heat altered peat (buried plant material), the coal is of little interest palaeontologically because no structures are visible. Associated with the coal seams are shale lenses and these more frequently preserve plant impressions. Shale outcrops may contain fossils but they are very friable and weather away rapidly. Very few vertebrates had evolved by this time and bones are hardly ever preserved together with plant fossils because they require different depositional conditions.

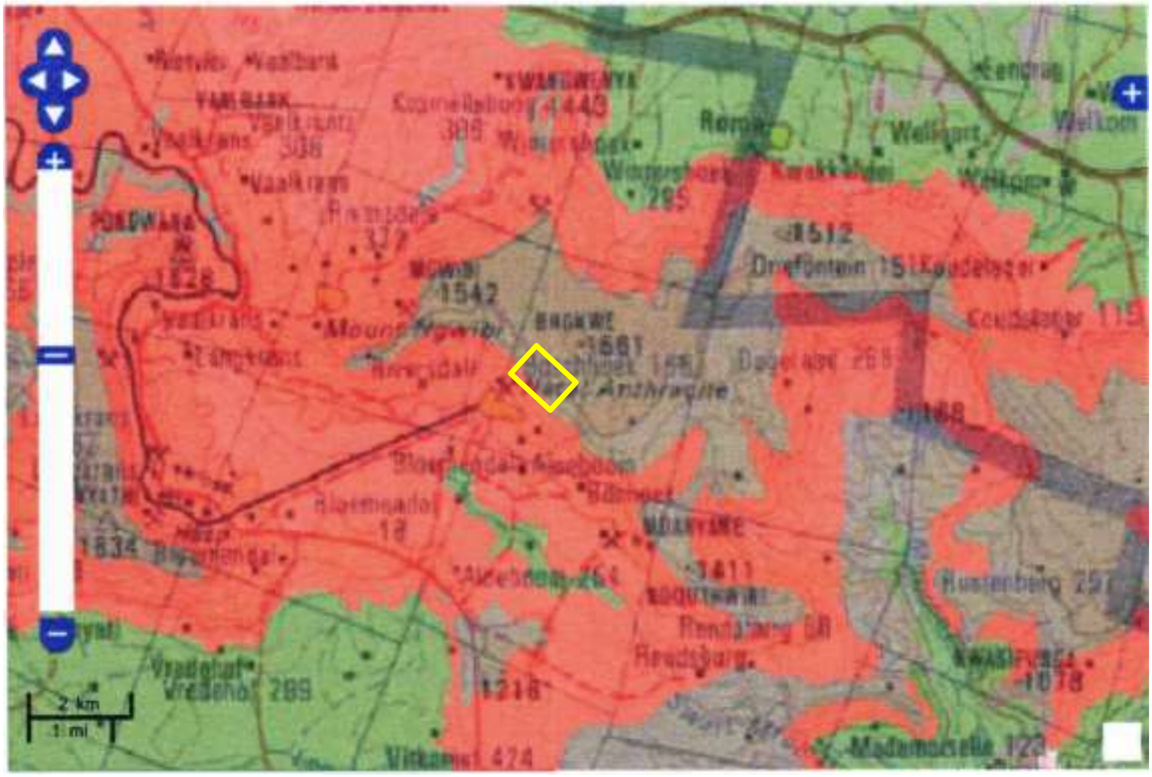


Figure 3: SAHRIS palaeosensitivity map for the Bhokwe Village site for the proposed upgrade of the sanitation system, shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as predominantly of zero palaeontological sensitivity (grey) and bordering on very highly sensitive (red). It should be noted, however, that the project site is within an established village, i.e. highly disturbed terrain, with the sewer oxidation ponds to be placed in ploughed fields that would have soils rather than shales or rocks.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table 3:

TABLE 3A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.

	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY **(of exposure to impacts)**	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 3B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Vryheid Fm plant fossils might occur in this region but the surface eis highly disturbed. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since the only possible fossils within the area would be fossil plants from the *Glossopteris* flora in the shales, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is extremely unlikely that any fossils would be found in the village or in the soils in the ploughed field where the oxidation ponds will be positioned Nonetheless a Fossil Chance Find Protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities are unlikely to impact upon the fossil heritage, even if preserved in the development footprint, because the village has already disturbed the soils and rocks, and the ploughed field indicates soils rather than rocks. The geological structures suggest that the rocks are the correct age to contain fossils but the dolerite does not preserve fossils. Since there is a small chance that fossils from the Vryheid Formation well below the surface may be disturbed, a Fossil Chance Find protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is very low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and do contain fossil plant, insect, invertebrate and vertebrate material. The dolerite does not preserve fossils. The sediments in the village are already very disturbed, and the ploughed field has a surface layer of soil. It is not known what lies below the soils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the dolerite, soils of the village or ploughed field (for the sewer oxidation tanks). There is a small chance that fossils may occur in the shales below the soils but this would only be discovered once excavations for the piping and tanks has commenced. Since there is a small chance that fossil plants of the *Glossopteris* flora may occur in the Vryheid Formation shales below the soils, a Fossil Chance Find Protocol should be added to the EMPr: if fossils are found once excavations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

7. References

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

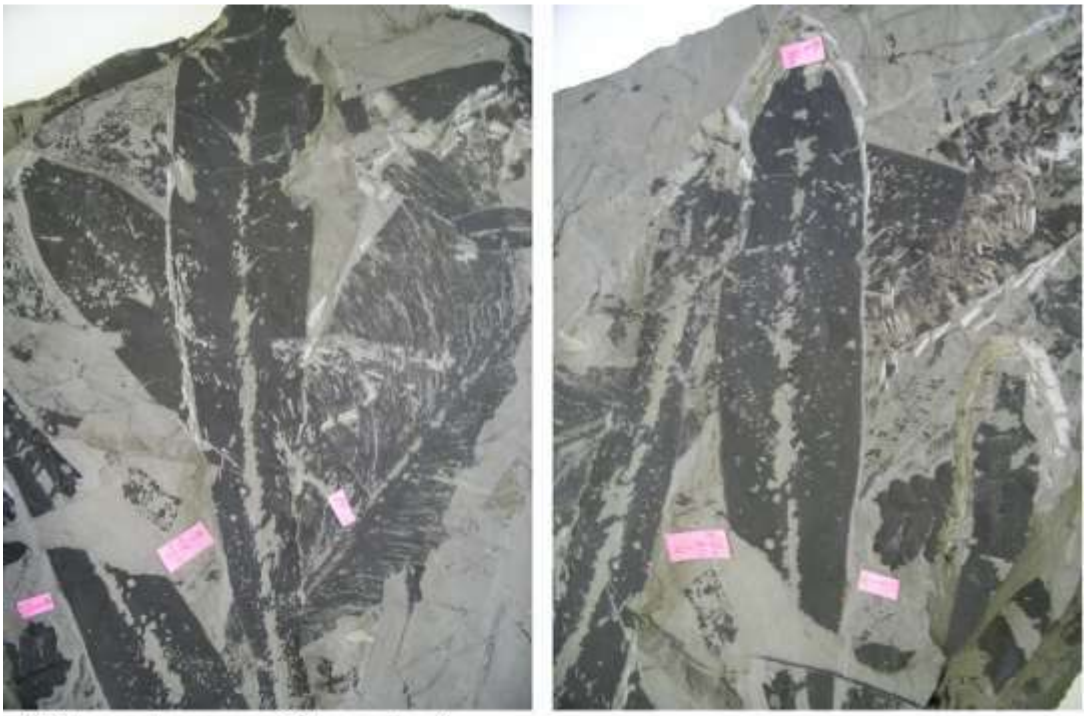
Plumstead, E.P., 1969. Three thousand million years of plant life in Africa. Geological Society of southern Africa, Annexure to Volume LXXII. 72pp + 25 plates.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations begin.

1. The following procedure is only required if fossils are seen on the surface and when excavations commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figures 4, 5). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officers then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then a site inspection by the palaeontologist will not be necessary.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of fossil plants from the Vryheid Formation



Wide and narrow Glossopteris leaves

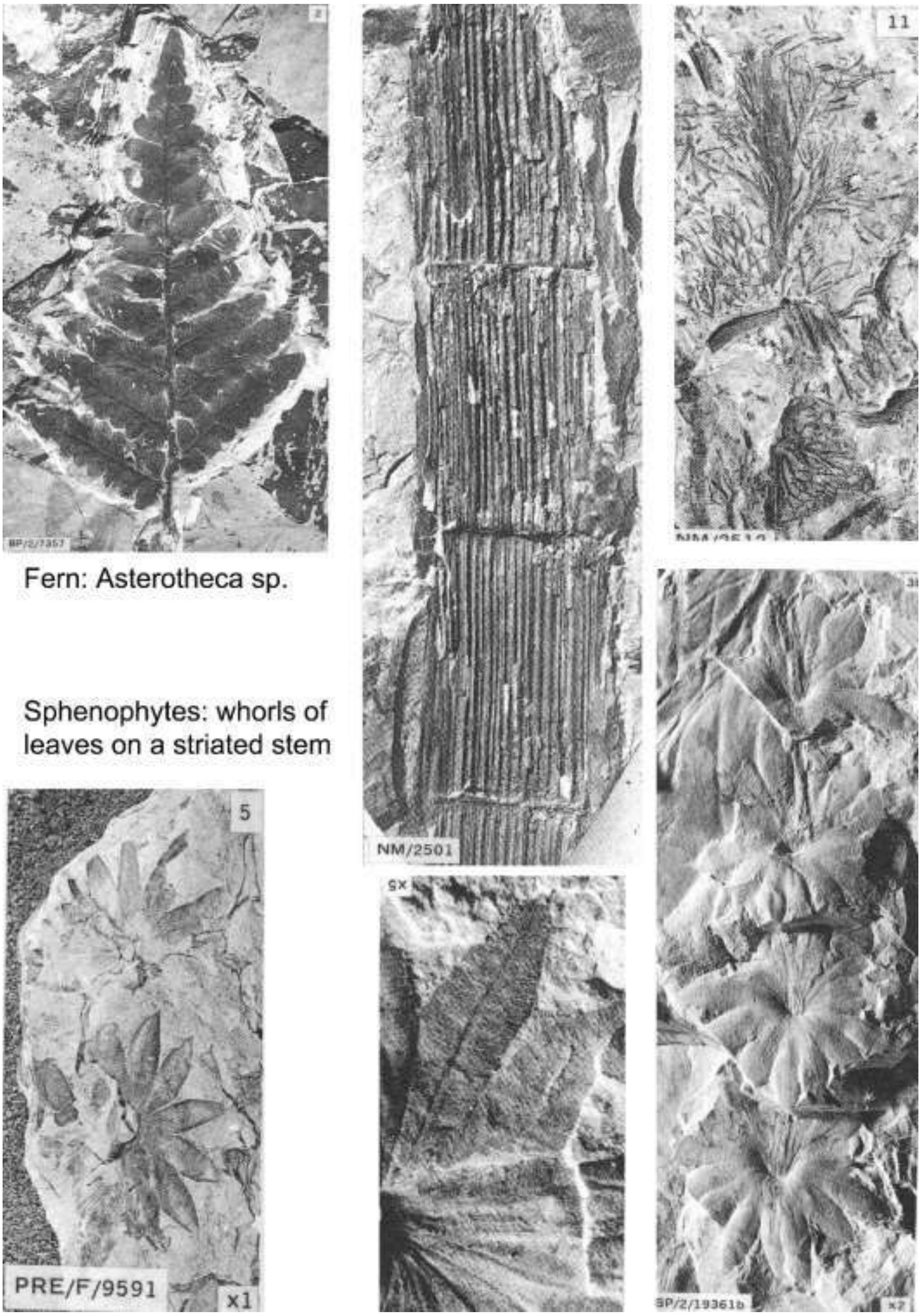
Narrow Glossopteris leaves

Lycopod stem with leaf abscission scars

Astertotheca (fern)

Hammanskraal fossil plants

Figure 4: examples of *Glossopteris* flora plants from the Vryheid Formation.



Fern: Asterotheca sp.

Sphenophytes: whorls of leaves on a striated stem

Figure 5: more plant impressions from the Vryheid Formation.

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
June 2019

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+

Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	6	1
Masters	8	1
PhD	10	3
Postdoctoral fellows	9	3

viii) Undergraduate teaching

Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing

Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics

- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO

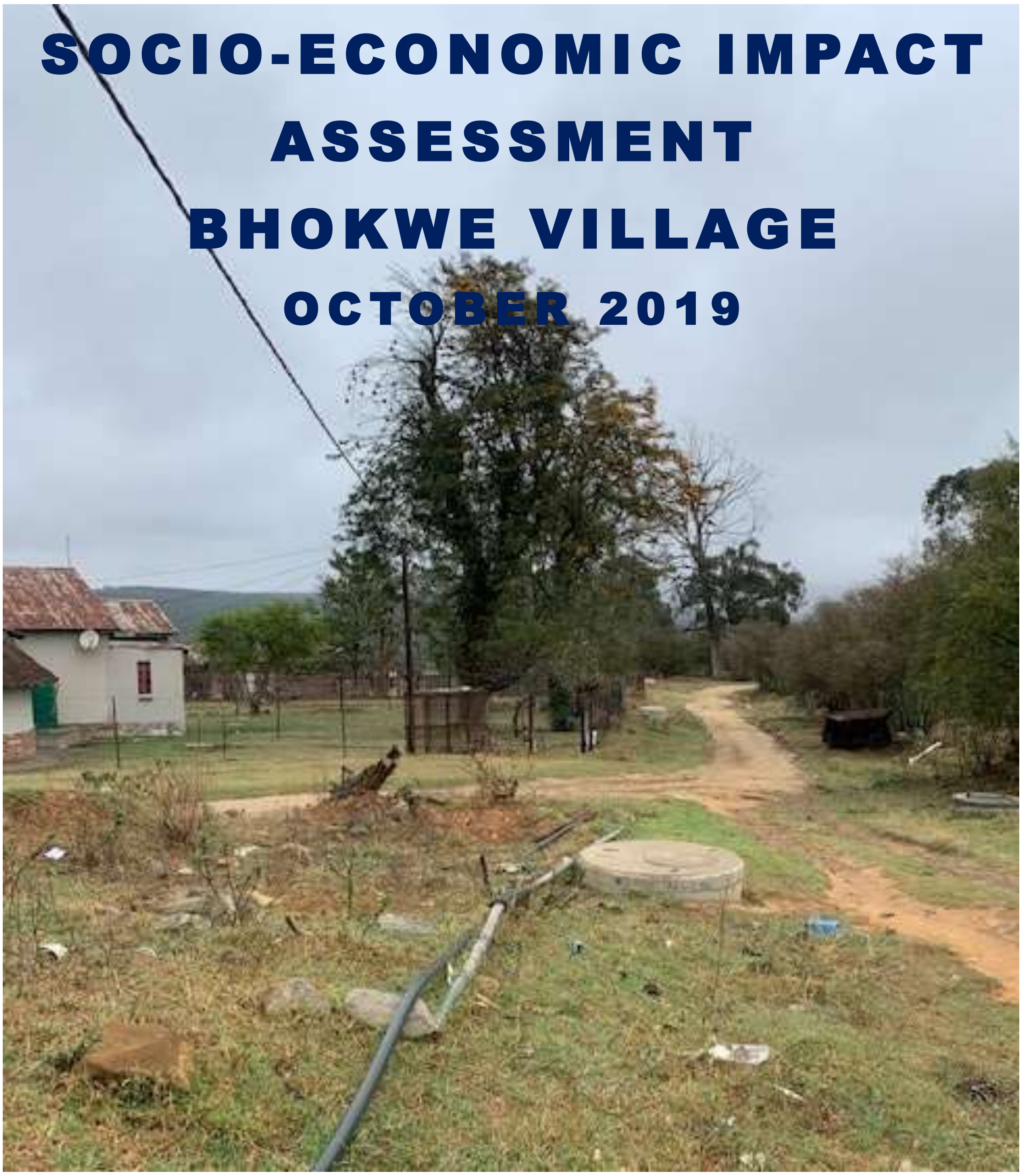
xi) Research Output

Publications by M K Bamford up to June 2019 peer-reviewed journals or scholarly books: over 130 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 26; Google scholar h index = 30;
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)

SOCIO-ECONOMIC IMPACT ASSESSMENT
BHOKWE VILLAGE
OCTOBER 2019



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LIST OF ACRONYMS

ALM	AbaQulusi Local Municipality
ANC	African National Congress
BID	Background Information Document
CLO	A Community Liaison Officer
COGTA	Cooperative Governance and Traditional Affairs
DM	District Municipality
EIA	Environmental Impact Assessment
HIV AIDS	Human Immunodeficiency Virus, Acquired Immunodeficiency Syndrome
IDP	Integrated Development Plan
IFP	Inkatha Freedom Party
KZN	KwaZulu-Natal
LM	Local Municipality
MDB	Municipal Demarcation Board
MISA	Municipal Infrastructure Support Agent
NEMA	National Environmental Management Act
SEIA	Socio-Economic Impact Assessment
SIA	Social Impact Assessment
TB	Tuberculosis
WWTP	Waste Water Treatment Plant
ZDM	Zululand District Municipality

1. INTRODUCTION

This Socio-Economic Impact Assessment (SIA) is prepared as part of an environmental authorisation, or Basic Assessment (BA), application for the construction of 1.8km of 160mm uPVC HD sewer reticulation, 110mm diameter uPVC housing connections, 165 meters of 200 mm diameter uPVC HD sewer fed piping, an oxidation sewer pond and evapotranspiration ponds and numerous 1250mm precast concrete ring manholes to manage sewer in the Bhokwe Village some 40km east of Vryhed. The BA is being carried out by 1World Consultants Ukuza Consulting, as independent environmental assessment practitioners, appointed by Ukuza Consulting. The SEIA, is a specialist report of the BA, and is carried out by Real Consulting.

Bhokwe Village lies in Ward 5 of AbaQulusi Local Municipality, KwaZulu-Natal. There is a degree of complicated history that has preceded the current intervention, and the site has political attention with the visit made by Minister of Cooperative Governance and Traditional Affairs (CoGTA), Dr Zweli Mkhize, on 04 May 2019, during which a commitment was made to resolve water and sanitation issues in both Bhokwe and nearby eMondlo.

This SEIA is presented, alongside other specialist studies, to contribute to the body of decision-support information designed to enable developers to manage developments for the best impact for all affected stakeholders, both locally and generally. This is done by surfacing issues, concerns, potentials and other possible outcomes that could be experienced by affected communities of any proposed intervention. This is done through engaging with stakeholders, and streaming any findings into the BA process. The aim is not only to address possible negative impacts, but also to maximise potential positive impacts. As a social process, it is primary to the SEIA investigation to build on a broader understanding through inviting local stakeholders to feed their local knowledge into the information gathering mechanism.

Being a prospective action, i.e. something that takes place prior to the execution of the development, it is not always clear to local stakeholders and to developers what the impacts will be, exactly. The SEIA is therefore inherently speculative in nature.

Also, as a social process, the SEIA is dialogic and information is inevitably traded. The researcher provides insight into the proposed development for the stakeholder, who trades his or her knowledge of local conditions, local concerns, and potential impacts.

The SEIA is based therefore on the following:

- A broader understanding of the context that would inform the *desirability* of the proposed intervention (in this case the sanitation infrastructure close to a residential village);
- A broader understanding of the areas around the site, from a socioeconomic, spatial, political and cultural perspective, at varying degrees of proximity to the development site.
- A detailed understanding of the proposed intervention itself.
- A detailed understanding of the proposed site of development.
- An investigation into the potential socioeconomic impacts of the development on the surrounding communities, addressing such issues as the following :
    - Quality of life impacts – on standard of living, sense of place, aesthetics and heritage, perception of belonging, security and liveability, and aspirations for the future.
    - Lifestyle impacts – on the way people live, behave and relate as communities.

- Cultural impacts – on shared customs, obligations, values, language, religious belief and other elements which make a social or ethnic group distinct.
- Community impacts – on infrastructure, services, voluntary organisations, activity networks and social cohesion.
- Health impacts – on mental, physical and social well-being, in general terms.

Purpose of this SEIA

This Socio-economic Impact Assessment (SIA) is a part of the mandatory Basic Assessment (BA) authorisation process to be submitted to the provincial Department of Economic Development, Tourism and Environmental Affairs (EDTEA), and focuses on the impacts on the receiving environment of the installation of sewer infrastructure, specifically including the areas surrounding the proposed intervention.

Methodology

The methodology proposed for this SEIA would be a combination of desktop study and stakeholder engagement with technical teams and the local community as well as other key stakeholders. The findings will be compiled into a report.

Real Consulting

Real Consulting specialises in local and regional economic development consulting, social consulting and social research. Real Consulting has prepared a number of SIAs and SEIAs over the years in the eThekwini area and beyond.

The SEIA Consultants

Luci Coelho and Dominic Mitchell are social and economic development consultants with Real Consulting, based in Hillcrest, Durban. They have both been engaged as specialists in a number of assignments related to social and economic research. Between them, they have worked on Socio-economic Impact Assessments for the King Shaka Airport and Dube Tradeport, Cornubia Development, Dudley Pringle, the Jozini Mall, The Point Development, the IIE Tertiary Campus in the Sibaya Precinct, and for the development of student accommodation at UniZulu.

Declaration of independence

I hereby declare that I am fully aware of my responsibilities in terms of the National Environmental Management Act (Act No 107 of 1998) EIA Regulations, 2014, and that I have no financial or other interest in the undertaking of the proposed activity other than the imbursement of consultant fees.

Name	Lucinda Jane Coelho	John Dominic Carlyle-Mitchell
Company	Real Consulting	Real Consulting
Date	01 October 2019	01 October 2019
Signature	ycoelho	

It has been noted above that an SEIA is a predictive exercise. For this reason, it is important that the contextual environment of the study area be well understood and that the likely impacts be carefully identified. To this mix it is important to be clear about the assessment criteria and the ratings used. The following tables, drawn from the work of Tony Barbour (Barbour, 2008) assist in understanding these assessment factors. There are three main criteria used, namely the **extent**, or spatial impact of the development; the **magnitude** of the impact; and the **duration** of the impact (see Table 1). Following this, the **probability** of the impact is noted (see Table 2). The **confidence** with which the impacts can be managed through access to information is described in Table 3. Finally it is useful to understand the degree to which an impact is **reversible** or not (see Table 4). In the impact on both nodes these criteria are combined into a single table.

While environmental impacts and others such as heritage impacts on human habitation areas are social in the way they are experienced, these impacts are presented as part of other studies that, along with the SEIA, provide a comprehensive understanding of impacts for all stakeholders to consider, and especially for authorities making the final decisions regarding the permission for the development to proceed.

2. SUMMARY OF THE SEWER INFRASTRUCTURE DEVELOPMENT PLANS

This chapter summarises the proposed sewer infrastructure development plans, which forms the basis of the Socio-economic Impact Assessment.

2.1 The current need

The proposed Bhokwe Sanitation Project is a continuation of a project that was started in mid-2016, when the Municipal Infrastructure Support Agent (MISA) appointed a service provider to design and rehabilitate sewer reticulation facilities in response to a protracted request from this community for help. According to Ukuza Consulting who have been appointed in 2019 to complete the job, "The contractor abandoned site approximately eighteen months ago … [and] has since been liquidated" (Govender, 2019, pg 5). Aside from the human rights aspect endorsed by the South African Constitution defining the right of all people to adequate water and sanitation, service delivery has become a highly politicised issue. This adds to the contextual pressure to ensure that this project is delivered well and timeously.

Abandoned materials from the unfinished job

There is a long-standing need for effective sanitation solutions in the area. The current facilities are a health hazard. The job was started but not completed. There are signs of abandoned infrastructure all over the village.

The efforts of the local community under the leadership of Councillors Ntombela and an active Ward Committee has brought attention not only to the need but the apparent "mismanagement" of the 2016 contract. This has added a socio-political imperative that the current project be done well and be done expeditiously. High profile politicians have pledged their support. The Bhokwe Sanitation Project is seen as being part of an intervention that also includes interventions at eMondlo. The Vryheid Herald published the following on 12 May 2019: "The eMondlo community is facing service delivery challenges due to an old waterborne sewer system, which is characterised by frequent pipe bursts, blockages, overflowing manholes, poor operations and maintenance of waste water treatment plant, and poor roads infrastructure," read a statement from the Ministry, at the time of Minister Zweli Mkhize's visit in May 2019. The article continues "The project will also serve the Enyathi/Bhokwe Villages. At present, an estimated 7.1km of water pipelines have been laid in Enyathi, 1.4km of water pipelines in Bhokwe, and excavations for the reservoir site are currently underway."

2.2 The proposed development plans

The Bhokwe Sanitation Project involves the upgrading of the existing sewer reticulation and construction of wastewater treatment works in the village of Bhokwe. While the scope of the proposed Project is not huge, it is speculated that it will be a R20million job in all, that will take approximately 12 months to construct with another one to two months to rehabilitate the sites post-construction.

According to the Background Information Document (BID), the project engineers propose, "the construction of 1.8 km of 160mmØ uPVC HD sewer reticulation, 110 mmØ uPVC housing connections, 165 meters of 200 mmØ uPVC HD sewer fed piping 90 m of 250mmØ uPVC sewer reticulation, an oxidation sewer and evapotranspiration ponds and numerous 1250mmØ precast concrete ring manholes, in Bhokwe Community, Ward 05, AbaQulusi Municipality, KwaZulu-Natal" (1 World, 2019). The sewer pond is described as having a "footprint … from edge of bank to edge of bank [of] 11 812m² or 1.18 ha. In order to cross the valley, an elevated section of steel pipe will be constructed that will be about 70m long. It should be noted that approximately 1.6m of the pipeline has already been laid." (Beater, 2019, pg 7). The oxidation ponds are located away from residential dwellings, based on an analysis of the failed 2016 implementation programme, and the best practice recommendation that the nature of such a pond may cause some nuisance odours, albeit much less than that of the earlier plan to use an anaerobic process. After various investigations and community consultations, the location of the WWTW was adjusted. The final approved location is indicted on the following figure.

Figure 1. Proposed layout of the Bhokwe Sanitation Project (Source: 1 World Consulting, 2019)

The current Bhokwe Sanitation Project is based on a thorough analysis of the 2016 project and has entailed significant changes due to professional recommendations based on a detailed critique of the incomplete 2016 job.

In summary the following criticisms[1] and recommendations were made of the 2016 project which was started and then abandoned at varying degrees of completion. These have informed the new design. The list is not exhaustive at all and is presented as an indication that the social impacts of the 2016 design would have been deleterious, and that these have been addressed and minimised in the new proposed design.

---

[1] The content has been drawn from the engineering report carried out by Zai Consultants

Table 1. Summary critique of 2016 design and proposed recommendations of 2019 design

2016 Design	**2019 Design**
The overall design was deemed to be flawed in multiple ways including that aspects are unclear and often not to industry. The coordinate system, benchmarks and reticulation setting out is not shown. Some pipes are laid too flat hampering necessary self-cleansing. Type 'b' benching where pipe runs change grade and direction are not shown. The pipe bridge is laid too flat. The corrosion specification is inadequate.	New designs will address all of these issues.
A critique of the reticulation infrastructure was that there were many faults not only with the transfer of design into implementation but with calculations such as peak flows, and recommended pipe sizes.	The use of 160mm pipes laid at minimum grade will be sufficient to accommodate shortcomings.
The anaerobic waste water treatment ponds were inappropriate for the scale and location, and would have resulted in extensive odour nuisance	Oxidation ponds, located away from residential areas based on CSIR guidelines
Facultative and maturation ponds are unusually deep and it is unlikely that there will be good oxygen transfer at lower depths leading to malfunction	shallow rock on the western edge so shallower ponds would be more desirable
Size and capacity constraints allowed no real scope for increased usage of ponds as population densities increase	Proposed WWTW is in the order of three times what is necessary (factoring in a growth rate of 1%)
Inadequate systems for effluent management	Treated effluent from final tertiary pond to be discharged via a channel with openings onto the existing bottom terrace where it will soak into the ground. Any nutrients will be used by the existing grass. Some treated effluent will be lost through evapotranspiration.
Inadequate systems for stormwater management	Proposed system designed to allow for berm redirection of water, as well as create an allowance to accommodate the same 15% infiltration.
Critique of work carried out before the contactor "abandoned site" revealed: - Approximately 2200m of pipeline was designed. 1386m (±63%) of the original design was installed leaving 814m not installed. - 39 Manholes were designed. 26No (±67%) of the manholes were installed leaving 13No manholes not installed. - Of the 1386m of installed pipework, 520m passed and 866m failed. - 222m did not pass the pressure test. - 644m did not pass the mirror test i.e. not laid in a straight line or was laid too flat and	To be sorted: - Repair and install where incomplete. - Repair and install where incomplete. - Repair, replace and install where incomplete. - Repair and install where incomplete. Leak(s) will have to be located and repaired. - Will have to be uplifted and re-laid.

Aside from the design aspects, MISA commissioned a quality assessment of work carried out to date by the 2016 contractors. This was done by Ukuza Consulting.

A summary is presented in the following table[2]:

Table 2. Summary critique of 2016 design and proposed recommendations of 2019 design

2016 work carried out	Recommendations for 2019 contract
Pipework analysis showed that of 23 identified stretches: - 20 were completed - 1 incomplete - 2 not done at all - 25 manholes laid - Of 20 pipes laid and pressure tested, 9 failed. - Of 20 pipes laid and tested for straightness and alignment, 6 failed.	Completion required to SANS 1200 specifications
Construction of the manholes not done in accordance to the SANS 1200 specifications. Benching failed quality checks. Instances of no waterproofing noted	Completion required to SANS 1200 specifications

The following tables show the proposed scope of work for the new contract.

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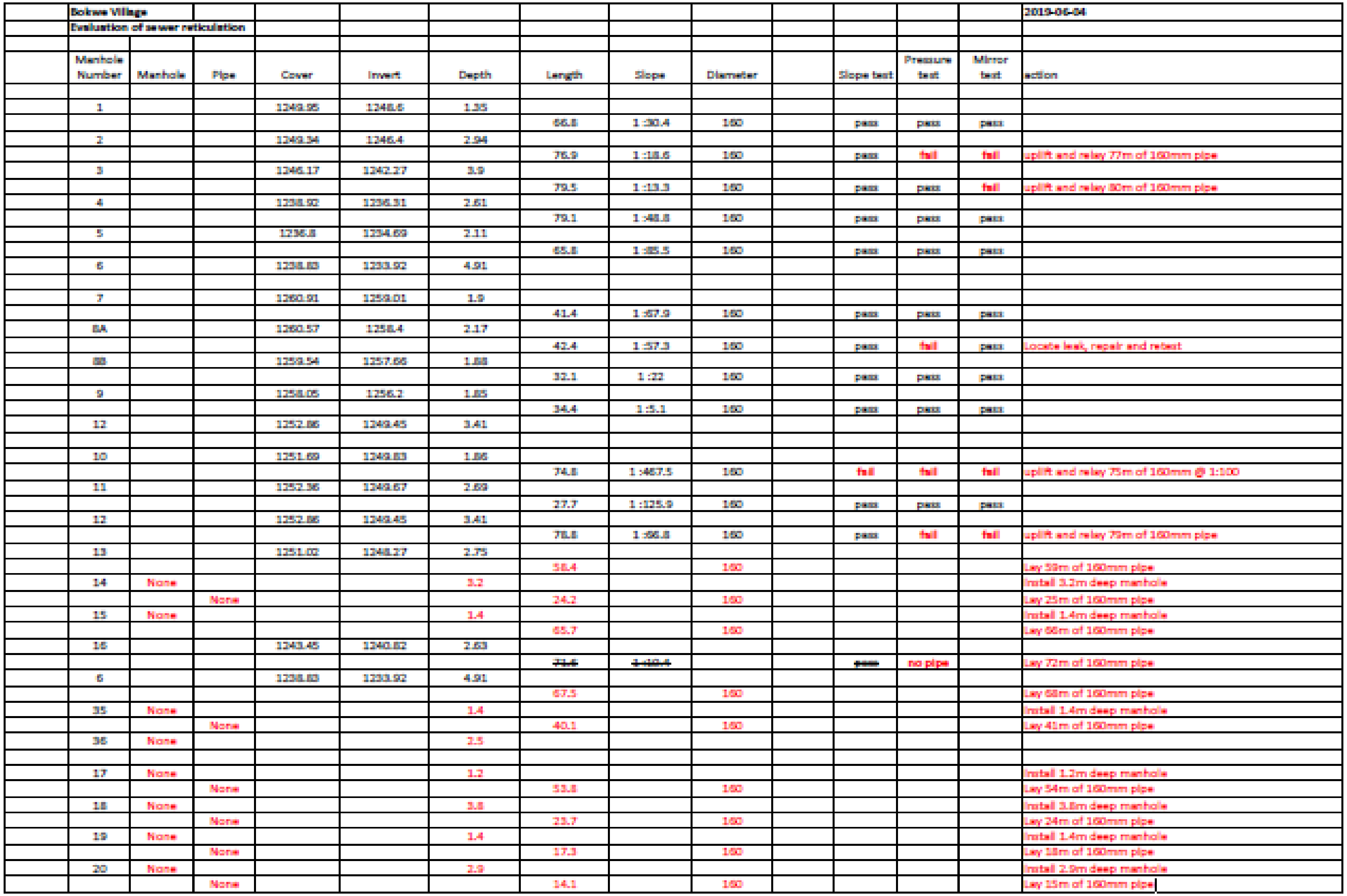
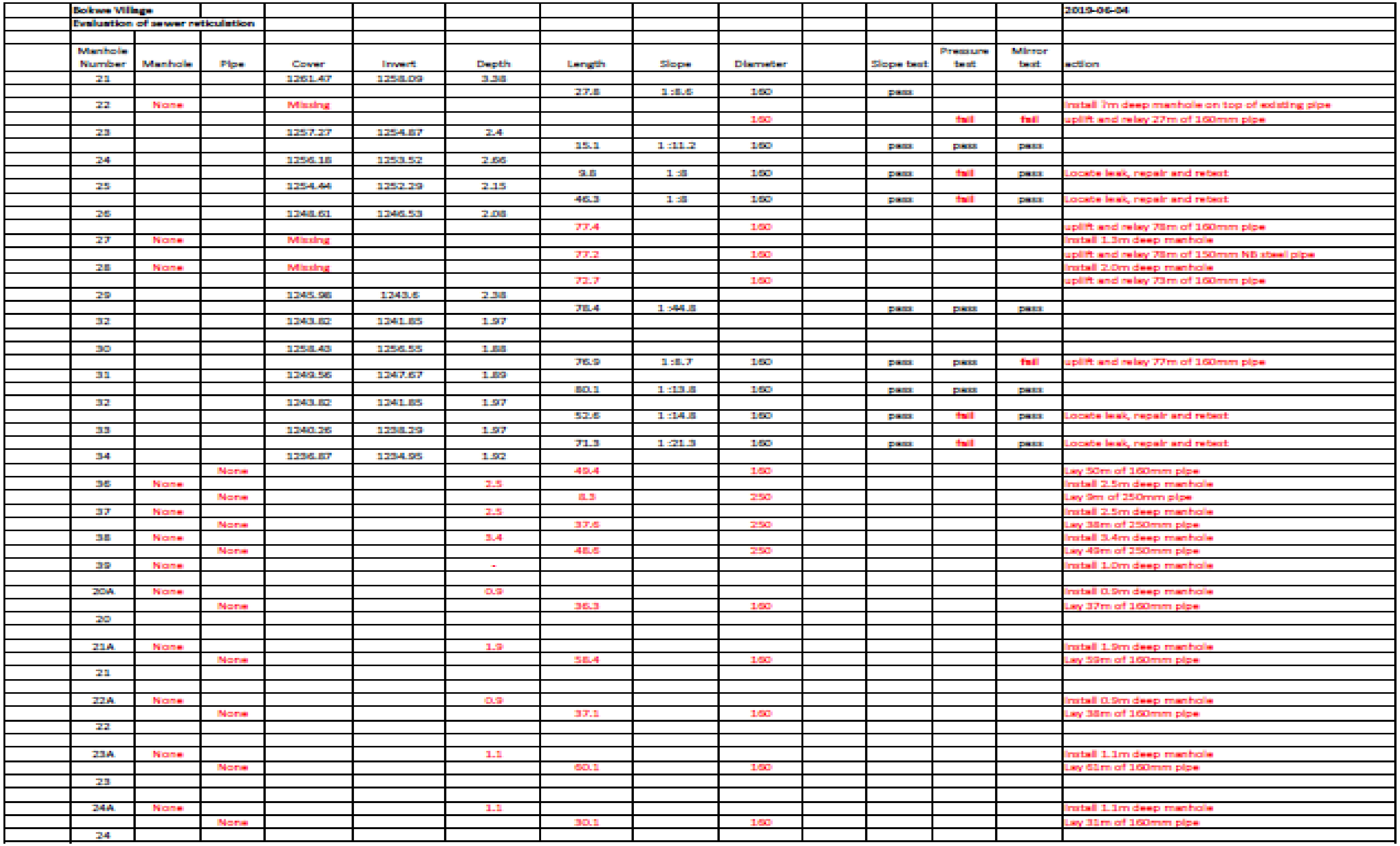
[2] The content has been drawn from the report carried out by Ukuza Consultants

Table 3 Scope of work for final contract based on assessment of 2016 contract



	Bokwe Village													2019-06-04
	Evaluation of sewer reticulation													
	Manhole Number	Manhole	Pipe	Cover	Invert	Depth	Length	Slope	Diameter		Slope test	Pressure test	Mirror test	action
	1			1249.95	1248.6	1.35								
							66.8	1 :30.4	160		pass	pass	pass	
	2			1249.34	1246.4	2.94								
							76.9	1 :18.6	160		pass	fail	fail	uplift and relay 77m of 160mm pipe
	3			1246.17	1242.27	3.9								
							79.5	1 :13.3	160		pass	pass	fail	uplift and relay 80m of 160mm pipe
	4			1238.92	1236.31	2.61								
							79.1	1 :48.8	160		pass	pass	pass	
	5			1236.8	1234.69	2.11								
							65.8	1 :85.5	160		pass	pass	pass	
	6			1238.83	1233.92	4.91								
	7			1260.91	1259.01	1.9								
							41.4	1 :67.9	160		pass	pass	pass	
	8A			1260.57	1258.4	2.17								
							42.4	1 :57.3	160		pass	fail	pass	Locate leak, repair and retest
	8B			1259.54	1257.66	1.88								
							32.1	1 :22	160		pass	pass	pass	
	9			1258.05	1256.2	1.85								
							34.4	1 :5.1	160		pass	pass	pass	
	12			1252.86	1249.45	3.41								
	10			1251.69	1249.83	1.86								
							74.8	1 :467.5	160		fail	fail	fail	uplift and relay 75m of 160mm @ 1:100
	11			1252.36	1249.67	2.69								
							27.7	1 :125.9	160		pass	pass	pass	
	12			1252.86	1249.45	3.41								
							78.8	1 :66.8	160		pass	fail	fail	uplift and relay 79m of 160mm pipe
	13			1251.02	1248.27	2.75								
							58.4		160					Lay 59m of 160mm pipe
	14	None				3.2								Install 3.2m deep manhole
			None				24.2		160					Lay 25m of 160mm pipe
	15	None				1.4								Install 1.4m deep manhole
							65.7		160					Lay 66m of 160mm pipe
	16			1243.45	1240.82	2.63								
							~~71.6~~	~~1 :40.4~~			~~pass~~	no pipe		Lay 72m of 160mm pipe
	6			1238.83	1233.92	4.91								
							67.5		160					Lay 68m of 160mm pipe
	35	None				1.4								Install 1.4m deep manhole
			None				40.1		160					Lay 41m of 160mm pipe
	36	None				2.5								
	17	None				1.2								Install 1.2m deep manhole
			None				53.8		160					Lay 54m of 160mm pipe
	18	None				3.8								Install 3.8m deep manhole
			None				23.7		160					Lay 24m of 160mm pipe
	19	None				1.4								Install 1.4m deep manhole
			None				17.3		160					Lay 18m of 160mm pipe
	20	None				2.9								Install 2.9m deep manhole
			None				14.1		160					Lay 15m of 160mm pipe

Table 4 Scope of work (continued) for final contract based on assessment of 2016 contract



	Bokwe Village													2019-06-04
	Evaluation of sewer reticulation													
	Manhole Number	Manhole	Pipe	Cover	Invert	Depth	Length	Slope	Diameter		Slope test	Pressure test	Mirror test	action
	21			1261.47	1258.09	3.38								
							27.8	1 :8.6	160		pass			
	22	None		Missing										Install 7m deep manhole on top of existing pipe
									160			fail	fail	uplift and relay 27m of 160mm pipe
	23			1257.27	1254.87	2.4								
							15.1	1 :11.2	160		pass	pass	pass	
	24			1256.18	1253.52	2.66								
							9.8	1 :8	160		pass	fail	pass	Locate leak, repair and retest
	25			1254.44	1252.29	2.15								
							46.3	1 :8	160		pass	fail	pass	Locate leak, repair and retest
	26			1248.61	1246.53	2.08								
							77.4		160					uplift and relay 78m of 160mm pipe
	27	None		Missing										Install 1.3m deep manhole
							77.2		160					uplift and relay 78m of 150mm NB steel pipe
	28	None		Missing										Install 2.0m deep manhole
							72.7		160					uplift and relay 73m of 160mm pipe
	29			1245.98	1243.6	2.38								
							78.4	1 :44.8			pass	pass	pass	
	32			1243.82	1241.85	1.97								
	30			1258.43	1256.55	1.88								
							76.9	1 :8.7	160		pass	pass	fail	uplift and relay 77m of 160mm pipe
	31			1249.56	1247.67	1.89								
							80.1	1 :13.8	160		pass	pass	pass	
	32			1243.82	1241.85	1.97								
							52.6	1 :14.8	160		pass	fail	pass	Locate leak, repair and retest
	33			1240.26	1238.29	1.97								
							71.3	1 :21.3	160		pass	fail	pass	Locate leak, repair and retest
	34			1236.87	1234.95	1.92								
			None				49.4		160					Lay 50m of 160mm pipe
	36	None				2.5								Install 2.5m deep manhole
			None				8.3		250					Lay 9m of 250mm pipe
	37	None				2.5								Install 2.5m deep manhole
			None				37.6		250					Lay 38m of 250mm pipe
	38	None				3.4								Install 3.4m deep manhole
			None				48.6		250					Lay 49m of 250mm pipe
	39	None				-								Install 1.0m deep manhole
	20A	None				0.9								Install 0.9m deep manhole
			None				36.3		160					Lay 37m of 160mm pipe
	20													
	21A	None				1.9								Install 1.9m deep manhole
			None				58.4		160					Lay 59m of 160mm pipe
	21													
	22A	None				0.9								Install 0.9m deep manhole
			None				37.1		160					Lay 38m of 160mm pipe
	22													
	23A	None				1.1								Install 1.1m deep manhole
			None				60.1		160					Lay 61m of 160mm pipe
	23													
	24A	None				1.1								Install 1.1m deep manhole
			None				30.1		160					Lay 31m of 160mm pipe
	24													

3. CONTEXTUAL ISSUES: THE RECEIVING AREA – BHOKWE VILLAGE, WARD 5, ABAQULUSI LOCAL MUNICIPALITY, ZULULAND DISTRICT MUNICIPALITY, KWAZULU-NATAL

The proposed Bhokwe Sanitation Project is planned to be implemented in the Bhokwe Village, a small settlement located in Ward 5 of the AbaQulusi Local Municipality (ABM). ABM is one of five local municipalities in the Zululand District Municipality.

This chapter provides contextual information about the locality, so as to provide greater understanding of the socio-economic impacts of the Bhokwe Sanitation Project in the context of a underserviced rural village in a somewhat marginalised local municipality. A project of the scale and scope of the Bhokwe Sanitation Project has very different implications depending on the location and context. /

3.1 Zululand District Municipality

Located in the northern region of the KwaZulu-Natal province, the Zululand District Municipality (ZDM) is one of 10 District Municipalities in. It is made up of five Local Municipalities, namely eDumbe (KZ261), uPhongolo (KZ262), AbaQulusi (KZ263) and Nongoma (KZ265). Geopolitically, the ZDM is largely rural, encompasses approximately 14 810 km², over half of which is under the jurisdiction of traditional authority (Ingonyama Trust). The remaining territory is divided between a few urban centres, commercially-owned farms and conservation areas. Vryheid, located in AbaQulusi Local Municipality, is the biggest commercial urban node, with the political centre in Ulundi.

The ZDM has demonstrated limited economic growth, and according to their Integrated Development Plan (IDP), the ZDM "recorded the slowest GVA growth during the period under review" (2012 – 2025), with figures 25 times less than that of eThekwini Municipality" (ALM IDP 2019-2020). Of the five local municipalities, AbaQulusi has the highest economic growth, or GVA, albeit limited at R5 532 000 as recorded in 2015, almost double that of the next highest performer being Ulundi at R2 795 000 recorded in the same year.

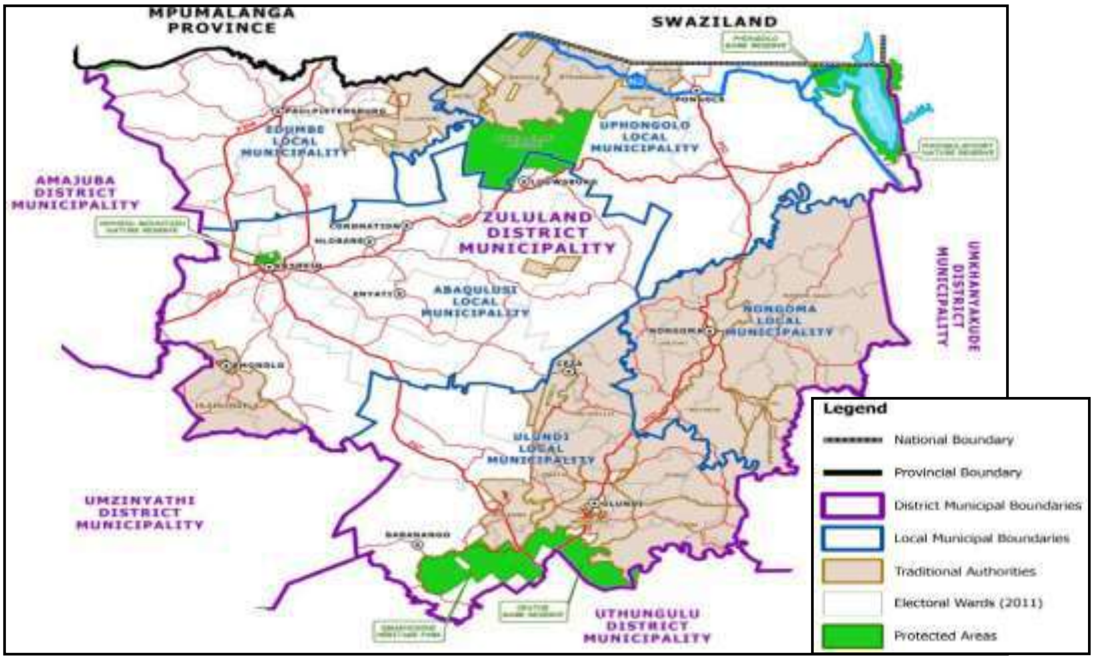


Figure 2. Map of Zuluand DM (Source: 2019-20 Final IDP Review)

3.2 AbaQulusi Local Municipality

AbaQulusi Local Municipality is one of five local municipalities that make up the Zululand District Municipality. The other four local municipalities are eDumbe, uPhongolo, Nongoma and Ulundi. While Ulundi has administrative significance, AbaQulusi is the major economic hub of Zululand DM, and is geophysically central to the area it borders all the other LMs of the District. Vryheid is the main urban centre, which town is strategically located on the route between Johannesburg and Richards Bay and Durban.

Despite the centrality of AbaQulusi LM to the Zululand DM, this municipality has been fraught with multiple problems since before 2013. It has faced extreme governance and administrative problems, as well as serious drought impacts which have further distressed its capacity for effective service delivery on any level.

In 2013 ALM was first placed under administration. Provincial government established the AbaQulusi Local Economic Development Initiative (ALEDI), which was designed to assist the municipality to reconfigure its administration, its functionality as well as assist with economic revitalisation through a large Gijima-managed funding mechanism. While there were some real gains from this interventions, the political and governance issues were not resolved, and on the 4th of March 2019, "Cooperative Governance and Traditional Affairs (Cogta) Nomusa Dube-Ncube today announced that the Provincial Executive Council has taken decisive action against widespread allegations of mismanagement and nepotism at Abaqulusi local municipality by placing it under administration in terms of section 139(1) (b) of the Constitution… The drastic decision by the Provincial Executive Council has been triggered by perennial service delivery, financial management and governance deficiencies that are threatening to collapse the AbaQulusi Municipality." (KZNCOGTA, 2019)

In addition to the challenges referred to by COGTA in making their decision, it was noted that AbaQulusi was in debt to Eskom for the amount of R48.7-million, as recorded in February 2019.

According to the 2016 Community Census, the population of AbaQulusi LM is 243 795 people living on 4320.5km² of land, with an average of 56.4 people per km² (Wazimap, 2019).

The following map shows AbaQulusi in relation to the other LMs that make up Zululand DM

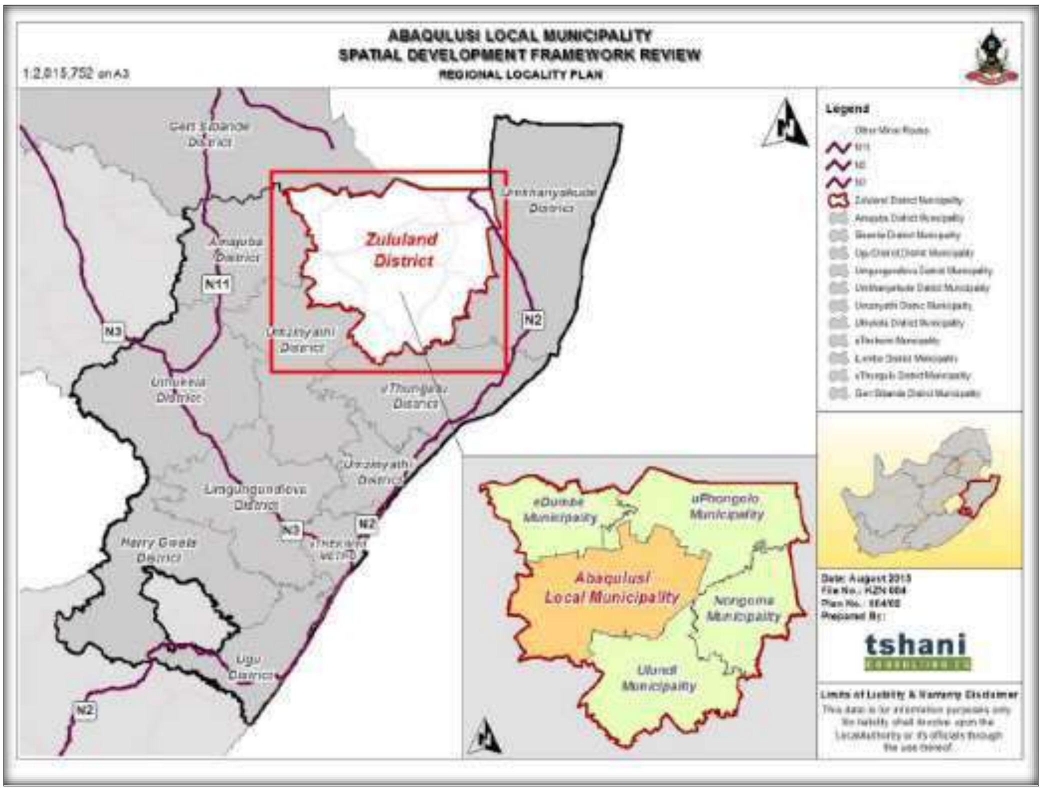


Figure 3. Map of AbaQulusi LM In relation to ZDM (Source: 2019-20 Final IDP Review)

In the following map, also of ALM, the major towns and roads are indicated. It is noted that ALM has one major and strategically located town, Vryheid, as well as two other smaller urban centres, Louwsburg and eMondlo. It is clear from both maps, that the area is sparsely populated with 56.5 households per square kilometre (Wazimap, 2019).

The economy is largely dominated by agriculture and mining. Since the closure of several mines, agriculture has taken the lead in driving the local economy. In respect of agricultural potential, the IDP reports the following: "The majority of the municipality has good to moderate agricultural potential. High agricultural land occupies 13% of the total land area of approximately 41 8461 ha. About 30% of the land has minimal agricultural value" (ALM IDM 2019-2020, pg 60). It should be noted that although there is good potential for extensive agriculture in ALM, this has been undermined in the past 30 years by several factors from climate change and changes rainfall and temperature patterns to land reform and insufficient support to new land owners.

The situation with mining may change and the IDP reflects plans to reactivate some of the coal mines, especially around Vryheid, as the pressure on coal provision increases to meet national energy requirements.

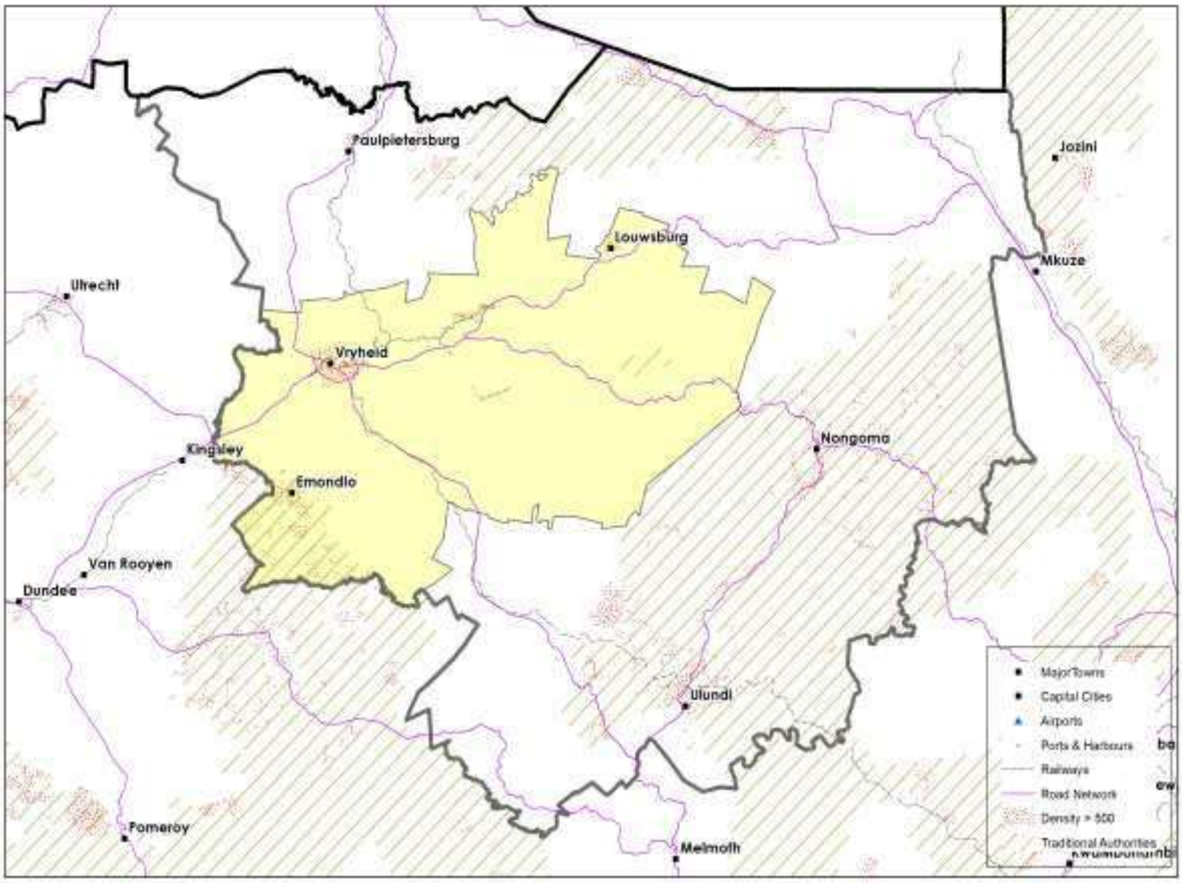


Figure 4. Map of AbaQulusi LM In relation to ZDM (Source: MDB Municipal Capacity Assessment 2018)

3.3 AbaQulusi Local Municipality, Ward 5

Ward 5 is one of 22 municipal wards and includes six Traditional Authorities namely, Khambi, Othaka, Hlahlindlela, Mpangisweni, Mathongeni, Msiyane Traditional Councils. Bhokwe village is in Ward 5. The ward is under the political leadership of Councillor Ntombela, who is aligned to the African National Congress.

The following series of maps provide insight into Ward 5 in relation to various aspects, including relational to areas around, to primary economic nodes and population density.

Name: Mr B Ntombela
Designation: Ward Councillor
Political Representation: ANC
Ward: 5

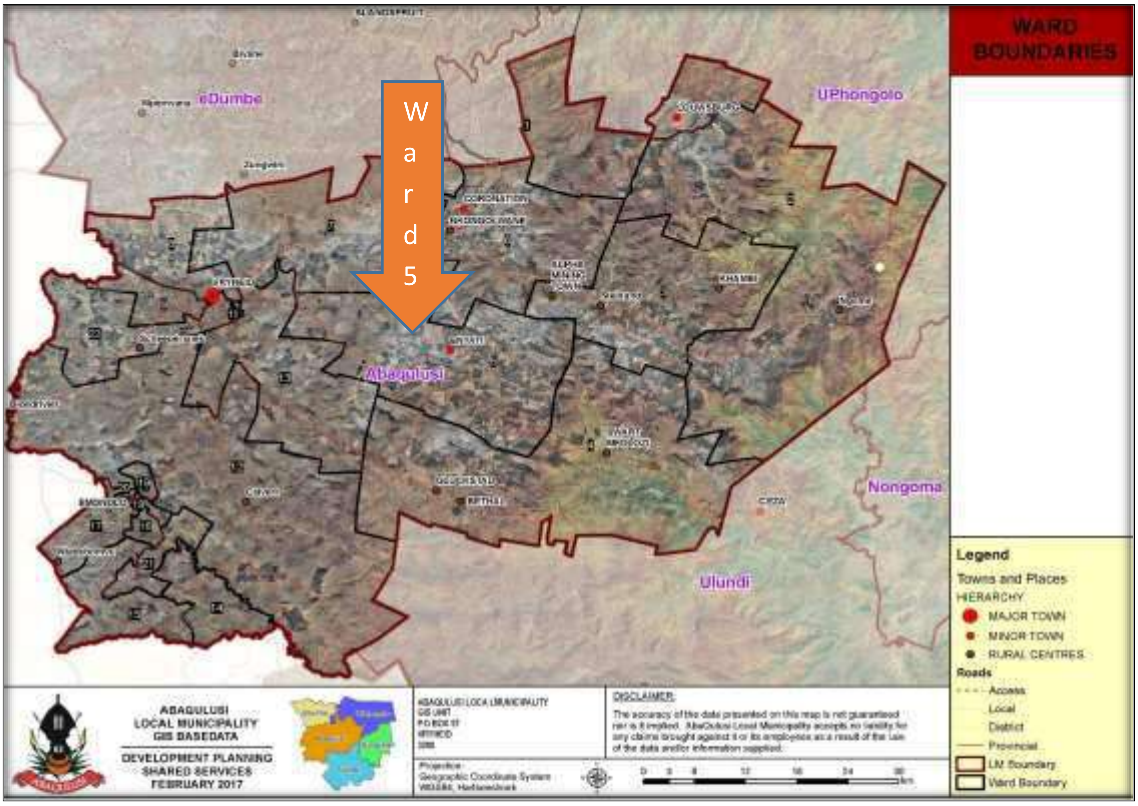


Figure 5. Map of Ward 5 in AbaQulusi LM (Source: IDP, 2019-2020)

A closer view of the ward is shown in the following map.

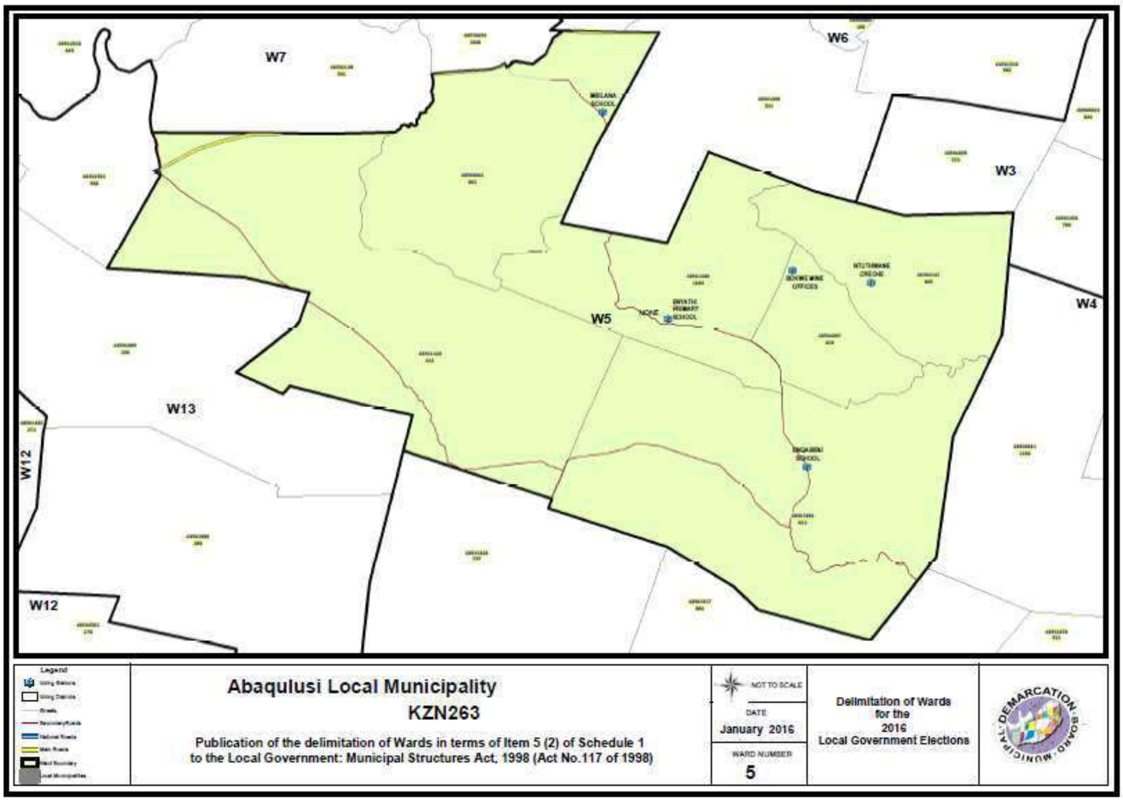


Figure 6. Map of Ward 5 in AbaQulusi LM (Source: MDB, 2016)

Ward 5 has a medium population density of approximately 10 009 – 10 944, as per the next map.

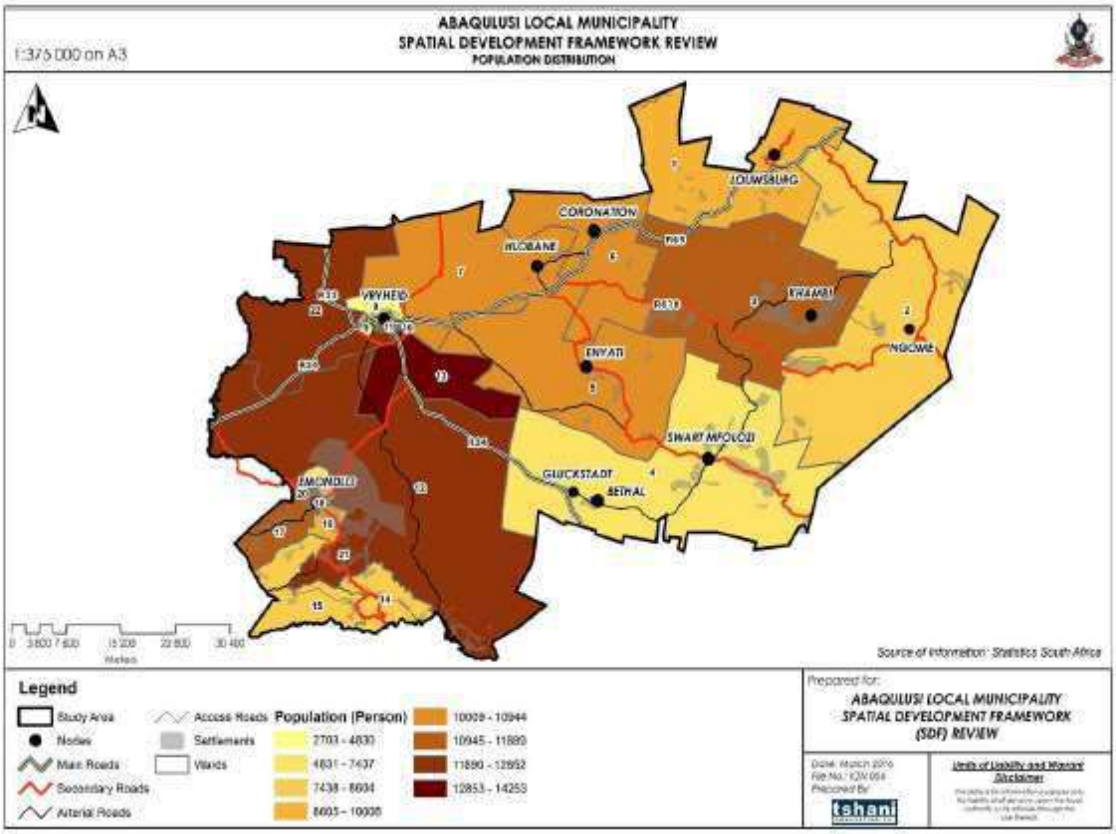
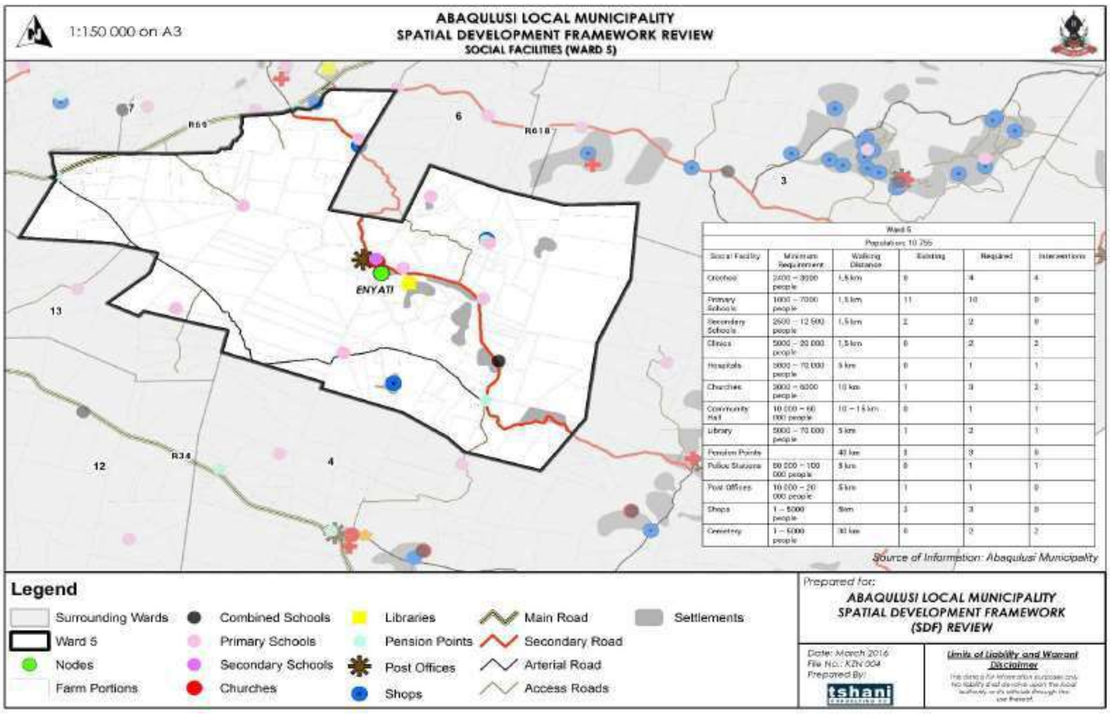


Figure 7. Population distribution by ward in ALM (Source: ALM IDP, 2019-2020

The ALM IDP, 2019-2020 identifies the following social facilities for Ward 5.



Ward 5

Population: 10 755

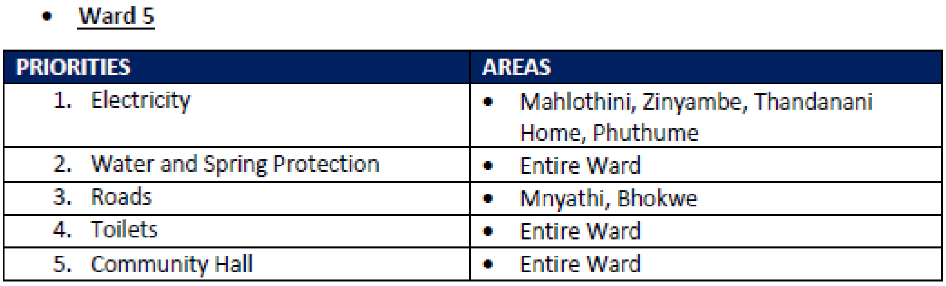
Social Facility	Minimum Requirement	Walking Distance	Existing	Required	Interventions
Creches	2400 – 3000 people	1,5 km	0	4	4
Primary Schools	1600 – 7000 people	1,5 km	11	10	0
Secondary Schools	2500 – 12 500 people	1,5 km	2	2	0
Clinics	5000 – 20 000 people	1,5 km	0	2	2
Hospitals	5000 – 70 000 people	5 km	0	1	1
Churches	3000 – 6000 people	10 km	1	3	2
Community Hall	10 000 – 60 000 people	10 – 15 km	0	1	1
Library	5000 – 70 000 people	5 km	1	2	1
Pension Points		40 km	3	3	0
Police Stations	60 000 – 100 000 people	5 km	0	1	1
Post Offices	10 000 – 20 000 people	5 km	1	1	0
Shops	1 – 5000 people	5km	3	3	0
Cemetery	1 – 5000 people	30 km	0	2	2

Source of Information: Abaqulusi Municipality

Figure 8. Social facilities recorded in AL Spatial Development Plan

There is a sense in the local community that Ward 5 is low on the LM development priority. The IDP confirms this with almost limited plans for development in the area. The following table drawn from the IDP identifies the plans for Ward 5 (AbaQulusi Local Municipality IDP, 2019-2020, pg 189).

Table 5. Plans for Ward 5



- Ward 5

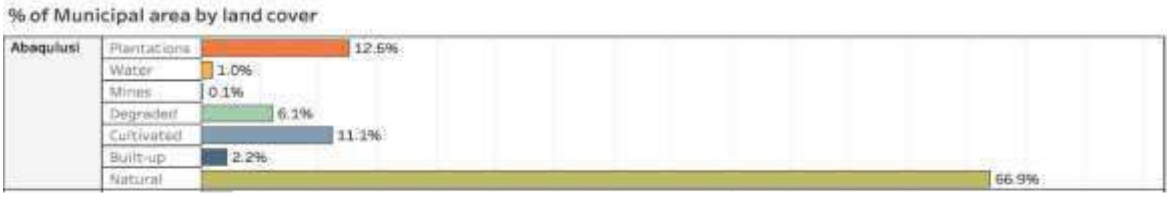
PRIORITIES	AREAS
1. Electricity	• Mahlothini, Zinyambe, Thandanani Home, Phuthume
2. Water and Spring Protection	• Entire Ward
3. Roads	• Mnyathi, Bhokwe
4. Toilets	• Entire Ward
5. Community Hall	• Entire Ward

3.4 Demographics of Zululand DM, AbaQulusi LM and Ward 5

A demographic study provides detail about the people living in a geographical area. The information provides powerful decision-support data, but importantly for the purposes of an SEIA, it assists to build an understanding of the context within which an intervention is taking place. While it is useful to examine the following table in detail, the information is provided as a reference. Attention will be drawn to specific indicators that are especially relevant to understanding the contextual factors related to the proposed Bhokwe Sanitation project.

The following table provides a comparative look at how the demographics of Ward 5 (within which Bhokwe Village is located) compare with the rest of the AbaQulusi LM and the Zululand DM. Attention is drawn to the fact that Bhokwe village a small settlement of approximately 150 households located in an undeveloped rural area. The information in the table is drawn from the 2011 census and the 2016 Household Survey. The accuracy is approximate but valid given that the data could be as much as 8 years old. Having made this disclaimer, the profile of the study area, namely Bhokwe Village is not likely to be much changed.

In general, the picture painted by the following data is unsurprising. The District is poor and undeveloped and largely rural. The area has been the site of extensive land claims, and much of the land is under the jurisdiction of the Ingonyama Trust. According to a study prepared by the Municipal Demarcation Board in 2018, there are 478 302 land claims in ALM (MDB, 2019, pg 19). There are large swathes of land that is not under production. The same Municipal Demarcation Board presents the following table in relation to the way in which the natural resources of ALM are used (MDB, 2019, pg 23):



The municipalities of the district seem unable to leverage development of any real kind, therefore the conditions of the residents of the whole district are limited and confined by lack of opportunity. This is borne out by the demographic data in the following table.

Table 6. Demographic profile of Zululand DM, AbaQulusi LM and Ward 5

		Zululand District Municipality	AbaQulusi Local Municipality	Ward 5
DM / LM / Ward ID number		DC 26	KZ 263	52603005
Main town / area			Vryheid	Enyati Bhokwe village
Size km²		14 991.7 km²	4 320.5 km²	373.8 km²
Total population		892 310	243 795	7863
Nr of households		178 516	51 909	1 462
Nr of people / km²		59.8	56.4	21
Language - isiZulu %		95.4%	94%	86%
Age - median		18 years	19 years	18 years
Political behaviour – registered voters		388 048	98 010	5 214
Municipal elections voting		58.2%	56.3%	61.6%
Political behaviour – allegiances and voting	ANC	38%	46%	64%
	IFP	49%	42%	30%
	DA	9%	8%	2%
	EFF	2%	2%	2%
Education - completed Gr 12 or higher		67.4%	70.1%	20.8%
Education - some secondary		31%	34%	27%
Education - nil		12%	8%	26%
Children in school (5-17 years)		95.7%	94.5%	87%
Employed		18%	22.1%	9.4%
Formal sector		71%	73%	76%
Informal sector		19%	17%	23%
Unemployed and		13%	12%	14%
Not economically active		57%	57%	69%
Average p.a. HH income		R14 600	R14 600	R14 600
Home ownership - own or paying off		68.46%	63.3%	72.4%
Home rent		3%	9%	3%
Home ownership - informal settlements		5.2%	9%	0.1%
Women-headed households		53.8%	50.2%	50.7%
Access to electricity		14.8%	17.3%	15.4%
Access to water from regional or local service provider		42%	75.4%	15.4%
Access to water from river		26%	11%	35%
Access to water from borehole		11	8%	18%
Access to water from other sources		21%	17%	31.6%
Access to flush toilets		44%	36%	12%
Access to pit latrines		44%	40%	20%
No toilet facilities		8.2%	5.3%	48%
Access to refuse removal		17.8%	37.8%	4.4%

From the above demographic table, the following observations are pertinent:

- Zululand DM is made up of 5 LMs, all of which are under-developed and mostly rural in character.

- Most of the land is under traditional ownership within the jurisdiction of the Ingonyama Trust.
- AbaQulusi LM is described as the economic hub of ZDM, and it is under administration, a circumstance that has prevailed on and off since 2013. Part of this condition is that there ise widespread administrative mismanagement which has included service delivery in all respects.
- The population is fairly spread out both in the DM and the LM. In Ward 5, this is especially true, with only 21 people per square kilometre.
- The community of the whole area from DM to ward is very homogenous, with between 87% - 95% isiZulu speaking people.
- The population of the whole area from DM to ward is young, with a median age of 18 years old. This is an especially important factor as it indicates the majority grouping living in an area that will be affected by any development. It also indicates who is *not* residing in the area. There are a number of possible explanations for this predominantly young age cohort living in the area:
    - There is likely a high migration of older people out of the area, likely in search of employment. This is backed by the lack of local opportunities and the low level of development across all LMs of the DM, and especially in outlying rural areas such as Ward 5 of ALM. This is also an historical trend and pattern of rural-urban migrancy that has typified South Africa for the past 160 years.
    - Health issues, specifically HIV AIDS and Tuberculosis (TB). In 2015, there were 80725 deaths in ZDM from TB, and in 2016 as many as 730 329 people tested positive for HIV out of a population of 892 310. While not proven, it is likely that there are a disproportionate number of deaths of adults in the area.
- The DM, the LM and the ward are aligned to the African National Congress (ANC) with the Inkatha Freedom Party (IFP) a close second, although in Ward 5, there is a stronger allegiance to the ANC. The current Councillor has been in position for eight years, and appears to have strong support, and there is also a relatively higher voter turnout in Ward 5. The Bhokwe Sanitation Project is apparently the result of the championing by Councillor Ntombela and his Ward Committee, who approached the Municipal Infrastructure Support Agent (MISA) to step in after the project failed in 2016, and after it became clear that the ALM was unable to resolve the issue.
- The education data is also highly revealing of a state of socio-economic marginalisation. While the ZDM and ALM have figures that are comparable with the province and the country in relation to numbers of people who have Grade 12 or higher qualifications, the picture in Ward 5 tells a different story, albeit one that is common to remote rural areas throughout the land. Only 20.8% of Ward 5 residents have a Grade 12 or higher qualification as compared to ALM at 70% and ZDM at 67%. Similarly 26% of Ward 5 residents have no education at all. It is hoped that this statistic will change as the number of children from the ward who are in school now is as high as 87%.
- There is a high level of unemployment across the whole District. Only 18% of people throughout the five LMs of ZDM are employed. ALM fares slightly better at 22.1%, likely because the two biggest towns in the district are located within ALM. Like other rural outback, ward 5 has an employment figure of only 9.4%. How do people survive? Almost all households receive grants of one kind or another, and there is a degree of localised subsistence food gardening, according to Councillor Ntombela.

- The average household income is similar across the whole district, and is almost certainly derived from grants. This figure has been cited as being an average of R14 600 per annum.
- Especially relevant to this study is the profile in relation to access that people have to basic services, such as electricity, water and sanitation, and refuse removal. This is a key marker of development and social well-being.
    - The most fundamental right is the right to potable[3] water. According to the data in Table 1, there is a significant difference between access to supplied water between the three focus areas, the ZDM, ALM and Ward 5. The average for the ZDM is measured at 42%, the average for the ALM is much higher at 75.4% and the figure for Ward 5 is a low 15.4%. These statistics tell the story of urbanisation and service delivery. ALM has the biggest urban centres with the highest level of infrastructure provision *in the urban areas*. The same is not true for the outlying areas of ALM. Rural undeveloped Ward 5 has almost no infrastructure, not even jojo tanks. Most people (35% of the population) in Ward 5 collect their own water from rivers and communal boreholes. Aside from household uses for water, this issue is especially critical to the realisation of economic development in an area where agriculture is the obvious resource to operationalize. It is the expressed view of the local residents that the reason they do not exploit the excellent agricultural potential of the area is because of challenges accessing water. This is despite the fact that there are big rivers in the area and a higher and more predictable rainfall than almost any other area in ALM. The issue is not water availability. The issue is the infrastructure to manage water in such a way as to put it to valuable use.
    - Like water, sanitation services are a clear indicator of poverty and underdevelopment, and have become highly profiled as a human rights issue and a political measure of service delivery in South Africa. 12% of people in Ward 5 have access to flush toilets, while 48% have no facilities at all, not even pit latrines. This issue is central to this SEIA investigation where the project in question exactly delivers on supporting the provision of basic services to all communities, including marginalised rural communities. The efforts made by the Bhokwe community and their political leadership are not only an issue of service deliver provision, which was the case four years ago. It has now become escalated into service provision + broken promises + making good on promises. The fact that

Water provisioning in Bhokwe Village (Gift of the

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[3] According to the municipal Demarcation Board, "Potable water refers to water that is treated or confirmed safe for human consumption. A potable water supply service refers to a service that delivers potable water through a pipe or similar duct that is connected to a network, the supply of which is relatively continuous given that it includes a deposit built for its storage. If a house or group of houses has a 'mother' pipe connected either provisionally or permanently; it shall be considered to have access to potable water." (MDB, 2018, pg 24)

MISA has stepped in to remediate the failed mission of 2016, is testimony to the commitment of government to provide services. The provision of effective sanitation solutions including grey water management systems, is not only about improving the wellbeing of residents in an area. It is also about the impacts of not having such facilities, as well as having such facilities that are poorly managed. Sanitation services that are faulty have impacts to people and to the environment, which again affects people. A good example is where sewer systems get blocked and leak into open areas and into waterways, resulting in damaging contamination.

According to interviewees at Bhokwe village, which is supported by studies done by consultants working on the proposed new project, the situation that the proposed Bhokwe sanitation Project aims to address includes both a new improved sanitation management solution, as well as a remediation of a faulty system. Currently the sanitation situation is hazardous, and is a "left behind" from the days that the area was a mining compound. It consists of some flush toilets in some of the dwellings that are "connected to a shallow sewer reticulation system that discharges into a common conservancy tank. There are two conservancy tanks in the ward, one servicing Bhokwe quarters and the other servicing Bhokwe hostels. The rest of the villages under Bhokwe settlements use VIP toilets. The municipal staff and community that are close to the wastewater treatment plant (WWTP) are exposed to health hazards due to the condition of the WWTP" (Beater, 2019, pg 2)

- Part of the sanitation issue is the matter of refuse removal. According to the Municipal Demarcation Board, "Regular solid waste collection is defined as having the solid waste picked up from a household, transported and taken to a proper treatment facility (recycling or landfill sites) on at least a weekly basis." (MDB, 2018, pg 25). The situation in Ward 5, which is visibly evident in Bhokwe Village, is typical of most rural areas: waste management is left to householders to manage in whatever way they can. At best, this is done through digging waste pits, covering them when they are full, and starting again. In Ward 5, the degree of formalised waste management is measured at 4% as compared to the ALM average of 37.8% (likely explained by practices in towns) and the ZDM average of 17.8% which flattens out again as the average is spread across the vast tracts of outlying rural areas that are the predominant profile of the five local municipalities.
- In relation to electricity, the data tells that Ward 5 has a slightly higher relative access to electricity than the district average, at 15% as compared to 14%. According to Councillor Ntombela from Ward 5, this is an area that he has been working hard to improve, and he quoted an increase in recent years of 5000 houses being connected into electricity. This circumstance is undermined however by the fact that the municipality owes an insurmountable debt to Eskom in unpaid electricity supplies.

The above demographic description of the situation in Ward 5 as compared to the local and district municipalities of which it is a part is presented to provide a context of the factors that impact on the quality of life that people enjoy. The Socio-Economic Impact Assessment takes these factors into account, when analysing the impacts of any intervention, in this case, the Bhokwe sanitation Project.

3.5 Profile of Bhokwe Village

Having developed a broad picture of Ward 5, this section aims to tighten the lens on Bhokwe Village.

The following information is gleaned from reports and discussions with local residents.

Bhokwe Village is a small settlement accommodating approximately 150 households, located in Ward 5 of the AbaQulusi Local Municipality. The village is about 40km from Vryheid, and the access road is in good condition. The village is built on either side of a small side road approximately 2km long, and is in the foothills of the Ngwibi / Bhokwe Mountain. The settlement has its history in mining. There used to be an Anglo-owned coal mine located on land owned by a farmer called van Rooyen at which most people worked. The mine closed in 1992, after which the land was "taken over by the government and redistributed to local families as part of land reform" (Councillor Ntombela, 2019). This process was finalised in 1996.

Figure 9. Image depicting rural nature of the Bhokwe village

The housing in which most of the local residents live was built by the mine to accommodate employees. The original structures included several homesteads, a number of quarters for married staff and seven large hostels which each consist of about 20 rooms apiece. Many of the old structures have fallen into disrepair, and a number of new homesteads have been added to the village since the closure of the mine

There is no reliable water supply to the community, despite the fact that there are two big rivers close by. In addition to challenges with water supply, the sewerage system that was installed by the mine stopped working and has not been fixed. The local Councillor has been championing the provision of effective water and sanitation services for the past five years.

There is a primary school in Bhokwe Village offering tuition to children from Grade 0 to Grade 7. Children at the school are provided with a meal and stationery. There is also uMfolozi High School, catering to older learners. It is a small school and the overflow attend school some 9km away in a neighbouring village.

Healthcare is provided by one "beautiful clinic providing excellent service" (Phineas Mtshali, Ward Committee member, 2019). However, for all medical supplies, residents must travel to Vryheid.

Community owned woodlot, showing unmanaged growth

Unemployment is very high in the area, and people subsist on grants and some remittances from migrant family members. Despite decent rains, the rivers and apparent good agricultural lands, there is little organised agriculture in the area, and very few job opportunities. There is evidence of plantations in the area, mostly owned by NCT aligned farmers. There are also several community-owned woodlots, which are evidently not optimally managed. Councillor Ntombela commented that there are no local people with sufficient skills to manage community forestry effectively. As a result of an uncooperative relationship between locals and NCT farmers, "not more than 20 people work in forestry" (Phineas Mtshali, Ward Committee member, 2019).

Poverty levels are high and there are few amenities close at hand. Shopping is done in Vryheid. Access to Vryheid is by taxi, a one-way trip costing R29.

Ward 5 has clear economic and social development potential, mainly related to agriculture. To initiate this infrastructure is critical especially that related to making water accessible for agriculture. In addition, this largely rural community would need a powerful input of skills into the area to capitalise on the potential. In the short term, this could relate to intervening on local timber-based enterprises, from the more efficient management of existing woodlots, to developing silviculture and other related activities at a professional level.

3.6 Conclusion

This chapter has aimed to create a socio-economic picture of the context within which Bhokwe Village is located. Relevant to the focus of this study, which is to look at impacts of the proposed Bhokwe Sanitation Project, it is clear that the receiving area is in definite need of the intervention, and that the impacts will be positive.

4. RELEVANT LEGISLATION

The provision of basic services is increasingly being understood as a human rights issue. It may not be specifically enshrined in the Constitution but, as Michelle Toxopeüs says, "It is implied by several constitutionally entrenched rights including the rights to an environment that is not harmful to human health or wellbeing, sufficient water, human dignity, equality, privacy and housing. The right to sanitation services has also been formally recognised and affirmed by the international community as "a human right that is essential for the full enjoyment of life and human rights" and is reiterated in national legislation."(Toxopeüs, 2019)

According to Toxopeüs, sanitation services are critical in general but should really be seen as central to health and wellbeing. She notes in an essay called *The state of sanitation and wastewater treatment services in South Africa*, "Effective sanitation services contribute significantly to reducing health risks and protecting the environment. Broadly speaking, it entails adequate sanitation facilities that collect and treat sewage effectively, ensuring human dignity is secured and health is protected. But South Africa's sanitation and wastewater treatment systems are under immense strain. Accessing safe and dignified sanitation facilities has been a long-standing problem for many South Africans" (Toxopeüs, 2019).

Municipalities have a duty to provide the basic services to the citizens within their areas of jurisdiction. According to the Water Services Act, each municipality "must give priority to providing basic sanitation services within its area of jurisdiction. Basic sanitation includes the prescribed minimum standard of services necessary for the safe, hygienic and adequate collection, removal, disposal or purification of human excreta, domestic waste water and sewage from households, including informal households" (Toxopeüs, 2019).

The South African Human Rights Commission has the following to say about water and sanitation provision, "The government of South Africa has made notable progress towards realising the right to water and sanitation for all. The progress made, however, is not enjoyed in an equitable manner by different members of society and in different geographical areas of the country."

In an era of increasing political discontent, where service delivery protests are widespread and common, it is essential that national, provincial and local government be as diligent as possible in regard to the implementation of their obligations in aspects of service delivery, including the suitable delivery of sanitation services both in urban and rural marginalised areas.

In relation to the socio-economic impact assessment, a number of policies and regulations are pertinent. The items included in this chapter stand alongside policies and regulations referred to in other specialist studies associated with the Proposed Bhokwe Community Sanitation Project. The selection and inclusion in this report is based on the impacts on the quality of life of affected communities, and include both general and specific policies and regulations.

4.1 Guidelines

Guidelines are produced by international or national interest groups who take up various issues of importance, often related to protection of human, environmental and other rights.

United Nations Millennium Development Goals (MDGs)

Adopted by all member states of the United Nations in 2000. The Declaration was an important acknowledgement of the development challenges facing especially underdeveloped nations of the world economy, as well as a statement of commitment to address these challenges. "The Millennium Development Goals (MDGs) constitute the unprecedented commitment of world leaders to address key development priorities through a set of specific goals & targets to eradicate extreme poverty & hunger, ensure all boys & girls complete primary school, promote gender equality, improve the health of mothers & children, reverse the spread of HIV/AIDS, protect the environment, & create a global partnership for development." (SNAP-UNDP) As a signatory, & as a country for whom each one of the eight MDGs is relevant, the South African Government has incorporated these principles into policies implemented by our national parliament.

South Africa is a member of the United Nations (UN), and as such is a signatory to the MDGs. These goals are designed to address issues of social, political, environmental and economic sustainability. There are eight clauses and focus areas, namely:

MDG1: To eradicate extreme poverty and hunger

MDG2: To achieve universal primary education

MDG3: To promote gender equality and empower women

MDG4: To reduce child mortality

MDG5: To improve maternal health

MDG6: To combat HIV/AIDS, malaria and other diseases

MDG7: To ensure environmental sustainability

MDG8: To develop a global partnership for development

It could be argued that all of these goals in some way are directly or indirectly connected to the provision of basic services to all communities, and creating the conditions for wellbeing and a good quality of life.

New Partnership for Africa's Development (NEPAD)

Similar to the Millennium Development Goals, the NEPAD was adopted at the 37th OAU Summit in Lusaka, Zambia in July 2001. The NEPAD, aims to (DFA):

- Eradicate poverty.
- Place African countries, both individually & collectively, on a path of sustainable growth & development.
- Halt the marginalisation of Africa in the globalisation process & enhance its full & beneficial integration into the global economy.
- Accelerate the empowerment of women.

Medium Term Strategic Framework Plans (MTSF)

The MTSF of the period 2009 – 2014 states the following as its areas of focus & commitment:

- Strategic Priority 1: Speeding up growth & transforming the economy to create decent work & sustainable livelihoods.
- Strategic Priority 2: Massive programme to build economic & social infrastructure.
- Strategic Priority 3: Comprehensive rural development strategy linked to land & agrarian reform & food security.
- Strategic Priority 4: Strengthen the skills & human resource base.
- Strategic Priority 5: Improve the health profile of all South Africans.
- Strategic Priority 6: Intensify the fight against crime & corruption.
- Strategic Priority 7: Build cohesive, caring & sustainable communities.
- Strategic Priority 8: Pursuing African advancement & enhanced international co-operation.
- Strategic Priority 9: Sustainable Resource Management & use.
- Strategic Priority 10: Building a developmental state including improvement of public services & strengthening democratic institutions.

National Development Plan (NDP), presented in 2013

It is described thus, "*The National Development Plan is a plan for the country to eliminate poverty & reduce inequality by 2030 through uniting South Africans, unleashing the energies of its citizens, growing an inclusive economy, building capabilities, enhancing the capability of the state & leaders working together to solve complex problems.*"[4] The objectives of NDP include the following:

- Increase employment from 13 million in 2010 to 24 million in 2030.
- Raise per capita income from R50 000 in 2010 to R120 000 by 2030.
- Increase the share of national income of the bottom 40 percent from 6% to 10%.
- Establish competitive base of infrastructure, human resources & regulatory frameworks.
- Ensure skilled, technical, professional & managerial posts better reflect the country's racial, gender & disability makeup.
- Broaden ownership of assets to historically disadvantaged groups.
- Increase quality of education so all children have at least two years preschool education & all Grade 3 children can read & write.
- Provide affordable access to quality health care while promoting health & wellbeing.
- Establish effective, safe & affordable public transport.
- Produce sufficient cost effective energy to support, ensuring access for poor households, while reducing carbon emissions per unit of power by about one-third.
- Ensure all South Africans have access to clean running water in their homes.
- Make high-speed cost-effective broadband internet universally available.
- Realise food trade surplus, one-third produced by small-scale farmers or households.
- Ensure household food & nutrition security.
- Entrench social security system covering all working people, with social protection for the poor & other groups in need, such as children & people with disabilities.

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[4] http://www.gov.za/issues/national-development-plan/development-plan-2012.html

- Realize developmental, capable & ethical state that treats citizens with dignity.
- Ensure all people live safely, with an independent & fair criminal justice system.
- Broaden social cohesion & unity while redressing past inequities.
- Play leading role in continental development, economic integration & human rights.

The Employment Strategy Framework (1998)

This framework speaks to the need to enhance employment opportunities particularly to those sectors identified as vulnerable, such as women, youth & the disabled.

KwaZulu-Natal Provincial Growth & Development Strategy

Revised regularly, the PGDS guided by KZN's vision of being, "Prosperous Province with a healthy, secure & skilled population, acting as a gateway to Africa & the world" (Provincial Planning Commission. March 2012). It aims to "grow … the economy for the development & the improvement of the Quality of Life of all people living in the province of KwaZulu-Natal". This to be done by focusing on key areas, including:

- Job creation, by expanding agriculture, enhancing industrial development through trade, investment, & exports; Expansion of government-led job creation programmes; Promoting SMME, entrepreneurial & youth development; Enhancing Knowledge Economy.
- Human & community development, through poverty alleviation & social welfare; Enhancing health of communities & citizens; Enhancing sustainable household food security; Promoting sustainable human settlements; Enhancing safety & security; Advancing social capital.
- Strategic Infrastructure, through development of harbours; Development of ports; Development of road & rail networks; Development of ICT infrastructure; Improving water resource management & supply; Developing energy production & supply.

Specific to sanitation, the following are relevant.

The White Paper on Integrated Pollution & Waste Management (2000)

This policy specifies the need for developments to include mechanisms & strategies to minimize pollution & thus protect the quality of life of those likely to be affected.

National Sanitation Strategy (2005)

This programme specifies "the roles and responsibilities in sanitation delivery, planning for sanitation, funding sanitation, implementation approaches, regulating the sanitation sector, and monitoring and evaluation."

Free Basic Sanitation Implementation Strategy (2009)

This strategy aimed to reach national access to sanitation by 2014.

Green Drop Certification

According to the Mail & Guardian, "Green Drop Certification is awarded to wastewater systems that obtain scores of 90% when compared against the criteria set for wastewater management. This assisted Water Services Authorities to strive for improvement in their management of wastewater as part of the incentive-based regulation approach."

4.2 Legislation

Enshrined in law, the following must be implemented.

The South African Constitution (Act 108 of 1996)

"Section 27(1)(b) of the Constitution of the Republic of South Africa, 1996 (Constitution) guarantees everyone the right of access to sufficient water and requires the state to adopt reasonable legislative and other measures to progressively realise this right within its available resources. Although section 27 of the Constitution addresses the right to water, it does not explicitly provide for the right to sanitation. The right to sanitation can, however, be derived from other sections in the Constitution such as environment, health and dignity and myriad international instruments to which South Africa is a signatory." (Water & Sanitation Research Brief, SAHRC, 2018

It is the Bill of Rights, within the Constitution of the Republic of South Africa that is the key feature of this Act that coincides with issues of relevance to an SIA. The Bill of Rights determines that all South Africans should be protected in respect of their human rights, namely to life, dignity, equality and freedom. Flowing from these principles are the rights to:

- A protected and safeguarded environment, now and for the future
- Safeguarded property ownership, unless this is against the rights of the public interest
- Adequate health care, food, water and social security
- Protection of culture, including language, religion, art and other social activities
- Protection within the law
- Access to information

Development Facilitation Act (Act 67 of 1995)

Addresses sustainable urban settlements and addresses following planning issues specifically (Tony Barbour, 2007):

- Promotion of integration of social, economic, institutional & physical aspects of land development.
- Promotion of integrated land development in rural and urban areas in support of each other.
- Promotion of the availability of residential and employment opportunities in close proximity to or integrated with each other.
- Optimisation of use of existing resources including those relating to agriculture, land, minerals, bulk infrastructure, roads, transportation & social facilities.
- Promotion of a diverse combination of land uses.
- Discouragement of "urban sprawl" in urban areas, supporting development of more compact towns & cities.
- Contributing to the correction of historically distorted spatial settlement patterns in SA and to the optimum use of existing infrastructure.
- Encouragement of environmentally sustainable land development practices and processes
- Promotion of land development within the fiscal, institutional and administrative means of the Republic
- Promotion of establishment of viable communities;
- Promotion of sustained protection of environment.

National Environmental Management (Act 107 of 1998)

NEMA contains a number of important constitutional rights that specify the relationship between people, their environment and sustainability. It addresses the balance between protecting human rights against the protection of the environment, and where the former can be accommodated by the appropriate management of the latter, based on the maximum benefit to the long term benefit of society. Included in NEMA are principles dedicated to:

- Ensuring that the environment is protected for greatest number of people for the greatest length of time
- Pollution control and management
- Sustainability issues
- Integration and equality enshrined in "environmental justice" based on participation and capacitation
- Balancing all forms of knowledge that may impact on a decision, including scientific and traditional
- Protection of health resulting from any given action

National Water Act (Act 36 of 1998)

This law states that ensures that water reserves are protected, used, developed, conserved, managed and controlled for the benefit of all in South Africa. It goes on to state that "all water services institutions (water services authorities, provider, committees and boards) must take reasonable steps to achieve every citizen's basic right to water supply and basic sanitation. Water service authorise must provide for this right in setting out water service development plans." (OSS Africa, 2019)

5. SOCIO-ECONOMIC IMPACTS OF PROPOSED BHOKWE SANITATION PROJECT

This chapter addresses the likely economic and social impacts of the development on the communities surrounding the installations. Impacts are typically defined as "any change whether adverse or beneficial, wholly or partially resulting from" an intervention (ISO 14001:2015). In the case of the Proposed Bhokwe Sanitation Project, the impacts are clearly positive, given that the area has suffered for a long time without adequate sanitation infrastructure, and then, when there was a possibility for improvement, the community was let down by a contractor who was unable to complete the task. At this point, there is high interest in the completion of the project, with high level involvement from MISA. The expectations of the community are high, and there are both beneficial practical and credibility impacts that should be managed by the effective and quality delivery of the project.

The proposed intervention is relatively small, although it will bring significant health and well-being benefits to the Bhokwe community. Other benefits that often flow from development will be less significant. There are almost no negative impacts that are likely other than the usual construction phase inconveniences, all of which must be managed by the contractors appointed.

In respect of exploring potential impacts, both economic and social, the following indicators are typically used:

- The likely **extent**, or spatial impact of the development;
- The likely **magnitude** of the impact;
- The likely **duration** of the impact.
- The likely **probability** of the impact is noted.
- The likely **confidence** with which the impacts can be managed.
- The likely **reversibility** of the impact.

The following tables provide some clarity on how these measures are understood.

Table 7. Assessment criteria for the evaluation of impacts

Criteria	Category	Description
Extent/spatial influence of impact	Regional	Beyond a 10 km radius of the Study Area
	Local	Within a 10 km radius of the Study Area
	Site specific	On site or within 75m of the Study Area
Magnitude of impact (at the indicated spatial scale)	High	Natural and/or social functions and/or processes are *severely* altered
	Medium	Natural and/or social functions and/or processes are *notably* altered
	Low	Natural and/or social functions and/or processes are *slightly* altered
	Very Low	Natural and/or social functions and/or processes are *negligibly* altered
	Zero	Natural and/or social functions and/or processes remain *unaltered*
Duration of impact	Construction period	Up to 2 years
	Medium Term	Up to 5 years after construction
	Long Term	More than 5 years after construction

Table 8. Definition of probability ratings

Probability Ratings	Criteria
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 9. Definition of confidence ratings

Confidence Ratings	Criteria
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 10. Definition of reversibility ratings

Reversibility Ratings	Criteria
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

5.1 Alternative situation: Retaining the Status Quo

This option involves retaining status quo. The used and unused infrastructure in place will remain as is, and the problems that resulted in community pressure to resolve the sanitation issues remain unaddressed. According to the EIA BID the current "sanitation systems in this settlement … are characterized by frequent bursts, blockages and overflowing resulting in a health hazard to the community." (BID, 2019, pg 1).

The following summary table illustrates the quality of life impacts of *not* implementing the proposed project.

Table 11. Retaining the status quo

	Impact	Comment
Overall	Negative	Not responding to the community of Bhokwe by not installing adequate sanitation infrastructure will have an extremely negative impact on the community as well as on the confidence of this community in the already beleaguered local government of AbaQulusi.
Extent Local / regional	Local	The current sanitation lines affect the small local community of Bhokwe, however, this community has since the early requested that the issue be addressed.

Magnitude	Medium to high	As the community grows, and as there are additional developments that are built in the neighbouring areas, so the need for functional sanitation lines will grow exponentially. In addition, as more pressure is placed on the current inadequate system, so the problems will escalate, leading to significant impacts on all aspects of social life in the surrounding area.
Duration Short/medium/long term	The impact will worsen over time until it is resolved.	
Probability Definite/probable/unlikely	The deterioration is probable, as pressure is increased on the existing system.	
Status Negative / positive	The impacts will be negative, escalating in severity.	
Significance High / medium / low	The significance of not providing the improved sanitation services is high. The community has been expecting improvement for some time, and the failure of the last contractor to deliver has undermined trust and confidence in the process. In a country where service delivery is at best sketchy, especially in outlying areas, and has become highly politicised, the significance of not delivering on this promise may lead to unnecessary volatility in the area. There is a sense already in the minds of Bhokwe villagers that "they do not matter". It would be unwise not to deliver.	
Reversibility	The possible impacts of non-delivery will be reversed by ensuring that the infrastructure is delivered on time and of good quality.	

The rest of this chapter assumes that the proposed Bhokwe Sanitation Project will go ahead.

5.2 Economic Impacts

Although the intervention is relatively small economically, there are a number of dimensions that are of potential economic significance. These dimensions include:

- Job creation – construction phase and permanent, direct and indirect.
- Potential enterprise development – direct and indirect.
- The overall impact of such a development in the surrounding area.

5.2.1 Job creation

In rural areas where there are limited job opportunities and where skills levels are typically low, expectations around job creation are high.

Description of the impact

This impact will be restricted to the construction phase. The potential is that a reasonable number of jobs will be created for the duration of the Project. It is assumed that the job will be labour-intensive and that minimal mechanisation will be utilised. This means that the tasks related to site preparation, digging trenches, laying pipes, in-filling and post construction site rehabilitation will be done by teams of people drawn from the immediate surrounds. Much of the work is unskilled, but supervision will be required. It is possible that there will be between 75 and 100 jobs created. The scope of the Bhokwe Sanitation Project is short-term, so it is unlikely that any long term or permanent jobs will be generated. The ongoing maintenance will be done by employees of AbaQulusi municipality.

Table 12. Job creation impacts

	Impact	Comment
Extent Local / regional	Local	During construction phase, there will be potential for local residents to be employed as temporary labourers on the construction site, both for the sewer lines and the treatment pond. This will be beneficial to **local** residents
Magnitude	Low to Medium	The intervention is the relatively small scale, so the number of jobs will be reasonably small. However, in an area such as Bhokwe where any job is of value, the opportunity is valuable.
Duration Short/medium/long term	**Short term** impacts will be enjoyed given the relatively small scale of the intervention.	
Probability Definite/probable/unlikely	The probability of the impact is **definite**, as there will definitely be scope for labour.	
Status Negative / positive	The impact will be **positive**.	
Confidence Sure / Unsure	The impact will be **certain**.	
Significance High / medium / low	In the context of low employment, the significance of the impact will be medium to **high**, albeit limited.	
Reversibility	The impact is **reversible** given that jobs will be restricted to the construction phase.	

Mitigation recommendations:

Job creation expectations will have to be well managed via management systems and communication mechanisms that regularly informs the local community (on site and at local community centres) of the progress and job / skills needs at the development sites. A formal job application process must be communicated. A Community Liaison Officer (CLO) should be employed to facilitate the process.

5.3 Construction phase environmental impacts

This aspect relates to the nuisance impact from the activities of the construction phase. It includes such factors as noise, air pollution, dust, mud, pollution run off, etc.

Description of the impact

The construction phase is likely to be between 12 – 15 months from start to post construction site rehabilitation. The area is rural and the rainfall is reasonably high in season. Much of the construction involves digging trenches. There is likely to be dust and mud and piles of earth in areas often used by local residents.

Table 13. Impact of construction activities

	Impact	Comment
Extent Local / regional	Local	People living close to the trenches may be affected by dust and mud.
Magnitude		**Limited** magnitude within the local area
Duration Short/medium/long term	**Short to medium term** impacts will be experienced as the construction phase is limited.	
Probability Definite/probable/unlikely	**Probable**.	
Status Negative / positive	The impact will be **negative**.	
Confidence Sure / Unsure	**Sure**, although it may not affect that many people.	
Significance High / medium / low	The significance of the impact will be **Low to medium**.	
Reversibility	The impact is **reversible** and will resolve post construction.	

Mitigation recommendations:

The contractors must implement site management good practices, including dust management and mud management for rainy days. Digging of trenches must be done in ways that minimise the impacts.

5.4 Social Impacts

By way of reminder, the social impacts that will be considered relate to quality of life issues, defined as follows:

- Improved/Diminished standard of living, and social well-being (most often related to income).
- Increased/Decreased access to services (electricity, water, sanitation).
- Improved/Diminished traffic, transport and road safety.
- Increased/Decreased rates of crime and insecurity, and protection there from.
- Altered Sense of place.

5.4.1 Improved/Diminished standard of living, and social well-being (not only, but often related to income)

The consideration of standard of living largely refers to “a level of material comfort in terms of goods and services available to someone or some group” (wordnet.princeton.edu). Social wellbeing is close to standard of living being the overall experience flowing from it.

Description of the impact

The provision of stable and functioning sewer management infrastructure will impact positively on the residents of Bhokwe Village. Currently there are unreliable systems in place “characterized by frequent bursts, blockages and overflowing resulting in a health hazard to the community” (BID, 2019, p1). In addition to this direct impact, there will be a relatively high number of jobs created, as discussed above. Although this is not a permanent situation, during the construction phase, those employed will enjoy the benefits associated with improved income.

Table 14. Improved standard of living, and social well-being

	Impact	Comment
Extent Local / regional	Local	The local community are currently plagued by discomfort and potential health hazards from problematic sewer infrastructure. For the health and wellbeing and general quality of life, the installation will be highly beneficial to **local** residents
Magnitude		**Significant** within the local area
Duration Short/medium/long term	**Long term** impacts will be enjoyed subject to normal wear and tear.	
Probability Definite/probable/unlikely	If the infrastructure is of a high standard, the probability of significant impact is **definite to probable.** Given the history of this project, there may be confidence issues from local residents.	
Status Negative / positive	The impact will be **positive**.	
Confidence Sure / Unsure	This is dependent on action and implementation after the authorisation period. The installation has had problems previously. There is therefore a measure of **uncertainty**.	
Significance High / medium / low	The significance of the impact will be **high**.	
Reversibility	It is possible that the impact is **reversible** if the post-construction maintenance plan is not implemented effectively.	

Mitigation recommendations:

Nil required.

5.4.2 Increased/Decreased access to services (electricity, water, sanitation)

This aspect of quality of life is inherent in the Bhokwe Sanitation Project, i.e. it is about access to services, in this case, improved sanitation services. In an area where there are shortages and/or malfunctioning existing services, the provision of effective services can have a significant effect on communities in multiple ways, including improving health.

Description of the impact

As this intervention is specifically related to improving access to functional sanitation services, the impact improves access to services, improving the quality of life of all the householders in the area. The impacts of improved sanitation will improve all aspects of people’s lives, from general comfrt and wellbeing to health. A managed sanitation system also minimises other environmental impacts such as sewer spills and contaminated water ways.

Table 15. Increased access to services (electricity, water, sanitation)

	Impact	**Comment**
Extent Local / regional	Local	The intervention is specific to the village of Bhokwe, therefore the impact will be **local**.
Magnitude		The scale of the intervention is **small**, but important to quality of life
Duration Short / medium / long term	**Long term** impacts will be enjoyed subject to normal wear and tear.	
Probability Definite/probable/unlikely	If the infrastructure is of a high standard, the probability of significant impact is **Definite to probable.**	
Status Negative / positive	The impact will be **positive**.	
Confidence Sure / Unsure	This is dependent on action and implementation after the authorisation period. The installation has had problems previously. There is therefore a measure of **uncertainty**.	
Significance High / medium / low	The significance of the impact will be **high**.	
Reversibility	It is possible that the impact is **reversible** if the post-construction maintenance plan is not implemented effectively.	

Mitigation recommendations:

Aside from ensuring that there is no repeat of the fiasco with the 2016 contract, no other issues arise.

5.4.3 Diminished traffic, transport and road safety

This refers typically to new road users both during the construction phase and the operational phase that are a direct result of the development.

Description of the impact

The impact in respect of traffic, transport and road safety is likely to be limited as the intervention is reasonably small and the area does not currently experience high traffic, being a small village, and will only apply during the brief construction phase. The fact that the area typically experiences little road traffic, may result in an increase in road safety concerns, especially for children who are unused to construction related traffic. There is a junior school on the road alongside of which pipes will be laid. Once the installation is complete, there will be no impact at all.

Table 16. Diminished traffic, transport and road safety

	Impact	Comment
Extent Local / regional	Local	The increase of **limited** disruption to traffic will pertain only to the main road and the short local road into the village along the course of the sanitation piping and treatment pond.
Magnitude	Limited	The impact will be restricted to the construction phase which will be **short**.
Duration Short / medium / long term	**Short**	
Probability Definite/probable/unlikely	As per the contract specifications, most of the work will be done manually with minimal involvement of heavy machinery. However the will be increased vehicular traffic relative to what is the norm in this rural area. Therefore the impact would be understood as **probable.**	
Status Negative / positive	**Negative**, although it can be managed reasonably easily.	
Confidence Sure / Unsure	Sure	
Significance High / medium / low	If road safety measures are implemented, the impact is likely to be **limited**.	
Reversibility	The negative impact is **reversible**, ending when construction is completed.	

Mitigation recommendations:

The Construction team must institute road safety measures within the community, briefing people of higher road use periods, and liaising with the primary school, crèche and clinic to institute road safety monitoring. The safety of learners, school staff and parents is critical. The developers must take all measures possible to ensure safety. School-based traffic education programmes must be carried out.

5.4.4 Increased/Decreased rates of crime and insecurity, and protection therefrom

Building sites are often perceived as security risks, generally as a result of higher opportunistic crime resulting from increased movement of people through the area and criminals taking advantage of the resulting increased invisibility.

Description of the impact

In the case of the installation of sewer piping and the treatment pond, there is unlikely to be any significant impact in relation to crime and insecurity.

Table 17. Increased/Decreased rates of crime and insecurity, and protection therefrom

	Impact	**Comment**
Extent Local / regional	Local	
Magnitude	Limited	
Duration Short / medium / long term	Short	
Probability Definite/probable/unlikely	It is **unlikely** that there will be a changed crime and insecurity impact from the intervention.	
Status Negative / positive	**Negative**, in as much as it may happen.	
Confidence Sure / Unsure	Unsure	
Significance High / medium / low	Low	
Reversibility	Reversible	

Mitigation measures:

As a precautionary, local community leaders and security services must be informed of the start and finish of the construction phase. The construction service providers should ensure that their own equipment and vehicles are safeguarded during the construction phase. The local councillor lives in Bhokwe and is open and amenable to liaising with the community. The construction teams must contact the councillor and make appropriate arrangements, and maintain clear and constant communication.

5.4.5 Altered Sense of place

The criteria for measuring this impact are highly subjective and personal, and are more obvious in homogenous and smaller communities and when the intervention is significant. Sense of place essentially refers to "a personal response to the environment, social and natural, which the individual experiences in daily life. At a broader level it can be the individual's perception of the whole region, state or nation." (Australian Department of Environment, 2008). It picks up on a *feeling* of 'spirit of a place' and is largely created by and is a consequence of a sense of community. (Barbour, 2007). It defines the *character* of a place. It is very often the most significant social impact of a development.

Description of the impact

In the case of the Bhokwe Sanitation Project, the impact on sense of place will be indirect, although it will add positively to the quality of life in the area.

Table 18. Altered Sense of place

	Impact	Comment
Extent Local / regional	Local	
Magnitude	Limited	The improvement in quality of life as a result of the Bhokwe Sanitation Project will add to a somewhat enhanced sense of place.
Duration Short / medium / long term	Long term	
Probability Definite/probable/unlikely	With an improved sanitation service, the probability of a positive impact is **definite**.	
Status Negative / positive	Positive	
Confidence Sure / Unsure	Sure but its specific noticeability will likely fade as people get used to having the service.	
Significance High / medium / low	Medium	
Reversibility	Reversible	

Mitigation measures

No specific mitigation required.

5.5 Conclusion

This chapter has specifically addressed the socioeconomic impacts of the proposed sewer infrastructure specifically on Bhokwe Village. There is no doubt that the development is desirable and will have many more positive impacts, both economically and socially, than negative impacts:

- Jobs will be created both in the short term for the duration of the construction phase.
- Quality of life for local residents will be improved as they enjoy access to a sanitation system that meets the needs of the local community.

6. CONCLUSION

This Socio-Economic Impact Assessment has looked at the Bhokwe Sanitation Project in the context of a small rural village in a somewhat under-developed local municipality in a district with limited economic infrastructure. It has noted the legislative and political context of sanitation as a basic service, in a time where service delivery has become a political rallying point. The summary statement regarding the impacts of this Project is that it is positive in every way, and will add real value to the quality of life of the residents of Bhokwe Village.

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Appendix F

ENVIRONMENTAL MANAGEMENT PLAN (EMPr)

FOR THE PROPOSED BHOKWE COMMUNITY SANITATION PROJECT, BHOKWE, ABAQULUSI MUNCIPALITY

[EIA REFERENCE NUMBER: DC26/0001/2020]

January 2020

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Prepared for : Zululand District Municipality

Table of Contents

Acronyms Used

Acronym	Definition
EDTEA	Department of Economic Development, Tourism and Environmental Affairs (Kwa-Zulu Natal)
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EMPr	Environmental Management Plan
I&AP	Interested and Affected Party(ies)
PM	Project Manager
ZDM	Zululand District Municipality

1. INTRODUCTION

1.1. Background Information

1World Consultants (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioner (EAP), by Ukuza Consultants to undertake the Basic Assessment Process for the Bhokwe Community Sanitation Project. The project proposes the construction of approximately 1.8 kilometres of 160 mm diameter HD uPVC piping, 110mm diameter uPVC housing connections, 150 meters of 200 mm diameter HD uPVC sewer fed piping, an oxidation sewer treatment plant and approximately 37 precast ring manhole covers, serving close to 112 households in the Bhokwe Community, Bhokwe, Zululand District Municipality, KwaZulu Natal. The project area is situated in Ward 05 , AbaQulusi Local Municipality, approximately 27 kilometers, as the crow flies, from the town of Vryheid.

Table 1 below provides project specific details for the proposed Bhokwe Community Sanitation Project.

Table 1:Project Specifications

	Bhokwe Community Sanitation Project
Ward	05
Property Description	Low income to middle income residential
Infrastructure Specifications	
Pipeline	1.8km of 160mm Ø, 150m of 200mm Ø, max of 850mm trench width, 1m trench depth, 5m construction servitude
Oxidation Development Footprint	11 500 m2
Evapotranspiration Ponds	27 216 m2
Total Development Footprint	40 000 m2

As per GNR 327 and 324 of the EIA Regulations, 2017, a Basic Assessment (BA) Process has been undertaken. All the environmental outcomes, impacts and residual risks of the proposed Listed Activity being applied for have been noted in this BA Report and assessed accordingly by the EAP. The requirements of the BA Process have been followed as per Appendix 1 of GNR 326 (2017) and are consequently adhered to in this report.

It must be noted that the Listed Activities in terms of GNR 327 of the 2017 EIA Regulations are applicable to this proposed project and will trigger activities in both the construction and operational phases. This BA Report focuses on the potential impacts that may arise during the construction and operational phases and provides recommended mitigation measures.

Ultimately, the outcome of a BA Process must be to provide the Competent Authority, the Department of Economic Development, Tourism and Environmental Affairs (EDTEA), with sufficient information to provide an informed decision on the Application, in terms of Environmental Authorisation (EA), in order to avoid or mitigate any detrimental impacts that the activity may inflict on the receiving environment.

The Bhokwe Community area is located in the North of KwaZulu Natal and in an easterly direction from the town of Vryheid. The proposed Bhokwe Community Sanitation project is situated approximately 40 km away from the suburb of Vryheid, located within the AbaQulusi Municipality, in an easterly direction and approximately 20km away from Hlobane in a southerly direction. The area of the study site is approximately 2Ha and is surrounded by several unauthorised low-income residential dwellings without waterborne sewage. The residents in these areas have constructed pit latrines for sanitation purposes. The lack of formal sewer infrastructure in this area poses severe health, environmental and safety hazards

The proposed construction of the sewer reticulation is located in Bhokwe which falls within the Enyathi area situated in ward 05 of the AbaQulusi Municipality. Bhokwe is a township that is found in Northern KwaZulu-Natal, approximately 40 km from the town of Vryheid. Bhokwe occupies a small area of approximately 750 households. Primary activities surrounding the area is forestry and coal mining. The closest hub is Hlobane, which is located 20km away north. The study area can be accessed via the R34 arterial route, along Suid street from Vryheid and the R69 from Hlobane.

The proposed project area is approximately 6.0 kilometers from the nearest town of Bloemendal. The study area is made up of rural dwellings and surrounded by forestry farming. The population density is sparse and households are sprawled. Bhokwe Community is made up of approximately 750 families. Tar roads are evident throughout the study area. Habitat loss and transformation has occurred due to farming activities.

The proposed development site can be regarded as moderately transformed, with pockets of indigenous vegetation remaining. The dominant plant type found is Paul Pietersburg Grassland. The general lack of naturally occurring vegetation is due to the human activity subjected to this local habitat in the form of mass clearing for informal residential areas and subsistence farming found throughout this area

An A3 copy of the map can be reviewed under Appendix C.

Table 2 below summarises features as per figure 1.

Table 2: Proposed Project Features and Co-ordinates

Description		Coordinates			
		Start		End	
1	Gravity Sewer Reticulation	27°48'29.79"S	31° 6'10.78"E	27°48'42.10"S	31° 6'3.96"E
2	Sewer Oxidation Treatment Plant	27°48'43.23"S	31° 5'59.78"E	27°48'55.52"S	31° 5'53.56"E
3	Existing Site Camp	27°48'38.33"S	31° 6'13.56"E	27°48'38.33"S	31° 6'13.56"E

Figure 1: Layout for the proposed project

1.2. Points to Consider

- Wetlands and Watercourses, regarding the impacts of excavating and trenching within a wetland instead of pipe jacking
- Rural Zoning of the Area
    - Motor vehicle and pedestrian traffic impacts in the construction and operational phases must be considered.
    - Nuisance factor must be considered
- Traffic pressures and access
- Soil erosion and stormwater
- Ground water pollution
- Surface water pollution
- Risk of alien invasive encroachment into disturbed areas
- Flora - damage and removal of existing indigenous vegetation
- Fauna - Hunting/ Fishing/ Poaching by construction workers
- Waste and littering around the site
- Noise disturbance
- Air quality
- Public safety and health
- Existing infrastructure disturbance
- Social impacts
- Noise and Disturbance

2. PROJECT RESPONSIBILITIES

The project team will consist of the Project Manager from Zululand District Municipality, the Project Engineer, the Environmental Control Officer (ECO) and the Contractor.

2.1. Project Engineer

The Project Engineer will provide the project specifications of the construction phase. The contractor is legally bound to follow these specifications unless agreed upon by the Engineer. The engineer has the following responsibilities:

- Monitor compliance of the project, following provision of inspection reports provided by the ECO;
- Assess the Contractors performance with regard to compliance and keep records on a monthly basis;
- Facilitate the site handover to the Contractor.

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2.2. Environmental Control Officer

The ECO is responsible for monitoring and reporting that the contractor and applicant are implementing and following the EMPr during the construction and operational phases (for the timeframe specified in the conditions of the environmental authorisation) and to liaise and report to EDTEA. The following will fall within the ECO responsibilities:

- Have a working knowledge of the recommendations and mitigation measures as provided in this EMPr and of the permits, authorisations and licenses.
- Conduct monthly audits of the construction site according to the EMPr and according to the conditions of the environmental authorisation.
- Provide the contractor with environmental training and a copy of the EMPr and ensure in writing that it is understood.
- Liaise regularly with the contractor and project manager.
- Recommend corrective steps for any non-compliance activity on site with respect to the EMPr.
- Compile a monthly audit report highlighting compliance and non-compliance with the EMPr and submit to EDTEA.
- All agreements between the contractor and the ECO with regard to the EMPr will be in writing and co-signed by the Project Manager.
- The ECO will **not** be on site on a daily basis and the Contractor is responsible for implementing the EMPr. The Contractor will be provided with a contact number for the ECO.

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2.3. Contractor and Sub-Contractors

The Contractor is responsible for implementing and adhering to the EMPr during the construction phase, in all respects as stipulated. Compliance with the EMPr by staff during the construction must be ensured by the contractor and this must be recorded by the contractor for audit purposes. The following will be the responsibility of the Contractor:

- Be familiar with the EMPr and all conditions of authorisations, licenses and/or permits.
- Supply construction method statement for implementation of the EMPr, which includes mitigation measures.
- Attend training provided by the ECO, and relay training to all staff and sub-contractors. Proof of training must be kept on record.
- Maintain an environmental file that must contain the following documents:
    - Company environmental policy
    - Hazardous material handling and storage protocols
    - Spill Contingency Plan
    - Emergency Response Plan and Contact Numbers
    - Waste disposal certificates
    - Servicing of portable toilets

- Maintain an environmental complaint register that must have carbon copies and numbered pages, to record all incidents that occur on site during construction. Incidents include but may not be limited to:
    - Public involvement / complaints
    - Occupational health and safety incidents

  - Incidents involving hazardous materials and/or equipment on site
  - Non-compliance incidents
  - Spills into or around watercourses
  - Encountering fauna of interest
  - Finding archaeological artefacts and/or human remains

- Bear any costs associated with non-compliance and/or damage to the environment as a result of not implementing the EMPr or due to negligence.

2.4. Developer (Zululand District Municipality)

The Developer is legally ultimately responsible for the overall compliance with the conditions of the environmental authorisation, since any authorisation and/or license is in the name of Zululand District Municipality. The following fall within the responsibilities of the Municipality:

- Be familiar with the recommendations and mitigation measures of the EMPr and ensure that the contractor and all staff agree to adhere to it.
- Monitor site activities on an ongoing basis or contract the service out.
- Conduct internal audits of the site.
- Ensure the contractor confines their activities to within the demarcated area.
- Rectify transgressions via communication with the contractor and staff and the ECO.
- Liaise with the ECO with regard to audit reports to be provided to EDTEA.

3. THE ENVIRONMENTAL MANAGEMENT PLAN

The focus of the environmental management plan is to allow installation of the sewer reticulation infrastructure whilst still protecting the environment. Particular reference is given to the following key aims:

- Ensure general protection of the receiving environment via compliance with all applicable laws, protocols and guidelines.
- Ensure that water courses and wetlands are protected.
- Prevent or minimise pollution of the receiving environment.
- Minimise disturbance of the environment and aim to protect flora and fauna.
- Prevent soil erosion and soil degradation.
- Facilitate the rehabilitation of disturbed areas.
- Restrict the nuisance factor by providing protocols for staff and/or vehicles.

Damage to water courses, vegetation, animal life, surroundings roads (by construction vehicles), etc. may result from the proposed construction activities. Chemicals such as paints, sealants, coatings, adhesives and solvents may contaminate the soils, groundwater and watercourses should proper procedure not be followed.

3.1. Objectives of the EMPr

The objectives of the EMPr are to:

- Ensure compliance with local, provincial, national and/or international regulations, standards and guidelines, relating to the protection of the environment.

- Clarify roles and responsibilities of the team members.
- Identify measures of mitigating any potential negative impacts thereby reducing or eliminating them.
- Provide detail on specific actions required for minimising negative impacts and provide tools or methods for monitoring the effectiveness of mitigation measures.
- Optimise positive impacts to maximise the benefit thereof.
- Provide management of concerns/complaints from I&AP's.
- Provide monitoring and auditing processes during all phases of the development.
- Provide methods of compliance monitoring and reporting of the monitoring.
- Provide waste management, recycling and re-use strategies.

3.2. Environmental Monitoring

A monitoring program to ensure compliance with the EMPr will be implemented for the duration of the proposed construction. The program will include the following:

- Monthly site visits and audits (subject to the conditions of any environmental authorisation or license) which will be conducted by the Environmental Control Officer (ECO) to ensure compliance to the final EMPr.
- Provide corrective recommendations to rectify any non-compliance.
- Compilation and submission of audit reports to EDTEA providing rating of compliance with the EMPr. Any evidence of damage to areas outside the construction zone will be recorded via photographs as well as a record of the date and time of damage, type of damage and reason for damage. The contractor will be liable for damages should it have resulted from non-compliance to the EMPr.
- A register of complaints from I&AP's will be opened and maintained. Complaints and concerns must be responded to immediately.

Note – The EMPr has been prepared during pre-construction and must be regarded as a working document that may be updated if and when necessary. Any amendments made to the proposed construction must be submitted to the Competent Authority as an amendment to the authorisation for approval before being implemented.

3.3. Compliance with the EMPr

The EMPr specifies the requirements to be implemented by the developer in order to minimise and manage any potential environmental impacts. The provisions of this EMPr will be legally binding to ZDM or any authority to whom responsibility has been delegated to, for the proposed development, for the duration of the construction phase.

The EMPr is legally binding to the contractors/sub-contractor(s) and must be included in the Contractual Clauses. A copy of the approved EMPr must be kept on site during construction and operation. In terms of the Environmental Conservation Act and the National Environmental Management Act, those parties responsible for damage to the environment must pay the costs to repair and compensate for environmental and/or human health as well as for preventative measures to avoid or reduce further damage. The Contractor must make provisions in the budget for implementation of the EMPr.

Non-compliances may result in the application of penalty(ies) following non-compliance after a written warning by the ECO. Failure to rectify non-compliances within one (1) week of the issue OR a repeat offense will result in a fine issued by the ECO.

The following rates will apply for issuing of fines:

Table 3: Fine Rates to be Applied

Offense	Fine Amount
Failure to demarcate working areas	R 1 000
Working or trespassing outside of the demarcated areas	R 3 000
Failure to strip topsoil with intact vegetation	R 5 000
Failure to stockpile topsoil correctly	R 3 000
Failure to stockpile materials in designated areas	R 1 000
Failure to implement dust suppression actions	R 1 000
Washing of vehicles on site	R 1 000
Pollution of surface or ground water	R 2 000
Failure to implement stormwater management plans	R 2 000
Failure to control stormwater runoff	R 3 000
Soil erosion	R 3 000
Failure to provide adequate sanitation	R 1 000
Failure to erect temporary fencing around trenches	R 1 000
Failure to provide adequate waste disposal facilities and services	R 5 000
Failure to re-instate disturbed areas within a specified time frame	R 3 000
Removal of protected flora without a permit to do so	Specified by DAFF
Removal of heritage resource or paleontological object	Specified by AMAFA
Any non-compliance of the project specifications	R 1 000

The fines will be paid by the Contractor to the Developer to be utilised in the landscaping and/or rehabilitation of the site.

3.4. Layout of the EMPr

The EMPr is presented in two phases namely, the construction phase and the rehabilitation phase of the water infrastructure. Each phase has specific mitigation measures that address potential impacts which may be unique to that phase.

- Design and Construction Phase – This phase includes pre-construction activities including the site handover, site establishment, environmental training and access routing. The specifications of all mitigation measures, the responsibilities and the procedures for this phase must form part of the contract documentation. Hence, the relevant personnel will be required to comply with this phase of the EMPr.
- Rehabilitation Phase – This phase of the EMPr provides for the removal of the contractor’s camp, rehabilitation of the site and any disturbed areas and handover to the Client.

3.5. Training

Contractors and workers must receive basic training in environmental awareness i.e. minimisation of impacts to sensitive elements, waste management, water pollution and the requirements of the EMPr.

3.6. Implementation of EMPr by Contractor

The contractor must ensure that the EMPr is implemented and complied with at all times. Should clarity be required the contractor must contact the ECO for advice. The ECO must provide the contractor with contact details.

3.7. Environmental File

The Environmental File comprises the following documents and must be kept on site in order to record compliance:

- Copy of any Environmental Authorisation, licenses, permits, Stormwater Management Plan, and the approved Final EMPr.
- Supply construction method statement for implementation of the EMPr, which includes mitigation measures.
- Record of complaints from I&AP's capturing the time, date, location and nature of complaint as well as the actions taken and by whom. The complaints register must have carbon copy pages and numbered pages.
- Emergency Response Plan and Record of emergencies and incidents.
- Spill Contingency Plans.
- Proof of Training.
- Emergency contacts and numbers.
- Material Safety Data Sheets for any hazardous substances.
- Dust suppression records.
- Written corrective action instructions provided by the ECO (including emails).
- Any Non-Conformance Reports (NCR) that have been issued to the contractor and/or sub-contractor(s). A Non-Conformance follows non-compliance to rectifying a problem area and must be reported to the Competent Authorities. A Non-Conformance Report typically contains the following information:
  - Details on the non-conformance;
  - Any plant or equipment involved;
  - Any chemicals or hazardous substances involved;
  - Details on the non-conforming action;
  - Nature of associated risk(s);
  - Corrective actions to rectify non-conformance, as agreed by all parties concerned;
  - Timeframes for corrective measures to be implemented;
  - Record of compliance by corrective actions, as verified by the ECO.

3.8. Environmental Emergency Response Plan

The Contractor is responsible for preparing an Environmental Emergency Response Plan. This is to exhibit the Contractors ability to respond appropriately to incidents that may have detrimental impacts on the environment. Such incidents include the following among others:

- Accidental spillage of hazardous substances (oil, fuels, sewage, etc.);
- Accidental toxic air emissions;
- Accidental discharges to watercourses and onto land;
- Specific impacts from accidental incidents, e.g. mass death of fish, etc.

The emergency response plan must include for the following:

- Provide actions to be taken in the event of an emergency, in the appropriate logical sequence of events;

- Emergency contact numbers;
- Roles of designated emergency response team members from the contractor's team;
- Incident recording;
- Remediation measures to be implemented;
- Information on hazardous substances, plant and equipment, including warnings and potential risks;
- Proof of emergency response training, including proof of emergency preparedness, as per legal requirements.

3.9. Method Statements

Beside the emergency response plan, the Contractor must provide the following method statements in the environmental file:

- Construction site establishment, including buffer establishment in the wetland section(s),
- Excavations and trenching (especially with regard to sections within wetland(s))
- Dust suppression;
- Cement mixing/concrete batching,
- Contaminated/used water,
- Erosion control and stormwater management,
- Storage, handling and decanting of fuel (diesel) and other hazardous substances,
- Bunding
- Project management including training,
- Personnel and public safety,
- Protection of fauna and flora,
- Rehabilitation of disturbed areas,
- Solid and liquid waste management,
- Top soil management including storage and re-use,
- Sourcing and Storage of materials,
- Rest and Wash areas, including toilets
- Interaction with public and stakeholders
- Site closure plans and steps
- Implementation of the wetland rehabilitation plan

4. RELEVANT LEGISLATION

4.1. Applicable Legislation and Guidelines

In terms of the Environmental Impact Assessment (EIA) Regulations (2017), promulgated in terms of the National Environmental Management Act, 1998 (NEMA), certain Listed Activities are specified for which either a Basic Assessment (GNR 327 and 324) or a full Scoping and EIA (GNR 325) is required. The following Listed Activity in Government Notice (GN) R 327 (Listing Notice 1) are triggered, requiring a Basic Assessment (BA) Process for the proposed construction of the Bhokwe Community Sanitation Project.

The EMPr presented covers activities authorised by the competent authority (EDTEA) only. Activities not approved must be submitted for environmental authorisation, before commencement. Should the impacts identified in the BAR be more significant than assessed, the environmental management plan must be reviewed; and updated if necessary. The EMPr is not independent of the BAR, therefore both must be read in conjunction with each other.

Table 4: Relevant Activities from EIA Regulations, 2017.

Regulation Year	Listing Activity NEMA	Description of Activity	Applicability to the Project
2017	LN 1; Activity 19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	The proposed activity requires the laying of a sewer reticulation, which includes the excavation, dredging and removal of soil.
2017	LN 1, Activity 27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation.	The proposed sewer oxidation treatment plant will require the clearing of approximately 1Ha of vegetation.

The draft environmental management plan is submitted and is subject to approval by the Department of Economic Development, Tourism and Environmental Affairs. The environmental management plan is formulated to include only those aspects pertaining to the environmental authorisation. It may not have taken all the necessary legislation and regulations, pertaining to the actual development activities. The appointed project manager and/or developer must ensure adherence to the necessary legal requirements.

Examples of such legislation or regulations, amongst others, include:
- The Constitution (1996)
- Labour Relations Act (1995)
- National Building Regulations and Building Standards Act (1977)
- Health Act (1977)
- National Water Act (1998)
- Occupational Health and Safety Act (1994)
- National public health and food hygiene regulations
- National Water Act 1998 (Act 36 of 1998)

The EMPr covers legislative requirements derived from the following:
- National Environmental Management Act (2014)
- National Water Act
- National Environment Management Act: Biodiversity Act

5. DESIGN AND PRE-CONSTRUCTION PHASES

The design and pre-construction phases include all activities that are required to render the project ready to begin construction.

5.1. Authorisations, Permits, Licenses:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
All legally required authorisations, permits and licenses must be obtained prior to commencement of construction.	Developer	Once
The Developer must appoint an EAP and/or ECO	Developer	Once
All I&AP's and stakeholders must be notified prior to commencement of construction	Developer/Contractor	Once

5.2. Appointment of Contractor:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
An experience and suitably qualified contractor must be appointed	Developer/Engineer	Once
The EMPr must form part of the contractual agreements with any Contractor which must include any Sub-Contractor(s). The Contractor must take cognisance of this when budgeting during the tender process.	Developer	Once
The Contractor must comply fully with the authorisations, permits and licenses pertaining to the construction phase of the project.	Developer/Contractor	Once
Tender documents must allow for the employment of local community members.	Developer/Contractor	Once
The Contractor must provide Method Statements pertaining to implementation of the EMPr, emergency response plans, stormwater management, hazardous substance handling and storage, spill contingency plans, environmental incidents records file and complaints register.	Developer/Contractor	Once
The Method Statements must be submitted to the ECO for record keeping.	Developer/Contractor	Once

5.3. Appointment of ECO:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
An independent ECO must be appointed to monitor the implementation of the EMPr.	Developer	Once
The Appointed ECO must monitor the project from an environmental perspective, as per the conditions of any authorisations, permits and licenses and according to the EMPr. The findings of each inspection must be documented in a monthly report.	ECO	Monthly or as specified in the Environmental Authorisation

5.4. Environmental Training:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
The Contractor must receive environmental training to adequately implement the EMPr.	Developer/ECO	Once
The Contractor must relay training received to all staff and sub-contractors, in a language easily understandable to them. All contractor's representatives, sub-contractors and staff must acknowledge receipt of training in writing.	Contractor/SHE Officer/ECO	
Toolbox sessions must be scheduled and must include refreshers on environmental responsibilities.	Contractor/SHE Officer	

5.5. Environmental Planning and Design:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
The site and/or route must be confirmed to be within servitudes or not. If not within servitudes, the environment must be closely examined for	Developer/ ECO	

sensitive elements in terms of flora and fauna.		Once
Any erosion control measures must be incorporated, by the engineer, into the design of the water infrastructure. These may be sandbags, hessian sheets, retention or replacement of vegetation, gabion walls, etc.	Engineer	Once
Records of relocated flora and fauna must be kept.	Contractor/ ECO	Once
A set of "before" photographs must be captured for record keeping purposes and to monitor any degradation of the environment.	Contractor/ ECO	Once
Ensure Stormwater Management Measures are in place.	Contractor	Monthly or as specified in the Environmental Authorisation

5.6. Environmental Education and Training:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
All site personnel must have a basic level environmental awareness training session. Topics covered must include: o What is meant by "The Environment" and the "wetland"? o Why the environment/wetland needs to be protected and conserved? o How construction activities can impact on the environment/wetland? o What can be done to mitigate against such impacts? o Awareness of emergency and spill response provisions. o Social responsibility during construction of the pipeline e.g. being considerate of the local community who share the roads.	ECO	Once
The ECO must provide training to the Contractor's representatives. It is the Contractors responsibility to provide the site foremen with	ECO/ Contractor	Once

environmental training and to ensure that the foremen have sufficient understanding to pass this information onto the construction staff. Translators may be used to ensure training is thorough.		
Training by the contractor must be provided to the staff members in the use of the appropriate firefighting equipment.	Contractor	Weekly/ monthly
Environmental awareness posters on site may be used to further facilitate compliance to the EMPr.	Contractor	Weekly/ monthly
The need for a clean site policy must be explained to the workers. This includes prohibiting sanitation activities outside of the ablution facilities and toilets provided by the Contractor.	Contractor	Weekly
Staff operating equipment (e.g. loaders, excavators, etc.) must be adequately trained and sensitized to any potential hazards associated with their tasks.	Contractor	Weekly/ Monthly
Although the Contractor is responsible for ensuring that the environmental awareness training of staff members is put in place, it must be the direct responsibility of the appointed ECO to carry out the training. Each staff member must sign a register confirming their attendance at this training. This register must be included in the site Environmental file.	ECO	Once
The contractor must monitor the performance of the workers to ensure that the training was properly understood and is being followed.	Contractor	Weekly
The ECO must monitor the construction phase periodically to ascertain if training was effective.	ECO	Monthly

6. CONSTRUCTION PHASE

The construction phase includes all activities on the site that are required to render the sewer reticulation operational. Environmental training must be provided to the contractor before commencement of construction activities.

Traffic and Access Control:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
All construction vehicles must adhere to traffic laws when travelling to and from the site.	Contractor	Ongoing
Pointsmen to guide traffic for entry and exit of construction vehicles must be used. Signage for presence of construction vehicles must be erected.	Contractor	Ongoing
Construction vehicles and personnel must adhere to business hours. This may be relaxed to accommodate abnormal vehicles so that they do not hinder daily life and/or regular traffic.	Contractor/ Engineer/ECO	Ongoing
All drivers and machinery operators must be sensitised to the fact that they are working in an area with vehicle traffic and must exercise due caution when entering/ exiting the site.	Contractor	Ongoing
Disruptions to vehicular and pedestrian accesses must be kept to a minimum at all times. Access to properties must be kept open at all times.	Contractor	Ongoing
The contractor must ensure that existing traffic flow is accommodated, so as to cause as little disruption/ congestion as possible.	Contractor	Ongoing
The site camp must be clearly marked and well-lit at night.	Contractor	Ongoing
Security gates and a guard must be appointed to prevent unauthorised access.	Contractor	Ongoing
Speed of construction vehicles and other heavy vehicles must be strictly controlled to avoid dangerous conditions for other road users.	Contractor	Ongoing
The Contractor must ensure that any large or abnormal loads that must be transported to/ from the site are routed appropriately, and that appropriate safety precautions are taken during transport to prevent road accidents.	Contractor	Ongoing
Where possible, heavy machinery should be parked at the site overnight, within a secure demarcated area within the footprint of the site camp, instead of moving the machinery to and from the site each day.	Contractor	Ongoing
Vehicles must park on demarcated site only.	Contractor	Ongoing
The site must be wet regularly to minimise dust. Vegetation must be removed as and where required only.	Contractor	Ongoing

Flora and Fauna		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
No-go areas must be identified and agreed upon prior to the commencement of the Construction Phase of this development and these must be well communicated to staff on site.	Contractor/ ECO	Ongoing
Impact zones or construction servitudes must be strictly adhered to and tape and/ or shade cloth fences must be used during construction to prevent access to the surrounding forest.	Contractor/ ECO	Ongoing
All fencing used must strive to prevent loss of life (reptiles, birds, mammals must not get caught in fences).	Contractor/ ECO	Ongoing
Strict and enforceable measures (fines, site closure) must be in place should Contractors not adhere to no-go areas, or unnecessary loss of life is observed.	ECO	Ongoing
Permanent Fencing used during operation must be agreed upon with the ECO.	Contractor/ ECO	Ongoing
A suitably qualified Environmental Officer (EO) must be appointed by the Contractor to complete the following tasks: - Liaise with the ECO and communicate recommendations to the rest of the professional team; - Ensure Day-to-day implementation of mitigation techniques and conditions of the Environmental Authorisation; - Facilitate the safe removal and relocation of protection trees and vegetation; - Facilitate the safe removal and relocation of all fauna found on site or caught in trenches.	Contractor	Once
Prior to the clearing of the site, the ECO and if necessary the Biodiversity Specialist must ensure that all plants of conservation significance are removed.	ECO	Once
Vegetation clearing must be done systematically as the project progresses to avoid stormwater damage, erosion and excessive amounts of bare soil.	Contractor/ ECO	Ongoing
Burning of removed vegetation is prohibited.	Contractor/ ECO	Ongoing
Identify sensitive fauna on the site prior to construction.	Contractor/ ECO	Ongoing

Removal or harvesting of vegetation by staff must be prohibited in the surrounding areas and training of staff will aid in this regard.	Contractor/ ECO	Ongoing
Hunting and catching of any animals must be prevented. This includes chance encounters with reptiles, which must be handled by a professional.	Contractor/ ECO	Ongoing
Noise levels, including vibrations caused by any ground drilling must be kept to a minimum to prevent animals abandoning nearby habitats.	Contractor/ ECO	Ongoing
Access to the proposed oxidation pond must be restricted to official use only. The Construction of a security gate would assist in this regard.	Contractor/ ECO	Ongoing
Strict soil maintenance and topsoil management must be implemented to reduce impacts to soil.	Contractor/ ECO	Ongoing
Special attention must be given to alien invasive plant species within the area and alien invasive.	Contractor/ ECO	Ongoing
Management steps must be implemented during the construction phase.	Contractor/ ECO	Ongoing
Use and/ or storage of hazardous substances on site (oil, cement etc.) must be conducted with caution, in order to prevent spills and contamination of both vegetation and soils on site.	Contractor/ ECO	Ongoing
If any species of conservation importance is found on site during construction, it must be report to the ECO and the relevant procedures must be adhered to.	Contractor/ ECO	Ongoing
The species list found in table 14, must form part of each environmental awareness training sessions conducted with the Contractor. Visual Illustrations must be used, and the Contractor and staff must be aware of species occurring within the study area.	Contractor/ ECO	Ongoing
The Rehabilitation measures mentioned in section 7 below must be adhere to. The Contractor a week prior to construction must submit a “Rehabilitation Method Statement” to the appointed ECO to confirm their understanding of the anticipated rehabilitation procedures.	Contractor/ ECO	Ongoing
Fishing near any surrounding wetland must be prohibited.	Contractor/ ECO	Ongoing
Trenches must have one sloped side to allow animals which fall in to get out.	Contractor/ ECO	Ongoing
Trenches must be checked daily while open for animals which may be unable to get out.	Contractor/ ECO	Ongoing
Any animals found must be returned uninjured to suitable safe habitat.	Contractor/ ECO	Ongoing
Should any species be found that are protected, either provincially or Nationally, the correct permit should be applied for in advance and the conditions of those permits should be followed to prevent or offset impacts during construction.	Contractor/ ECO	Ongoing

A site walk-through conducted either by the ECO or a qualified botanist, two months before construction will aid in identifying any additional/undetected species present and aid in apply for the appropriate permits after the issuing of the ROD. This will be particularly important to reduce the destruction of transplantable plant species that may have migrated onto the proposed site between the date of the survey and construction.	Developer	Once

Risk of Alien Invasive Encroachment onto Disturbed Areas:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Protect as much indigenous vegetation as possible.	Contractor/ECO	Ongoing
Ongoing alien plant control must be undertaken particularly in the disturbed areas. Areas which have been disturbed will be quickly colonised by invasive alien species. An ongoing management plan must be implemented for the clearing/eradication of alien species.	Contractor/ECO	Ongoing
Alien invasive plant eradication plan must be implemented on an ongoing basis to limit the establishment of exotic species during the rehabilitation of the disturbed areas.	Contractor/ECO	Ongoing
The ECO must supply the Contractor with a list of problematic alien invasive plant species that are likely to occupy the site during construction.	Contractor/ECO	Ongoing
Regular Environmental Toolbox Talks must be implemented by the Contractor on site.	Contractor	Ongoing

Soil Erosion and Stormwater:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Environmental awareness training of the contractor and his workers must take place wherein acceptable construction methods and stormwater management practices will be discussed.	Contractor	Ongoing
Project management of construction activities must be done to ensure that only small and/or necessary portions will be disturbed at any given time. Vegetation must not be removed until necessary.	Contractor	Ongoing
Minimising the extent of disturbance in high risk areas must be done. This is best achieved through hand excavation and backfilling of trenches. Otherwise strict control and use of the smallest machines possible must occur.	Contractor	Ongoing
Ensure that work progresses, and trenches are backfilled rapidly. The opening of small sections of trench at any one time should help to ensure that this occurs.	Contractor	Ongoing

Soil erosion measures must be placed on sensitive areas like banks and slopes.	Contractor	Ongoing
Stormwater control must be undertaken to prevent soil loss from the site.	Contractor	Ongoing
Strict soil maintenance and topsoil management must be implemented to reduce impacts to soil.	Contractor	Ongoing
Soil management and rehabilitation is also important in order to ensure that vegetative cover establishes over the backfilled trench/ disturbed areas as rapidly as possible.	Contractor	Ongoing
Topsoil (top 300mm layer minimum) must be removed prior to the construction by earthmoving equipment. Topsoil must be stored in heaps of not higher than 2m in a way that prevents damming. Stored top soil must not be compacted.	Contractor	Ongoing
Top soil must not be used as fill material for backfilling of excavations on site.	Contractor	Ongoing
Offsite runoff around disturbed areas should be diverted to reduce the amount of stormwater which comes into contact with exposed soils, as a result there will be less erosion.	Contractor	Ongoing
Contractor must monitor and manage drainage of the entire site including the site camp.	Contractor	Ongoing
The length of open trench excavations will be limited to a maximum of 50m.	Contractor	Ongoing
Cut-off catch water berms must be constructed on the high side of the trench. This will be particularly relevant for areas with steep slopes. For the steep areas, berms will be positioned so that the velocity of the storm water run-off will be reduced.	Contractor	Ongoing
Where material is highly erodible, sand bags must be used channel the flows.	Contractor	Ongoing
Storm water run-off must be directed on to vegetated buffer zones and not directly into water courses	Contractor	Ongoing
Trench barricading must have openings to prevent the build-up of storm water run-off behind them.	Contractor	Ongoing
Pumps must be available at all times on site for dewatering of trenches after storm events.	Contractor	Ongoing
The open ends of the pipe must be blocked with end caps or geo-textile fabric (Bidim) to prevent debris from entering the pipe.	Contractor	Ongoing
Sediment traps and fencing must be utilized to prevent excess levels of sediments entering watercourses from work areas and afterwards disposed of in a lawful manner the contractor will check weather forecasts to mitigate potential storm damage.	Contractor	Ongoing
During rehabilitation process, in steep areas, sand bags must be placed perpendicular to the trench.	Contractor	Ongoing
Runoff from the site camp site must not discharge into neighbor’s properties especially in the residential zone.	Contractor	Ongoing

Conservation of topsoil during project inception stage must be applied, for easily reinstatement of vegetation after completion of a sections of work during construction to prevent erosion.	Contractor	Ongoing
Stockpiles of soil must be positioned approx. 50m away from watercourses or stormwater drains to prevent soil from eroding directly into the watercourse or adjacent wetlands.	Contractor	Ongoing
Stockpiles of topsoil & spoil material must be protected from wind & water erosion.	Contractor	Ongoing
Removal of vegetation unnecessarily on steep slopes must be prevented.	Contractor	Ongoing
To prevent stormwater damage, the increase in stormwater runoff resulting from the construction activities must be estimated and planned for accordingly.	Contractor	Ongoing
A drainage plan must be prepared by the contractor for approval by the Engineer and must include the location and design of temporary stream crossing.	Contractor	Ongoing
Incorrect disposal of substances and materials and polluted runoff can have negative impact on groundwater, where the stormwater discharge take place.	Contractor	Ongoing
Discharging of hazardous substances in the stormwater stream is prohibited.	Contractor	Ongoing
Upon completion of construction top soil must be replaced in bare ground areas.	Contractor	Ongoing
Land clearing, earth moving, and construction activities should not take place during heavy rains, or windy conditions.	Contractor	Ongoing
Construction should proceed quickly and efficiently to minimise the amount of time that exposed surfaces are without a suitable cover.	Contractor	Ongoing
After each construction phase is completed, the contractor must ensure that all disturbed surfaces are provided with suitable cover and/or rehabilitated. Hardened surfaces (including within the working area and site camp) should be ripped and mulched to improve filtration & reduce run-off. The ECO is to ensure that these areas are adequately rehabilitated and re-vegetated where appropriate.	Contractor/ECO	Ongoing

Groundwater Pollution:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Chemical substances must be mixed or handled on impervious surfaces. Concrete must be mixed on impervious surfaces. There should be a contained/ designated area for washing out and cleaning of concrete mixing equipment, to further prevent pollution. In addition, waste waters from site should be collected and disposed of off-site.	Contractor/ ECO	Ongoing
An adequate number of chemical toilets for the staff must be provided and serviced regularly. The positioning of the toilets must be determined taking cognisance of the neighbours. The ECO must authorise the positioning of the toilets.	Contractor	Once
Spills that result in the contamination of ground and/or surface water must be reported immediately to the ECO	Contractor	Ongoing
Spills must be managed in the following manner: - Stop the spill - Contain the spill - Report significant spills to DWS and the Local Municipality Water and Sanitation Department. - Remove spilled material for treatment/disposal. - Determine any possible impact to soils, groundwater, storm water, etc. - Undertake any necessary remedial actions - Document the spill	Contractor	Ongoing

Surface Water Pollution (wetland):

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Restrict all activities to within the project footprint area.	Contractor	Ongoing
Whilst replacing existing infrastructure, contain all working areas to prevent spillages and leaks during this phase of the project.	Contractor	Ongoing
Any waste, leaks or spills must be cleaned up immediately and removed from site. This must be disposed of in designated licensed facilities.	Contractor	Ongoing

Comments from Ezemvelo and Environmental protection bodies must be kept in consideration in order to protect the wetland which is located within the project area	Contractor	Once
A no-go area to protect the wetland must be demarcated. The limits of the working space must be demarcated and adhered to. No personnel working on the site, may enter the designated no-go areas.	Contractor	Once
Environmental training must be provided to personnel.	Contractor	Once
No laundry and ablutions are allowed in the wetland. Contractors must provide ablution facilities to staff.	Contractor	Ongoing
Abstraction of water for construction use is prohibited unless obtained legally. Municipal water must be brought in by tanker/vessels to the site for use by the contractors.	Contractor	Ongoing
Concrete and cement mixing wash areas should be placed at least 20m from any watercourse/ surface water drainage line to minimise the risk of run-off entering a water source.	Contractor	Once

Pollution due to site operations:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Waste must be separated especially with regard to hazardous waste. This would include soils that have been contaminated by cement, fuel, paints, etc. Care must be taken to avoid contamination of soils.	Contractor/ ECO	Ongoing
Personnel must be trained in etiquette regarding littering and waste management.	Contractor/ ECO	Ongoing
Appropriate scavenger proof vessels for wastes must be provided in suitable locations and must be adequate in number.	Contractor/ ECO	Ongoing
A waste storage area must be allocated and adhered to.	Contractor/ ECO	Ongoing
Careful storage and handling of materials such as fuels, paints and chemicals to minimize the risk of spillage onto open ground or into surface water systems. All potentially polluting materials should be stored in closed containers away from sensitive areas.	Contractor/ ECO	Ongoing
Spills in bunded areas must be cleaned up, removed and disposed of safely from the bunded area as soon as after detection as possible.	Contractor/ ECO	Once
Mixing/ decanting of all chemicals and hazardous substances including concrete and asphalt must take place either on a tray or on an impermeable surface away from sensitive areas. Waste from these should then be disposed of to a suitable waste site.	ECO	Once

Bins and/ or skips should be provided at convenient intervals for disposal of waste within the construction area. These shall be regularly emptied. Bins should have liner bags for efficient control and safe disposal of waste. Recycling should be facilitated and encouraged. Littering on site should be prohibited and the site should be cleared of litter at the end of each day.	Applicant	Ongoing
Waste must be disposed of at registered landfill sites or appropriate facilities. Proof of disposal must be provided when requested.	Contractor/ ECO	Ongoing
Staff must have a system of housekeeping to ensure litter is minimised.	Contractor/ ECO	Ongoing
Where waterborne sewerage is not available, temporary chemical toilets must be provided by a company that is approved by the Municipality/ Engineer/ Environmental Consultant. These shall be maintained in a clean state by a registered chemical waste company. These must be located within the Contractors camp and on site as agreed by the Municipality/ Engineer/ Environmental Consultant. The construction of 'long drop' toilets is forbidden.	Contractor/ ECO	Ongoing
Provision should be made during set up for all polluted runoff to be treated to the Department of Water Affair's/ Municipality's/ Engineer's/ Environmental Consultant's approval before being discharged into the stormwater/ surface water system.	Contractor/ ECO	Ongoing
A spill contingency plan must be prepared for the construction phase.	Contractor/ ECO	Ongoing
The responsibility rests with the applicant to identify any sources or potential sources of pollution from his undertaking and to take appropriate measures to prevent any pollution of the environment.	Contractor/ ECO	Ongoing

Disturbance to Residential Area by Noise and Dust from Construction Processes:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Construction operations and deliveries should be restricted to normal working hours.	Contractor	Ongoing
When works are to be undertaken within residential properties, ○ The extent and timing of the works shall be agreed with the property owner/ resident; ○ Photographic records shall be prepared by the contractor pre-construction detailing the condition of the site prior to the works progress and mitigation measures weekly/ monthly; ○ All necessary measures shall be in place to ensure that the property is secure; ○ A supervisor shall be on the property during all work to supervise workers; ○ Rehabilitation works shall be undertaken as quickly as possible to the same standard as existing finishes/ planting prior to disturbance by the workers.	Contractor	Ongoing

People from adjacent areas should be kept informed of the need and extent of noisy disruptive processes, particularly blasting activities.	Contractor	Ongoing
Appropriate dust suppression measures must be applied as and when deemed necessary by the ECO, engineer or local authority.	Contractor	Ongoing
Such measures may include the use of water bowsers to damp down dust-generating surfaces or use of shade-cloth/ netting to prevent dust moving beyond the boundaries of the site.	ECO	Ongoing
The contractor should ensure that plant where appropriate is fitted with properly functioning silencers.	ECO	Ongoing

Air Quality:

ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Damping down of exposed soil areas, to reduce dust pollution.	Contractor	Ongoing
Speed limit sign boards must be erected during the construction phase to limit dust emissions.	Contractor	Ongoing
No fires must be permitted.	Contractor	Ongoing
Limit stripping of vegetation and existing material to necessary working areas.	Contractor	Ongoing
Vehicles and machinery must be kept in good working order to limit emissions and oil spillage.	Contractor	Ongoing
Chemical toilets must be used for the workforce.	Contractor	Ongoing
Toilets, cooking areas and waste collection areas must be located away from houses.	Contractor	Ongoing

Visual Impacts:

ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
The contractor tasked with the maintenance of the pipeline must adhere to project schedule in order to minimise the length of the maintenance and repair period.	Contractor	Ongoing

The site must be well maintained and neat.	Contractor	Ongoing
Inspections of the site by an Environmental Control Officer are required.	ECO	Ongoing
The site camp, storage facilities, stockpiles, waste bins and any other temporary structures on site should be located in such a way that they will present as little visual impact on surrounding residents and road users as possible.	Contractor	Ongoing
Upon completion of the repair and maintenance activities undertaken during the operational phase, the site must be well maintained and neat.	Contractor	Ongoing
The oxidation plant area must be well demarcated and fenced off.	Contractor	Ongoing
Signage must be erected to indicate the area of the oxidation plant.	Contractor	Ongoing

Damage to existing services:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Check the location of all underground and above ground services, if any, as well as working requirements with all service providers prior to commencing excavation.	Contractor	Ongoing
Proving the location of all underground service prior to trench excavation.	Contractor	Ongoing
Working in accordance with service providers requirements adjacent to their service runs.	Contractor	Ongoing
Should damage to service runs occur, taking all necessary measures to minimize damage, inform the relevant service provider immediately and undertake all necessary remedial work including the employment of specialist contractors in order to minimize disruption of the service.	Contractor	Ongoing

Disturbance to existing infrastructure and impact on Heritage and Paleontological resources:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
No dwellings or structures should be impacted by the proposed sewage reticulation. If structures are to be impacted, then an application for permission to alter any structure older than 60 years must be made to Amafa in terms of section 33 (1) (a) of the KZN Heritage Act.	ECO	Ongoing
Stakeholders must be notified as soon as possible. This includes the community, the municipalities, the service providers and ward councillor.	ECO	Ongoing

Due to difficulties accessing aspects of the project, it is recommended that when the vegetation is removed in preparation of construction of the rising main, pump station and access road, the ECO inspects the cleared areas for ash deposits (unnaturally grey appearance of the soil in comparison to the surrounding soil); bone concentrations (either animal or human), shell middens, ceramic fragments such as pottery shards and beads. If such sites are found then a heritage specialist must assess the significance of the find/s.	ECO	Ongoing
No work may proceed until the desktop palaeontological assessment has been undertaken on the location of the proposed pump station and access road and the recommendations of this study are implemented.	ECO	Ongoing
The construction team should be made aware that heritage resources, such as archaeological remains, usually occur below the ground surface level. Should any archaeological material and other heritage resources be accidentally unearthed during the course of construction, all such activities are to be halted immediately, and the Contractor will immediately inform the Project Manager. A registered heritage specialist must be called to site for inspection. Amafa must also be informed about the findings.	Contractor/ ECO	Ongoing
The heritage specialist will assess the significance of the resource and provide guidance on the way forward.	Heritage Specialist	Ongoing
Servitudes of infrastructure must be confirmed prior to design of the development and permission granted.	ECO	Once
No-Go areas must be demarcated. This would include any known existing grave sites.	Contractor/ ECO	Ongoing
Should any remains be found on site that is potentially human remains, the South African Police Service should also be contacted. AMAFA must be contacted immediately.	Contractor/ ECO	Ongoing
If there are chance finds of fossils during construction, a paleontologist must be called to the site in order to assess the fossils and rescue them if necessary (with an AMAFA permit). The fossils must then be housed in a suitable, recognized institute.	Contractor	Ongoing
Written permission must be obtained from Amafa if heritage resources are to be removed, destroyed or altered.	ECO	Ongoing
All heritage resources found in close proximity to the construction area to be protected by a 5m buffer in which no construction can take place. The buffer material (danger tape, fencing, etc.) must be highly visible to construction crews.	Contractor/ ECO	Ongoing
Under no circumstances may any heritage material be destroyed or removed from site unless under direction of a heritage specialist.	Contractor/ ECO	Ongoing
The protocol for fossil finds recommended by the desktop palaeontological study must form part of the mitigation measures and implemented where necessary.	EAP	Once
It is likely that some fossils occur along the route of the proposed pipeline, however, it is not possible to determine precisely what fossils could be found until the construction and excavations begin. It is recommended that either a professional palaeontologist/geologist or a well-informed environmental control officer be present when excavations commence.	Contractor/ ECO	Ongoing
The responsible person must contact the appointed ECO to allow photography and recording of the position of any fossils before collecting them (with an AMAFA permit).	Contractor	Once

The fossils should be deposited in a recognized local museum. Given that the pipeline footprint will be very narrow and likely to cross cut the potentially fossiliferous strata rescue is recommended rather than preservation in situ.	Contractor/ ECO	Ongoing
Public Safety and Health:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
The design and planning of the development must be conducted by trained and relevant consultants.	ECO/ EAP	Once
Skilled contractors must be utilised for specialised tasks.	Contractor	Ongoing
Residents must be made aware of the works.	Contractor	Ongoing
Trenches must not be left open and unmarked.	Contractor/ ECO	Ongoing
Supervisors are to be vigilant particularly of children who may come close to the construction works without realizing the danger to themselves.	Contractor/ ECO	Ongoing
Appropriate barricades and signs should be used where necessary.	ECO	Ongoing
Implementation of safety measures and work procedures.	Contractor	Ongoing
The most dangerous operations are likely to be the operation of heavy machinery and plant and blasting. Mitigation should ensure that all plant and machinery is properly maintained and is operated in accordance with safety requirements and manufacturer's recommendations.	Engineer	Ongoing
The engineer shall have the right to order the immediate removal from the site of any plant which he may deem to be unsatisfactory for the proper execution of the work.	Contractor/ ECO	Ongoing
All relevant Health and Safety legislation as required in South Africa should be strictly adhered to. This includes the Occupational Health and Safety Act.	ECO	Ongoing
Fire safety measures must be included in the design of the facility. Fire safety equipment must be provided on site during construction.	ECO	Ongoing
First aid kits are required on site as well as an incident records file.	Contractor/ ECO	Ongoing
Construction related vehicles must adhere to speed limits of the surrounding roads and a limit of 20km/hr on site.	Contractor	Ongoing
Safety gear including hard hats and safety shoes must be provided and worn at all times while on site.	Contractor/ ECO	Ongoing
Emergency numbers must be clearly visible on site.	Contractor/ ECO	Ongoing
Trespassing and/or utilising the site as a thorough fare is prohibited by unauthorised persons.	Contractor	Ongoing

Contractor staff are prohibited from trespassing over the site boundaries.	Contractor	Ongoing
Interaction with neighbours and objecting parties at the site must be well documented. A complaints register must be readily available on site. Interaction with external parties must be courteous.	Contractor/ ECO	Ongoing
Construction staff are prohibited from wandering freely in neighboring houses.	Contractor	Ongoing
Permission must be granted prior to entering a private property, if applicable.	Contractor	Ongoing

Socio Economic Impacts:

ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Community members and leaders must be notified as soon as possible by posting notice boards with illustrations on site.	ECO	Once
Local people must be employed where possible.	Contractor	Ongoing
Traditional leaders and/or ward councillors must be involved in the public participation and they will aid in appeasing the community.	ECO	Ongoing

Health and Safety:

ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Unskilled labour must be trained relevantly including environmental training. Workers must receive thorough training in using potentially dangerous equipment or chemicals.	Contractor	Ongoing
The ECO is not responsible for the health and safety policies of workers on site. The EMPr briefly addresses this issue since the main aim of the EMPr is protection of the environment and surrounds.	Contactor	Ongoing
Safety measures, work procedures and first aid must be implemented on site. First aid facilities must be available on site at all times. Compliance with the Occupational Health and Safety Act is the responsibility of the contractor.	Contractor	Ongoing
The contractor is responsible for ensuring that all equipment is maintained in a safe operating condition.	Contractor	Ongoing

A safety officer must be appointed and keep records of health and safety incidents on site. Any incidents must be reported to the project manager immediately.	Contractor	Ongoing
Protective gear such as safety harnesses, hard hats, safety shoes and other equipment must be provided by the contractor. Workers have the right to refuse work in unsafe conditions. No person may enter the site without training and appropriate protective gear	Contractor	Ongoing
A record of drugs administered or precautions taken and the time and dates when this was done must be kept. This can be used in court if necessary for any claims	Contractor	Once
The contractor must ensure that workers are educated about HIV/AIDS and its risks	Contractor	Once
Material stockpiles or stacks, such as pipes must be stable and well secured to avoid collapse and possible injury to site workers	Contractor	Ongoing
Eating and resting areas must be regularly serviced and cleaned to ensure hygiene	Contractor	Ongoing
Hazardous working areas must be marked	Contractor	Ongoing
Emergency numbers for local police and emergency personnel/units must be placed in a prominent area	Contractor	Ongoing
Trespassing and/or utilising the site as a thorough fare is prohibiting by unauthorised persons. Contractor staff are prohibited from trespassing over the site boundaries	Contractor	Ongoing
Interaction with neighbours and objecting parties at the site must be well documented. A complaints register must be readily available on site. Interaction with external parties must be courteous.	Contractor	Ongoing

Security:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Access to the equipment and facilities on site must be strictly controlled and authorised only by the contractor. 24-hour security on site could aid in theft control.	Contractor	Ongoing
Trespassing on adjoining properties by workers is prohibited.	Contractor	Ongoing
All houses, walls, fences, gardens, trees and livestock situated within the site are private property. No encroachment is to be made onto	Contractor	Ongoing

these properties by the contractor or his employees, without the owner's consent.		
The Contractor shall advise the community liaison officer to notify property owners at least two days in advance of the activities to be carried out inside their properties. Property owners consent should be obtained prior to excavation through crops and properties, etc.	Contractor	Ongoing
Movement and access to properties are to be maintained for all current residents at all times during the contract.	Contractor	Ongoing
Existing services to individual properties within the site, e.g. water reticulation, electrical reticulation and telephone lines shall be kept operational as much as possible.	Contractor	Ongoing

Fire Management:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Fire-fighting equipment must be provided at strategic points, including fire blankets as per OHSA.	Contractor	Ongoing
All staff must be trained in fire hazard control and firefighting techniques.	Contractor	Ongoing
All flammable substances must be stored in dry areas which do not pose an ignition risk.	Contractor	Ongoing
No open fires are allowed on site.	Contractor	Ongoing

Incident Reporting:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Incidents regarding complaints of noise and disturbances must be recorded by the contractor and/or his representative immediately with details of time of incident, time of complaint and nature of complaint.	Contractor	Ongoing
Incidents regarding minor injuries must be recorded in an incidents and injuries file detailing time of incident, nature of incident and any medication and/or medical supplies provided from the first aid kit that must be available on site at all times.	Contractor	Ongoing
Incidents regarding safety breaches including non-compliance to the safety guidelines must be recorded detailing the time of the incident, the	Contractor	Ongoing

persons involved/responsible and the nature of the incident.		
Incidents regarding major spills of more than 5ℓ of a hazardous material must be dealt with in the manner described previously and recorded and reported within two days of the spill. The incident must be reported to the ECO who will relay it to the DW&S and EDTEA.	Contractor	Ongoing
Any other incidents of concern that are covered in the various sections of this EMPr must be recorded appropriately in an incident records file and reported to the ECO during the monthly audit.	Contractor	Ongoing
The records file and other paperwork including the EMPr, Emergency Protocols and waybills for appropriate disposals must be available in the site office for inspection at any given time.	Contractor	Ongoing

Remedial Actions:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Depending on the nature and extent of the spill, contaminated soil must be either excavated or treated on-site. Excavation of contaminated soil must involve careful removal of soil using appropriate tools to storage containers until disposed of at a registered hazardous landfill site. The application of soil absorbent materials as well as oil-digestive powders to the contaminated soil may be required. Contaminated remediation materials must also be removed from spill area, stored and disposed of with due diligence.	Contractor	Ongoing
Spill incidents must be recorded and reported to Department of Water Affairs (DW&S), the ECO and any other relevant authorities. In the event of a spill, the following steps can be taken: • Stop the source of the spill; • Contain the spill; • Report the spill; • Remove the spilled product for treatment or authorised disposal; • Determine if there is any soil, groundwater or other environmental impact;	Contractor	Ongoing

• If necessary, remedial action must be taken in consultation with the relevant government departments. • The incident must be documented and recorded. Mitigation measures to prevent recurrences must immediately be devised and implemented		

Reference Marks, Site Establishment and Contractor's Camp:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
The Contractor will have the responsibility of referencing each and every setting out peg on the Contract, in a position such that the reference pegs will not be disturbed by his operations on the site, and to safeguard and maintain such reference pegs until the completion of the Works.	Engineer/Contractor	Once
The Contractor shall provide the Engineer with a record of the position of the reference pegs and he shall assist the Engineer throughout the Contract in the checking of the setting out of the Works, using these reference pegs.	Contractor	Once
Choice of site for Contractors Camp requires authorisation by ECO and must take into account the location of local residents and/or ecologically sensitive areas, including the watercourse, flood plains and slip/unstable zones.	ECO	Once
The camp must not be situated within any flood plains/wetlands. The route construction servitude must be demarcated with chevron tape or similar measures. Visually the site must be as compact as the required equipment and personnel allows. Suitable control measures over the contractor's area, plant and material storage to mitigate any visual impact must be implemented. Excess materials, equipment etc. must not be stored at site but rather brought in only as and when required. Equipment and materials must be stacked in a compact and safe manner. The site must have the contractors name signage including contact details.	Contractor	Once

The site must have signage indicating that safety attire is required. The site must have "no unauthorised entry" signs at the boundary of the camp site		
The contractor must make his own arrangements concerning the supply of electrical power, water, telephone and other services. All required amenities, including ablution facilities must be moved to the site before the main workforce arrives	Contractor	Once
The toilets must be situated more than 50m from any watercourse edge (Section 1(24 and 29) National Water Act (36 of 1998))	Contractor	Once
The Contractor must inform all site staff to make use of the supplied ablution facilities and under no circumstances must sanitary activities be allowed elsewhere, including the floodplains and watercourse. Washing of laundry is prohibited at the site	Contractor	Once
No open fires for cooking, etc. are allowed within the contractor's camp	Contractor	Ongoing
Progressive and systematic finishing and tidying will form an essential part of this Contract. On no account must spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of others, and in the event of this occurring, the Employer shall have the right to withhold payment for as long as may be necessary in respect of the relevant Works in the area(s) concerned without thereby prejudicing the rights of others to institute claims against the Contractor on the ground of unnecessary obstruction. All finishing and tidying shall be carried out to the best advantage of the project as a whole.	Contractor	Once

Scope of Work:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
Contractor must provide method statements and adhere to the agreed scope of works.	Contractor	Once
Contractors must provide project schedules that will enforce penalties for delays.	Contractor	Once

Closure of Construction Camp Site:

- Once installation of the pipeline has been completed and all excess material has been removed, the camp site must be rehabilitated.
- Any spilled concrete must be removed and any soil compacted during the construction phase must be ripped, levelled and re-vegetated or surfaced.
- After all construction work is complete, the contractor is required to dismantle/detach/demolish and remove the temporary facility from site and make good all damage, to

the satisfaction of the engineer and ECO.

- All structures comprising the camp site must be removed from the site.
- The camp, storage and waste storage areas must be inspected for spills of substances such as paint, oil, etc. and these must be cleaned up.
- All temporary worker facilities must be removed or decommissioned.
- Copies of all certificates from any waste disposals are to be provided to the ECO.
- Burying of any waste on site is prohibited. All waste must be disposed of at the appropriate facilities.
- The contractor must repair any damage that the construction works may have caused to neighbouring sites.
- The ECO must be notified of the complete decommissioning of the site camp after which the ECO will perform a final audit of the site.

7. REHABILITATION AND OPERATIONAL PHASE/ MAINTENANCE PHASE

The Rehabilitation Phase refers to the closing of the camp site and site handover to the Developer. The Operational Phase is briefly addressed and refers to the Management and Maintenance of the Pipeline and Treatment Plant.

Infrastructure:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE PERSON(S)**	**MONITORING FREQUENCY**
All pipelines and manholes have to be waterproof and are tested as part of the construction process.	Contractor/ ECO	Ongoing
The proposed oxidation plant must be well secured, and lining must be completed and teste for any leaks or irregularities.	Contractor	Once
The oxidation treatment plant staff must be trained on the operation and procedures of the plant.	Contractor	Once
A walk through by the engineer to ensure all aspects of the treatment plant are in accordance with necessary design must be undertaken.	Contractor	Once

Soil Erosion:		
ACTIONS AND MITIGATION MEASURES	**RESPONSIBLE**	**MONITORING**

	PERSON(S)	FREQUENCY
On-going rehabilitation to address areas of erosion as they occur.	ECO	Once
The use of trench breakers in steep trenches.	Contractor/ ECO	Ongoing

Monitoring:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Monthly inspections of the wetland crossing should be carried out for one year after construction to monitor the pipline.	ECO	Once
Daily inspections must be carried by the oxidation treatment staff to ensure the plant is running efficiently, no leakages or blockages occur, and no animals are entrapped within.	Developer	Once

Noise and Disturbance:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
All noise generation are to comply with noise standards.	ECO	Once

Surface runoff:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
The applicant must ensure regular maintenance of all drainage systems within the project area as they help in improving site drainage, and reduce pollutants entering surface waters and groundwater.	ECO	Once

Employees:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Staff and contractors must take cognisance of this EMPr as well as the ZDM Standard EMPr for construction, maintenance and management.	Developer	Ongoing
Staff must abide by the mitigation measures that apply to waste management, sanitation, surface water pollution, traffic, access, soil erosion, stormwater management, protection of flora and fauna, public safety & health and the noise and disturbance factor.		
Employees must receive necessary training with regard to environmental management.		
Employees must wear uniforms, supplied by the employer.		

Management and Maintenance:

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY
Pipeline monitoring will be the most effective measure in identifying possible leakages. Laying the pipes in soils that are not conducive to lateral flow may prevent excessive erosive.	Developer	Ongoing
All pipelines are to be inspected for cracks, leakages, incorrect placement prior to sealing of the trenches by the Engineer.		
Immediate repair operation for any damaged portion of the infrastructure must be taken.		
Buffer zones, gabion walls, ripraps etc., must be implemented to prevent stormwater from pooling and to direct stormwater to existing stormwater infrastructure on the surrounding roads and residential area		

Decommissioning of septic tanks (If applicable)

ACTIONS AND MITIGATION MEASURES	RESPONSIBLE PERSON(S)	MONITORING FREQUENCY

The recommended practice for decommissioning a septic or holding tank is as follows: 1. All solids and liquids must be removed by a registered hauler and disposed of at a licensed sewage treatment plant, lagoon or receiving facility. 2. Any electrical devices or components must be removed and disposed of. Devices containing mercury, such as pump floats, must be disposed of at a licensed hazardous waste disposal facility. 3. Once solids and liquids have been removed the empty tank should be filled with clean sand, gravel or other acceptable material and sealed. 4. The area should be graded and vegetative cover (grass) must be established. • The best practice would be to fill the empty tank rather than crush it as crushing a tank will introduce contaminants into the surrounding soil. • Septic tanks, whether in use or out-of-use pose a significant safety hazard to animals and small children. Lids must be secured to ensure unauthorized access is denied.	Landowner	Ongoing

Rehabilitation

The act of returning land to some degree of functioning by implementing best management practices without the intention of fully restoring it to the existing levels of ecosystem functioning, prior to perturbations and land use changes having taken place. Rehabilitation therefore is the act of trying to return the land cover / vegetation at a level that superficially mirrors what was there prior to the construction of the sewage infrastructure. The proposed access road and pump station will impact some areas of an indigenous forest and the removal of protected species will be unavoidable.

Project Constraints

- Portions of the natural grassland will be permanently lost, for the oxidation treatment plant;
- Construction working servitudes, which do not form part of the operational footprint of the development can only be rehabilitated.
- This will be a rehabilitation exercise and not a restoration ecology exercise. ZDM is recommended to investigate if restoration ecology practises are required, which can be conducted internally once development has taken place and at the landowner’s consent.

Sequence of rehabilitation

Successful rehabilitation is dependent on planting of appropriate species at the correct time of year. Ideally areas that are ready for rehabilitation should be planted as soon as practically possible. However, as the working servitude is often the only access available to the Main Contractor, the environmental rehabilitation is often delayed until the Main Contractor no longer requires the working servitude for access to the Works. The Rehabilitation Specialist, Contractor and ESO/ECO are to liaise to ensure that the risk of erosion is minimised and that top soil is not replaced prematurely.

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8.

8.1. Site Audits

- The route and construction activities must be inspected during the construction and operational phases, according to the conditions of the environmental authorisation, which is generally once a month during construction.
- The date and time of the inspection may not be available to the contractor and/or developer.
- The audit must be executed by an independent environmental control officer (ECO).

8.2. Audit Methodology

- The inspection will cover all aspects stipulated in the proposed management plan.
- Each action will be assigned according to “Adequately done”, “Inadequately done” and “Not done”.
- The ECO may adjust actions should they not be effective in protecting sensitive elements or mitigating threats. This may require an amendment to the EMPr and EDTEA must be consulted prior to any changes.
- Audits will be well documented in Monthly Audit Reports and submitted to the Competent Authority and the Project Manager.

8.3. Responsibility

- Ultimately, the client (Zululand District Municipality) is responsible for the implementation of the environmental management plan.
- Should a concern be raised by an interested and affected party and/or stakeholder, EDTEA will refer to the monthly audit reports from the ECO.
- The ECO is not responsible for the implementation of the EMPr but is responsible for auditing the developer’s and contractor’s compliance to the EMPr.
- Following the rehabilitation of the affected site and the final ECO inspection and report, a site handover to the developer must be scheduled.

CLOSING COMMENTS

- This Final EMPr will be submitted to KZN EDTEA for approval.
- The Client’s/Contractor’s Environmental Code of Conduct, the Wetland Rehabilitation measures, the stormwater management plan and specialist study reports must be provided as Appendices to this EMPr in the Environmental File.