ILEMBE DISTRICT MUNICIPALITY SCHOOLS GROUNDWATER ASSESSMENT REPORT FOR ISINYABUSI TECHNICAL SCHOOL

REPORT NO.: ID 20200021/5 **NOVEMBER 2020**

REPORT PREPARED FOR:

KWAZULU-NATAL DEPARTMENT OF WORKS

ON BEHALF OF

MZANSI DRILLING (PTY) LTD

PREPARED BY:

GROUNDWATER CONSULTING

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ILEMBE DISTRICT MUNICIPALITY SCHOOLS GROUNDWATER ASSESSMENT REPORT FOR ISINYABUSI TECHNICAL SCHOOL

MMN Groundwater Consulting (PTY) Ltd
38 Khayalami Estate
1 Impala Street
EMalahleni
1034

Mzansi Drilling (PTY) Ltd
Plot 77, Hardingsdale Farm
No.01 Claridge Extension
Ottosbluf Road
Pietermaritzburg
3215

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Compiled by:

Mfundo Nyembe

Director/Hydrogeologist

Executive Summary

Mzansi Drilling (PTY) Ltd was appointed by the KwaZulu-Natal (KZN) Department of Public Works to develop groundwater sources for Isinyabusi Technical High School located in Isulabashe village which lies approximately 25 km northeast of Mandini, in the Ilembe District Municipality, in KwaZulu-Natal Province, South Africa.

A site visit to Isinyabusi Technical School was undertaken on 30 September 2020, to establish the water supply status quo at the school. The school, reportedly, relies on municipal bulk water supply but it is not reliable due to water cuts by the municipality. There were no other reported and/or observed water sources at the school.

Geophysical surveys was not carried out at the school due to limited space. A site walk over was conducted on 30 September 2020, to locate the best possible point for groundwater to be accessed. The position was selected based on local geological and hydrogeological conditions (desktop study); There is a grave located north east; There are pit latrines located along the north east – east boundary of the school; There is an old pit latrine, which is no longer used and has since been buried, on the southern boundary of the school; and The school buildings were close together and did not offer space for resistivity profiling to be conducted.

The position that was selected to be drilled was at location -29.070974°S; 31.555182°E. The final locations/positions of the traverse lines were determined by the site hydrogeologist and were based on accessibility, man-made interferences, field observations and interpreted groundwater flow direction. The positions of the traverses were recorded with a Garmin GPS.

The borehole was drilled and completed on 18 October 2020. The total depth of the borehole was 46 mbgl after a decision by the hydrogeologist on site, due to the softer formation that was encountered deeper at 30 mbgl which was threatening to collapse the borehole, together with the high yielding fracture. The 8 inch (203 mm) diameter was used from surface, down to 21 mbgl. Steel casing was then installed from 0 – 21 mbgl. The 6.5 inch diameter drill bit was used from 21 – 46 mbgl to complete the borehole. Groundwater was intercepted at the depths of 24 mbgl (0.14 L/s) and 30 mbgl (1.25 L/s), accumulatively. The total blow yield of 2.08 L/s was measured at the end of drilling.

The borehole was subjected to a maximum of 1 hours of development after the final depth.

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List of abbreviations

DWS	Department of Water and Sanitation
EPWP	Expanded Public Works Programme
KZN	KwaZulu-Natal
OD	Outer Diameter

List of measurements

L	litres
m	metres
mamsl	metres above mean sea level
mbgl	metres below ground level
mm	millimetres

1 INTRODUCTON

Mzansi Drilling (PTY) Ltd was appointed by the KwaZulu-Natal (KZN) Department of Public Works to develop groundwater sources for Isinyabusi Technical High School located in Isulabashe village which lies approximately 25 km northeast of Mandini, in the Ilembe District Municipality, in KwaZulu-Natal Province, South Africa.

MMN Groundwater Consulting was appointed by Mzansi Drilling to conduct hydrogeological assessment for the project. The activities and outcomes are presented in this report.

2 SCOPE OF WORK

2.1 Project objectives

The stipulated objectives of the program are as follows:

- Assess and describe the geological/hydrogeological characteristics of the rock units underlying the identified schools in the province.
- Determine the groundwater yield potential class within and around the identified school areas.
- Establish school water supply status quo as well as the condition of the water supply source and related infrastructures at the school.
- Provide reliable water supply to Isinyabusi Technical School by sighting, drilling and equipping a borehole; and
- to ensure that the work is of a high standard and is completed in the shortest practical time whilst complying with EPWP requirements for using labour intensive construction methods to deliver public infrastructure, and complying with the Occupational Health and Safety Act's requirements for safety.

2.2 Client requirements

We understand the scope of work to be the following:

- assessment of the drilling needs of a borehole;
- geophysical surveying, drilling, testing and equipping of a borehole;
- provision and installation of electric submersible pumps;
- provision and installation of all ancillary works to render the borehole functional.

This report seeks to detail the events that have been executed so far in the project, i.e. hydrogeological assessment.

3 SITE LOCATION AND DESCRIPTION

3.1 Site details

Isinyabusi Technical School (central co-ordinates: Lat. -29.071379°, Long. 31.555334°) is a public technical high school located in Isulabashe village which lies approximately 25 km northeast of Mandini, in the Ilembe District Municipality, South Africa (Figure 3-1).

Figure 3-1: Isinyabusi Technical School locality map

3.2 Topography and Drainage

The school is situated at an approximate elevation of 20 meters above mean sea level (mamsl). The school topography settings can best be described as relatively flat, located in a valley.

The drainage system of the area is defined by a non-perennial stream located adjacent to the school on the north and a perennial Amatikulu river, passing on the east, adjacent to the school.

3.3 Climate Settings

The climate in Mandini is classified as humid and sub-tropical. The mean annual precipitation (MAP) for the area is approximately 991 mm, which occurs which occurs mainly during rainy seasons (September – March) and may occur even during the driest months. **Figure 3.2** illustrates the average monthly rainfall data.

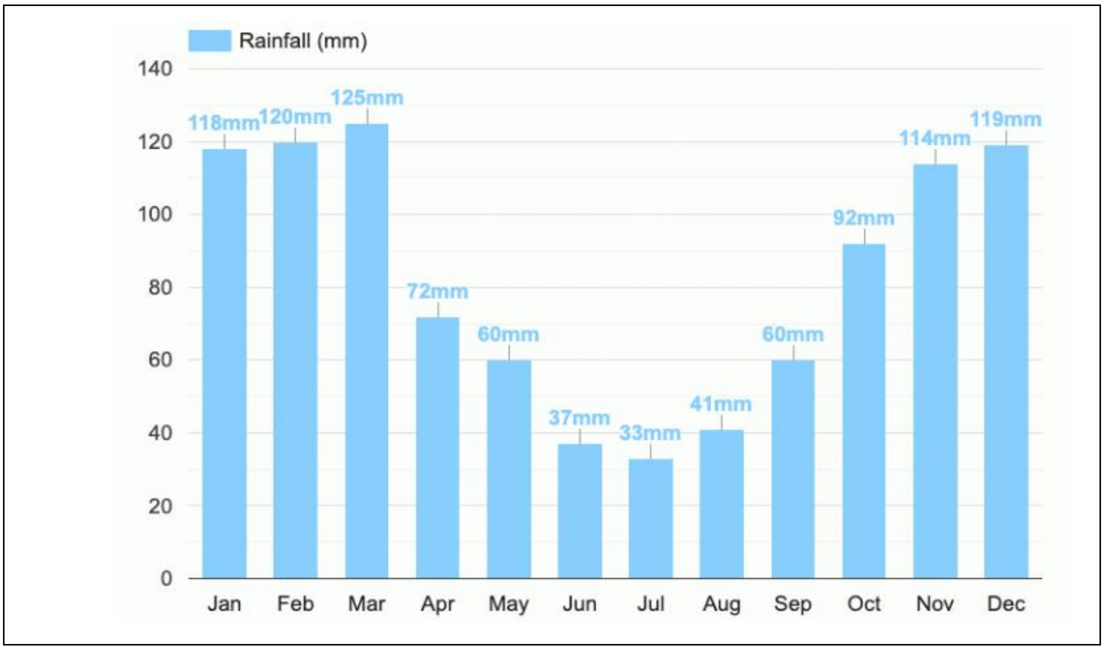

Figure 3-2: Average monthly precipitation in Mandini

The monthly average daily maximum temperatures show that the average midday temperatures for Mandini, range from 22.8 °C in July to 28.7 °C in February. Figure 3.3 shows the graphs indicating the average day-time and night-time temperatures in the area.

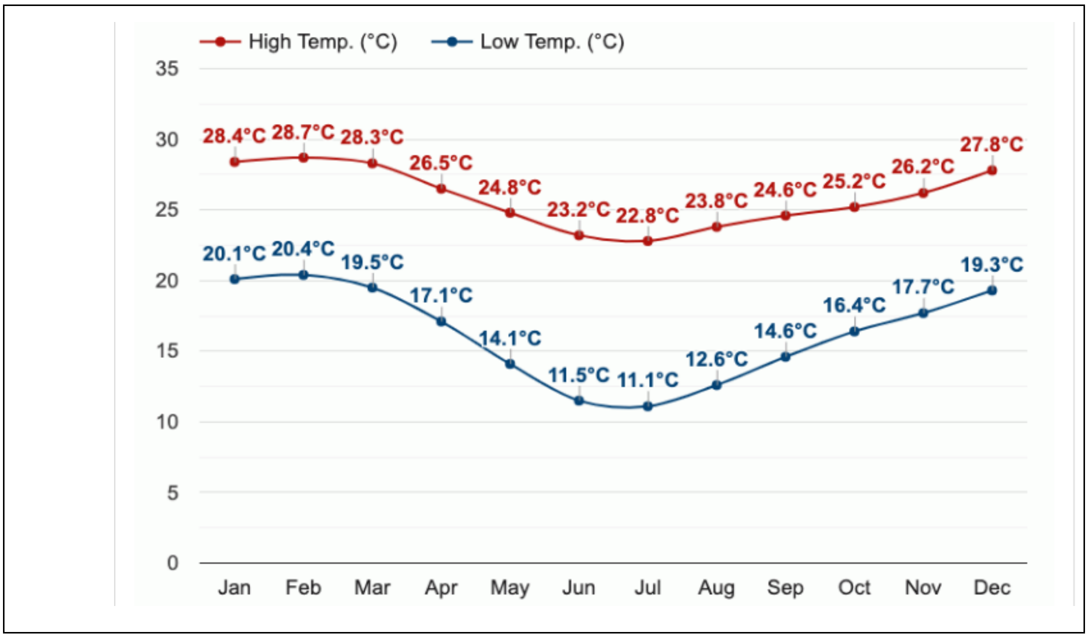

Figure 3-3: Average monthly temperatures in Mandini

3.4 Geological and hydrogeological settings

The 1:500 000 General Hydrogeological map for the Republic of South Africa published by DWAF (2000), 1:250 000 Geological map series and Aquifer Classification of South Africa by R. Parsons (1999) have been used to describe the geology and hydrogeology for Mandini.

3.4.1 Geology

The regional geology comprises of the Karoo Supergroup which is characterised by quaternary alluvium, shale and post Karoo dolerite. Sandstone of the Natal Group is found in some areas.

3.4.2 Hydrogeology

The aquifer in the area is characterised as minor aquifer, which is moderately-yielding aquifer system of variable water quality. The vulnerability[1] of the aquifer is the least in the area and the susceptibility [2]is low. The principal groundwater occurrence in the area is intergranular and fractured aquifers systems that are capable of supporting borehole with yields between 0.5 – 2.0 l/s. The intergranular and fractured aquifer systems which are associated with predominantly meta-arenaceous rocks.

It should be noted that groundwater occurrences depict the aquifer types with the highest borehole yield which does not always correlate with surface lithology.

The groundwater occurrence in these aquifer systems is generally associated with zones of weathering as well as fracturing. Groundwater is often encountered in the weathered material and the transition zone between weathered and fresh rocks. The zones of deep weathering normally coincide with the drainage pattern.

[1] Aquifer Vulnerability – The tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer.
[2] Aquifer Susceptibility – A quantitative measure of the relative ease at with which a groundwater body can be potentially contaminated by anthropogenic activities and includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification.

4 FIELD WORK

A site visit to Isinyabusi Technical School was undertaken on 30 September 2020, to establish the water supply status quo at the school. The visit was followed by assessing and recording of existing on-site water sources as well as related water infrastructures.

According to the Principal, Mr Lushozi, the school relies on municipal bulk water supply but it is not reliable due to water cuts by the municipality. There were no other reported and/or observed water sources at the school. A new borehole needed to be drilled.

4.1 Geophysical survey

Geophysical surveys was not carried out at the school due to limited space. A site walk over was conducted on 30 September 2020, to locate the best possible point for groundwater to be accessed. The position was selected based on the following conditions and/or limitations:

- Local geological and hydrogeological conditions (desktop study);
- There is a grave located north east;
- There are pit latrines located along the north east – east boundary of the school;
- There is an old pit latrine, which is no longer used and has since been buried, on the southern boundary of the school; and
- The school buildings were close together and did not offer space for resistivity profiling to be conducted.

The position that was selected to be drilled was at location -29.070974°S; 31.555182°E. The final locations/positions of the traverse lines were determined by the site hydrogeologist and were based on accessibility, man-made interferences, field observations and interpreted groundwater flow direction. The positions of the traverses were recorded with a Garmin GPS.

4.2 Borehole drilling

4.2.1 Drilling method

The borehole was drilled according to the recommended drilling standards and guidelines (SANS 10299 and DWA, 1997 & 2008).

The preferred drilling method for the drilling programme was rotary air percussion using a down-the-hole hammer. This drilling technique is ideally suited for hard rock formations. The construction of the boreholes of varying depths was drilled using an 8 inches (203 mm) diameter from the surface, throughout the weathered zone and then completed using the 6.5 inches (165 mm) drilling through solid rock. The drill cuttings brought to the surface by air return from the borehole were collected per each meter drilled, and logged by the project hydrogeologist. The rate at which the drill bit penetrates the rock every meter was measured by the contractor. The samples of drill chips which were used to log the borehole were collected every 1 meter by the drilling contractor. The samples were washed to remove excess dust, sieved and placed in collection boxes for borehole logging.

The boreholes were equipped with a 165 mm (6 mm OD) steel casing and the depth of casing was dependant on the depth of the weathering zone.

Every water strike was noted and drilling was temporarily interrupted on instruction from the project hydrogeologist in order to develop the borehole. During drilling and development, a container of known volume was permanently set up in an approved manner, level and vertical, in the drain line so that continuous monitoring of airlift yields can be obtained. Average yields were read and noted every 2 m of penetration or as directed by the project hydrogeologist and recorded in the driller’s log.

4.2.2 Drilling outcomes

The borehole was drilled and completed on 18 October 2020. The total depth of the borehole was 46 mbgl after a decision by the hydrogeologist on site, due to the softer formation that was encountered deeper at 30 mbgl which was threatening to collapse the borehole, together with the high yielding fracture. The 8 inch (203 mm) diameter was used from surface, down to 21 mbgl. Steel casing was then installed from 0 – 21 mbgl. The 6.5 inch diameter drill bit was used from 21 – 46 mbgl to complete the borehole. Groundwater was intercepted at the depths of 24 mbgl (0.14 L/s) and 30 mbgl (1.25 L/s), accumulatively. The total blow yield of 2.08 L/s was measured at the end of drilling.

The borehole was subjected to a maximum of 1 hours of development after the final depth.

Figure 4-1: Drilling at Isinyabusi Technical High School

5 Health, safety, environment and risk assessment

5.1 Health and safety plan

In order to establish and maintain safe working conditions, conditions of Occupational Health and Safety Act 85 of 1993 were adopted and maintained for the duration of the project. A Health & Safety Plan (HASP) established personnel protection standards and mandatory safety practices and procedures for the field activities for the environmental site assessment will be drafted. The HASP assigned responsibilities, established standard operating procedures, and provided for contingencies that may arise during site activities. The objective of this plan was to establish procedures that ensured a safe and incident free operation during field activities.

The Site Supervisor conducted a pre-mobilisation briefing on the contents of the HASP for all site personnel involved in the covered activities. All such personnel signed the Project Health and Safety Plan Briefing Acknowledgment form, acknowledging that they have attended the pre mobilisation briefing, and have understood this HASP and will abide by its contents.

5.2 Stop work authority

All site personnel are empowered, expected, and have the responsibility to stop their own work and the work of other site personnel if any person's safety or the environment are at risk. No repercussions will result from this action. Should a Stop Work Authority be used at the site then the details must be recorded in the Stop Work Register which will be included in the H&S File. Work can continue once the unsafe conditions have been eliminated or removed and the site is deemed safe by the site safety officer (SSO).

5.3 Hazard analysis and risk mitigation by task

Some of the potential hazards/risks that were likely to be encountered during the course of the construction component of the hydrogeological project included the following:

- Vehicle traffic and driving conditions;
- Slip, trip, falls;
- Fatigue;
- Lifting and improper ergonomics;
- Mechanical failure of equipment;
- Dropping heavy equipment;
- Underground services;
- Extreme weather conditions;
- Pinch and shear points/sharp objects;
- Fires; and
- Biological hazards.

Minimum Protective Clothing/Equipment Requirements are as follows:

- Long sleeved shirts and long pants;
- Safety glasses with side shields or “wrap-around” protection;
- Steel-toed work boots;
- Ear plugs;
- High visibility safety vest;
- Protective gloves

Safety, physical, and biological hazards can be mitigated by the use of proper work procedures and controls, safety equipment (e.g. hard hat, safety glasses, steel-toed shoes, protective gloves), good communication among all on-site personnel and being alert to potential hazards.

6 References

Department of Mineral and Energy (1988), Extract of 1:250 000 Geological map sheet 2930 map for Durban, Government Printer. Pretoria, Republic of South Africa.

Directorate: Geohydrology (1995). Extract of 1:500 000 Hydrogeological Map Series of the Republic of South Africa Durban sheet 2930. Associated Printing. Cape Town, Republic of South Africa.

Google Maps. (2020). AfriGIS; Maxar Technologies. 10 November 2020.

Parsons, R. (1998). Explanatory Notes for the Aquifer Classification Map of South Africa. WRC Report No. KV 116/98. Water Research Commission. Pretoria.

Yu Media Group. 2002-2020. 10 November 2020. (https://www.weather-atlas.com/en/south-africa/kwadukuza-climate)

7 Appendix A: Drilling log

BOREHOLE ID: Isinyabusi

School Name	Isinyabusi Technical High School	**Borehole Depth:**	120 mbgl	**Latitude:**	-29.070992°
Client Name:		**Collar elevation:**	0,24	**Longitude:**	31.555204°
Site Location:	Isulabashe, Mandini, KZN	**RWL:**	Not measured	**Datum:**	WGS84
Drilling Company:	Mzansi Drilling	**Drilling Method:**	Air Percussion	**Date Drilled:**	18 October 2020
Logged by:	Mfundo Nyembe	**Project Name**	Ilembe DM Schools Groundwater Assessment		

Depth (mbgl)	Lithology	Hole diameter (mm)	Casing	Annulus	Water Level (mbgl)	Water Strikes (L/s)
2						
4						
6						
8						
10	SHALE. Brown, highly to moderately weathered, fine, rounded grained	203	Steel			
12						
14						
16						
18						
20						
22						
24						0,14
26						
28						
30						1,25
32						
34	SHALE. Grey, slighty weathered, fine,rounded grained.	165				
36						
38						
40						
42						
44						
46						

Notes: Final blow yield is 2,08 L/s.