
GEOHYDROLOGICAL IMPACT ASSESSMENT REPORT FOR A LANDFILL CONSTRUCTION IN MALETSWAI, WALTER SISULU MUNICIPALITY, EASTERN CAPE PROVINCE



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EXECUTIVE SUMMARY

Muhura Group (Pty) Ltd have been appointed to conduct a geohydrological Impact Assessment for the proposed Maletswai landfill project in Portion 1 and 6 of the Farm Rietvalei 195 located in Walter Sisulu Local Municipality of Eastern Cape Province. Walter Sisulu Local Municipality is applying for a Water Use Licence (WUL) in terms of section 40 of the National Water Act (NWA), 36 of 1998.

Walter Sisulu Local Municipality intends to apply for Section 21(a) and (g) to abstract groundwater for domestic use and to dispose of waste in a way that may pollute groundwater environment. The current geohydrological impact assessment aims to determine groundwater availability status and potential impact related to the project's activities. The study will further propose mitigation measures to be implemented by the client as part of the Water Use License Application (WULA) documents to be submitted to the Department of Water and Sanitation.

A hydrocensus was conducted to collect data on the potential impact associated with the activities. Three boreholes were identified on NGA while only one of the three boreholes was identified on the ground with the groundwater level measured at 12 mbgl. Land use and landcover was identified around the project area as consisting of bare grassland and cultivated commercial land. Borehole drilling survey, drilling, pump testing and water quality sampling was conducted during hydrocensus. Two boreholes (MAL BH 1 and MAL Bh2) were drilled to the depth of 60 mbgl. These boreholes were further pump tested for 12-hour period wherein the yield of MAL Bh 1 was 1.66 l/s while MAL BH 2 was 0.02l/s. MAL Bh 1 was aimed to be used for domestic water use as it was upstream of the proposed landfill site.

Water quality sampling was conducted for the two boreholes. The analysis result showed that the water quality for MAL Bh 1 was fit for domestic use while MAL Bh 2 water quality was not fit for use prior treatment due to high total cauliform. Based on the observation during hydrocensus, the aquifer may be classified as minor aquifer as it was not the main source of water in the area.

Impact assessment on the aquifer and the surrounding ecosystem due to the proposed water use activities was conducted and the potential risk and mitigation measures were

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indicated in the report. The impact rating for the proposed activities had medium to high potential impact on the local groundwater system. However, mitigation measures were recommended to reduce the impact. Mitigation measures included groundwater monitoring and lining of the landfill site according to the GN R653 requirements of the landfill development. The risk of potential pollution of the aquifer by the proposed activities may reduce when the mitigation measures are implemented. However, an updated geohydrological assessment which include the pollution plume modelling should be conducted within the first five years of the operation of the landfill.

It is recommended that the WULA be granted provided that the applicant implements all remedial and mitigation measures as indicated in this report.

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1 INTRODUCTION

1.1 Project Background

Muhura Group (Pty) Ltd have been appointed to conduct a geohydrological Impact Assessment for the proposed Maletswai landfill project in Portion 1 and 6 of the Farm Rietvalei 195 located in Walter Sisulu Local Municipality of Eastern Cape Province. Walter Sisulu Local Municipality is applying for a Water Use Licence (WUL) in terms of section 40 of the National Water Act (NWA), 36 of 1998.

Walter Sisulu Local Municipality intends to apply for Section 21(a) and (g) to abstract groundwater for domestic use and to dispose of waste in a way that may pollute groundwater environment. The current geohydrological impact assessment aims to determine groundwater availability status and potential impact related to the project's activities. The study will further propose mitigation measures to be implemented by the client as part of the Water Use License Application (WULA) documents to be submitted to the Department of Water and Sanitation.

2 Scope of Work

The scope of work will include the following:

- Desktop and field hydrocensus within 1.5 km radius of the proposed Maletswai Landfill site to determine water use in the area, boreholes and land-use activities which may be impacted by the proposed application
- Drilling of monitoring and abstraction boreholes
- Pump testing of boreholes to determine hydraulic properties
- Groundwater quality sampling for the pump-tested boreholes
- Groundwater impact assessment for the proposed activity
- Compilation of geohydrological impact assessment report with recommendations

3 METHODOLOGY

3.1 Desktop Review

The following information was used for this project:

- DWS, National Groundwater Database (NGA)

4 RECEIVING ENVIRONMENT

Baseline information outlined in this section includes discussions on the regional and local catchment hydrology and geohydrology.

4.1 Project Site Location

The proposed landfill project is in Maletswai under Walter Sisulu Local Municipality. The Walter Sisulu Local Municipality falls under Joe Gqabi District Municipality of the Eastern Cape Province. The proposed landfill is approximately 3 kms east of the Orange River.

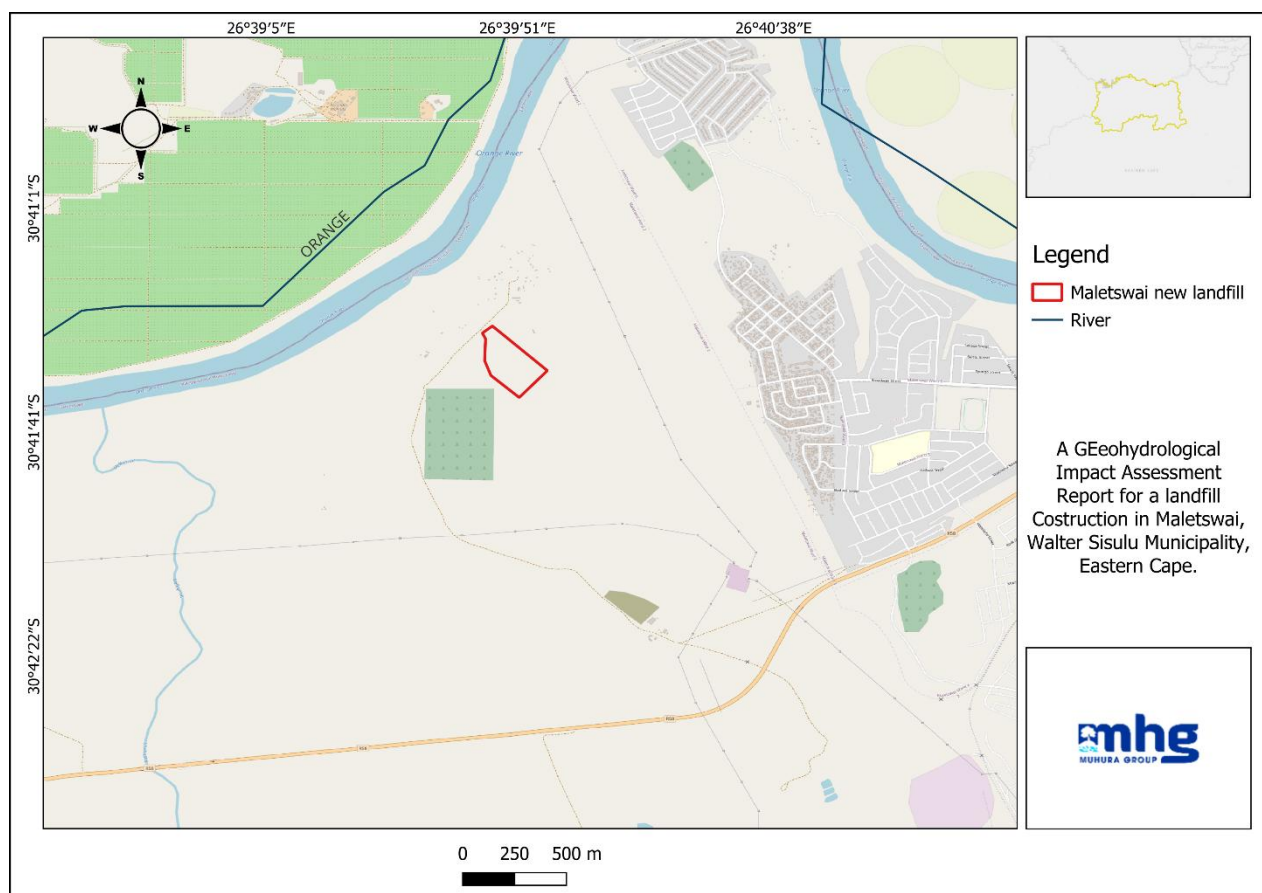


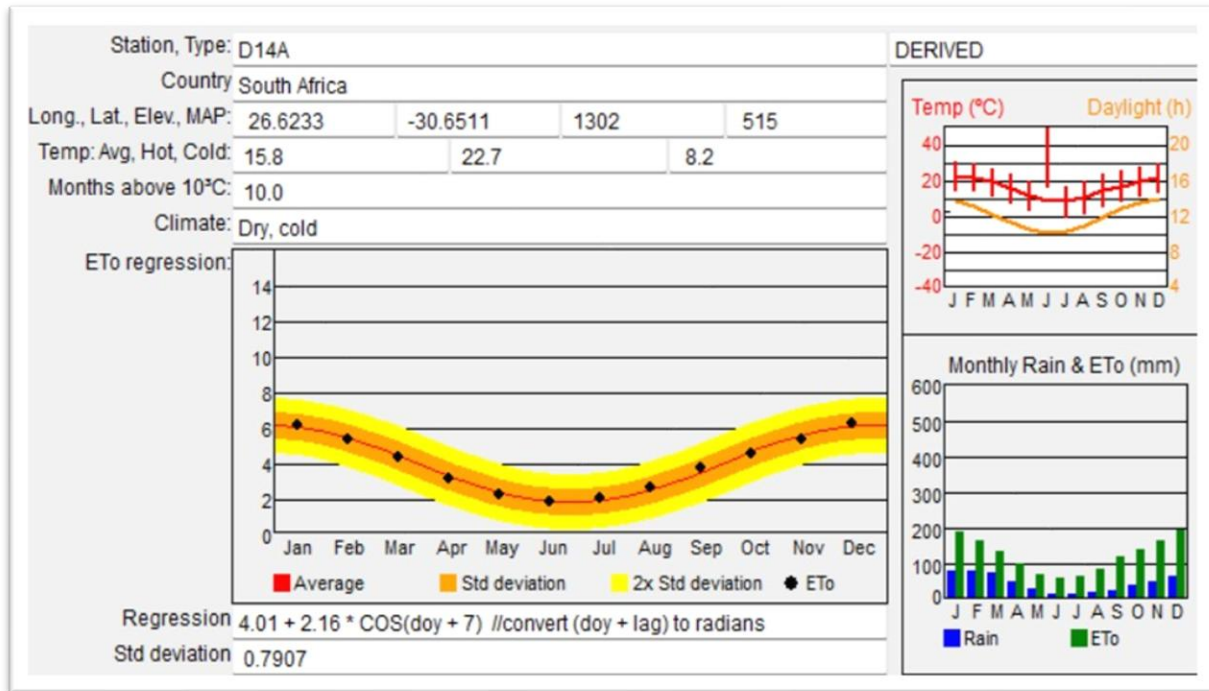
Figure 4-1 Project Locality

4.2 Climatic Condition

Table 4.1 Illustrates the average climate for the site based on data from the virtual centroid weather station for quaternary catchment D14A as extracted from the SAPWAT tool (Van

Heerden *et.al.* 2016). The climatic variables presented on the datasets are temperature, daylight hours, monthly rainfall and reference evapotranspiration (evaporation of grass under ideal conditions).

Table 4:1 Average Climate (Schulze and Maharaj, 2006)



The climate of this region can generally be classified as dry and cold. The average monthly temperature is 15.8°C while the average summer and winter temperatures are 22.7°C and 8.2°C, respectively. Due to a dry climate, the monthly reference evapotranspiration is always higher than monthly total rainfalls. The Mean Annual Precipitation (MAP) of the project area is around 515 mm which is higher than the country's MAP which ranges between 400 mm and 450 mm. The average MAP may indicate a moderate probability of high runoff and groundwater recharge, especially during the high rainfall months of November, December, January and February.

4.2 Catchment Hydrology

The catchment hydrology of the project area is indicated on Figure 4.2. The project is within the D41A Quaternary catchment of the Orange River Water Management Area. The

primary river within this catchment is the Orange River which flows approximately 3 km north east of the project area. Runoff to be generated from the project area may directly flow into the Orange River therefore it is important that stormwater management is implemented.

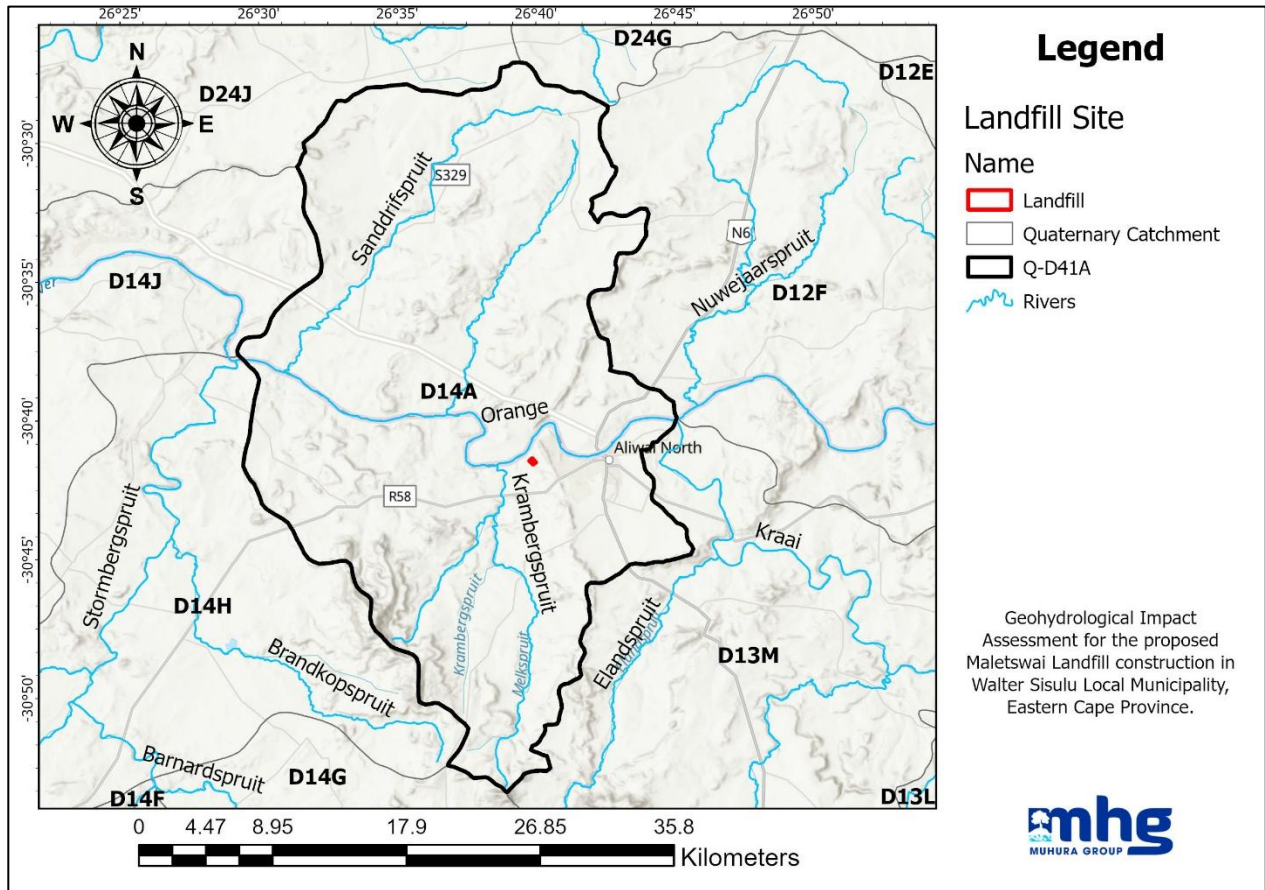


Figure 4-2 Regional Hydrological setting

4.3 Regional Geology and Local Geology

The general regional geology of the area comprises alluvium, dolerite, mudstone and sandstone rock. These rock units form part of the Tarkastad Subgroup; Beaufort Group; Karoo Supergroup (Geotechnical Investigation – Alheit Van Der Merwe School – Aliwal North - Eastern Cape). The area generally has deep soils with clay content, giving way to

shallow soils on red clay with poor drainage capabilities (WSLM Integrated Development Plan, 2020).

The local geology as indicated of Figure 4-3 comprises of approximately equal proportion of argillaceous and arenaceous rocks.

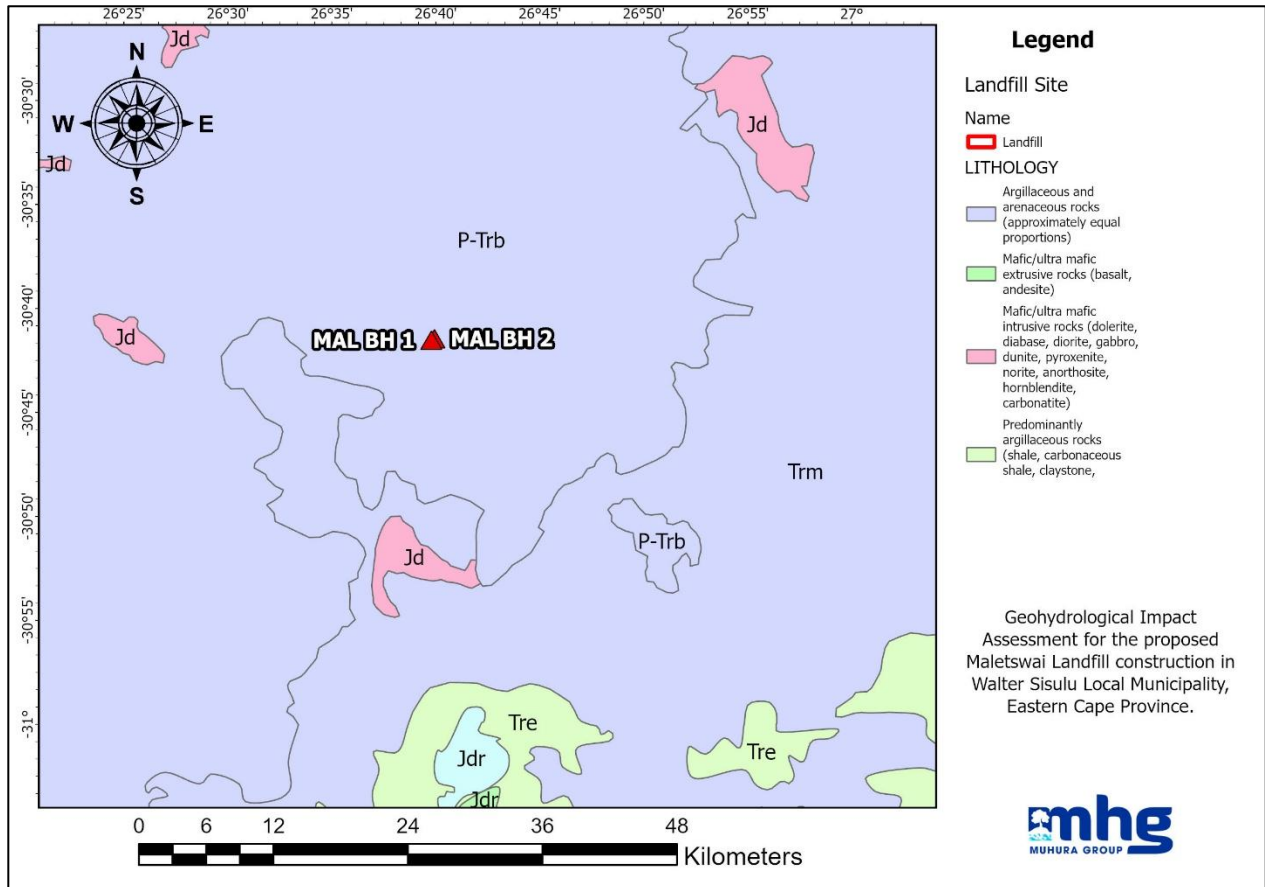


Figure 4-3: Regional Geology

4.4 Catchment's Geohydrology

South African aquifers have been characterised by DWS based on the rock formations in which it occurs together with its capacity to transmit water to boreholes drilled into specific formations. The water bearing properties of rock formations in South Africa are therefore classified into four classes defined as:

Class A - Intergranular

Aquifers associated either with loose and unconsolidated formations such as sands and gravels or with rock that has weathered to only partially consolidated material.

Class B - Fractured

Aquifers associated with hard and compact rock formations in which fractures, fissures and/or joints occur that are capable of both storing and transmitting water in useful quantities.

Class C - Karst

Aquifers associated with carbonate rocks such as limestone and dolomite in which groundwater is predominantly stored in and transmitted through cavities that can develop in these rocks.

Intergranular and fractured

Aquifers that represent a combination of Class A and B aquifer types. This is a common characteristic of South African aquifers. Substantial quantities of water is stored in the intergranular voids of weathered rock but can only be tapped via fractures penetrated by boreholes drilled into the fractured aquifer.

These classes are further subdivided into groups relating to the capacity of an aquifer to transmit water to boreholes, typically measured in l/s. The groups therefore represent various ranges of borehole yields. South African aquifers are classified according to the classification scheme shown in **Figure 4-5**.

The project area is underlain by a fractured aquifer predominantly consisting of sandstones, mudstones and dolomite as observed during the drilling and recorded on the drilling report in **Appendix A**. According to DWAF, 2006 Groundwater Resource Assessment Project Report, the weathered aquifer in the area was 54 m thick while the fractured aquifer was 189 m thick. Groundwater availability on weathered and fractured aquifers was estimated to be 6,247,380 m³/km² and 1,928,470 m³/km², respectively. These volumes indicated high groundwater availability in the area.

A segment of the 1:500 000 hydrogeological map illustrating the typical groundwater occurrences for the study region is shown in Figure 4-5 while the explanation is provided on Figure 4-4. Based on the hydrogeological map, the project area is located within the B3 with fractured aquifer as the main aquifer in the region. This aquifer has an estimated yield of 0.5 to 2 l/s which is closer to the yield of 1.6 l/s measured during pump testing. According to groundwater occurrence assessment of the area, yields more than 2 l/s may often be obtained on joints and on bedding planes in shale and interbedded sandstone of the Eccra Group and the Beaufort Group, even in the absence of dolerite intrusions. However, this is lesser true to a lesser extent in the mudstone and sandstone of the Molteno formation and Elliot formation in the eastern portion of the project area where the landscape is often more dissected resulting in higher surface run-off and lesser recharge.

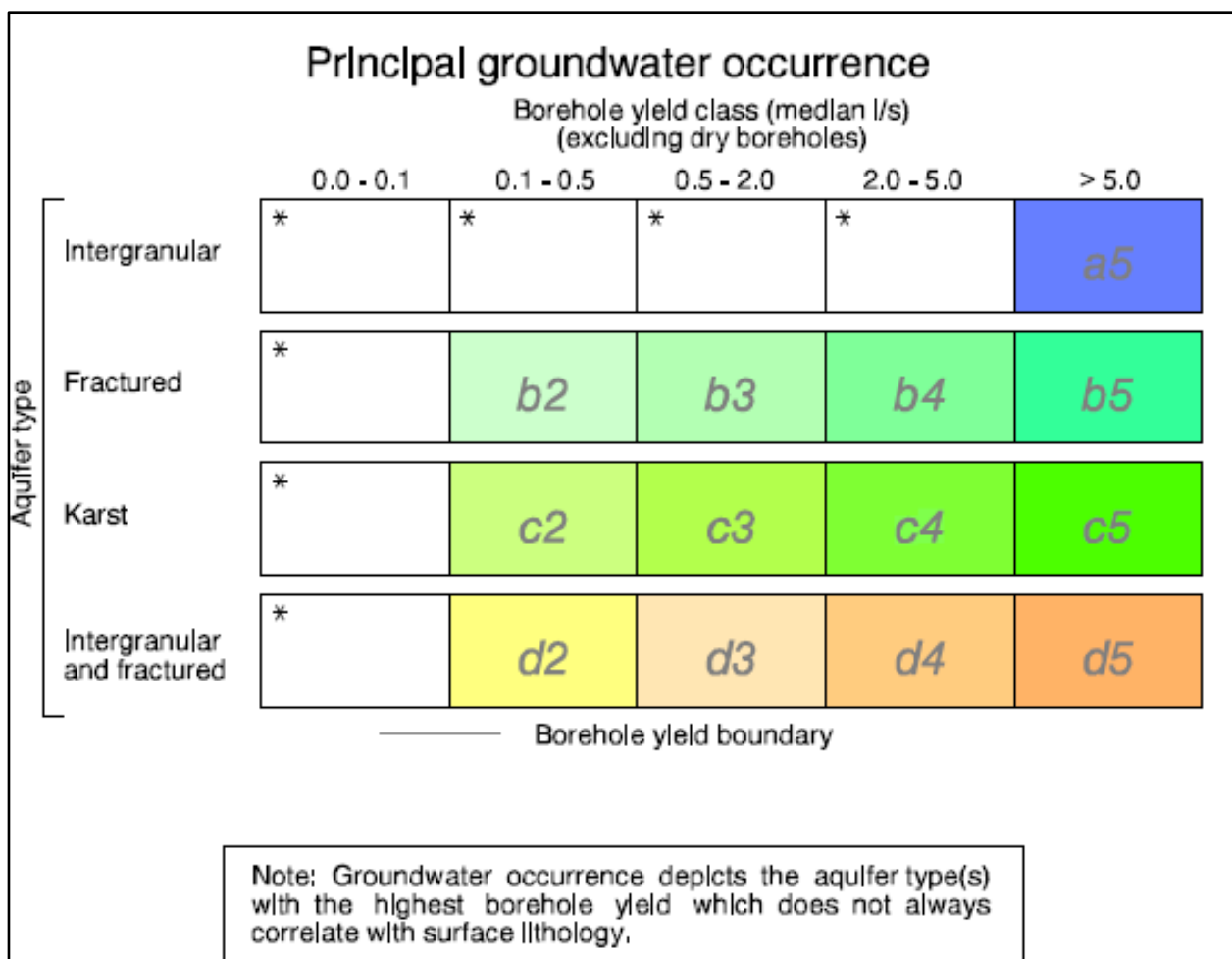


Figure 4-4 Aquifer Characteristics

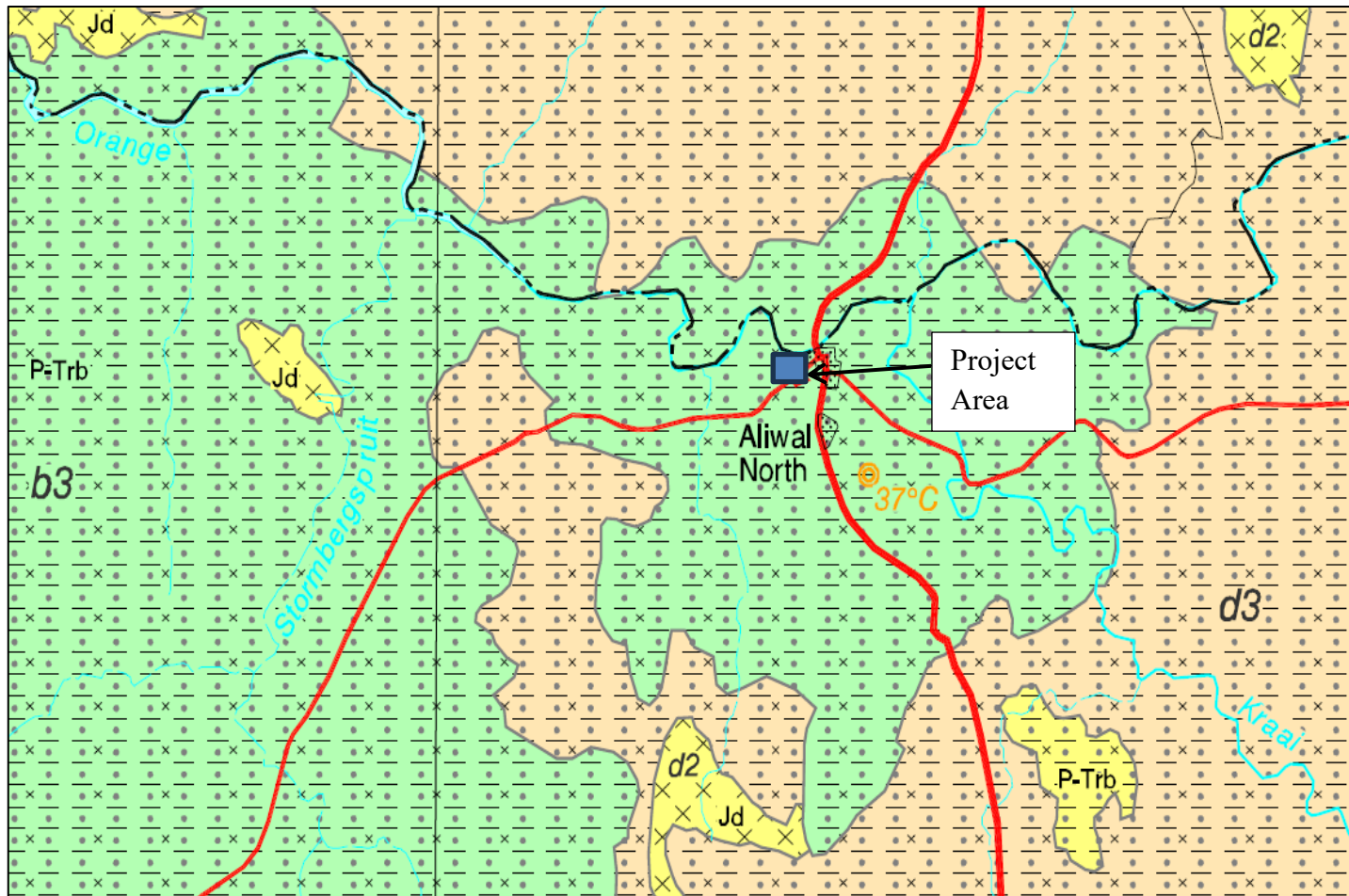


Figure 4-5 Geohydrological map of study area

4.5 Aquifers Classification

Aquifer classification was conducted in terms of the “South African Aquifer System Management Classification, December 1995” manual developed by Parsons (1995). The following definitions of aquifer management classification were used:

Sole Aquifer:

An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative source should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.

Major Aquifer System:

Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support high abstractions for public supply and other purposes. Water quality is generally very good (less than 150 mSm Electrical Conductivity).

Minor Aquifer System:

These can be fractured or potentially fractured rocks which do not have 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 for local supplies and in supplying base flow for rivers.

Non-Aquifer System:

These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risks associated with persistent pollutants.

Special Aquifer System:

An aquifer designated as such by the Minister for Water Affairs (Water and Sanitation), after due process.

Maletswai project area as indicated on geology and geohydrology section, is directly underlain by sandstones, mudstones and dolomite lithologies as observed during the drilling. The aquifer in the project area was not the main source of water supply as irrigation was supplied from the nearby Orange River. Based on the observation during hydrocensus, the aquifer may therefore be classified as a **Minor aquifer**.

5 HYDROCENSUS

5.1 Hydrocensus Investigations

Desktop hydrocensus was conducted before the site visit. This was done to identify land use activities and boreholes within the 1.5 km radius of the project site. The National Groundwater Archive (NGA) data from the Department of Water and Sanitation was accessed to identify boreholes within the project area. Three boreholes were found to be within the 1.5 km hydrocensus boundary on the NGA database, of the 3 boreholes within the radius, only one had a measured water level.

Table 5:1 Hydrocensus information

Borehole number	Site Name	Latitude	Longitude	Water Level (mbgl)
BH 01	DWS/3026DA00013	-30.7003	26.65374	12
BH 02	DWS/3026DA00022	-30.70033	26.66346	-
BH 03	DWS/3026DA00023	-30.70031	26.65735	-

Groundwater levels in the area were around 12 meters below ground level (mbgl) as indicated on **Table 5:1**. This showed that groundwater levels in the area were not too shallow and may therefore not be easily contaminated from surface activities.

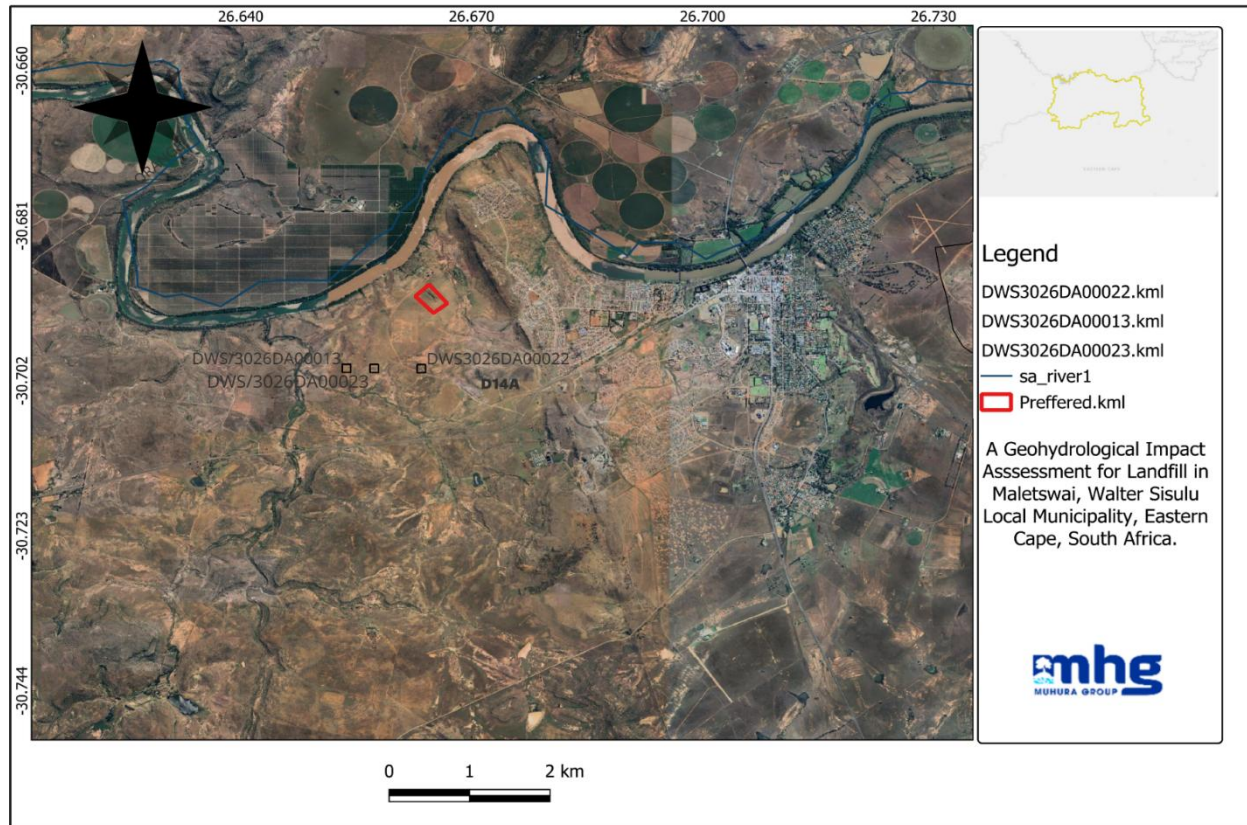


Figure 5-1 Hydrocensus boreholes

Land cover map shows that the proposed landfill area is in a fallow/old field. The land use activities around the proposed landfill largely consist of commercial and open grassland (Figure 5-2). The land use and land cover activities around the area were confirmed during hydrocensus where it was discovered that almost the whole area was cover by grasslands. The area was deemed suitable for the landfill activity as it was more than 3 kms away from the Orange River and farming activities.



A desktop assessment of the site was conducted to determine the site's expected geological and hydrogeological conditions. This assessment included a review of the available information such as the published maps which include Google Earth Imagery and geological map sheets of the area. The desktop assessment was followed by the field assessment wherein geophysical survey was conducted.

Geophysical survey was conducted on the 27th of November and 3rd December 2024. This investigation was conducted using Magnetotelluric (PQWT 300TC). Magnetotelluric (PQWT 300TC) is a simplified version of the CSAM which dispenses with regular measurements of the magnetic field. The PQWT 300Tc is a single frequency and multifrequency which can measure signals up to a maximum depth of 300m with 33 points

with accuracy of 4.5m or 0.001mV. station spacing of 10 m was used during the survey. Data from the Magnetotelluric survey was processed and presented as profiles in Excel.

The objective of Colour chart is for the representation, identification, description, variations, comparison, and analysis of subsurface rock formation and its distribution, this chart gives the easy way to identify best possible drilling points. Figure 4.1 till Figure 4.2 below shows colour chart and analysis for Telluric method.

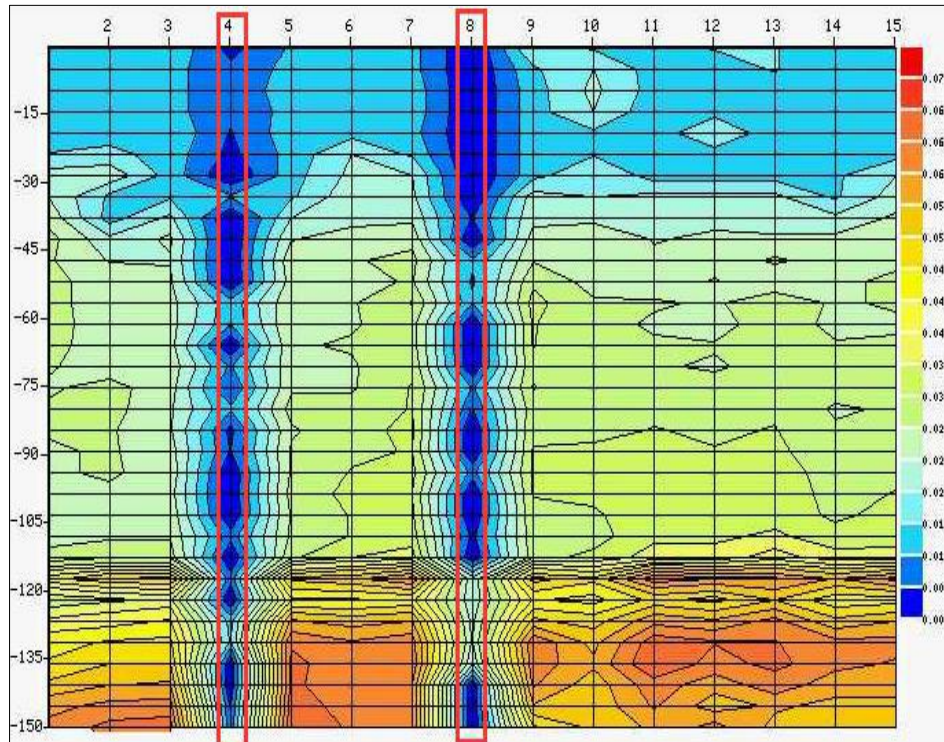


Figure 5-3 Ideal Drill Boreholes Targets

Red Colour represents highly strengthen/ high resistivity of rock formation, and the colour indicate danger symbol, we don't get water in this zones/ getting in limited areas	
Orange Colour represents less than the highly strengthen rock formation, this colour also indicates some of danger zone, here we don't get water in this zones / getting in the limited areas	
Yellow Color represents medium strengthen rock formation, this colour also indicates warning to getting water in these zones	
Green Colour represents the less-than medium strengthen rock formation; this colour also indicates starting of water zones	
Light Blue Colour represents the soft rock formation / water bearing rock formation, this colour indicates wealthy chances of getting water in the zone	
Blue Colour represents the soft rock formation / water bearing rock formation, this colour indicates wealthy chances of getting water in the zone	

Figure 5-4 Telluric Method Output Colour Chart And Analysis

5.2.2 Results

Two (2) traverses were conducted on site during the investigation. Traverse stations were marked out in the field and a hand-held GPS was used to gather coordinates at 10m interval. These traverses were intended to traverse geological structures identified perpendicularly, such as contacts and deep weathering and dyke intrusions. Significant anomalies in selected traverses showed the presence of fracture and weathering on the contact zones between the host rock and the intrusive dykes. Other modest differences in magnetic signatures might indicate the presence of small geological structures (possible preferred groundwater flow paths), which would be examined further. Traverses map is indicated in Figure 5-5.

Drilling targets were recommended on both survey traverse A and B as indicated on figure 5-6 and figure 5-7. Recommended drilling depth was 60 mbgl for each target area.

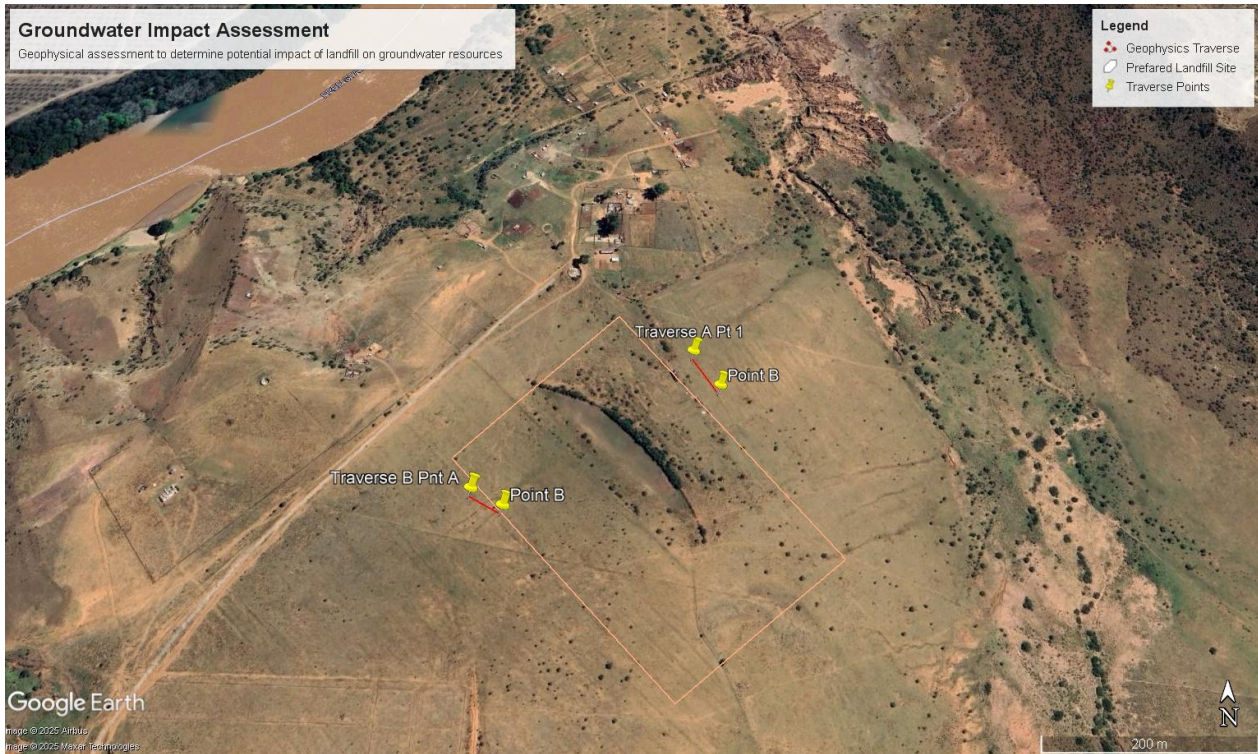


Figure 5-5 Traverses and drilling targets Map

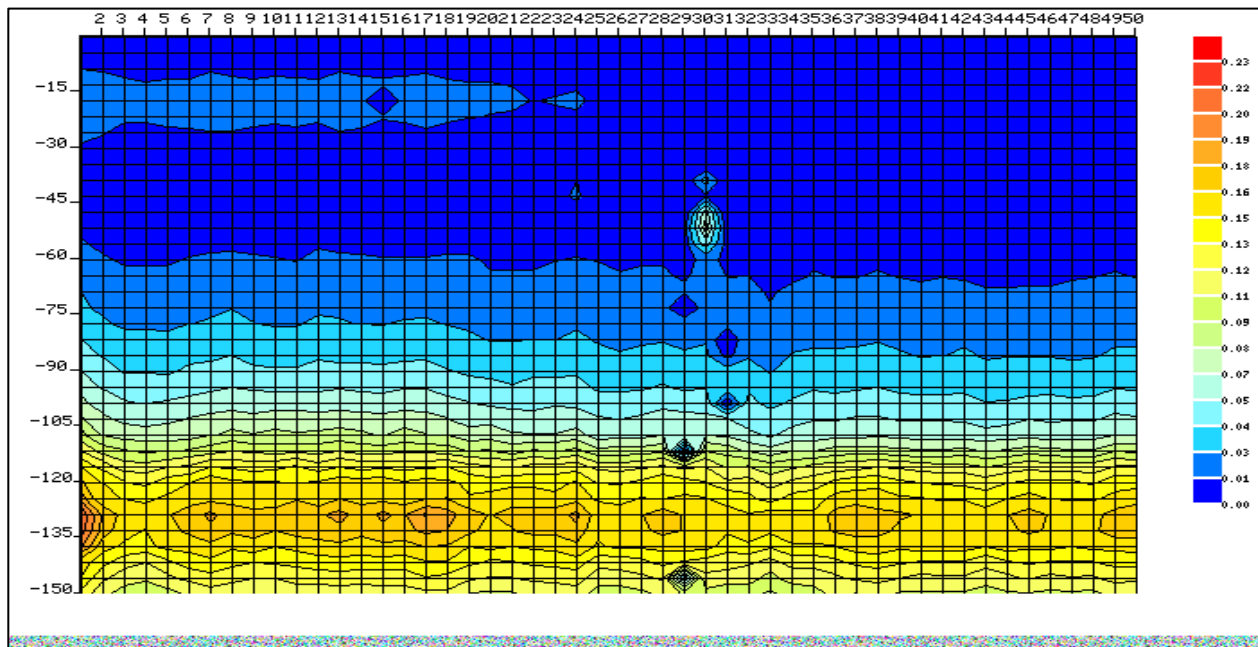


Figure 5-6 LINE A PQWT RESULTS

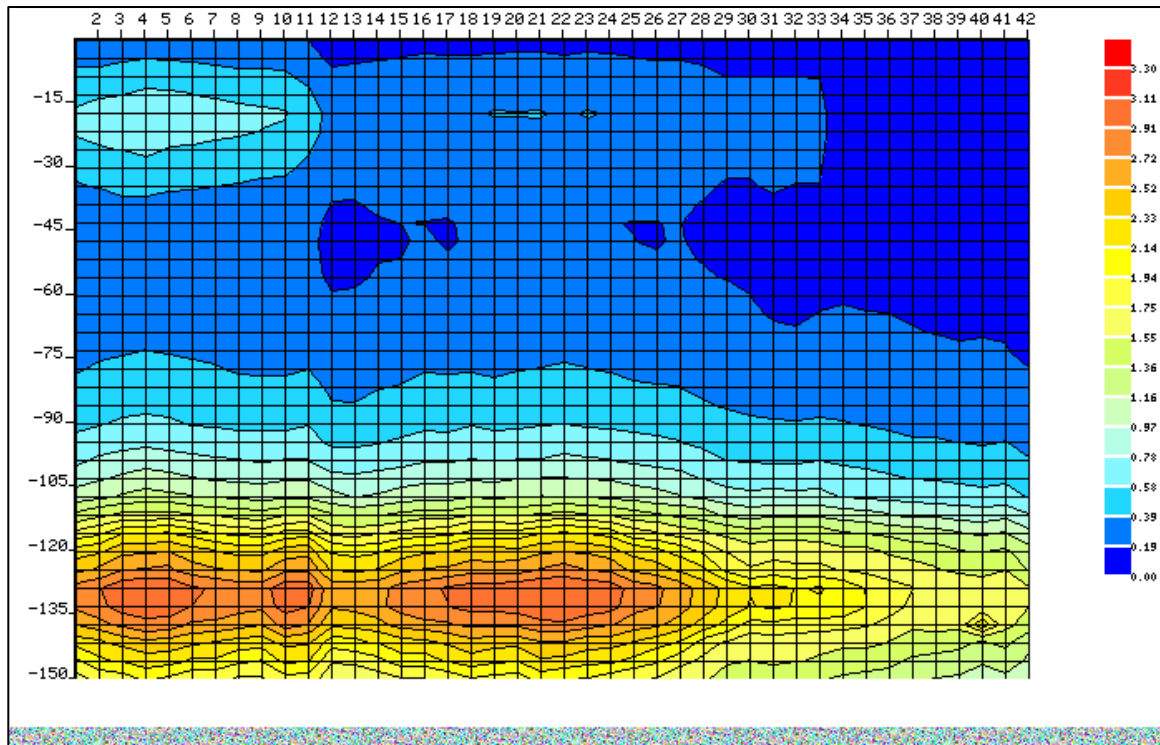


Figure 5-7 LINE B PQWT RESULTS

5.3 Borehole Drilling

Two (2) boreholes were drilled targeting the deep fractures, contact zones and weathering. The drilled boreholes were named MAL Bh 1 and MAL BH 2 with coordinates indicated on Table 5:2. Detailed borehole drilling report was attached to **Annexure A**.

Table 5:2 Summarised Borehole Drilling Report

location	Borehole ID	Bh Depth (m)	Water Strike (m)	Drilling position	
				Coordinate	
				S	E
Maletswai Landfill	BH1	62	20 and 24	26.663010	-30.691010
	Bh 2	60	41	26.665480	-30.689850

The newly drilled boreholes were mainly for monitoring purposes as their location was intended to serve as an early warning for pollution migration from the landfill site. MAL Bh 1 was also intended for domestic water use by the employees at the landfill site.

5.4 Borehole Pump Testing

Aquifer yield test was performed in accordance with minimum requirements expected by the Department of Water and Sanitation (DWS), 1997 guidelines regarding the proper and effective development of groundwater resources for community water supply purposes, and its applicability to the development of groundwater resources in general.

Aquifer test pumping serves two primary objectives. The first of which is an assessment of the productive capacity (yield potential) of the borehole and the second objective addresses the productivity of the groundwater resource. Step test, constant test and recovery measurement were performed as indicated from the field data sheets on **Appendix B**.

5.4.1 Step Test

Step test is also referred to as step drawdown test. This test was performed to assess the productivity of the borehole, i.e. the highest yield the borehole can produce. Step tests were also critical in determining the optimum yield at which the borehole may be subjected to at a constant discharge. During this test, boreholes are pumped at varying abstraction rates for periods of 60 minutes each and water levels are measured in the borehole at pre-determined intervals. The test effectively stresses the hole and gives an indication of its capable yield. The abstraction rate for the longer duration aquifer sustainability test is determined from the step test and its resultant data.

5.4.2 Constant discharge Test

The constant discharge test is usually carried out for a period of approximately 12 to 24-hours and involves measuring the water levels in the borehole while pumping the water out and thus creating “drawdown” within the borehole.

Drawdown is the difference between the measured water level at any time during the test and the position at which the water level would have been (static water level) if abstraction

had not taken place. The main aim of the test is to lower the water level in the borehole to approximately 65% of the available drawdown and maintain the water level at this depth. The constant discharge test is performed to assess the productivity of the aquifer according to its response to the abstraction of water. The response is analysed and provide information regarding the hydraulic properties of the groundwater system and arrive at an optimum yield for the medium to long-term utilization of the borehole. Constant discharge test was conducted for the two boreholes.

5.4.3 Recovery Test

The rate at which the borehole recovers (water level rises) was also measured and recorded once the pump is switched off. This data was useful in determining the storage available to the borehole and the position of the main water strike(s).

5.4.4 Sustainable Yield Test

The sustainable yields for boreholes were calculated using two methods the Basic Sustainable Borehole method and the FC method. Sustainable Borehole Yield method uses the following Equation:

$$Q_{sust} = (Q/S') \times S$$

Where:

Q (l/s) is the rate used during the pumping test;

s' (m) is the maximum available drawdown;

and S (m) is the available drawdown during pump test.

The FC method, which is a more conservative approach, uses the derivatives and subjected information about boundaries surrounding tested boreholes; it uses the input parameters shown below:

5.4.5 Summary of Pump Test Data Analysis

A summary of the values obtained from the aquifer pump testing is provided Table 5-3:

Table 5:3 Pumping Details

Borehole Number	Aquifer testing						
	BH depth	Pump Depth	Measured WL	Drawdown	CDT Yield 12 Hr	Transmissivity	Storativity
Unit	mbgl	mbgl	mbgl	mbgl	l/s	m ² /d	N/A
MAL BH A	62	60	6.0	28.12	1.66	5.21	0,001
MAL BH B	60	58	5.1	45.12	0.029	2.32	0,001

(mbgl – meters below ground level)

MAL BH 1 was aimed to be used for domestic water use. This borehole had a sustainable yield of 1.66 l/s for a duration of 12-hours. This volume equated to 52 350 m³/a and it is recommended that the applicant applies for water use below the sustainable yield volume.

5.5 Water Quality Results

Groundwater quality sampling was conducted for MAL Bh1 and MAL Bh2 on the 26 of June 2026. The sample laboratory results are attached in **Annexure B**.

The sample was analysed for suitability for domestic use based on the SANS 241-1:2015 Drinking Water Standard and WRC,1998 Quality of Domestic water supplies Standard as indicated in Table 5:4.

Table 5:4: DWS/WRCw Classification System of Suitability for Domestic Water Use

Class 0	Ideal water quality-suitable for lifetime use.
Class 1	Good water quality-suitable for use, rare instances of negative effects.
Class 2	Marginal water quality condition. Negative effects may occur in some sensitive groups.
Class 3	Poor water quality-unsuitable for use without treatment. Chronic effects may occur.
Class 4	Dangerous water quality-totally unsuitable for use. Acute effects may occur.

The water quality for MAL Bh1 sample was described as neutral (pH 6.0 -8.5), non-saline (TDS < 450 mg/l) and hard (total hardness > 15 CaCO₃) with total coliforms detected below the limit.

Compliance with the 'SANS 241-1:2015 Drinking Water Standard (SABS, 2015)' guidelines was as follows:

- Chronic health Risk: Compliant as total coliform was below 10 CFU/100ml
- Acute health Risk: Compliant as total coliform was below 10 CFU/100ml
- Operational (non-health): Compliant due to turbidity less than 1 NTU
- Aesthetic (non-health): Complaint due to Turbidity 1.54 NTU (> 5.00 NTU)

In terms of the classification system of the 'Quality of Domestic water supplies' (WRC, 1998) the quality was classified as follows:

- Drinking: Class 1 – Good due to low Total coliforms
- Bathing: Class 1 – Good due to low Total coliforms
- Washing: Class 1 – Good due to low Total Hardness
- Food Preparation: Class 1 – Good due to low Total coliforms
- Aesthetic: Class 1 – Good due to low Turbidity

According to the Langelier Saturation Index, the water was scale forming and corrosive. Based on the assessment of variables analysed in comparison to 'SANS 241-1:2015 Drinking Water Standard (SABS, 2015)' and 'Quality of Domestic water supplies' (WRC, 1998), the tested water sample was **Fit** for use as potable water and domestic use.

The water quality for MAL Bh2 sample was described as neutral (pH 6.0 -8.5), non-saline (TDS < 450 mg/l) and hard (total hardness > 15 CaCO₃) with total coliforms detected above the limit.

Compliance with the 'SANS 241-1:2015 Drinking Water Standard (SABS, 2015)' guidelines was as follows:

- Chronic health Risk: Compliant as total coliform was below 10 CFU/100ml

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- Acute health Risk: Compliant as total coliform was below 10 CFU/100ml
- Operational (non-health): Compliant due
- Aesthetic (non-health): Complaint due to Turbidity 1.54 NTU (> 5.00 NTU)

In terms of the classification system of the 'Quality of Domestic water supplies' (WRC, 1998) the quality was classified as follows:

- Drinking: Class 1 – Not suitable due to Total coliforms above 10 CFU
- Bathing: Class 1 – Good due to low turbidity
- Washing: Class 1 – Good due to low Total Hardness
- Food Preparation: Class 1 – Not suitable due to Total coliforms above 10 CFU
- Aesthetic: Class 1 – Good due to low Turbidity

According to the Langelier Saturation Index, the water was not scale forming and corrosive. Based on the assessment of variables analysed in comparison to 'SANS 241-1:2015 Drinking Water Standard (SABS, 2015)' and 'Quality of Domestic water supplies' (WRC, 1998), the tested water sample was **Not Fit** for use as potable water and domestic use prior treatment. However, this borehole's water was only intended for monitoring purposes.

6 GROUNDWATER IMPACT ASSESSMENT

The activities applied for authorisation has potential to impact groundwater in the area. Potential impact was assessed using a standard EIA Methodology. The impact assessment methodology was detailed on **Annexure C**:

6.1 Construction Phase

Activities to be conducted during the construction phase include trenching and construction of infrastructure. These activities are associated with oil leakage which may pollute groundwater and therefore mitigation measures should be implemented.

6.2 Operational Phase

Maletswai activities to be authorised include abstraction of groundwater through a borehole and disposal of waste into the land fill. The impact of these activities is rated on Table 6:1.

Table 6:1 Operational Phase Groundwater Impact – Aquifer Dewatering

Dimension	Rating	Motivation	Significance
Activity and Interaction: Groundwater over-abstraction causing a decrease in groundwater reserves in the area			
Impact Description: Groundwater abstraction required for domestic water requirements at the landfill. The volume required will be extracted from the underground aquifer with the potential to draw-down groundwater levels			
Prior to Mitigation/Management			
Duration	6	Expected for life of the project	

Extent	2	Limited to Maletswai landfill Farm	Low (56)
Intensity/Magnitude of Impact	6	Moderate, long-term effects but not affecting surrounding aquifers	
Probability	4	Low probability of the impact	
Nature	Negative		
Mitigation/Management Actions			
Maletswai landfill should only abstract the volume applied for provided that its lower than the yield of the borehole			
Maletswai landfill should abstract and store the water in the tanks to avoid constant pumping			
Groundwater level monitoring should be conducted to serve as an early warning to groundwater drawdown.			
Post-Mitigation			
Duration	5	Expected for life of the project	Low (44)
Extent	3	Limited to project area and surroundings.	
Intensity/Magnitude of Impact	3	Moderate, long-term effects but not affecting ecosystem functions.	
Probability	4	Low probability of the impact	

Nature	Negative		
---------------	----------	--	--

Groundwater Contamination Impact:

- Pollution of groundwater by waste disposed of at the landfill site.
- Potential groundwater contamination from waste disposal at the landfill.

Table 6:2 Operational Phase Groundwater Impact – Groundwater Contamination

Dimension	Rating	Motivation	Significance
Activity and Interaction: Groundwater contamination by waste disposal			
Impact Description: Due to waste disposal and poor sanitation.			
Prior to Mitigation/Management			
Duration	6	Expected for life of project	Medium (60)
Extent	3	Limited to the landfill farm area	
Intensity/Magnitude of Impact	6	High as the waste will be disposed into the land fill and also due to the geology which consists of sandstones with low permeability	
Probability	4	High chances of occurrence	
Nature	Negative		
Mitigation/Management Actions			

Lining of landfill foundation as per the Government Notice (GN) R636			
Groundwater quality should be monitored on a regular basis throughout the life of the project			
Updated geohydrological Impact assessment which include pollution plume modelling should be conducted within the first five years of the operation of the landfill			
Post-Mitigation			
Duration	5	Expected for life of the project	Low (30)
Extent	2	Limited to Maletswai landfill farm.	
Intensity/Magnitude of Impact	3	Low impact on the aquifers around the farm	
Probability	3	Low probability based on the mitigation measures	
Nature	Negative		

7 GROUNDWATER MONITORING PLAN

Impact assessment conducted indicated that the activities which Maletswai landfill has applied for authorisation has medium to high impact to contaminate the groundwater system and the environment. The high impact reduces when mitigation measures such as lining of the foundation as per the GN R653 for landfill sites. It is important that mitigation measures which include the development of groundwater monitoring plan be implemented.

Groundwater monitoring plan is developed for implementation at Maletswai landfill. The monitoring plan was for groundwater level and quality. It is recommended current MAL Bh 1 and 2 be used for monitoring.

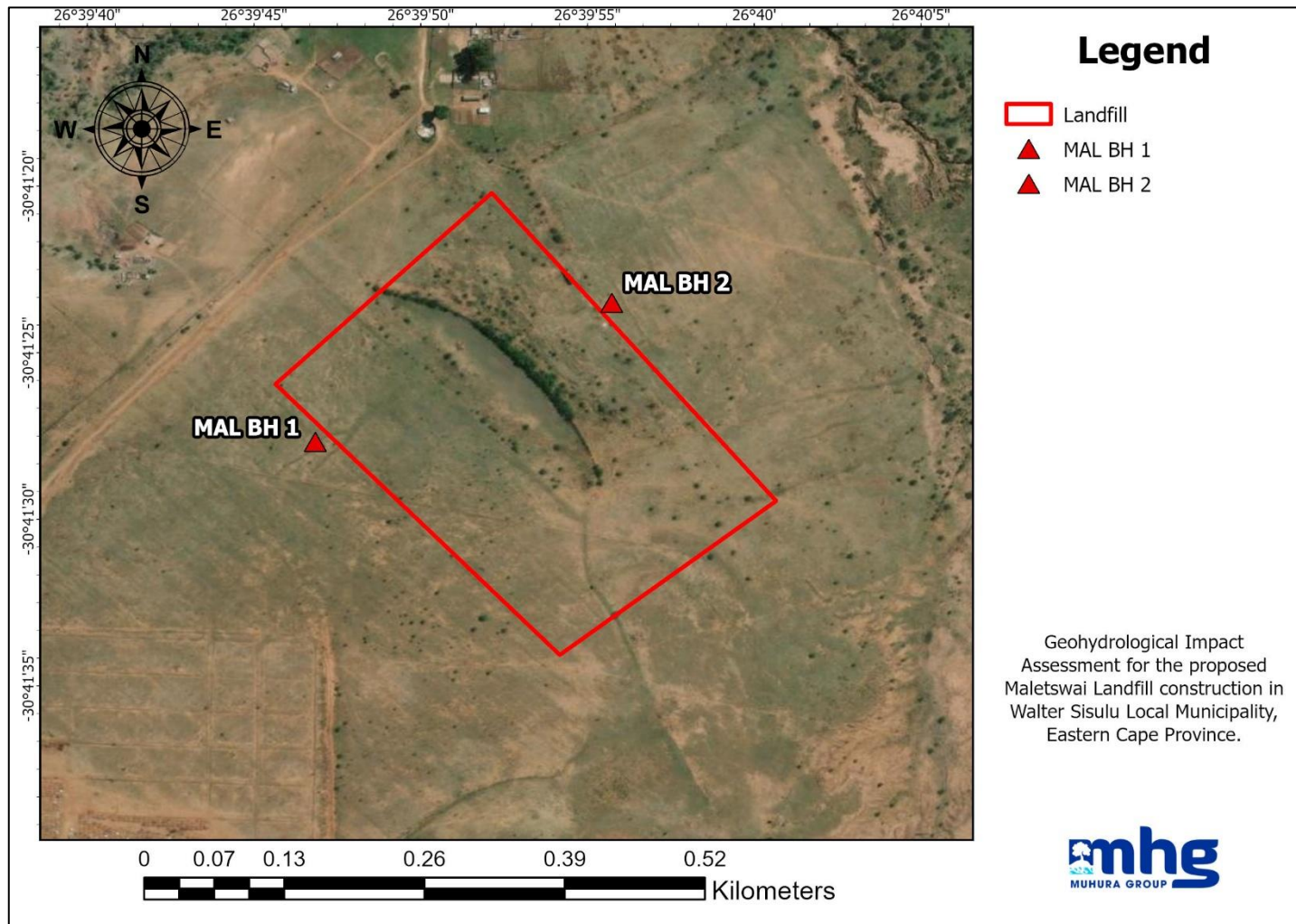


Figure 7-1 Monitoring Plan

Groundwater quality monitoring data will serve as an early warning for groundwater pollution and decline in the area. Samples should be analysed for chemical and physical constituents normally associated with coal mining. These constituents are listed in **Table 7-1**.

Table 7:1 Groundwater constituents for routine analysis

Monitoring	Variable
Quarterly*	EC, pH, TDS, total hardness, total alkalinity, calcium, magnesium, sodium, potassium, phosphate, chloride, sulphate, fluoride, nitrate, iron, manganese, aluminium, cadmium, turbidity and heavy metals.

Note: * = Once trends are established, some of these constituents may be sampled less frequent, while others found to be problematic may be added as determined on consultation with the relevant role players, such as the DWS.

8 CONCLUSION & RECOMMENDATION

The aim of the study was to assess groundwater impact associated with groundwater abstraction and disposal of waste at the proposed Maletswai landfill site. A hydrocensus was conducted to collect data on the potential impact associated with the activities. Three boreholes were identified on NGA while only one of the three boreholes was identified on the ground with the groundwater level measured at 12 mbgl. Land use and landcover was identified around the project area as consisting of bare grassland and cultivated commercial land. Borehole drilling survey, drilling, pump testing and water quality sampling was conducted during hydrocensus. Two boreholes (MAL BH 1 and MAL Bh2) were drilled to the depth of 60 mbgl. These boreholes were further pump tested for 12-hour period wherein the yield of MAL Bh 1 was 1.66 l/s while MAL BH 2 was 0.02l/s. MAL Bh 1 was aimed to be used for domestic water use as it was upstream of the proposed landfill site.

Water quality sampling was conducted for the two boreholes. The analysis result showed that the water quality for MAL Bh 1 was fit for domestic use while MAL Bh 2 water quality was not fit for use prior treatment due to high total cauliform. Based on the observation during hydrocensus, the aquifer may be classified as minor aquifer as it was not the main source of water in the area.

Impact assessment on the aquifer and the surrounding ecosystem due to the proposed water use activities was conducted and the potential risk and mitigation measures were indicated in the report. The impact rating for the proposed activities had medium to high potential impact on the local groundwater system. However, mitigation measures were recommended to reduce the impact. Mitigation measures included groundwater monitoring and lining of the landfill site according to the GN R653 requirements of the landfill development. The risk of potential pollution of the aquifer by the proposed activities may reduce when the mitigation measures are implemented. Therefore, it is important that an updated geohydrological assessment including pollution plume migration be conducted within the first five years of the operation of the landfill.

It is recommended that the WULA be granted provided that the applicant implements all remedial and mitigation measures as indicated in this report.

REFERENCES

Barnett B., Townley L.R., Post V., Evans R.E., Hunt R.J., Peeters L., Richardson S., Werner A.D., Knapton A. and Boronkay A. (2012) Australian groundwater modelling guidelines, Waterlines report. National Water Commission, Canberra.

BREDENKAMP DB, BOTHA LJ, VAN TONDER GJ AND VAN RENSBURG HJ (1995) Manual on Quantitative Estimation of Groundwater Recharge and Aquifer Storativity. WRC Report No TT 73/95.

Hodgson, F.D.I. and Krantz, R.M. (1998) Groundwater quality deterioration in the Olifants River Catchment above the Loskop Dam with Specialised Investigations in the Witbank Dam Sub-Catchment. WRC Report No 291/1/98, 1998.

KIRCHNER R, VAN TONDER GJ and LUKAS E (1991) Exploitation Potential of Karoo Aquifers. WRC Report No. 170/1/91.

Department of Water Affairs and Forestry (DWAF). 2006: Groundwater Resource Assessment: Task 1D: Groundwater Quantification.

Department of Water Affairs and Forestry (DWAF). 2006: Best Practice Guideline N. G3. Water Monitoring Systems.

Department of Water Affairs and Forestry (DWAF). Targeted Water Quality Guidelines: Domestic Use (Volume 01), Livestock Watering (Volume 05), Irrigation (Volume 04). 1998.

Schulze, R.E. and Maharaj, M. (2006). 50 Years of Daily Hydro-Climatic Data per Quaternary Catchment in South Africa. University of KwaZulu-Natal School of Bio-Resource Engineering and Environmental Hydrology. Pietermaritzburg.

PARSONS, R. (1995). A South African Aquifer System Management Classification. Water Research Commission Report No. KV 77/95.

Piper, A.M. (1944) A Graphic Procedure in the Geochemical Interpretation of Water-Analyses. Eos, Transactions American Geophysical Union, 25, 914-928.

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Van Heerden, P.S. and Walker, S. (2016). Upgrading of SAPWAT3 as a management tool to estimate the irrigation water use of crops, revised edition SAPWAT4. WRC Report TT 662/16, Water Research Commission, Pretoria, RSA.

ANNEXTURE A: DRILLING RESULTS



BOREHOLE COMPLETION REPORT

CLIENT:	Muhura Group			BOREHOLE NR:	1		
FARM:		NUMBER:	Aliwal North	TOPO & WELL NR:	1		
DISTRICT:	Aliwal North			LATITUDE:	-30.69101	°	
START DATE:	24/06/2026			LONGITUDE:	26.66301	°	
END DATE:	25/06/2026			COLLAR HEIGHT:	0.5	m	

GEOLOGY	TOTAL DEPTH FROM SURFACE (m): 62m
----------------	--

FROM - TO IN (m)	DESCRIPTION	DIAMETER OF BOREHOLE					
0-12	Sand & muddstone no solids	220	mm	FROM	0	TO	12
12-19m	Sand & muddstone some dolorite	165	mm	FROM	0	TO	62
20m	Water strike - good		mm	FROM		TO	
22-30m	Loose muddstone & sandstone	FIRST WATER STRIKE					12m
20 & 24m	Waterstrike - great	SECOND WATER STRIKE					20m
34-49	Sandstone, dolorite layers	THIRD WATER STRIKE					24m
49-50	Dolorite & Muddstone	WATER LEVEL					6m
50-62	Rock	YIELD m³/h					4000lph
		APPARENT QUALITY OF WATER					Good
		TDS WHEN DRILLED					
		INITIAL CAPACITY TEST					
		AIRLIFT YIELD			4000+ lph		
		PUMP YIELD			3500 lph		
		DRILLING COST					
		ITEM:			TOTAL:		
		METERS DRILLED			62m		
		TESTING OF BOREHOLE			12 hrs		
		CASING					
		PLAIN	x	LENGTH PER CASING	12m	TOTAL m	12m
		PERFORATED	0	LENGTH PER CASING	0	TOTAL m	0
		TOTAL COST			R		

STATE WHETHER THE BOREHOLE IS			
YES	SUCCESSFUL	YES	CASING LEFT IN BOREHOLE
	UNSUCCESSFUL		CASINGS RECOVERED

DECLARATION BY DRILLER AND DRILLING INSPECTOR			
I, THE DRILLER HEREBY DECLARE THAT THE INFORMATION SUPPLIED		I, THE DRILLING INSPECTOR, DECLARE THAT THE INFORMATION SUPPLIED	
ABOVE IS TRUE AND CORRECT		ABOVE IS TRUE AND CORRECT	
SIGNATURE:		SIGNATURE:	
RANK		RANK	
PLACE	DATE	PLACE	DATE

NAME AND SURNAME:			
CLIENT SIGNATURE:		PLACE:	DATE:



BOREHOLE COMPLETION REPORT

CLIENT:	Muhura Group		BOREHOLE NR:	2	
FARM:		NUMBER:	Aliwal North	TOPO & WELL NR:	2
DISTRICT:	Aliwal North		LATITUDE:	-30.68985	°
START DATE:	24/06/2026		LONGITUDE:	26.66548	°
END DATE:	25/06/2026		COLLAR HEIGHT:	0.5	m

GEOLOGY		TOTAL DEPTH FROM SURFACE (m): 60m					
FROM - TO IN (m)	DESCRIPTION	DIAMETER OF BOREHOLE					
0-10	Mudstone	220	mm	FROM	0	TO	10
10-32	Mixed layers	165	mm	FROM	0	TO	60
32m	moisture but scale present		mm	FROM		TO	
33-40	Mudstane	FIRST WATER STRIKE				32m moisture	
41m	small water strike	SECOND WATER STRIKE				41m - poor	
42-50	Mudstone and scale	THIRD WATER STRIKE				0	
51-60	Formation dead no possibility of water	WATER LEVEL				51m	
		YIELD m³/h				700lph	
		APPARENT QUALITY OF WATER				Bad	
		TDS WHEN DRILLED					
		INITIAL CAPACITY TEST					
		AIRLIFT YIELD			700+ lph		
		PUMP YIELD			500 lph		
		DRILLING COST					
		ITEM:			TOTAL:		
		METERS DRILLED			60m		
		TESTING OF BOREHOLE			6 hrs		
		CASING					
		PLAIN	x	LENGTH PER CASING	12m	TOTAL m	12m
		PERFORATED	0	LENGTH PER CASING	0	TOTAL m	0
		TOTAL COST			R		

STATE WHETHER THE BOREHOLE IS			
	SUCCESSFUL	YES	CASING LEFT IN BOREHOLE
YES	UNSUCCESSFUL		CASINGS RECOVERED

DECLARATION BY DRILLER AND DRILLING INSPECTOR							
I, THE DRILLER HEREBY DECLARE THAT THE INFORMATION SUPPLIED				I, THE DRILLING INSPECTOR, DECLARE THAT THE INFORMATION SUPPLIED			
ABOVE IS TRUE AND CORRECT				ABOVE IS TRUE AND CORRECT			
SIGNATURE:				SIGNATURE:			
RANK				RANK			
PLACE		DATE		PLACE		DATE	

NAME AND SURNAME:					
CLIENT SIGNATURE:			PLACE:		DATE:

ANNEXTURE B: PUMP TEST RESULTS



CLIENT: Muhura Group Pty Ltd
Aliwal North

DATE: 26/06/2026

SITE: Aliwal North Free State

GPS: -30.691010 26.663010

Discription: Borehole Test 12hrs

Power supply: Generator 25kva, no alternative power supply available

WORK PERFORMED:

- 1) Borehole Drilled
- 2) Borehole blow yield
- 3) Borehole tested 12hrs

Final Results

Certificate nr:9505

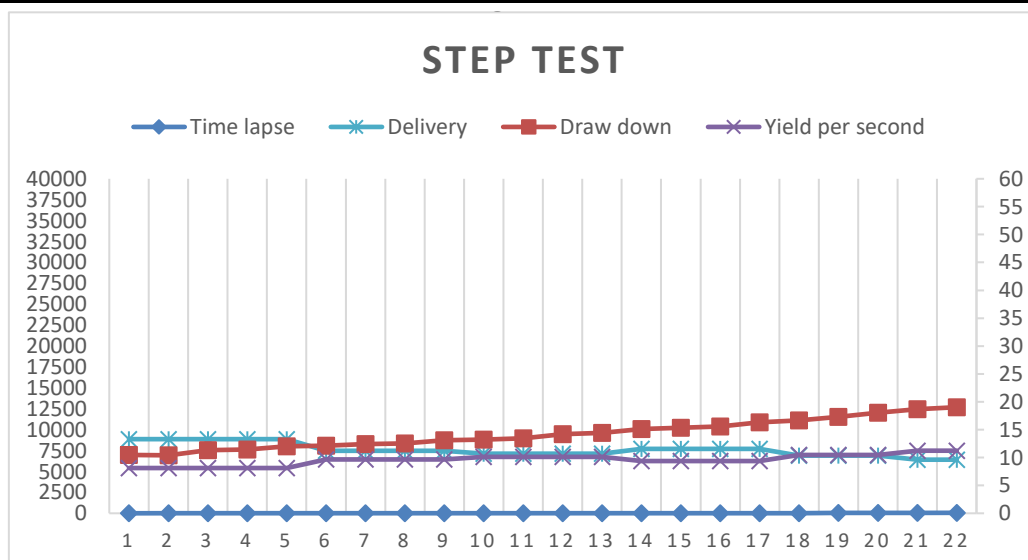
Client: Muhura Group Pty Ltd

Project	Aliwal North	Pumped Borehole No.	1
Project No.	Ip 001	Discription of site	
Contractor	BTT Pty Ltd	Distance to observation boreh	0.3m
Observer	Jonathan	Pumped borehole depth (m)	60m
Pump Type	2.2kw Submersable	Borehole diameter (mm)	165mm
Pump inlet depth	62m	Static Water Level (m)	0
GPS		Base of aquifer (m)	0
		Available drawdown (m) before	0
Borehole Depth	62m	Electricity available at site	3fase / solar
Pump test depth	60m	Pump size advized	0.55kw
Before pump insert level	60m	Recommendation	50% pump rate
After pump insert level	10.45	Test duration	4hrs
Draw down level	0	Recovery rate	Excellent
Test yield rate	11.02	Recovery time	12min
Borehole Yield per sec	1.66 LPS	Allowed pump rate	2000 LPHOUR
Borehole yield per hour	3500 liters per hour		

Borehole Step Test



STEP TEST - STEP 1						
Planned yield:			Start @ 5LPS			
Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
10h15	0	10.45	20	8.12	8866.995074	80% choke rate on pump
	0.5	10.4	20	8.12	8866.995074	
	1	11.3	20	8.12	8866.995074	
	1.5	11.45	20	8.12	8866.995074	
	2	12.03	20	8.12	8866.995074	
	2.5	12.13	20	9.65	7461.139896	
	3	12.41	20	9.65	7461.139896	
	4	12.55	20	9.65	7461.139896	
	5	13.08	20	9.65	7461.139896	
	6	13.21	20	10.12	7114.624506	
	7	13.46	20	10.12	7114.624506	
	8	14.21	20	10.12	7114.624506	
	9	14.43	20	10.12	7114.624506	
	10	15.1	20	9.36	7692.307692	
	12	15.35	20	9.36	7692.307692	
	15	15.56	20	9.36	7692.307692	
	20	16.32	20	9.36	7692.307692	
	25	16.65	20	10.44	6896.551724	
	30	17.32	20	10.44	6896.551724	
	40	18.02	20	10.44	6896.551724	
	50	18.65	20	11.23	6411.398041	
	60	19.03	20	11.23	6411.398041	



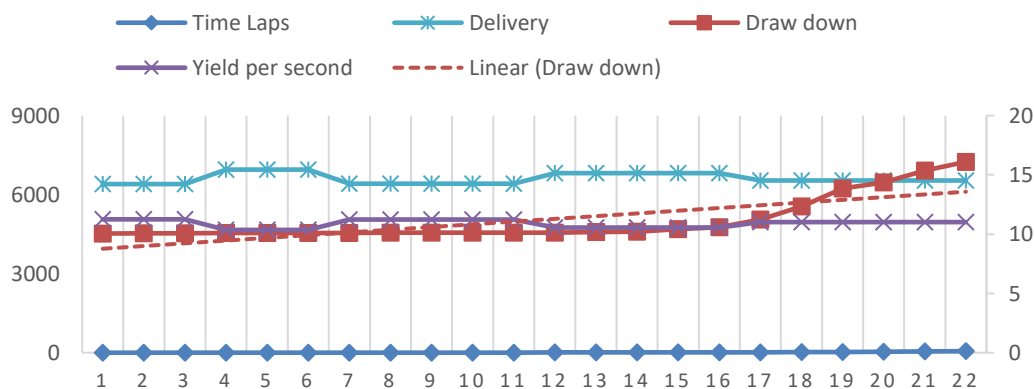
Planned yield:	Start @ 3LPS	
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STEP TEST - STEP 2



Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
Planned yield:			Start @ 5LPS			Date:
Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
11h00	0	10.05	20	11.25	6400	90% increase pump rate
	0.5	10.07	20	11.25	6400	
	1	10.08	20	11.25	6400	
	1.5	10.09	20	10.36	6949.80695	
	2	10.09	20	10.36	6949.80695	
	2.5	10.1	20	10.36	6949.80695	
	3	10.11	20	11.23	6411.398041	
	4	10.12	20	11.23	6411.398041	
	5	10.12	20	11.23	6411.398041	
	6	10.12	20	11.23	6411.398041	
	7	10.12	20	11.23	6411.398041	
	8	10.13	20	10.56	6818.181818	
	9	10.18	20	10.56	6818.181818	90% increase pump rate
	10	10.22	20	10.56	6818.181818	
	12	10.43	20	10.56	6818.181818	
	15	10.58	20	10.56	6818.181818	
	20	11.23	20	11.02	6533.575318	
	25	12.35	20	11.02	6533.575318	
	30	13.85	20	11.02	6533.575318	
	40	14.35	20	11.02	6533.575318	
	50	15.36	20	11.02	6533.575318	
	60	16.1	20	11.02	6533.575318	

STEP TEST

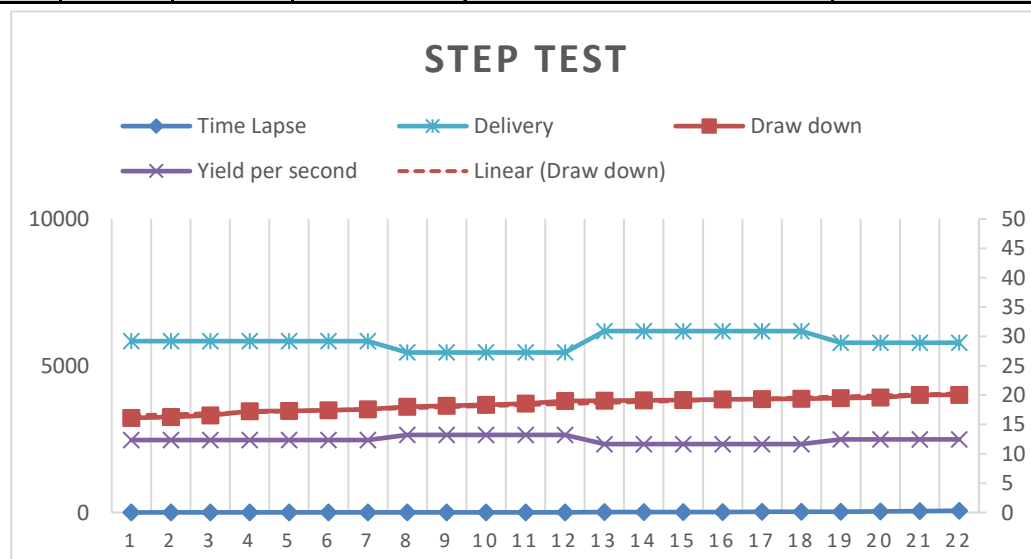




Planned yield:	Start @ 1LPS	
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STEP TEST - STEP 3

Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
Planned yield:			Start @ 6LPS			Date:
12h00	0	16.1	20	12.33	5839.416058	
	0.5	16.28	20	12.33	5839.416058	
	1	16.56	20	12.33	5839.416058	
	1.5	17.23	20	12.33	5839.416058	
	2	17.31	20	12.33	5839.416058	
	2.5	17.42	20	12.33	5839.416058	
	3	17.59	20	12.33	5839.416058	
	4	18.03	20	13.21	5450.416351	
	5	18.16	20	13.21	5450.416351	
	6	18.34	20	13.21	5450.416351	
	7	18.56	20	13.21	5450.416351	
	8	19.01	20	13.21	5450.416351	
	9	19.06	20	11.65	6180.257511	
	10	19.08	20	11.65	6180.257511	
	12	19.15	20	11.65	6180.257511	
	15	19.25	20	11.65	6180.257511	
	20	19.32	20	11.65	6180.257511	
	25	19.39	20	11.65	6180.257511	
	30	19.48	20	12.44	5787.78135	
	40	19.58	20	12.44	5787.78135	
	50	20.01	20	12.44	5787.78135	
	60	20.03	20	12.44	5787.78135	

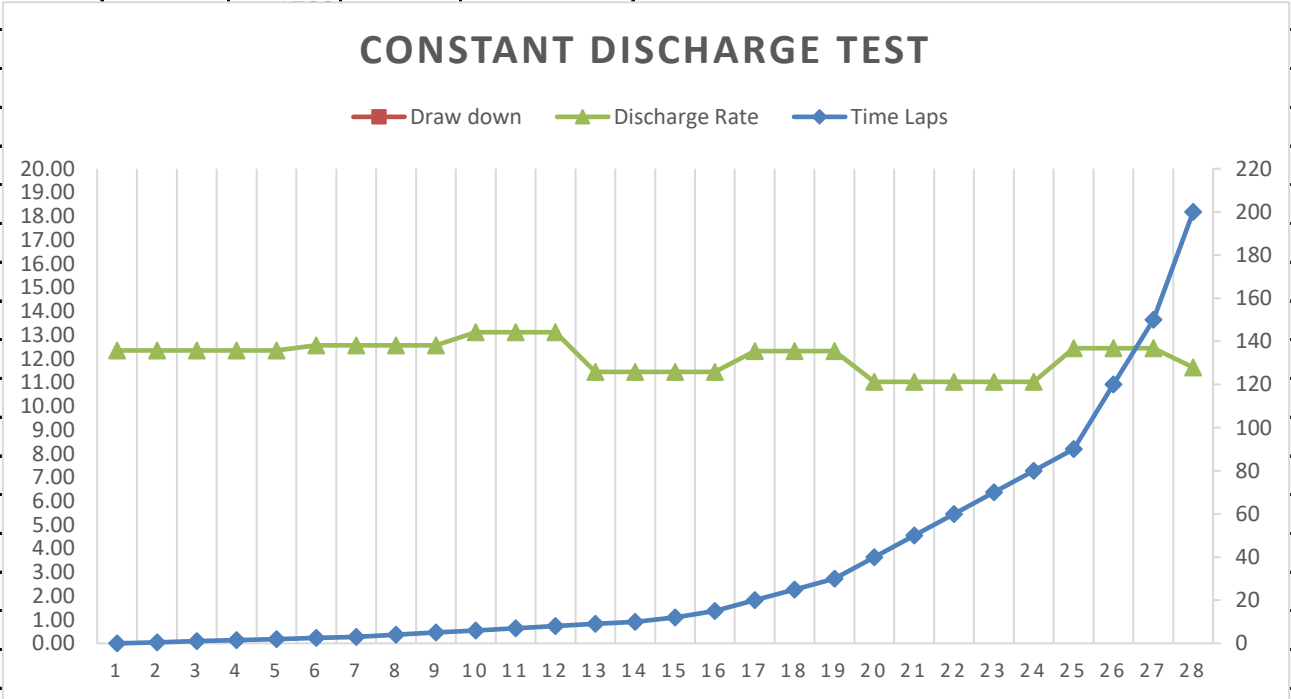


Borehole Constant Discharge Test



Project		Aliwal North		Pumped Borehole No.		1	
Project No.		lp 001		Discription of site		Closer to the dam	
Contractor		BTT Pty Ltd		Distance to observation boreh		0.3m	
Observer		Jonathan		Pumped borehole depth (m)		60m	
Pump Type		2.2kw Submersable		Borehole diameter (mm)		165mm	
Pump inlet depth		60m		Static Water Level (m)		0	
Datum (above ground)				Base of aquifer (m)		30m	
				Available drawdown (m)		28.12m	
CDT							
				</			

19h20		250	25.86	11.63		
		300	26.11	12.01		
20h30		350	26.45	12.01		
		400	26.93	13.24		
22h20		500	27.22	14.14		
		600	27.56	12.34		
		700	27.96	13.01		
23h00		800	28.12	14.11		
		900	0	0		
		1000	0	0		
		1100	0	0		
		1200	0	0		
		1300	0	0		
		1400	0	0		
		1500	0	0		
		1600				



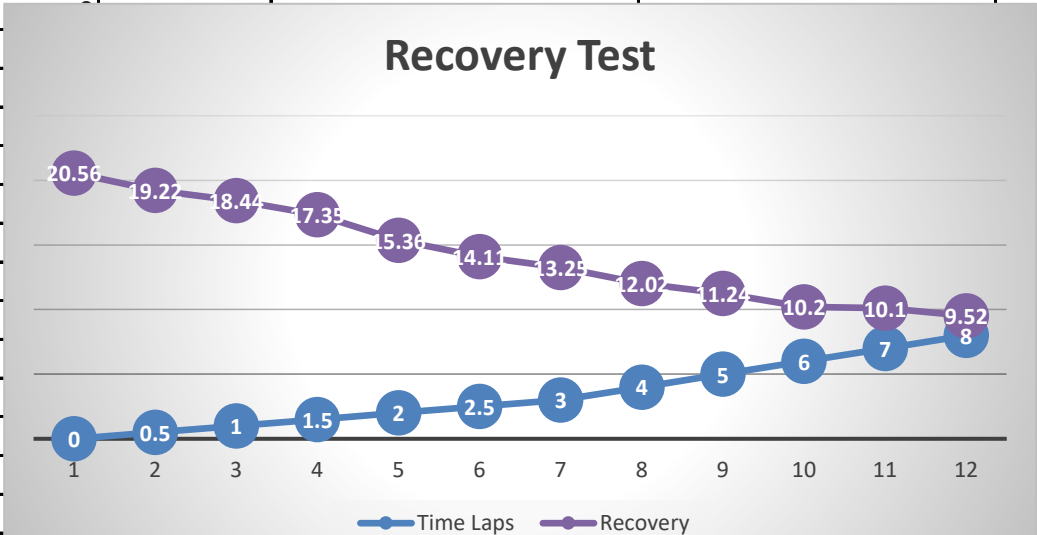
		3500			
		3600			
		3700			
		3800			
		3900			
		4000			
		4100			
		4200			
		4300			
		4320			

Borehole Recovery Test



RECOVERY STAND TIME : 11min
 RECOVERY TIME OF BOREHOLE: 11min

Recovery			0			Date:	
Date	Real Time	Time t1 elapsed since pumping stopped (min)	Time t elapsed since pumping started (min)	t/t1	Recovery (m)	Remarks	
23h00		0	0		20.56		
		0.5	0		19.22		
		1	0		18.44		
		1.5	0		17.35		
		2	0		15.36		
		2.5	0		14.11		
		3	0		13.25		
		4	0		12.02		
		5	0		11.24		
		6	0		10.2		
		7	0		10.1		
		8	0		9.52		
		9	0				
		10	0				
		12	0				
		15	0				
		20	0				
		25	0				
		30	0				
		40	0				
		50	0				
		60	0				
		70	0				
		80	0				
		90	0				
		100	0				
		120	0				
		150	0				
		200	0				
		250	0				
		300	0				



		400	
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CLIENT: Muhura Group Pty Ltd
Aliwal North

DATE: 26/06/2026

SITE: Aliwal North Free State

GPS: -30.689850 26.665480

Discription: Borehole Test 4hrs

Power supply: Generator 25kva, no alternative power supply available

WORK PERFORMED:

- 1) Borehole Drilled
- 2) Borehole blow yield
- 3) Borehole tested 4hrs

Final Results

Certificate nr:9506

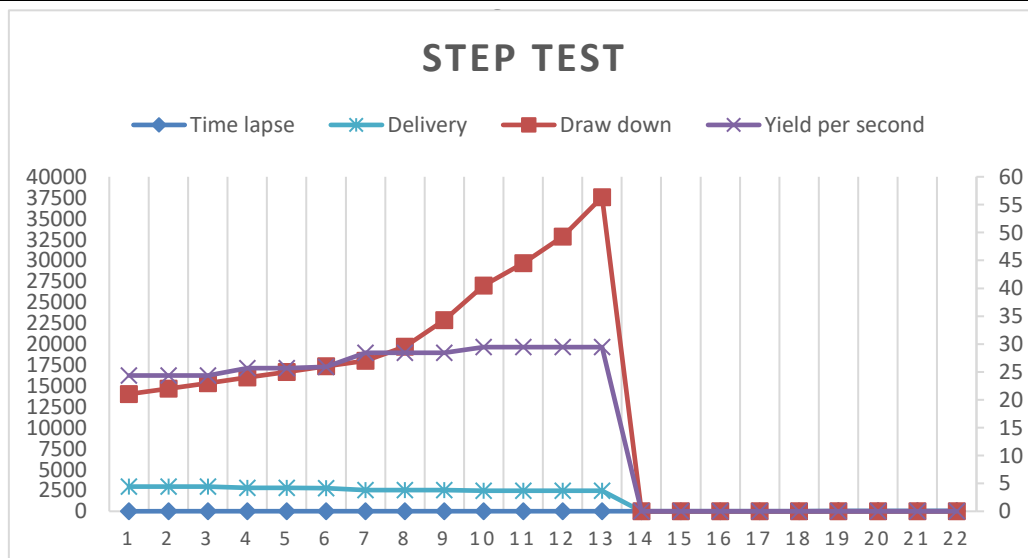
Client: Muhura Group Pty Ltd

Project	Aliwal North	Pumped Borehole No.	2
Project No.	Ip 001	Discription of site	
Contractor	BTT Pty Ltd	Distance to observation boreh	0.3m
Observer	Jonathan	Pumped borehole depth (m)	60m
Pump Type	2.2kw Submersable	Borehole diameter (mm)	165mm
Pump inlet depth	60m	Static Water Level (m)	0
GPS		Base of aquifer (m)	0
		Available drawdown (m) before	0
Borehole Depth	60m	Electricity available at site	3fase / solar
Pump test depth	58m	Pump size advized	0.55kw
Before pump insert level	21m	Recommendation	50% pump rate
After pump insert level	20.50m	Test duration	4hrs
Draw down level	0	Recovery rate	Excellent
Test yield rate	0.029	Recovery time	30min
Borehole Yield per sec	106 LPS	Allowed pump rate	500 LPHOUR
Borehole yield per hour	750 liters per hour		

Borehole Step Test



STEP TEST - STEP 1						
Planned yield:			Start @ 5LPS			
Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
16h10	0	21	20	24.36	2955.665025	70% choke rate on pump
	0.5	22	20	24.36	2955.665025	
	1	23	20	24.36	2955.665025	
	1.5	24	20	25.66	2805.923617	
	2	25	20	25.66	2805.923617	
	2.5	26	20	25.88	2782.071097	
	3	27	20	28.44	2531.64557	
	4	29.5	20	28.44	2531.64557	
	5	34.3	20	28.44	2531.64557	
	6	40.5	20	29.45	2444.821732	
	7	44.5	20	29.45	2444.821732	
	8	49.25	20	29.45	2444.821732	
16h20	9	56.36	20	29.45	2444.821732	stopped wait for recovery
	10	0	20	0	#DIV/0!	
	12	0	20	0	#DIV/0!	
	15	0	20	0	#DIV/0!	
	20	0	20	0	#DIV/0!	
	25	0	20	0	#DIV/0!	
	30	0	20	0	#DIV/0!	
	40	0	20	0	#DIV/0!	
	50	0	20	0	#DIV/0!	
	60	0	20	0	#DIV/0!	



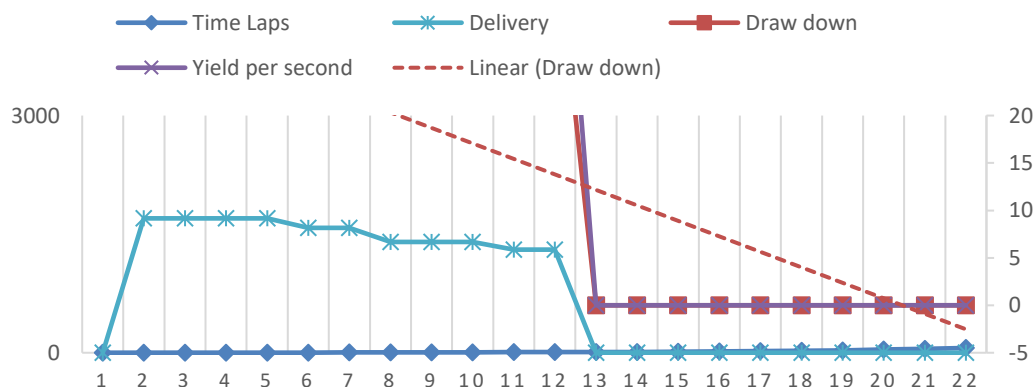
Planned yield:	Start @ 3LPS	
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STEP TEST - STEP 2

Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
Planned yield:			Start @ 5LPS			Date:
Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
17h00	0	22.5	20	28.66	0	80% increase pump rate
	0.5	23	20	42.36	1699.716714	
	1	23.5	20	42.36	1699.716714	
	1.5	24	20	42.36	1699.716714	
	2	24.5	20	42.36	1699.716714	
	2.5	25	20	45.62	1578.255151	
	3	25.5	20	45.62	1578.255151	
	4	26	20	51.36	1401.869159	
	5	28	20	51.36	1401.869159	
	6	29	20	51.36	1401.869159	
	7	30.5	20	55.22	1303.875407	
	8	40	20	55.22	1303.875407	stop wait for recovery
	9	0	20	0	#DIV/0!	
	10	0	20	0	#DIV/0!	
	12	0	20	0	#DIV/0!	
	15	0	20	0	#DIV/0!	
	20	0	20	0	#DIV/0!	
	25	0	20	0	#DIV/0!	
	30	0	20	0	#DIV/0!	
	40	0	20	0	#DIV/0!	
	50	0	20	0	#DIV/0!	
	60	0	20	0	#DIV/0!	

STEP TEST

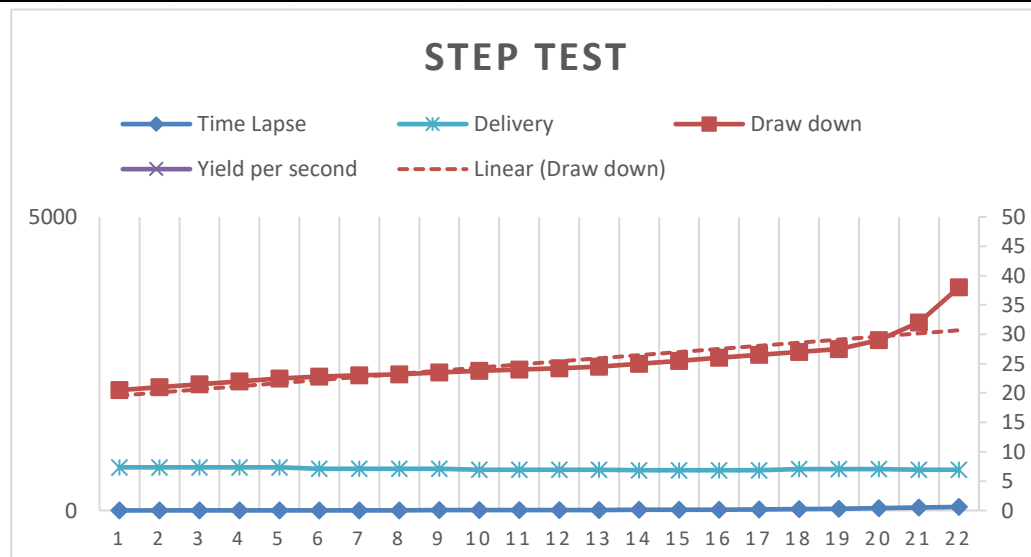




Planned yield:	Start @ 1LPS	
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STEP TEST - STEP 3

Real Time	Elapsed Time (min)	Drawdown (m)	Calibrated container size	Yield per second	Yield per hour	Remarks and discharge rate
Planned yield:			Start @ 6LPS			Date:
18h10	0	20.5	20	98	734.6938776	95% choke
	0.5	21	20	98	734.6938776	
	1	21.5	20	98	734.6938776	
	1.5	22	20	98	734.6938776	
	2	22.5	20	98	734.6938776	
	2.5	22.8	20	101	712.8712871	
	3	23	20	101	712.8712871	
	4	23.2	20	101	712.8712871	
	5	23.5	20	101	712.8712871	
	6	23.8	20	103.5	695.6521739	
	7	24	20	103.5	695.6521739	
	8	24.2	20	103.5	695.6521739	
	9	24.5	20	103.5	695.6521739	
	10	25	20	105	685.7142857	
	12	25.5	20	105	685.7142857	
	15	26	20	105	685.7142857	
	20	26.5	20	105	685.7142857	
	25	27	20	102.4	703.125	
	30	27.5	20	102.4	703.125	
	40	29	20	102.4	703.125	
	50	32	20	104	692.3076923	
	60	38	20	104	692.3076923	Stoped for recovery

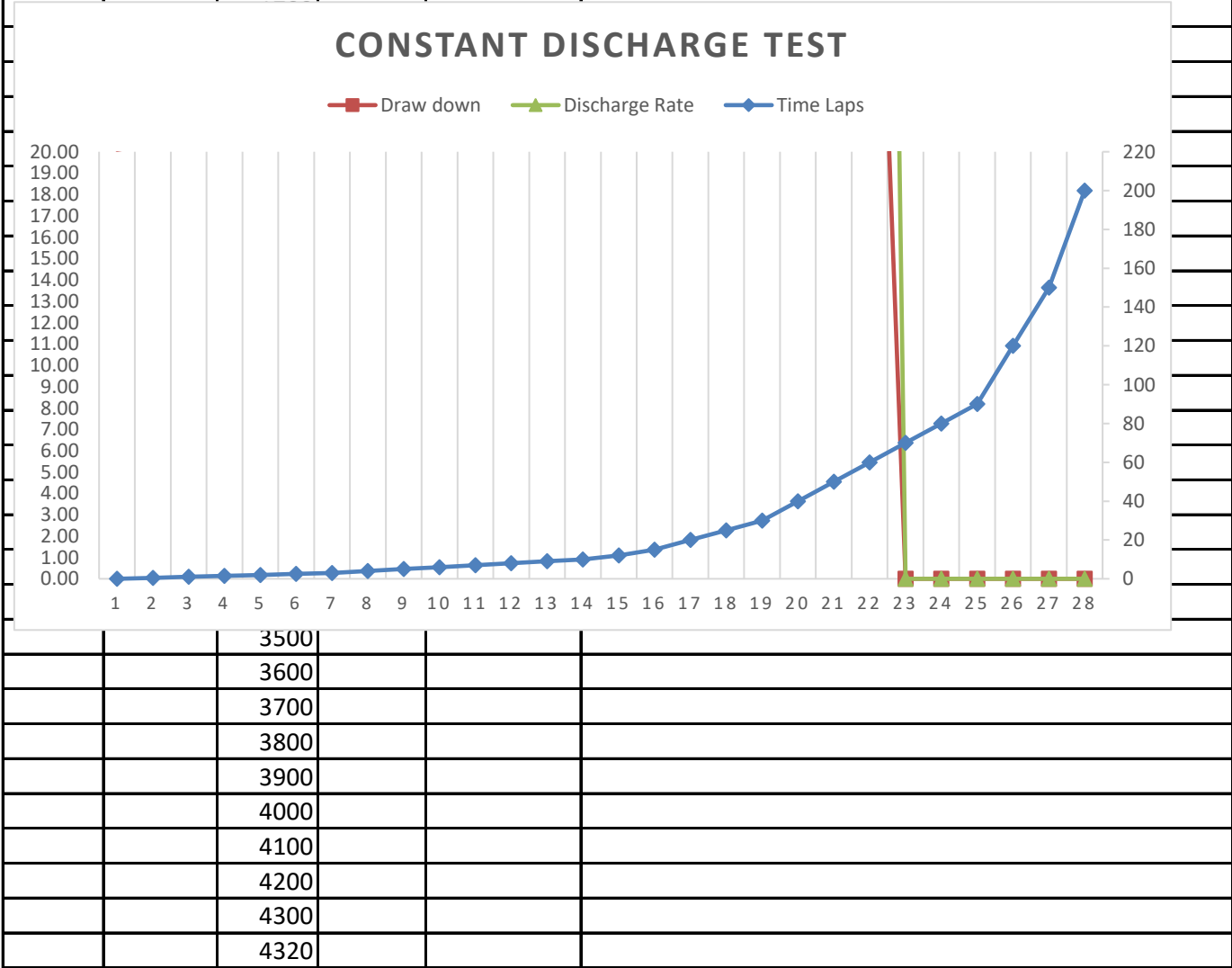


Borehole Constant Discharge Test



Project		Aliwal North		Pumped Borehole No.		2	
Project No.		lp 001		Discription of site			
Contractor		BTT Pty Ltd		Distance to observation boreh		0.3m	
Observer		Jonathan		Pumped borehole depth (m)		60m	
Pump Type		2.2kw Submersable		Borehole diameter (mm)		165mm	
Pump inlet depth		60m		Static Water Level (m)		0	
Datum (above ground)				Base of aquifer (m)		30m	
				Available drawdown (m)		45.12m	
CDT							
		</					

		250	0	0		
		300	0	0		
		350	0	0		
		400	0	0		
		500	0	0		
		600	0	0		
		700	0	0		
		800	0	0		
		900	0	0		
		1000	0	0		
		1100	0	0		
		1200	0	0		
		1300	0	0		
		1400	0	0		
		1500	0	0		
		1600				

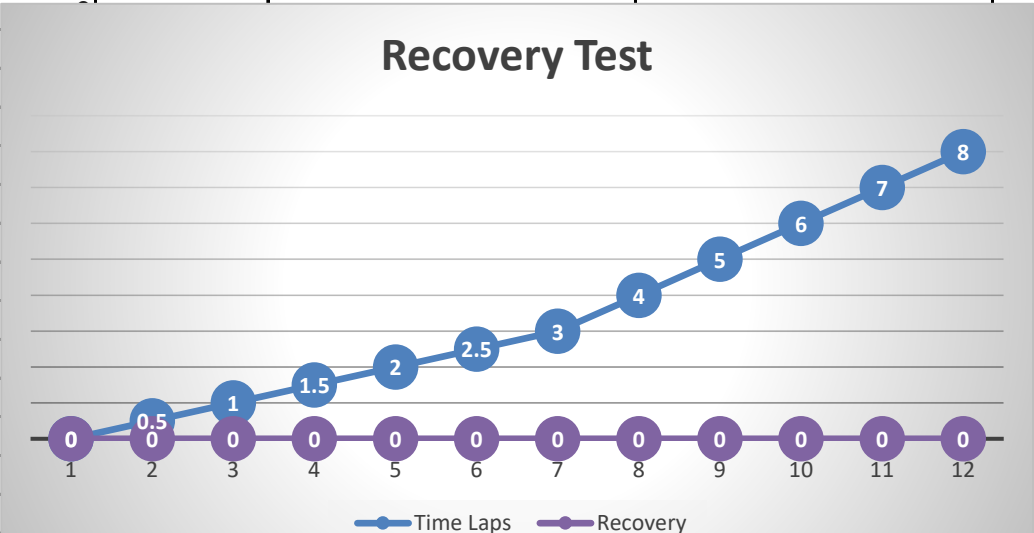


Borehole Recovery Test



RECOVERY STAND TIME : 11min
 RECOVERY TIME OF BOREHOLE: 11min

Recovery			0			Date:	
Date	Real Time	Time t1 elapsed since pumping stopped (min)	Time t elapsed since pumping started (min)	t/t1	Recovery (m)	Remarks	
00-Jan		0	0		0		
		0.5	0		0		
		1	0		0		
		1.5	0		0		
		2	0		0		
		2.5	0		0		
		3	0		0		
		4	0		0		
		5	0		0		
		6	0		0		
		7	0		0		
		8	0		0		
		9	0				
		10	0				
		12	0				
		15	0				
		20	0				
		25	0				
		30	0				
		40	0				
		50	0				
		60	0				
		70	0				
		80	0				
		90	0				
		100	0				
		120	0				
		150	0				
		200	0				
		250	0				
		300	0				



		400	
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ANNEXTURE C: WATER QUALITY LAB RESULTS

Test Report

Page 1 of 2

Client: Muhura Group
Address: 146 Steve Biko Road, Sunnyside, Pretoria
Report no: 219458
Project: Muhura Group

Date of report: 08 July 2026
Date accepted: 27 June 2026
Date completed: 08 July 2026
Date received: 27 June 2026

Lab no:					240583	240584
Date sampled:					26-Jun-26	26-Jun-26
Aquatico sampled:					No	No
Sample type:					Water	Water
Locality description:					MAL BH1	MAL BH2
Analyses					Unit	Method
A	AQL	pH @ 25°C			pH	ALM 20
A	AQL	Electrical conductivity (EC) @ 25°C			mS/m	ALM 20
A	AQL	Total dissolved solids (TDS)			mg/l	ALM 26
A	AQL	Total Alkalinity			mg CaCO ₃ /l	ALM 01
A	AQL	Chloride (Cl)			mg/l	ALM 02
A	AQL	Sulphate (SO ₄)			mg/l	ALM 03
A	AQL	Nitrate (NO ₃) as N			mg/l	ALM 06
A	AQL	Total oxidised nitrogen as N			mg/l	ALM 06
A	AQL	Ammonium (NH ₄) as N			mg/l	ALM 05
A	AQL	Fluoride (F)			mg/l	ALM 08
A	AQL	Calcium (Ca)			mg/l	ALM 30
A	AQL	Magnesium (Mg)			mg/l	ALM 30
A	AQL	Sodium (Na)			mg/l	ALM 30
A	AQL	Potassium (K)			mg/l	ALM 30
A	AQL	Aluminium (Al)			mg/l	ALM 31
A	AQL	Iron (Fe)			mg/l	ALM 31
A	AQL	Manganese (Mn)			mg/l	ALM 31
A	AQL	Chromium (Cr)			mg/l	ALM 31
A	AQL	Copper (Cu)			mg/l	ALM 31
A	AQL	Nickel (Ni)			mg/l	ALM 31
A	AQL	Zinc (Zn)			mg/l	ALM 31
A	AQL	Cadmium (Cd)			mg/l	ALM 31
A	AQL	Lead (Pb)			mg/l	ALM 31
A	AQL	E.coli			CFU/100ml	ALM 40
A	AQL	Total coliform			CFU/100ml	ALM 40

A = Accredited N = Non accredited Sub = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; Results relate only to the items received and tested ; Results reported against the limit of detection; Results marked 'Non SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory; Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation; The report shall not be reproduced except in full without approval of the laboratory

Hermie Holtzhausen
Director Laboratory Services

Test Report

Page 2 of 2

Client:	Muhura Group	Date of report:	08 July 2026
Address:	146 Steve Biko Road, Sunnyside, Pretoria	Date accepted:	27 June 2026
Report no:	219458	Date completed:	08 July 2026
Project:	Muhura Group	Date received:	27 June 2026

Lab no:				240583	240584
Date sampled:				26-Jun-26	26-Jun-26
Aquatico sampled:				No	No
Sample type:				Water	Water
Locality description:				MAL BH1	MAL BH2
Analyses				Unit	Method
A	AQL	Turbidity		NTU	ALM 21
A	AQL	Total hardness		mg CaCO ₃ /l	ALM 26
A	AQL	Total organic carbon (TOC)		mg/l	ALM 63
A	AQL	Langelier Saturation Index		LSI	ALM 26

A = Accredited N = Non accredited Sub = Sub-contracted NR = Not requested RTF = Results to follow NATD = Not able to determine ATR = Alternative test report ; Results relate only to the items received and tested ; Results reported against the limit of detection; Results marked 'Non SANAS Accredited' in this report are not included in the SANAS Schedule of Accreditation for this laboratory; Uncertainty of measurement available on request for all methods included in the SANAS Schedule of Accreditation; The report shall not be reproduced except in full without approval of the laboratory

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ANNEXTURE D: EIA METHODOLOGY

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The impacts are assessed as either having a:
negative effect (i.e. at a 'cost' to the environment),
positive effect (i.e. a 'benefit' to the environment), or
Neutral effect on the environment.

Extent of the Impact

- (1) Site (site only),
- (2) Local (site boundary and immediate surrounds),
- (3) Regional (within the City of Johannesburg),
- (4) National, or
- (5) International.

Duration of the Impact

The length that the impact will last for is described as either:

- (1) immediate (<1 year)
- (2) short term (1-5 years),
- (3) medium term (5-15 years),
- (4) long term (ceases after the operational life span of the project),
- (5) Permanent.

Magnitude of the Impact

The intensity or severity of the impacts is indicated as either:

- (0) none,
- (2) Minor,
- (4) Low,
- (6) Moderate (environmental functions altered but continue),
- (8) High (environmental functions temporarily cease), or
- (10) Very high / Unsure (environmental functions permanently cease).

Probability of Occurrence

The likelihood of the impact actually occurring is indicated as either:

- (0) None (the impact will not occur),
- (1) improbable (probability very low due to design or experience)
- (2) low probability (unlikely to occur),
- (3) medium probability (distinct probability that the impact will occur),
- (4) high probability (most likely to occur), or
- (5) Definite.

Significance of the Impact

Based on the information contained in the points above, the potential impacts are assigned a significance rating (**S**). This rating is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.
 $S=(E+D+M)P$

The significance ratings are given below

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