Borehole Yield and Quality Testing at Kleinfontein farm, Villiersdorp.

Prepared by
GEOSS
13 March 2025

GROUNDWATER AND EARTH SCIENCES
GEOSS
SOUTH AFRICA (Pty) Ltd

Executive Summary

Jaco Viljoen of Elgin Free Range Chickens appointed GEOSS South Africa (Pty) Ltd to conduct yield and groundwater quality testing of four boreholes at Kleinfontein farm, Villiersdorp. ATS undertook the yield testing under the management and supervision of GEOSS SA from 31 January to 05 February 2025 This included a Step Test, Constant Discharge Test (CDT) and Recovery Test at each borehole and sampling of the groundwater for chemical analysis. It is recommended that groundwater abstraction can occur within the below mentioned parameters from the tested boreholes. Aquifer over-abstraction is unlikely to occur if these rates are adhered to and if the boreholes are managed through long-term monitoring data. It should be noted that boreholes KF_BH3 and KF_BH4 have very low yields as such the testing was stopped after the Step Test for both boreholes. These boreholes are considered too low yielding for the desired use.

Borehole Details				
Borehole Name	**Latitude (DD)**	**Longitude (DD)**	**Borehole Depth (m)**	**Inner Diameter (mm)**
KF_BH1	-33.922230°	19.385410°	96.94	150
KF_BH2	-33.92208°	19.38852°	163.00	210
KF_BH3	-33.923882°	19.393724°	206.00	210
KF_BH4	-33.923930°	19.394008°	90.30	210
Abstraction Recommendations				
Borehole Name	Abstraction rate (L/s)	Abstraction Duration (hrs)	Recovery Duration (hrs)	Possible Volume Abstracted (L/d)
KF_BH1	3.7	24	0	319 680
KF_BH2	1.2	24	0	103 680
KF_BH3	*Low yield - testing stopped*			-
KF_BH4	*Low yield - testing stopped*			-
			Total	**423 360**
Pump Installation Details				
Borehole Name	Pump Installation Depth (mbgl)	Critical Water Level (mbgl)	Dynamic Water Level (mbgl)*	Rest Water Level (mbgl)
KF_BH1	55.00	47.33	34.00	22.97
KF_BH2	115.00	110.80	77.00	5.31

* Typical water level expected during long-term production

Through long-term water level monitoring data, the abstraction volumes can be optimised by adjusting the abstraction rate if required. It is recommended that the boreholes are equipped with variable frequency drives. This enables adjustments to the flow rate to be made if required, as determined by the hydrogeological analysis of water level and flow rate monitoring data.

Laboratory results show that groundwater from the boreholes does not meet potable water quality standards due to elevated levels of several parameters, including high iron in all four boreholes and manganese in all except KF_BH1. Turbidity levels are significantly high (4.01–1 536 NTU), likely linked to iron and manganese, increasing the risk of biofouling and clogging of infrastructure. While the pH and electrical conductivity are generally acceptable, KF_BH1 has a low pH (4.1), and KF_BH3 shows elevated fluoride (9.15 mg/L) exceeding the chronic health limits. Low levels of arsenic (0.015 mg/L) and lead (0.010 mg/L) were detected in KF_BH3 and KF_BH2, respectively,

posing chronic health risks per SANS 241-1:2015. Ongoing monitoring of arsenic and lead is recommended. The groundwater is unsuitable for potable use without treatment but remains viable for irrigation if turbidity and iron concentrations are managed.

To address the potential for iron to clog the borehole and abstraction infrastructure, it is recommended to maintain a constant and continuous pumping schedule as much as possible. Thus, should a daily volume of less than 319 680 L/d for KF_BH1 and 103 680 L/d for KF_BH2 be required, it is recommended to decrease the pumping rate and not the pumping duration. By pumping continuously instead of a stop-start schedule, iron oxidation in the borehole is minimised, decreasing the amount of iron precipitation inside the boreholes and pumps.

The proposed groundwater consumption from the boreholes is 70 000 m^3/annum. With regards to the regional groundwater availability within the local aquifer, a more localised aquifer (i.e., a groundwater resource unit (GRU)) was defined. The GRU encompassed an area of 9.78 km^2. Using the GRAII recharge values, the combined direct vertical recharge was calculated to be 202 063.33 m^3/a, with a firm yield of 132 048.60 m^3/a. The current volume of groundwater abstracted within the GRU, based on the registered WARMS boreholes (database last updated in May 2023), is 45 798.00 m^3/a. Based on these volumes, a volume of 86 250.60 m^3/a is available within the GRU.

As the proposed application volume is within the sustainable yield of the borehole and can be supported by the Firm Yield calculated for that GRU, the abstraction of the total volume of 70 000 m^3/a can be considered within the local aquifer`s capacity and sustainable. The proposed additional abstraction is not likely to impact on the regional groundwater flow, however site-specific long-term monitoring is required to ensure the sustainability of the abstraction.

As of January 2018 the Department of Water and Sanitation released a Government Gazette stating that: "All water use sector groups and individuals taking water from any water resource (surface or groundwater) regardless of the authorisation type, in the Berg, Olifants and Breede Gouritz Water Management Area, shall install electronic water recording, monitoring or measuring devices to enable monitoring of abstractions, storage and use of water by existing lawful users and establish links with any monitoring or management system as well as keep records of the water used."

To facilitate monitoring and informed management of the borehole, it is recommended to equip the boreholes with the following monitoring infrastructure and equipment:

- Installation of a 32 mm (inner diameter, class 10) observation pipe from the pump depth to the surface, closed at the bottom and slotted for the bottom 5 – 10 m.
- Installation of an electronic water level logger (for automated water level monitoring)
- Installation of a sampling tap (to monitor water quality)
- Installation of a flow volume meter (to monitor abstraction rates and volumes)

This report is an important document for obtaining legal authorisation with the Department of Water and Sanitation with regard to the use of the groundwater. However, it does not serve as a Geohydrological Assessment Report in support of a Water Use Licence Application. Such a report would need to incorporate and expand upon the information provided here. GEOSS SA cannot guarantee that there is sufficient water in the aquifer to support the intended usage, or that the Department of Water and Sanitation will authorise the desired abstraction from this aquifer.

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Abbreviations

AD	Available Drawdown
bh	Borehole
CDT	Constant Discharge Test
CGS	Council for Geoscience
DD	Decimal degree
DWA	Department of Water Affairs (pre- 1994)
DWAF	Department of Water Affairs and Forestry (1994 – 2009)
DWS	Department of Water and Sanitation (2009 – ….)
EC	Electrical Conductivity
FC	Flow Characteristic
GRF	Generalised Radial Flow
IARF	Infinite Acting Radial Flow
ID	inner diameter
L/d	litres per day
L/s	litres per second
m	metres
m^2/d	meters squared per day
mamsl	metres above mean sea level
mbch	metres below collar height
mbgl	metres below ground level
mg	milligram
mg/L	milligram per litre
mm	millimetres
nd	not detected
OD	outer diameter
RWL	rest water level below ground level
SANS	South African National Standard
T	Transmissivity
TDS	total dissolved solids
WGS84	The official co-ordinate system for South Africa
WL	water level
WULA	Water Use Licence Application

Glossary of Terms

aquifer	a geological formation, which has structures or textures that hold water or permit appreciable water movement through them [from National Water Act (Act No. 36 of 1998)].
available drawdown	available drawdown in a borehole is the difference between the rest water level or piezometric surface and the depth that the water level may drop to (typically major water baring unit, boundary inflection or pump depth).
borehole	includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer [from National Water Act (Act No. 36 of 1998)].
confined aquifer	an aquifer confined between two impermeable beds
dynamic water level	the stabilised water level in the borehole during production over long periods of time.
electrical conductivity	the ability of groundwater to conduct electrical current, due to the presence of charged ionic species in solution (Freeze and Cherry, 1979).
fractured aquifer	Fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly within fissures and fractures.
groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e., the water table marks the upper surface of groundwater systems.
intergranular aquifer	an aquifer in which groundwater is stored in and flows through open pore spaces in the unconsolidated Quaternary deposits.
isotope	atoms of a chemical element with the same number of protons (atomic number) but different number of neutrons (differing mass). Isotopes have nearly identical chemical behaviour but possess different physical properties.
rest water level	the groundwater level in a borehole not influenced by abstraction or artificial recharge.
sustainable yield	sustainable yield is defined as the rate of withdrawal that can be sustained by an aquifer without causing an unacceptable decline in the hydraulic head or deterioration in water quality in the aquifer.
transmissivity	the rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient.
unconfined aquifer	an aquifer which has free water surface - which means the water table exists for this type of aquifer; primarily recharged by the infiltration of precipitation from the ground surface

SPECIALIST EXPERTISE

CURRICULUM VITAE – Reuben Lazarus

GENERAL

Nationality:	South African
Profession:	Hydrogeologist
Specialisation:	Groundwater development, yield testing, geochemistry and camera logging
Position in firm:	Hydrogeologist, Business Unit Leader: Yield and Water Quality Testing at GEOSS South Africa (Pty) Ltd
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Year of birth & ID #:	1992 – 9207075195083
Language skills:	Afrikaans (mother tongue) English (excellent)

KEY SKILLS

- Groundwater component of Catchment Management Strategies and other Groundwater Resource Directed Measures.
- Groundwater development – borehole drilling and test pumping supervision and analysis.
- Groundwater monitoring – development and analysis of groundwater level and quality data.
- Groundwater management – sustainable aquifer development and management.
- Groundwater contamination assessments – geochemical analysis.
- Writing of hydrogeological reports
- ArcMap / Geochemist's Workbench / WISH and typical software skills.

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2018	BSc (Geology – Environmental Geochemistry)	University of Stellenbosch, South Africa
2016	BSc (Hons) (Earth Science)	University of Stellenbosch, South Africa
2015	BSc (Earth Science)	University of Stellenbosch, South Africa

Courses and symposiums

2023	VFD Level 1 and Level 2 (ElectroMechanica)
2023	PLC Level 1 and Level 2 AS 200 (ElectroMechanica)
2023	Basic hydraulics & Pumps (Dudley Willer)
2022	Environmental Sampling Workshop (Van Walt)
2019	SA remediation workshop (Enviro Workshops)

Memberships/Organisations

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- Groundwater Division of the Geological Society of South Africa UID 9661/21
- Geological Society of South Africa Mem. No. 970021

EMPLOYMENT RECORD

June 2021 – present:	GEOSS South Africa (Pty) Ltd, Stellenbosch *Project Hydrogeologist: Yield and Water Quality Testing Business Unit Leader*
October 2018 – June 2021:	GEOSS South Africa (Pty) Ltd, Stellenbosch *Project Hydrogeologist*
October 2017 – October 2018:	GEOSS - Geohydrological and Spatial Solutions International (Pty) Ltd *Student Hydrogeologist*

SPECIALIST DECLARATION

We, Reuben Lazarus and Julian Conrad, as the appointed independent specialist(s) hereby declare that we:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to our specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the South African National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes);
- have and will not have no vested interest in the proposed activity proceeding;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not

Reuben Lazarus
GEOSS South Africa (Pty) Ltd
SACNASP – Pr.Sci.Nat: 120711
13 March 2025

Julian Conrad
GEOSS South Africa (Pty) Ltd
SACNASP – Pr.Sci.Nat 400159/05
13 March 2025

1 Introduction

GEOSS South Africa (Pty) Ltd was appointed by Jaco Viljoen of Elgin Free Range Chickens to conduct yield and water quality testing of four (4) boreholes at Kleinfontein farm, Villiersdorp.

The boreholes were tested by under the management and supervision of GEOSS SA from 31 January to 05 February 2025, and details of this are presented in this report. The borehole's details are presented in **Table 1** below with their locations spatially shown in **Map 1.** No drilling logs were made available, however; estimations of the borehole constructions are presented in **Appendix A.** The geological setting of the area suggests that KF_BH1 was drilled into the Gydo Formation of the Bokkeveld Group while KF_BH2, KF_BH3 and KF_BH_4 was drilled into the Rietvlei Formation of the Table Mountain Group. The Bokkeveld Group typically overlies the Table Mountain Group and therefore it is anticipated that all four (4) boreholes intersect the feldspathic and quartzitic sandstones of the Table Mountain Group (**Map 2**).

Table 1: Borehole details.

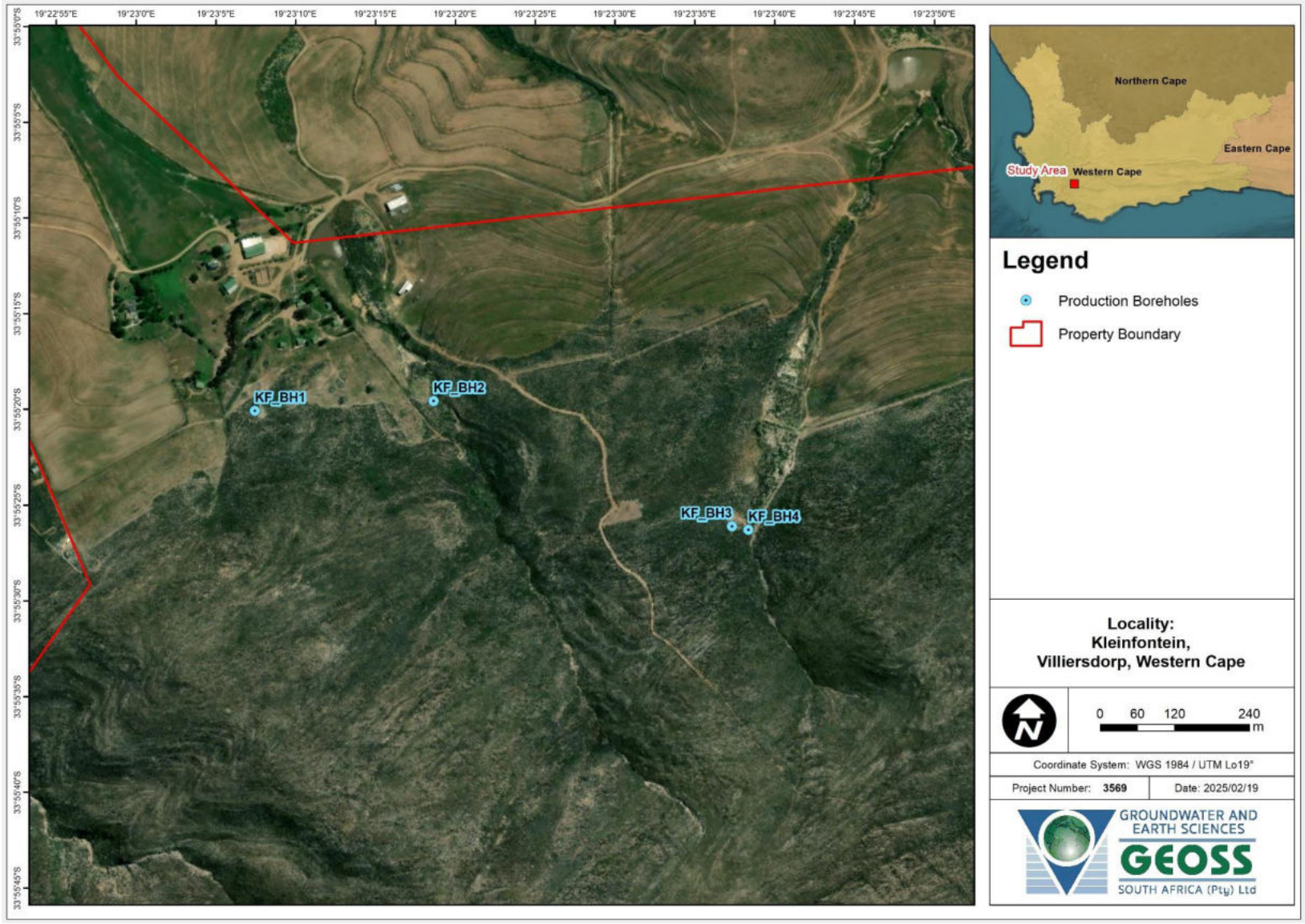
Borehole	Latitude (DD, WGS84)	Longitude (DD, WGS84)	Depth (m)
KF_BH1	-33.922230°	19.385410°	96.94
KF_BH2	-33.922080°	19.388520°	163.00
KF_BH3	-33.923882°	19.393724°	206.00
KF_BH4	-33.923930°	19.394008°	90.30

Figure 1: KF_BH1, KF_BH2, KF_BH3 and KF_BH4, respectively (from left to right).

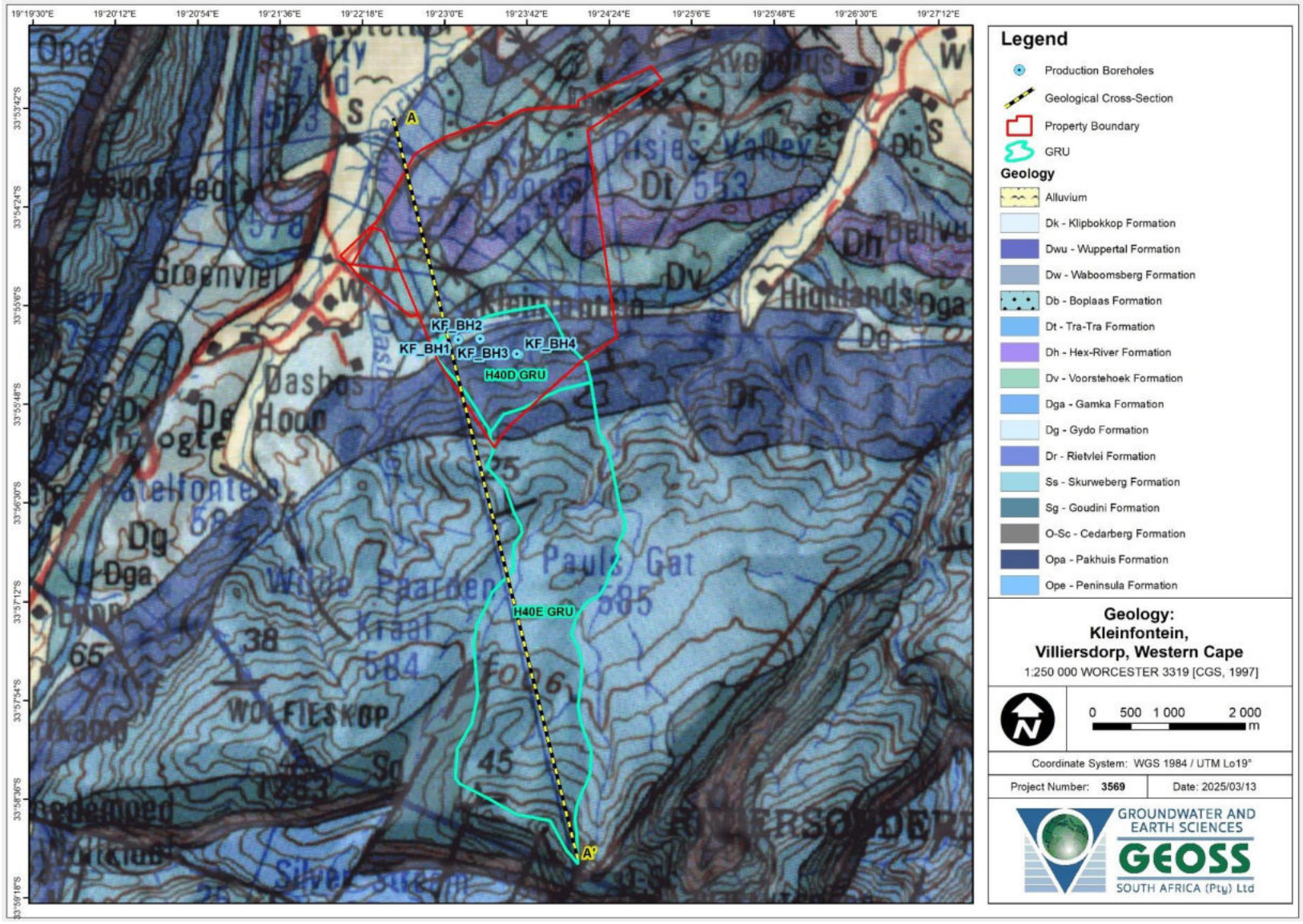
2 Yield Testing

2.1 Methodology

The yield testing was undertaken by under the management and supervision of GEOSS SA from 31 January to 05 February 2025 and carried out according to the National Standard (SANS 10299-4:2003, Part 4 – Test pumping of water boreholes). This included a Step Test, Constant Discharge Test (CDT) and recovery monitoring of the borehole. For the Step Test, a borehole is pumped at a constant rate for one-hour intervals and the flow rates are incrementally increased for each step. This test is followed by a Constant Discharge Test where the boreholes are pumped at a constant rate for an extended period of time, followed by recovery monitoring. The water level drawdown is monitored at pre-determined intervals during these tests (drawdown refers to the difference in water level from the rest water level (RWL) measured before commencement of the yield test). Raw data and measurements taken during the yield tests are presented in **Appendix B.**



Map 1: Borehole Locality Map.



Map 2: Geological Map with Property Boundary and Tested Borehole Positions (1:250 000 Geological Map Series, 3319 Worcester) (CGS, 1997).

The yield test data was analysed using the excel-based FC program, developed by the IGS (Institute for Groundwater Studies) in Bloemfontein. The sustainable yield of the borehole was calculated based upon long-term extrapolations of the CDT data according to (1) the Cooper-Jacob approximation of the Theis solution for confined aquifers, (2) the Barker Generalised Radial Flow Model (GRF) for hydraulic tests in fractured rock and (3) the Flow Characteristic (FC) method(s) using first and second derivative calculations. Boundary conditions are accounted for in multiplication factors to the rate of drawdown (derivatives), according to each of the above three methods. These three methods are briefly described below.

1. The Cooper-Jacob approximation of the Theis solution for confined aquifers was designed for porous media aquifers, where infinite acting radial flow (IARF) was observed during the pumping of a borehole. The application of this method to fractured aquifers was discussed by Meier et al (1998), concluding that T estimates using the Cooper-Jacob analysis gave an effective T for the fracture zone. The Cooper-Jacob analysis (and more accurately the Theis method) is therefore viable for analysing pumping test data for fractured aquifers where IARF is observed. The parameters are then used to predict theoretical long-term drawdowns.
2. The Barker GRF Model (Barker, 1988) uses fracture hydraulic conductivity, fracture storativity and flow domain to predict drawdown due to abstraction in a borehole in a fractured medium. By changing these values, a curve of drawdown predictions can be made to fit real-world data and therefore predict theoretical long-term drawdowns.
3. The FC methods are the Basic FC, the FC Inflection Point and the FC Non-Linear. The Basic FC and the FC Inflection Point methods make use of the derivatives of the drawdown data to predict theoretical long-term drawdowns and the scale-back factors are applied to selected available drawdowns. The FC Non-Linear method uses curve fitting of the Step Test data to predict theoretical long-term drawdowns. Due to the short nature of the Step Test, this method is usually not included if the other methods of analysis differ from it.

In all three methods, the available drawdown (AD) was carefully selected to ensure that the flow regime described by the analytical solution is not extrapolated beyond its applicable depth, which may easily result in an overuse of the resource. For both KF_BH1 and KF_BH2 this was conservatively calculated as the geometric mean of the maximum drawdown reached during the CDT and the drawdown to the pump depth (24.1 m and 92.1 m respectively). A two-year extrapolation time without recharge to the aquifer was selected as per the recommendations within the FC method program.

Water samples were collected at the end of the yield tests and submitted for inorganic chemical analyses.

2.2 Yield Testing at KF_BH1

The yield testing was conducted between the 28th and the 30th of January 2025. The borehole was measured to a depth of 96.94 meters below ground level (mbgl). The test pump was installed at a depth of 90.50 mbgl. The rest water level (RWL) at the start of the test was 22.97 mbgl.

During the Step Test, the water level was drawn down 6.13 meters below the rest water level to 29.10 mbgl during the 3rd step at a rate of 5.11 L/s (18 396 L/hour, pump max due to borehole inner diameter). **Figure 2** shows the time-series drawdown for the Step Test.

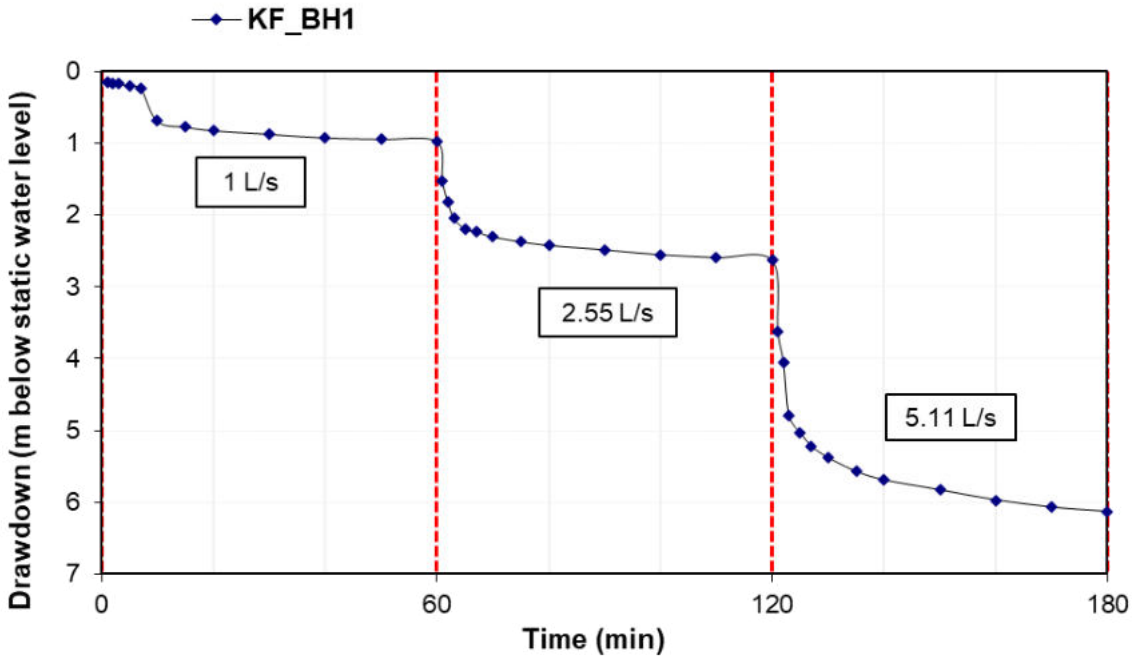


Figure 2: Step Test drawdown data for KF_BH1.

The water level was left to recover overnight. Before starting the CDT, the water level recovered to 23.23 mbgl. Based on the results of the Step Test, the planned 24-hour CDT was conducted at a rate of 5.13 L/s (18 468 L/hour). At the end of the 24-hour period, the water level had drawn down 8.67 meters below the rest water level (31.9 mbgl).

The semi-log plot of the drawdown from the CDT is presented in **Figure 3**. The available drawdown (AD) is indicated with the horizontal red line at 24.1 m.

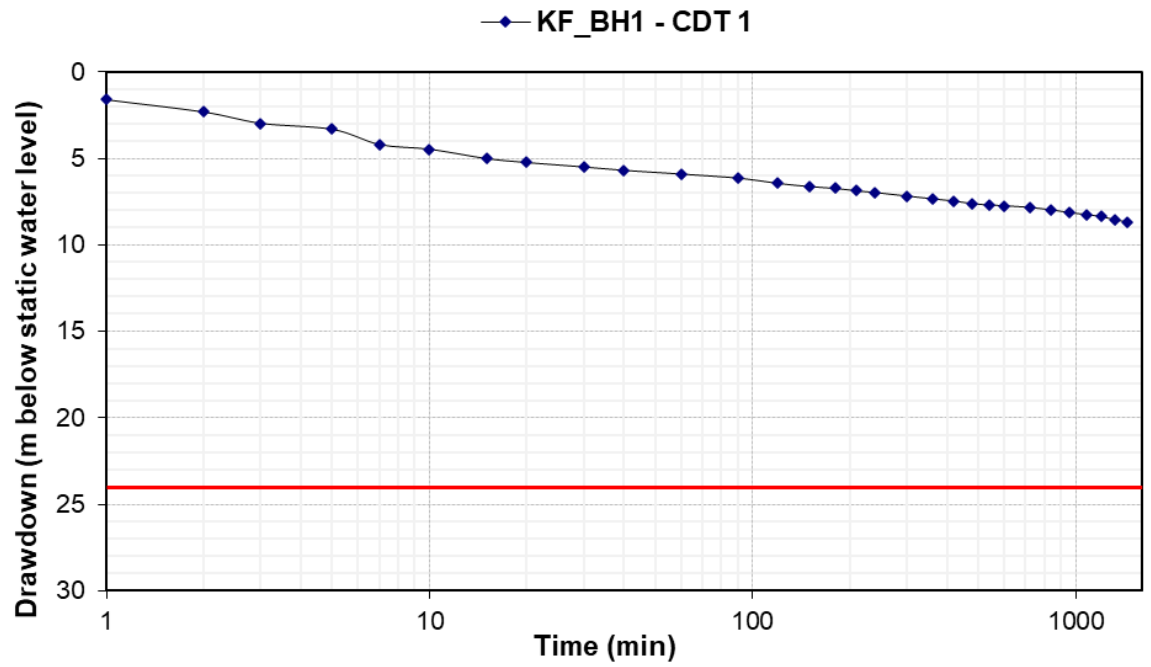


Figure 3: Semi-Log Plot of drawdown during the CDT of KF_BH1 (5.13 L/s).

The recovery of the water level was monitored after the CDT and is presented in **Figure 4.** The recovery was moderate to slow, only reaching 82.7% in 24 hours. Monitoring will be essential to determine the long-term recovery of the borehole.

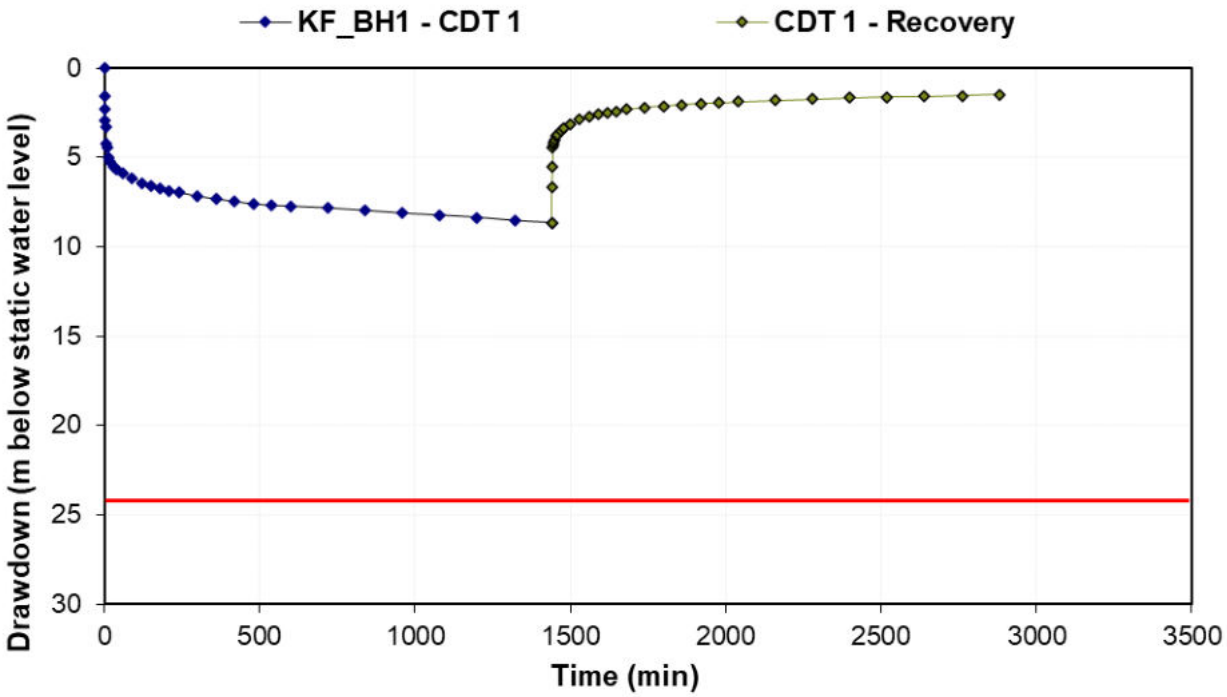


Figure 4: Time-series drawdown and recovery for KF_BH1 (5.13 L/s).

Several methods were used to assess the yield test data as presented in **Table 2.** It is recommended that the borehole can be abstracted from at a rate of up to 3.7 L/s (13 320 L/hour) for up to 24 hours per day. The assessments were based on an available drawdown (AD) of 24.10 meters below the RWL of the CDT, which equates to 47.33 mbgl.

Table 2: Yield Determination - KF_BH1.

KF_BH1			
Method	**Sustainable Yield (L/s)**	**Late *T (m^2/d)**	***AD used (m)**
Basic FC	3.6	29.5	24.1
Cooper-Jacob	4.3	35.5	24.1
Barker	3.1		24.1
Average Q_sust (L/s)	**3.7**		
Recommended Abstraction			
Abstraction Rate (L/s)	**Abstraction Duration (hours)**		**Recovery Duration (hours)**
3.7	24		0

**AD- Available Drawdown

* T – Transmissivity

2.3 Yield Testing at KF_BH2

The yield testing was conducted between 31 January and 05 February 2025. The borehole was measured to a depth of 163 meters below ground level (mbgl. The test pump was installed at a depth of 140.00 mbgl. The rest water level (RWL) at the start of the test was 5.31 mbgl.

During the Step Test, the water level was drawn down 113.32 meters below the rest water level (pump inlet) during the 4th step at a rate of 2.4 L/s (8 640 L/hour). **Figure 5** shows the time-series drawdown for the Step Test.

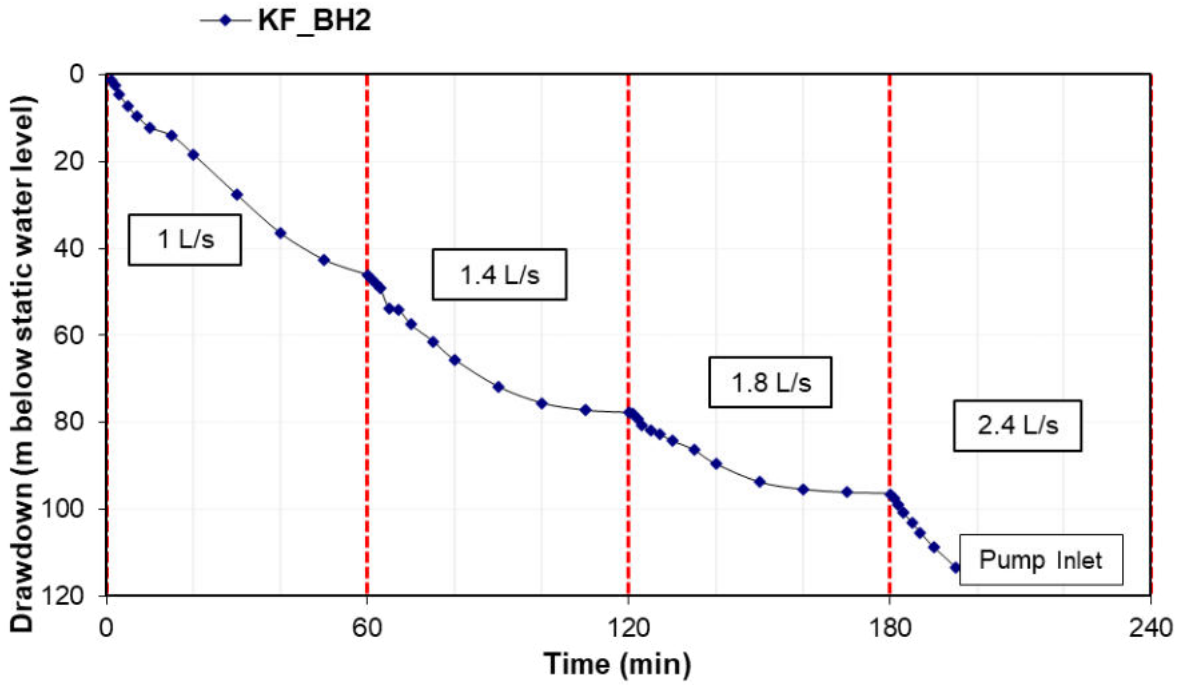


Figure 5: Step Test drawdown data for KF_BH2.

The water level was left to recover overnight. Before starting the CDT, the water level recovered to 18.71 mbgl. Based on the results of the Step Test, the planned 24-hour CDT was conducted at a rate of 1.5 L/s (5 400 L/hour). At the end of the 24-hour period, the water level had drawn down 70.07 meters below the rest water level (88.78 mbgl).

The semi-log plot of the drawdown from the CDT is presented in **Figure 6.** The available drawdown (AD) is indicated with the horizontal red line at 92.10 m

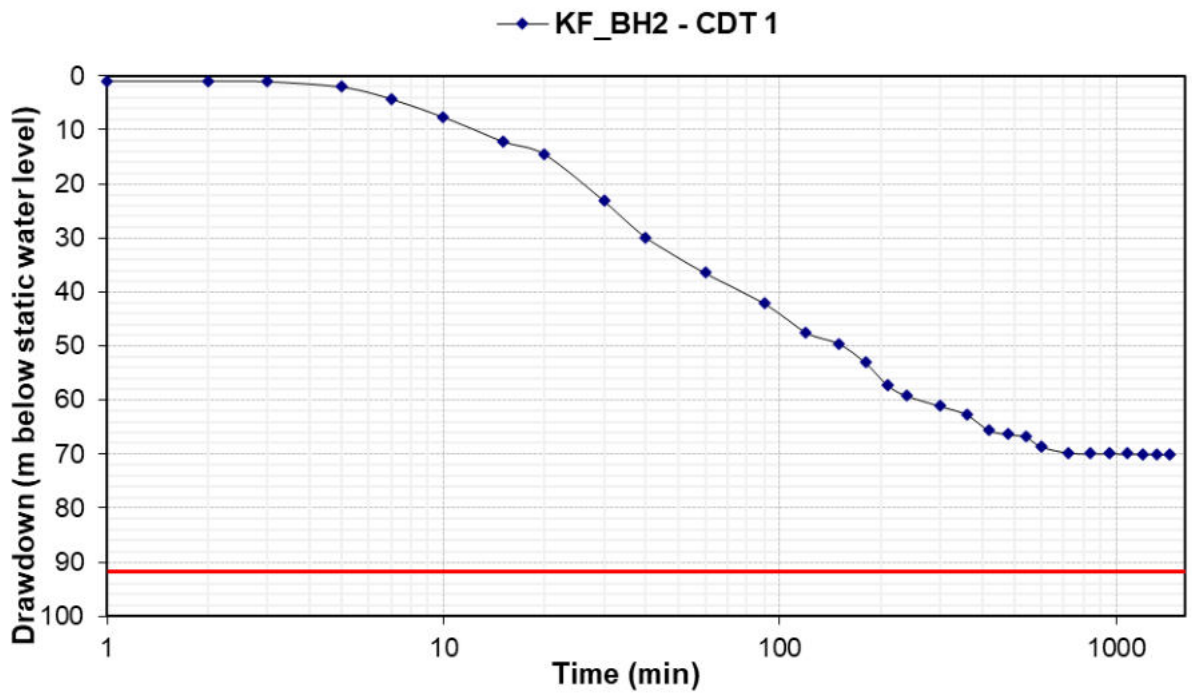


Figure 6: Semi-Log Plot of drawdown during the CDT of KF_BH2 (1.5 L/s).

The recovery of the water level was monitored after the CDT and is presented in **Figure 7.** The recovery was good, reaching 96.2% in 24 hours. Monitoring will be essential to determine the long-term recovery of the borehole.

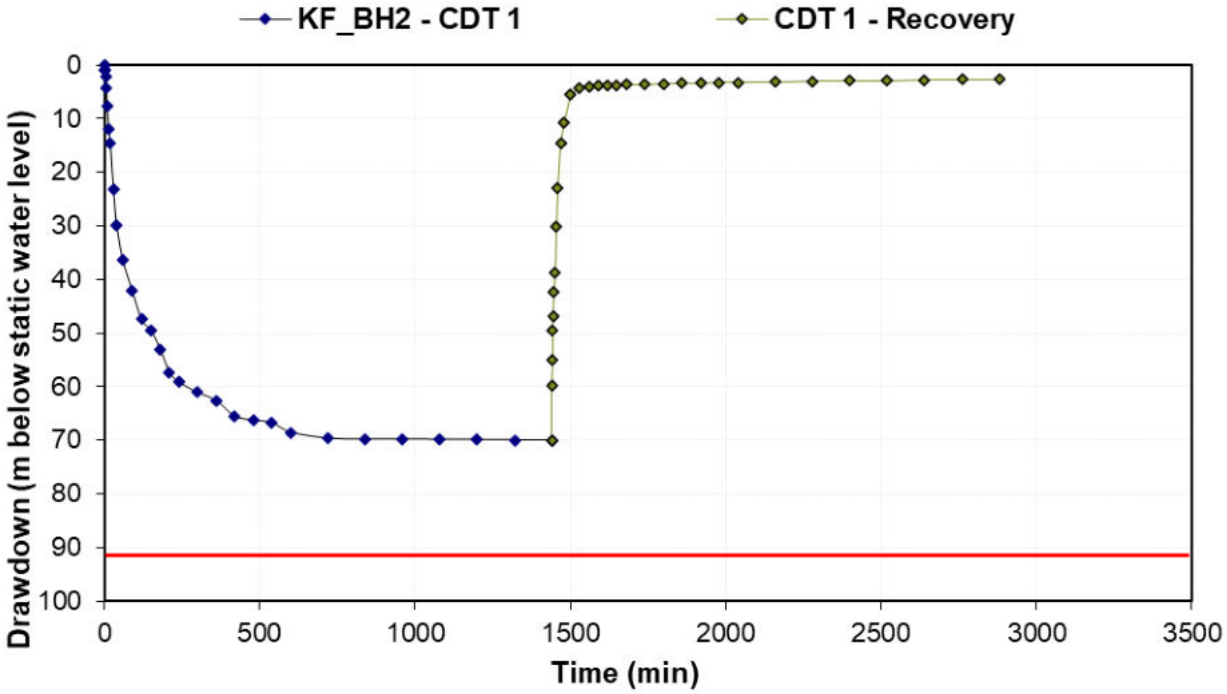


Figure 7: Time-series drawdown and recovery for KF_BH2 (1.5 L/s).

Several methods were used to assess the yield test data as presented in **Table 3.** It is recommended that the borehole can be abstracted from at a rate of up to 1.2 L/s (4 320 L/hour) for up to 24 hours per day. The assessments were based on an available drawdown (AD) of 92.10 meters below the RWL of the CDT, which equates to 110.81 mbgl.

Table 3: Yield Determination – KF_BH2.

KF_BH2			
Method	**Sustainable Yield (L/s)**	**Late *T (m^2/d)**	***AD used (m)**
Basic FC	1.4	6.9	92.1
Cooper-Jacob	1.0	29.6	92.1
Barker	1.2		92.1
Average Q_sust (L/s)	**1.2**		
Recommended Abstraction			
Abstraction Rate (L/s)	**Abstraction Duration (hours)**		**Recovery Duration (hours)**
1.2	24		0

**AD- Available Drawdown

* T – Transmissivity

2.4 Yield Testing at KF_BH3

The yield testing was conducted on 02 February 2025. The borehole was measured to a depth of 206 meters below ground level (mbgl) The test pump was installed at a depth of 149.71 mbgl. The rest water level (RWL) at the start of the test was 48.62 mbgl.

During the Step Test, the water level was drawn down 98.25 meters below the rest water level (Pump inlet) during the 2nd step at a rate of 1.0 L/s (3 600 L/hour). **Figure 8** shows the time-series drawdown for the Step Test.

During the Step Test it was determined that the yield of the borehole is considered insufficient. Accordingly continued monitoring and further CDT testing of the borehole was abandoned. The use of this borehole is not recommended due to insufficient yield.

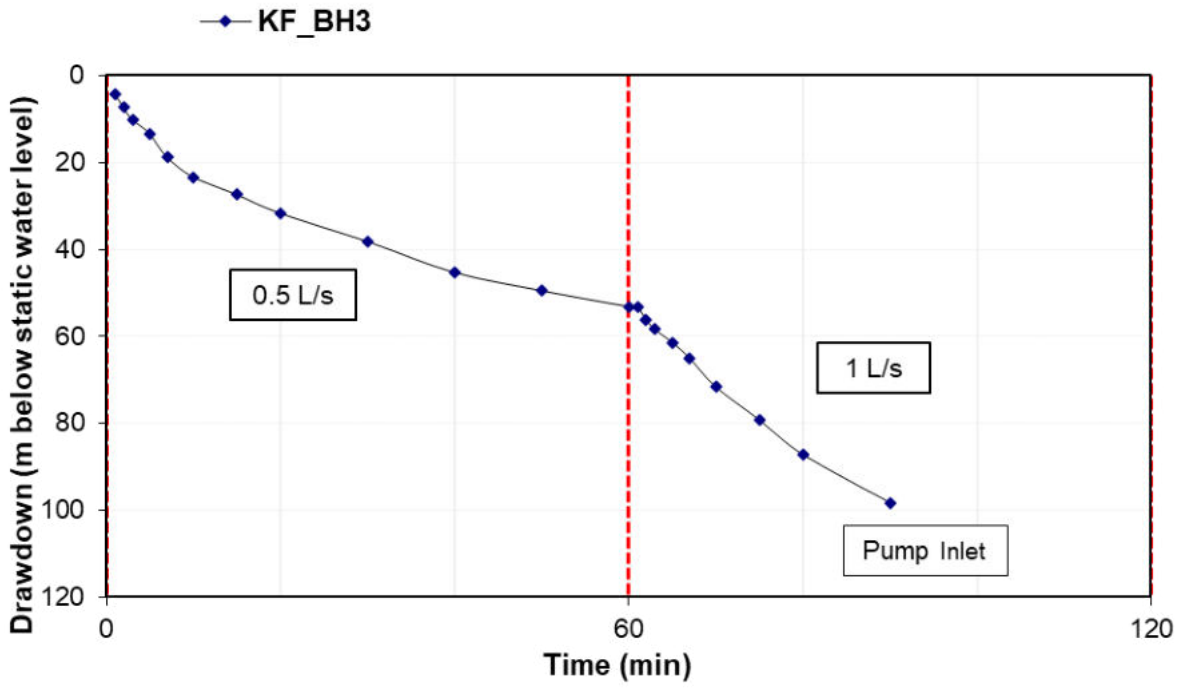


Figure 8: Step Test drawdown data for KF_BH3.

2.5 Yield Testing at KF_BH4

The yield testing was conducted on 31 January 2025. The borehole was measured to a depth of 90.3 meters below ground level (mbgl). The test pump was installed at a depth of 88.60 mbgl. The rest water level (RWL) at the start of the test was 45.14 mbgl.

During the Step Test, the water level was drawn down 42.80 meters below the rest water level (pump inlet) during the 2nd step at a rate of 1.6 L/s (5 760 L/hour). **Figure 8** shows the time-series drawdown for the Step Test.

During the Step Test it was determined that the yield of the borehole is considered insufficient. Accordingly continued monitoring and further CDT testing of the borehole was abandoned. This use of this borehole is not recommended due to insufficient yield.

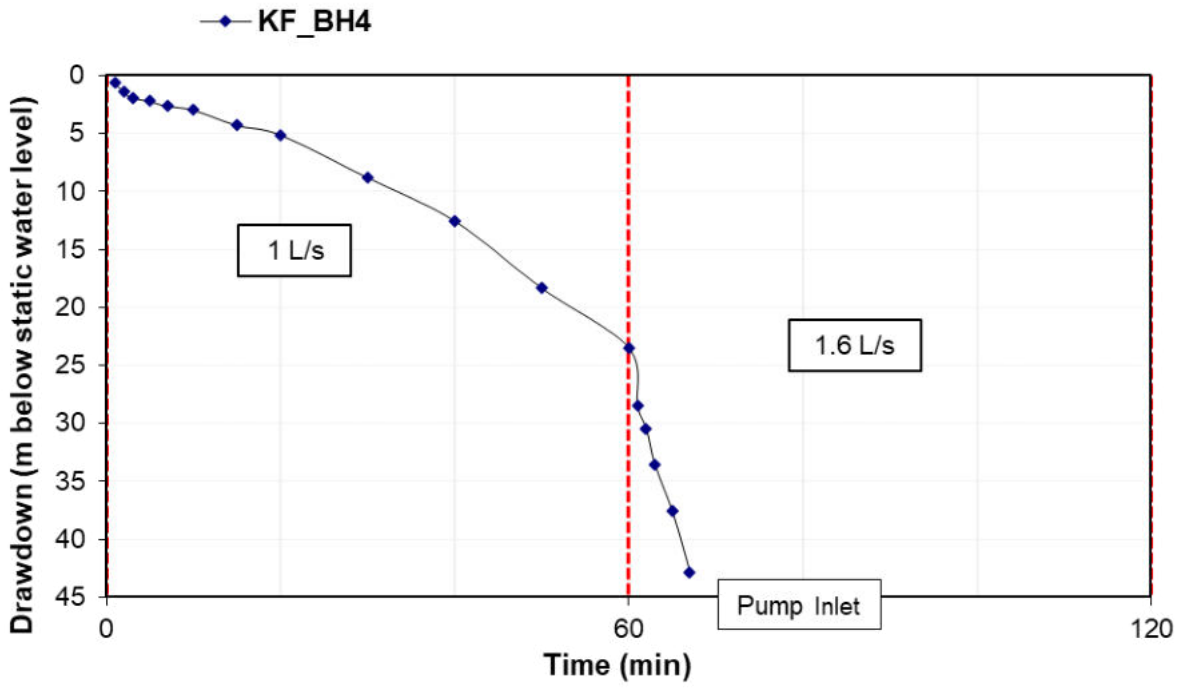


Figure 9: Step Test drawdown data for KF_BH4.

2.6 Radius of influence

No influence was observed between boreholes during the testing process. As such aquifer parameters could not be determined from the monitoring boreholes. Transmissivities were calculated through the Theis method using the drawdown response in the tested boreholes during the CDTs. The transmissivity of KF_BH1 and KF_BH2 were respectively calculated at 35.5 and 29.6 m^2/d. A storativity value of 5x10-4 was used for the radius of influence calculation based on an average expected value for confined aquifers as reported by Todd (1980). Based on the aquifer parameters the radii of influence were calculated for the recommended sustainable yields of the boreholes. A drawdown of up to 3 m and 1.1 m, respectively, can be expected 1 kilometre away from KF_BH1 and KF_BH2 at the recommended sustainable rates (3.7 L/s and 1.2 L/s for 24 hours per day) after 2 years of abstraction without recharge (**Figure 10**).

It must be noted that the Cooper-Jacob modelling of radius of influence is based on a homogenous, confined aquifer and therefore does not account for the heterogeneity associated with secondary aquifers (fractured rock). Thus, the radius of influence solution will only provide an indication of how abstraction at KF_BH1 and KF_BH2 will impact the water level in the fracture network. This suggests that the cone of depression will not expand equivalently in all directions surrounding the borehole, but will rather propagate along the fracture network within the secondary aquifer.

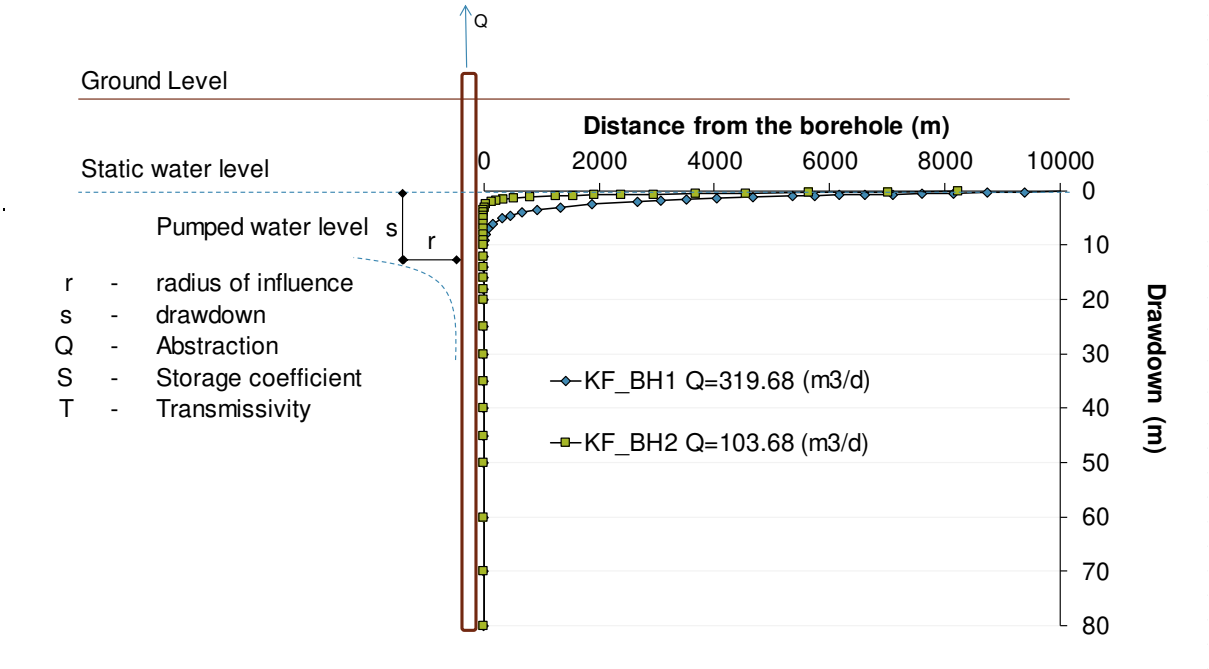


Figure 10: Radii of influence for KF_BH1 and KF_BH2 at the recommended sustainable yields.

3 Water Quality Analysis

Groundwater samples were collected from the boreholes at the end of the yield tests and submitted for inorganic chemical analyses to a SANAS accredited laboratory (Vinlab) in the Western Cape. The certificate of analysis for the samples are presented in **Appendix C**. The chemistry results obtained for the boreholes have been classified according to the SANS241-1: 2015 standards for drinking water (**Table 4**). **Table 6** presents the water chemistry analysis results, colour coded according to the SANS241-1: 2015 drinking water assessment standards.

Table 4: Classification table for the specific limits.

Acute Health	Aesthetic	Chronic Health	Operational	Acceptable

The limits and associated risks for domestic water as determined by the South African National Standard (SANS) 241:2015 are as follows, where:

- Health risks: parameters falling outside these limits may cause acute or chronic health problems in individuals.
- Aesthetic risks: parameters falling outside these limits indicate that water is visually, aromatically or palatably unacceptable.
- Operational risks: parameters falling outside these limits may indicate that operational procedures to ensure water quality standards are met may have failed.

The chemistry results obtained have also been classified according to the DWAF (1998) standards for domestic water. **Table 5** enables an evaluation of the water quality with regards to the various parameters measured (DWAF, 1998). **Table 7** presents the water chemistry analysis results colour coded according to the DWAF domestic water assessment standards.

Table 5: Classification table for the groundwater results (DWAF, 1998).

Class	Water quality	Description
Class 0	Ideal	Suitable for lifetime use.
Class I	Good	Suitable for use, rare instances of negative effects.
Class II	Marginal	Conditionally acceptable. Negative effects may occur.
Class III	Poor	Unsuitable for use without treatment. Chronic effects may occur.
Class IV	Dangerous	Totally unsuitable for use. Acute effects may occur.

Table 6: Production borehole results classified according to SANS241-1:2015.

Analyses	KF_ BH1	KF_ BH2	KF_ BH3	KF_ BH4	SANS 241-1:2015
Date and Time Sampled	29/01/25 14:40	04/02/25 06:30	02/02/25 08:20	31/01/25 14:05	
pH (at 25 °C)	4.2	5.6	6.4	6.4	5.0≤ Operational ≤ 9.7
Conductivity (mS/m) (at 25 °C)	40.8	34.0	61.1	53.8	Aesthetic ≤170
Total Dissolved Solids (mg/L)	276.62	230.52	414.26	364.76	Aesthetic ≤1200
Turbidity (NTU)	4.01	1536.00	543.00	96.00	Operational ≤1 Aesthetic ≤5
Colour (mg/L as Pt)	<15	<15	<15	<15	Aesthetic ≤15
Sodium (mg/L as Na)	54	50	85	85	Aesthetic ≤200
Potassium (mg/L as K)	7	4	8	7	N/A
Magnesium (mg/L as Mg)	7	6	9	7	N/A
Calcium (mg/L as Ca)	<0.20	<0.20	8	7	N/A
Chloride (mg/L as Cl)	96.17	85.15	112.58	113.93	Aesthetic ≤300
Sulphate (mg/L as SO_4)	23.04	14.85	53.10	20.50	Aesthetic ≤250 Acute ≤500
Nitrate & Nitrite Nitrogen (mg/L as N)	0.068	0.068	0.068	0.068	≤1 Acute Health
Nitrate Nitrogen (mg/L as N)	<1.00	<1.00	<1.00	<1.00	Acute Health ≤11
Nitrite Nitrogen (mg/L as N)	<0.05	<0.05	<0.05	<0.05	Acute Health ≤0.9
Ammonia Nitrogen (mg/L as N)	<0.15	<0.15	<0.15	<0.15	Aesthetic ≤1.5
Total Alkalinity (mg/L as $CaCO_3$)	<10.00	10.3	61.7	58.4	N/A
Total Hardness (mg/L as $CaCO_3$)	29.2	25.1	56.9	46.2	N/A
Fluoride (mg/L as F)	<0.15	<0.15	9.15	0.59	Chronic Health ≤1.5
Aluminium (mg/L as Al)	0.972	0.299	4.892	0.238	Operational ≤0.3
Total Chromium (mg/L as Cr)	<0.004	<0.004	0.016	<0.004	Chronic Health ≤0.05
Manganese (mg/L as Mn)	0.054	0.796	1.907	1.734	Aesthetic ≤0.1 Chronic ≤0.4
Iron (mg/L as Fe)	1.146	1.891	56.355	3.494	Aesthetic ≤0.3 Chronic ≤2
Nickel (mg/L as Ni)	0.010	0.016	0.012	<0.008	Chronic Health ≤0.07
Copper (mg/L as Cu)	0.025	0.034	0.015	0.017	Chronic Health ≤2
Zinc (mg/L as Zn)	0.094	0.091	0.061	0.145	Aesthetic ≤5
Arsenic (mg/L as As)	<0.010	<0.010	0.015	<0.010	Chronic Health ≤0.01
Selenium (mg/L as Se)	<0.008	<0.008	<0.008	<0.008	Chronic Health ≤0.04
Cadmium (mg/L as Cd)	0.002	<0.001	0.002	0.002	Chronic Health ≤0.003
Antimony (mg/L as Sb)	<0.013	<0.013	0.014	<0.013	Chronic Health ≤0.02
Mercury (mg/L as Hg)	<0.001	0.001	0.001	0.002	Chronic Health ≤0.006
Lead (mg/L as Pb)	<0.008	0.010	<0.008	<0.008	Chronic Health ≤0.01
Uranium (mg/L as U)	<0.028	<0.028	<0.028	<0.028	Chronic Health ≤0.03
Cyanide (mg/L as CN^-)	<0.01	0.017	0.061	0.010	Acute Health ≤0.2
Total Organic Carbon (mg/L as C)	1.46	7.55	3.73	3.60	N/A
Charge Balance Error %	2.0	2.9	2.9	1.8	≥-5 - ≤5 Acceptable

.

Table 7: Classified production borehole results according to DWAF (1998).

Sample Marked:	KF_BH1	KF_BH2	KF_BH3	KF_BH4	DWAF (1998) Domestic Water Assessment Guide				
					Class 0	Class I	Class II	Class III	Class IV
					Ideal	Good	Marginal	Poor	Dangerous
Date and Time Sampled	29/01/25 14:40	04/02/25 06:30	02/02/25 08:20	31/01/25 14:05					
pH	4.2	5.6	6.4	6.4	5-9.5	4.5-5 & 9.5-10	4-4.5 & 10-10.5	3-4 & 10.5-11	< 3 & >11
Conductivity (mS/m)	40.8	34.0	61.1	53.8	<70	70-150	150-370	370-520	>520
Turbidity (NTU)	4.01	1536.00	543.00	96.00	<0.1	0.1-1	1.0-20	20-50	>50
	mg/L								
Total Dissolved Solids	276.62	230.52	414.26	364.76	<450	450-1000	1000-2400	2400-3400	>3400
Sodium (as Na)	54	50	85	85	<100	100-200	200-400	400-1000	>1000
Potassium (as K)	7	4	8	7	<25	25-50	50-100	100-500	>500
Magnesium (as Mg)	7	6	9	7	<70	70-100	100-200	200-400	>400
Calcium (as Ca)	<0.20	<0.20	8	7	<80	80-150	150-300	>300	
Chloride (as Cl)	96.17	85.15	112.58	113.93	<100	100-200	200-600	600-1200	>1200
Sulphate (as SO_4)	23.04	14.85	53.10	20.50	<200	200-400	400-600	600-1000	>1000
Fluoride (as F)	<0.15	<0.15	9.15	0.59	<0.7	0.7-1.0	1.0-1.5	1.5-3.5	>3.5
Manganese (as Mn)	0.054	0.796	1.907	1.734	<0.1	0.1-0.4	0.4-4	4.0-10.0	>10
Iron (as Fe)	1.146	1.891	56.355	3.494	<0.5	0.5-1.0	1.0-5.0	5.0-10.0	>10
Copper (as Cu)	0.025	0.034	0.015	0.017	<1	1-1.3	1.3-2	2.0-15	>15
Zinc (as Zn)	0.094	0.091	0.061	0.145	<20	>20			
Arsenic (as As)	<0.010	<0.010	0.015	<0.010	<0.010	0.01-0.05	0.05-0.2	0.2-2.0	>2.0
Cadmium (as Cd)	0.002	<0.001	0.002	0.002	<0.003	0.003-0.005	0.005-0.020	0.020-0.050	>0.050
Hardness (as $CaCO_3$)	29.20	25.10	56.90	46.20	<200	200-300	300-600	>600	
Charge Balance Error %	2.0	2.9	2.9	1.8	≥-5 - ≤5 Acceptable				

From the chemical results presented in **Table 6** and **Table 7**, groundwater from the boreholes does not meet the required quality standards for potable use. Iron concentrations are elevated in all four boreholes, with manganese levels also exceeding acceptable limits, except in KF_BH1. Turbidity is significantly elevated across all boreholes, ranging from 4.01 NTU to 1 536 NTU, likely attributed to high iron and manganese concentrations. If not properly managed, iron and manganese biofouling is expected to occur, potentially leading to clogging of both the borehole and abstraction infrastructure.

The pH and electrical conductivity of the boreholes are generally within acceptable limits, with the exception of KF_BH1, which has a pH of 4.1—falling below the operational limit of SANS 241-1:2015. KF_BH3 exhibits an elevated fluoride concentration (9.15 mg/L) above the chronic health limits of SANS 241-1:2015. Additionally, low concentrations of arsenic (0.015 mg/L) and lead (0.010 mg/L) were detected in KF_BH3 and KF_BH2, respectively, both classified as chronic health risks according to SANS 241-1:2015. Continuous groundwater monitoring for arsenic and lead is recommended to assess whether these concentrations persist.

Given the observed water quality, the groundwater from these boreholes is unsuitable for direct potable use and should undergo treatment prior to consumption. However, it remains suitable for irrigation purposes as long as the turbidity and iron concentrations are considered.

A number of chemical diagrams have been plotted for the groundwater sample and these are useful for chemical characterisation of the water and illustrate the similarities and differences in the water types.

The chemistry of the samples has been plotted on a tri-linear diagram known as a Piper diagram. This diagram indicates the distribution of cations and anions in separate triangles and then a combination of the chemistry in the central diamond. **Figure 11**, the tested borehole groundwater samples are classified as potassium/chloride hydrofacies, which is typical of groundwater that is hosted within the rocks of the Table Mountain Group.

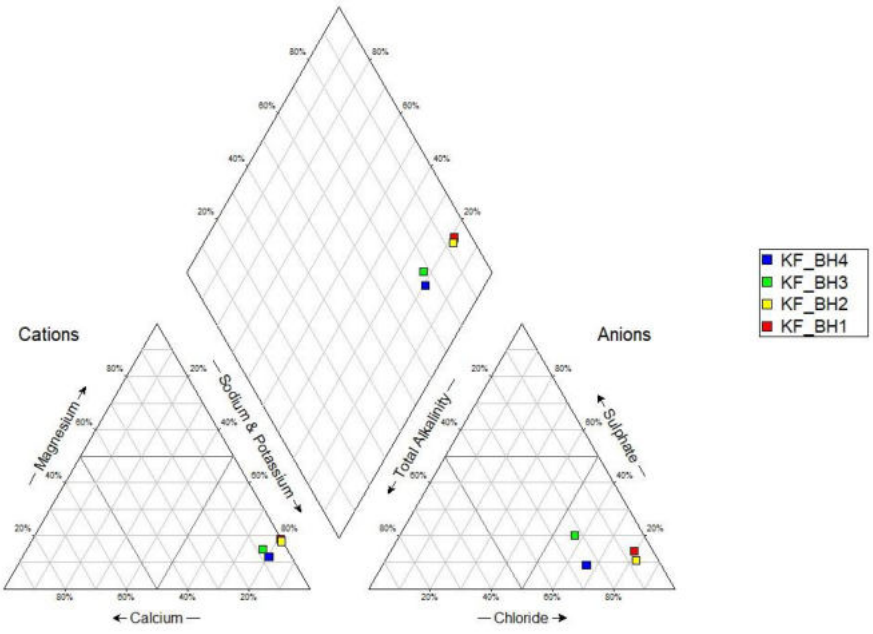


Figure 11: Piper diagram of the groundwater samples.

The Sodium Adsorption Ratio (SAR) of the groundwater is plotted in **Figure 12.** All four boreholes (KF_BH1 – KF_BH4) plots as S1/C2, thus classified as low risk in terms of sodium adsorption and medium risk in terms of salinity hazard. This graph is typically applicable to irrigation, however, is dependent on soil texture and crop type.

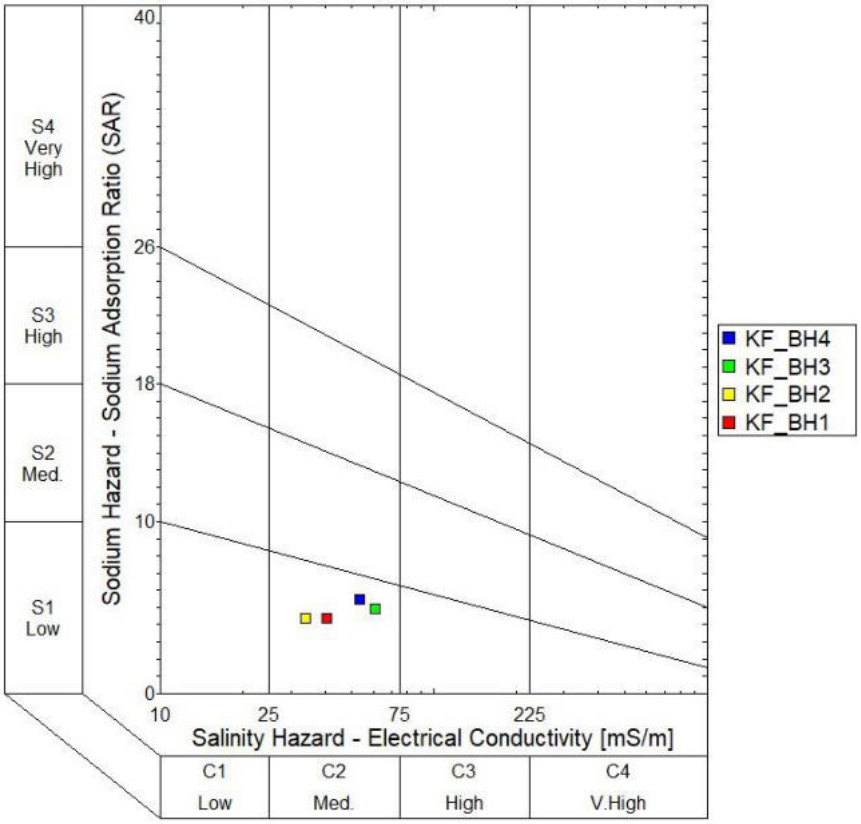


Figure 12*: SAR diagram of the groundwater samples.*

4 Aquifer Firm Yield Model

To evaluate the sustainable volume of groundwater that can be abstracted from the aquifer for the property, the Aquifer Firm Yield Model (AFYM) was utilised (WRC, 2012). The model uses a single-cell "Box Model" approach and makes use of a critical management water level, below which aquifer storage levels cannot be drawn down, to provide estimates of aquifer firm and assured yields.

The "Box Model" approach is schematically presented in **Figure 13.**

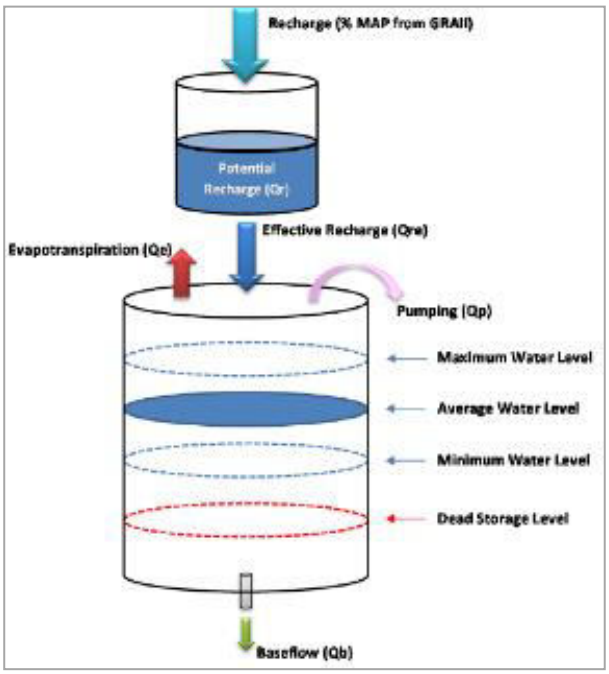


Figure 13: Aquifer Firm Yield lumped box model (WRC, 2012).

An evaluation was completed using the Aquifer Firm Yield model (WRC, 2012). The Input parameters used for the catchment are the default values presented in WRC (2012). These are taken from datasets like WR2005 (e.g., rainfall data) (Middleton and Bailey, 2008) and GRAII (e.g. specific yield and recharge (%MAP)) (DWAF, 2005), and others generated during the WRC (2012) (e.g. recharge threshold and riparian zone (% catchment area)). Although the boreholes are situated in catchment H40E, recharge to the aquifer is likely to extend to catchment H40D. The parameters for quaternary catchments H40D (181.76 km^2) and H40E (285.43 km^2), are presented in **Table 8.**

Table 8: Hydrogeological Parameters for Quaternary catchment H40D and H40E (WRC, 2012).

Parameter	H40D	H40E
Groundwater Level (mbgl)	17.2	13.5
Max Drawdown (m)	5	5
Specific Yield	0.002091	0.002091
Firm Yield (L/s)	75.2	53.3
Firm Yield (L/s/km^2)	0.4136	138.5
Recharge %	3.6	0.4853
Recharge Threshold (mm)	23	22
MAP (mm)	556.7	539.1
Hydrological MAR (mm)	136.3	126.3
Hydrological MAE (mm)	1500	1545
Baseflow: Default (Mm^3/a)	20.15	0
ET Model	Linear	Linear
ET Extinction Depth (m)	4	4
Riparian Zone (%)	3.6	2.6

The Aquifer Firm Yield Model was run for both catchments. For catchment H40D, the Aquifer Firm Yield was determined to be 2 373 131.52 m^3/a (75.20 L/s) with a recharge of 3 642 628.40 m^3/a (**Table 9**). For catchment H40E, the Aquifer Firm Yield was determined to be 4 370 727.60 m^3/a (138.50 L/s) with a recharge of 6 616 522.60 m^3/a (**Table 9**).

Table 9: Results of the Aquifer Firm Yield Model for Quaternary Catchments H40D and H40E.

Name	Q (L/s)	Q (m^3/month)	Q (m^3/a)
H40D	75.20	194 918.40	2 373 131.52
H40E	138.50	358 992.00	4 370 727.60

For this study area there are geological features that enable the definition of a more localised aquifer (i.e., a groundwater resource unit (GRU)).The Kleinfontein farm is located on the South Eastern limb of a North East – South West trending synform hosted in the Cape Supergroup. All the boreholes are drilled intersecting the fractured rock aquifer of the Table Mountain Group. The southern boundary of the GRU was delineated based on the quaternary catchment boundary and the Skurweberg-Goudini contact. The northern boundary of the GRU was delineated based on the Gydo-Gamka contact with the western and southern boundaries delineated as per the topographical lay of the area. The area is highly faulted, with major faults in both NE-SW and NW-SE orientations, creating groundwater flow paths. The GRU has been delineated and is displayed in **Map 3,** and **Figure 14** depicts a schematic cross-section of the geology and the groundwater flow.

On assessment of the geological map, the GRU has an extent of approximately 9.78 km^2, predominantly within catchment H40D and catchment H40E (H40D = 7.85 km^2 + H40E = 1.93 km^2). Using the GRAII recharge values, the combined direct vertical recharge (minimum recharge volume) is calculated to be 202 063.33 m^3/a (H40D = 157 323.42 m^3/a + H40E = 44 739.91 m^3/a). The firm yield of the GRU is calculated to be 132 048.60 m^3/a (H40D = 102 494.4 m^3/a + H40E = 29 554.20 m^3/a), which is estimated to be approximately 65% of groundwater recharge within the GRU.

It is important to note that a conservative approach was used to calculate the recharge and firm yield volumes and that the actual volumes are believed to be higher than the calculated volumes.

The current volume of groundwater abstracted within the GRU, based on the registered WARMS boreholes (database last updated in May 2023), is 45 798.00 m^3/a (**Figure 14**). Note that only registered and active sites were taken into account. Based on these volumes, a volume of 86 250.00 m^3/a is available for abstraction in the GRU. The additional volume of **70 000** m^3/a for which a licence is being applied, is less than the volume of 86 250.00 m^3/a available within the firm yield of the GRU. Because the firm yield of the GRU is in excess of the predicted water demand of the property, the proposed abstraction volume is considered to be within the sustainable supply volume of the local aquifer The proposed additional abstraction is not likely to impact on the regional groundwater flow, however site-specific long-term monitoring is required to ensure the sustainability of the abstraction.

GRU (9.78 km^2)	Total recharge = 202 063.33 m^3/a Total firm yield = 132 048.60 m^3/a Authorised existing abstraction (from WARMS 2023) = 45 798.00 m^3/a Available groundwater = 86 250.60 m^3/a Requested additional groundwater use = **70 000.00** m^3/a Is there sufficient groundwater for the proposed demand? **YES**

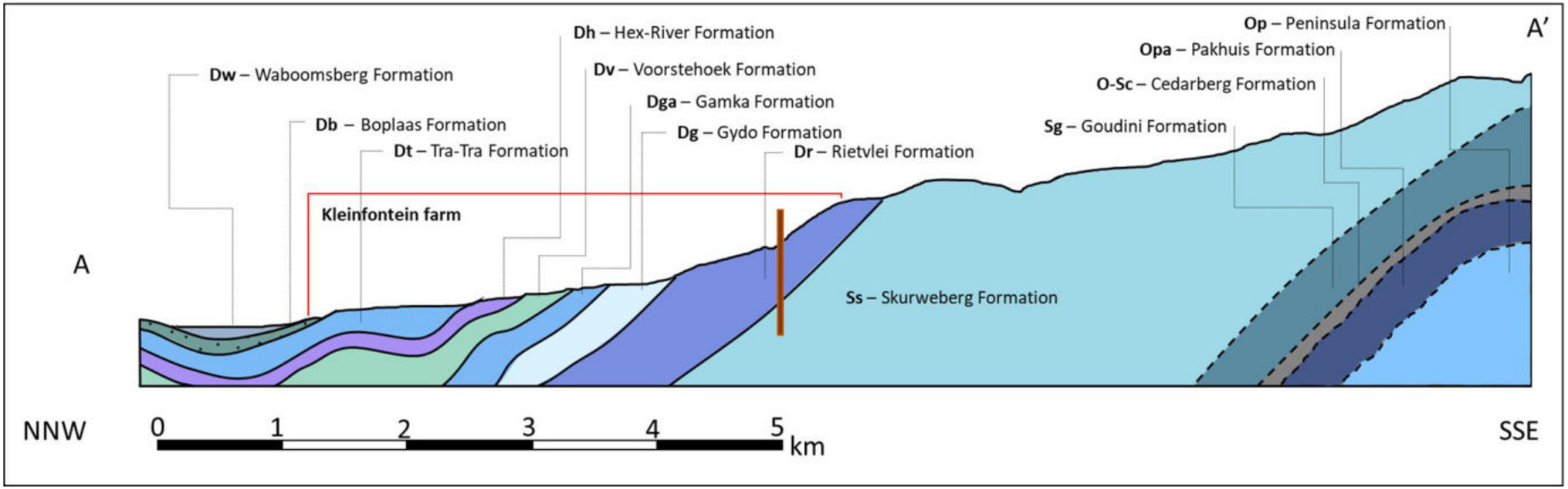
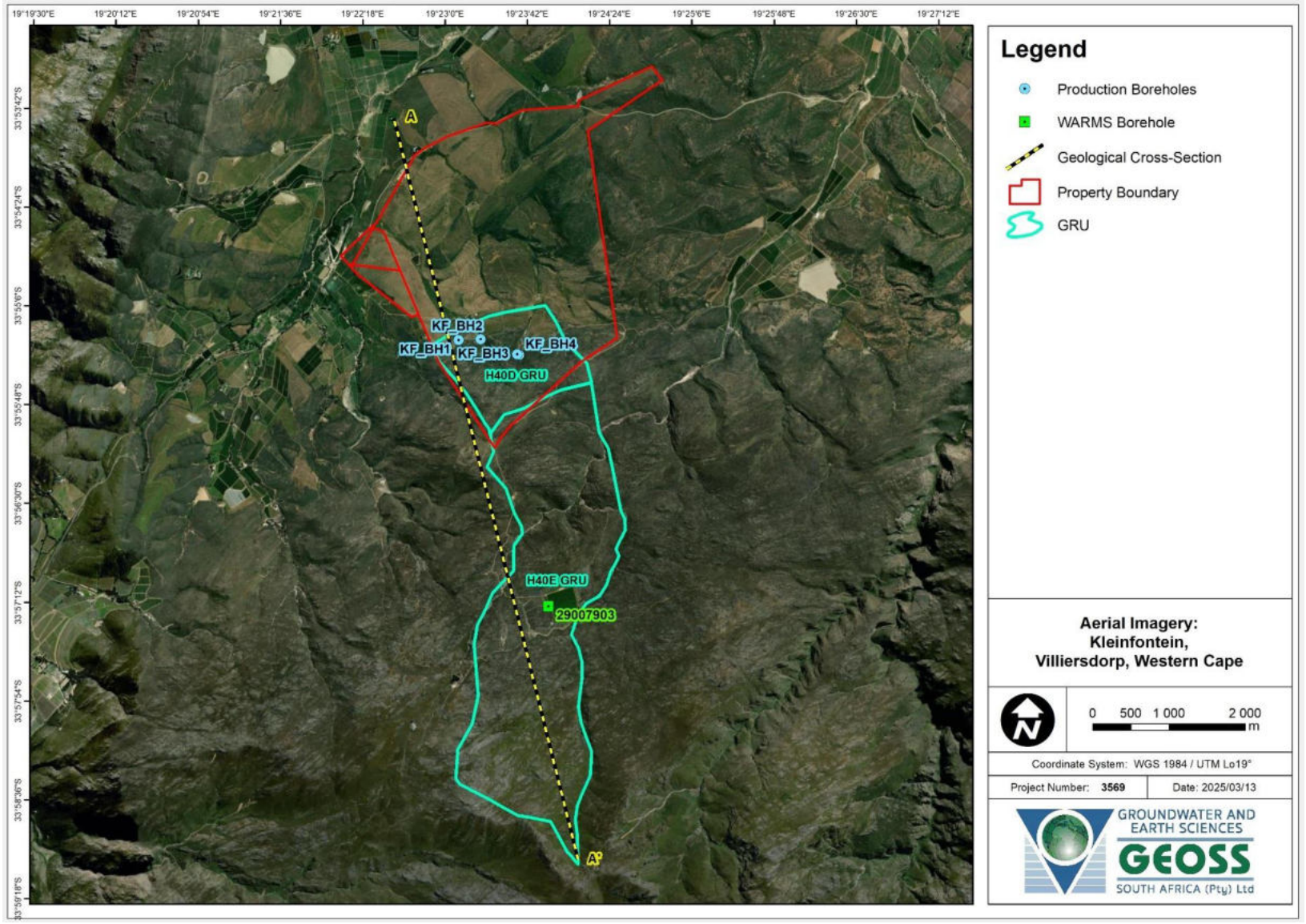


Figure 14: A schematic and conceptual east-west geological cross section.



Map 3: GRU, property boundaries and WARMS boreholes superimposed on a satellite image.

5 Recommendations

Based on the information obtained from the yield test, the abstraction recommendations for the boreholes are presented in **Table 10.** The yield testing was conducted with a Step Test, Constant Discharge Test and Recovery Test and while this data can be analysed to estimate sustainable yields, additional drilling in the area may result in long term cumulative impacts. Optimisation of the resource is also likely through making small changes to the abstraction rates, should the dynamic water level's drawdown be less or more than expected as per **Table 10.** Both of these points are best managed through long term monitoring data.

Table 10: Borehole Abstraction Recommendations.

Borehole Details				
Borehole Name	**Latitude (DD)**	**Longitude (DD)**	**Borehole Depth (m)**	**Inner Diameter (mm)**
KF_BH1	-33.922230°	19.385410°	96.94	150
KF_BH2	-33.922080°	19.388520°	163.00	210
KF_BH3	-33.923882°	19.393724°	206.00	210
KF_BH4	-33.923930°	19.394008°	90.30	210
Abstraction Recommendations				
Borehole Name	Abstraction rate (L/s)	Abstraction Duration (hrs)	Recovery Duration (hrs)	Possible Volume Abstracted (L/d)
KF_BH1	3.7	24	0	319 680
KF_BH2	1.2	24	0	103 680
KF_BH3	*Low yield - testing stopped*			-
KF_BH4	*Low yield - testing stopped*			-
			Total	**423 360**
Pump Installation Details				
Borehole Name	Pump Installation Depth (mbgl)	Critical Water Level (mbgl)	Dynamic Water Level (mbgl)*	Rest Water Level (mbgl)
KF_BH1	55.00	47.33	34.00	22.97
KF_BH2	115.00	110.80	77.00	5.31

* Typical water level expected during long-term production

For borehole KF_BH1 it is recommended that continuous abstraction can occur at a rate of up to 3.7 L/s. A pump suitable to deliver the recommended rate should be installed at a depth of 55.00 mbgl. It is anticipated that abstraction at the recommended rate will cause the water level to drop to a depth of approximately 34.00 mbgl – this is referred to as the dynamic water level. During abstraction, a maximum level cut off switch should be installed to 47.33 mbgl to ensure the groundwater level does not drop to the pump inlet.

For borehole KF_BH2 it is recommended that continuous abstraction can occur at a rate of up to 1.2 L/s. A pump suitable to deliver the recommended rate should be installed at a depth of 115.00 mbgl. It is anticipated that abstraction at the recommended rate will cause the water level to drop to a depth of approximately 77.00 mbgl (dynamic water level). During abstraction, a maximum level cut off switch should be installed to 110.80 mbgl to ensure the groundwater level does not drop to the pump inlet.

For both boreholes KF_BH3 and KF_BH4, yields are considered insufficient for use.

Laboratory results show that groundwater from the boreholes does not meet potable water quality standards due to elevated levels of several parameters, including high iron in all four boreholes and manganese in all except KF_BH1. Turbidity levels are significantly high (4.01–1 536 NTU), likely linked to iron and manganese, increasing the risk of biofouling and clogging of infrastructure. While pH and electrical conductivity are generally acceptable, KF_BH1 has a low pH (4.1), and KF_BH3 shows elevated fluoride (9.15 mg/L) exceeding the chronic health limits. Low levels of arsenic (0.015 mg/L) and lead (0.010 mg/L) were detected in KF_BH3 and KF_BH2, respectively, posing chronic health risks per SANS 241-1:2015. Ongoing monitoring of arsenic and lead is recommended. The groundwater is unsuitable for potable use without treatment but remains viable for irrigation if turbidity and iron concentrations are managed.

To address the potential for iron to clog the borehole and abstraction infrastructure, it is recommended to maintain a constant and continuous pumping schedule as much as possible. Thus, should a daily volume of less than 319 680 L/d for KF_BH1 and 103 680 L/d for KF_BH2 be required, it is recommended to decrease the pumping rate and not the pumping duration. By pumping continuously instead of a stop-start schedule, iron oxidation in the borehole is minimised, decreasing the amount of iron precipitation inside the boreholes and pumps.

Through long term water level monitoring data, the abstraction volumes can be optimised by adjusting the abstraction rate if required. It is recommended that the boreholes are equipped with a variable frequency drive. This enables adjustments to the flow rate to be made if required, as determined by the hydrogeological analysis of water level and flow rate monitoring data.

The proposed groundwater consumption from the boreholes is 70 000 m^3/annum. With regards to the regional groundwater availability within the local aquifer, a more localised aquifer (i.e., a groundwater resource unit (GRU)) was defined. The GRU encompassed an area of 9.78 km^2. Using the GRAII recharge values, the combined direct vertical recharge was calculated to be 202 063.33 m^3/a, with a firm yield of 132 048.60 m^3/a. The current volume of groundwater abstracted within the GRU, based on the registered WARMS boreholes (database last updated in May 2023), is 45 798.00 m^3/a. Based on these volumes, a volume of 86 250.60 m^3/a is available within the GRU.

As the proposed application volume is within the sustainable yield of the borehole and can be supported by the Firm Yield calculated for that GRU, the abstraction of the total volume of 70 000 m^3/a can be considered within the local aquifer`s capacity and sustainable. The proposed additional abstraction is not likely to impact on the regional groundwater flow, however site-specific long-term monitoring is required to ensure the sustainability of the abstraction.

As of January 2018 the Department of Water and Sanitation released a Government Gazette stating that: "All water use sector groups and individuals taking water from any water resource (surface or groundwater) regardless of the authorisation type, in the Berg, Olifants and Breede Gouritz Water Management Area, shall install electronic water recording, monitoring or measuring devices to enable monitoring of abstractions, storage and use of water by existing lawful users and establish links with any monitoring or management system as well as keep records of the water used."

Therefore, to facilitate monitoring and informed management of the boreholes, it is highly recommended that the boreholes be equipped with the following monitoring infrastructure and equipment (diagram included in **Appendix D**):

- Installation of a 32 mm (inner diameter, class 10) observation pipe from the pump depth to the surface, closed at the bottom and slotted for the bottom 5 – 10 m.
- Installation of an electronic water level logger (for automated water level monitoring).
- Installation of a sampling tap (to monitor water quality).
- Installation of a flow volume meter (to monitor abstraction rates and volumes).

This report is an important document for obtaining legal authorisation with the Department of Water and Sanitation with regard to the use of the groundwater. However, it does not serve as a Geohydrological Assessment Report in support of a Water Use Licence Application. Such a report would need to incorporate and expand upon the information provided here. GEOSS SA cannot guarantee that there is sufficient water in the aquifer to support the intended usage, or that the Department of Water and Sanitation will authorise the desired abstraction from this aquifer.

6 References

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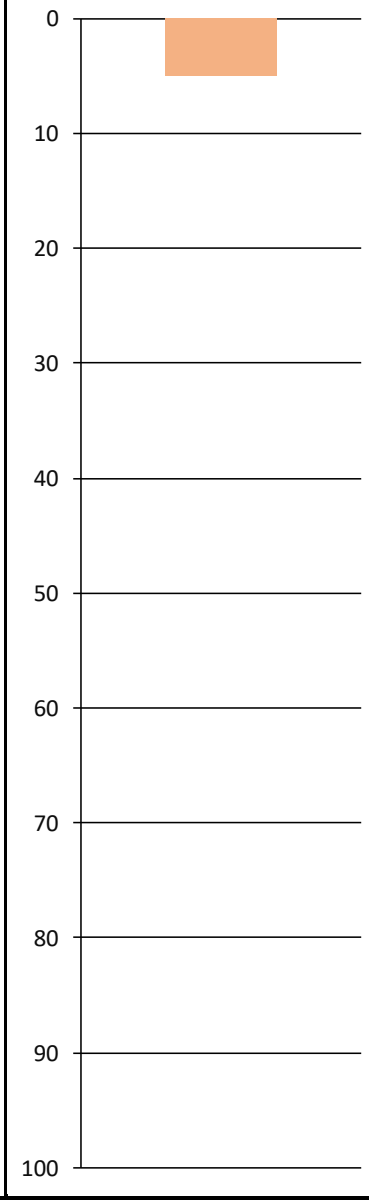
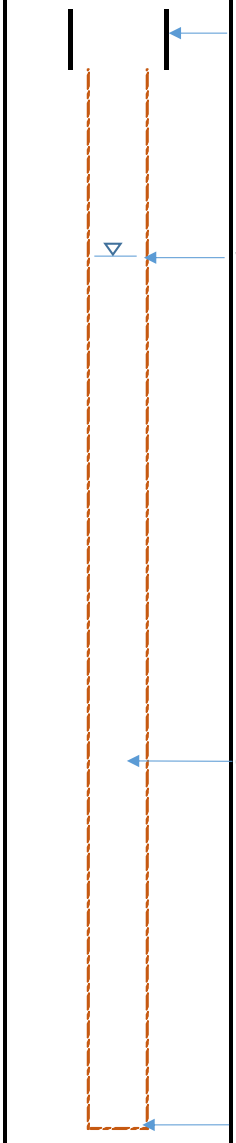
7 Appendix A: Estimated Borehole Logs

Log of Borehole No.: KF_BH1

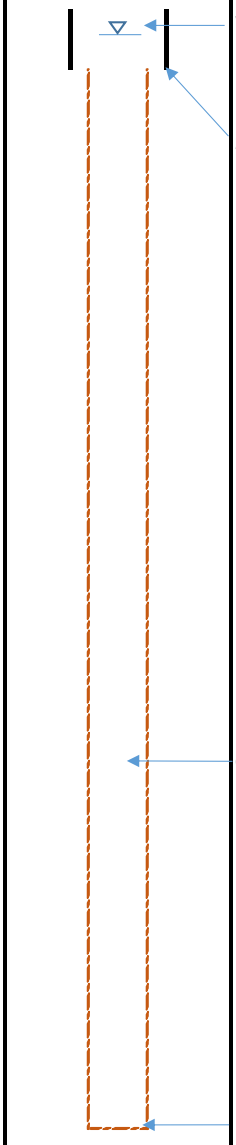
Location:	Villiersdorp	**Latitude:**	-33.92223
Date:	19/02/2025	**Longitude:**	19.38541
Client:	EFRC	**Ground Elevation:**	372 mamsl

Lithological Description	Lithology Symbol & Depth (m)	Borehole Construction	Description & water strike
Expected: Overburden **Unknow Geology** Expected: Gydo Fm. Black to dark-grey shale, siltstone and thin sandstone Expected: Rietvlei Fm. Light-grey feldspathic sandstone and micaceous shale bands			150 mm (ID) Steel casing (to unknown depth) Water level (22.97 mbgl) Open hole EOH (96.94 mbgl)

Drilled By:	Unknown	**Remarks:**	None of the estimated information included here is collected from the drilling records, but comes from the published 1:250 000 Geological Map of the area and measurements made during testing.
Drill Method:	Unknown		
Logged By:	Not logged, estimated from available data		

Log of Borehole No.: KF_BH2

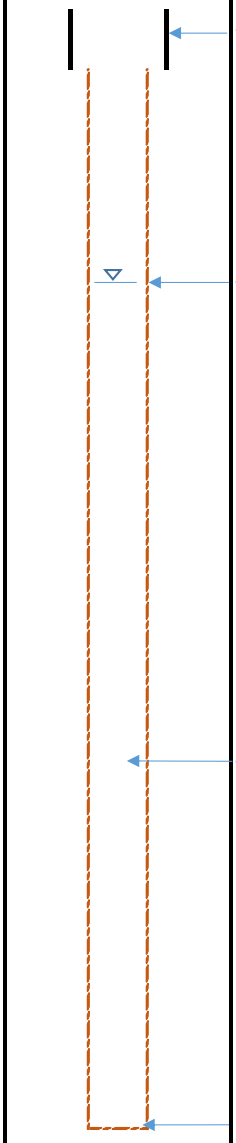
Location:	Villiersdorp	**Latitude:**	-33.92208
Date:	19/02/2025	**Longitude:**	19.38852
Client:	EFRC	**Ground Elevation:**	379 mamsl

Lithological Description	Lithology Symbol & Depth (m)	Borehole Construction	Description & water strike
Expected: Overburden **Unknow Geology** Expected: Rietvlei Fm. Light-grey feldspathic sandstone and micaceous shale bands	0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170		Water level (5.31 mbgl) 210 mm (ID) Steel casing (to unknown depth) Open hole EOH (163 mbgl)

Drilled By:	Unknown	**Remarks:**	None of the estimated information included here is collected from the drilling records, but comes from the published 1:250 000 Geological Map of the area and measurements made during testing.
Drill Method:	Unknown		
Logged By:	Not logged, estimated from available data		

Log of Borehole No.: KF_BH3

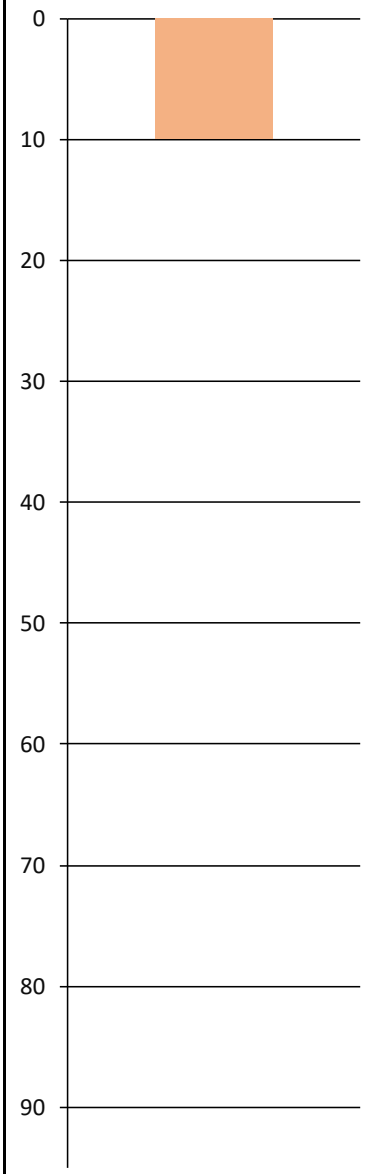
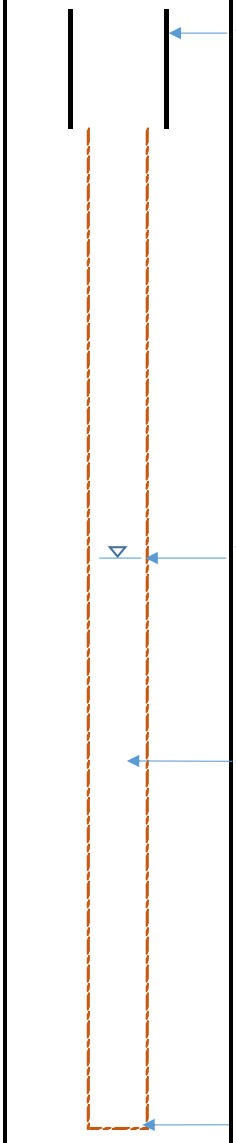
Location:	Villiersdorp	**Latitude:**	-33.923882
Date:	19/02/2025	**Longitude:**	19.393724
Client:	EFRC	**Ground Elevation:**	415 mamsl

Lithological Description	Lithology Symbol & Depth (m)	Borehole Construction	Description & water strike
Expected: Overburden **Unknow Geology** Expected: Rietvlei Fm. Light-grey feldspathic sandstone and micaceous shale bands	0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210		210 mm (ID) Steel casing (to unknown depth) Water level (48.62 mbgl) Open hole EOH (206 mbgl)

Drilled By:	Unknown	**Remarks:**	None of the estimated information included here is collected from the drilling records, but comes from the published 1:250 000 Geological Map of the area and measurements made during testing.
Drill Method:	Unknown		
Logged By:	Not logged, estimated from available data		

Log of Borehole No.: KF_BH4

Location:	Villiersdorp	**Latitude:**	-33.92393
Date:	19/02/2025	**Longitude:**	19.394008
Client:	EFRC	**Ground Elevation:**	413 mamsl

Lithological Description	Lithology Symbol & Depth (m)	Borehole Construction	Description & water strike
Expected: Overburden **Unknow Geology** Expected: Rietvlei Fm. Light-grey feldspathic sandstone and micaceous shale bands			210 mm (ID) Steel casing (to unknown depth) Water level (45.14 mbgl) Open hole EOH (90.3 mbgl)

Drilled By:	Unknown	**Remarks:**	None of the estimated information included here is collected from the drilling records, but comes from the published 1:250 000 Geological Map of the area and measurements made during testing.
Drill Method:	Unknown		
Logged By:	Not logged, estimated from available data		

8 Appendix B:Yield Test Data

Abbreviations	
EC	Electrical conductivity
mbgl	Meters below ground level
mbch	Meters below casing height
mbdl	Meters below datum level
magl	Meters above ground level
L/S	Litres per second
RPM	Rates per minute
S/WL	Static water level
µS/cm	Microsiemens per centimeter

BOREHOLE TEST RECORD

PR0JECT #	P3056
TEAM MEMBERS	

CONSULTANT: GEOSS
DISTRICT: BREEDE VALLEY
PROVINCE: WESTERN CAPE
FARM / VILLAGE NAME : ELGIN VILLIERSDORP
DATE TESTED: 28-01-2025

BOREHOLE LOCATION & ACCESS INFORMATION:

BOREHOLE COORDINATES

LATITUDE (SOUTH):	S33.92223
LONGITUDE (EAST):	E19.38541

COMMENTS ON ACCESS IF ANY:

BOREHOLE NO:	**BH01**
TRANSMISSIVITY VALUE:	
TYPE INSTALLATION:	**SUBMERSIBLE PUMP**
BOREHOLE DEPTH: (mbg	**96.94**

MAINTENANCE RECORD:		**REHABILITATION RECORD:**		**DIGITAL CAMERA LOGGING:**		**EQUIPMENT FISHING RECORD**	
Labour hours:		**Jetting hours:**		**Camera logged once:**		**Hours spent:**	
Cost of material:		**Brushing hours:**		**Camera logged twice:**			
Travelling (km):		**Airlifting hours:**		**Camera logged three times:**		**OTHER COSTS ON PROJECT:**	
		Sulphamic Acid KG's		**Camera work sent to client:**		**Courier of samples:**	
		Boresaver KG's				**Km's for delivery:**	
		Soda Ash KG's				**Cost of packaging:**	

COMMENTS:	**RECOMMENDATIONS / CORRECTIVE ACTIONS:**

SAMPLE INSTRUCTIONS :

Water sample taken	Yes	No	If consultant took sample, give name:		**DATA CAPTURED BY**	AH
Date sample taken	29-01-2025		If sample courier, to where:		**DATA CHECKED BY:**	AH
Time sample taken	14H40					

DESCRIPTION:	**UNIT**	**QTY**		**UNIT**	**QTY**
STRAIGHTNESS TEST:	**NO**	0	BOREHOLE DEPTH AFTER TEST:	**M**	96.90
VERTICALLY TEST:	**NO**	0	BOREHOLE WATER LEVEL AFTER TEST: (mbch)	**M**	24.35
CASING DETECTION:	**NO**	1	SAND/GRAVEL/SILT PUMPED?	**YES/NO**	**0**
SUPPLIED NEW STEEL BOREHOLE COVER:	**NO**	0	DATA REPORTING AND RECORDING	**NO**	1
BOREHOLE MARKING	**NO**	0	SLUG TEST:	**NO**	0
SITE CLEANING & FINISHING	**NO**	1	LAYFLAT (M):	**M**	100
LOGGERS FOR WATERLEVEL MONITORING	**NO**	0	LOGGERS FOR pH AND EC:	**NO**	0

It is hereby acknowledged that upon leaving the site, all existing equipment is in an acceptable condition.

NAME: _____ **SIGNATURE:** _____

DESIGNATION: _____ **DATE:** _____

FORM 5 E

STEPPED DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3056	Coordinates:	SOUTH: S33.92223	PROVINCE:	WESTERN CAPE
BOREHOLE NO:	BH01		EAST: E19.38541	DISTRICT:	BREEDE VALLEY
ALT BH NO:	0			SITE NAME:	ELGIN VILLIERSDORP
ALT BH NO:	0				
BOREHOLE DEPTH (m)	96.94	DATUM LEVEL ABOVE CASING (m):	0.64	EXISTING PUMP:	SUBMERSIBLE
WATER LEVEL (mbdl):	23.61	CASING HEIGHT: (magl):	0.00	CONTRACTOR:	ATS
DEPTH OF PUMP (m):	90-50	DIAM PUMP INLET (mm):	150.00	PUMP TYPE:	WA30-2

STEPPED DISCHARGE TEST & RECOVERY

DISCHARGE RATE 1			RPM 408		DISCHARGE RATE 2			RPM 610		DISCHARGE RATE 3			RPM 1110	
DATE: 28-01-2025		TIME: 07H00			DATE: 28-01-202		TIME: 08H00			DATE: 28-01-202		TIME: 09H00		
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1	0.15		**1**		**1**	1.52		**1**		**1**	3.62		**1**	4.86
2	0.16		**2**		**2**	1.82	1.97	**2**		**2**	4.05		**2**	3.02
3	0.17		**3**		**3**	2.04	2.54	**3**		**3**	4.80	5.13	**3**	2.55
5	0.20	0.87	**5**		**5**	2.19		**5**		**5**	5.03	5.13	**5**	1.61
7	0.23	1.01	**7**		**7**	2.23	2.55	**7**		**7**	5.22		**7**	1.54
10	0.69		**10**		**10**	2.30		**10**		**10**	5.38	5.11	**10**	1.38
15	0.77	1.03	**15**		**15**	2.37	2.53	**15**		**15**	5.57		**15**	1.19
20	0.82		**20**		**20**	2.42		**20**		**20**	5.69	5.12	**20**	1.07
30	0.87	1.02	**30**		**30**	2.48	2.54	**30**		**30**	5.83		**30**	0.92
40	0.92		**40**		**40**	2.55		**40**		**40**	5.97	5.10	**40**	0.80
50	0.94	1.01	**50**		**50**	2.59	2.55	**50**		**50**	6.07		**50**	0.73
60	0.97		**60**		**60**	2.63		**60**		**60**	6.13	5.13	**60**	0.69
70			**70**		**70**			**70**		**70**			**70**	0.64
80			**80**		**80**			**80**		**80**			**80**	0.59
90			**90**		**90**			**90**		**90**			**90**	0.57
100			**100**		**100**			**100**		**100**			**100**	0.54
110			**110**		**110**			**110**		**110**			**110**	0.51
120			**120**		**120**			**120**		**120**			**120**	0.48
pH			**150**		**pH**			**150**		**pH**			**150**	0.41
TEMP	11.90	°C	**180**		**TEMP**	11.40	°C	**180**		**TEMP**	11.70	°C	**180**	0.37
EC	1023	µS/cm	**210**		**EC**	534	µS/cm	**210**		**EC**	525	µS/cm	**210**	

DISCHARGE RATE 4			RPM		DISCHARGE RATE 5			RPM		DISCHARGE RATE 6			RPM	
DATE:		TIME:			DATE:		TIME:			DATE:		TIME:		
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1			**1**		**1**			**1**		**1**			**1**	
2			**2**		**2**			**2**		**2**			**2**	
3			**3**		**3**			**3**		**3**			**3**	
5			**5**		**5**			**5**		**5**			**5**	
7			**7**		**7**			**7**		**7**			**7**	
10			**10**		**10**			**10**		**10**			**10**	
15			**15**		**15**			**15**		**15**			**15**	
20			**20**		**20**			**20**		**20**			**20**	
30			**30**		**30**			**30**		**30**			**30**	
40			**40**		**40**			**40**		**40**			**40**	
50			**50**		**50**			**50**		**50**			**50**	
60			**60**		**60**			**60**		**60**			**60**	
70			**70**		**70**			**70**		**70**			**70**	
80			**80**		**80**			**80**		**80**			**80**	
90			**90**		**90**			**90**		**90**			**90**	
100			**100**		**100**			**100**		**100**			**100**	
110			**110**		**110**			**110**		**110**			**110**	
120			**120**		**120**			**120**		**120**			**120**	
pH			**150**		**pH**			**150**		**pH**			**150**	
TEMP		°C	**180**		**TEMP**		°C	**180**		**TEMP**		°C	**180**	
EC		µS/cm	**210**		**EC**		µS/cm	**210**		**EC**		µS/cm	**210**	
			240					**240**					**240**	
			300					**300**					**300**	
			360					**360**					**360**	

S/W/L:(mbch) 22.97

FORM 5 F

CONSTANT DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3056	Coordinates: SOUTH:	S33.92223	PROVINCE:	WESTERN CAPE
BOREHOLE NO:	BH01	EAST:	E19.38541	DISTRICT:	BREEDE VALLEY
ALT BH NO:	0			SITE NAME:	ELGIN VILLIERSDORP
ALT BH NO:	0				
BOREHOLE DEPTH:	96.94	DATUM LEVEL ABOVE CASING (m):	0.64	EXISTING PUMP:	SUBMERSIBLE
WATER LEVEL (mbdl):	23.87	CASING HEIGHT: (magl):	0.00	CONTRACTOR:	ATS
DEPTH OF PUMP (m):	90-50	DIAM PUMP INLET(mm):	150	PUMP TYPE:	WA30-2

CONSTANT DISCHARGE TEST & RECOVERY

TEST STARTED				**TEST COMPLETED**					
DATE:	28-01-2025	TIME:	15H00	DATE:		TIME:		TYPE OF PUMP:	WA30-2

					OBSERVATION HOLE 1			OBSERVATION HOLE 2			OBSERVATION HOLE 3	
					NR: **BH02**			NR:			NR:	
DISCHARGE BOREHOLE					Distance(m);		290	Distance(m);			Distance(m);	
TIME	DRAW	YIELD	TIME	RECOVERY	TIME:	Drawdown	Recovery	TIME:	Drawdown	Recovery	TIME:	Drawdown
(MIN)	DOWN (M)	(L/S)	MIN	(M)	(min)	m	(m)	(min)	(m)		(min)	(m)
1	1.61		**1**	6.66	**1**			**1**			**1**	
2	2.32		**2**	5.50	**2**			**2**			**2**	
3	2.97	4.77	**3**	4.48	**3**			**3**			**3**	
5	3.32	5.14	**5**	4.34	**5**			**5**			**5**	
7	4.20		**7**	4.17	**7**			**7**			**7**	
10	4.47	5.15	**10**	4.03	**10**			**10**			**10**	
15	5.01		**15**	3.82	**15**			**15**			**15**	
20	5.24	5.13	**20**	3.70	**20**			**20**			**20**	
30	5.50		**30**	3.50	**30**	0.00		**30**			**30**	
40	5.69	5.12	**40**	3.35	**40**			**40**			**40**	
60	5.91		**60**	3.13	**60**	0.00		**60**			**60**	
90	6.14	5.10	**90**	2.90	**90**	0.00		**90**			**90**	
120	6.45		**120**	2.73	**120**	0.00		**120**			**120**	
150	6.63	5.15	**150**	2.60	**150**	0.00		**150**			**150**	
180	6.74		**180**	2.50	**180**	0.00		**180**			**180**	
210	6.88	5.13	**210**	2.41	**210**	0.00		**210**			**210**	
240	6.98		**240**	2.33	**240**	0.00		**240**			**240**	
300	7.18	5.14	**300**	2.21	**300**	0.00		**300**			**300**	
360	7.34		**360**	2.12	**360**	0.00		**360**			**360**	
420	7.47	5.12	**420**	2.06	**420**	0.00		**420**			**420**	
480	7.62		**480**	2.01	**480**	0.00		**480**			**480**	
540	7.70	5.13	**540**	1.96	**540**	0.00		**540**			**540**	
600	7.74		**600**	1.90	**600**	0.00		**600**			**600**	
720	7.87	5.15	**720**	1.82	**720**	0.00		**720**			**720**	
840	7.98		**840**	1.73	**840**	0.00		**840**			**840**	
960	8.14	5.14	**960**	1.67	**960**	0.00		**960**			**960**	
1080	8.25		**1080**	1.63	**1080**	0.00		**1080**			**1080**	
1200	8.37	5.11	**1200**	1.59	**1200**	0.00		**1200**			**1200**	
1320	8.55		**1320**	1.55	**1320**	0.00		**1320**			**1320**	
1440	8.67	5.12	**1440**	1.50	**1440**	0.00		**1440**			**1440**	
1560			**1560**		**1560**			**1560**			**1560**	
1680			**1680**		**1680**			**1680**			**1680**	
1800			**1800**		**1800**			**1800**			**1800**	
1920			**1920**		**1920**			**1920**			**1920**	
2040			**2040**		**2040**			**2040**			**2040**	
2160			**2160**		**2160**			**2160**			**2160**	
2280			**2280**		**2280**			**2280**			**2280**	
2400			**2400**		**2400**			**2400**			**2400**	
2520			**2520**		**2520**			**2520**			**2520**	
2640			**2640**		**2640**			**2640**			**2640**	
2760			**2760**		**2760**			**2760**			**2760**	
2880			**2880**		**2880**			**2880**			**2880**	
3000			**3000**		**3000**			**3000**			**3000**	
3120			**3120**		**3120**			**3120**			**3120**	
3240			**3240**		**3240**			**3240**			**3240**	
3360			**3360**		**3360**			**3360**			**3360**	
3480			**3480**		**3480**			**3480**			**3480**	
3600			**3600**		**3600**			**3600**			**3600**	
3720			**3720**		**3720**			**3720**			**3720**	
3840			**3840**		**3840**			**3840**			**3840**	
3960			**3960**		**3960**			**3960**			**3960**	
4080			**4080**		**4080**			**4080**			**4080**	
4200			**4200**		**4200**			**4200**			**4200**	
4320			**4320**		**4320**			**4320**			**4320**	
Total time pumped(min):				1440		**W/L**	**5.44**		**W/L**			**W/L**
Average yield (l/s):				5.12								

Abbreviations	
EC	Electrical conductivity
mbgl	Meters below ground level
mbch	Meters below casing height
mbdl	Meters below datum level
magl	Meters above ground level
L/S	Litres per second
RPM	Rates per minute
S/W/L	Static water level
uS/cm	Microsiemens per centimeter

BOREHOLE TEST RECORD

CONSULTANT:	GEOSS
DISTRICT:	BREEDE VALLEY
PROVINCE:	WESTERN CAPE
FARM / VILLAGE NAME :	ELGIN VILLIERS DORP
DATE TESTED:	31/01/2025

PR0JECT #	P3056
TEAM MEMBERS	PIETER
	KOLEN
	LUKHANYO

BOREHOLE LOCATION & ACCESS INFORMATION:

BOREHOLE COORDINATES		**COMMENTS ON ACCESS IF ANY:**
LATITUDE (SOUTH):	33.92208	
LONGITUDE (EAST):	19.38852	

BOREHOLE NO:	**BH 2**
TRANSMISSIVITY VALUE:	
TYPE INSTALLATION:	**NEW**
BOREHOLE DEPTH: (mbg	**163**

MAINTENANCE RECORD:		**REHABILITATION RECORD:**		**DIGITAL CAMERA LOGGING:**		**EQUIPMENT FISHING RECORD**	
Labour hours:		**Jetting hours:**		**Camera logged once:**		**Hours spent:**	
Cost of material:		**Brushing hours:**		**Camera logged twice:**			
Travelling (km):		**Airlifting hours:**		**Camera logged three times:**		**OTHER COSTS ON PROJECT:**	
		Sulphamic Acid KG's		**Camera work sent to client:**		**Courier of samples:**	
		Boresaver KG's				**Km's for delivery:**	
		Soda Ash KG's				**Cost of packaging:**	

COMMENTS:	**RECOMMENDATIONS / CORRECTIVE ACTIONS:**
DID STEPS AT 121M, AS PER INSTRUCTION WE NEED TO LOWER THE PUMP TO 150M.RODS STRIPPED AT 150MIN INTO THE CDT. RE-INSTALLED A SMALL PUMP AND RE-STARTED THE CDT	

SAMPLE INSTRUCTIONS :

Water sample taken	**Yes**	No	If consultant took sample, give name:		**DATA CAPTURED BY**	EC
Date sample taken	04/02/2025		If sample courier, to where:		**DATA CHECKED BY:**	AH
Time sample taken	06H30					

DESCRIPTION:	**UNIT**	**QTY**		**UNIT**	**QTY**
STRAIGHTNESS TEST:	**NO**	0	BOREHOLE DEPTH AFTER TEST:	**M**	163.00
VERTICALLY TEST:	**NO**	0	BOREHOLE WATER LEVEL AFTER TEST: (mbch)	**M**	21.71
CASING DETECTION:	**NO**	1	SAND/GRAVEL/SILT PUMPED?	**YES/NO**	**0**
SUPPLIED NEW STEEL BOREHOLE COVER:	**NO**	0	DATA REPORTING AND RECORDING	**NO**	1
BOREHOLE MARKING	**NO**	0	SLUG TEST:	**NO**	0
SITE CLEANING & FINISHING	**NO**	1	LAYFLAT (M):	**M**	100
LOGGERS FOR WATERLEVEL MONITORING	**NO**	0	LOGGERS FOR pH AND EC:	**NO**	0

It is hereby acknowledged that upon leaving the site, all existing equipment is in an acceptable condition.

NAME: _____ **SIGNATURE:** _____

DESIGNATION: _____ **DATE:** _____

FORM 5 E

STEPPED DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3056	Coordinates:	SOUTH: 33.92208	PROVINCE:	WESTERN CAPE
BOREHOLE NO:	BH 2		EAST: 19.38852	DISTRICT:	BREEDE VALLEY
ALT BH NO:	0			SITE NAME:	ELGIN VILLIERS DORP
ALT BH NO:	0				

BOREHOLE DEPTH (m)	163.00	DATUM LEVEL ABOVE CASING (m):	0.80	EXISTING PUMP:	0
WATER LEVEL (mbdl):	6.24	CASING HEIGHT: (magl):	0.13	CONTRACTOR:	ATS
DEPTH OF PUMP (m):	121.50	DIAM PUMP INLET (mm):	210.00	PUMP TYPE:	WA 50-2

STEPPED DISCHARGE TEST & RECOVERY

DISCHARGE RATE 1			RPM 121		DISCHARGE RATE 2			RPM 229		DISCHARGE RATE 3			RPM 314	
DATE:	31/01/2025	TIME:	12H10		DATE:	31/01/2025	TIME:	13H00		DATE:	31/01/2025	TIME:	14H10	
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1	1.25		**1**		**1**	46.95		**1**		**1**	78.10		**1**	
2	2.67		**2**		**2**	48.15	1.27	**2**		**2**	79.34	1.62	**2**	
3	4.71	0.68	**3**		**3**	49.50	1.44	**3**		**3**	80.54	1.84	**3**	
5	7.33		**5**		**5**	53.98		**5**		**5**	81.95		**5**	
7	9.65	1.05	**7**		**7**	54.04	1.42	**7**		**7**	82.70	1.81	**7**	
10	12.21		**10**		**10**	57.52		**10**		**10**	84.29		**10**	
15	14.05	1.03	**15**		**15**	61.38	1.41	**15**		**15**	86.38	1.82	**15**	
20	18.40		**20**		**20**	65.60		**20**		**20**	89.59		**20**	
30	27.69	1.04	**30**		**30**	71.78	1.43	**30**		**30**	93.73	1.84	**30**	
40	33.50		**40**		**40**	75.58		**40**		**40**	95.47		**40**	
50	42.62	1.02	**50**		**50**	77.26	1.45	**50**		**50**	96.15	1.81	**50**	
60	46.75		**60**		**60**	77.88		**60**		**60**	96.45		**60**	
70			**70**		**70**			**70**		**70**			**70**	
80			**80**		**80**			**80**		**80**			**80**	
90			**90**		**90**			**90**		**90**			**90**	
100			**100**		**100**			**100**		**100**			**100**	
110			**110**		**110**			**110**		**110**			**110**	
120			**120**		**120**			**120**		**120**			**120**	
pH			**150**		**pH**			**150**		**pH**			**150**	
TEMP	16.10	°C	**180**		**TEMP**	16.10	°C	**180**		**TEMP**	16.10	°C	**180**	
EC	274	µS/cm	**210**		**EC**	309	µS/cm	**210**		**EC**	336	µS/cm	**210**	

DISCHARGE RATE 4			RPM 387		DISCHARGE RATE 5			RPM		DISCHARGE RATE 6			RPM	
DATE:	31/01/2025	TIME:	15H10		DATE:		TIME:			DATE:		TIME:		
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1	97.49		**1**	110.25	**1**			**1**		**1**			**1**	
2	98.98	1.98	**2**	98.95	**2**			**2**		**2**			**2**	
3	100.63	2.42	**3**	94.87	**3**			**3**		**3**			**3**	
5	103.06		**5**	89.63	**5**			**5**		**5**			**5**	
7	105.38	2.41	**7**	83.83	**7**			**7**		**7**			**7**	
10	108.64		**10**	76.65	**10**			**10**		**10**			**10**	
15	113.32		**15**	65.36	**15**			**15**		**15**			**15**	
	113.32	1.68	**20**	55.15	**20**			**20**		**20**			**20**	
	113.32	1.62	**30**	38.87	**30**			**30**		**30**			**30**	
	113.32	1.60	**40**	28.08	**40**			**40**		**40**			**40**	
			50	23.01	**50**			**50**		**50**			**50**	
			60	19.39	**60**			**60**		**60**			**60**	
			70	17.97	**70**			**70**		**70**			**70**	
			80	17.27	**80**			**80**		**80**			**80**	
			90	16.90	**90**			**90**		**90**			**90**	
			100	16.65	**100**			**100**		**100**			**100**	
			110	16.48	**110**			**110**		**110**			**110**	
			120	16.17	**120**			**120**		**120**			**120**	
pH			**150**	15.97	**pH**			**150**		**pH**			**150**	
TEMP		°C	**180**	15.59	**TEMP**		°C	**180**		**TEMP**		°C	**180**	
EC		µS/cm	**210**	15.18	**EC**		µS/cm	**210**		**EC**		µS/cm	**210**	
			240					**240**					**240**	
			300					**300**					**300**	
			360					**360**					**360**	

S/W/L:(mbch) 5.4

FORM 5 F

CONSTANT DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3056	Coordinates: SOUTH:	33.92208	PROVINCE:	WESTERN CAPE
BOREHOLE NO:	BH 2	EAST:	19.38852	DISTRICT:	BREEDE VALLEY
ALT BH NO:	0			SITE NAME:	ELGIN VILLIERS DORP
ALT BH NO:	0				
BOREHOLE DEPTH:	163.00	DATUM LEVEL ABOVE CASING (m):	0.80	EXISTING PUMP:	0
WATER LEVEL (mbdl):	20.70	CASING HEIGHT: (magl):	0.13	CONTRACTOR:	ATS
DEPTH OF PUMP (m):	151.50	DIAM PUMP INLET(mm):	210	PUMP TYPE:	WA 50-2

CONSTANT DISCHARGE TEST & RECOVERY

TEST STARTED				**TEST COMPLETED**					
DATE:	03/02/2025	TIME:	07H00	DATE:		TIME:		TYPE OF PUMP:	WA 50-2

					OBSERVATION HOLE 1			OBSERVATION HOLE 2			OBSERVATION HOLE 3	
					NR: **BH 1**			NR:			NR:	
DISCHARGE BOREHOLE					Distance(m);		270	Distance(m);			Distance(m);	
TIME	DRAW	YIELD	TIME	RECOVERY	TIME:	Drawdown	Recovery	TIME:	Drawdown	Recovery	TIME:	Drawdown
(MIN)	DOWN (M)	(L/S)	MIN	(M)	(min)	m	(m)	(min)	(m)		(min)	(m)
1	0.90		**1**	59.72	**1**			**1**			**1**	
2	0.92		**2**	55.02	**2**			**2**			**2**	
3	1.00		**3**	49.49	**3**			**3**			**3**	
5	2.05		**5**	47.00	**5**			**5**			**5**	
7	4.26	1.18	**7**	42.41	**7**			**7**			**7**	
10	7.61	1.31	**10**	38.67	**10**			**10**			**10**	
15	12.05	1.51	**15**	30.02	**15**			**15**			**15**	
20	14.52		**20**	23.02	**20**			**20**			**20**	
30	23.12	1.53	**30**	14.60	**30**	0.00		**30**			**30**	
40	29.85		**40**	10.65	**40**			**40**			**40**	
60	36.44	1.52	**60**	5.38	**60**	0.00		**60**			**60**	
90	42.09		**90**	4.39	**90**	0.00		**90**			**90**	
120	47.45	1.50	**120**	4.04	**120**	0.00		**120**			**120**	
150	49.55		**150**	3.93	**150**	0.00		**150**			**150**	
180	53.03	1.53	**180**	3.86	**180**	0.00		**180**			**180**	
210	57.30		**210**	3.80	**210**	0.00		**210**			**210**	
240	59.19	1.53	**240**	3.69	**240**	0.00		**240**			**240**	
300	61.09	1.50	**300**	3.60	**300**	0.00		**300**			**300**	
360	62.67		**360**	3.49	**360**	0.00		**360**			**360**	
420	65.57	1.53	**420**	3.45	**420**	0.00		**420**			**420**	
480	66.28		**480**	3.40	**480**	0.00		**480**			**480**	
540	66.79	1.50	**540**	3.34	**540**	0.00		**540**			**540**	
600	68.58		**600**	3.28	**600**	0.00		**600**			**600**	
720	69.70	1.51	**720**	3.15	**720**	0.00		**720**			**720**	
840	69.84	1.52	**840**	3.08	**840**	0.00		**840**			**840**	
960	69.86	1.53	**960**	2.98	**960**	0.00		**960**			**960**	
1080	69.90		**1080**	2.87	**1080**	0.00		**1080**			**1080**	
1200	69.95	1.50	**1200**	2.79	**1200**	0.00		**1200**			**1200**	
1320	70.01		**1320**	2.70	**1320**	0.00		**1320**			**1320**	
1440	70.07	1.52	**1440**	2.64	**1440**	0.00		**1440**			**1440**	
1560			**1560**		**1560**			**1560**			**1560**	
1680			**1680**		**1680**			**1680**			**1680**	
1800			**1800**		**1800**			**1800**			**1800**	
1920			**1920**		**1920**			**1920**			**1920**	
2040			**2040**		**2040**			**2040**			**2040**	
2160			**2160**		**2160**			**2160**			**2160**	
2280			**2280**		**2280**			**2280**			**2280**	
2400			**2400**		**2400**			**2400**			**2400**	
2520			**2520**		**2520**			**2520**			**2520**	
2640			**2640**		**2640**			**2640**			**2640**	
2760			**2760**		**2760**			**2760**			**2760**	
2880			**2880**		**2880**			**2880**			**2880**	
3000			**3000**		**3000**			**3000**			**3000**	
3120			**3120**		**3120**			**3120**			**3120**	
3240			**3240**		**3240**			**3240**			**3240**	
3360			**3360**		**3360**			**3360**			**3360**	
3480			**3480**		**3480**			**3480**			**3480**	
3600			**3600**		**3600**			**3600**			**3600**	
3720			**3720**		**3720**			**3720**			**3720**	
3840			**3840**		**3840**			**3840**			**3840**	
3960			**3960**		**3960**			**3960**			**3960**	
4080			**4080**		**4080**			**4080**			**4080**	
4200			**4200**		**4200**			**4200**			**4200**	
4320			**4320**		**4320**			**4320**			**4320**	
Total time pumped(min):				1440		**W/L**	**23.81**		**W/L**			**W/L**
Average yield (l/s):				1.50								

Abbreviations	
EC	Electrical conductivity
mbgl	Meters below ground level
mbch	Meters below casing height
mbdl	Meters below datum level
magl	Meters above ground level
L/S	Litres per second
RPM	Rates per minute
S/W/L	Static water level
uS/cm	Microsiemens per centimeter

BOREHOLE TEST RECORD

CONSULTANT:	GEOSS
DISTRICT:	VILLIERSDORP
PROVINCE:	WESTERN CAPE
FARM / VILLAGE NAME :	ELGIN
DATE TESTED:	01-02-2025

PR0JECT #	P3056
TEAM MEMBERS	TAFARA
	LUTHANDO
	TSHIFIWA
	COLLEN

BOREHOLE LOCATION & ACCESS INFORMATION:

BOREHOLE COORDINATES		**COMMENTS ON ACCESS IF ANY:**
LATITUDE (SOUTH):	33.923914	
LONGITUDE (EAST):	19.89369	

BOREHOLE NO:	**BH 03**
TRANSMISSIVITY VALUE:	
TYPE INSTALLATION:	**OPEN BOREHOLE**
BOREHOLE DEPTH: (mbg	**206**

MAINTENANCE RECORD:		**REHABILITATION RECORD:**		**DIGITAL CAMERA LOGGING:**		**EQUIPMENT FISHING RECORD**	
Labour hours:		**Jetting hours:**		**Camera logged once:**		**Hours spent:**	
Cost of material:		**Brushing hours:**		**Camera logged twice:**			
Travelling (km):		**Airlifting hours:**		**Camera logged three times:**		**OTHER COSTS ON PROJECT:**	
		Sulphamic Acid KG's		**Camera work sent to client:**		**Courier of samples:**	
		Boresaver KG's				**Km's for delivery:**	
		Soda Ash KG's				**Cost of packaging:**	

COMMENTS:	**RECOMMENDATIONS / CORRECTIVE ACTIONS:**

SAMPLE INSTRUCTIONS :

Water sample taken	**Yes**	No	If consultant took sample, give name:		**DATA CAPTURED BY**	EC
Date sample taken	02/02/2025		If sample courier, to where:		**DATA CHECKED BY:**	AH
Time sample taken	08H20					

DESCRIPTION:	**UNIT**	**QTY**		**UNIT**	**QTY**
STRAIGHTNESS TEST:	**NO**	0	BOREHOLE DEPTH AFTER TEST:	**M**	206.15
VERTICALLY TEST:	**NO**	0	BOREHOLE WATER LEVEL AFTER TEST: (mbch)	**M**	55.62
CASING DETECTION:	**NO**	6.1	SAND/GRAVEL/SILT PUMPED?	**YES/NO**	**0**
SUPPLIED NEW STEEL BOREHOLE COVER:	**NO**	0	DATA REPORTING AND RECORDING	**NO**	1
BOREHOLE MARKING	**NO**	0	SLUG TEST:	**NO**	0
SITE CLEANING & FINISHING	**NO**	1	LAYFLAT (M):	**M**	50
LOGGERS FOR WATERLEVEL MONITORING	**NO**	0	LOGGERS FOR pH AND EC:	**NO**	0

It is hereby acknowledged that upon leaving the site, all existing equipment is in an acceptable condition.

NAME: _____ **SIGNATURE:** _____

DESIGNATION: _____ **DATE:** _____

FORM 5 E

STEPPED DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3056	Coordinates:	SOUTH: 33.92391	PROVINCE:	WESTERN CAPE
BOREHOLE NO:	BH 03		EAST: 19.89369	DISTRICT:	VILLIERSDORP
ALT BH NO:	0			SITE NAME:	ELGIN
ALT BH NO:	0				

BOREHOLE DEPTH (m)	206.00	DATUM LEVEL ABOVE CASING (m):	0.39	EXISTING PUMP:	0
WATER LEVEL (mbdl):	49.41	CASING HEIGHT: (magl):	0.40	CONTRACTOR:	ATS
DEPTH OF PUMP (m):	150.50	DIAM PUMP INLET (mm):	210.00	PUMP TYPE:	WA 30-2

STEPPED DISCHARGE TEST & RECOVERY

DISCHARGE RATE 1			RPM 180		DISCHARGE RATE 2			RPM 278		DISCHARGE RATE 3			RPM	
DATE: 02/02/2025		TIME: 07H00			DATE: 02/02/2025		TIME: 08H00			DATE:		TIME:		
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1	4.19		**1**		**1**	53.21		**1**	97.10	**1**			**1**	
2	7.31		**2**		**2**	56.11		**2**	96.39	**2**			**2**	
3	10.15		**3**		**3**	58.40	0.79	**3**	94.20	**3**			**3**	
5	13.40	0.61	**5**		**5**	61.39	0.99	**5**	91.00	**5**			**5**	
7	18.77	0.55	**7**		**7**	65.02	1.02	**7**	83.61	**7**			**7**	
10	23.36		**10**		**10**	71.60	1.04	**10**	75.30	**10**			**10**	
15	27.40	0.50	**15**		**15**	79.22		**15**	62.19	**15**			**15**	
20	31.72		**20**		**20**	87.15	1.06	**20**	50.51	**20**			**20**	
30	38.20	0.50	**30**		**30**	98.25	1.05	**30**	37.20	**30**			**30**	
40	45.31		**40**		**40**		0.77	**40**	33.75	**40**			**40**	
50	49.50	0.51	**50**		**50**		0.62	**50**	28.95	**50**			**50**	
60	53.17		**60**		**60**		0.59	**60**	22.32	**60**			**60**	
70			**70**		**70**			**70**	18.07	**70**			**70**	
80			**80**		**80**			**80**	12.55	**80**			**80**	
90			**90**		**90**			**90**	8.01	**90**			**90**	
100			**100**		**100**			**100**		**100**			**100**	
110			**110**		**110**			**110**		**110**			**110**	
120			**120**		**120**			**120**		**120**			**120**	
pH			**150**		**pH**			**150**		**pH**			**150**	
TEMP	22.20	°C	**180**		**TEMP**	30.10	°C	**180**		**TEMP**		°C	**180**	
EC	709	µS/cm	**210**		**EC**	505	µS/cm	**210**		**EC**		µS/cm	**210**	

DISCHARGE RATE 4			RPM		DISCHARGE RATE 5			RPM		DISCHARGE RATE 6			RPM	
DATE:		TIME:			DATE:		TIME:			DATE:		TIME:		
TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY	TIME	DRAW	YIELD	TIME	RECOVERY
(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)	(MIN)	DOWN (M)	(L/S)	(MIN)	(M)
1			**1**		**1**			**1**		**1**			**1**	
2			**2**		**2**			**2**		**2**			**2**	
3			**3**		**3**			**3**		**3**			**3**	
5			**5**		**5**			**5**		**5**			**5**	
7			**7**		**7**			**7**		**7**			**7**	
10			**10**		**10**			**10**		**10**			**10**	
15			**15**		**15**			**15**		**15**			**15**	
20			**20**		**20**			**20**		**20**			**20**	
30			**30**		**30**			**30**		**30**			**30**	
40			**40**		**40**			**40**		**40**			**40**	
50			**50**		**50**			**50**		**50**			**50**	
60			**60**		**60**			**60**		**60**			**60**	
70			**70**		**70**			**70**		**70**			**70**	
80			**80**		**80**			**80**		**80**			**80**	
90			**90**		**90**			**90**		**90**			**90**	
100			**100**		**100**			**100**		**100**			**100**	
110			**110**		**110**			**110**		**110**			**110**	
120			**120**		**120**			**120**		**120**			**120**	
pH			**150**		**pH**			**150**		**pH**			**150**	
TEMP		°C	**180**		**TEMP**		°C	**180**		**TEMP**		°C	**180**	
EC		µS/cm	**210**		**EC**		µS/cm	**210**		**EC**		µS/cm	**210**	
			240					**240**					**240**	
			300					**300**					**300**	
			360					**360**					**360**	

S/W/L:(mbch) 49.05

Abbreviations	
EC	Electrical conductivity
mbgl	Meters below ground level
mbch	Meters below casing height
mbdl	Meters below datum level
magl	Meters above ground level
L/S	Litres per second
RPM	Rates per minute
S/W/L	Static water level
uS/cm	Microsiemens per centimeter

BOREHOLE TEST RECORD

CONSULTANT:	GEOSS
DISTRICT:	VILLIERSDORP
PROVINCE:	WESTERN CAPE
FARM / VILLAGE NAME :	ELGIN
DATE TESTED:	31/01/2025

PR0JECT #	P3056
TEAM MEMBERS	JOHANNES
	LUTHANDO
	TAFARA
	TSHIFIWA

BOREHOLE LOCATION & ACCESS INFORMATION:

BOREHOLE COORDINATES		**COMMENTS ON ACCESS IF ANY:**
LATITUDE (SOUTH):	31.67636	
LONGITUDE (EAST):	18.91052	

BOREHOLE NO:	**BH 4**
TRANSMISSIVITY VALUE:	
TYPE INSTALLATION:	**NEW BOREHOLE**
BOREHOLE DEPTH: (mbg	**90.3**

MAINTENANCE RECORD:		**REHABILITATION RECORD:**		**DIGITAL CAMERA LOGGING:**		**EQUIPMENT FISHING RECORD**	
Labour hours:		**Jetting hours:**		**Camera logged once:**		**Hours spent:**	
Cost of material:		**Brushing hours:**		**Camera logged twice:**			
Travelling (km):		**Airlifting hours:**		**Camera logged three times:**		**OTHER COSTS ON PROJECT:**	
		Sulphamic Acid KG's		**Camera work sent to client:**		**Courier of samples:**	
		Boresaver KG's				**Km's for delivery:**	
		Soda Ash KG's				**Cost of packaging:**	

COMMENTS:	**RECOMMENDATIONS / CORRECTIVE ACTIONS:**

SAMPLE INSTRUCTIONS :

Water sample taken	**Yes**	No	If consultant took sample, give name:		**DATA CAPTURED BY**	EC
Date sample taken	31/01/2025		If sample courier, to where:		**DATA CHECKED BY:**	AH
Time sample taken	14H05					

DESCRIPTION:	**UNIT**	**QTY**		**UNIT**	**QTY**
STRAIGHTNESS TEST:	**NO**	0	BOREHOLE DEPTH AFTER TEST:	**M**	90.30
VERTICALLY TEST:	**NO**	0	BOREHOLE WATER LEVEL AFTER TEST: (mbch)	**M**	65
CASING DETECTION:	**NO**	1	SAND/GRAVEL/SILT PUMPED?	**YES/NO**	**0**
SUPPLIED NEW STEEL BOREHOLE COVER:	**NO**	0	DATA REPORTING AND RECORDING	**NO**	1
BOREHOLE MARKING	**NO**	0	SLUG TEST:	**NO**	0
SITE CLEANING & FINISHING	**NO**	1	LAYFLAT (M):	**M**	50
LOGGERS FOR WATERLEVEL MONITORING	**NO**	0	LOGGERS FOR pH AND EC:	**NO**	0

It is hereby acknowledged that upon leaving the site, all existing equipment is in an acceptable condition.

NAME: _____ **SIGNATURE:** _____

DESIGNATION: _____ **DATE:** _____

FORM 5 E

STEPPED DISCHARGE TEST & RECOVERY

BOREHOLE TEST RECORD SHEET

PROJ NO :	P3056	Coordinates:	SOUTH:	31.67636	PROVINCE: WESTERN CAPE
BOREHOLE NO:	BH 4		EAST:	18.91052	DISTRICT: VILLIERSDORP
ALT BH NO:	0				SITE NAME: ELGIN
ALT BH NO:	0				

BOREHOLE DEPTH (m)	90.30	DATUM LEVEL ABOVE CASING (m):	0.51	EXISTING PUMP:	0
WATER LEVEL (mbdl):	45.80	CASING HEIGHT: (magl):	0.15	CONTRACTOR:	ATS
DEPTH OF PUMP (m):	88.60	DIAM PUMP INLET (mm):	210.00	PUMP TYPE:	WA 50-2

STEPPED DISCHARGE TEST & RECOVERY

DISCHARGE RATE 1			RPM 508		DISCHARGE RATE 2			RPM 621		DISCHARGE RATE 3			RPM	
DATE: 31/01/2025		TIME: 13H00			DATE: 31/01/2025		TIME: 14H00			DATE:		TIME:		
TIME (MIN)	DRAW DOWN (M)	YIELD (L/S)	TIME (MIN)	RECOVERY (M)	TIME (MIN)	DRAW DOWN (M)	YIELD (L/S)	TIME (MIN)	RECOVERY (M)	TIME (MIN)	DRAW DOWN (M)	YIELD (L/S)	TIME (MIN)	RECOVERY (M)
1	0.66		**1**		**1**	28.50		**1**	31.82	**1**			**1**	
2	1.40		**2**		**2**	30.42		**2**	30.61	**2**			**2**	
3	1.91		**3**		**3**	33.60	1.21	**3**	29.98	**3**			**3**	
5	2.22		**5**		**5**	37.58	1.58	**5**	29.76	**5**			**5**	
7	2.64		**7**		**7**	42.80		**7**	29.60	**7**			**7**	
10	2.98	1.05	**10**			42.80	0.49	**10**	29.56	**10**			**10**	
15	4.30		**15**			42.80	0.42	**15**	29.50	**15**			**15**	
20	5.12	1.03	**20**			42.80	0.39	**20**	29.43	**20**			**20**	
30	8.80		**30**					**30**	29.37	**30**			**30**	
40	12.54	1.05	**40**					**40**	29.18	**40**			**40**	
50	18.33		**50**					**50**	29.00	**50**			**50**	
60	23.50		**60**					**60**	28.88	**60**			**60**	
70			**70**					**70**	28.70	**70**			**70**	
80			**80**					**80**		**80**			**80**	
90			**90**					**90**		**90**			**90**	
100			**100**					**100**		**100**			**100**	
110			**110**					**110**		**110**			**110**	
120			**120**					**120**		**120**			**120**	
pH	24.40		**150**		**pH**			**150**		**pH**			**150**	
TEMP	664.00	°C	**180**		**TEMP**		°C	**180**		**TEMP**		°C	**180**	
EC		µS/cm	**210**		**EC**		µS/cm	**210**		**EC**		µS/cm	**210**	

DISCHARGE RATE 4			RPM		DISCHARGE RATE 5			RPM		DISCHARGE RATE 6			RPM	
DATE:		TIME:			DATE:		TIME:			DATE:		TIME:		
TIME (MIN)	DRAW DOWN (M)	YIELD (L/S)	TIME (MIN)	RECOVERY (M)	TIME (MIN)	DRAW DOWN (M)	YIELD (L/S)	TIME (MIN)	RECOVERY (M)	TIME (MIN)	DRAW DOWN (M)	YIELD (L/S)	TIME (MIN)	RECOVERY (M)
1			**1**		**1**			**1**		**1**			**1**	
2			**2**		**2**			**2**		**2**			**2**	
3			**3**		**3**			**3**		**3**			**3**	
5			**5**		**5**			**5**		**5**			**5**	
7			**7**		**7**			**7**		**7**			**7**	
10			**10**		**10**			**10**		**10**			**10**	
15			**15**		**15**			**15**		**15**			**15**	
20			**20**		**20**			**20**		**20**			**20**	
30			**30**		**30**			**30**		**30**			**30**	
40			**40**		**40**			**40**		**40**			**40**	
50			**50**		**50**			**50**		**50**			**50**	
60			**60**		**60**			**60**		**60**			**60**	
70			**70**		**70**			**70**		**70**			**70**	
80			**80**		**80**			**80**		**80**			**80**	
90			**90**		**90**			**90**		**90**			**90**	
100			**100**		**100**			**100**		**100**			**100**	
110			**110**		**110**			**110**		**110**			**110**	
120			**120**		**120**			**120**		**120**			**120**	
pH			**150**		**pH**			**150**		**pH**			**150**	
TEMP		°C	**180**		**TEMP**		°C	**180**		**TEMP**		°C	**180**	
EC		µS/cm	**210**		**EC**		µS/cm	**210**		**EC**		µS/cm	**210**	
			240					**240**					**240**	
			300					**300**					**300**	
			360					**360**					**360**	

S/W/L:(mbch) 47.46

9 Appendix C: Water Quality

vinlab H2O
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Distillery Road
Stellenbosch
Tel 021-8828866/7
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www.vinlab.com
2025-02-07

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

Attn: Alison McDuling

P.O.Box 12412
Die Boord, Stellenbosch
7613
+27218801079

@VinlabSA

Sample Details					
SampleID	W59949	W59950	W59951		
Water Type	Drinking Water	Drinking Water	Drinking Water		
Water Source	Borehole	Not Indicated	Not Indicated		
Sample Temperature					
Description	KF_BH1	KF_BH3	KF_BH4		
Batch Number	KF_BH1	KF_BH3	KF_BH4		
PO Number	3569_M	3569_M	3569_M		
Date Received	2025-02-04	2025-02-04	2025-02-04		
Condition	Good	Good	Good		

Water - Routine	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
pH@25C (Water)		VIN-05-MW01	^^^	>= 5 to <= 9.7	4.20	6.39	6.42		
Conductivity@25C (Water)	mS/m	VIN-05-MW02	^	<= 170	40.8	61.1	53.8		
Turbidity (Water)*	ntu			<= 5	4.01	543.00	96.0		
Total dissolved solids (Water)*	mg/L			<= 1200	276.62	414.26	364.76		
Free Chlorine (Water)*	mg/L			<= 5	0.02	<0.02	0.02		
Ammonia (NH4) as N (Water)	mg/L	VIN-05-MW08	8.90%	<= 1.5	<0.15	<0.15	<0.15		
Nitrate as N (Water)	mg/L	VIN-05-MW08	11.00%	<= 11	<1.00	<1.00	<1.00		
Nitrite as N (Water)	mg/L	VIN-05-MW08	4.50%	<= 0.9	<0.05	<0.05	<0.05		
Chloride (Cl-) - Water	mg/L	VIN-05-MW08	10.12%	<= 300	96.17	112.58	113.93		
Sulphates (SO4) - Water	mg/L	VIN-05-MW08	7.56%	<= 500	23.04	53.10	20.50		
Fluoride (F) - Water	mg/L	VIN-05-MW08	12.30%	<= 1.5	<0.15	9.15	0.59		
Alkalinity as CaCO3 (Water)*	mg/L				<10.00	61.70	58.40		
Colour (Water)*	mg/L Pt-Co			<= 15	<15	<15	<15		
Total Organic Carbon (Water)*	mg/L			<=10	1.46	3.73	3.60		
Date Tested					2025-02-04	2025-02-04	2025-02-04		

Water - Metals	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
Calcium (Ca) - Water	mg/L	VIN-05-MW43	14.60%		<0.20	8	7		
Magnesium (Mg) - Water	mg/L	VIN-05-MW43	8.49%		7	9	7		
Sodium (Na) - Water	mg/L	VIN-05-MW43	11.45%	<= 200	54	85	85		
Potassium (K) - Water	mg/L	VIN-05-MW43	9.42%		7	8	7		

Please click here for SANS241-1:2015 drinking water limits

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

sanas Testing Laboratory T1131

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2025-02-07

TEST REPORT

Water

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Zinc (Zn) - Water	mg/L	VIN-05-MW43	19.40%	<= 5	0.094	0.061	0.145		
Antimony (Sb) - Water*	µg/L			<=20	<13.0	14	<13.0		
Arsenic (As) - Water*	µg/L			<= 10	<10.0	15	<10.0		
Boron (B) Water	µg/L	VIN-05-MW43	11.79%	<= 2400	9	27	19		
Cadmium (Cd) Water	µg/L	VIN-05-MW43	12.26%	<= 3	2	2	2		
Chromium (Cr) - Water	µg/L	VIN-05-MW43	13.03%	<= 50	<4	16	<4		
Copper (Cu) - Water	µg/L	VIN-05-MW43	11.57%	<= 2000	25	15	17		
Iron (Fe) - Water	µg/L	VIN-05-MW43	12.49%	<= 2000	1146	56355	3494		
Lead (Pb) - Water	µg/L	VIN-05-MW43	16.32%	<= 10	<8	<8	<8		
Manganese (Mn) - Water	µg/L	VIN-05-MW43	12.44%	<= 400	54	1907	1734		
Nickel (Ni) - Water	µg/L	VIN-05-MW43	17.38%	<= 70	10	12	<8		
Selenium (Se) - Water*	µg/L			<= 40	<10.0	<10.0	<10.0		
Aluminium (Al) - Water	µg/L	VIN-05-MW43	13.49%	<= 300	972	4892	238		
Cyanide (CN) - Water*	µg/L			<= 200	<10.0	61.0	10.0		
Mercury (Hg) - Water*	µg/L			<= 6	<1.0	1	2		
Barium (Ba) Water	µg/L	VIN-05-MW43	14.09%	<= 700	254	135	74		
Uranium (U) - Water*	µg/L			<= 30	<28	<28	<28		
Date Tested					2025-02-04	2025-02-04	2025-02-04		

Comments
W59949 Two Samples received, Ion balance = 2.0%
W59950 Two Samples received, Ion balance = 2.9% Recheck: Arsenic(As) = 17.0 µg/l
W59951 Two Samples received, Ion balance = 1.8%

Please click here for SANS241-1:2015 drinking water limits

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

sanas Testing Laboratory T1131

vinlab H_2O
Your partner in quality water analysis

TEST REPORT

Water

Distillery Road
Stellenbosch
Tel 021-8828866/7
info@vinlab.com
www.vinlab.com
2025-02-07

Geoss South Africa (Pty) Ltd

Attn: Alison McDuling

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Die Boord, Stellenbosch
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@VinlabSA

Adelize Fourie
Laboratory Manager (Waterlab)
VIN-05-
M01,M02,M03,M04,M05,MO8,M10,M28,
M43, MW01, MW02, MW03, MW04,
MW05, MW06, MW07, MW08/9/10,
MW12, MW13, MW14

Please click here for SANS241-1:2015 drinking water limits

Test results relate only to the items tested as received. This Document shall not be reproduced without the written approval of Vinlab (Pty) Ltd.Opinions and interpretations expressed herein are outside the scope of SANAS accreditation. Results for methods VIN-05-MW12, 13 and 14, are based on Cq values, a positive result (detected) indicates a Cq value <35 and a negative result (non-detected) indicates a Cq value of >35.

*** Not SANAS Accredited. Results marked "Not SANAS Accredited" in this report are not included in the SANAS Scope of Accreditation for Vinlab.**

Vinlab is not liable to any client for any loss or damages suffered which could, directly or remotely, be linked to our services Alcohol results are obtained using the most appropriate or a combination of one of the following methods: Py= pycnometer; W=winescan; Al=alcolyzer. W = Winescan. Micro results: Enumeration of yeast: WL nutrient, 3 days unless otherwise specified, 30°C. Samples that have had prior microbiological spoilage or treatment for spoilage should always be sterile filtered at bottling. SO2 additions less than 10 days may depress the growth of microbes in culture although they are viable/active in the wine. Some microbes, especially lactobacilli, may not grow in culture even where viable/potentially active in the wine.

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

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2025-02-18

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

Attn: Alison McDuling

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Sample Details					
SampleID	W60071				
Water Type	Drinking Water				
Water Source	Not Indicated				
Sample Temperature					
Description	KF_BH2				
Batch Number	KF_BH2				
PO Number	3569_M				
Date Received	2025-02-06				
Condition	Good				

Water - Routine									
	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
pH@25C (Water)		VIN-05-MW01	^^^	>= 5 to <= 9.7	5.62				
Conductivity@25C (Water)	mS/m	VIN-05-MW02	^	<= 170	34				
Turbidity (Water)*	ntu			<= 5	1536				
Total dissolved solids (Water)*	mg/L			<= 1200	230.52				
Free Chlorine (Water)*	mg/L			<= 5	0.05				
Ammonia (NH4) as N (Water)	mg/L	VIN-05-MW08	8.90%	<= 1.5	<0.15				
Nitrate as N (Water)	mg/L	VIN-05-MW08	11.00%	<= 11	<1.00				
Nitrite as N (Water)	mg/L	VIN-05-MW08	4.50%	<= 0.9	<0.05				
Chloride (Cl-) - Water	mg/L	VIN-05-MW08	10.12%	<= 300	85.15				
Sulphates (SO4) - Water	mg/L	VIN-05-MW08	7.56%	<= 500	14.85				
Fluoride (F) - Water	mg/L	VIN-05-MW08	12.30%	<= 1.5	<0.15				
Alkalinity as CaCO3 (Water)*	mg/L				10.30				
Colour (Water)*	mg/L Pt-Co			<= 15	<15				
Total Organic Carbon (Water)*	mg/L			<=10	7.55				
Date Tested					2025-02-06				

Water - Metals									
	Unit	Method	Uncertainty	Limit	Results	Results	Results	Results	Results
Calcium (Ca) - Water	mg/L	VIN-05-MW43	14.60%		<0.20				
Magnesium (Mg) - Water	mg/L	VIN-05-MW43	8.49%		6				
Sodium (Na) - Water	mg/L	VIN-05-MW43	11.45%	<= 200	50				
Potassium (K) - Water	mg/L	VIN-05-MW43	9.42%		4				

Please click here for SANS241-1:2015 drinking water limits

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

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2025-02-18

TEST REPORT

Water

Geoss South Africa (Pty) Ltd

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Zinc (Zn) - Water	mg/L	VIN-05-MW43	19.40%	<= 5	0.091				
Antimony (Sb) - Water*	µg/L			<=20	<13.0				
Arsenic (As) - Water*	µg/L			<= 10	<10.0				
Boron (B) Water	µg/L	VIN-05-MW43	11.79%	<= 2400	26				
Cadmium (Cd) Water	µg/L	VIN-05-MW43	12.26%	<= 3	<1				
Chromium (Cr) - Water	µg/L	VIN-05-MW43	13.03%	<= 50	<4				
Copper (Cu) - Water	µg/L	VIN-05-MW43	11.57%	<= 2000	34				
Iron (Fe) - Water	µg/L	VIN-05-MW43	12.49%	<= 2000	1891				
Lead (Pb) - Water	µg/L	VIN-05-MW43	16.32%	<= 10	10				
Manganese (Mn) - Water	µg/L	VIN-05-MW43	12.44%	<= 400	796				
Nickel (Ni) - Water	µg/L	VIN-05-MW43	17.38%	<= 70	16				
Selenium (Se) - Water*	µg/L			<= 40	<10.0				
Aluminium (Al) - Water	µg/L	VIN-05-MW43	13.49%	<= 300	299				
Cyanide (CN) - Water*	µg/L			<= 200	17.0				
Mercury (Hg) - Water*	µg/L			<= 6	1				
Barium (Ba) Water	µg/L	VIN-05-MW43	14.09%	<= 700	250				
Uranium (U) - Water*	µg/L			<= 30	<28				
Date Tested					2025-02-06				

Comments

W60071
Two Samples received,

Metal analysis - sample centrifuged prior to analysis

Memo
Ion balance = 2.9%

AEFourie

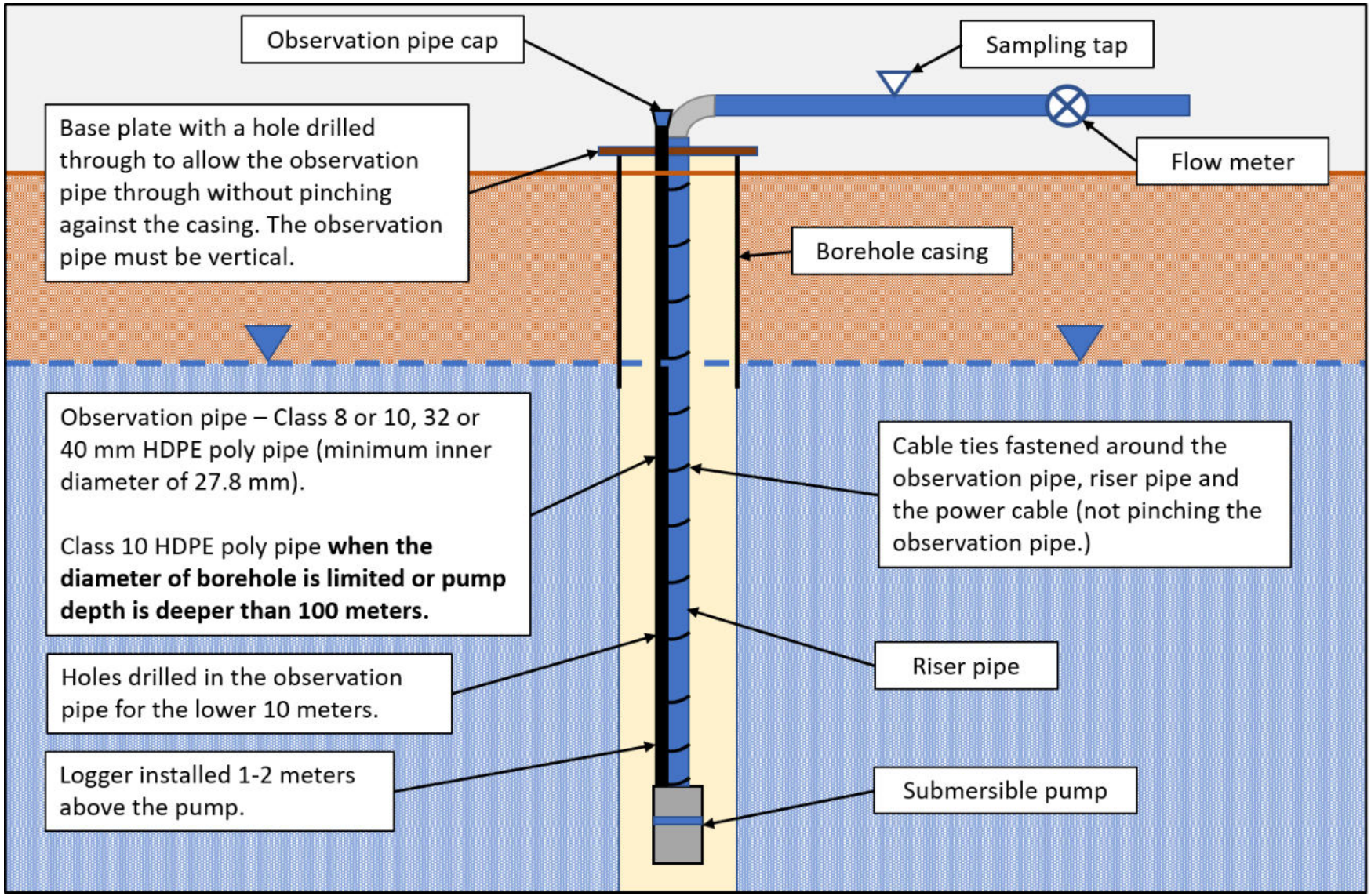
Adelize Fourie
Laboratory Manager (Waterlab)
VIN-05-
M01,M02,M03,M04,M05,MO8,M10,M28,
M43, MW01, MW02, MW03, MW04,
MW05, MW06, MW07, MW08/9/10,
MW12, MW13, MW14

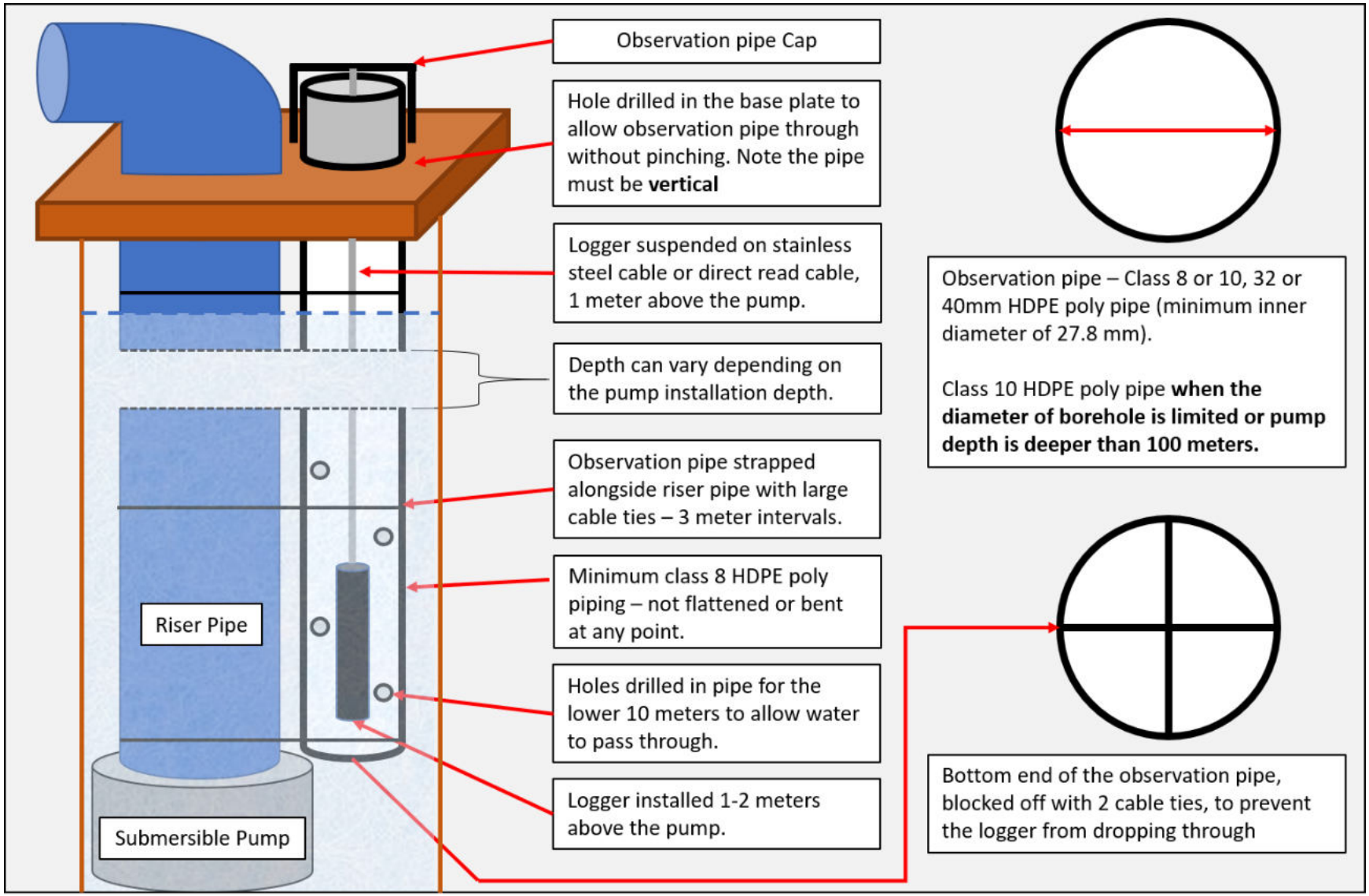
Please click here for SANS241-1:2015 drinking water limits

^ - Conductivity <1000mS/m = ±1mS/m , >1000mS/m = ±9mS/m
^^ - COD, LR = ±16mg/L, MR = ±48mg/L, HR = ±477mg/L
^^^ - pH ± 0.1

sanas Testing Laboratory T1131

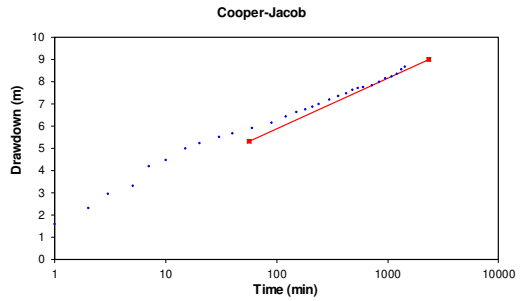
10 Appendix D: Monitoring Infrastructure Diagram


Observation pipe cap
Sampling tap
Base plate with a hole drilled through to allow the observation pipe through without pinching against the casing. The observation pipe must be vertical.
Flow meter
Borehole casing
Observation pipe – Class 8 or 10, 32 or 40 mm HDPE poly pipe (minimum inner diameter of 27.8 mm).
Class 10 HDPE poly pipe **when the diameter of borehole is limited or pump depth is deeper than 100 meters.**
Cable ties fastened around the observation pipe, riser pipe and the power cable (not pinching the observation pipe.)
Holes drilled in the observation pipe for the lower 10 meters.
Riser pipe
Logger installed 1-2 meters above the pump.
Submersible pump


Observation pipe Cap
Hole drilled in the base plate to allow observation pipe through without pinching. Note the pipe must be **vertical**
Logger suspended on stainless steel cable or direct read cable, 1 meter above the pump.
Depth can vary depending on the pump installation depth.
Observation pipe strapped alongside riser pipe with large cable ties – 3 meter intervals.
Minimum class 8 HDPE poly piping – not flattened or bent at any point.
Holes drilled in pipe for the lower 10 meters to allow water to pass through.
Logger installed 1-2 meters above the pump.
Riser Pipe
Submersible Pump
Observation pipe – Class 8 or 10, 32 or 40mm HDPE poly pipe (minimum inner diameter of 27.8 mm).
Class 10 HDPE poly pipe **when the diameter of borehole is limited or pump depth is deeper than 100 meters.**
Bottom end of the observation pipe, blocked off with 2 cable ties, to prevent the logger from dropping through

11 Appendix E: Yield Test Data Analysis

KF_BH1

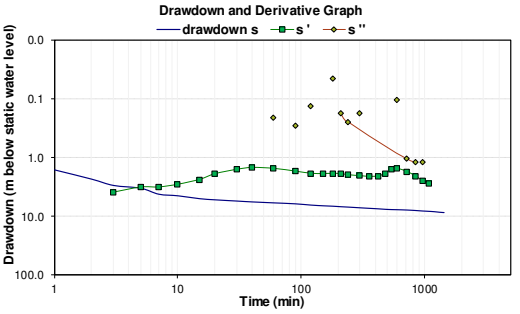


Cooper-Jacob method

T(m²/d) =	35.5	r_e (m)=	0.1
S =	1.49E+00	Q (l/s) =	5.13

	No boundaries	1 no-flow	2 no-flow	Closed
Q_sust	8.21	4.10	2.71	2.05
Avg. Q_sust =		4.27	std. dev =	2.76

Boundaries selected	0 - closed

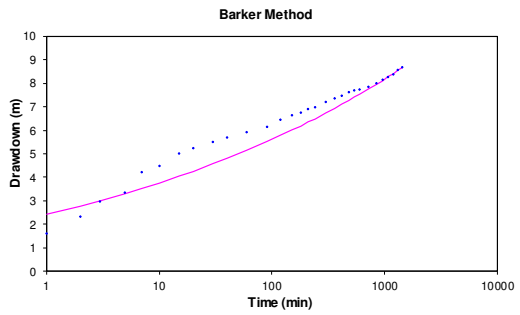


FC method

Extrapolation time in years	2	1051200	Extrapol.time in minutes	
Effective borehole radius (r_e)	49.2430621	49.24306206	Est. r_e	From r(e) sheet
Q (l/s) from pumping test	5.13	4.22885E-05	S-late	Change r_e
s_a (available drawdown), sigma_s	**24.1**	0	Sigma_s from risk	
Annual effective recharge (mm)	0	24.1	s_available working drawdown(m)	
t(end) and s(end) of pumping test	1440	8.67	End time and drawdown of test	
Average maximum derivative	**2.75**	2.759103159	Estimate of average of max deriv	
Average second derivative	**1.15**	0.025377577	Estimate of average second deriv	
Derivative at radial flow period	2.26586781	2.265867805	Read from derivative graph	
T-early[m²/d]		35.79708217	Aqui. thick (m)	60
T and S estimates	**T-late [m²/d]**	**29.49507491**	Est. S-late	0.0033
	S-late	0.0033		

BASIC SOLUTION

	No boundaries	1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	21.26	29.13	37.01	60.63
Q_sust (l/s) =	5.82	4.24	3.34	2.04
Average Q_sust (l/s) =	3.60			
with standard deviation=	1.59			
Boundaries selected	0 - closed			

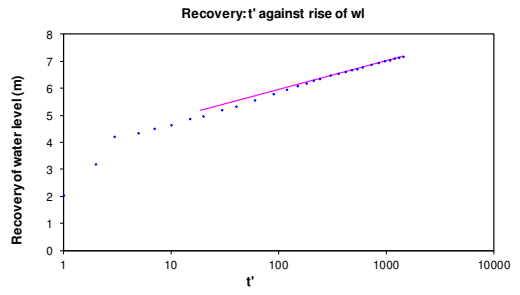


Barker method

	K_f [m/d]	S_f [1/m]	b	n	N
Fit Parameters	54.00	2.00E-03	2.26	1.72	0.1400

	No boundaries	1 no-flow	2 no-flow	Closed
sWell(Extrapol.time)	23.49	39.23	47.11	54.98
Q_sust	5.26	3.15	2.62	2.25

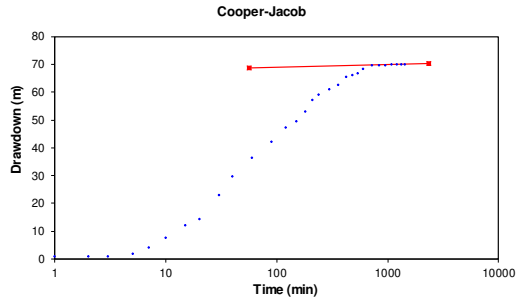
Fractal n = 1.72	Average Q-sust (l/s)=	3.15	std. dev =	1.35
	Boundaries selected	0 - closed		



Recovery

T [m2/d]	76.61
CDT Duration	1440
Recovery Duration	1440
Max % Recovery	82.70

KF_BH2

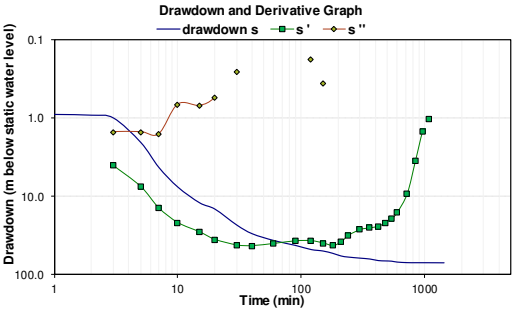


Cooper-Jacob method

T(m²/d) =	29.6	r_e (m)=	0.1
S =	3.97E-84	Q (l/s) =	1.50

	No boundaries	1 no-flow	2 no-flow	Closed
Q_sust	1.91	0.95	0.63	0.48
Avg. Q_sust =		0.99	std. dev =	0.64

Boundaries selected	0 - closed

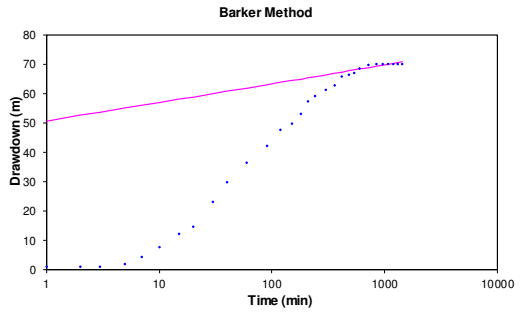


FC method

Extrapolation time in years	2	1051200	Extrapol.time in minutes	
Effective borehole radius (r_e)	26.4068394	26.40683937	Est. r_e	From r(e) sheet
Q (l/s) from pumping test	1.5	1.32932E-05	S-late	Change r_e
s_a (available drawdown), sigma_s	**92.1**	0	Sigma_s from risk	
Annual effective recharge (mm)	0	92.1	s_available working drawdown(m)	
t(end) and s(end) of pumping test	1440	70.07	End time and drawdown of test	
Average maximum derivative	**3.45**	42.24083805	Estimate of average of max deriv	
Average second derivative	**0**	-0.300237	Estimate of average second deriv	
Derivative at radial flow period	20.3943513	20.39435133	Read from derivative graph	
T-early[m²/d]		1.16291024	Aqui. thick (m)	60
T and S estimates	**T-late [m²/d]**	**6.874434783**	Est. S-late	0.0033
	S-late	0.0033		

BASIC SOLUTION

	No boundaries	1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	79.95	89.83	99.71	129.34
Q_sust (l/s) =	1.73	1.54	1.39	1.07
Average Q_sust (l/s) =	1.41			
with standard deviation=	0.28			
Boundaries selected	0 - closed			

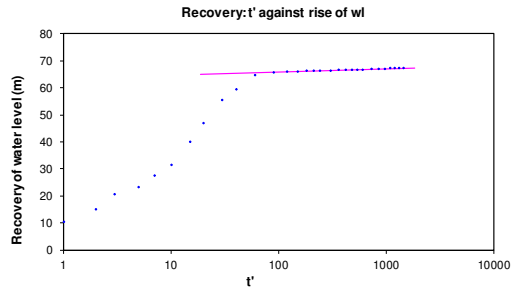


Barker method

	K_f [m/d]	S_f [1/m]	b	n	N
Fit Parameters	215.20	1.00E-07	0.02	1.99	0.0050

	No boundaries	1 no-flow	2 no-flow	Closed
sWell(Extrapol.time)	89.60	109.36	119.23	129.11
Q_sust	1.54	1.26	1.16	1.07

Fractal n = 1.99	Average Q-sust (l/s)=	1.25	std. dev = 0.20
	Boundaries selected	0 - closed	



Recovery

T [m2/d]	21.51
CDT Duration	1440
Recovery Duration	1440
Max % Recovery	96.23

(LAST PAGE)