



**GEOHYDROLOGICAL ASSESSMENT FOR
PROPOSED NAAZ QUARRY SITE,
PIETERMARITZBURG, KWAZULU-NATAL**

April 2021
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Prepared by:

JG AFRIKA (PTY) LTD

DURBAN BRANCH

PO Box 2762

Westway Office Park, Durban

3635

Telephone: (031) 275 5500

Email: schapersr@jgafrika.co.za

Project Lead: Robert Schapers

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CARRIED OUT BY: JG AFRIKA (PTY) LTD - DURBAN Block C 1 st Floor 1 The Boulevard Westway Office Park 3629 Tel.: 031 275 5500 Email: schapersr@jgafrika.com	COMMISSIONED BY: GREENMINED ENVIRONMENTAL 36 Baker Square Block One De Beers Avenue Paardevlei Somerset West 7130 Tel: 021 851 2673 Email: Murchellin.S@greenmined.co.za
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AUTHOR Robert Schapers	CLIENT CONTACT PERSON Murchellin Saal
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SYNOPSIS
Specialist geohydrological site assessment of proposed Naaz Quarry site in support of the Water Use Licence Application

KEY WORDS:
Geology, geohydrology, hydrocensus, groundwater use, groundwater potential, groundwater, risk, impact and mitigation

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QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2015 which has been independently certified by DEKRA Certification



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By Author	Geohydrologist	Robert Schapers		05 Apr 2021
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GEOHYDROLOGICAL ASSESSMENT FOR PROPOSED NAAZ QUARRY SITE, PIETERMARITZBURG, KWAZULU-NATAL

1 INTRODUCTION

This report presents the results of preliminary geohydrological assessment carried out for the mining permit area for the proposed Naaz Quarry Site located on Portion 0 (Remaining Extent) of the farm Thandisizwe No 16691. The geohydrological report is required as a specialist study in support of the water use licence application for the proposed activities associated with the quarry site. The scope of the geohydrological report is to include a hydrocensus within a 5 km radius, and to include impacts of activities on water resources and mitigation measures.

We refer to our proposal reference 005324 2017203/rs, titled “Specialist Geohydrological Assessment for Proposed Quarry Development off the R33 Near Pietermaritzburg”, dated 17 February 2021. JG Afrika (Pty) Ltd were requested to undertake the geohydrological assessment by Greenmined Environmental by means of signed acceptance of JG Afrika’s “Quotation Acceptance and Appointment” form, dated 1 March 2021, received by email on 2 March 2021.

2 INFORMATION SUPPLIED

The following information has been used in the preparation of this report:

Reports and Documents

- Report referenced KZN 30/5/1/3/2/10724 MP of Greenmined Environmental titled “Proposed Mining on a Portion of Portion 0 (Remaining Extent) of the Farm Thandisizwe No 16691, Umshwathi Municipal Area, Kwazulu-Natal Province - Final Basic Assessment Report”, dated January 2021
- Report referenced 3132R01 of Jeffares & Green (Pty) Ltd titled “Geohydrological Assessment Report for the Proposed Umgungundlovu Landfill Near Pietermaritzburg, KwaZulu-Natal”, dated September 2012
- Report referenced 005136R01 of JG Afrika (Pty) Ltd titled “Augmented Geohydrological Site Assessment Report for Thandisizwe Farm, Pietermaritzburg, Kwazulu-Natal”, dated 17 March 2020
- Report referenced LL3570 of Engeolab titled “Preliminary Report on a Geohydrological Investigation for the Proposed Service Station Along The R33, uMgungundlovu District Municipality – KwaZulu-Natal”, dated 25 June 2020
- The Department of Water Affairs, First Edition, February 2010. Operational Guideline: Integrated Water and Waste Management Plan
- The Department of Water Affairs and Forestry, Second Edition, 1998. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill
- The Department of Water Affairs and Forestry, Third Edition, 2005. Waste Management Series. Minimum Requirements for Water Monitoring at Waste Management Facilities

Maps and Drawings

- Map Sheet titled, “2930 Durban”, at a scale of 1:250000, dated 1988, digital version, of the Geological Map Series, supplied by the Department of Mineral and Energy Affairs
- Map Sheet titled, “Durban 2928”, at a scale of 1:500000, first edition, dated 1998, of the Hydrogeological Map Series of the Republic of South Africa, supplied by the Directorate: Geohydrology, of the Department of Water Affairs and Forestry

Data

- National Groundwater Archive (NGA) digital information, as supplied by The Department of Water and Sanitation (DWS) as at July 2019
- Groundwater Resource Information Project (GRIP) digital information, as supplied by the Department of Water and Sanitation (DWS) as at June 2011
- Water Allocation Resource Management System (WARMS) digital information, as supplied by The Department Water and Sanitation (DWS) as at May 2012
- National Freshwater Ecosystem Priority Areas Wetland coverage, 2011
- Google Earth Pro version 7.3.3 of July 2020.

3 DESKTOP ASSESSMENT

3.1 Site and Project Description

The site is located on a portion of Portion 0 (Remaining Extent) of the farm Thandisizwe No 16691, and is approximately 10km north north east of Pietermaritzburg. The permit area has an area of 4.9 ha. The site can be accessed via a dirt road off the R33 between Pietermaritzburg and New Hanover. The location of the site is shown in Figure 1.

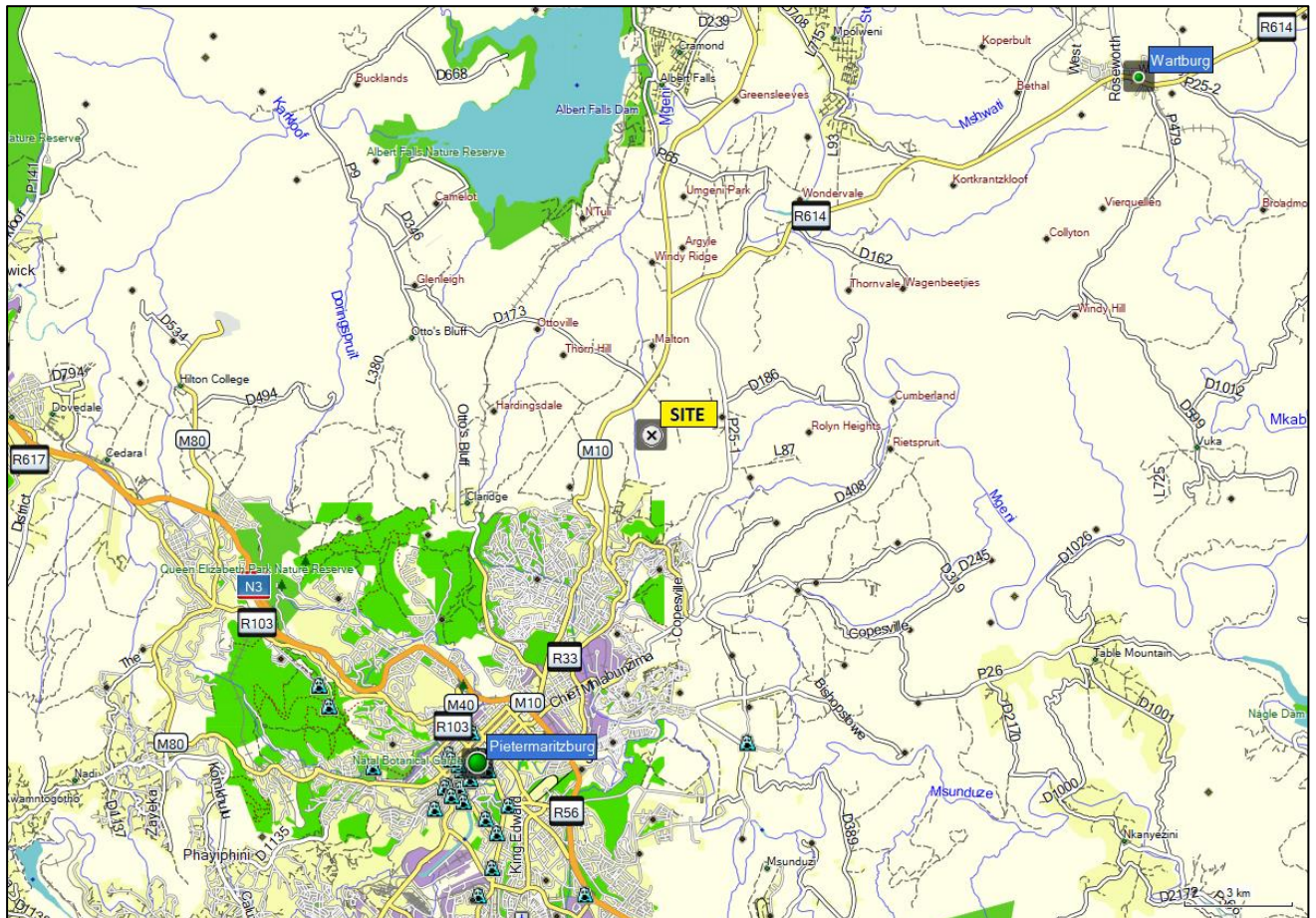


Figure 1: Locality Plan

The project area comprises a dolerite “koppie” with the east and west sides dropping down to valley lines on either side. The permit area is located on the eastern side of the koppie. The approximate elevation range of the surrounding area is 720 to the north, to 880 maMSL to the south. The permit area itself is at an elevation of 857 maMSL in the south western corner, to 796 maMSL in the north eastern corner.

The project area is mostly undeveloped with areas of grassland, bush, trees and farmland. Power lines are present 125 m to the east of the permit area. Adjacent land is occupied by sugar cane farms to the south and west, the R33 road on the north western boundary, a brick works facility to the north east, residential properties of Copesville to the south, and farmland to the east.

The project area is located within the U20G quaternary catchment. A valley line with seasonable stream flow is located on the western side of the koppie. An unnamed perennial stream flows from south west to north east, 400 m to the south east, then turns north west, 800 m to the east. A non-perennial water course bounds the permit area on the eastern side and joins the perennial stream 830 m to the north north east. Evidence of small dams along this water course are present. The project area is described as valley thicket of the thicket biome and is characterised by mostly thicket and bushland with some unimproved grassland.

Application for environmental authorisation to mine dolerite has been made for the permit area. The proposed mining method will make use of blasting in order to loosen the hard rock. The material will be loaded and hauled to the crushing plant where it will be screened to various sized stockpiles. The aggregate will be stockpiled until it is transported from site using tipper trucks. The mining related activities will be contained within the approved mining permit boundaries. The permit area is shown in Figure 2.

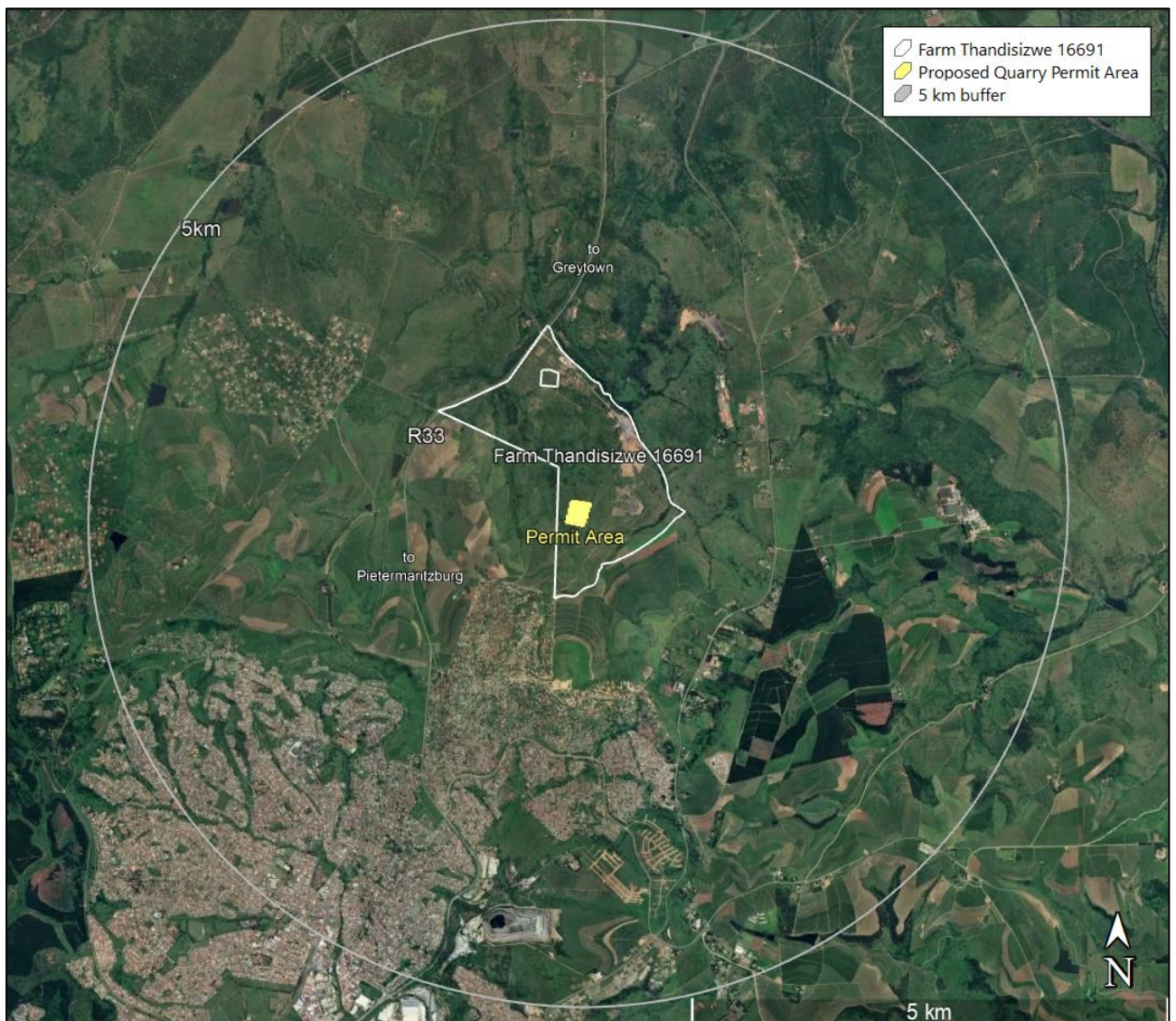


Figure 2: Project Area

The following project activities are proposed:

- site establishment and infrastructure development
- stripping and stockpiling of topsoil from the proposed mining footprint area
- blasting and excavation of the mining area
- crushing and screening of the loosened material at the processing plant
- stockpiling of product until sold and transported off site.

The proposed quarry will appoint 11 employees including management. Due to the small scale of the operation, no permanent infrastructure will be built at the mining area. The Applicant plans to establish the following mobile/temporary infrastructure within the mining footprint:

- Chemical ablation facilities to be serviced by a registered contractor
- Crushing and screening plant
- Containers that will be used as site offices, workshops and storage rooms
- Temporary wash bay.

3.2 Regional Geology and Structures

The regional geology of the area comprises Ecca Group Permian deposits of the Pietermaritzburg Formation including dark grey shale, siltstone and subordinate sandstone, which have been extensively intruded by Post Karoo age dolerite. Regional mapping indicates intrusive dolerite of Jurassic age to be present in the project area as mapped by the koppie to the west of the permit area.

Regional faults and dykes were not evident within 1 km of the site, with the closest regional fault mapped nearly 5 km to the east. A north west to south east trending lineament was located 770 m to the north east, and further east, a near north south trending lineament was evident approximately 2 km away. The regional geology and structures of the project area are shown in Figure 3.

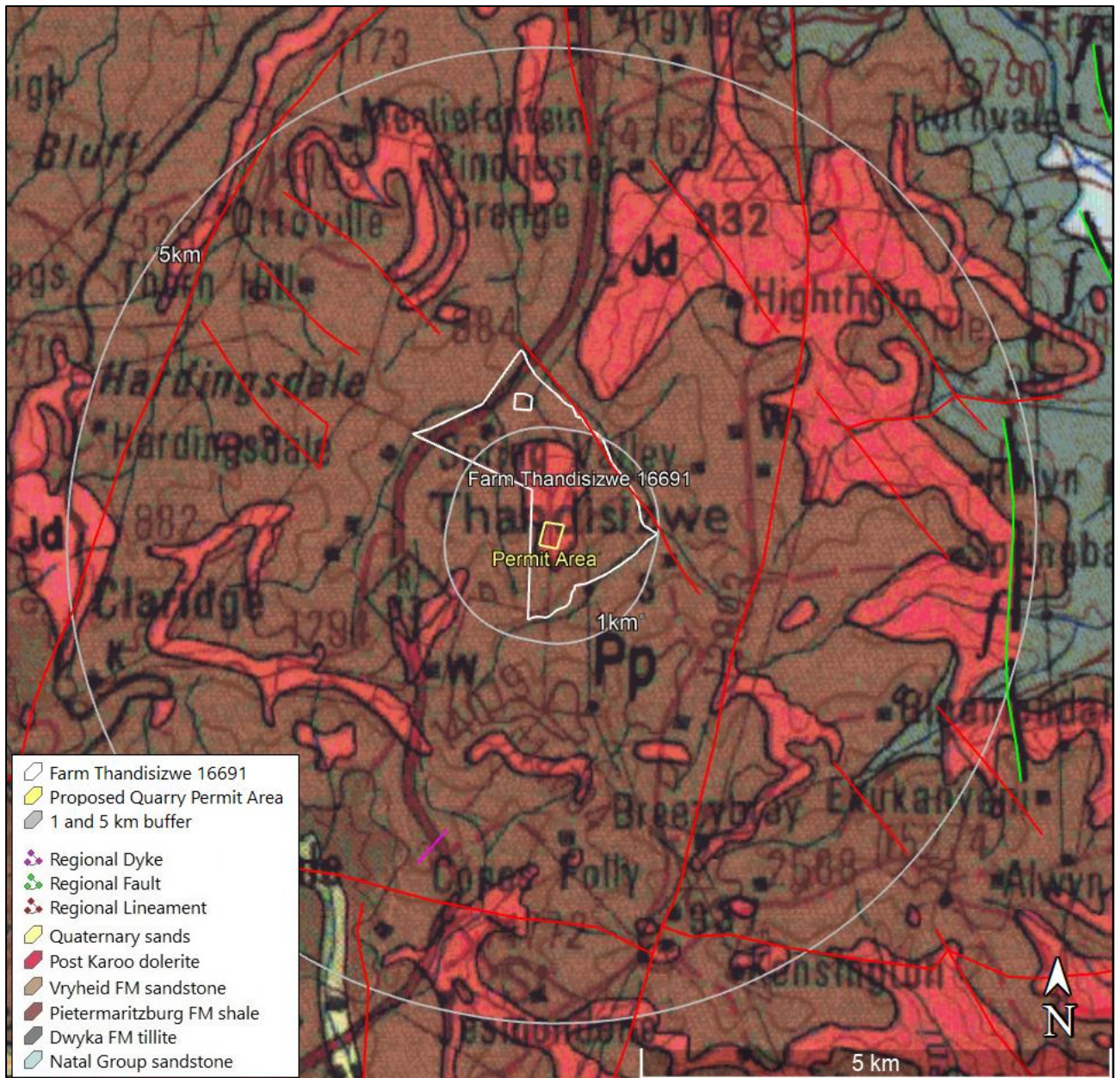


Figure 3: Regional Geology and Structures

3.3 Regional Geohydrology and Conceptual Groundwater Flow

The regional geohydrology of the area can be broadly described as predominantly argillaceous rocks comprising shale, mudstone and siltstone. The principal groundwater occurrence is from an intergranular and fractured aquifer type, with median borehole yields in the range 0.5 to 2.0l/s. The regional geohydrology of the area is presented Figure 4.

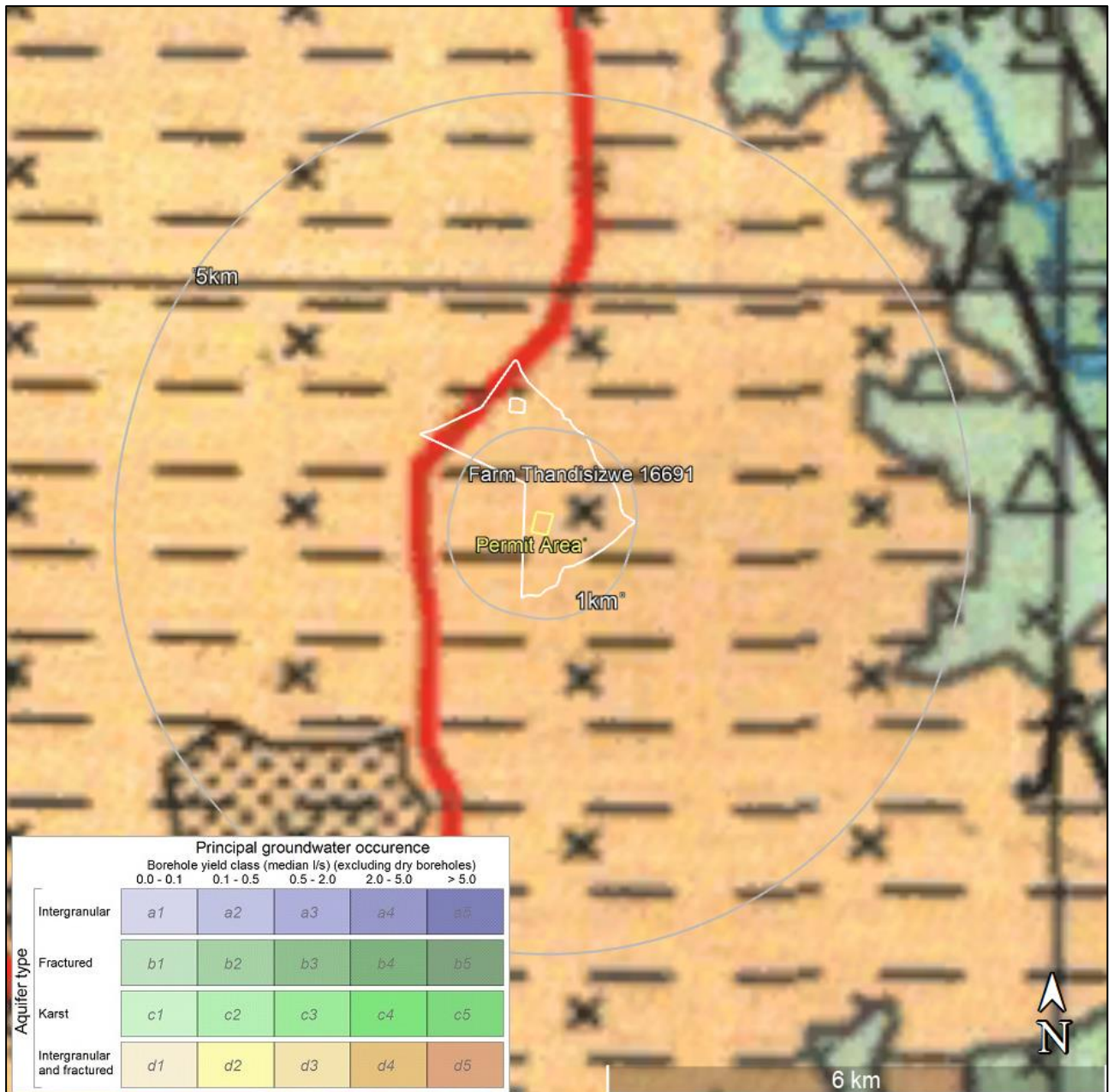


Figure 4: Regional Geohydrology

The site is located within the U20G quaternary catchment. Based on WR90 data (WRC; Surface Water Resources of South Africa 1990 Study) the Mean Annual Precipitation (MAP) is 895 mm/annum and the recharge is 51.3 mm/annum.

The project area comprises one aquifer class unit which is characterised as a Minor aquifer in terms of the South African Aquifer Classification System. The inferred groundwater flow direction for the project area is presented in Figure 5.

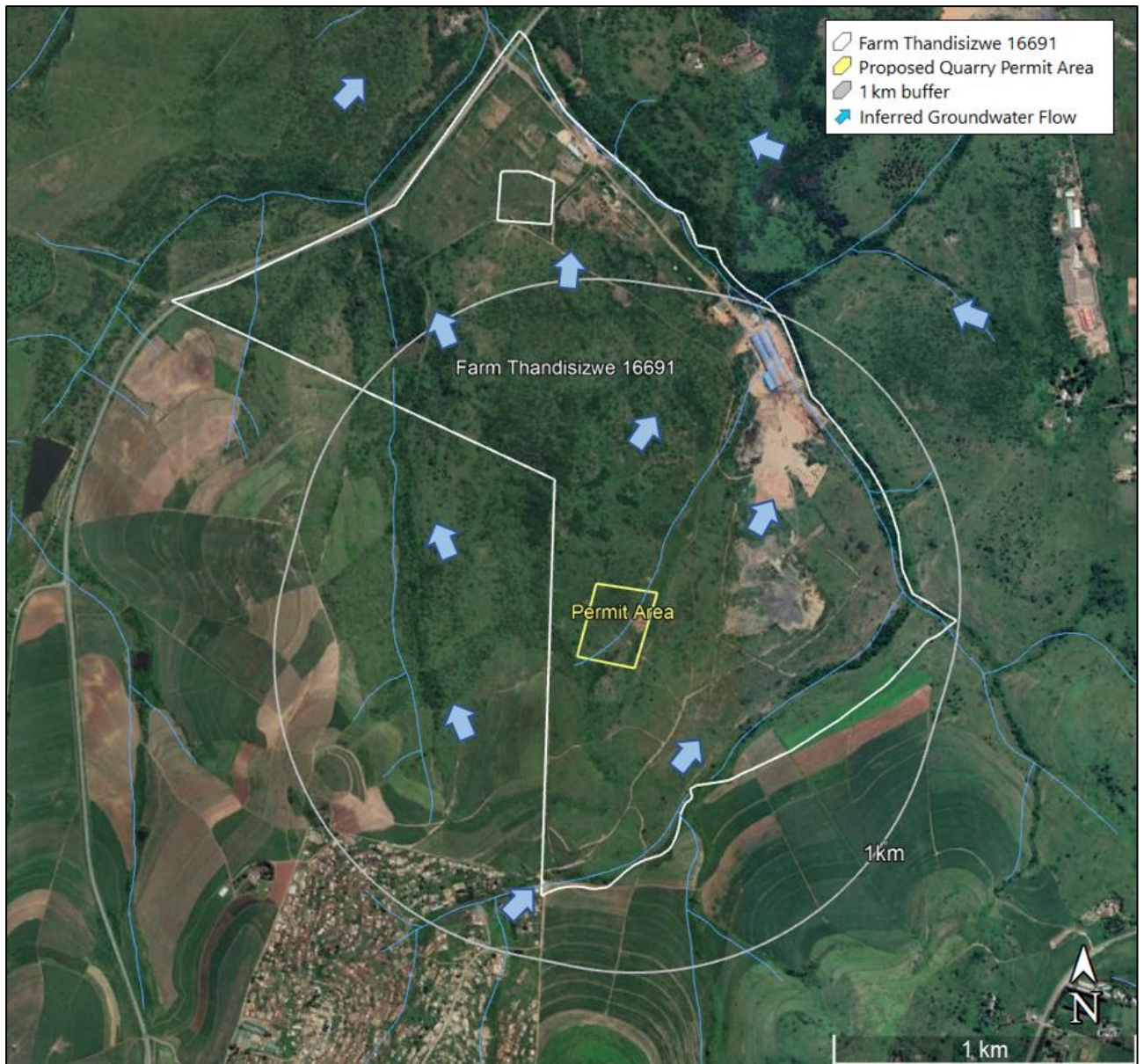


Figure 5: Inferred Groundwater Flow Direction

3.4 Existing Groundwater Resources

The National Groundwater Archive (NGA), Groundwater Resource Information Project (GRIP), and Water Allocation Resource Management System (WARMS) of the DWS were interrogated to establish the existence of any groundwater resources and groundwater use within 5 km of the project area. The NGA reported 32 (No.) resources, the GRIP reported 14 (No.) resources, and the WARMS reported five (5 No.) registered boreholes. A summary of the resource information is presented in Annexure A. The distribution of resources presented in DWS datasets is shown in Figure 6.

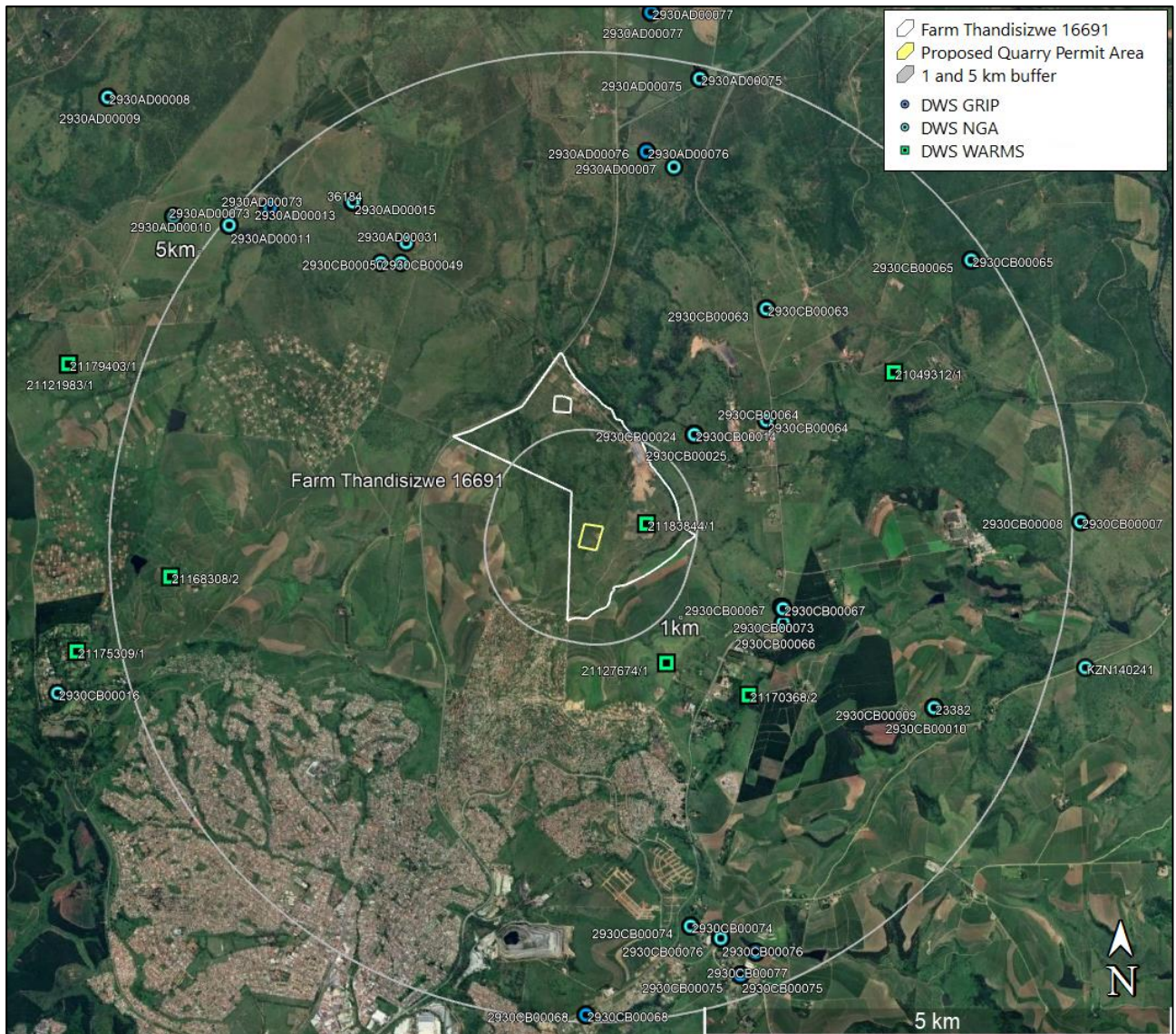


Figure 6: Hydrocensus Resources (DWS NGA, GRIP and WARMS Datasets)

3.5 Regional Magnetic Mapping

Regional magnetic mapping with a contour interval of 50 nT, as generated for the whole country, is presented for the project area in Figure 7. The mapping indicates that magnetic flux for the project area has a range of 50 to 300 nT. Closer to the site, the flux is consistently 120 to 150 nT, showing the response to the dolerite outcrop on the farm. No major anomalies near the site are evident from the regional mapping. An extensive magnetic high is evident to the south and east of the project area in excess of 1 km from the site. This may be as a result of an extended lithological response.

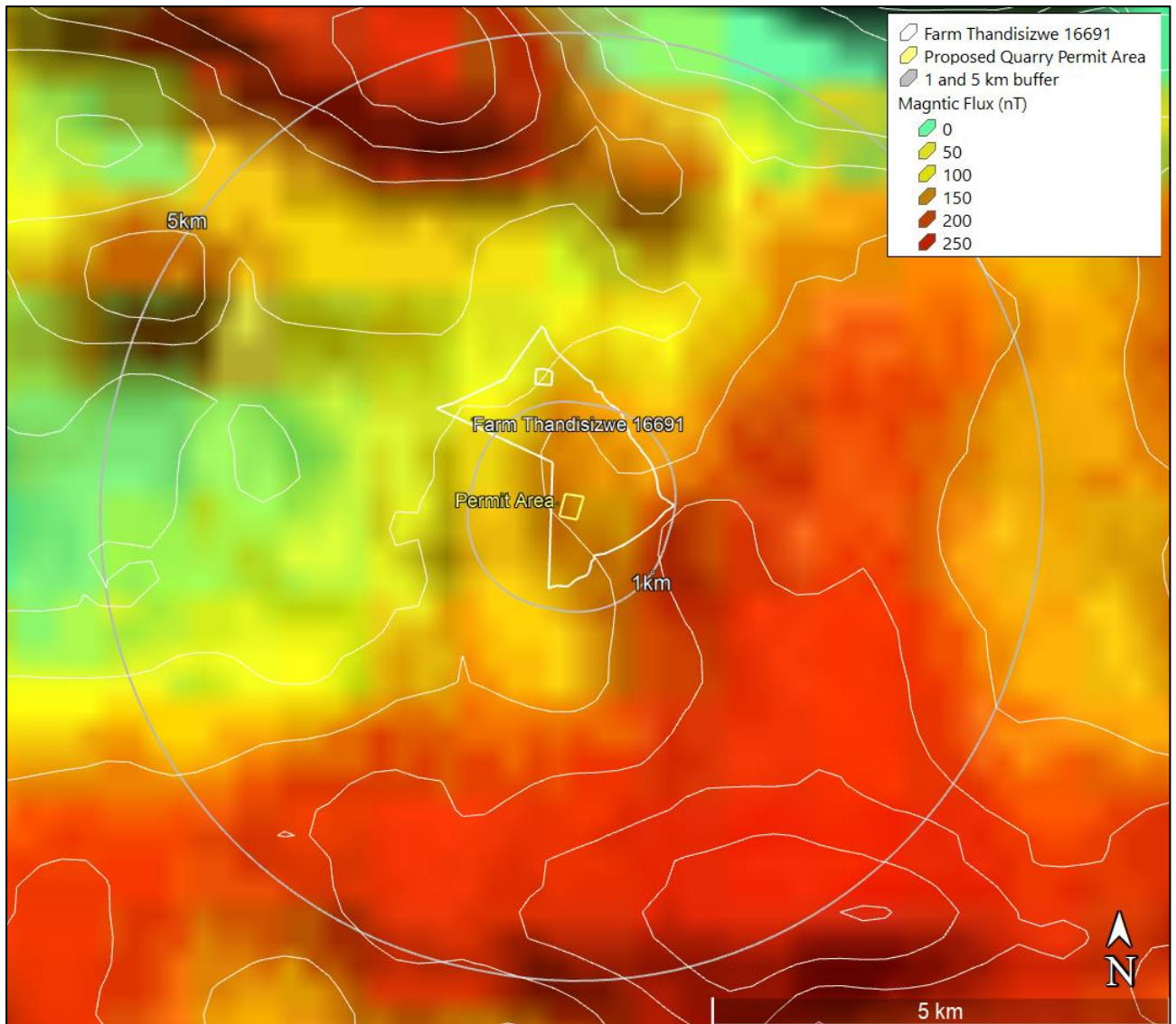


Figure 7: Regional Magnetic Mapping

4 SITE ASSESSMENT

4.1 Previous Studies by the Specialist

Reference to the Jeffares & Green study of 2012 is made: Three (3 No.) inspection pits, four (4 No.) geophysical traverses and five (5 No.) boreholes formed part of the geohydrological characterisation of the site in 2012.

Reference to the JG Afrika study of 2020 is also made. The objectives of the study were to delineate the dolerite outcrop through surface mapping, geophysical ground surveys, and the drilling of additional holes. Seven (7 No.) inspection pits, six (6 No.) geophysical traverses and the installation of seven (7 No.) boreholes, formed part of the geohydrological characterisation of the site in 2020. This information was used in the current site characterisation.

4.2 Site Appraisal, Geological Mapping and Monitoring

Geological mapping was conducted during the JG Afrika study of 2020. Locations of any visible contacts between the shale and dolerite were recorded using a handheld GPS. Visible surface contacts and the results of the geophysical survey were used to map the inferred dolerite outcrop on the site. The inferred mapping is presented in Figure 8.

Logging of boreholes drilled during the previous studies confirms dolerite to extend to in excess of 54 (KZN180389) and 42 m (KZN180392), where the boreholes were terminated. During the current site assessment, water levels were recorded at boreholes that could be located in the field. A summary of borehole information is presented in Table 1. Photographs of field verified resources is presented in Annexure B. The locations of borehole drilled during both phases is presented in Figure 8.

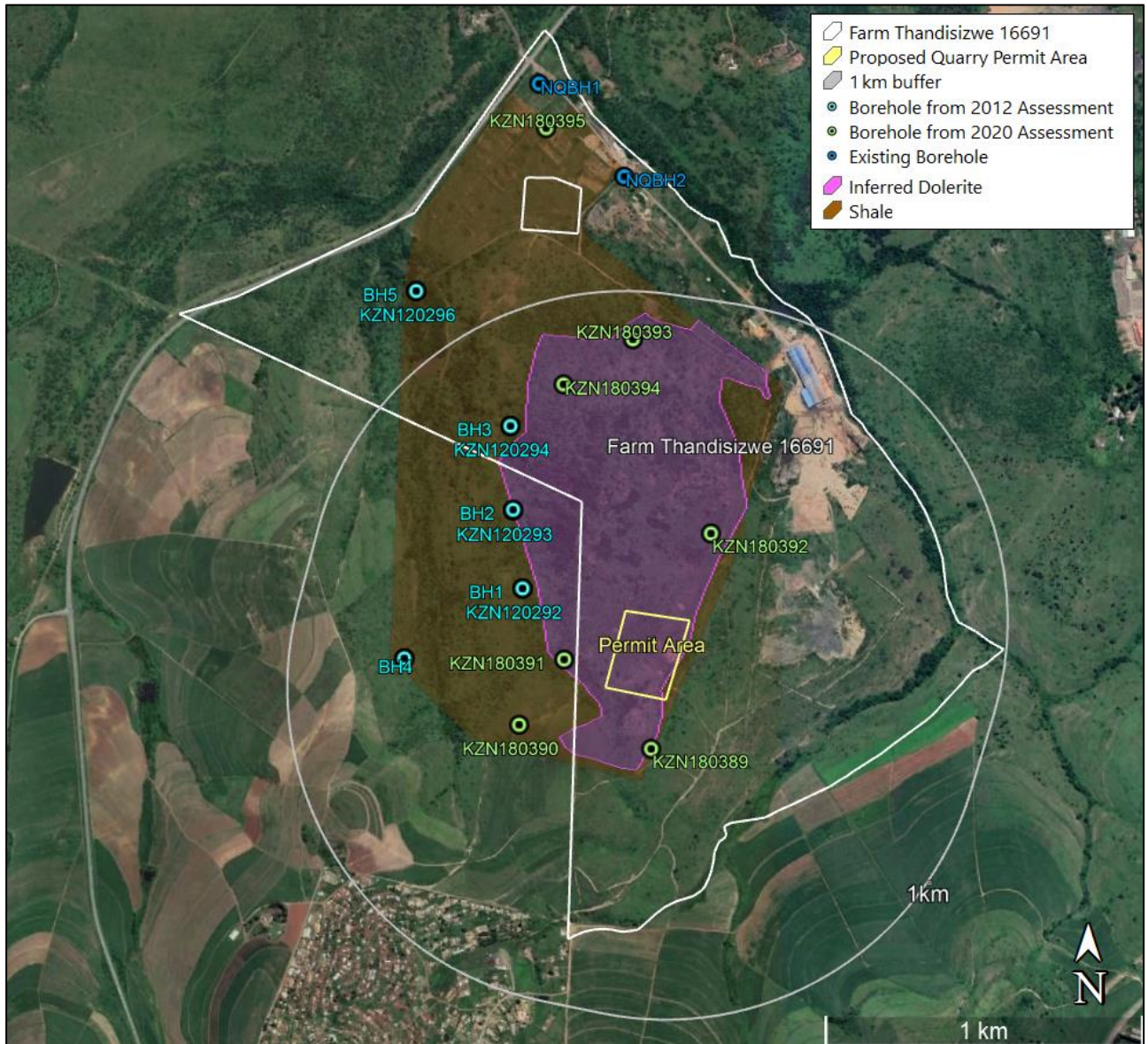


Figure 8: Field Verified Boreholes and Geological Mapping

Table 1: Summary Borehole Information

Borehole Number	Assessment Source	South	East	Approximate Elevation	Date Drilled	Final Depth (m)	Casing Depth (m)	Current Water Level (m)	Strike (mbgl)	Blow Yield (l/s)	Comment
KZN120292	J&G 2012	29.52506	30.43061	834	20-Aug-12	30	-	-	none	-	Shale
KZN120293	J&G 2012	29.52286	30.43061	817	23-Aug-12	78	45	-	43	1.9	Residual Dolerite underlain by Shale
KZN120294	J&G 2012	29.52047	30.43022	806	24-Aug-12	30	-	-	none	-	Shale
KZN120295	J&G 2012	29.52703	30.42678	820	24-Aug-12	30	-	-	24	<0.1	Shale
KZN120296	J&G 2012	29.51667	30.42717	744	24-Aug-12	30	7	-	8	<0.1	Shale
KZN180389	JGA 2020	29.52958	30.43478	853	04-Mar-20	54	6	-	51	<0.1	Shale underlain by Dolerite, hole blocked at 12.9
KZN180390	JGA 2020	29.52890	30.43050	871	05-Mar-20	52	6	-	25	0.92	Shale, hole blocked at 11.5
KZN180391	JGA 2020	29.52706	30.43196	865	05-Mar-20	60	12	51.98	none	-	Dolerite
KZN180392	JGA 2020	29.52351	30.43672	782	06-Mar-20	42	12	12.82	none	-	Dolerite
KZN180393	JGA 2020	29.51803	30.43419	784	06-Mar-20	42	12	39.3	none	-	Residual Dolerite underlain by Shale
KZN180394	JGA 2020	29.51930	30.43194	817	07-Mar-20	54	21	-	18	<0.1	Dolerite underlain by Shale
KZN180395	JGA 2020	29.51207	30.43138	722	07-Mar-20	30	6	3.65	9	<0.1	Shale
NQ BH1	Field	29.51082	30.43115	717	unknown	3	unk	2.03	-	-	Likely blocked
NQ BH2	Field	29.51344	30.43391	726	unknown	-	unk	-	-	-	Equipped with submersible, but not operational

4.3 Water Quality Status Quo

Groundwater samples were collected by JG Afrika from boreholes KZN180392 and KZN180395 during the current assessment to establish the baseline downstream groundwater quality status quo. The samples were submitted to Talbot Laboratory for analysis of selected compounds of the Domestic Consumption SANS241 (2015) suite, to assess the potability and suitability of use. The results of analysis are summarised in Table 2.

Table 2: Summary Results of Groundwater Analysis

Sample Position		KZN120293	NQBH2	NQBH2	KZN180392	KZN180395	SANS 241 : 2015 Drinking Water		
Sample Date		13/09/2012	17/08/2012	25/06/2020	05-Jun-17	07-Jun-17			
Sampled by		MD	MD	Engeolab	AG	AG			
Sample Method		pump test	bailer	unk	sample pump	sample pump			
Laboratory Certificate Number		15581/12	13701/12	010506/20	006468/21	006469/21	Upper Limits		
Laboratory Sample Reference							Acute health	Aesthetic	Operational
Determinand	Unit	BH2	BH IND	GW001	KZN180392	KZN180395	Chronic health		
Micro biological determinands									
E. coli or faecal coliforms	Count per 100 mL	0	0	<1	1014	1	Not detected		
Total coliforms	Count per 100 mL	0	0	2420	129970	43520			≤10
Heterotrophic plate count	Count per mL	na	na	>10000	>10000	>10000			1 000
Physical and aesthetic determinands									
Colour	mg/L Pt-Co	<1	1	<1	<10	<10		15	
Conductivity at 25 °C	ms/m	42	42	72.5	32.2	47.2		170	
Turbidity	NTU	8.8	43.8	13	11	98		5	1
pH at 25 C	pH units	7.1	9	7.3	7.4	7.4			5 to 9.7
Chemical determinands — macro-determinands									
Nitrate as N	mg/L	<0.01	<0.01	0.16	2.34	2.52		11	
Nitrite as N	mg/L	na	na	<0.01	<0.05	<0.05		0.9	
Combined nitrate-nitrite	-	na	na	<0.12	0.27	0.28		1	
Sulphate as SO42-	mg/L	2.81	16.3	26.6	<2.5	<2.5		500	250
Fluoride as F-	mg/L	0.19	0.35	0.35	0.2	0.51		1.5	
Chloride as Cl-	mg/L	8	33	31	13.1	17.7			300
Calcium as Ca	mg/L	32	42	50	8.66	28			150/300*
Magnesium as Mg	mg/L	19	30	23	1.41	18.2		70/100*	
Potassium as K	mg/L	0.5	0.6	na	na	na		50/100*	50/100*
Sodium as Na	mg/L	21	42	61	50	31		200	
Chemical determinands — micro-determinands									
Copper as Cu	µg/L	na	na	0.463	1.46	<1		2000	
Iron as Fe	µg/L	770	5200	213	33	23		2000	300
Lead as Pb	µg/L	na	na	<0.29	<1	<1		10	
Manganese as Mn	µg/L	350	550	2010	7.89	618		400	100
Chemical determinands — organic determinands									
Total organic carbon as C	mg/L	<0.7	0.95	na	na	na		10	

* SANS 241:2006 Limits - Class I Class II

Groundwater samples collected by Jeffares & Green during the 2012 assessment and Engeolab during the 2020 assessment were included in Table 2. Samples were collected from KZN120293 and NQBH2 (Jeffares & Green), and NQBH2 (Engeolab). The laboratory certificates are included in Annexure C.

The analysis indicates the groundwater quality to have elevated iron and manganese in some instances, and elevated turbidity and microbiological counts. These determinants were reported above the drinking water quality screening limits and the groundwater is considered unsuitable for human consumption without treatment. These results form part of the baseline for the groundwater monitoring plan.

5 GEOHYDROLOGICAL RISK AND IMPACT

5.1 Geohydrological Potential

Further to Section 3 and 4, the aquifer beneath the site is classified as a Minor aquifer in terms of the South African Aquifer Classification System. The aquifer is a moderate to low yielding formation with groundwater targets being associated with contacts along dolerite intrusions into the host rock, and fractures at depth. Two (2 No.) boreholes drilled in 2012 and 2020 reported blow yields of 1.9 (KZN120293) and 0.9 l/s (KZN180390). The sustainable yield of KZN120293 was determined through yield testing as 0.4 l/s. The sustainable yield of KZN180390 was not determine during the previous studies due to project termination. Generally, borehole yields are expected to be less than 2l/s. While geological structures are present within the project area, the potential is considered moderate to low due to the prevailing geology, the elevation, and lack of magnetic variation at the site.

5.2 Vulnerability

Vulnerability is considered Low, especially in areas underlain by dolerite due to the high clay content of weathered material. This will restrict infiltration to the groundwater systems. In addition, sanitation options include temporary chemical portable toilets which should have zero sanitation load to the immediate environment. The depth to groundwater is also a key component to assess vulnerability. The depth to groundwater was recorded at 12.8 mbgl at KZN1803092, which is located 280 m downslope and north of the permit area. This indicates a substantial vadose zone which will provide some protection to the underlying aquifer.

The associated Parsons Groundwater Quality Management System gives the site a Low Level of Protection index when comparing vulnerability as the second variable.

TABLE A and B: Ratings for the Groundwater Quality Management classification system.				Variable 1	Variable 2	
AQUIFER SYSTEM MANAGEMENT CLASSIFICATION		SECOND VARIABLE CLASSIFICATION		Aquifer System	Second Variable Description	
		AQUIFER VULNERABILITY CLASSIFICATION				
Class	Points	Class	Points	Minor Aquifer System	Vulnerability	
Sole Source Aquifer System	6	High	3			Low Medium
Major Aquifer System	4	Medium	2		2	1.5
Minor Aquifer System	2	Low	1			
Non-aquifer System	0				GQM Index	Level of Protection
Special Aquifer System	0-6			3.0	Low level protection	
TABLE C: Appropriate level of groundwater protection required, based on the Groundwater Quality Management classification						
GQM INDEX	LEVEL OF PROTECTION					
< 1	Limited protection					
01-03	Low level protection					
03-06	Medium level protection					
06-10	High level protection					
> 10	Strictly non-degradation					

5.3 Strategic Value

The strategic value of groundwater is based on existing groundwater use. From the desktop hydrocensus and site assessment, groundwater use was identified in the area, primarily for agricultural and domestic use. The strategic value is considered Medium, although water quality is

typically unsuitable for human consumption without treatment. Other contaminant sources include the surrounding existing industrial activities like the brick making facility, which may already be impacting on groundwater quality. Future activities were not considered. The associated Parsons Groundwater Quality Management System gives the site a Medium Level of Protection index when comparing strategic value as the second variable.

TABLE A and B: Ratings for the Groundwater Quality Management classification system.				Variable 1	Variable 2
AQUIFER SYSTEM MANAGEMENT CLASSIFICATION		SECOND VARIABLE CLASSIFICATION		Aquifer System	Second Variable Description
		AQUIFER VULNERABILITY CLASSIFICATION			
Class	Points	Class	Points		
Sole Source Aquifer System	6	High	3	Minor Aquifer System	Strategic Value
Major Aquifer System	4	Medium	2		Medium
Minor Aquifer System	2	Low	1		
Non-aquifer System	0				
Special Aquifer System	0-6			2	2
TABLE C: Appropriate level of groundwater protection required, based on the Groundwater Quality Management classification				GQM Index	Level of Protection
GQM INDEX	LEVEL OF PROTECTION				
< 1	Limited protection			4.0	Medium level protection
01-03	Low level protection				
03-06	Medium level protection				
06-10	High level protection				
> 10	Strictly non-degradation				

5.4 Impacts During Construction

The exploration phase poses risks related to machinery fuel, lubricants, explosives and chemical stores. Impacts are associated with drilling on site, blasting, excavations and use of haul roads. All stores facilities and sanitation are considered temporary and therefore pose a low and short term risk. Inadequate stormwater management associated with all quarry infrastructure may pose additional risks, although primarily to surface water resources.

The use of liquid explosives for blasting may increase nitrogen loads in the rock mass and underlying aquifers. Exploration drilling may provide new conduits to underlying strata for the transport of contaminants. Excavation areas, roads and new infrastructure may result in accelerated erosion, increased storm water runoff, increased turbidity loading, and increased associated microbiological loading. Earthworks may also mobilise existing macro and micro determinants in the soils which may percolate to the groundwater systems below. The absence of sulphide rich coal bearing formations in quarry rock bodies, and resulting oxidation and dissolution of heavy metals through acid rock drainage (ARD), is a non-occurrence. Stockpiles are therefore considered inert and the only impacts include increased turbidity loading from runoff from these areas. Workshop areas, maintenance of heavy vehicles, and fuel stores, all pose a risk of hydrocarbon contamination. Localised recharge of pit water to the aquifer may occur, but with the proximity to the downslope river, it is more likely to have a contribution to baseflow and/or impact on the surface water resource.

Adequate storage infrastructure for chemical stores should be implemented. Temporary sanitation facilities should be well managed to avoid spills. Appropriate berms and surface water runoff controls should be implemented around excavations and stockpiles. Any temporary return water dams should be implemented with natural clay materials available on site to minimise groundwater ingress.

5.5 Impacts During Operation

The operational phase poses risks related to machinery fuel, lubricants, explosives and chemical stores. Operational activity water requirements include temporary office ablutions, wash bay

operations, plant operating requirements, dust suppression, and product washing. It is understood that all water for use at the site will be imported for operations, hence no impact on quantity is expected. As with construction phase impacts, excavation areas, roads and new infrastructure may result in accelerated erosion, increased storm water runoff, increased turbidity loading, and increased associated microbiological loading. Earthworks may also mobilise existing macro and micro determinants in the soils which may percolate to the groundwater systems below. The occurrence of pit water accumulation could not be assessed based on the information gathered.

During operations, quarry pit water should be controlled and the quarry designed such that no decant of pit water, albeit it likely from surface water ingress, will take place. This water, if any, can be recycled in to quarry operations and dust suppression. Adequate storage infrastructure for chemical stores should be implemented and maintained. Temporary sanitation facilities should be well managed to avoid spills. Appropriate berms and surface water runoff controls should be implemented around excavations and stockpiles. Any temporary return water dams should be implemented with natural clay materials available on site to minimise groundwater ingress.

5.6 Quantitative Environmental Risk Assessment and Mitigation

The quantitative environmental risk assessment (ERA) identifies operational phase activities that may impact on the groundwater receiving environments. The Significance Points (SP) score is calculated from the following equation using ranking scales:

$$SP = \text{probability} \times (\text{duration} + \text{scale} + \text{magnitude})$$

The ERA for the construction and operation phase for the groundwater receiving environment is summarised as follows:

Significance / Consequence		Activity	Probability	Duration	Scale	Magnitude	Significance	SP SCORE and RATING	>60 indicates high environmental significance <30 indicates low environmental significance
Construction phase	quality	Blasting and nitrogen loading	medium	short	site	low	medium negative	3(2+1+4) = 21	LOW
		Exploratory drilling and creating conduits to groundwater system	medium	medium to long	site to local	low to moderate	medium high negative	3(3.5+1.5+5) = 30	LOW
		Excavations areas and increased turbidity and micro biological loads	medium to high	short to medium	site	low to moderate	medium high negative	3.5(2.5+1+5) = 30	LOW
		Mobilisation of existing elevated compounds in the soils and rock	low	short	site	low	low medium negative	2(2+1+4) = 14	LOW
		Sanitation facilities (portable chemical toilets)	improbable to low	short	site	moderate	low medium negative	1.5(2+1+6) = 14	LOW
		Chemical stores, explosives etc (small scale)	medium to high	short to medium	site	low to moderate	medium high negative	3.5(2.5+1+5) = 30	LOW
		Washday, workshop and plant storage areas	medium	short to medium	site	moderate	medium high negative	3(2.5+1+6) = 29	LOW
		Operation and maintenance of plant	low to medium	short to medium	site	moderate	medium negative	2.5(2.5+1+6) = 24	LOW
		Leachate from stockpiles	medium to high	short to medium	site	low to moderate	medium high negative	3.5(2.5+1+5) = 30	LOW
		Dust suppression activities	medium to high	immediate	site	minor to low	low medium negative	3.5(1+1+3) = 18	LOW
	quantity	construction phase water requirements	improbable	short	site	minor	positive	1(2+1+2) = 5	LOW
Operation Phase	quality	Blasting and nitrogen loading	medium	short	site	low	medium negative	3(2+1+4) = 21	LOW
		Exploratory drilling and creating conduits to groundwater system	medium	medium to long	site to local	low to moderate	medium high negative	3(3.5+1.5+5) = 30	LOW
		Excavations areas and increased turbidity and micro biological loads	medium to high	short to medium	site	low to moderate	medium high negative	3.5(2.5+1+5) = 30	LOW
		Mobilisation of existing elevated compounds in the soils and rock	low	short	site	low	low medium negative	2(2+1+4) = 14	LOW
		Sanitation facilities (portable chemical toilets)	improbable to low	short	site	moderate	low medium negative	1.5(2+1+6) = 14	LOW
		Chemical stores, explosives etc (small scale)	medium to high	short to medium	site	low to moderate	medium high negative	3.5(2.5+1+5) = 30	LOW
		Washday, workshop and plant storage areas	medium	short to medium	site	moderate	medium high negative	3(2.5+1+6) = 29	LOW
		Operation and maintenance of plant	low to medium	short to medium	site	moderate	medium negative	2.5(2.5+1+6) = 24	LOW
		Leachate from stockpiles	medium to high	short to medium	site	low to moderate	medium high negative	3.5(2.5+1+5) = 30	LOW
		Dust suppression activities	medium to high	immediate	site	minor to low	low medium negative	3.5(1+1+3) = 18	LOW
	Operational pit water and potential decant	improbable to low	long	site to local	moderate	low medium negative	1.5(4+1.5+6) = 17	LOW	
quantity	construction phase water requirements	improbable	short	site	minor	positive	1(2+1+2) = 5	LOW	

All identified activities score LOW, with the following scoring on the upper end of LOW:

- Exploratory drilling and creating conduits to groundwater system
- Excavations areas and increased turbidity and micro biological loads
- Chemical stores, explosives etc (small scale)
- Washday, workshop and plant storage areas
- Leachate from stockpiles.

Mitigations for the above activities are summarised in Table 3.

Table 3: Summary Mitigation Recommendations

Activity	Mitigation
Exploratory drilling and creating conduits to groundwater system	Flushing and grouting boreholes after adequately logged. Grout may comprise 5% bentonite, 10% cement and 85 % water weight.
Excavations areas and increased turbidity and micro biological loads	Excavation area management, stormwater management and return water recycling.
Chemical stores, explosives etc (small scale)	Hardstand storage. Spill kits on site. Remove impacted soils immediately.
Washday, workshop and plant storage areas	Hardstand, compacted areas. On site oil water separators. Drip trays.
Leachate from stockpiles	Stormwater management and return water recycling.

6 CONCLUSIONS

This report presents the results of a preliminary geohydrological assessment for the proposed mining permit area for Naaz Quarry located on Farm 16691, Thandisizwe, near Pietermaritzburg, KwaZulu-Natal. The aim of the assessment was to characterise the geohydrological setting, and to determine the risk of potential impacts by the anticipated activities associated with construction and operation of the quarry site on the receiving groundwater environment.

The project area is underlain by a fractured and intergranular aquifer that is moderate to low yielding. The underlying aquifer is classified as Minor. The inferred depth to groundwater is >10 mbgl.

The Parsons Groundwater Quality Management System gives the site a Low Level of Protection index for the second variable vulnerability, and a Medium Level of Protection index for the second variable strategic value. Existing potential contaminating sources in the project area include the surrounding agricultural practises and industry including the brick works factory.

The quantitative environmental risk assessment determined all identified activities to score LOW, with the following to score at the upper end of LOW:

- Exploratory drilling and creating conduits to groundwater system
- Excavations areas and increased turbidity and micro biological loads
- Chemical stores, explosives etc (small scale)
- Washday, workshop and plant storage areas

- Leachate from stockpiles.

All activity scores can be reduced with appropriate mitigation. As per the operational guidelines and regulations for water use;

- The quarry must prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource, either by natural flow or by seepage, and must retain or collect such substance or water containing waste for use, re-use, evaporation or for purification and disposal
- Abstraction, storage, discharge and any controlled activity must be authorised in terms of Section 21 and 22 of the National Water Act (Act No. 36 of 1998)
- The quarry must have appropriately designed stormwater, dirty water and recycle water systems
- No sanitary convenience, fuel depots, reservoir, or depots for any substance which causes or is likely to cause pollution of a water resource may be located within the 1:50 year flood-line of any watercourse
- All domestic waste water which cannot be disposed of in a municipal sewage system is to be disposed of in terms of an authorisation.

It is further recommended that

- Temporary sanitation facilities provided at the site must be appropriately managed/maintained
- Earthwork plant/machinery spills must be remediated immediately by appropriate removal of all impacted soils
- Refuelling of plant and machinery must be carried out in a controlled environment as per the Environmental Management Plan
- Any hazardous store areas should be placed undercover on hardstand or in bunded areas
- Bi annual water quality monitoring must be carried out as per the Water Quality Monitoring Plan.

Annexure A: Hydrocensus DWS Datasets

Source	Site ID	Type	Latitude	Longitude	Accuracy (m)	Equipment	Status	Purpose	Application	Depth (m)	Water Level (m)	Yield (l/s)	Authorised Volume (m3/a)
NGA	23382		-29.54317	30.47250									
NGA	36184		-29.49482	30.40861									
NGA	2930AD00007		-29.49149	30.44388									
NGA	2930AD00010		-29.49704	30.39499									
NGA	2930AD00011		-29.49705	30.39500									
NGA	2930AD00013		-29.49483	30.40862									
NGA	2930AD00015		-29.49484	30.40863									
NGA	2930AD00016		-29.49484	30.40862									
NGA	2930AD00031		-29.49871	30.41444									
NGA	2930CB00009		-29.54315	30.47250									
NGA	2930CB00010		-29.54316	30.47250									
NGA	2930CB00011		-29.54315	30.47251									
NGA	2930CB00012		-29.51705	30.44611									
NGA	2930CB00014		-29.51706	30.44612									
NGA	2930CB00024		-29.51707	30.44613									
NGA	2930CB00025		-29.51708	30.44614									
NGA	2930CB00049		-29.50065	30.41166									
NGA	2930CB00050		-29.50065	30.41388									
NGA/GRIP	2930AD00073	Borehole	-29.49533	30.39950	100	Monotype	In Use	Production	Domestic	140		2.5	
NGA/GRIP	2930AD00075	Borehole	-29.48303	30.44672	100	No equipment	Unused	Production		7	6.6		
NGA/GRIP	2930AD00076	Borehole	-29.49003	30.44088	100	Monotype	Unused	Production		30	9.1		
NGA/GRIP	2930CB00063	Borehole	-29.50504	30.45405	100	Windpump	In Use	Production	Domestic				
NGA/GRIP	2930CB00064	Borehole	-29.51570	30.45405	100	Monotype	In Use	Production	Domestic				
NGA/GRIP	2930CB00065	Borehole	-29.50037	30.47655	100	Monotype	In Use	Production	Domestic	140		6.67	
NGA/GRIP	2930CB00066	Borehole	-29.53503	30.45589	100	Windpump	In Use	Production	Domestic	52	10.0		
NGA/GRIP	2930CB00067	Borehole	-29.53369	30.45589	100	Submersible	In Use	Production	Domestic	50	21.2		
NGA/GRIP	2930CB00068	Borehole	-29.57253	30.43422	100	Windpump	Unused						
NGA/GRIP	2930CB00073	Borehole	-29.53353	30.45572	100	Submersible	In Use	Production	Domestic	49	19.9		
NGA/GRIP	2930CB00074	Borehole	-29.56403	30.44572	100	Windpump	Unused			58			
NGA/GRIP	2930CB00075	Borehole	-29.56869	30.45122	100	Submersible	In Use	Production	Domestic	30	8.4	4.17	
NGA/GRIP	2930CB00076	Borehole	-29.56519	30.44905	100	Submersible	In Use	Production	Domestic	30	10.5	2.78	
NGA/GRIP	2930CB00077	Borehole	-29.56653	30.45288	100	No equipment	Unused			30		0.88	
WARMS	21049312/1	Borehole	-29.51111	30.46806				Irrigation	No Charge - Agriculture				60000
WARMS	21127674/1	Borehole	-29.53889	30.44306				Schedule 1	No Charge				1000
WARMS	21168308/2	Borehole	-29.53065	30.38853				Schedule 1	No Charge				2000
WARMS	21170368/2	Borehole	-29.54197	30.45211				Schedule 1	No Charge				500
WARMS	21183844/1	Borehole	-29.52558	30.44086				Urban	No Charge - Domestic & Irrigation				1050

Annexure B: Field Resource Photographs



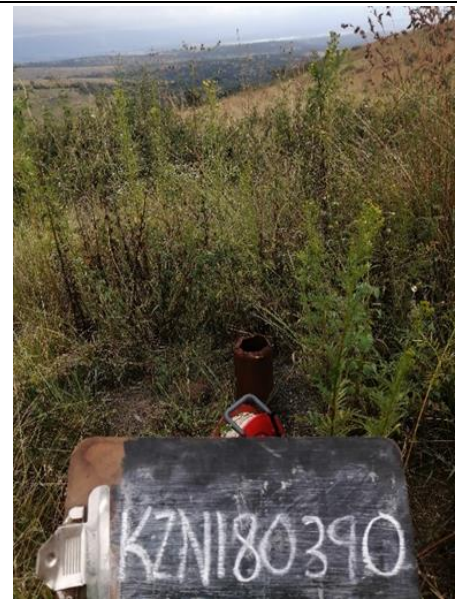
NQBH1



NQBH2



KZN180389







KZN180390



KZN180391



KZN180392

 <p style="text-align: center;">KZN180393</p>	 <p style="text-align: center;">KZN180394</p>
 <p style="text-align: center;">KZN180395</p>	<p style="text-align: center;">Not found</p> <p style="text-align: center;">KZN120292</p>
 <p style="text-align: center;">KZN120293</p>	<p style="text-align: center;">Not found</p> <p style="text-align: center;">KZN120294</p>

<p>Not found</p> <p>KZN120295</p>	<p>Not found</p> <p>KZN120296</p>
-----------------------------------	-----------------------------------

Annexure C: Laboratory Certificates of Analysis

[002176/21], [2021/04/01]

Certificate of Analysis

Project details

Customer Details

Customer reference:	NAAZ QUARRY GHI (5532)
Quotation number:	QU04-0067
Order number:	5532
Company name:	JG AFRIKA
Contact address:	P O BOX 2762, WESTWAY OFFICE PARK, 3635
Contact person:	ANDILE GUMEDE

Sampling Details

Sampled by:	CUSTOMER
Sampled date:	2021/03/25

Sample Details

Sample type(s):	GROUNDWATER SAMPLES
Date received:	2021/03/25
Delivered by:	CUSTOMER
Temperature at sample receipt (°C):	21.4

Report Details

Testing commenced:	2021/03/25
Testing completed:	2021/04/01
Report date:	2021/04/01
Our reference:	002176/21



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P.O Box 22598 Pietermaritzburg 3203 South Africa
+27 (0) 33 346 1444 www.talbot.co.za

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Analytical Results

Methods	Determinands	Units	006468/21	006469/21
			KZN 180392 25.03.2021	KZN180395 25.03.2021
Chemical				
85	Dissolved Calcium	mg Ca/l	8.66	28
85	Dissolved Magnesium	mg Mg/l	1.41	18.2
84	Sodium	mg Na/l	50	31
83A	Dissolved Copper	µg Cu/l	1.461	<1
83A	Dissolved Iron	µg Fe/l	33	23
83A	Dissolved Manganese	µg Mn/l	7.888	618
83A	Dissolved Lead	µg Pb/l	<1	<1
10G	Total Alkalinity	mg CaCO ₃ /l	121	190
16G	Chloride	mg Cl/l	13.1	17.7
40A	Colour (True)*	mg Pt-Co/l	<10	<10
2A	Electrical Conductivity at 25°C	mS/m	32.2	47.2
18G	Fluoride	mg F/l	0.20	0.51
65Gc	Nitrate	mg N/l	2.34	2.52
65Gb	Nitrite	mg N/l	<0.05	<0.05
Calc.	Combined Nitrate + Nitrite (sum of Ratios)*	-	0.27	0.28
4	Turbidity	NTU	11	98
1	pH at 25°C	pH units	7.4	7.4
67G	Sulphate	mg SO ₄ /l	<2.5	<2.5
Calc.	Total Hardness*	mg CaCO ₃ /l	27	146
Microbiological				
32	<i>E.coli</i>	MPN/100ml	1014	1
32	Total Coliforms	MPN/100ml	129970	43520
31	Standard Plate Count	colonies/ml	>10000	>10000

Refer to the "Notes" section at the end of this report for further explanations.

Where the laboratory detection limit for a test is higher than the required specification limit, the raw data is reviewed and the detection limit highlighted in bold font if outside of specification.

Specific Observations

Results that appear in bold do not meet the specification limits in Appendix 1 of this report.



Quality Assurance

Technical signatories



Inorganic Chemistry: Denise Nairico



Microbiology: Jocelyn Winchester

Notes to this report

Limitations

This report shall not be reproduced except in full without prior written approval of the laboratory. Results in this report relate only to the samples as taken, and the condition received by the laboratory. Any opinions and interpretations expressed herein are outside the scope of SANAS accreditation. The decision rule applicable to this laboratory is available on request. Sample preparation may require filtration, dilution, digestion or similar. Final results are reported accordingly. Where the laboratory has undertaken the sampling, the location of sampling and sampling plan are available on request. Talbot Laboratories is guided by the National Standards SANS 5667-3:2006 Part 3 Guidance on the Preservation and Handling of Water Samples; SANS 5667-1:2008 Part 1 Guidance on the Design of Sampling Programmes and Sampling Techniques and SANS 5667-2:1991 Part 2: Guidance on Sampling Techniques. Customers to contact Talbot Laboratories for further information.

Uncertainty of measurement

Talbot Laboratories' Uncertainty of Measurement (UoM) values are:

- Identified for relevant tests.
- Calculated as a percentage of the respective results.
- Applicable to total, dissolved and acid soluble metals for ICP element analyses.
- Available upon request.

Analysis explanatory notes

Tests may be marked as follows:

^	Tests conducted at our Port Elizabeth satellite laboratory.
*	Tests not included in our Schedule of Accreditation and therefore that are not SANAS accredited.
#	Tests that have been sub-contracted to a peer laboratory.
NR	Not required -shown, for example, where the schedule of analysis varied between samples.
σ	Field sampling point on-site results.
a	Testing has deviated from Method.



Appendix 1: Specifications - SANS 241-1:2015 RECOMMENDED LIMITS

Reported Determinands	Limits	Reported Determinands	Limits
E.coli	0 Count/100mℓ (0 MPN/100mℓ)	Zinc	≤5000 µg/l (≤5 mg/ℓ)
Faecal Coliforms	0 Count/100mℓ (0 MPN/100mℓ)	Antimony	≤20 µg/ℓ (≤0.02 mg/ℓ)
Cryptosporidium species	Not Detected	Arsenic	≤10 µg/ℓ (≤0.01 mg/ℓ)
Giardia species	Not Detected	Barium	≤700 µg/ℓ (≤0.7 mg/ℓ)
Total Coliforms	≤10 Count/100mℓ (10 MPN/100mℓ)	Boron	≤2400 µg/ℓ (≤2.4 mg/ℓ)
Standard Plate Count	≤1000 Count/1mℓ	Cadmium	≤3 µg/ℓ (≤0.003 mg/ℓ)
Somatic Coliphages	Not Detected	Total Chromium	≤50 µg/ℓ (≤0.05 mg/ℓ)
Cytopathogenic viruses	Not detected	Copper	≤2000 µg/ℓ (≤2 mg/ℓ)
Enteric Virus (Sub#)	Not Detected	Cyanide	≤200 µg/ℓ (≤0.2 mg/ℓ)
Colour	≤15 mg/ℓ Pt-Co	Iron	Chronic: ≤ 2000 µg/ℓ (≤2 mg/ℓ)
Electrical Conductivity	≤170 mS/m	Iron	Aesthetic: ≤ 300 µg/ℓ (≤0.3 mg/ℓ)
Total Dissolved Solids at 180°C	≤1200 mg/ℓ	Lead	≤10 µg/ℓ (≤0.01 mg/ℓ)
Turbidity	Operational ≤1 NTU	Manganese	Chronic: ≤ 400 µg/ℓ (≤0.4 mg/ℓ)
Turbidity	Aesthetic ≤5 NTU	Manganese	Aesthetic: ≤100 µg/ℓ (≤0.1 mg/ℓ)
pH	≥ 5 to ≤ 9.7	Mercury	≤6 µg/ℓ (≤0.006 mg/ℓ)
Odour	Inoffensive	Nickel	≤70 µg/ℓ (≤0.07 mg/ℓ)
Free Chlorine	≤5 mg/ℓ	Selenium	≤40 µg/ℓ (≤0.04 mg/ℓ)
Monochloramine	≤3000 µg/ℓ (≤3 mg/ℓ)	Uranium	≤30 µg/ℓ (≤0.03 mg/ℓ)
Nitrate	≤11 mg/ℓ	Aluminium	≤300 µg/ℓ (≤0.3 mg/ℓ)
Nitrite	≤0.9 mg/ℓ	Total Organic Carbon	≤10 mg/ℓ
Combined Nitrate plus Nitrite (sum of Ratios)	≤1	Chloroform	≤300 µg/ℓ (≤0.3 mg/ℓ)
Sulphate	Acute: ≤ 500 mg/ℓ	Bromoform	≤100 µg/ℓ (≤0.1 mg/ℓ)
Sulphate	Aesthetic: ≤ 250 mg/ℓ	Dibromochloromethane	≤100 µg/ℓ (≤0.1 mg/ℓ)
Fluoride	≤1500 µg/ℓ (≤1.5 mg/ℓ)	Bromodichloromethane	≤60 µg/ℓ (≤0.06 mg/ℓ)
Ammonia	≤1.5 mg/ℓ	Trihalomethanes Ratio	≤1
Chloride	≤ 300 mg/ℓ	Microcystins	≤1 µg/ℓ
Sodium	≤200 mg/ℓ	Phenols	≤10 µg/ℓ (≤0.01 mg/ℓ)

*****End of Report*****



[003736/20]. [2020/06/30]

Certificate of Analysis

Project details

Customer Details

Order number:	LL3570
Company name:	ENGEOLAB CC
Contact address:	33 WALTERS ROAD, HILTON, 3245
Contact person:	JACQUES DU PREEZ

Sampling Details

Sampled by:	CUSTOMER
Sampled date:	NO SAMPLED DATE PROVIDED

Sample Details

Sample type(s):	GROUNDWATER SAMPLES
Date received:	2020/06/25
Delivered by:	CUSTOMER
Temperature at sample receipt (°C):	12.0
Deviations:	010506/20,010507/20 - No sample date supplied

Report Details

Testing commenced:	2020/06/25
Testing completed:	2020/06/30
Report date:	2020/06/30
Our reference:	003736/20


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 +27 (0) 33 346 1444 www.talbot.co.za

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Analytical Results

Methods	Determinands	Units	010506/20	010507/20
			GW001 R33	GW002 R33
Chemical				
85	Dissolved Calcium	mg Ca/l	37	50
85	Dissolved Magnesium	mg Mg/l	20	23
84	Sodium	mg Na/l	49	61
83A	Copper	µg Cu/l	2.949	0.463
83A	Iron	µg Fe/l	993	213
83A	Manganese	µg Mn/l	371	2010
83A	Lead	µg Pb/l	0.344	<0.29
10G	Total Alkalinity	mg CaCO ₃ /l	146	202
16G	Chloride	mg Cl/l	26	31
123	Free Chlorine*	mg Cl ₂ /l	<0.1	<0.1
122	Monochloramine*	mg/l	<3	<3
48	Colour*	mg Pt-Co/l	<1	<1
2A	Electrical Conductivity at 25°C	mS/m	60.2	72.5
18G	Fluoride	mg F/l	0.14	0.35
65Gc	Nitrate	mg N/l	0.15	0.16
65Gb	Nitrite	mg N/l	<0.01	<0.01
Calc.	Combined Nitrate + Nitrite (sum of Ratios)*	-	<0.12	<0.12
4	Turbidity	NTU	29	13
1	pH at 25°C	pH units	7.4	7.3
67G	Sulphate	mg SO ₄ /l	52.0	26.6
Calc.	Total Hardness*	mg CaCO ₃ /l	176	221
Microbiological				
32	<i>E. coli</i>	MPN/100ml	<1 (Not detected)	<1 (Not detected)
32	Total Coliforms	MPN/100ml	128000	2420
31	Standard Plate Count	colonies/ml	>10000	>10000

Refer to the "Notes" section at the end of this report for further explanations.

Where the laboratory detection limit for a test is higher than the required specification limit, the raw data is reviewed and the detection limit highlighted in bold font if outside of specification.

Where a deviation has been noted, the validity of the results may be affected. Results should be used with this consideration in mind.

Specific Observations

Results that appear in bold do not meet the specification limits in Appendix 2 of this report.

Quality Assurance

Technical signatories



Inorganic Chemistry: Derise Ndlovu



Microbiology: Jocelyn Winchester

Notes to this report

Limitations

This report shall not be reproduced except in full without prior written approval of the laboratory. Results in this report relate only to the samples as taken, and the condition received by the laboratory. Any opinions and interpretations expressed herein are outside the scope of SANAS accreditation. The decision rule applicable to this laboratory is available on request. Sample preparation may require filtration, dilution, digestion or similar. Final results are reported accordingly. Customers to contact Talbot Laboratories for further information.

Uncertainty of measurement

Talbot Laboratories' Uncertainty of Measurement (UoM) values are:

- Identified for relevant tests in the attached Appendix.
- Calculated as a percentage of the respective results.
- Applicable to total, dissolved and acid soluble metals for ICP element analyses.
- Available upon request for microbiological results.
- Available upon request for subcontracted tests.

Analysis explanatory notes

Tests may be marked as follows:

^	Tests conducted at our Port Elizabeth satellite laboratory.
*	Tests not included in our Schedule of Accreditation and therefore that are not SANAS accredited.
#	Tests that have been sub-contracted to a peer laboratory.
NR	Not required -shown, for example, where the schedule of analysis varied between samples.
σ	Field sampling point on-site results.
*	Testing has deviated from Method.

Appendix 2: Specifications - SANS 241-1:2015 RECOMMENDED LIMITS

Reported Determinands	Limits	Reported Determinands	Limits
E.coli	0 Count/100ml (0 MPN/100ml)	Zinc	≤5000 µg/l (≤5 mg/l)
Faecal Coliforms	0 Count/100ml (0 MPN/100ml)	Antimony	≤20 µg/l (≤0.02 mg/l)
Cryptosporidium species	Not Detected	Arsenic	≤10 µg/l (≤0.01 mg/l)
Giardia species	Not Detected	Barium	≤700 µg/l (≤0.7 mg/l)
Total Coliforms	≤10 Count/100ml (10 MPN/100ml)	Boron	≤2400 µg/l (≤2.4 mg/l)
Standard Plate Count	≤1000 Count/1ml	Cadmium	≤3 µg/l (≤0.003 mg/l)
Somatic Coliphages	Not Detected	Total Chromium	≤50 µg/l (≤0.05 mg/l)
Cytopathogenic viruses	Not detected	Copper	≤2000 µg/l (≤2 mg/l)
Enteric Virus (Sub#)	Not Detected	Cyanide	≤200 µg/l (≤0.2 mg/l)
Colour	≤15 mg/l Pt-Co	Iron	Chronic: ≤ 2000 µg/l (≤2 mg/l)
Electrical Conductivity	≤170 mS/m	Iron	Aesthetic: ≤ 300 µg/l (≤0.3 mg/l)
Total Dissolved Solids at 180°C	≤1200 mg/l	Lead	≤10 µg/l (≤0.01 mg/l)
Turbidity	Operational ≤1 NTU	Manganese	Chronic: ≤ 400 µg/l (≤0.4 mg/l)
Turbidity	Aesthetic ≤5 NTU	Manganese	Aesthetic: ≤100 µg/l (≤0.1 mg/l)
pH	≥ 5 to ≤ 9.7	Mercury	≤6 µg/l (≤0.006 mg/l)
Odour	Inoffensive	Nickel	≤70 µg/l (≤0.07 mg/l)
Free Chlorine	≤5 mg/l	Selenium	≤40 µg/l (≤0.04 mg/l)
Monochloramine	≤3000 µg/l (≤3 mg/l)	Uranium	≤30 µg/l (≤0.03 mg/l)
Nitrate	≤11 mg/l	Aluminium	≤300 µg/l (≤0.3 mg/l)
Nitrite	≤0.9 mg/l	Total Organic Carbon	≤10 mg/l
Combined Nitrate plus Nitrite (sum of Ratios)	≤1	Chloroform	≤300 µg/l (≤0.3 mg/l)
Sulphate	Acute: ≤ 500 mg/l	Bromoform	≤100 µg/l (≤0.1 mg/l)
Sulphate	Aesthetic: ≤ 250 mg/l	Dibromochloromethane	≤100 µg/l (≤0.1 mg/l)
Fluoride	≤1500 µg/l (≤1.5 mg/l)	Bromodichloromethane	≤80 µg/l (≤0.08 mg/l)
Ammonia	≤1.5 mg/l	Trihalomethanes Ratio	≤1
Chloride	≤ 300 mg/l	Microcystins	≤1 µg/l
Sodium	≤200 mg/l	Phenols	≤10 µg/l (≤0.01 mg/l)

*****End of Report*****

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2012/09/21

ANALYTICAL REPORT

OUR REF: JEFFARES & GREEN (PTY) LTD DURBAN 15581/12
 COMPANY NAME: JEFFARES & GREEN (PTY) LTD DURBAN
 CONTACT ADDRESS: P O BOX 2762, WESTWAY OFFICE PARK, 3635
 CONTACT PERSON: MARK DURHAM
 SAMPLE TYPE: BOREHOLE WATER
 DATE SUBMITTED: 2012/09/13

Determinand	Units	Method No	SANS 241-1 (2011) RECOMMENDED LIMITS	Results
				15581/12 BH 2
Chloride	mg Cl/l	16	<300	8
Colour*	mg Pt-Co/l	48	<15	<1
Conductivity at 25°C	mS/m	2	<170	42
Dissolved calcium	mg Ca/l	8A	not specified	32
Dissolved magnesium	mg Mg/l	9A	not specified	19
Faecal coliforms	colonies per 100ml	31	0	0
Fluoride	µg F/l	18	<1500	190
Nitrate/Nitrite	mg N/l	65	<11	(<0.01)
Odour*	descriptive	-	inoffensive	NIL
pH at 25°C	pH units	1	5.0 - 9.7	7.1
Potassium	mg K/l	7A	not specified	0.5
Sodium	mg Na/l	6A	<200	21
Soluble organic carbon*	mg C/l	-	<10	<0.70**
Sulphate	mg SO ₄ /l	67	<250	2.81
Total iron	mg Fe/l	20A	<0.3	0.77
Total alkalinity	mg CaCO ₃ /l	10	not specified	198
Total coliforms	colonies per 100ml	31	<10	0
Total hardness*	mg CaCO ₃ /l	Calc.	not specified	158
Total manganese	mg Mn/l	19A	<0.1	0.35
Turbidity	NTU	4	<1	8.8

Technical Signatory: Chemistry _____ Bacteriology _____

- This report relates only to the samples tested. This report shall not be reproduced, except in full, without the written approval of TALBOT LABORATORIES
- Test marked * in this report are not SANAS accredited and are not included in the SANAS accreditation schedule for our laboratory.
- Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.
- Figures reported in () were analysed after preservation according to the laboratory's preservation procedure.
- Note: results marked ** have been sub-contracted to a peer laboratory.
- Note: Estimates of Uncertainty of Measurement may be obtained from the laboratory.

Directors: Dr MNU-F Talbot, Dr MMB Talbot, Mr FD Urbaniak-Hedley (British), Mr CS McArthur (British)
 Talbot & Talbot (Pty) Ltd • Company Registration Number: 2000/021130/07

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Tel: +27 (0) 33 346 1444 • Fax: +27 (0) 33 346 1445 • E-mail: talbot@talbot.co.za • http://www.talbot.co.za

2012/08/27

ANALYTICAL REPORT

OUR REF: JEFFARES & GREEN (PTY) LTD DURBAN 13700/12
COMPANY NAME: JEFFARES & GREEN (PTY) LTD DURBAN
CONTACT ADDRESS: P O BOX 2762, WESTWAY OFFICE PARK, 3635
CONTACT PERSON: MARK DURHAM
SAMPLE TYPE: BOREHOLE WATER
DATE SUBMITTED: 2012/08/17

Determinand	Units	Method No	SANS 241-1 (2011) RECOMMENDED LIMITS	Results	
				13700/12	13701/12
				SW1 UL 17.08.12	BH IND UL 17.08.12
Chloride	mg Cl/l	16	<300	26	33
Colour*	mg Pt-Co/l	48	<15	4	1
Conductivity at 25°C	mS/m	2	<170	32	42
Dissolved calcium	mg Ca/l	8A	not specified	9.6	42
Dissolved magnesium	mg Mg/l	9A	not specified	10	30
Faecal coliforms	colonies per 100ml	31	0	12	0
Fluoride	µg F/l	18	<1500	160	350
Nitrate/Nitrite	mg N/l	65	<11	(0.03)	(<0.01)
Odour*	descriptive	-	inoffensive	Nil	Nil
pH at 25°C	pH units	1	5.0 - 9.7	6.9	9.0
Potassium	mg K/l	7A	not specified	0.5	0.6
Sodium	mg Na/l	6A	<200	21	42
Soluble organic carbon*	mg C/l	-	<10	3.00**	0.95**
Sulphate	mg SO ₄ /l	67	<250	4.02	16.3
Total iron	mg Fe/l	20A	<0.3	1.83	5.20
Total alkalinity	mg CaCO ₃ /l	10	not specified	80	251
Total coliforms	colonies per 100ml	31	<10	272	0
Total hardness*	mg CaCO ₃ /l	Calc.	not specified	65	228
Total manganese	mg Mn/l	19A	<0.1	0.28	0.55
Turbidity	NTU	4	<1	22.9	43.8

Directors: Dr MNU-F Talbot, Dr MMS Talbot, Mr FD Urbaniak-Hedley (British), Mr CS McArthur (British)
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