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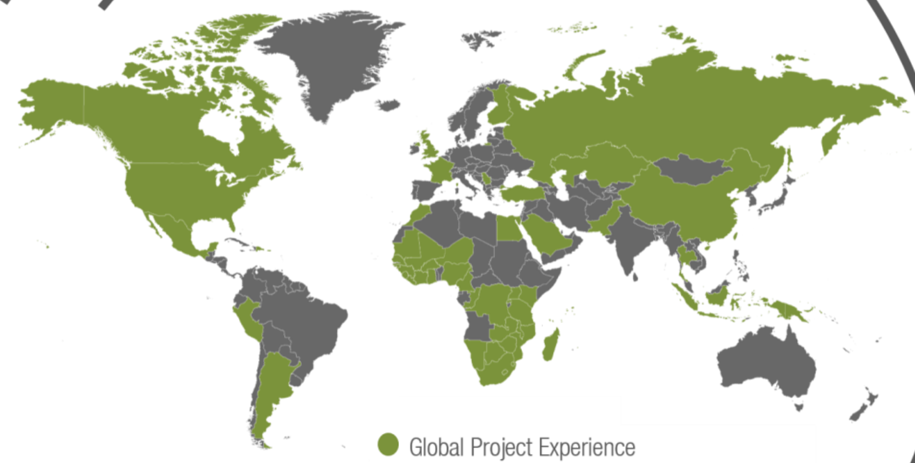

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Groundwater Supply Investigation for the Uis Tin Project, Namibia

Hydrogeological Assessment

Prepared for:
AfriTin Mining (Namibia) (Pty) Ltd

Project Number:
AFT7220

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EXECUTIVE SUMMARY

Digby Wells Environmental (hereinafter Digby Wells) was appointed by AfriTin Mining (Namibia) (Pty) Ltd (hereinafter AfriTin) to undertake a water supply assessment for their planned expansion of production at the Uis Tin Mine, in Namibia.

The pilot plant is currently producing ~65 tonnes of tin concentrate per month for Phase 1 Stage I, with a water demand of ~0.288 Ml/day (12 m^3/hr). The expansion of the pilot processing plant to Phase 1 Stage II will increase production at the mine to ~100 tonnes of tin concentrate per month, which will increase the water demand of the plant to ~0.432 Ml/day (18 m^3/hr). Water is currently sourced from water supply boreholes in the Uis River channel as well as contributions from water stored within the K5 pit and this investigation assesses whether the water supply boreholes can meet the increased demand for the planned 18-year Life of Mine of the Phase 1 Stage II expansion.

A later Phase 2 expansion plans to increase production to ~1 250 tonnes of tin concentrate per month.

Baseline

The project area is characterised by fractured igneous and metamorphic rock aquifers which are overlain by shallow alluvial aquifers in river channels and as surface cover in some areas. The aquifers receive low recharge, with ~0.7% of rainfall (average of 88 mm/a) reaching the aquifer. Stormwater runoff flows via the Uis River tributary towards the Ugab River located to the north of the project area. The mine is located on the Uis River near the water divide between the Ugab and Omaruru River Catchments.

Water supply boreholes for the mine have been drilled in the Uis River and an unnamed river tributary to the south of the mine, which comprise the Uis and Southern wellfields. The alluvial aquifer in these channel has an average thickness of 5.5 m and are important for recharging the underlying fractured aquifers. The fractured aquifer is weathered to an average depth of 25 m and has a higher fracture frequency to depths of 50 m. Although the fracture frequency decreases below 50 m, high yielding fractures can still be intersected in this low fractured aquifer. The groundwater levels (pre-abstraction) range between 15 – 37 mbgl indicating the water table is in the weathered fractured aquifer.

The quality of the groundwater indicates the groundwater has a long residence time in the aquifer, allowing rock-water interaction processes to occur. These processes result in elevated concentrations of chloride, sulphate, sodium, calcium, magnesium and nitrate which elevate the electrical conductivity levels in the groundwater. The groundwater quality is classified as Group D for all water supply boreholes in the Uis and Southern wellfields, which is the highest health risk category and is not suitable for human consumption based on the drinking water guideline limits for Namibia.

Field Assessments

Ten (10) water supply boreholes were aquifer tested by Hammerstein Mining and Drilling between December 2021 and January 2022. The results indicate that the hydraulic conductivities range between 0.1 – 3.5 m/d, with an average of 0.8 m/d and the transmissivities range between 0.6 – 586 m^2/d, with an average of 51 m^2/d. These ranges are comparable to the previous 2018 aquifer test results for the water supply boreholes as well as aquifer parameters available in literature sources.

The aquifer test results were used to determine the sustainable yield for the water supply boreholes. The sustainable yield ranges between 0.2 – 8.5 m^3/hr with a cumulative 18.7 m^3/hr for the 10 water supply boreholes. This yield just meets the demand for the Phase 1 Stage II expansion and therefore it is recommended to locate (potentially three boreholes) or drill additional boreholes to supplement water supply during borehole maintain periods or replace boreholes if scaling or fouling reduces the capacity of existing boreholes.

Numerical Model Findings

The numerical model was used to simulate the sustainable yield (18.7 m^3/hr) abstractions from the water supply boreholes for the planned 18-year Life of Mine and assess the impact of cumulative abstraction from known third-party boreholes.

The simulation indicates that the abstraction of water supply for the mine of 18 m^3/hr is deemed to be sustainable for the planned Life of Mine. However, the aquifer will be stressed due to the low recharge potential in the region. The cone of drawdown will extend over time reaching a maximum of ~6.5 km from the mine with a regional drawdown of ~4.5 m in 2040 (when compared against the current situation) because of the abstractions.

Should there be any significant increases in the demand from the aquifer (by the mine or third-party groundwater users) or as a result of draughts or climate change there may be an impact to the long-term sustainable yield of the wellfields.

Water Management Plan

The Phase 1 Stage II expansion will require 127 440 m^3 per year (at 18 m^3/hr) for the planned 18 years. The water stored within the K5 pit can provide 190 634 m^3 which would supply the plant for ~1.5 years. This can be used to supplement the supply from the water supply boreholes during maintenance periods until the K5 Pit will need to be dewatered for mining to continue.

The sustainable yield from the current water supply boreholes will just meet the demand for the Phase 1 Stage II expansion (at 18.7 m^3/hr) and therefore it is recommended to locate or drill additional boreholes which can be used to supplement water supply during borehole maintenance periods or replace boreholes if scaling or fouling reduces the capacity of existing boreholes.

It is recommended that the water supply boreholes be cleaned every 2-years to remove sediment, debris, roots and deposits of iron, calcium and magnesium from the borehole and/or pumps to maintain the capacity of the boreholes. However, cleaning may be required on a more frequent basis. Frequently monitoring the borehole yields and drawdowns will provide an indication on when boreholes will need to be cleaned.

Current aquifer testing observations indicates that BH2 has a reduced yield compared to what was originally achieved and BH9 has issues with roots and oxide deposits. Cleaning the boreholes may improve the current sustainable yield results which would allow the water supply boreholes to be used in a more flexible schedule rather than all boreholes operating for ~20 hours per day every day.

The groundwater monitoring programme must include daily rainfall measurements, weekly groundwater level measurements (in actively used water supply boreholes), quarterly groundwater level measurements (in unused water supply boreholes) and water quality sampling which will allow the mine to timeously detect any changes in the aquifers which may affect the water supply potential so alternative water sources can be investigated and implemented.

Conclusions

- The yield demand for the Phase 1 Stage II expansion of 18 m^3/hr can be provided by the existing water supply boreholes which have a combined sustainable yield of 18.7 m^3/hr based on the interpreted aquifer test results;
- The groundwater quality is not suitable for human consumption, however it can be used as raw water supply in the plant;
- Based on the numerical model simulations the water supply abstractions is deemed to be sustainable, however the water supply abstractions will stress the aquifer due to the low recharge potential of the region. The cumulative abstractions for the proposed 18-year Life of Mine will create a drawdown cone with a maximum extent of ~6.5 km and a drawdown of ~4.5 m;
- Should there be any significant increases in demand from the aquifer (by the mine or third-party groundwater users), draughts or climate changes there may be an impact to the long-term sustainable yield of the wellfield;
- AfriTin will need to install additional boreholes for the Phase 1 Stage II expansion to enable maintenance and to mitigate any losses in yield from the existing water supply boreholes;
- A groundwater monitoring programme has been recommended to assist AfriTin with managing their groundwater resource. Although it is recommended that boreholes be cleaned every two (2) years, any drop in yield or increased drawdown within the water supply borehole can indicate that maintenance is required;

- The groundwater monitoring will also assist AfriTin with determining if there are any changes occurring within the aquifer which may require intervention;
- AfriTin will need to investigate alternative water sources for the planned Phase 2 expansion once water demands for this phase have been confirmed. Abstracting higher yields of groundwater from the possible alternative groundwater wellfields could potentially have significant impacts to the groundwater aquifer in the region. Alternative water supply options such as piping water from the Orano Desalination plant or directly from the sea should also be considered for the Phase 2 expansion.

Recommendations

- Integrate the groundwater outcomes into the site water balance to assist with the efficient management of water resources on site and identify and minimise water losses from the system;
- Implement the monitoring, operational and maintenance requirements as outlined in the Water Management Plan (Section 6);
- Schedule borehole maintenance every 2 years unless the monitoring data (yield vs drawdown) indicates more frequent cleaning is required (Section 6.1);
- Locate or drill alternative boreholes to replace the existing boreholes if yields cannot be improved or maintained or to supplement water supply during borehole maintenance periods (after the K5 pit has been drained);
- Establish a covered water storage area nearby to the plant which contains water storage tanks with a minimum capacity of 1 week (~2 700 m^3) which can provide an emergency water source to the plant;
- AfriTin will need to amend their permitted abstraction volume to account for the required 18 m^3/hr (127 440 m^3/a) required by the plant for the Phase 1 Stage II expansion;
- Locate third-party groundwater users within a minimum 10 km radius of the mine wellfields and confirm their current abstraction requirements and planned future abstraction requirements;
- It is recommended to plan the dewatering of the K5 pit well in advance so the dewatered volumes can be used to meet the plant requirements instead of being discharged to the environment. The water in the pit has higher concentrations of calcium, magnesium, sodium, potassium chloride, sulphate, iron, manganese and electrical conductivity compared to the groundwater samples which may dictate how much of the pit water can be used during a month (if this needs to be diluted with clean or groundwater contributions). The water quality requirements of the plant will therefore need to be defined as soon as possible or the establishment of a water treatment plant could be considered;

- The numerical model must be recalibrated every 2 (two) years to incorporate the latest monitoring data as well as any changes to the water supply network or plant yield requirements. The model will be an asset to AfriTin to assess any changes which could affect the water supply for the project;
- The numerical model can be refined in future updates to simulate climate change responses to the expected rainfall volumes over the life of mine. The IPCC report indicates that drought events in Southern Africa (caused by the El Nino oscillation) are predicted to become more frequent and intense, which could affect the recharge potential to aquifers in the region.

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1. Introduction

Digby Wells Environmental (hereinafter Digby Wells) was appointed by AfriTin Mining (Namibia) (Pty) Ltd (hereinafter AfriTin) to undertake a water supply assessment for the planned expansion of production at the Uis Tin Mine, in Namibia.

Currently the pilot processing plant in operation for the Phase 1 Stage I project produces ~65 tonnes of tin concentrate per month. Water demand for the Phase 1 Stage I plant requires ~0.288 Ml/day (12 m^3/hr), which is sourced from the Uis wellfield boreholes, located in the alluvial aquifer of the Uis River. AfriTin has completed a Definitive Feasibility Study (DFS) for the expansion of its Phase 1 Stage I Pilot Processing Facility, which will occur in two phases. The Phase 1 Stage II expansion is a precursor to the long-term Phase 2 expansion, which aims to increase the mining area and develop a full-scale processing plant for the mine.

The expansion of the pilot processing plant for Phase 1 Stage II will increase production to ~100 tonnes of tin concentrate per month, which will increase the water demand of the plant to ~0.432 Ml/day (18 m^3/hr). The Phase 2 expansion plans to increase production to ~1 250 tonnes of tin concentrate per month. The water demand for the Phase 2 expansion still needs to be confirmed.

The aim of the water supply assessment is to:

- Verify the potential supply constraints of the Uis wellfield for the planned Phase 1 Stage II expansion; and
- Investigate the regional aquifer systems as an additional source of groundwater for the Phase 2 expansion.

The focus of this report is on the water supply requirements for Phase 1 Stage II and the potential constraints of the Uis wellfield.

2. Study Assumptions and Limitations

Aquifer test study limitations:

- Although boreholes were scheduled to be switched off prior to aquifer testing each of the cluster areas, observation borehole data may be influenced by abstraction in other cluster areas; and
- The community, landowners and other business operations may have boreholes in the riverbed near the Uis and Southern wellfields. Abstraction from these third-party boreholes may influence the aquifer test results.

Numerical Model Assumptions:

- The daily abstractions for third-party groundwater users are unknown and was assumed to be 200 m^3/d for the borehole at the Brandberg Rest Camp (which currently being used to supply large volumes for road construction) and 100 m^3/d for the NamClay borehole. It is understood that the abstraction from the Brandberg Rest

Camp is only expected to continue for the next 18 months, however the assumed abstraction values for both third party boreholes were modelled for the duration of the Life of Mine as a worse case scenario;

- It is assumed that these abstraction rates will continue as mentioned above for the proposed Phase 1 Stage II Life of Mine;
- The numerical model assumes abstraction boreholes will pump for a 24-hour period however the plant requirements are based on a 90% availability and 90% utilisation target equating to ~19.7- hour abstraction period per day; and
- The numerical model was calibrated with the abstractions and drawdowns currently measured and assumed for the aquifer. The Phase 1 Stage II modelled abstractions start the simulation using the current groundwater levels as reference.

3. Baseline Description

3.1. Climate

Uis is classified as a hot desert climate (BWh) based on the Köppen-Geiger classification system. The BWh classification characterises areas where evaporation and transpiration exceed precipitation with hot to exceptionally hot (over 40°C) periods of the year. Annual rainfall data was collected from four weather stations around the project area, which were measured daily between 1979 and 2014 (Figure 3-1). Rainfall typically occurs between October and April, with the months of February and March receiving the highest rainfall.

The rainfall data is relatively consistent between the weather stations with the highest variability occurring between 2011 – 2015. The annual rainfall for the project area ranges between ~2 - 592 mm, with an average of 88 mm per year (National Centers for Environmental Prediction, 2022) (Environmental Compliance Consultancy, 2021) (Environmental Compliance Consultancy, 2021). The period between 2000 – 2017 indicates a wetter period with an average rainfall of 137 mm/a compared with the previous 1979 – 1999 period which had an average rainfall of 54 mm/a. Long-term variations in rainfall will affect recharge to the groundwater aquifers, however, since 1979 there are regular peak rainfall events occurring every 2 – 4 years which will assist in buffering longer-term periods of low recharge.

3.2. Topography and Drainage

The town of Uis is located within the Uis River which is a tributary within the Ugab Catchment Area. The Uis River drains the project area in a north-westerly direction until it joins the Ugab River. The Ugab River is the main river that drains the Ugab Catchment which has an area of ~29 000 m^2. The Ugab Catchment starts in a mountainous region which receives a higher annual rainfall of between ~500 - 550 mm (Figure 3-3).

Although the town of Uis is located in the Ugab Catchment Area, the town receives water from the Omaruru River. The Omaruru River drains the Omaruru Catchment which has an area of

~11 500 m^2 and receives an annual rainfall of between ~300 - 350 mm from the mountainous region upstream.

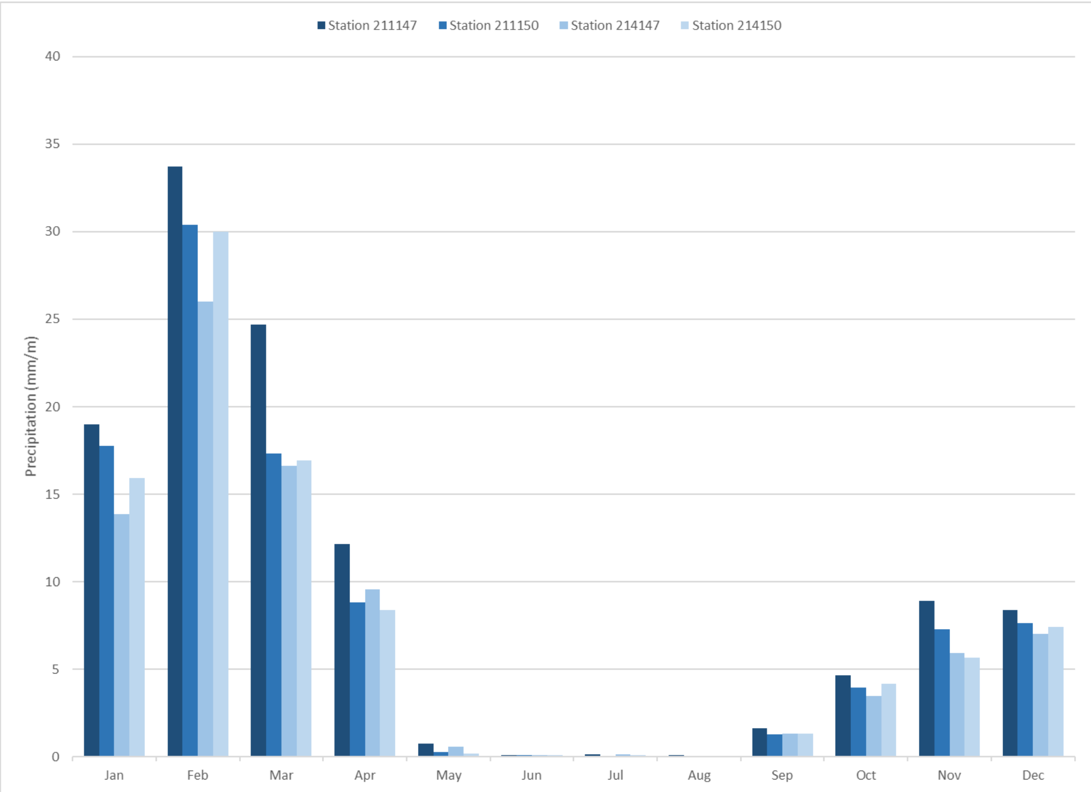

Figure 3-1: Average Monthly Rainfall per Station (1979 – 2014)

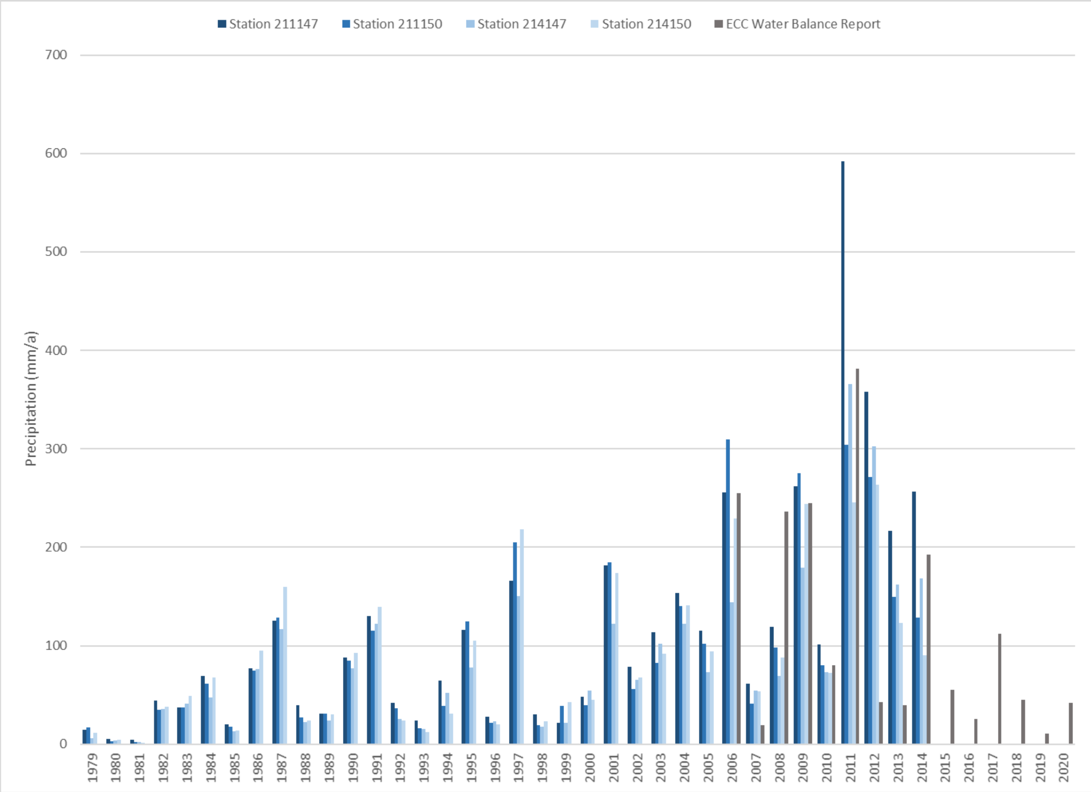

Figure 3-2: Annual Rainfall per Station (1979 – 2020)

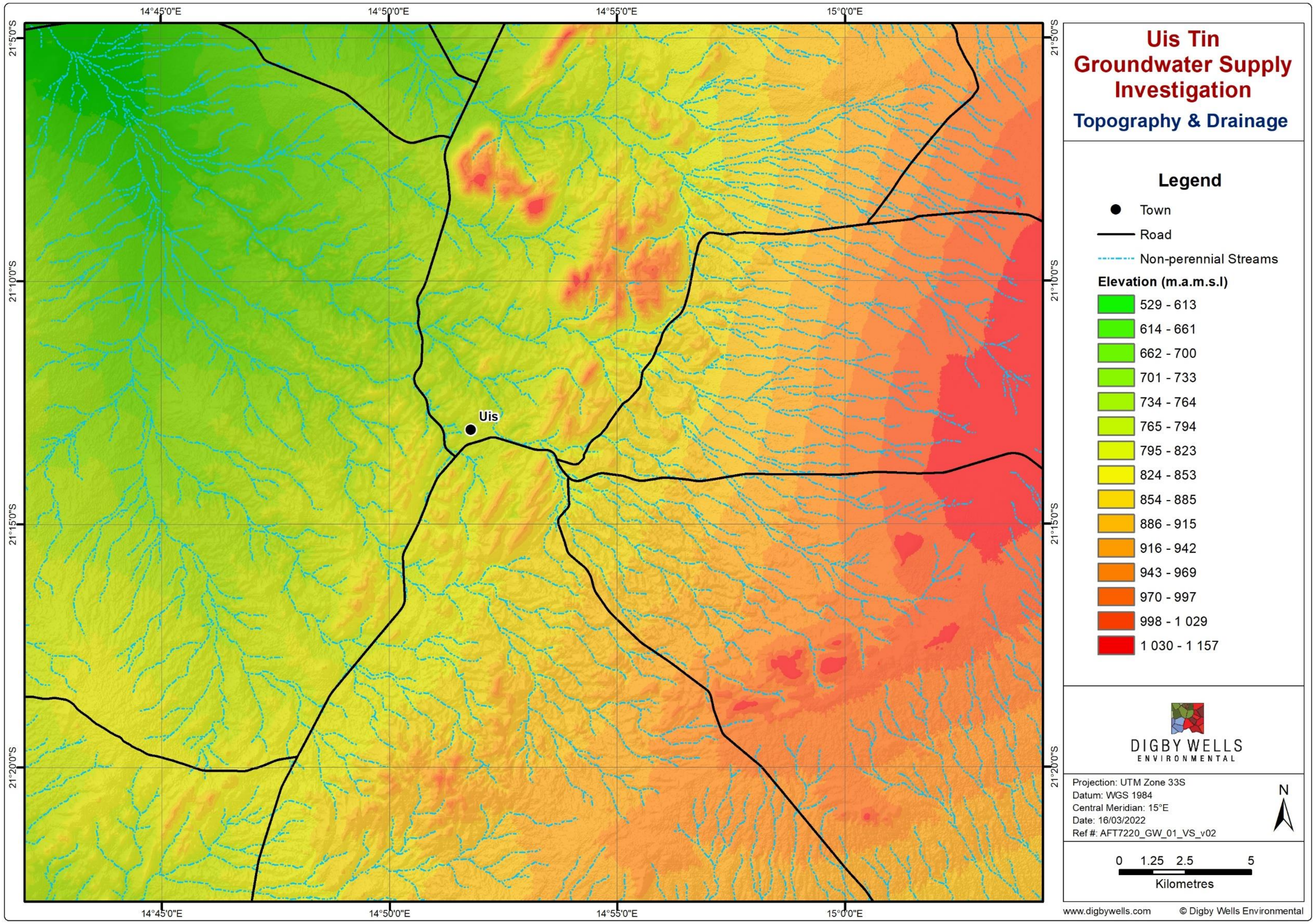

Figure 3-3: Topography and Drainage

3.3. Geology

The 1:250 000 geological map indicates that the project is located within the Southern Kaoko tectonostratigraphic zone of the Damara Orogen (Belt). The Damara Orogen is an East-North-East trending belt formed during the convergence between the Congo and Kalahari Cratons. The belt comprises of multiple fault and shear bounded zones with varying structural styles and lithologies (Gray, et al., 2008).

The regional stratigraphy around the project area (within the Southern Kaoko Zone) comprises of meta-greywacke and meta-pelite lithologies associated with the Amis Formation (Zerrissene Group), post-tectonic granites and isolated dolerite intrusions. The North-East trending Autseib Fault separates the Southern Kaoko Zone (in the North) from the Northern Central tectonostratigraphic zone (to the South) which comprises of mica schists and marbles associated with the Kuiseb and Karibib Formations of the Swakop Group (Figure 3-4). Mineralisation is hosted within granitic pegmatites. The pegmatites intruded into the Amis Formation post-tectonically and are associated with minor faulting (AfriTin Mining, 2017). Boreholes which intersect fractures associated with the pegmatites can be high yielding.

In 2018, eight (8) water supply boreholes were drilled in river channels around the mine (Figure 3-7). The river channels had alluvial gravels between 2 -13 mbgl, with an average of 6 mbgl. Below the gravels the geological logs indicate that quartzite, schist and pegmatite lithologies were intersected (BVW Groundwater Consulting Services, 2019). These lithologies are weathered to depths of between 14 – 50 mbgl (with an average of 25 mbgl) (Figure 3-6). Images of the core from exploration holes indicates that the core samples are highly broken and weathered between 2 – 19 mbgl. Below the weathered zone the core becomes more competent except at fracture and/or faulted zones.

The geological logs for the water supply boreholes indicate fractures were intersected between 27 – 111 mbgl, with an average depth of 46 mbgl (Figure 3-5). Although most boreholes indicate low yields for fractures below 50 mbgl, BH8 did intersect a high yielding fracture at a depth of 85 mbgl (with an estimate yield of 20 m^3/hr).

Table 3-1: Regional Stratigraphy

Supergroup	Group	Formation	Lithology	Map Code
			Quaternary sediments	Qs
			Granite (coarse grained)	OgSAs
			Granite (fine-medium grained)	ϵggp
			Granite (fine-medium grained, leucogranite)	ϵgls
			Granite (medium-course grained, porphyritic)	NgSAp
Damara Sequence	Swakop	Kuiseb	Mica schist	NKs
		Karibib	Marbles	NKb
	Zerrissene	Amis	Meta-greywacke and meta-pelites, minor carbonate and quartz-wacke	NAm

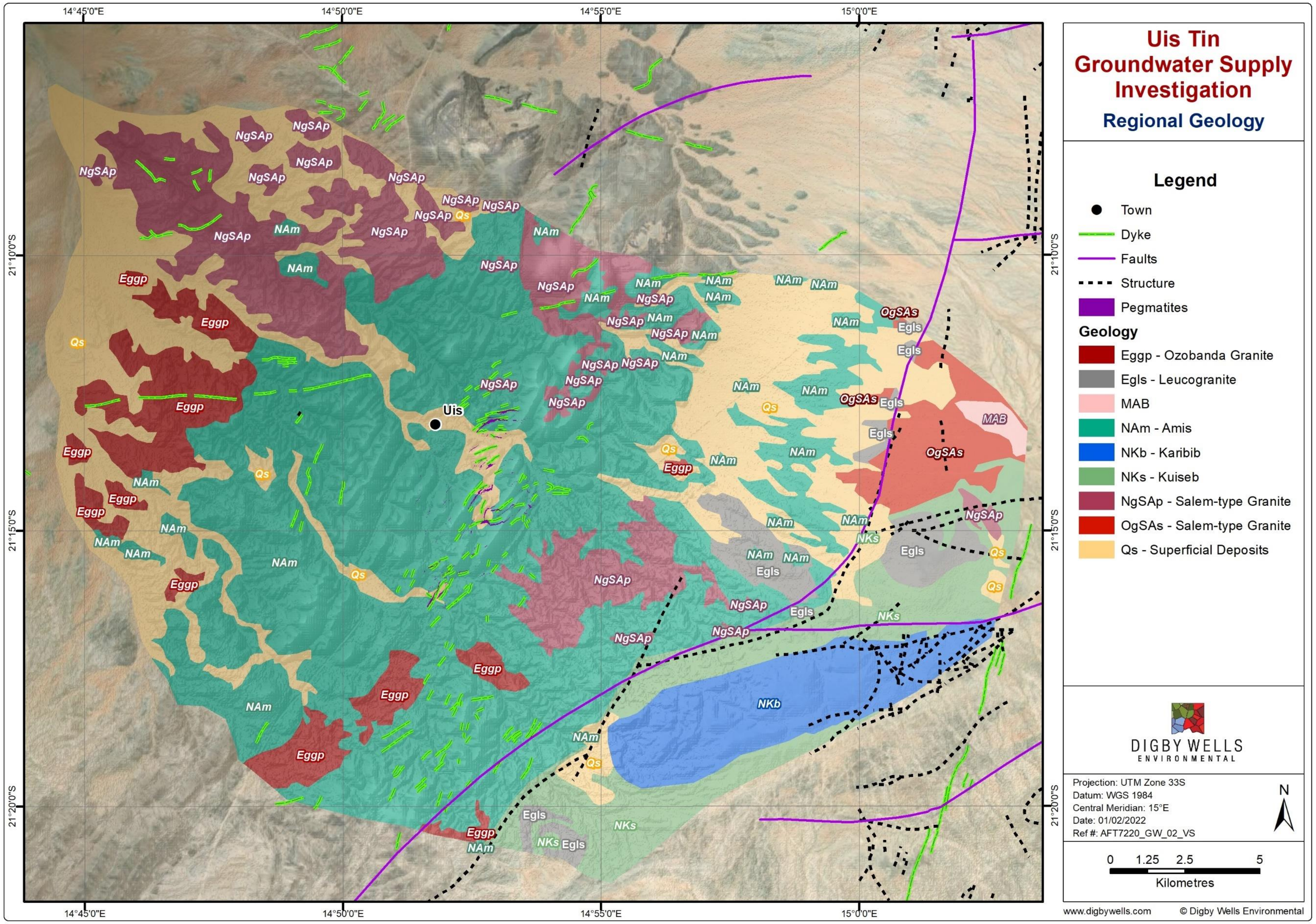

Figure 3-4: Regional Geology

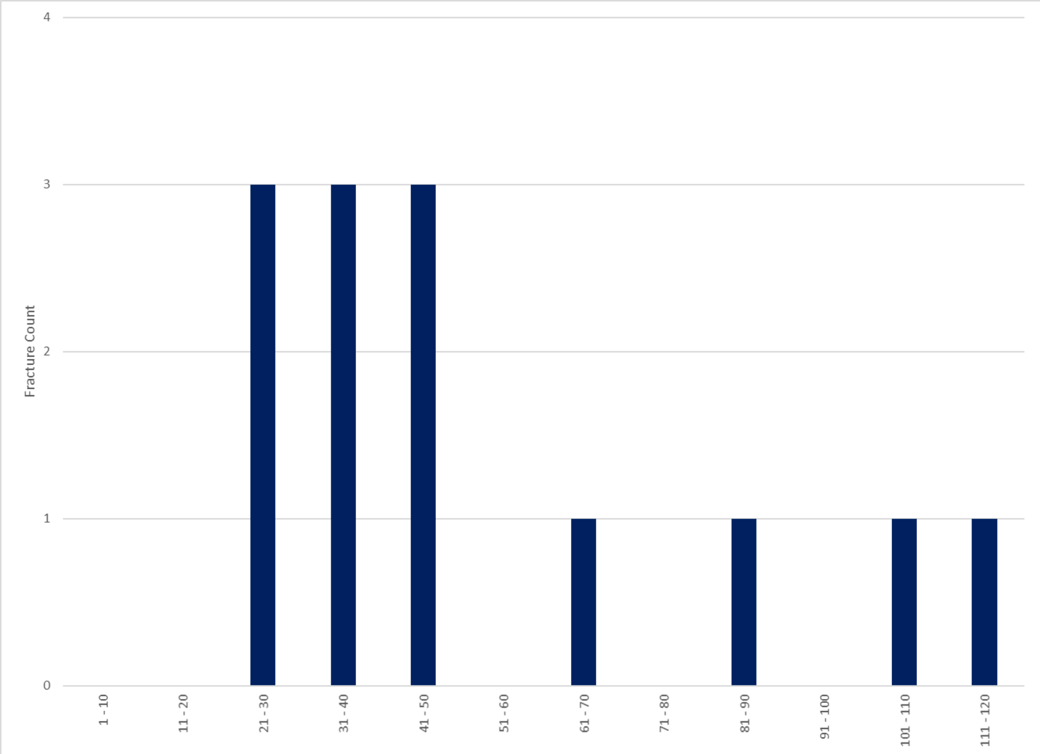

Figure 3-5: Fracture Frequency in Water Supply Boreholes

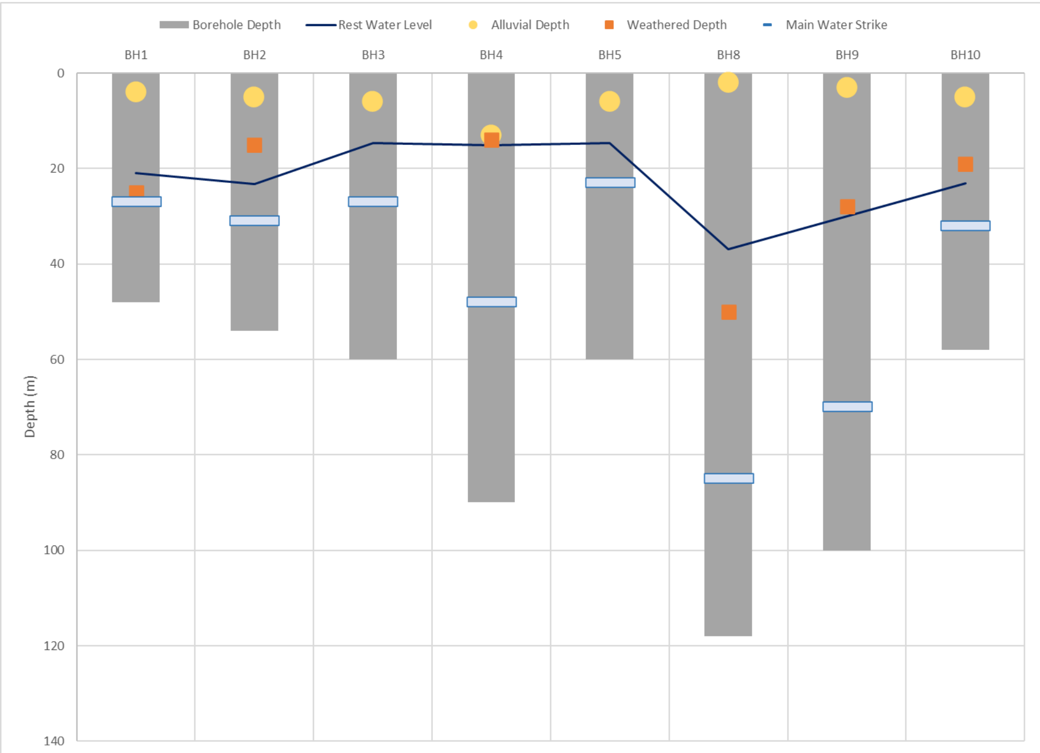

Figure 3-6: Water Supply Boreholes[1]

[1] Lithological logs for BH6, BH11 and BH12 were not available.

3.4. Hydrogeology

Uis is located within the Brandberg – Waterberg hydrogeological region of Namibia bordering with the Northern Namib and Kaokoveld hydrogeological region immediately to the Northwest (Ministry of Agriculture, Water and Rural Development, 2011). Boreholes have been established in the Uis River as far back as 1926 (approximately 3 locations), with historical mining operations drilling an additional 16 boreholes between 1950 and 1960. AfriTin currently have 11 water supply boreholes around their project area (Figure 3-7), 8 of which were drilled in 2018. Seven of the water supply boreholes are located in the Uis wellfield and the remaining four boreholes are in the Southern wellfield.

3.4.1. Groundwater Levels

Historical water level records are limited but indicate that water levels in the Uis River were approximately 16 mbgl in 1926 which is comparable to the water levels currently measured in the Southern wellfield. The boreholes drilled in the Uis River during the 1950's indicate an initial water level of between 18 – 23 mbgl. Historical records indicate that abstraction from these boreholes ranged between 2 – 8 m^3/hr. During the five-year monitoring period in the 1950's the groundwater levels dropped to between 31 – 37 mbgl (Figure 3-8). Abstraction would reduce the groundwater levels during this period however the influence of low recharge (or rainfall) may also be a contributing factor but cannot be confirmed.

The current Uis (BH1, BH2, BH8, BH9, BH10) and Southern (BH3, BH4, BH5, BH6) wellfield boreholes were aquifer tested in July 2018. The July 2018 rest groundwater levels (RWL) ranged between 21.0 – 36.9 mbgl, with an average of 26.8 mbgl in the Uis wellfield. The 2018 groundwater levels in the Southern wellfield were shallower ranging between 14.6 – 16.5 mbgl, with an average of 15.2 mbgl.

AfriTin commenced monitoring groundwater levels in six of the Uis wellfield boreholes in September 2020. The monitoring data shows that the groundwater levels in all the monitored boreholes have declined by between 2.4 – 7.8 m (Table 3-2 and Figure 3-9). The largest drop in groundwater levels is within BH2, BH8 and BH10. Although no abstraction has taken place from BH9 and BH12, and a minimal volume has been abstracted from BH2, the groundwater levels in these boreholes show a general decline in levels indicating the aquifer is either being affected by the current abstraction and/or by limited recharge to the aquifer. Abstraction volumes range between 237 m^3/month and 12 224 m^3/month, with an average of 5 534 m^3/month (Figure 3-10).

The Southern wellfield boreholes are not equipped and are not currently in use. Recent water level measurements indicate that the groundwater level in the Southern wellfield have declined by between 1.3 – 1.6 m (Table 3-2 and Figure 3-9). As no abstraction is taking place from these wells, the decline in groundwater levels is associated with low recharge to the catchment or external third-party groundwater use in the catchment.

Between 19 January and 15 February 2022, the site has received approximately 90 mm of rainfall, which has resulted in a rise in groundwater levels of between 0.8 – 8.3 m (Table 3-2).

Table 3-2: Water Level Summary Table

Borehole	Jul-18	Sep-20	Apr-21	Dec-21	Jan-22	Feb-22	Mar-22[2]	Change in Water Level Prior to Rainfall Event[3]	Change in Water Level After Rainfall Event[4]	Total Volume Abstracted to Date
BH1	21.01	21.43	-	23.85	-	23.10	23.20	-2.42	0.75	10 644
BH2	23.18	25.78	-	29.95	-	29.00	31.00	-4.17	0.95	386
BH3	14.71	-	-	-	15.98	-	-	-1.27	-	-
BH4	15.08	-	-	-	16.66	-	-	-1.58	-	-
BH6	16.51	-	-	-	17.88	-	-	-1.37	-	-
BH8	36.90	-	36.04	40.60	-	35.20	35.20	-4.56	5.40	21 011
BH9	29.98	30.75	-	31.50	33.74	29.20	28.50	-2.99	2.30	-
BH10	23.03	26.82	-	34.60	-	32.90	32.70	-7.78	1.70	40 985
BH11	-	-	-	-	41.25	33.00	32.74	-	8.25	-
BH12	-	28.65	-	31.55	31.90	29.10	28.90	-3.25	2.45	-

[2] Groundwater level as at 04/03/2022.
[3] Change in groundwater level prior to rainfall calculated with Jul-2018/Sept-2020 water levels compared to Dec-2021/Jan-2022 water levels.
[4] Change in groundwater level after rainfall calculated with Dec-2021 water levels compared to Feb-2022 water levels. Current groundwater levels for March are similar to Feb and therefore comparison has not been updated to March groundwater levels.

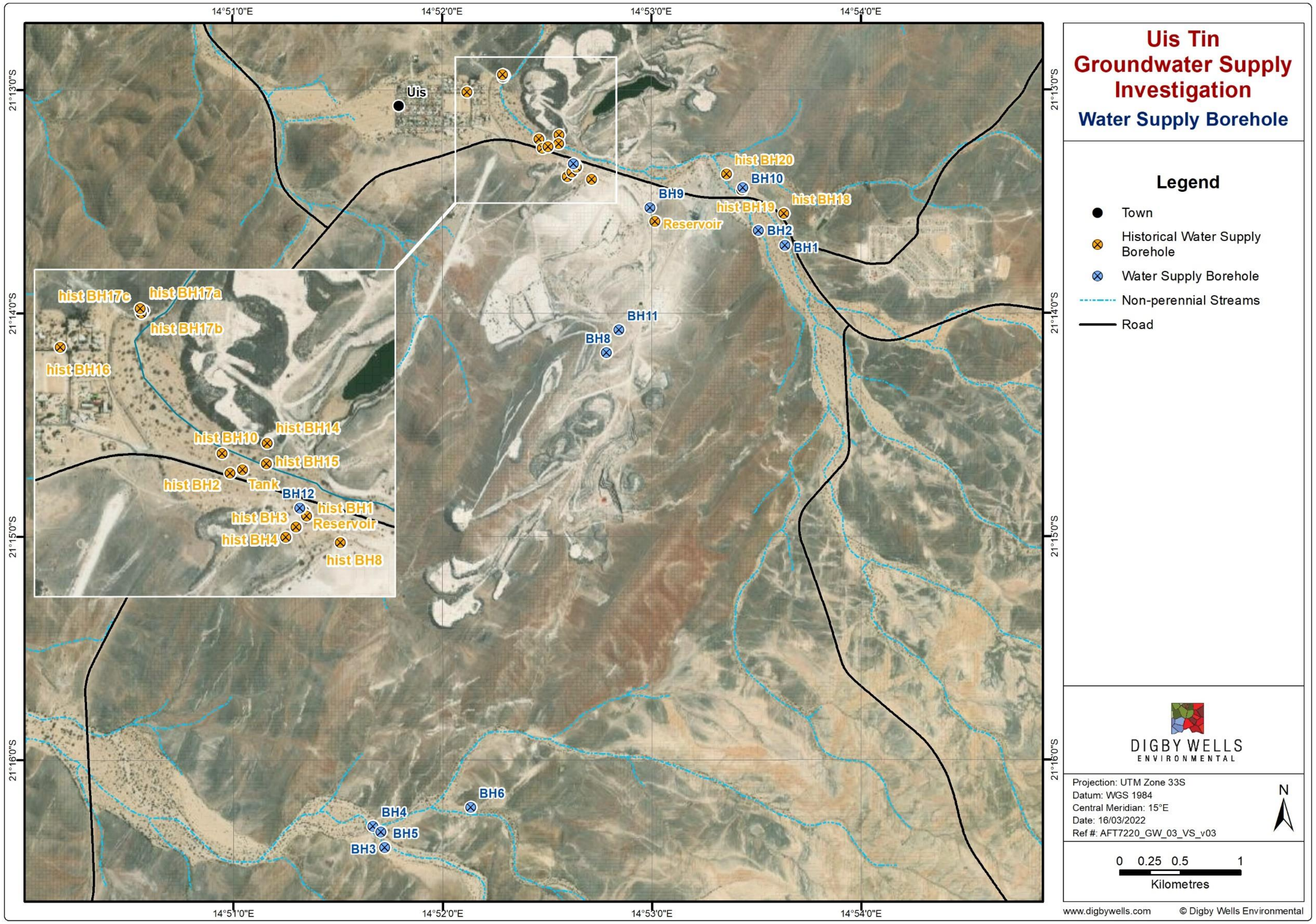

Figure 3-7: Water Supply Borehole Locations

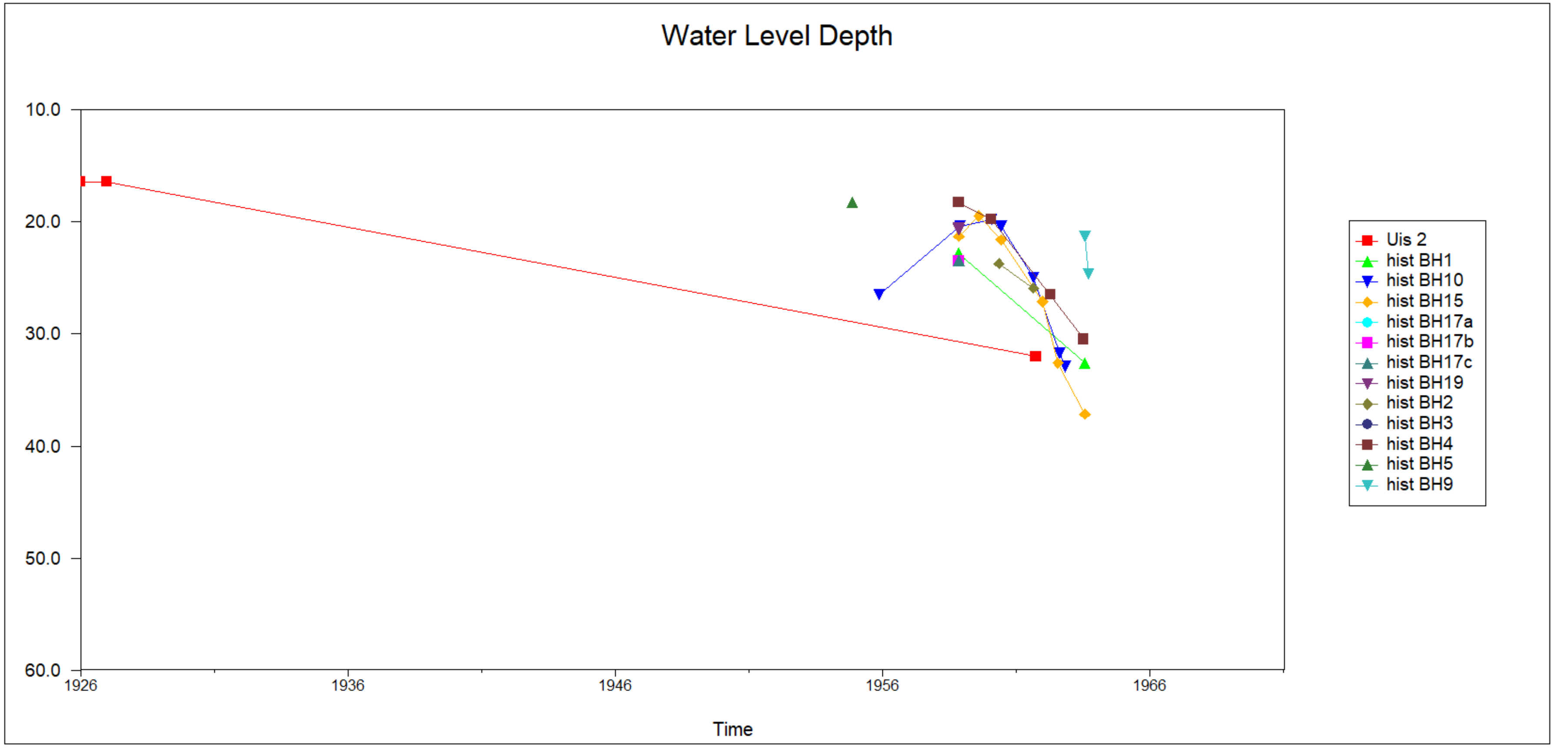

Figure 3-8: Groundwater Levels in Historical Water Supply Boreholes

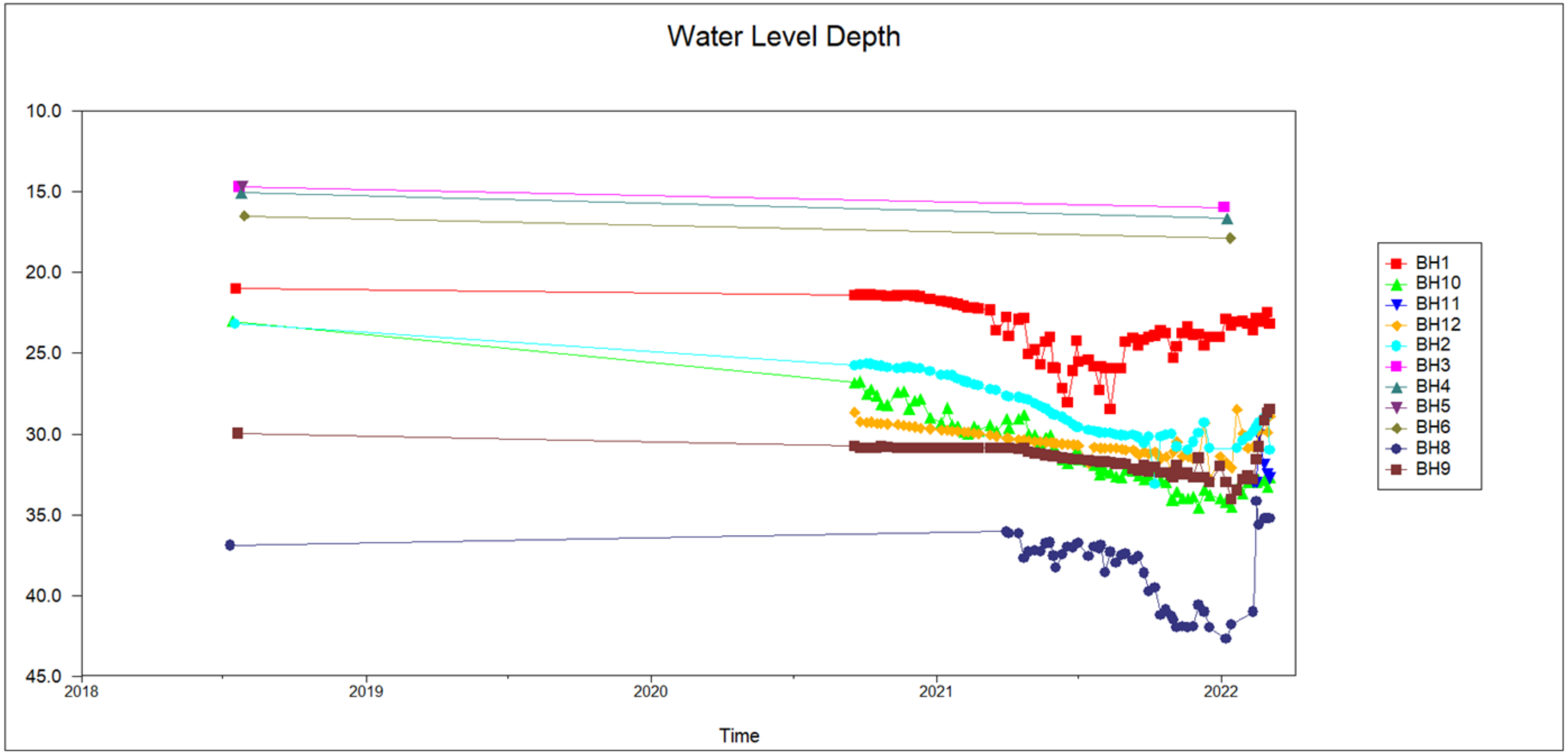

Figure 3-9: Groundwater Levels in Current Water Supply Boreholes

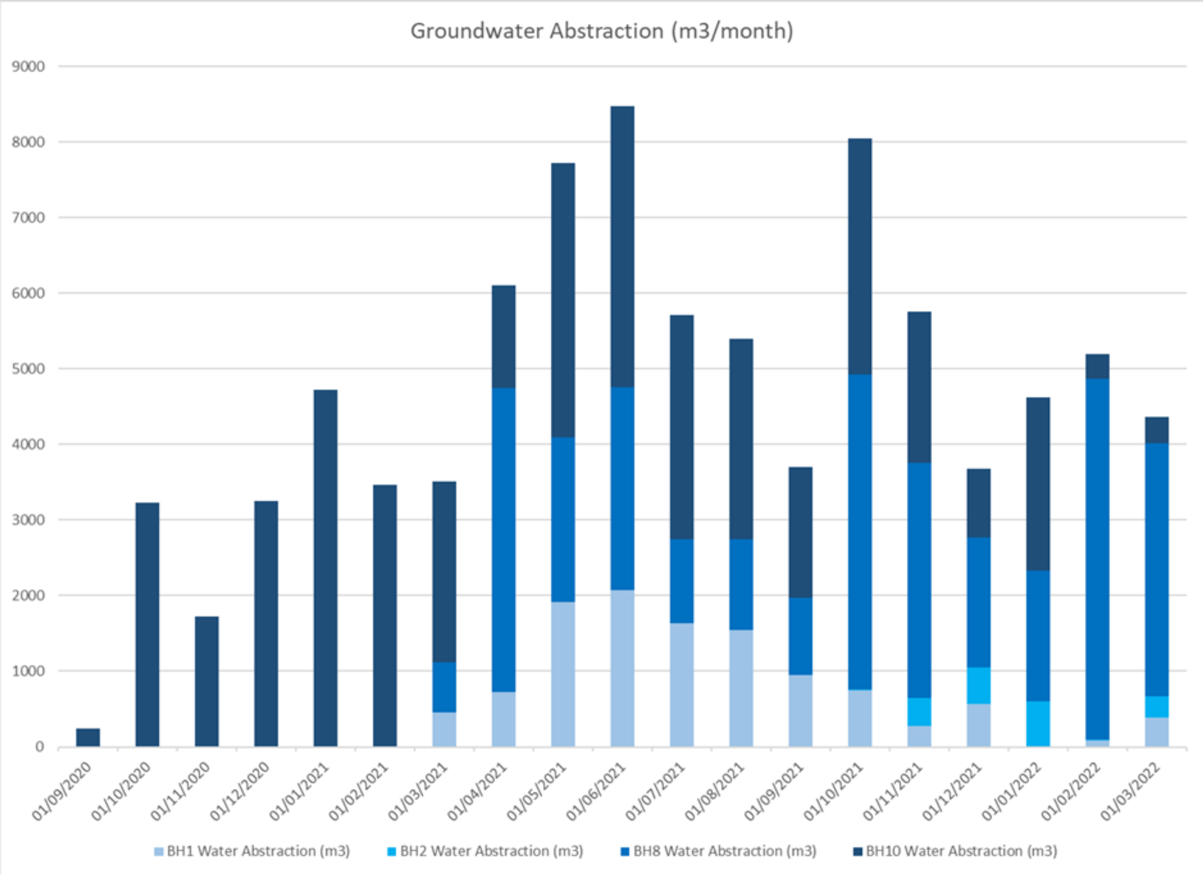

Figure 3-10: Groundwater Abstraction Volumes

3.4.2. Groundwater Quality

The laboratory certificates are provided in Appendix B.

3.4.2.1. Hydrochemistry

The chemical composition of natural waters can be interpreted using Piper, Expanded Durov and STIFF Diagrams. The Piper Diagram (Figure 3-11) is useful for identifying different types of groundwater facies which can be improved upon with the Expanded Durov Diagram (Figure 3-12). The Expanded Durov Diagram is useful for interpreting hydrochemical processes such as ion exchange and/or simple dissolution. The STIFF Diagrams (Figure 3-13) are useful to make visual comparisons between samples with different sources.

- The Piper and Expanded Durov Diagrams indicate that the samples can be differentiated into four (4) distinctive groups:
  - A sodium-chloride water type typically indicates groundwater with a long residence time or stagnant (slow moving) groundwater with little to no recharge which typically indicates the end of the hydrogeological cycle or that salts (sodium-chloride) have affected the source. This group is represented by

samples for BH3, BH6, BH8, BH10, BH11 and BH12 and will be referred to as the main sodium-chloride water type group;

    - Within the sodium-chloride water type the BH1 and BH9 samples form a separate subgroup on the Piper Diagram with a slightly higher sodium and alkalinity level compared to the other boreholes within this group;
    - The K5 pit sample indicates a sodium-chloride water type and plots near to the main sodium-chloride water type group however this sample has a higher sodium concentration comparable to the BH1 and BH9 subgrouping;

  - The magnesium-chloride water type typically indicates a mix of different water types or contamination by chlorides. This group is represented by the samples for BH2 and BH4 and although they have a different dominant cation they plot with the main sodium-chloride water type group;

- The STIFF Diagrams indicate BH1 and BH9 have a slightly different signature compared to the other boreholes. BH 1 and BH9 signatures show a smaller influence of sulphate in the signature compared with the other boreholes, however the remaining anions and the cations are comparable to the other signature; and
- The K5 pit sample has a similar signature to the groundwater samples but at significantly higher concentrations.

The project area is characterised by fractured igneous and metamorphic rock aquifers which are overlain by shallow alluvial aquifers in river channels. The aquifers receive low recharge (less than 0.7% MAP or 0.61 mm/a), and the hydrochemistry is therefore representative of groundwater with a long residence time or slow-moving groundwater allowing rock interaction processes to occur over long periods.

The available logs for the water supply boreholes indicate that quartzite (and in some instances schist) was intersected by the boreholes. The slight differences between the water types and signatures may be representative of different rock interactions and/or mixing of different waters during abstraction.

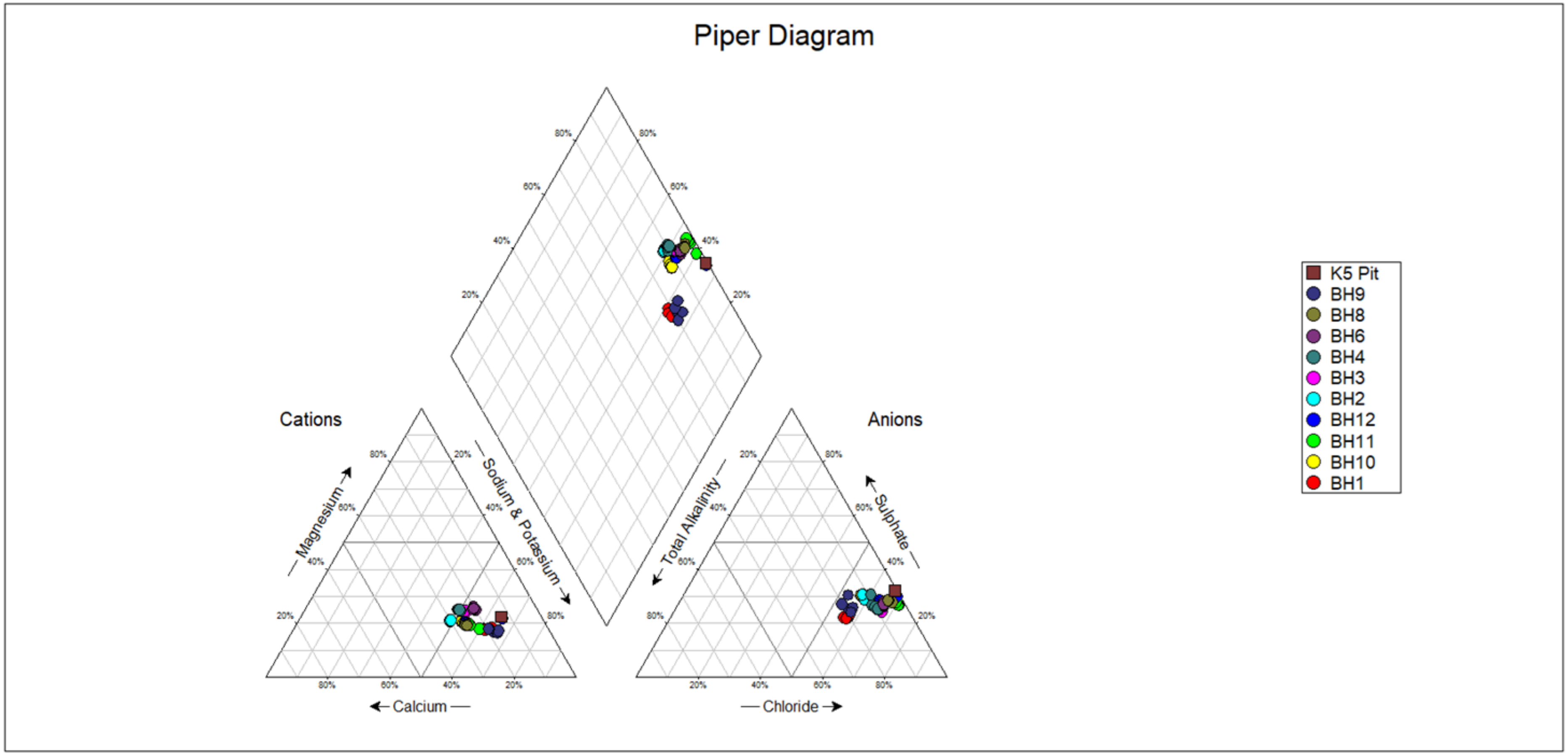

Figure 3-11: Piper Diagram

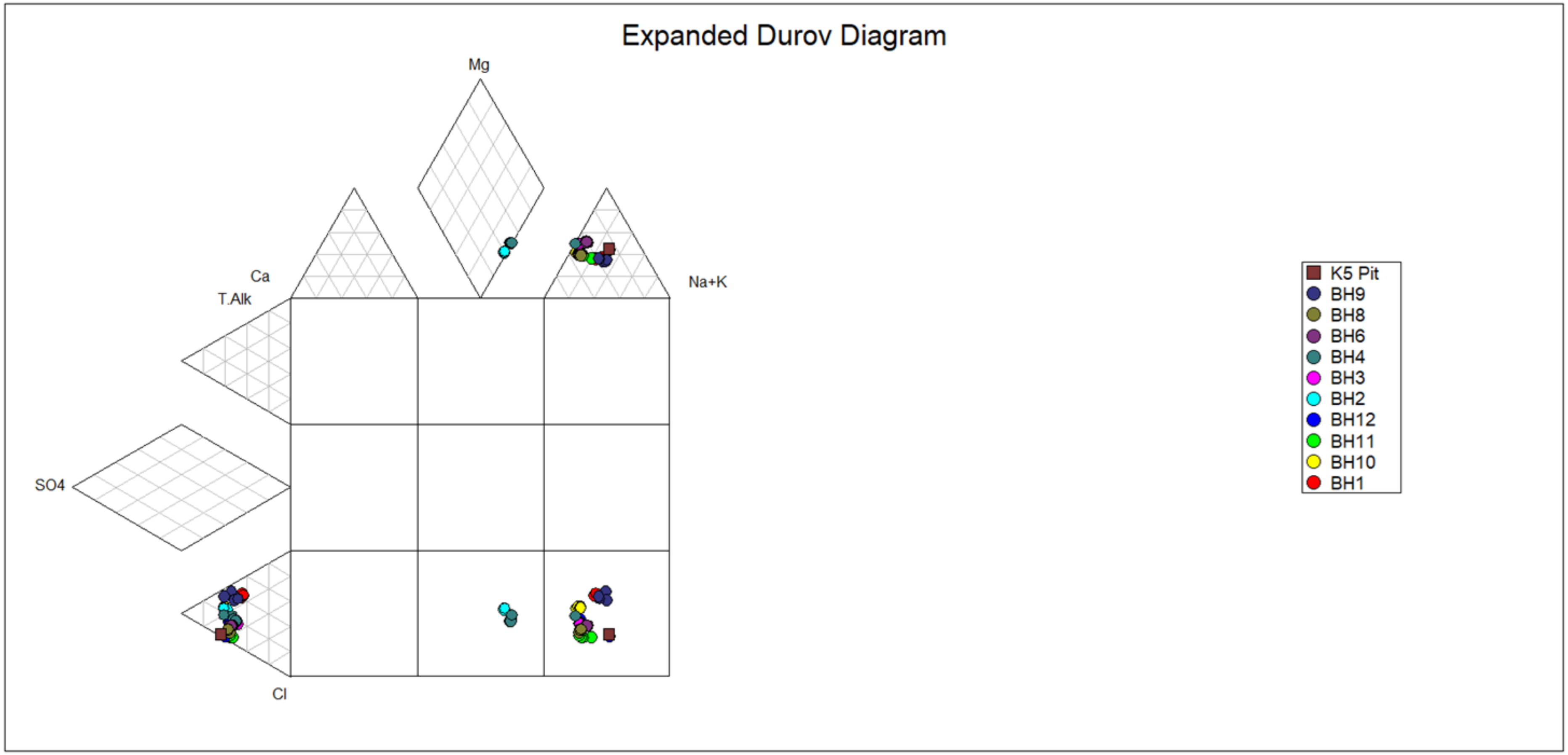

Figure 3-12: Expanded Durov

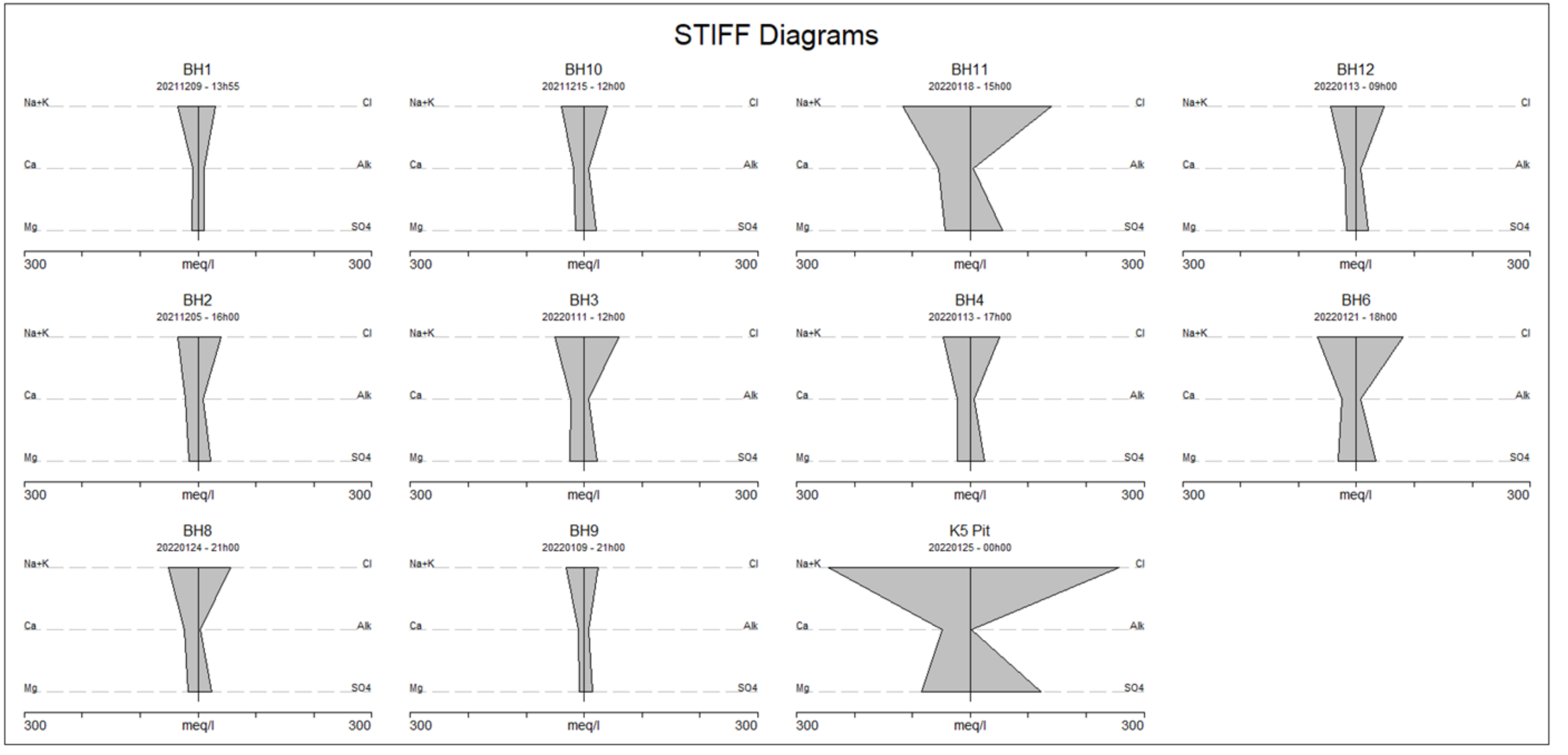

Figure 3-13: STIFF Diagrams

3.4.2.2. Quality

There are currently no water quality guideline requirements for the process water used by Uis Tin Mine processing plant. The groundwater quality has therefore been compared to the guidelines for safe drinking water as described by the Namibia Water Corporation (Namibia Water Corporation, 1998) (Department of Water Affairs (Namibia), 1988). The drinking water guideline limits provide a basis of comparison between samples with regards to elevated concentrations. The concentration of and limits for the aesthetic, physical and inorganic determinants define the group into which water will be classified. The water quality has been grouped into 4 quality classes:

- Group A: Water with an excellent quality;
- Group B: Water with acceptable quality;
- Group C: Water with low health risk; and
- Group D: Water with a high health risk, or water unsuitable for human consumption.

Water should ideally be of excellent quality (Group A) or acceptable quality (Group B), however in practice many of the determinants may fall outside the limits for these groups. If water is classified as having a low health risk (Group C), attention should be given to this problem, although the situation is often not critical as yet. If water is classified as having a higher health risk (Group D), urgent and immediate attention should be given to this matter.

The overall quality group, into which water is classified, is determined by the constituent that complies the least with the guidelines for the quality of drinking water. The groundwater quality, in each borehole, compared to the guidelines for drinking-water quality is summarised in Table 3-3.

The overall quality group for all the water supply boreholes and the K5 Pit is Group D. This is due to the elevated concentrations of chloride, sulphate, sodium and to a less extent the slightly elevated calcium, magnesium and nitrate concentrations. Subsequently the electrical conductivity is also elevated in all samples. The observed elevated concentrations are geogenic (naturally occurring), likely as a consequence of the geochemical characteristics of the parent rocks and rock-water interaction.

Five (5) samples were collected during the 48-hour CDT aquifer tests which allows for trend analysis. Time-series trends are provided for pH and electrical conductivity (Figure 3-14), chloride and sulphate (Figure 3-15), and magnesium and sodium (Figure 3-16). There are minor fluctuations between samples for majority of the boreholes, however BH8 and BH11 do show a slight change in concentrations between the samples.

Initially BH8 and BH11 indicated high concentrations for major anions, cations and electrical conductivity which decreased and stabilized after the third sample. BH8 has four (4) fractures at depths of 50 m, 85 m, 106 m and 111 m. The fracture at 85 m is the highest yielding fracture (with an estimate of >20 m^3/hr) with the other fractures noted as being small. The change in water quality could initially indicate contributions from the smaller fracture until this is depleted and the larger deeper fracture provides more water to the borehole. The borehole log for BH11 is not available but based on proximity to BH8, BH11 may have a similar fracture set.

An anomalous spike is present for the fourth sample in BH12, which has water quality results similar to the K5 pit water sample. It was confirmed with Analytical Laboratories that the analysis was correct for this sample. It is unlikely that water from the pit would have been drawn into BH12 as the fifth sample would have shown a change in water quality as well, and therefore it is concluded that there may have been a sampling error for this sample and should therefore be disregarded

3.4.2.3. Corrosion

The equilibrium saturation point of water for calcium carbonate and other salts is described by various indices which provide an indication of the scale-forming or corrosive potential of the water. If water is supersaturated, it is scale forming, whereas if it is undersaturated, it is non-scale forming or corrosive. Corrosion can be a problem in distribution systems and appliances with metallic structures in contact with water.

The following corrosion/scaling indices were calculated:

- Langelier index: A positive Langelier index indicates scale-forming tendency and a negative Langelier index indicates a scale-dissolving tendency, with the possibility of corrosion.
- Ryznar index: A value less than 6.5 indicate scale-forming tendency and a value greater than 6.5 corrosive tendency.
- Corrosion ratio: A ratio less than 0.1 indicates general freedom from corrosion in neutral to slightly alkaline oxygenated waters. Higher ratios indicate a tendency towards progressive corrosion, that is, aggressive waters.

A summary of the corrosion/scaling indices is shown in Table 3-4. The groundwater observed in all the water supply boreholes and the K5 Pit sample is scale-forming and has progressive corrosion tendencies.

Table 3-3: Groundwater Quality of Water Supply Boreholes Compared to the Guidelines for Safe Drinking Water

Constituents[5]	Guidelines For Human Consumption				BH1	BH1	BH1	BH1	BH1	BH2	BH2	BH2	BH2	BH2	BH10	BH10	BH10	BH10	BH10
	Group A	Group B	Group C	Group D	07/12/21 08:56	07/12/21 19:00	08/12/21 05:03	08/12/21 15:01	19/12/21 13:55	03/12/21 15:59	04/12/21 06:42	04/12/21 16:10	05/12/21 12:35	05/12/21 16:00	13/12/21 11:00	13/12/21 19:00	14/12/21 05:00	14/12/21 20:00	15/12/21 12:00
pH	6-9	5.5-9.5	4-11	<4->11	7.5	7.5	7.2	7.1	7.1	7.1	6.7	6.9	7	6.97	7	7	7.1	6.9	6.9
Electrical Conductivity mS/m	150	300	400	>400	535	530	532	531	536	651	652	652	654	657	658	664	668	670	670
Total Dissolved Solids[6]	-	-	-	-	3,295	3,213	3,210	3,181	3,190	4,126	4,195	4,096	4,120	4,148	4,100	4,164	4,164	4,241	4,386
Turbidity	1	5	10	>10	1.3	0.35	0.95	0.29	0.62	26	0.3	0.55	0.35	0.6	0.5	0.7	0.75	0.4	0.4
Calcium as Ca	150	200	400	>400	199	229	230	228	198	434	426	434	428	427	377	376	361	368	369
Magnesium as Mg	70	100	200	>200	117	120	121	118	122	180	182	178	180	183	176	174	178	173	175
Sodium as Na	100	400	800	>800	799	778	761	776	791	791	778	790	787	790	832	866	874	894	892
Potassium as K	200	400	800	>800	32	31	31	30	31	32	32	31	31	31	34	33	34	34	34
Total Alkalinity as $CaCO_3$	-	-	-	-	525	550	545	550	550	395	395	400	410	405	410	420	420	435	425
Total Alkalinity as $CaCO_3$	-	-	-	-	525	550	545	550	550	395	395	400	410	405	410	420	420	435	425
Chloride as Cl	250	600	1200	>1200	1,060	1,037	1,037	991	1,037	1,383	1,452	1,406	1,429	1,406	1,383	1,360	1,383	1,406	1,429
Sulphate as SO_4	200	600	1200	>1200	561	531	550	528	534	992	1,002	932	942	1,008	948	981	964	1,002	1,002
Nitrate as N	10	20	40	>40	47	35	34	40	33	17	19	19	17	13	23	27	26	23	52
Nitrite as N	-	-	-	-	0.01	0.01	0.02	0.02	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride as F	1.5	2	3	>3	1.8	1.9	1.9	2	1.9	1.3	1.3	1.2	1.2	1.2	1.5	1.6	1.6	1.6	1.6
Iron as Fe	0.1	1	2	>2	0.01	0.01	<0.01	0.01	0.01	2.2	0.01	0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.01
Manganese as Mn	0.05	1	2	>2	<0.01	0.01	0.01	0	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia as N	1	2	4	>4	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Hardness as $CaCO_3$	300	650	1300	>1300	979	1,066	1,073	1,055	997	1,825	1,813	1,817	1,810	1,820	1,666	1,655	1,634	1,631	1,642
Ca-Hardness as $CaCO_3$	375	500	1000	>1000	497	572	574	569	494	1,084	1,064	1,084	1,069	1,066	941	939	901	919	921
Mg-Hardness as $CaCO_3$	290	420	840	>840	482	494	498	486	502	741	749	733	741	754	725	717	733	712	721
Overall Quality Group[7]	-	-	-	-	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**

[5] All constituents are in mg/l unless otherwise stated.
[6] Calculated value
[7] The overall quality group into which a water is classified, is determined by the determinant that complies the least with the guidelines for the quality of drinking water.

Table 3-3: Groundwater Quality of Water Supply Boreholes Compared to the Guidelines for Safe Drinking Water

Constituents[8]	Guidelines For Human Consumption				BH3	BH3	BH3	BH3	BH3	BH4	BH4	BH4	BH4	BH4	BH6	BH6	BH6	BH6	BH6
	Group A	Group B	Group C	Group D	06/01/2022 19:50	07/01/2022 18:00	09/01/2022 18:00	10/01/2022 18:00	11/01/2022 12:00	11/01/2022 17:00	12/01/2022 05:00	12/01/2022 17:00	13/01/2022 05:10	13/01/2022 17:00	15/01/2022 13:00	16/01/2022 00:40	16/01/2022 14:00	21/01/2022 06:00	21/01/2022 18:00
pH	6-9	5.5-9.5	4-11	<4->11	7	7	7	7	6.92	6.9	6.9	7	7	7	6.9	7	7	6.9	6.9
Electrical Conductivity mS/m	150	300	400	>400	899	888	884	881	883	793	798	798	803	805	1,152	1,141	1,178	1,167	1,147
Total Dissolved Solids[9]	-	-	-	-	5,505	5,416	5,434	5,447	5,408	4,651	4,719	4,843	4,917	5,074	7,211	7,048	7,106	7,387	7,132
Turbidity	1	5	10	>10	0.35	0.3	0.3	0.55	0.4	0.2	0.25	0.25	0.75	0.3	0.35	0.2	0.6	0.35	0.2
Calcium as Ca	150	200	400	>400	459	467	465	463	459	440	462	455	457	462	492	485	490	517	493
Magnesium as Mg	70	100	200	>200	291	294	294	294	295	262	272	270	273	280	377	369	386	383	378
Sodium as Na	100	400	800	>800	1,160	1,159	1,149	1,154	1,147	994	1,002	976	993	1,030	1,526	1,466	1,465	1,503	1,482
Potassium as K	200	400	800	>800	55	53	54	53	55	46	47	47	48	48	84	81	84	82	81
Total Alkalinity as $CaCO_3$	-	-	-	-	410	400	400	400	395	400	380	385	385	380	410	410	405	405	405
Chloride as Cl	250	600	1200	>1200	2,166	2,120	2,143	2,166	2,143	1,659	1,728	1,866	1,889	1,774	2,857	2,834	2,857	2,949	2,857
Sulphate as SO_4	200	600	1200	>1200	1,101	1,057	1,062	1,052	1,046	959	953	948	986	1,215	1,593	1,517	1,552	1,688	1,579
Nitrate as N	10	20	40	>40	5.8	5.6	5.8	5.4	5.6	12	6	11	8.8	8.1	7.8	11	6.3	4.6	4
Nitrite as N	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride as F	1.5	2	3	>3	1	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.9	1.4	1.4	1.4	1.3	1.3
Iron as Fe	0.1	1	2	>2	0.01	0.02	0.03	0.03	0.02	0.05	0.02	0.01	0.02	0.03	0.04	0.04	0.05	0.04	<0.02
Manganese as Mn	0.05	1	2	>2	<0.01	<0.01	0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02
Ammonia as N	1	2	4	>4	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Hardness as $CaCO_3$	300	650	1300	>1300	2,344	2,377	2,372	2,367	2,361	2,178	2,274	2,248	2,265	2,307	2,781	2,731	2,813	2,868	2,788
Ca-Hardness as $CaCO_3$	375	500	1000	>1000	1,146	1,166	1,161	1,156	1,146	1,099	1,154	1,136	1,141	1,154	1,229	1,211	1,224	1,291	1,231
Mg-Hardness as $CaCO_3$	290	420	840	>840	1,198	1,211	1,211	1,211	1,215	1,079	1,120	1,112	1,124	1,153	1,552	1,520	1,590	1,577	1,557
Overall Quality Group[10]	-	-	-	-	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

[8] All constituents are in mg/l unless otherwise stated.
[9] Calculated value
[10] The overall quality group into which a water is classified, is determined by the determinant that complies the least with the guidelines for the quality of drinking water.

Table 3-3: Groundwater Quality of Water Supply Boreholes Compared to the Guidelines for Safe Drinking Water

Constituents[11]	Guidelines For Human Consumption				BH8	BH8	BH8	BH8	BH8	BH9	BH9	BH9	BH9	BH9	BH11	BH11	BH11	BH11	BH11
	Group A	Group B	Group C	Group D	22/01/2022 22:00	23/01/2022 09:40	23/01/2022 21:00	24/01/2022 09:00	24/01/2022 21:00	07/01/2022 20:00	07/01/2022 08:00	08/01/2022 20:00	09/01/2022 08:00	09/01/2022 21:00	16/01/2022 15:00	17/01/2022 02:40	17/01/2022 14:20	18/01/2022 03:40	18/01/2022 15:00
pH	6-9	5.5-9.5	4-11	<4->11	7.3	7	6.9	7	7	7.3	7.3	7.7	7.2	7.2	6.9	6.9	6.9	6.9	7
Electrical Conductivity mS/m	150	300	400	>400	1,107	921	885	884	898	433	428	437	453	474	2,190	2,010	1,961	1,938	1,910
Total Dissolved Solids[12]	-	-	-	-	6,924	5,790	5,537	5,143	5,193	2,490	2,556	2,583	2,605	2,864	14,809	13,410	12,764	12,799	12,371
Turbidity	1	5	10	>10	5.8	0.15	0.2	0.2	0.2	0.7	0.25	0.25	0.3	0.35	0.35	0.3	0.25	0.2	0.2
Calcium as Ca	150	200	400	>400	613	484	469	478	479	156	162	146	178	189	1,126	1,120	1,120	1,087	1,113
Magnesium as Mg	70	100	200	>200	276	220	214	212	218	90	90	93	100	106	554	535	543	535	536
Sodium as Na	100	400	800	>800	1,439	1163	1139	1,127	1,162	677	650	665	662	689	3,448	2,891	2,787	2,723	2,639
Potassium as K	200	400	800	>800	56	50	48	48	49	29	28	29	30	31	110	95	94	91	90
Total Alkalinity as $CaCO_3$	-	-	-	-	200	195	185	185	190	395	395	365	395	385	230	235	235	240	235
Chloride as Cl	250	600	1200	>1200	2,650	2,097	1,982	1,982	1,982	737	830	853	853	876	5,991	5,530	5,185	5,300	4,954
Sulphate as SO_4	200	600	1200	>1200	1,444	1,210	1,133	1,139	1,144	509	504	523	485	678	3,131	2,785	2,656	2,670	2,656
Nitrate as N	10	20	40	>40	73	101	99	10	9.8	12	12	12	13	14	70	70	53	56	54
Nitrite as N	-	-	-	-	0.6	0.86	0.9	1	1.1	0.01	0.01	0.01	0.01	0.02	<0.01	0.01	<0.01	<0.01	<0.01
Fluoride as F	1.5	2	3	>3	1.2	1.3	1.3	1.3	1.3	2	2.1	2	2.1	2	1.3	1.2	1.2	1.2	1.2
Iron as Fe	0.1	1	2	>2	1.8	0.05	0.02	0.02	0.01	0.04	0.01	0.02	0.01	0.02	0.18	0.19	0.49	0.97	0.16
Manganese as Mn	0.05	1	2	>2	<0.02	0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.1	<0.1	0.24	<0.1
Ammonia as N	1	2	4	>4	1.1	1.4	2.2	2.1	2.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Total Hardness as $CaCO_3$	300	650	1300	>1300	2,667	2,115	2,052	2,067	2,094	760	775	748	856	908	5,093	5,000	5,033	4,917	4,986
Ca-Hardness as $CaCO_3$	375	500	1000	>1000	1,531	1,209	1,171	1,194	1,196	390	405	365	444	472	2,812	2,797	2,797	2,714	2,779
Mg-Hardness as $CaCO_3$	290	420	840	>840	1,137	906	881	873	898	371	371	383	412	437	2,281	2,203	2,236	2,203	2,207
Overall Quality Group[13]	-	-	-	-	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**

[11] All constituents are in mg/l unless otherwise stated.
[12] Calculated value
[13] The overall quality group into which a water is classified, is determined by the determinant that complies the least with the guidelines for the quality of drinking water.

Table 3-3: Groundwater Quality of Water Supply Boreholes Compared to the Guidelines for Safe Drinking Water

Constituents[14]	Guidelines For Human Consumption				BH12	BH12	BH12	BH12	BH12	K5 Pit
	Group A	Group B	Group C	Group D	11/01/2022 09:00	11/01/2022 21:40	12/01/2022 09:20	12/01/2022 21:00	13/01/2022 09:00	25/01/2022
pH	6-9	5.5-9.5	4-11	<4->11	7.1	7.1	7.2	7.2	7.2	7.5
Electrical Conductivity mS/m	150	300	400	>400	838	812	802	3,260	785	3270
Total Dissolved Solids[15]	-	-	-	-	5,262	5,022	5,075	22,768	4,826	22,763
Turbidity	1	5	10	>10	0.25	0.3	0.3	3	0.6	4.8
Calcium as Ca	150	200	400	>400	473	450	451	986	420	979
Magnesium as Mg	70	100	200	>200	229	216	215	1004	201	1023
Sodium as Na	100	400	800	>800	1,121	1,069	1,081	5,596	1,000	5,505
Potassium as K	200	400	800	>800	52	51	51	232	50	236
Total Alkalinity as $CaCO_3$	-	-	-	-	385	285	345	190	345	133
Chloride as Cl	250	600	1200	>1200	1,843	1,751	1,751	9,332	1,728	9,102
Sulphate as SO_4	200	600	1200	>1200	1,035	1,052	1,062	5,449	1,002	5,830
Nitrate as N	10	20	40	>40	62	59	58	12	49	1.4
Nitrite as N	-	-	-	-	0.07	0.04	0.05	0.13	0.06	0.22
Fluoride as F	1.5	2	3	>3	1.4	1.4	1.4	2.1	1.4	1.9
Iron as Fe	0.1	1	2	>2	0.02	0.03	0.02	<0.1	0.02	0.18
Manganese as Mn	0.05	1	2	>2	<0.01	<0.01	<0.01	<0.1	<0.01	0.21
Ammonia as N	1	2	4	>4	<0.02	<0.02	0.49	0.44	<0.02	1.2
Total Hardness as $CaCO_3$	300	650	1300	>1300	2,124	2,013	2,012	6,597	1,876	6,657
Ca-Hardness as $CaCO_3$	375	500	1000	>1000	1,181	1,124	1,126	2,462	1,049	2,445
Mg-Hardness as $CaCO_3$	290	420	840	>840	943	889	885	4,134	828	4,213
Overall Quality Group[16]	-	-	-	-	**D**	**D**	**D**	**D**	**D**	**D**

[14] All constituents are in mg/l unless otherwise stated.
[15] Calculated value
[16] The overall quality group into which a water is classified, is determined by the determinant that complies the least with the guidelines for the quality of drinking water.

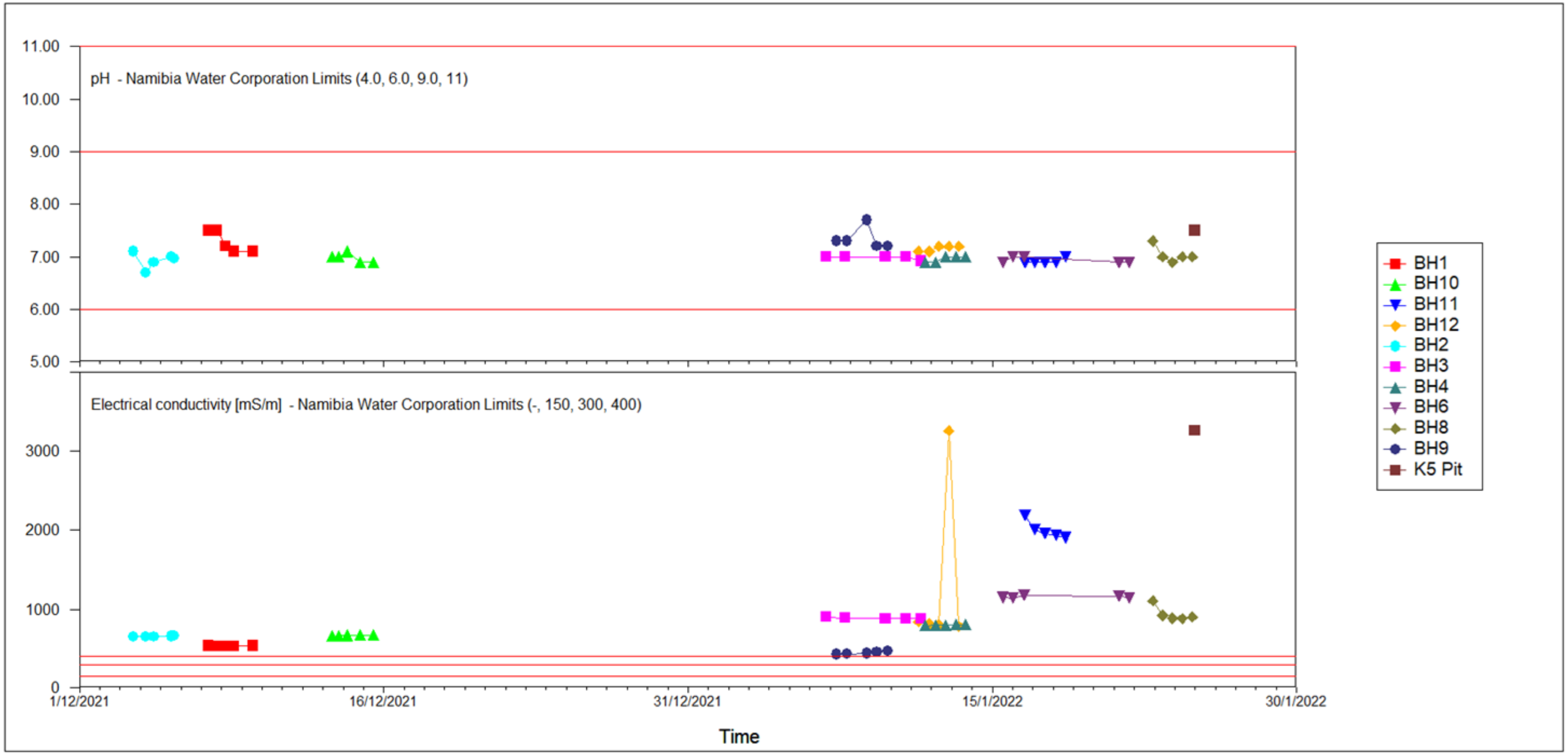

Figure 3-14: Electrical Conductivity Trends

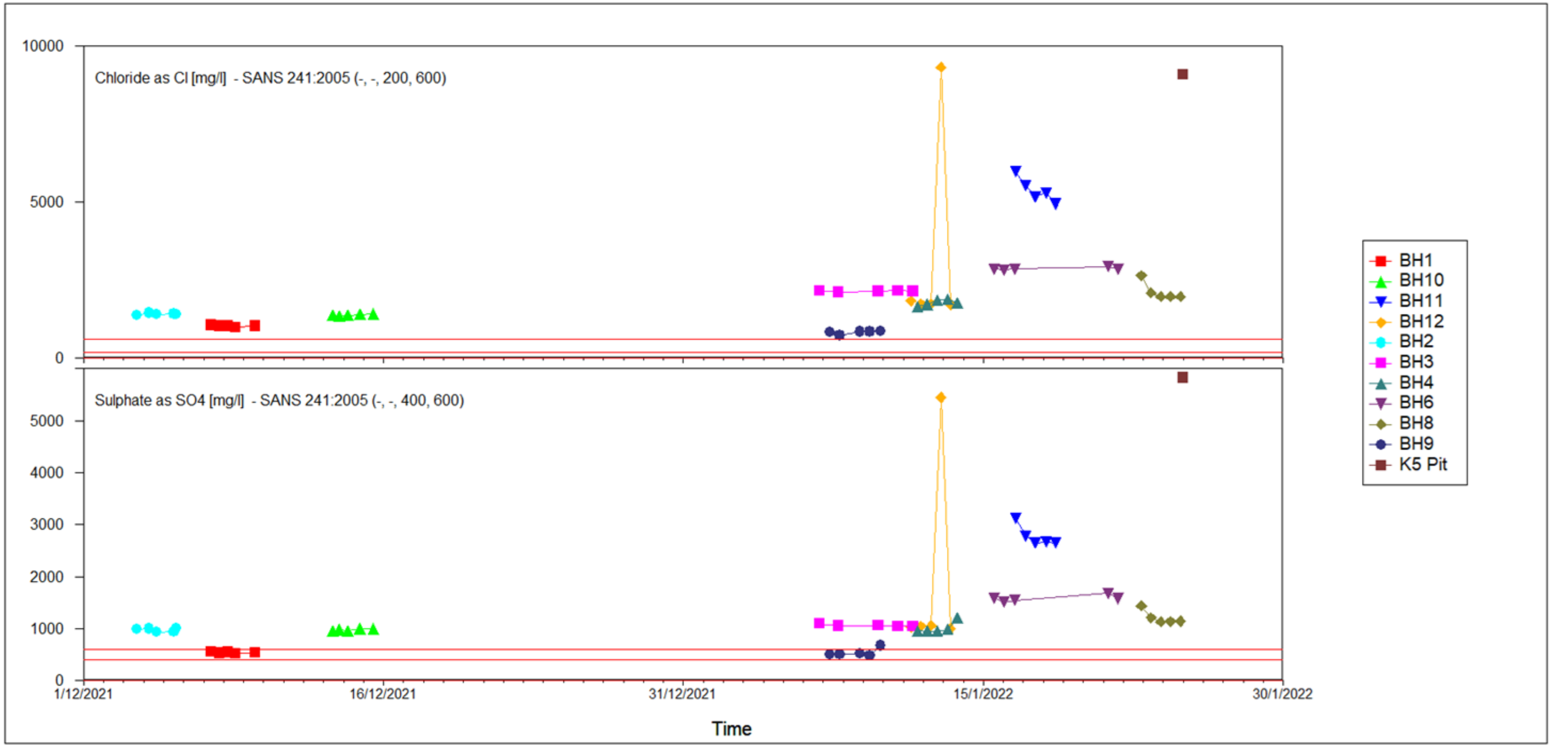

Figure 3-15: Chloride and Sulphate Trends

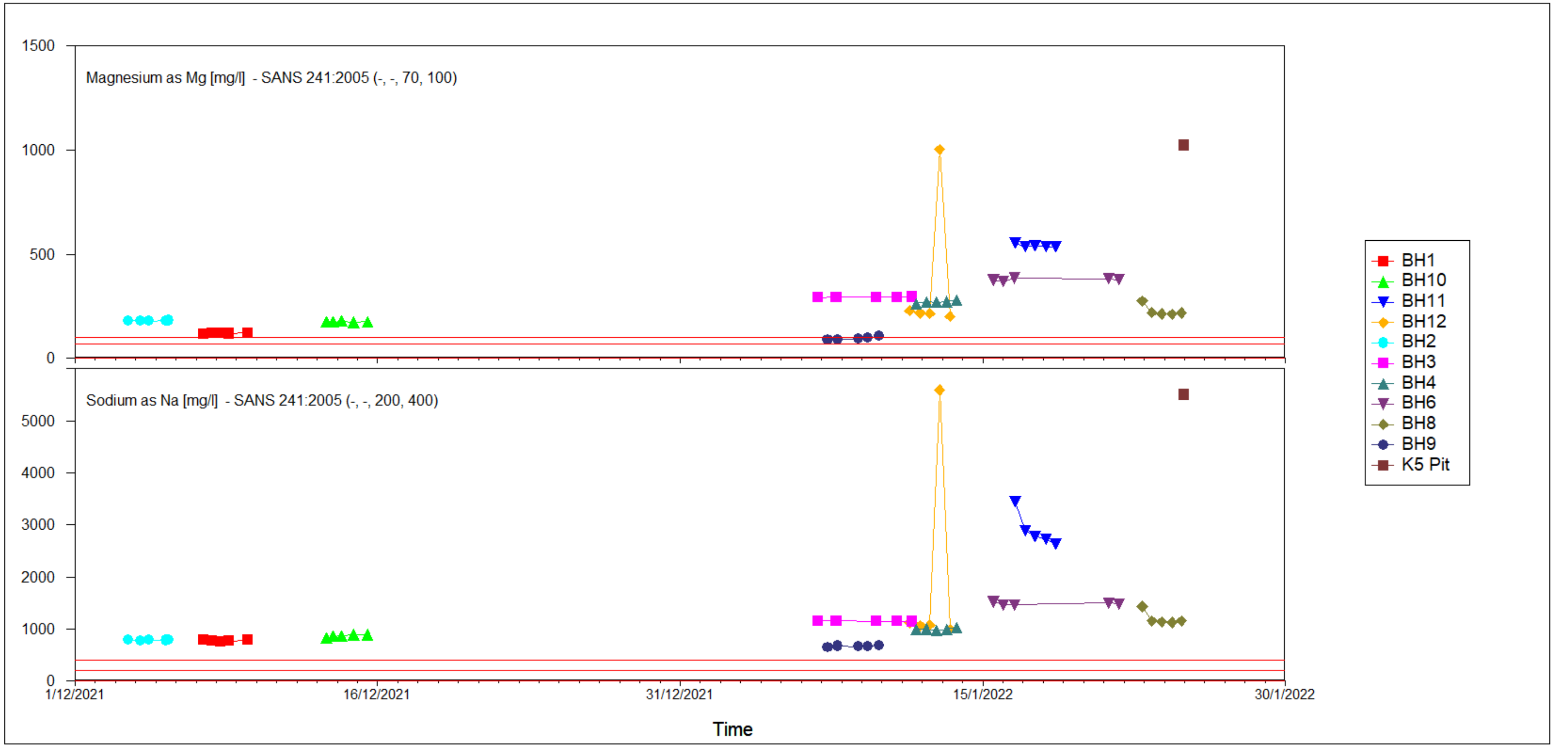

Figure 3-16: Magnesium and Sodium Trends

Table 3-4: Corrosion/Scaling Indices

	BH1	BH2	BH10	BH3	BH4	BH6	BH8	BH9	BH11	BH12	K5 Pit
Langelier Index	0.78	0.58	0.62	0.68	0.66	0.64	0.46	0.60	0.72	0.76	1.00
	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency
Ryznar Index	5.70	5.74	5.78	5.62	5.72	5.64	6.16	6.14	5.48	5.60	5.50
	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency	Scale-forming tendency
Corrosivity Ratio	3.72	7.52	7.08	10.32	9.26	14.02	22.36	4.48	44.76	28.36	142.3
	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion	Tendency towards progressive corrosion

3.4.3. Aquifer Testing

Hammerstein Mining and Drilling tested the water supply boreholes between 5 December 2021 and 25 January 2022. The duration of the aquifer tests was planned for 48 hours for each borehole. A summary of these aquifer tests is provided in Table 3-5. The methodology is provided in Appendix A and the test data, observation comments and Aqtesolv interpretations are provided in Appendix C.

The aquifer test data was interpreted using the FC method and Aqtesolv (Version 4.5 professional). The FC method was used to determine the sustainable yield (Table 3-8) for the boreholes whilst Aqtesolv was used to interpret the hydraulic parameters for the aquifer (Table 3-6). The solutions used in the Aqtesolv software include the Cooper-Jacob, Theis and Theis Recovery for confined aquifers as well as the Moench solution for fractured aquifers.

Although the applied methodology for calculating hydraulic parameters is based on assumptions which may differ from actual site conditions (e.g., infinite areal extent, homogenous and isotropic aquifer conditions, no delayed gravity response of aquifer), the resulting hydraulic parameter from these calculations are representative of the aquifer system in the vicinity of the tested boreholes.

The hydraulic conductivities calculated from the Moench solution indicate a range between 0.1 – 3.5 m/d with an average of 0.8 m/d, a harmonic (harmean) mean of 0.2 m/d and a geometric (geomean) mean of 0.3 m/d. The transmissivities calculated from the Cooper-Jacob and Theis solutions indicate a range between 0.6 – 586 m^2/d with an average of 51 m^2/d, a harmean of 6 m^2/d and a geomean of 18 m^2/d. The previous aquifer test data was interpreted with Aqtesolv, and a similar range of hydraulic conductivities and transmissivities were obtained (Table 3-7).

The hydraulic conductivities calculated from the water supply boreholes correspond to what is expected for fractured igneous and metamorphic rocks which can range between $1x10^{-3}$ – $1x10^{1}$ m/d (Domenico & Schwartz, 1990). The results also correspond with the hydraulic conductivities for a study undertaken for the Swakop River Catchment (within the Damara Orogen) which indicates that the hydraulic conductivities can range between $8.6x10^{-4}$ – 0.86 m/d in fractured aquifers with a moderate groundwater potential and between $8.6x10^{-4}$ – 8.6 m/d in fractured aquifers with a high groundwater potential (Winker, 2010).

The combined average sustainable yield for all the aquifer tested boreholes is 18.7 m^3/hr (Table 3-8)[17].

During the aquifer test on BH9 it was observed that the installed pump had iron oxide deposits and that roots were growing within the borehole. An initial recommendation would be to clean borehole BH9 to assess if yields can be improved.

- Roots could be removed by welding steel blades onto a heavy rod. Sharper blades should be positioned on the lower portion to assist with cutting roots when the rod is

[17] The average sustainable yield provides an intermediate estimation between the 1 and 2 no flow boundaries which is likely to be present on site. A no flow boundary is an impermeable unit that does not allow flow through it (i.e., dyke, sealed fault)

being lowered and blunter blades can be positioned higher up to assist with grabbing the loose roots when pulling the rod out of the borehole. An auger-type fitting may also be an option. The borehole will need to be cleaned regularly to prevent the roots regrowing;

- Complete a downhole camera survey to assess if the fractures are blocked which may need to be flushed, brushed or redrilled to a slightly larger diameter to try clear surface deposits on the borehole walls which may be blocking yields;
- Chemical additives could be used provided this doesn't interfere with the water chemistry needed in the plant or surrounding water supply boreholes; and
- Alternative boreholes may need to be drilled or located to supplement water supply during borehole maintenance periods.

It is also recommended to clean BH2. The 2021 aquifer test on BH2 was done at a reduced rate of 2m^3/hr (compared to the previous 6 m^3/hr) and resulted in a higher drawdown compared to the original test (15 m compared to the previous 5 m). This may indicate that scaling could be affecting the operation of the borehole.

Table 3-5: Aquifer Test Summary

Borehole	Test	Test Duration (hours)	Test Rate (m^3/hr)	Test Rate (l/s)	Pump Depth (mbgl)	Borehole Depth (m)	SWL (mbgl)	Drawdown (m)	Observation Boreholes	Lithology	Main Water Strike Depth (m)	Comment
BH1	CDT 1	16	8	2.2	44	48	24.20	18.79	BH2, BH10	Quartzite	27	Yield was not sustainable. Casing has been installed.
	CDT 2	24	5	1.4	44	48	25.13	2.48		Quartzite	27	Casing has been installed.
BH2	CDT 1	48	2	0.6	50	54	29.95	15.16	BH1, BH10	Quartzite	31	No casing installed.
BH3	CDT 1	5	3	0.8	56	60	17.10	35.21	BH4, BH6	Quartzite, Schist	27	Yield was not sustainable. No casing installed.
	CDT 2	52	2	0.6	56	60	16.80	8.12		Quartzite, Schist	27	Rate was initially set to 4 m^3/hr (pressure issues in the pipes). No casing installed
BH4	CDT1	48	4.5	1.3	86	90	21.89	12.62	BH3, BH6	Pegmatite, Quartz, Schist	48	No casing installed.
BH5	Collapsed at 15.45 mbgl											
BH6	CDT 1	11	15	4.2	70	90	17.41	49.83	BH3, BH4	Unknown	Unknown	Accidentally started at 18 m^3/hr reduced to 15 m^3/hr. Yield was not sustainable
	CDT 2	8	11	3.1	70	90	20.65	26.02		Unknown	Unknown	Yield was not sustainable
	CDT 5	28	6	1.7	70	90	19.32	8.18		Unknown	Unknown	
BH8	CDT1	48	18.5	5.1	70	118	37.00	5.14	BH11	Schist, Pegmatite	50, 85, 106, 111	Casing has been installed.
BH9	CDT1	48	7.5	2.1	96	100	34.46	38.78	BH10, BH12	Schist, Quartz	46, 70	No casing installed.
BH10	CDT 1	8	12	3.3	54	58	33.56	1.48	BH1, BH2	Quartzite	28, 32, 40	Pumped at a lower rate to verify yield and fill plant reservoir. Casing has been installed.
	CDT 2	40	18	5.0	54	58	34.14	3.32		Quartzite	28, 32, 40	Casing has been installed.
BH11	CDT1	48	9.6	2.7	74	78	41.25	14.60	BH8	Unknown	Unknown	
BH12	CDT1	48	2.5	0.7	54	58	31.90	7.60	BH9	Unknown	Unknown	Rate was increased to 3 m3/hr after 24 hours

Table 3-6: Summary of Hydraulic Parameters

		Literature	Swakop River Catchment Study	Fractured Aquifer		Cooper Jacob (Early)	Cooper Jacob (Late)	Theis Recovery (Early)	Theis Recovery (Late)	Theis (Early)	Theis (Late)	Theis (Recovery)
		k (m/d)	k (m/d)	k (m/d)	Ss (m-1)	T (m^2/d)						
BH1	2021 CDT1			1.8	$2.3x10^{-2}$	36.8	0.8	2.1	30.4	39.7		28.1
	2021 CDT2			1.9	$1.1x10^{-2}$	42	28.4	43.7	21.2	31.9		29.8
BH2	2021 CDT1			0.2	$5.7x10^{-2}$	9.1	3.3	0.5	14.7	-	-	4.9
BH3	2022 CDT1			0.1	$1.9x10^{-4}$	0.6	3.4	2.6	1.4	3.3		-
	2022 CDT2			0.1	$1.1x10^{-4}$	4.9	1.8	4.2	2	-	-	3.9
BH4	2022 CDT1			0.2	$2.8x10^{-5}$	5.2	13.4	1.8	63.3	-	-	11.1
BH6	2022 CDT1			0.1	$7.4x10^{-20}$	38	37.5	32.8	-	36.87	37.9	-
	2022 CDT2			0.1	$1.5x10^{-5}$	82.1	6.4	54.8	14	85.1	9	7.9
	2022 CDT3			0.1	$1.4x10^{-3}$	84.5	3.8	92.6	8.1	99	4.2	3.7
BH8	2022 CDT1			0.5	$3.4x10^{-4}$	257.8	25.4	586	176.5	257.8	25.9	27.2
BH9	2022 CDT1			0.1	$1.8x10^{-6}$	8.5	1	1.2	9.4	3.7		4.4
BH10	2021 CDT1			3.5	0.1	154	84.3	215.5	195.9	183.4	73.3	81.6
	2021 CDT2			3.2	0.2	182.2	39.1	162.2	80.8	163	35.9	57.7
BH11	2022 CDT1			0.2	$5.1x10^{-2}$	32.8	4.3	16.6	7.7	34.1	4.5	-
BH12	2022 CDT1			0.4	$2.1x10^{-4}$	20.7	2.3	3.8	12.6	-		12.29
Minimum		**0.001**	**$8.6x10^{-4}$**	**0.1**	**$7.4x10^{-20}$**	**0.6**						
Maximum		**10**	**8.6**	**3.5**	**0.2**	**586**						
Average		**-**	**-**	**0.8**	**0.03**	**50.8**						
Harmonic Mean		**-**	**-**	**0.2**	**$1.1x10^{-18}$**	**5.9**						
Geometric Mean		**-**	**-**	**0.3**	**$1.0x10^{-4}$**	**17.6**						

Table 3-7: Summary of Previous Aquifer Test Parameters

	2018 Test Rate (m^3/hr)	2018 SWL (mbgl)	2018 Drawdown (m)	Fractured Aquifer		Cooper Jacob (Early)	Cooper Jacob (Late)	Theis Recovery (Early)	Theis Recovery (Late)	Theis (Early)	Theis (Late)	Theis (Recovery)
				k (m/d)	Ss (m-1)	T (m^2/d)						
BH1	5	21.05	1.69	1.7	$5.3x10^{-5}$	90.5	47	72.2	43.6	-	-	51.7
BH2	6	23.24	5.06	0.9	$6.6x10^{-6}$	34.4	22.7	42.1	23.5	-	-	27.1
BH3	2	14.75	4.6	0.1	$3.4x10^{-4}$	6.7	-	8.2	-	-	-	7.4
BH4	3	15.11	8.14	0.1	$9.9x10^{-7}$	3	55.6	2	90.5	-	-	55.6
BH5	2.5	14.92	31.75	0.05	$1.8x10^{-2}$	4.8	2.3	-	1.8	2		-
BH6	6	16.6	1.83	0.2	$1.4x10^{-4}$	94.1	25.5	107.1	43.5	109.8	19.7	-
BH8	17.5	36.93	2.16	1.2	$8.2x10^{-7}$	855.2	79.3	957.9	122.5	747.2	73.4	-
BH9	6	30.07	7.86	0.3	$2.8x10^{-7}$	13.2	18.4	33.4	36.4	-	-	21.2
BH10	19	23.03	19.7	2.3	0.2	298.2	112.1	239.8	114.3	-	-	109.6
Minimum				**0.05**	$2.8x10^{-7}$	**2**						
Maximum				**2.3**	**0.2**	**958**						
Average				**0.8**	**0.02**	**112**						
Harmonic Mean				**0.2**	$\mathbf{1.5x10^{-6}}$	**12**						
Geometric Mean				**0.4**	$\mathbf{6.2x10^{-5}}$	**38**						

Table 3-8: Sustainable Yield Interpretations

Borehole	Sustainable Yield (m^3/hr)				
	No Boundaries[18]	1 No Flow Boundary	2 No Flow Boundaries	4 No Flow Boundaries	Average
BH1	0.9	0.5	0.4	0.2	0.4
BH2	0.4	0.3	0.2	0.1	0.2
BH3	0.6	0.4	0.3	0.1	0.3
BH4	2.1	1.3	0.9	0.5	1.0
BH6	2.2	1.2	0.8	0.4	1.0
BH8	16.6	10.2	7.4	4.1	8.5
BH9	1.9	1.1	0.8	0.4	0.9
BH10	7.6	4.9	3.6	2.0	4.0
BH11	3.0	1.7	1.2	0.6	1.4
BH12	1.9	1.2	0.9	0.5	1.0
Total Yield	**37.2**	**22.7**	**16.4**	**9.0**	**18.7**

[18] A no flow boundary is an impermeable unit that does not allow flow through it (i.e., dyke, sealed fault).

4. Conceptual Model

The conceptual model describes the hydrogeological environment and is used as input into the numerical model to represent simplified, but relevant conditions of the groundwater system. The conceptual model is based on the source-pathway-receptor principle.

4.1. Sources

4.1.1. Recharge

The NA-MIS (Namibian Monitoring Information System) and hydrogeological map of Namibia indicates the project area has an effective groundwater recharge percentage of 0% of the average annual recharge. Surrounding areas associated with the mica schists of the Kuiseb Formation and the marbles of the Karibib Formation can receive up to a maximum of 0.5% of the average annual recharge (Groundwater Management Institute, 2022). With an average annual rainfall of 88 mm, the recharge to isolated areas of the project area could be a maximum of 0.44 mm/a.

A rainwater sample was collected on 19 January 2022 and submitted to a SANAS accredited laboratory for chloride analysis. Chloride can be used as a tracer to estimate the recharge to the groundwater aquifers using the following equation:

$$R = P.\frac{Clp}{Clgw}$$

Where R is the groundwater recharge flux, P is the average annual precipitation, Cl_p is the average chloride concentration for precipitation and Cl_{gw} is the average chloride concentration for groundwater.

The results of the chloride method estimate indicate approximately 0.7% (0.61 mm/a) of rainfall contributes to recharging the groundwater aquifer in the project area. This would indicate a maximum contribution percentage as the equation above does not account for surface water runoff or the presence of chloride in the environment (i.e., gypsum) which may influence the chloride concentration recharging to or occurring within the aquifer.

4.2. Pathways

4.2.1. Aquifers

The project area comprises of igneous (local pegmatites and regional granites) and metamorphic (schist and quartzite) rocks with alluvial sediment cover in the Uis river channel. Two aquifers have been interpreted based on the available information.

4.2.1.1. *Alluvial Aquifer*

An alluvial aquifer occurs predominantly within river channels but can also be present as a surface cover overlaying the fractured aquifer (Figure 3-4).

Observations on site indicate that the alluvial sediments are coarse-grained. Coarse-grained unconsolidated sediments can have a range in hydraulic conductivity of between 0.08 – 518 m/d (Domenico & Schwartz, 1990). The drill logs of the water supply boreholes indicate that the alluvial sediments in the Uis and Southern wellfield river channels vary between 2 – 13 m thick, with an average thickness of 5.5 m. The static water levels measured in the water supply boreholes occur below the alluvial aquifer indicating this aquifer will be important for recharging the underlying fractured aquifer but is of low importance for water supply.

4.2.1.2. Fractured Aquifer

Majority of the project area is exposed as schists (meta-pelites), marble or granites (Figure 3-4). Intrusive and metamorphic rocks typically have poor aquifer properties but can yield successful boreholes if secondary fracture or fault features are intersected. Marble aquifers can have a higher groundwater potential if karstic features have developed, however yields may still be dependent on the degree of weathering and availability of rainfall for recharge.

The NA-MIS (Namibian Monitoring Information System) and hydrogeological map of Namibia indicates that the geology of the project area has a very low and limited groundwater potential. The schists (Kuiseb Formation) and the marbles (Karibib Formation) are considered to have a low potential for groundwater, but localised areas can have a higher moderate potential for groundwater. The NA-MIS hydrogeological map indicates that the project area occurs in the region with the lowest abstraction volume (Groundwater Management Institute, 2022).

The hydraulic conductivity of igneous and metamorphic rocks can range between $1x10^{-3}$ – $1x10^{1}$ m/d for fractured rocks and between $3x10^{-9}$ – $2x10^{-5}$ m/d in unfractured rocks (Domenico & Schwartz, 1990). The aquifer testing results indicates that the fractured aquifer in the project area occurs within the expected range of hydraulic conductivities (ranging between 0.01 – 7 m/d with an average of 0.9 m/d).

The weathering profiles for the water supply boreholes indicate that the fractured aquifer is weathered to an average depth of 25 m and has a higher frequency of fractures between 20 – 50 m. Although the fracture frequency decreases after 50 m the fractures that are intersected can still be high yielding. Initial groundwater levels measured in 2018 indicate that the water table typically occurs within the weathered zone of the fractured aquifer. Abstraction from the Uis wellfield boreholes since operations began in 2020 has drawn down the water levels in these boreholes by between 2.4 – 7.8 m. Groundwater levels within the Southern wellfield have decreased by an average of 1.4 m between 2018 and 2022, even though these boreholes are not operational.

4.3. Receptors

AfriTin have two wellfields from which water can be drawn to supply the processing plant. The Uis wellfield is located in the Uis river, which runs through the mine area. There are seven boreholes located in this wellfield which are currently being used to supply water to the plant. The Uis wellfield boreholes are located within 2 km of each other and are expected to provide a combined average sustainable yield of 16.4 m^3/hr. Two third-party boreholes are located in Uis River catchment.

The Southern wellfield is located within a river channel approximately 6 km south of the mine and comprises of three boreholes. A fourth low yielding borehole was drilled in this wellfield but has subsequently collapsed. The Southern wellfield is not currently operational. The three boreholes in the southern wellfield are located within 700 m of each other and are expected to provide a combined average sustainable yield of 2.3 m^3/hr.

5. Numerical Model

A finite difference numerical groundwater flow model was constructed based on the conceptual model for the Uis Tin Mine. The numerical model was calibrated and verified with the available monitoring data.

The numerical model was constructed using GMS 10.5.9, a pre- and post- processing package for MODFLOW and MT3DMS. MODFLOW is a three-dimensional groundwater flow model published by the United States Geological Survey (USGS). MODFLOW is a widely used simulation code which is well documented.

The numerical model was constructed to represent the hydrogeological units as described in Section 4 for the alluvial, weathered, highly fractured and low fractured aquifers. The model thickness was set at 250 m to accommodate the maximum depth of abstraction boreholes (maximum of 90 mbgl) but also to allow incorporation of the topography and extents and depths of geological units.

5.1. Model Confidence Level Classification

The level of confidence depends upon the available data for the conceptualisation, design and construction of the model. Consideration was given to the spatial and temporal coverage of the available datasets to characterise the aquifer and the historic groundwater behaviour that was useful for model calibration.

Factors that affect the model confidence level include the type and quality of data used for model calibration, the degree to which the model was able to reproduce observations, and whether the model was able to represent present-day hydrogeological conditions during the calibration procedure. For the calibration process, the following data was available for the project:

- Surface geology maps for the mining and wellfield areas;
- Geological logs and aquifer tests for 11 boreholes, in the alluvial aquifer and weathered and highly fractured parts of the underlying lithologies, mainly in meta-sedimentary rocks and pegmatite;
- Historic groundwater level data for 21 boreholes, mostly in the Uis Riverbed and at the southern wellfield, with most boreholes intersecting thin alluvial deposits on top of fractured rock; and

- Recharge estimations based on available information for the region.

Based on a semi-quantitative assessment of the available data on which the model was based on and the manner in which the model was calibrated, the model was classified as a Class 1 model using the Australian Guidelines (Australian Government - National Water Commission, 2012).

This model could be updated to a Class 2 model should the following data become available:

- Obtain additional hydraulic parameters such as transmissivity and hydraulic conductivity of rock units present in the area surrounding the mine site, including to the north, east and south of the mine site;
- Periodical, long-term groundwater water level monitoring in the surrounding area of the mine;
- Increased accuracy of recharge estimates; and
- Flow measurements in the Uis River.

5.2. Model Setup

The conceptual model was translated into the numerical model during the model setup. This involves:

- Defining the model domain and boundary conditions;
- Discretising the data spatially and over time;
- Defining the initial conditions;
- Selecting the aquifer types; and
- Preparing the model input data.

5.2.1.1. Model Domain

The model domain is irregularly shaped with approximate dimensions of 33 km west-east by 25 km north-south, which is a relatively large model area due to the size of the catchment. The model grid was discretised by 974 x 708 cells in the x and y direction for 8 model layers, resulting in a total of 5 146 616 active cells. A grid refinement of 10 m x 10 m cells covering the area including the wellfields was applied with gradually coarser grid cell sizes to a maximum size of 300 m x 300 m away from the abstraction boreholes to reduce model run time (Figure 5-1).

5.2.1.2. Time Discretisation

Time parameters are relevant when modelling transient (time-dependent) conditions. They include time units, the length and number of stress periods and the number of time steps within each stress period. All model parameters associated with boundary conditions and various stresses remain constant during one stress period.

For the purpose of simulation of borehole abstraction, transient simulations was discretized into stress periods as follows:

- For the production borehole abstraction: monthly stress periods with average abstractions and drawdowns.

Stress periods were subdivided in timesteps to allow for accurate iterations as follows:

- Yearly stress periods divided in 10-time steps; and
- Monthly stress periods divided in 10-time steps.

5.2.1.3. Boundary Conditions

Boundary conditions are sets of differential equations that must be solved to express the known water fluxes and variables (such as hydraulic heads) within the model domain. Local hydraulic boundaries were identified for the model boundary, which are represented by local water courses and topographical highs. These hydraulic boundaries as shown in Figure 5-1 and detailed in Table 5-1 were selected far enough from the proposed mining activities so that the boundaries don't influence the numerical model artificially.

Table 5-1: Identification of Real-World Boundaries and Adopted Model Boundary Conditions

Boundary	Boundary Description	Boundary Condition
Top	Top surface of water table	Mixed type: Drain cells for non-perennial streams. Different recharge rates were assigned for different recharge areas (based on topography and available information) and hydrogeological units. Recharge flux was applied to the highest active cell.
North	Topographical / non-perennial stream	Drain and constant head boundaries
East	Geological contact / topographical	Constant head boundary
South	Topographical / non-perennial stream	Drain and constant head boundaries
West	Non-perennial streams	Drain boundary

As input into the numerical model, the following assumptions were made for the Uis Tin Mine:

- Available groundwater levels for historical and current boreholes were used for steady state calibration;
- For transient calibration, the following was used:
  - Drawdown and abstraction data for the current production boreholes (period September 2020 – March 2022).

The most up-to-date abstraction data, as received from Uis Tin Mine, was used as input for the numerical model. The extent and depth of hydrostratigraphic units were determined based on a combination of the available regional and local surface geology and borehole lithological logs and is shown in Figure 5-2 to Figure 5-3.

5.2.1.4. Input Parameters

Model input parameters for this groundwater flow model are divided into two groups:

- hydrogeological parameters; and
- initial conditions.

Initial estimates for hydraulic properties were assigned based on pump test results as carried out as part of the fieldwork. Initial head conditions were estimated based on measured groundwater levels. Recharge rates were applied to different hydrogeological units and recharge areas within the model area as a percentage of MAP. These rates were based on topography (there is an elevated area along the eastern boundary of the model for which available data indicated a recharge rate of >0.5% of MAP) and recharge rates for the different lithological units for the remainder of the model. The highest recharge was used as input for the elevated area (high recharge area), followed by the sediments, due to them receiving higher infiltration rates when compared to areas underlain by weathered rocks. For the steady-state and transient models an annual recharge rate was used (Table 5-2).

Table 5-2: Annual Recharge Values for Hydrogeological Units

Hydrogeological unit	Percentage of MAP	Recharge rate (m/d)
Sediments	0.4%	1.1×10^{-6}
Meta-sedimentary rocks	0.1%	2.7×10^{-7}
Granite	0.08%	2.1×10^{-7}
Schist	0.08%	2.1×10^{-7}
Higher recharge area	1%	2.7×10^{-6}

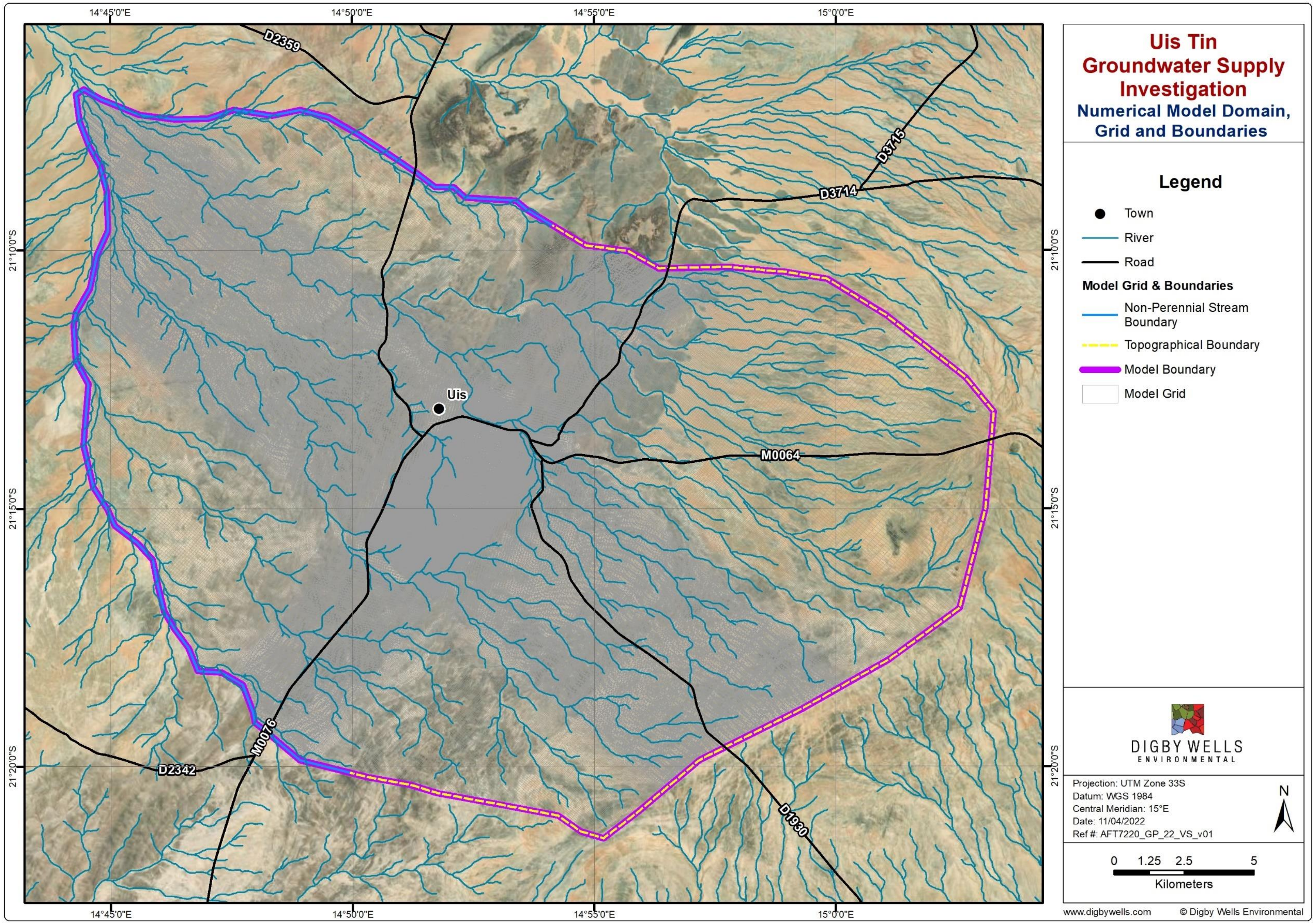

Figure 5-1: Numerical Model Domain, Grid and Boundaries

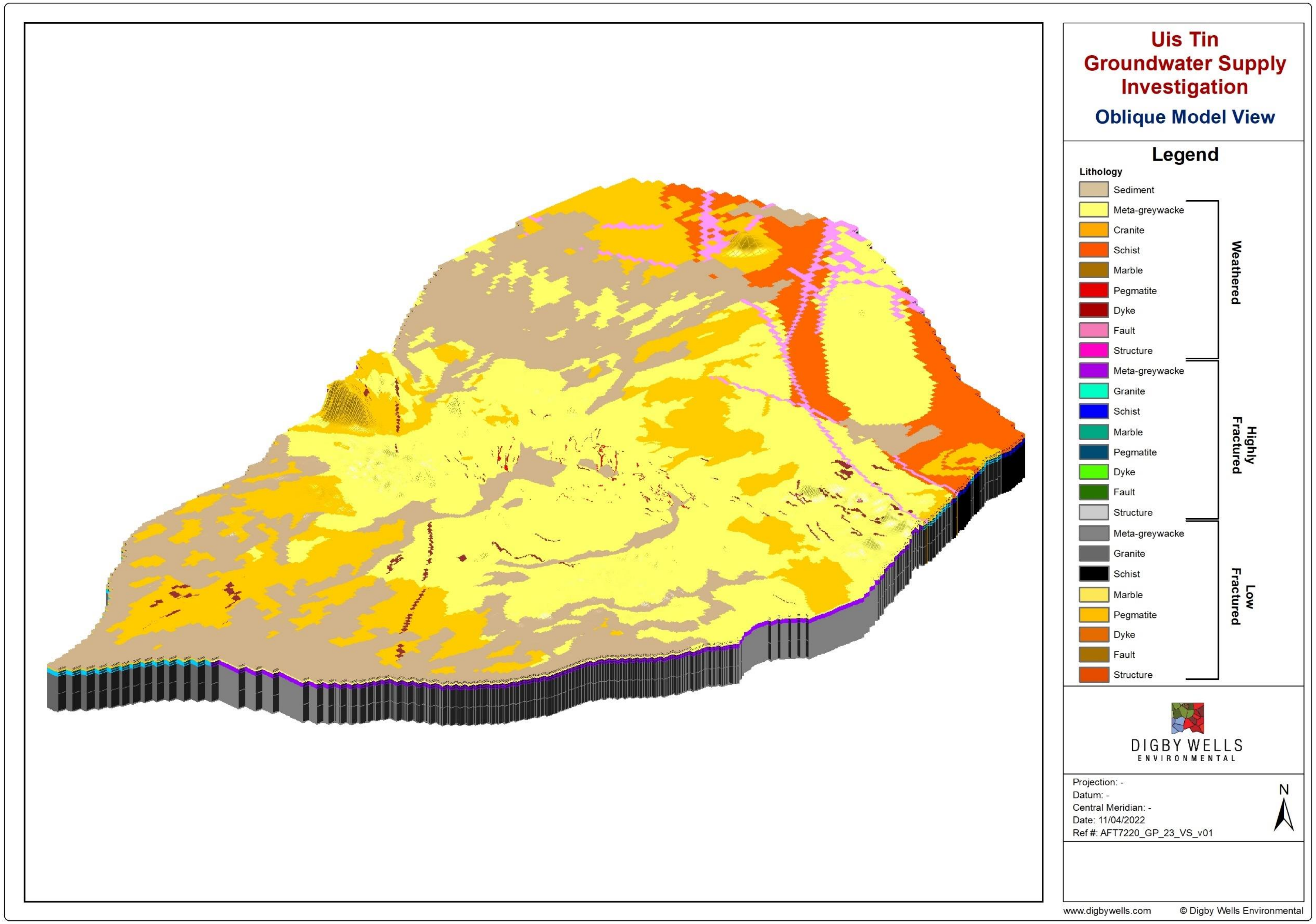

Figure 5-2: Oblique Model View

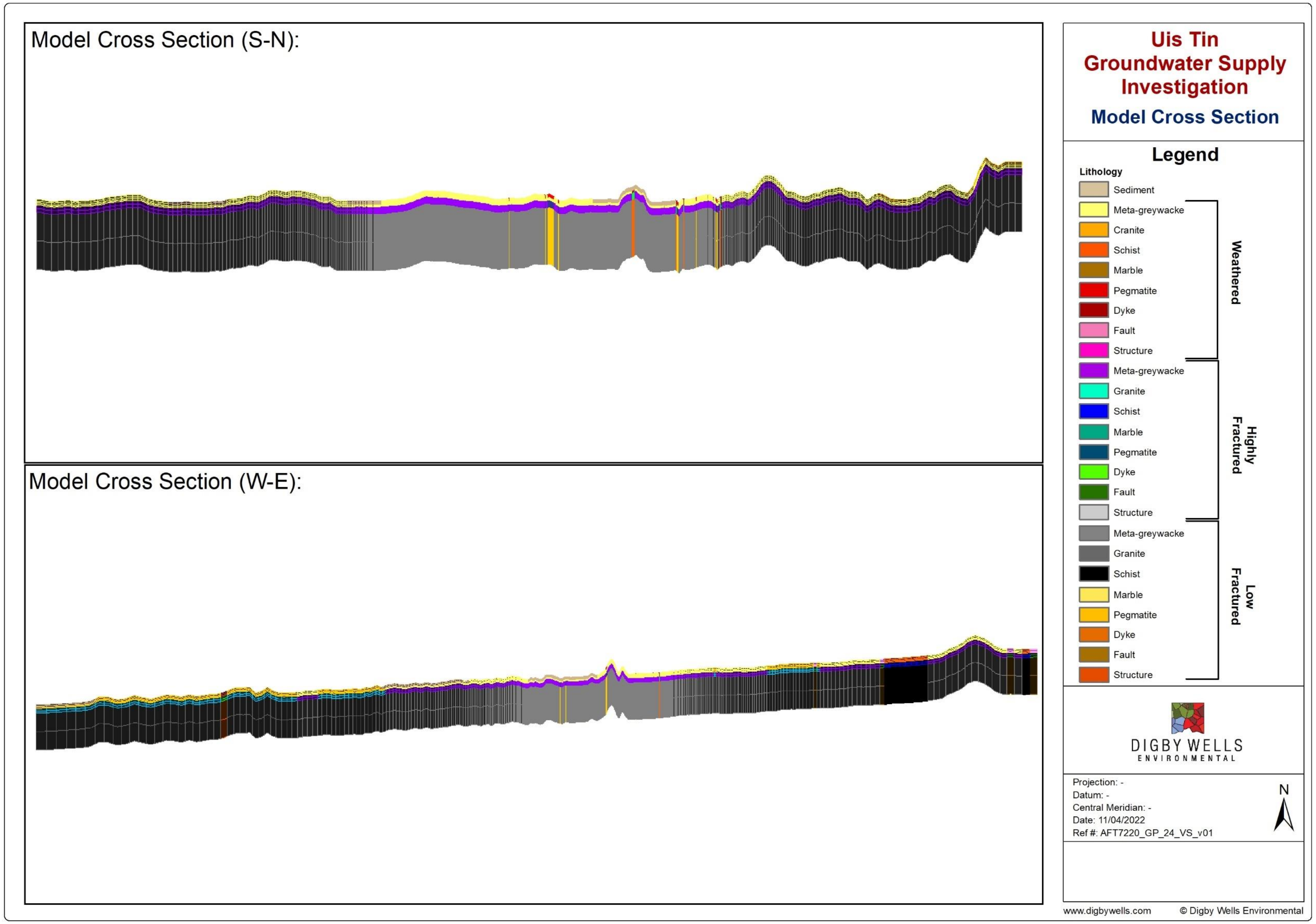

Figure 5-3: Model Cross-Sections

5.2.1.5. Steady State Simulation

Calibration is the process of finding a set of boundary conditions, stresses and hydrogeological parameters that produce results that most closely match field measurements of hydraulic heads and flows. In a regional groundwater flow model, a difference between calculated and measured heads of up to several meters can be tolerated and is usually expressed as a function of the total range of observations.

The calibration was undertaken for steady state conditions as the hydrogeological system is at current not impacted by mining activities. Based on available information, groundwater levels measured in 17 boreholes in total were used for model calibration.

The numerical model calculated head distribution ($h_{x,y,z}$) is dependent upon the recharge, hydraulic conductivity and boundary conditions. For a certain timestep and a given set of boundary conditions, the simulated head distribution across the aquifer can be obtained for a given set of hydraulic conductivity values and specified recharge values. This simulated head distribution can then be compared to the measured head distribution and the hydraulic conductivity and/ or recharge values can be altered until an acceptable correspondence between measured and simulated heads is obtained.

Steady-state calibration of the Uis Tin Mine model area was accomplished by refining the vertical and horizontal hydraulic conductivity until a reasonable resemblance between the measured and simulated piezometric levels was obtained. This was done by a combination of PEST and manual calibration using aquifer zone properties for all model layers.

The steady-state calibration was regarded as sufficient at ME= -2.37 m, MAE =5.51 m and RMSE = 6.5 m. The graph in Figure 5-4 shows the relation between measured and simulated head at the end of steady state calibration process. The calibration results show a 91 % correlation between measured and observed values which is deemed acceptable.

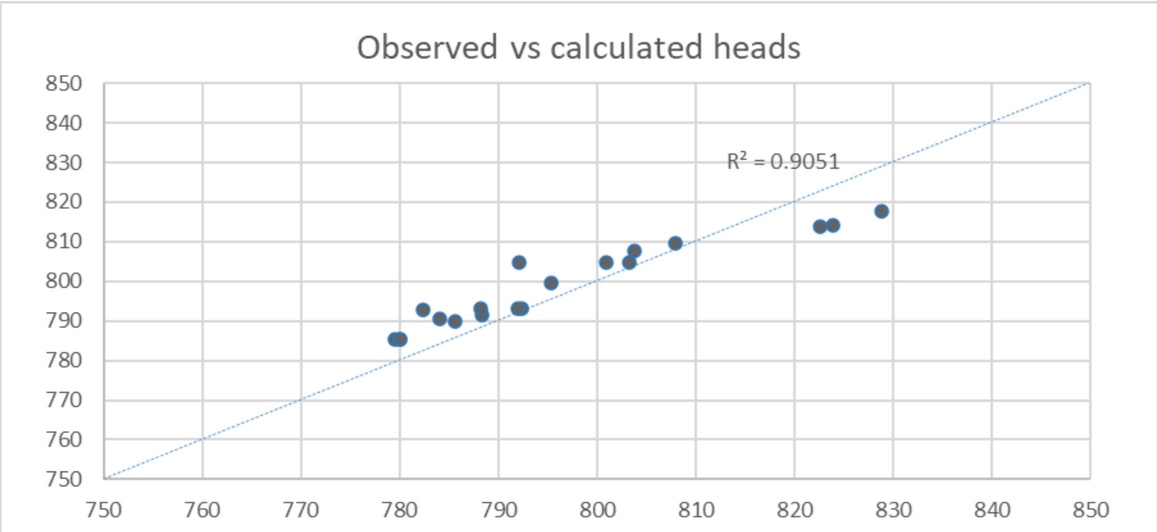

Figure 5-4: Steady State Calibration Results

A water balance error (all flows into the model minus all flows out of the model) of less than 0.5% is regarded as an accurate balance calculation. The mass balance for the entire model domain for the steady state stress period achieved a water balance error of 0.03% (Table 5-3).

Table 5-3: Mass Balance: Steady State Model

Description	Flow In (m^3/day)	Flow Out (m^3/day)
Recharge	498.9	-
Drains	-	4476.4
Head dependant bounds	6046.9	2071.1
TOTAL FLOW	6545.8	6547.1
Summary	**In - Out**	**% difference**
Total	-1.65	0.03

5.2.1.6. Aquifer Hydraulic Conductivity

The calibrated hydraulic conductivities used in the steady-state model are listed in Table 5-4. The calibrated values for each unit were based on results from local aquifer tests, descriptions of the different lithologies and regional knowledge of the hydrogeological setting. The hydraulic conductivity of the alluvial deposits was assumed to be uniform for the study area as based on borehole logs and field observations of a mixture of clayey and sandy sediments. A k_h/k_v factor of 1 was used for the alluvial deposits and 10 for the fractured rock lithologies.

Table 5-4: steady State Model Calibrated Hydraulic Conductivities

Lithological Unit	Layer(s)	k_h (m/d)	Unit T (m^2/d)
Sediments	1-2	13.2	66
Meta-greywacke - weathered	1-4	1.2	30
Granite - weathered	1-4	0.52	13
Schist - weathered	1-4	0.82	21
Pegmatite - weathered	1-4	6	150
Dyke - weathered	1-4	0.33	8.3
Fault/structure - weathered	1-4	1.2	30
Meta-greywacke - highly fractured	5-6	0.21	6.3
Granite - highly fractured	5-6	0.08	2.4
Schist - highly fractured	5-6	0.08	2.4
Pegmatite - highly fractured	5-6	0.4	12

Lithological Unit	Layer(s)	k_h (m/d)	Unit T (m^2/d)
Dyke - highly fractured	5-6	0.024	0.7
Fault/structure - highly fractured	5-6	0.08	2.4
Meta-greywacke - low fractured	7-8	0.08	20
Granite - low fractured	7-8	0.08	20
Schist - low fractured	7-8	0.08	20
Pegmatite - low fractured	7-8	0.2	49
Dyke - low fractured	7-8	0.08	20
Fault/structure - low fractured	7-8	0.008	1.6

5.2.1.7. Other Model Parameters: Recharge

Based on background information and results from the calibration process, the following was derived:

- Recharge to the area is between 0.08 and 1% of MAP;
- Higher recharge was assigned for the elevated area and sedimentary deposits, ranging between 0.4 and 1% of MAP; and
- Lower recharge was assigned for the weathered lithologies for the remainder of the model, ranging between 0.08 and 0.1% of MAP.

5.3. Sensitivity Analysis

A sensitivity analysis was carried out on the calibrated model. The purpose of the sensitivity analysis was to quantify the uncertainty in the calibrated model caused by the uncertainty in the estimates of aquifer parameters. During the sensitivity analysis, horizontal conductivity and recharge were assessed. Parameters that model results are most sensitive to can be seen in Figure 5-5. Results of the sensitivity analysis indicate that the water levels in the model are mainly sensitive to changes in horizontal hydraulic conductivities of the highly fractured marble and pegmatite units, and to a lesser extent in highly fractured meta-greywacke, dyke and granite units and low fractured meta-greywacke, schist and marble units.

Based on these results, it is recommended that continuous groundwater monitoring should include the bedrock units in close proximity and surrounding the abstraction holes with focus on monitoring boreholes intersecting the units above. Continued time series groundwater level data from selected groundwater monitoring boreholes will most benefit future model updates

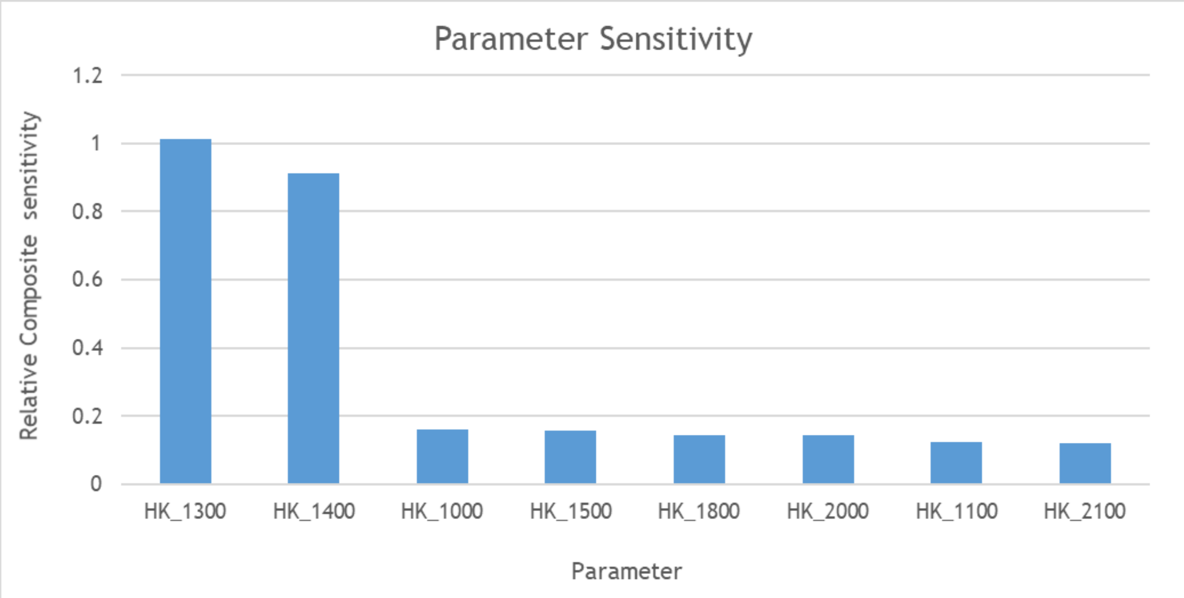

Figure 5-5: Model Parameter Relative Composite Sensitivity

5.4. Simulated Water Levels and Flow Direction

The simulated groundwater levels for the pre-abstraction situation are shown in Figure 5-6. The groundwater levels show the general east to west flow direction of groundwater from the elevated area underlain by marble units towards the outflow point of the Uis River. This aligns with the topographical gradient of the area and general drainage patterns. The lowest groundwater levels are located at the westernmost end of the model representing the river outflow.

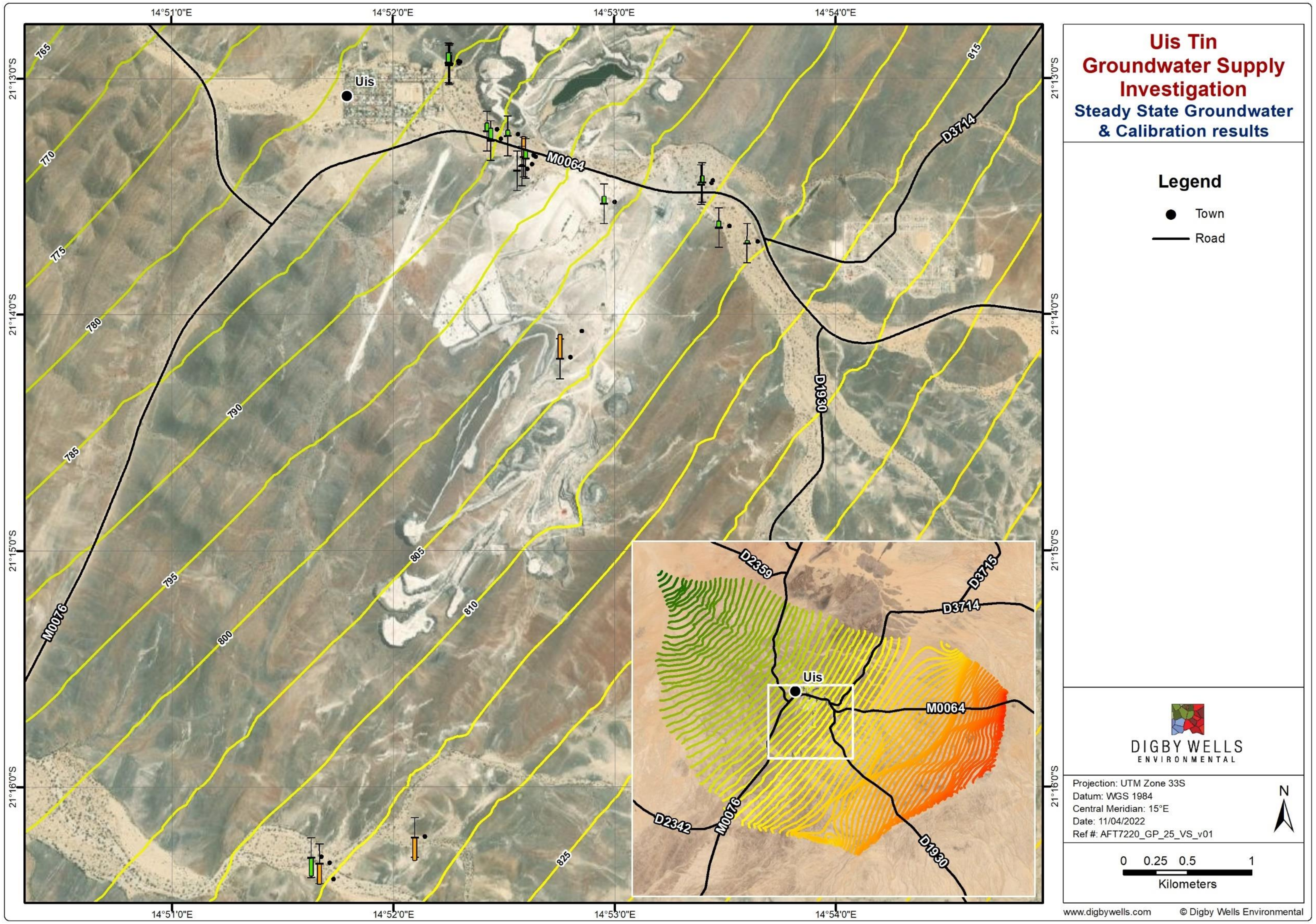

Figure 5-6: Steady-State Groundwater Levels and Calibration Results

5.5. Model Outcomes

The numerical model was used to assess the drawdown impacts associated with abstracting the average sustainable yield (Table 3-8) for each of the water supply boreholes for the Phase 1 Stage II Life of Mine (LoM) of 18 years. The numerical model was calibrated using the transient abstraction data and the simulated drawdowns (within the water supply boreholes which are currently being monitored) are deemed to be representative of the current drawdowns measured. The simulated drawdowns are compared with the observed groundwater drawdowns in Figure 5-7 to Figure 5-11 and show a general fluctuation in drawdowns over time.

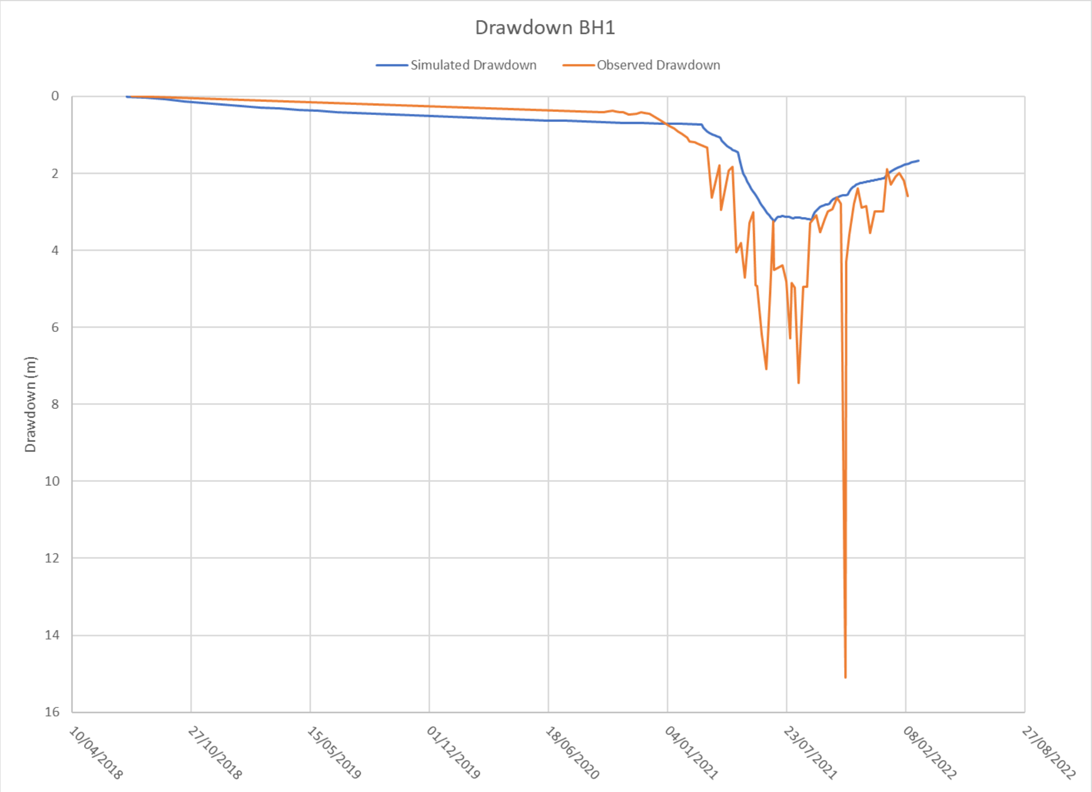

Figure 5-7: Simulated Drawdowns in BH1

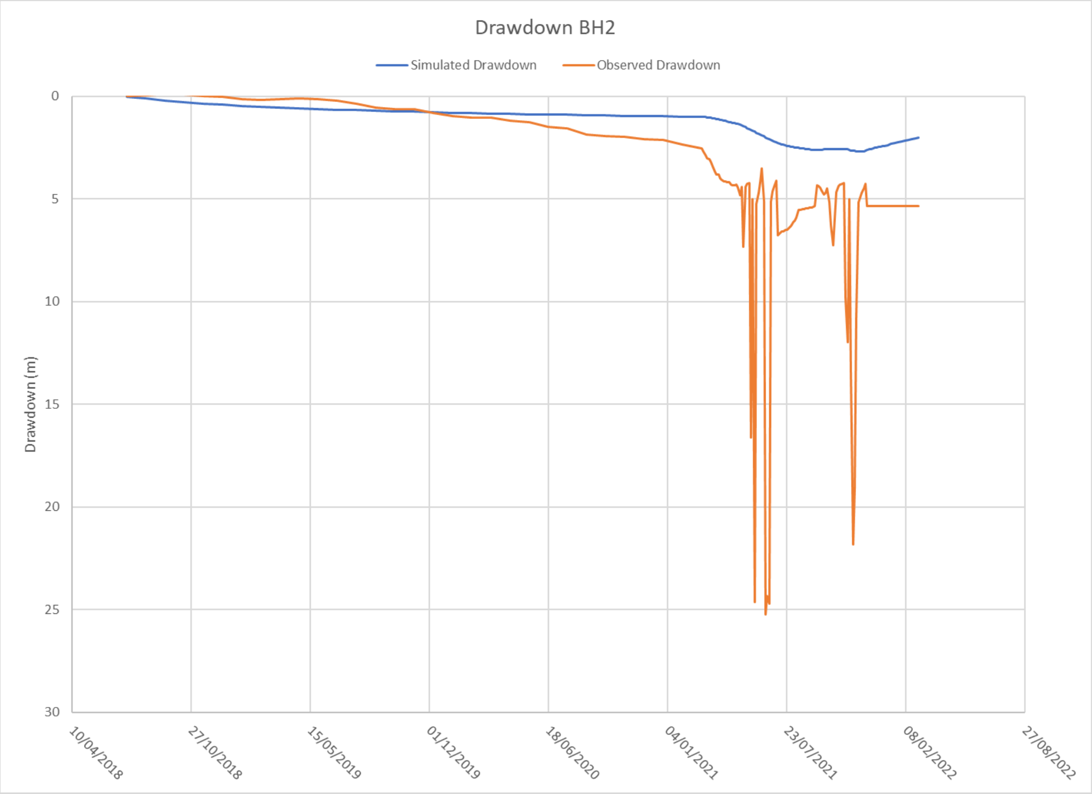

Figure 5-8: Simulated Drawdowns in BH2

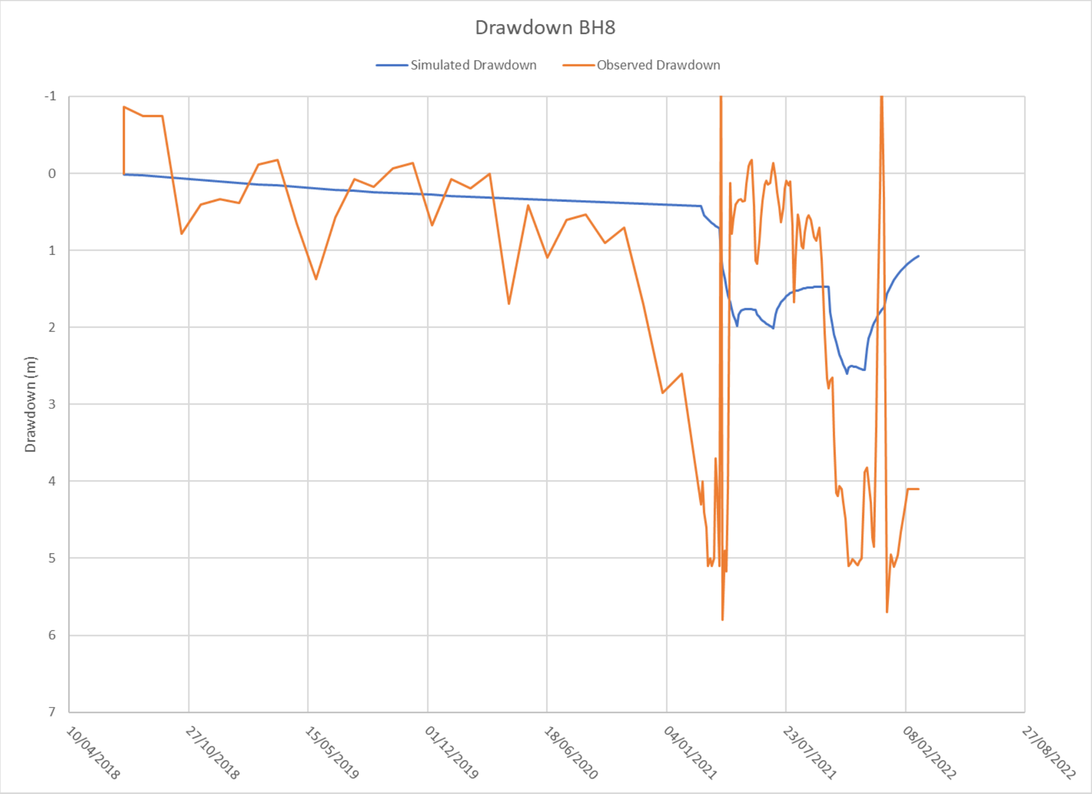

Figure 5-9: Simulated Drawdowns in BH8

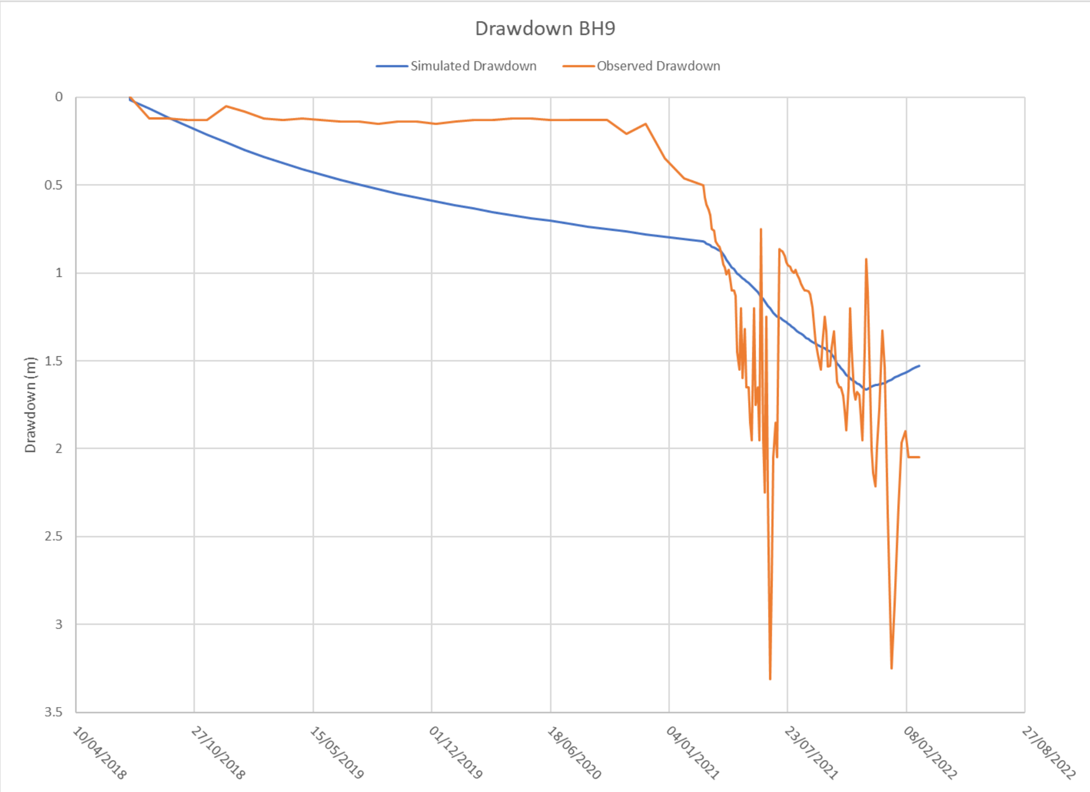

Figure 5-10: Simulated Drawdowns in BH9

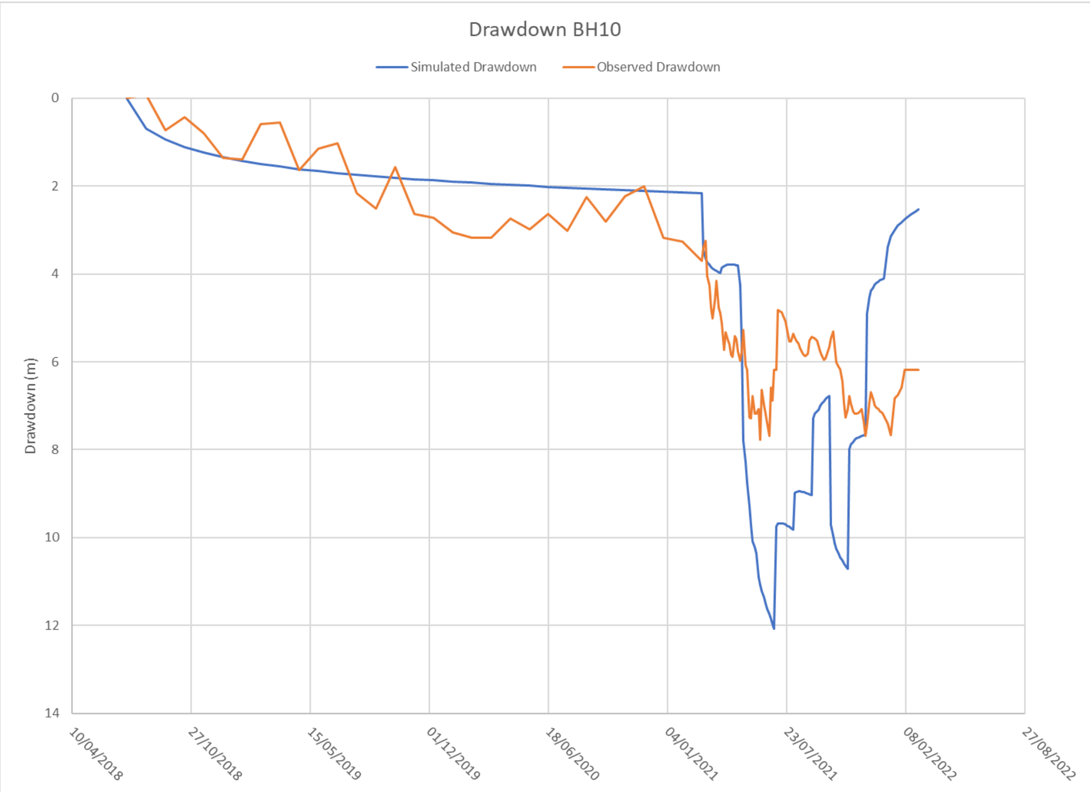

Figure 5-11: Simulated Drawdowns in BH10

The abstraction for the Phase 1 Stage II requirements begins from the current groundwater levels (Figure 5-13) simulated for the Uis River Catchment which has already been impacted by abstractions for the Uis Tin Mine and by third-party groundwater users (Section 2). The cumulative drawdown for the Uis Tin Mine water supply boreholes and third-party groundwater users is shown in Figure 5-14, and represents a worst-case scenario with regards to the drawdown in the catchment.

The drawdown impacts associated with pumping the average sustainable yield from each of the water supply boreholes for a period of 18 years will extend to a maximum of ~6.5 km from the Uis Tin Mine and have a maximum regional drawdown of ~4.5 m in 2040 when compared to the current situation. The drawdown impacts will recover once abstraction activities cease, however based on the low recharge the impact may remain for an extended period of time (Table 5-5). The drawdown impacts have been assessed as minor using the impact assessment methodology defined in Appendix D.

5.5.1. Recharge Scenarios

The numerical model was run with different recharge inputs to determine the effect variable recharges to the simulated groundwater levels. The following recharge scenarios were modelled:

- Average monthly recharge rates;
- Average yearly recharge rates (Figure 5-12);

Simulating the monthly and annual recharge rates for the pre-abstraction period (1979 to 2019) showed a variation in simulated groundwater levels by between 0.15 – 5 m. Based on these results it is possible that the groundwater levels could fluctuate by 5 m as a result of changes in recharge over the proposed LoM which will need to be accounted for within the anticipated drawdowns associated with the abstraction boreholes.

Table 5-5: Abstracting Groundwater for Water Supply

Dimension	Rating	Motivation	Significance
Activity and Interaction: Abstracting groundwater for water supply purposes			
Impact Description: Drawing down the groundwater levels around the Uis River and Southern wellfields, reducing aquifer yields to third-party groundwater users.			
Prior to Mitigation/Management			
Duration	6	The impact will remain for some time after the life of mine.	Minor (negative) - 51
Extent	4	The impact extends beyond the site.	
Intensity	3	Moderate loss and/or effects to the physical resource.	
Probability	7	Definite	
Nature	Negative		
Mitigation/Management Actions			
• Implement best practice and investigate new technologies to use water as efficiently as possible during the LoM; • Collect stormwater runoff (when available and where possible); • Manage abstraction from the boreholes with a water management plan; • Implement regular borehole maintenance to improve the yields from the boreholes (reduce scaling, fouling, precipitation of oxides and presence of roots within the boreholes); • Drill additional (or locate existing) water supply boreholes near the mine, to supplement water supply during borehole maintenance periods; • Continue monitoring the groundwater levels on a weekly basis to monitor for any changes to the predicted drawdowns; • Monitor abstraction rates and volumes from the water supply boreholes; • Monitor rainfall events on site; and • Monitor the water quality from the water supply boreholes on a quarterly basis to monitor for any changes in quality which may indicate if any changes are occurring in the aquifer.;			
Post-Mitigation			
Duration	6	The impact will remain for some time after the life of mine.	Minor (negative) - 48
Extent	3	The impact extends beyond the site.	
Intensity	3	Moderate loss and/or effects to the physical resource.	
Probability	7	Definite	
Nature	Negative		

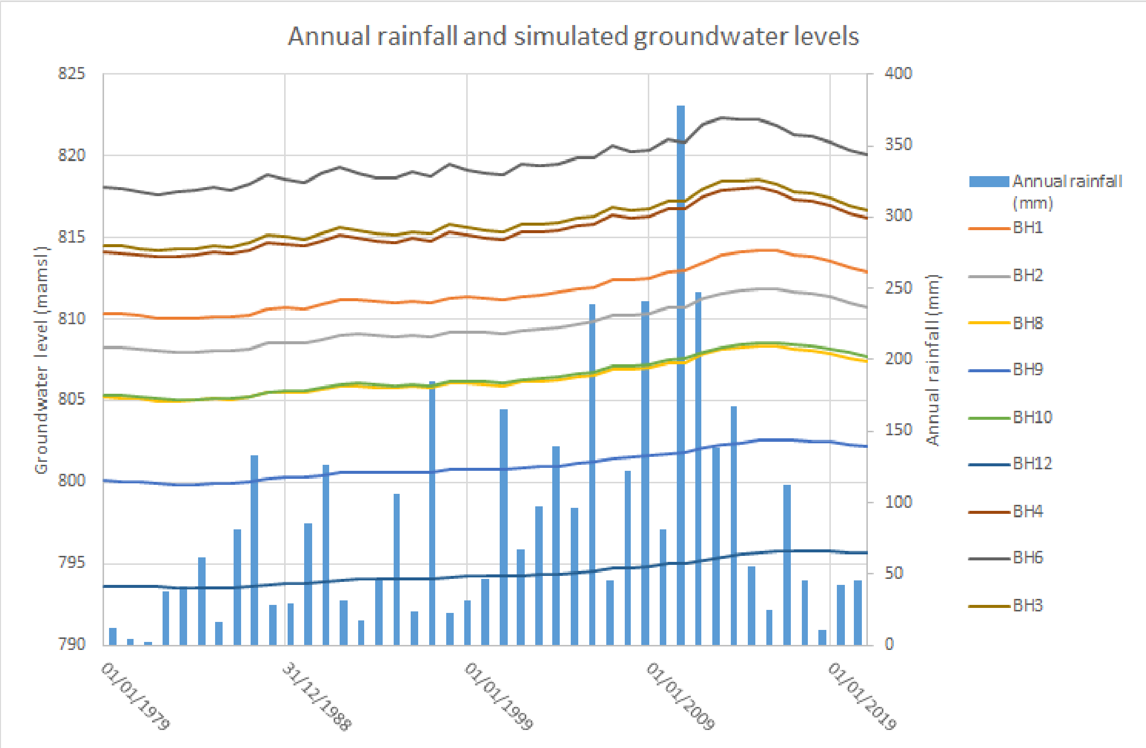

Figure 5-12: Pre-Abstraction Simulated Groundwater Levels and Annual Rainfall Inputs

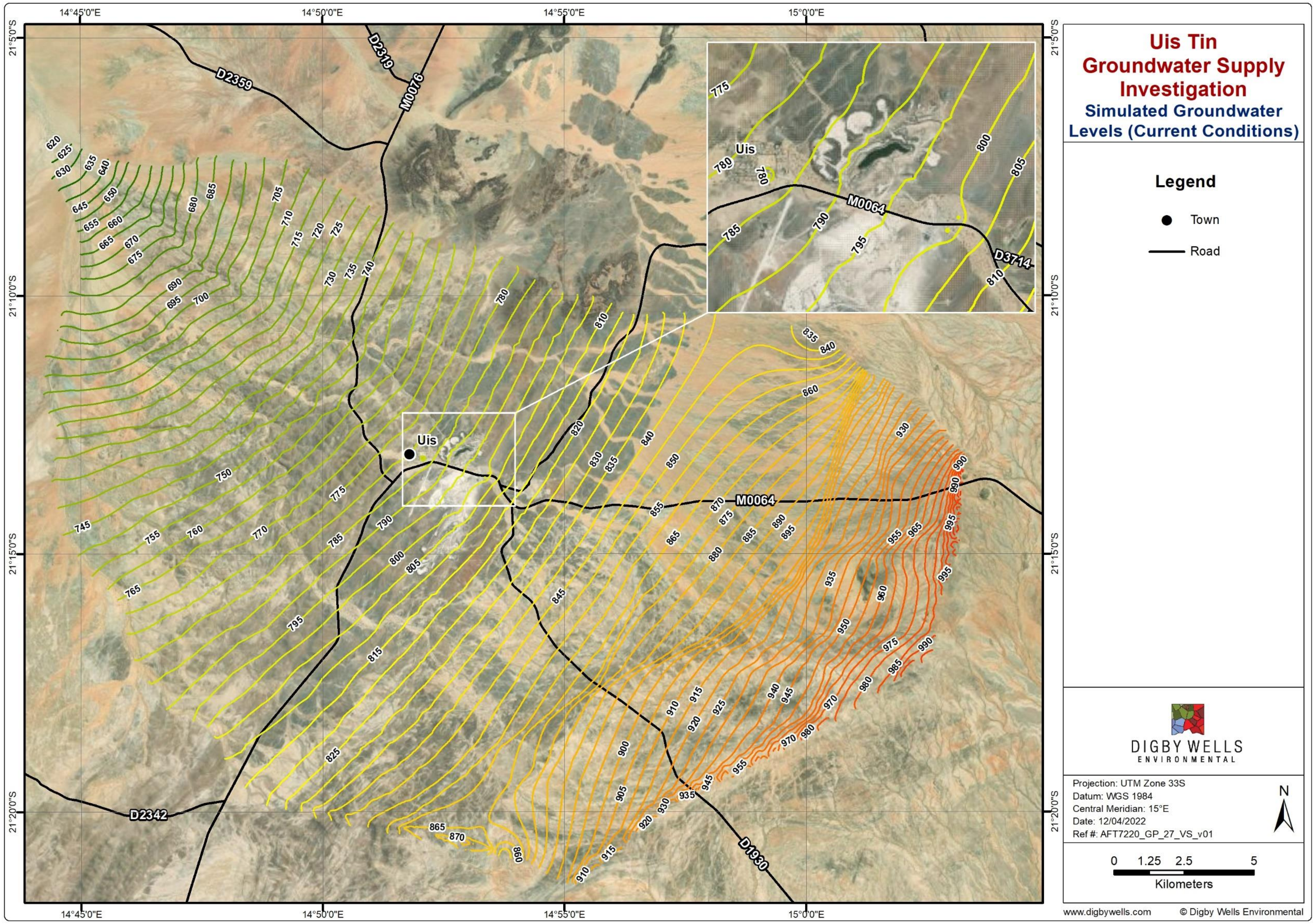

Figure 5-13: Simulated Groundwater Levels (Current Conditions)

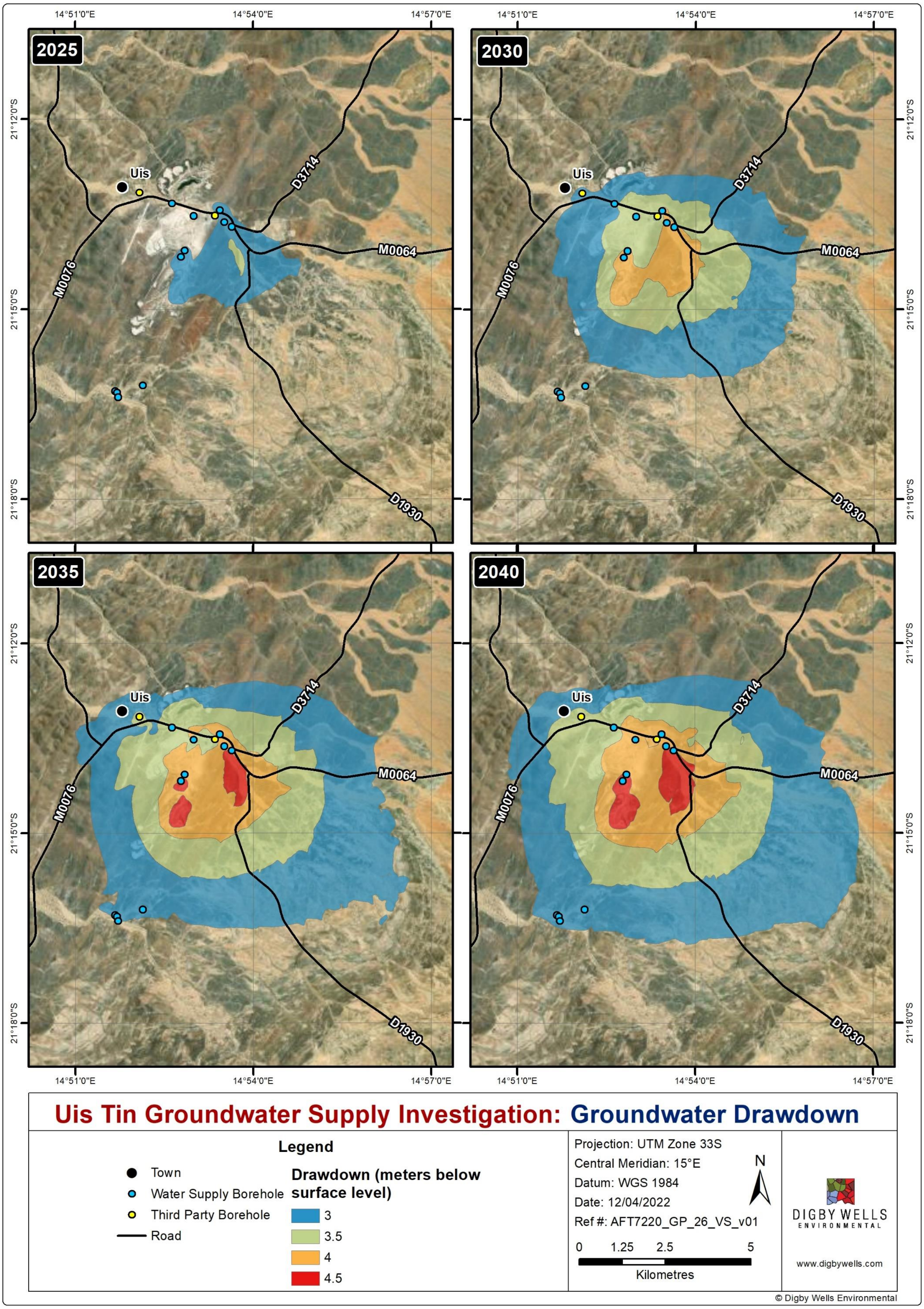

Figure 5-14: Simulated Drawdown Cones for 2025, 2030, 2035 and 2040

6. Water Management Plan

The objective of the Water Management Plan is to ensure a consistent supply of water to the processing plant whilst not depleting the groundwater resource for other third-party groundwater users. The availability of water is dependent on a climate change, increasing demand, lowered water tables and environmental degradation and it is therefore important to manage the groundwater resource so that it may sustain long term use. The Phase 1 Stage II expansion will require ~354 m^3/d (18 m^3/hr for ~590 hours per month) for 18 years based on the reserve LoM, which equates to a total volume of 2 293 920 m^3.

6.1. K5 Pit Water Use

AfriTin plan to continue mining from the K5 pit area in the future and would require that the pit be drained before mining commences but the timeline for this has not been confirmed. A bathymetric survey undertaken for the K5 pit indicates that the current volume of water within the pit is 190 634 m^3 (Strydom & Associates, 2022). The current volume in the K5 pit can provide ~ 8% of the total volume required, which would be able to supply the processing plant for ~1.5 years.

By supplementing the water supply to the plant with the water stored in the K5 pit the demand from the water supply boreholes can be reduced allowing time to clean the current water supply boreholes. Abstractions from the pit however could potentially influence the yields of the boreholes located nearby to the K5 pit and this will need to be monitored once dewatering activities commence. It is recommended to plan the dewatering of the K5 pit as far as possible in advance so that the available water within the pit can be used by the plant instead of being discharged to the environment.

AfriTin could consider constructing an emergency water storage area near to the plant which is covered to minimise losses from evaporation. The capacity of the tanks within the storage area should be able to supply a week's water supply to the plant (~2 700 m^3) that can be used in case of emergencies or to supplement the plant during borehole maintenance periods.

6.2. Water Supply Borehole Use

The current water supply boreholes have a combined 18.7 m^3/hr average sustainable yield which can just sustain the Phase 1 Stage II expansion requirements, however the water supply from the boreholes will need to be monitored and managed to prevent depleting the groundwater resource or reducing the efficiency of the borehole as the boreholes will need to be operated for ~20 hours per day every day to meet the plant requirements. The proposed management plan for the water supply boreholes is provided in Table 6-1 and Figure 6-1.

Table 6-1: Water Supply Borehole Management Plan

<table>
<tr><th>Water Supply Borehole</th><th>Surface Elevation (mamsl)</th><th>Operational Times (hours per day)</th><th>Currently Used</th><th>Sustainable Yield Pump Rate (m³/hr)</th><th>Pump Rate (m³/d)</th><th>Pump Rate (m³/month)</th><th>Current Static / Dynamic GWL (mbgl)[19]</th><th>Anticipated Dynamic GWL (mbgl)[20]</th><th>Monitoring Requirements</th><th colspan="2">Operational and Maintenance Requirements</th></tr>
<tr><td>BH1</td><td>829</td><td>19.7</td><td>Yes</td><td>0.4</td><td>7.9</td><td>236</td><td>24.2</td><td>34.9929.2</td><td rowspan="13">• Monitor daily abstraction rates and volumes;
• Monitor rainfall on site;
• Monitor groundwater levels in active abstraction boreholes on a weekly basis;
• Monitor groundwater levels in unused boreholes on a quarterly basis; and
• Monitor water quality on a quarterly basis.</td><td rowspan="10">4 hours per day have been allocated to allow water levels to recover in the water supply boreholes.

This can be used as a buffer (if needed) to conduct maintenance on boreholes, pumps and/or the reticulation system. Maintenance on the boreholes and/or pumps should be scheduled if there is a drop in the borehole yield or the water levels begin to drop significantly compared with the established trend. Boreholes should be cleaned every 2 years unless the monitoring data indicates a higher frequency is required.

The monitoring data collected must be used to recalibrate the numerical model once every two years to confirm the impact to the resource and allow early detection of any water supply issues.</td><td></td></tr>
<tr><td>BH2</td><td>827</td><td>19.7</td><td>Yes</td><td>0.2</td><td>3.9</td><td>118</td><td>30.0</td><td>42.035.</td><td>The efficiency of this borehole has declined since 2018. This borehole must be cleaned and retested to verify if the yield can be improved. This borehole may need to be cleaned on an annual basis to maintain yields based on the observed aquifer test response. Monitoring results will confirm this.
Consider casing this borehole to reduce the risk of collapse.</td></tr>
<tr><td>BH3</td><td>839</td><td>19.7</td><td>No</td><td>0.3</td><td>5.9</td><td>177</td><td>17.1</td><td>28.8822.1</td><td>Consider casing this borehole to reduce the risk of collapse.</td></tr>
<tr><td>BH4</td><td>838</td><td>19.7</td><td>No</td><td>1.0</td><td>19.7</td><td>590</td><td>21.9</td><td>35.2226.9</td><td></td></tr>
<tr><td>BH6</td><td>845</td><td>19.7</td><td>No</td><td>1.0</td><td>19.7</td><td>590</td><td>17.4</td><td>29.3322.4</td><td></td></tr>
<tr><td>BH8</td><td>829</td><td>19.7</td><td>Yes</td><td>8.5</td><td>167.2</td><td>5015</td><td>37.0</td><td>49.9942.0</td><td></td></tr>
<tr><td>BH9</td><td>825</td><td>19.7</td><td>No</td><td>0.9</td><td>17.7</td><td>531</td><td>34.5</td><td>49.7739.5</td><td>Clean this boreholes of the roots currently growing into it and casing to prevent roots blocking the borehole and losing the installed pump.
This borehole had oxide deposits on the existing pump and may need to be cleaned on an annual basis to maintain yields and the pump condition. Monitoring results will confirm this.</td></tr>
<tr><td>BH10</td><td>824</td><td>19.7</td><td>Yes</td><td>4.0</td><td>78.7</td><td>2360</td><td>33.6</td><td>44.8838.6</td><td></td></tr>
<tr><td>BH11</td><td>829</td><td>19.7</td><td>No</td><td>1.4</td><td>27.5</td><td>826</td><td>41.3</td><td>53.9946.3</td><td>Case this borehole to reduce the risk of collapse.</td></tr>
<tr><td>BH12</td><td>811</td><td>19.7</td><td>No</td><td>1.0</td><td>19.7</td><td>590</td><td>31.9</td><td>45.4436.9</td><td></td></tr>
<tr><td>A</td><td colspan="8">Estimate yield (6.5 m³/hr)</td><td colspan="2" rowspan="3">Locate and aquifer test these boreholes as an alternative water supply borehole to supplement the plant during periods of maintenance on the existing boreholes or should the efficiency of the current boreholes reduce.</td></tr>
<tr><td>B</td><td colspan="8">Estimate yield (12.2 m³/hr)</td></tr>
<tr><td>C</td><td colspan="8">Estimate yield (5.0 m³/hr)</td></tr>
</table>

[19] Current groundwater level (GWL) is based on the static water level at the time of aquifer testing as a worst-case scenario.
[20] The anticipated dynamic GWL in the boreholes is calculated based on a comparative drawdown with the aquifer testing data with an additional 5 m added to accommodate potential fluctuations in recharge rates and 4.5 m to accommodate regional drawdown impacts.

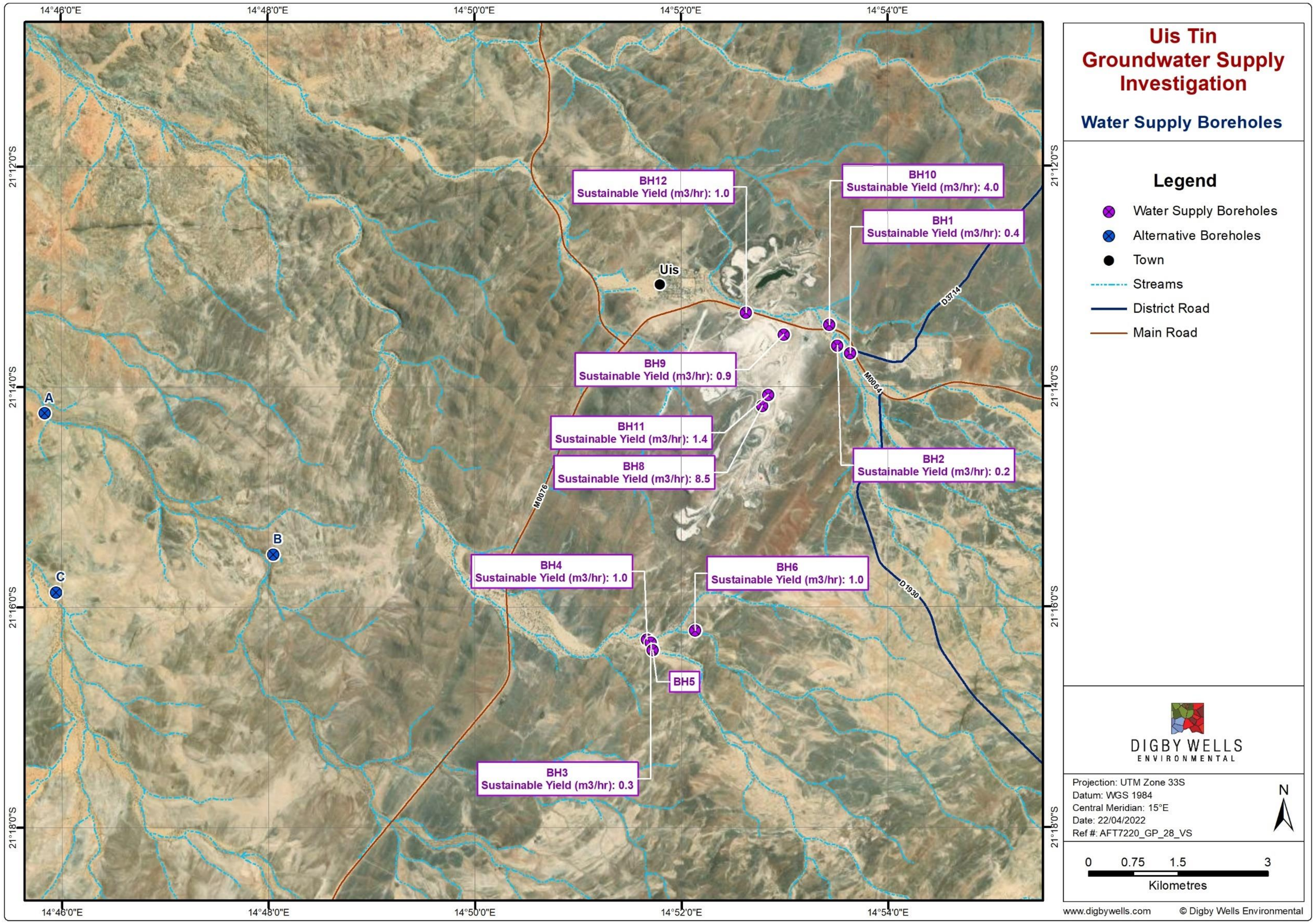

Figure 6-1: Water Supply Boreholes and Potential Alternative Boreholes

6.2.1. Additional Abstraction Boreholes

It is recommended to locate or drill additional boreholes to supplement the water supply to the plant (during borehole maintenance periods) or supplement the current abstraction boreholes in case the efficiency of the current water supply boreholes deteriorates.

Any new water supply boreholes should be drilled to the following specifications:

- 12-inch (305 mm) open hole drilling to 5 mbgl;
- Install 11-inch (279 mm) mild steel casing to 5 mbgl;
- 10-inch (254 mm) open hole drilling to 80 – 100 mbgl;
- Install 8-inch (203 mm) PVC casing with screened sections across intersected fractures;
- Fill the annulus with a gravel pack to 5 m above the shallowest screened section;
- Install a grout / bentonite seal above the gravel pack, backfill the annulus with borehole risings;
- Install a 4-inch (102 mm) submersible pump and include a motor cooling sleeve where necessary;
- Install 2-inch (50.8 mm) uPVC rising main to the top of the well; and
- Construct steel well headworks with flange to connect to the water supply system.

If boreholes intersect higher yielding fractures (with blow yields >20 m^3/hr), the borehole must be reamed to a larger diameter to accommodate a large pump size. After the construction of the new boreholes are completed, the boreholes must be aquifer tested to verify the sustainable yields. A four (4) hour step test with forty-eight (48) hour constant discharge test should be performed on the boreholes. After aquifer testing has been completed groundwater quality samples should be taken to a lab for analysis to determine the groundwater quality.

6.2.2. Borehole Maintenance

The ability of a borehole to perform optimally can be reduced if sediment builds up in the borehole (i.e., sediments entering the borehole through damaged casing or screens, or precipitation of calcium and iron) or high levels of iron, calcium and magnesium form precipitates which block equipment or casing screens.

The monitoring data will help with determining when boreholes will need to be cleaned (or maintained) so that it can operate optimally and prolong the lifespan of the pumps. It is recommended that boreholes be cleaned every two (2) years unless the monitoring data indicates more frequent cleaning is required (colour changes to brown or red, yields decrease, or water levels drop).

The following borehole maintenance is recommended:

- Using high pressure compressor to flush the sediment and debris from boreholes;
- Brushing (sweeping) the borehole casing (or side walls) with brushes to remove build-up of slime (produced by iron bacteria) or deposits from the casing screens;
- Chemical additives could be used provided this doesn't interfere with the water chemistry needed in the plant or surrounding water supply boreholes;
- Roots could be removed by reaming the borehole, using a wiper tool or welding steel blades onto a heavy rod. Sharper blades should be positioned on the lower portion to assist with cutting roots when the rod is being lowered and blunter blades can be positioned higher up to assist with grabbing the loose roots when pulling the rod out of the borehole. An auger-type fitting may also be an option. The borehole will need to be cleaned regularly to prevent the roots regrowing;
- Steel casing will corrode over time, and it is recommended to install PVC casing in newly drilled boreholes (or uncased) or replace the steel casing in existing boreholes to prolong the life of the borehole;
- Complete a downhole camera survey (in uncased boreholes) to assess if the fractures are blocked which may need to be flushed, brushed or redrilled to a slightly larger diameter to try clear surface deposits on the borehole walls which may be blocking yields.

6.2.3. Groundwater Monitoring

Groundwater monitoring will assist the mine with determining any changes in the aquifer sources (with the quality results) as well as the borehole efficiency (with the abstraction rates, yields and groundwater levels). The collected monitoring data can be used to recalibrate numerical model updates which will allow the mine to detect any changes with the potential water supply in a timely so that an alternative arrangement can be implemented. The following parameters must be monitored:

- Rainfall must be measured daily at the project site. This data can be compared with the groundwater level data to determine recharge responses to the groundwater aquifer;
- Abstraction rates and volumes must be measured on a daily basis. This will be used to track requirements from the plant and the sustainable use of the water supply boreholes. Changes in the demand from the plant above the 18 m^3/hr requirement or ability of the water supply boreholes to produce the sustainable yields, will require additional water supply boreholes to be incorporated into the water supply network;
- Groundwater levels must be measured on a weekly basis (in active water supply boreholes) and on a quarterly basis (in unused water supply boreholes). The groundwater levels can be used to monitor if the yields abstracted from the boreholes are sustainable or if scaling or fouling of the borehole may be occurring. Water levels

that start dropping significantly compared to established trends could indicate that maintenance is required to remove scale and/or oxide deposits from the borehole:

  - Groundwater level measurements which change by more than 5 m between readings will need to be verified as correct with an additional measurement. Comments should be included with the verified measurement as to the cause of the change in water levels;

- Water quality must be sampled and analysed on a quarterly basis. This will assist in establishing if any changes in the aquifer water sources are occurring as a result of abstraction. Samples must be submitted to an accredited laboratory for analysis. The following constituents must be included in the water quality analysis as a minimum (Table 6-2):

  - Taking note of the water colour (becomes brown or reddish) in the samples could also assist with determining if the borehole will need to be cleaned.

Table 6-2: Water Quality Monitoring Constituents

pH	Calcium	Fluoride
Electrical Conductivity	Magnesium	Sulphate
Total Dissolved Solids	Sodium	Nitrate
Total Alkalinity	Potassium	Iron
Total Hardness	Chloride	Manganese

6.3. Water Management Recommendations

The following recommendations are required to reduce the groundwater abstraction risk for the mine or manage the groundwater resource:

- Integrate the groundwater outcomes into the site water balance and keep the water balance updated throughout the LoM;
- It is recommended to plan the dewatering of the K5 pit well in advance so the dewatered volumes can be used to meet the plant requirements instead of being discharged to the environment. The water in the pit has higher concentrations compared to the groundwater samples which may dictate how much of the pit water can be used during a month (if this needs to be diluted with clean or groundwater contributions). The water quality requirements of the plant will therefore need to be defined as soon as possible or the establishment of a water treatment plant could be considered;
- Establish a covered water storage area nearby to the plant which contains water storage tanks with a minimum capacity of 1 week (~2 700 m^3) which can provide an emergency water source to the plant;

- As the water supply boreholes just meet the demand requirement for the plant, it is recommended to include additional water supply boreholes into the network to supplement yields during borehole maintenance periods (once the K5 pit is dewatered) or supplement abstraction in case the efficiency of the current water supply boreholes deteriorates;
- These additional boreholes should be established as soon as possible to prevent any water supply delays to the plant and should preferably be located outside of the Uis River Catchment to reduce the cumulative drawdown impacts within this catchment. Based on the available information there are potentially three (3) boreholes located within a ~13 km radius from the mine which have a combined estimated yield of 23.7 m^3/hr. If these boreholes can be located and used, the sustainable yield would need to be assessed with aquifer tests;
- Where processes allow for it, water used in the plant should be recovered and reused as much as possible;
- Reticulation system must be maintained to prevent leaks and minimise losses of water from the system;
- Recover and reuse water from the Uis wastewater treatment works to supplement the plant requirements (if possible);
- Collect and store rainwater in pit areas (when not operational) as an additional temporary source of water, which could supplement the supply from the water supply boreholes when available;
- AfriTin are currently allowed to abstract a total of 75 000 m3/a (permit No. 11429) (AfriTin Mining Limited, 2021). The permitted abstraction volume will need to be increased for the Phase 1 Stage II abstraction requirements

7. Conclusion

The following conclusions are drawn from the hydrogeological assessment:

- The yield demand for the Phase 1 Stage II expansion of 18 m^3/hr can be provided by the existing water supply boreholes which have a combined sustainable yield of 18.7 m3/hr based on the interpreted aquifer test results;
- The groundwater quality is not suitable for human consumption, however it can be used as raw water supply in the plant;
- Based on the numerical model simulations the water supply abstractions is deemed to be sustainable, however the water supply abstractions will stress the aquifer due to the low recharge potential of the region. The cumulative abstractions for the proposed 18-year Life of Mine will create a drawdown cone with a maximum extent of ~6.5 km and a drawdown of ~4.5 m;

- Should there be any significant increases in demand from the aquifer (by the mine or third-party groundwater users), draughts or climate changes there may be an impact to the long-term sustainable yield of the wellfield;
- AfriTin will need to install additional boreholes for the Phase 1 Stage II expansion to enable maintenance and to mitigate any losses in yield from the existing water supply boreholes;
- A groundwater monitoring programme has been recommended to assist AfriTin with managing their groundwater resource. Although it is recommended that boreholes be cleaned every two (2) years, any drop in yield or increased drawdown within the water supply borehole can indicate that maintenance is required;
- The groundwater monitoring will also assist AfriTin with determining if there are any changes occurring within the aquifer which may require intervention;
- AfriTin will need to investigate alternative water sources for the planned Phase 2 expansion once water demands for this phase have been confirmed. Abstracting higher yields of groundwater from the possible alternative groundwater wellfields could potentially have significant impacts to the groundwater aquifer in the region. Alternative water supply options such as piping water from the Orano Desalination plant or directly from the sea should also be considered for the Phase 2 expansion.

8. Recommendations

The following recommendations are proposed:

- Integrate the groundwater outcomes into the site water balance to assist with the efficient management of water resources on site and identify and minimise water losses from the system;
- Implement the monitoring, operational and maintenance requirements as outlined in the Water Management Plan (Section 6);
- Schedule borehole maintenance every 2 years unless the monitoring data (yield vs drawdown) indicates more frequent cleaning is required (Section 6.2);
- Locate or drill alternative boreholes to replace the existing boreholes if yields cannot be improved or maintained or to supplement water supply during borehole maintenance periods (after the K5 pit has been drained);
- Establish a covered water storage area nearby to the plant which contains water storage tanks with a minimum capacity of 1 week (~2700 m^3) which can provide an emergency water source to the plant;
- AfriTin will need to amend their permitted abstraction volume to account for the required 18 m^3/hr (127 440 m^3/a) required by the plant for the Phase 1 Stage II expansion;

- Locate third-party groundwater users within a 10 km radius of the mine wellfields and confirm their current abstraction requirements and planned future abstraction requirements;
- It is recommended to plan the dewatering of the K5 pit well in advance so the dewatered volumes can be used to meet the plant requirements instead of being discharged to the environment. The water in the pit has higher concentrations of calcium, magnesium, sodium, potassium chloride, sulphate, iron, manganese and electrical conductivity compared to the groundwater samples which may dictate how much of the pit water can be used during a month (if this needs to be diluted with clean or groundwater contributions). The water quality requirements of the plant will therefore need to be defined as soon as possible or the establishment of a water treatment plant could be considered;
- The numerical model must be recalibrated every 2 (two) years to incorporate the latest monitoring data as well as any changes to the water supply network or plant yield requirements. The model will be an asset to AfriTin to assess any changes which could affect the water supply for the project;
- The numerical model can be refined in future updates to simulate climate change responses to the expected rainfall volumes over the life of mine. The IPCC report indicates that drought events in Southern Africa (caused by the El Nino oscillation) are predicted to become more frequent and intense, which could affect the recharge potential to aquifers in the region.

9. References

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Appendix A: Methodology

Aquifer testing

A subcontractor (Hammerstein Mining and Drilling) was appointed to undertake the aquifer testing under the supervision of Digby Wells. 48-hour constant discharge (CDT) aquifer pump and recovery tests were carried out on existing boreholes. These tests will be used to determine aquifer parameters that will serve as input into the groundwater model but will also provide input to determine the sustainable yield of each borehole.

The following methodology was used for the CDT tests:

- Boreholes in each cluster were switched off prior to undertaking the aquifer tests in each cluster:
  - Cluster 1: BH1, BH2, BH10;
  - Cluster 2; BH9, BH12;
  - Cluster 3; BH8, BH11;
  - Cluster 4: BH3, BH4, BH5, BH6
- A 30-minute calibration test was undertaken on boreholes which had previously been aquifer tested in 2018 to confirm the previous rates:

Borehole	Previous CDT Rate (m3/hr)	Previous CDT Duration (hours)
BH1	5	8 (recovery in 8 hours)
BH2	6	8 (recovery in 8 hours)
BH3	2	8 (recovery in 8 hours)
BH4	3	8 (recovery in 8 hours)
BH5	2.5	8 (recovery in 8 hours)
BH6	6	8 (recovery in 8 hours)
BH8	17.5	24 (recovery in 24 hours)
BH9	6	8 (recovery in 8 hours)
BH10	17.5	24 (recovery in 24 hours)
BH11	3 (Blow Yield Estimate)	Not tested
BH12	-	Not tested

- A step drawdown and recovery test were undertaken on boreholes which weren’t previously aquifer tested (BH11 and BH12). The step test comprised of three 1-hour long steps with increasing rates followed by recovery;
- Following the calibration or step test 48-hour constant discharge test (yield permitting) on each borehole followed by a recovery test (48-hours or to 90% of initial level);
- During the CDT test a water sample was collected every 12-hours and submitted to an Analytical Laboratory in Windhoek Namibia for Analysis.

Appendix B: Laboratory Certificates

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TEST REPORT

To:	**Digby Wells Environmental SA**			
	48 Grosvenor Road		Date received:	15/Dec/21
	Bryanston		Date analysed:	14 Jan - 8 Feb 2022
	2191		Date reported:	10/Feb/22
	South Africa			
Attn:	Megan Edwards		Client Reference no.:	AFT 7220
email:	megan.edwards@digbywells.com		Quotation no.:	QU-6835
Tel:	27117899495		Lab Reference:	I212234
			Enquiries: Ms Manuela Mayer	

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH2-1
Date of sampling	3 Dec 2021,16h00
Test item number	I212234/1

				Recommended maximum limits			
				Human consumption			**Livestock**
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.1**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**651**	**mS/m**	D	150	300	400	
Turbidity	**26**	**NTU**	D	1	5	10	
Total Dissolved Solids (calc.)	**4126**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**395**	**mg/l**					
Total Hardness as $CaCO_3$	**1825**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1084**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**741**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1383**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**992**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**17**	**mg/l**	B	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**791**	**mg/l**	C	100	400	800	2000
Potassium as K	**32**	**mg/l**	A	200	400	800	
Magnesium as Mg	**180**	**mg/l**	C	70	100	200	500
Calcium as Ca	**434**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.06**	**mg/l**	B	0.05	1.0	2.0	10
Iron as Fe	**2.2**	**mg/l**	D	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.6**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22

Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH2-3
Date of sampling	4 Dec 2021, 06h42
Test item number	I212234/2

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.7**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**652**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4195**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**395**	**mg/l**					
Total Hardness as $CaCO_3$	**1813**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1064**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**749**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1452**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1002**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**19**	**mg/l**	B	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**778**	**mg/l**	C	100	400	800	2000
Potassium as K	**32**	**mg/l**	A	200	400	800	
Magnesium as Mg	**182**	**mg/l**	C	70	100	200	500
Calcium as Ca	**426**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.4**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.0**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.8**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

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Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
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Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
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Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22
Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH2-4
Date of sampling	4 Dec 2021, 16h10
Test item number	I212234/3

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**652**	**mS/m**	D	150	300	400	
Turbidity	**0.55**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4096**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**400**	**mg/l**					
Total Hardness as $CaCO_3$	**1817**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1084**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**733**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1406**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**932**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**19**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**790**	**mg/l**	C	100	400	800	2000
Potassium as K	**31**	**mg/l**	A	200	400	800	
Magnesium as Mg	**178**	**mg/l**	C	70	100	200	500
Calcium as Ca	**434**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.4**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

Approved Technical Signatory
Ms S. Rügheimer

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22
Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH2-5
Date of sampling	5 Dec 2021, 12h35
Test item number	I212234/4

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**654**	**mS/m**	D	150	300	400	
Turbidity	**0.35**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4120**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**410**	**mg/l**					
Total Hardness as $CaCO_3$	**1810**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1069**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**741**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1429**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**942**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**17**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**787**	**mg/l**	C	100	400	800	2000
Potassium as K	**31**	**mg/l**	A	200	400	800	
Magnesium as Mg	**180**	**mg/l**	C	70	100	200	500
Calcium as Ca	**428**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.3**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
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South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22

Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH2-6
Date of sampling	5 Dec 2021, 16h00
Test item number	I212234/5

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.97**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**657**	**mS/m**	D	150	300	400	
Turbidity	**0.60**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4148**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**405**	**mg/l**					
Total Hardness as $CaCO_3$	**1820**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1066**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**754**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1406**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1008**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**13**	**mg/l**	B	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**790**	**mg/l**	C	100	400	800	2000
Potassium as K	**31**	**mg/l**	A	200	400	800	
Magnesium as Mg	**183**	**mg/l**	C	70	100	200	500
Calcium as Ca	**427**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.5**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.
toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
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Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22

Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH1-1
Date of sampling	7 Dec 2021, 08h56
Test item number	I212234/6

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.5**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**535**	**mS/m**	D	150	300	400	
Turbidity	**1.3**	**NTU**	B	1	5	10	
Total Dissolved Solids (calc.)	**3295**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**525**	**mg/l**					
Total Hardness as $CaCO_3$	**979**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**497**	**mg/l**	B	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**482**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1060**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**1.8**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**561**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**47**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**799**	**mg/l**	C	100	400	800	2000
Potassium as K	**32**	**mg/l**	A	200	400	800	
Magnesium as Mg	**117**	**mg/l**	C	70	100	200	500
Calcium as Ca	**199**	**mg/l**	B	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**0.9**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**4.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
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Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
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Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

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Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22
Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH1-2
Date of sampling	7 Dec 2021, 19h00
Test item number	I212234/7

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.5**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**530**	**mS/m**	D	150	300	400	
Turbidity	**0.35**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**3213**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**550**	**mg/l**					
Total Hardness as $CaCO_3$	**1066**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**572**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**494**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1037**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**1.9**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**531**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**35**	**mg/l**	C	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**778**	**mg/l**	C	100	400	800	2000
Potassium as K	**31**	**mg/l**	A	200	400	800	
Magnesium as Mg	**120**	**mg/l**	C	70	100	200	500
Calcium as Ca	**229**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**1.1**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.4**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**3.7**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms S. Rügheimer

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Unit 16, Ben Amathila Ave
PO Box 86782, Windhoek, Namibi

Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To:	**Digby Wells Environmental SA**		
	48 Grosvenor Road	Date received:	15/Dec/21
	Bryanston	Date analysed:	14 Jan - 8 Feb 2022
	2191	Date reported:	10/Feb/22
	South Africa		
Attn:	Megan Edwards	Client Reference no.:	AFT 7220
email:	megan.edwards@digbywells.com	Quotation no.:	QU-6835
Tel:	27117899495	Lab Reference:	I212234
		Enquiries:	Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH1-3
Date of sampling	8 Dec 2021, 05h03
Test item number	I212234/8

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.2**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**532**	**mS/m**	D	150	300	400	
Turbidity	**0.95**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**3210**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**545**	**mg/l**					
Total Hardness as $CaCO_3$	**1073**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**574**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**498**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1037**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**1.9**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**550**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**34**	**mg/l**	C	10	20	40	100
Nitrite as N	**0.02**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**761**	**mg/l**	C	100	400	800	2000
Potassium as K	**31**	**mg/l**	A	200	400	800	
Magnesium as Mg	**121**	**mg/l**	C	70	100	200	500
Calcium as Ca	**230**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**<0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**3.7**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22

Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH1-4
Date of sampling	8 Dec 2021, 15h01
Test item number	I212234/9

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.1**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**531**	**mS/m**	D	150	300	400	
Turbidity	**0.29**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**3181**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**550**	**mg/l**					
Total Hardness as $CaCO_3$	**1055**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**569**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**486**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**991**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**2.0**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**528**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**40**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.02**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**776**	**mg/l**	C	100	400	800	2000
Potassium as K	**30**	**mg/l**	A	200	400	800	
Magnesium as Mg	**118**	**mg/l**	C	70	100	200	500
Calcium as Ca	**228**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.8**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**3.5**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms S. Rügheimer

This test report is only valid without any alterations and shall not be published or reproduced excep
laboratory.

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
3.5-4.0 mg/l fluoride: severe tooth damage especially in infants' temporary and permanent teeth; softening of the enamel and dentine will occur on continuous use of water. Threshold for chronic effects of fluoride exposure.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
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Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22

Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH1-6
Date of sampling	9 Dec 2021, 13h55
Test item number	I212234/10

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.1**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**536**	**mS/m**	D	150	300	400	
Turbidity	**0.62**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**3190**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**550**	**mg/l**					
Total Hardness as $CaCO_3$	**997**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**494**	**mg/l**	B	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**502**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1037**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**1.9**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**534**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**33**	**mg/l**	C	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**0.02**	**mg/l**					
Sodium as Na	**791**	**mg/l**	C	100	400	800	2000
Potassium as K	**31**	**mg/l**	A	200	400	800	
Magnesium as Mg	**122**	**mg/l**	C	70	100	200	500
Calcium as Ca	**198**	**mg/l**	B	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.0**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**3.7**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

Approved Technical Signatory
Ms S. Rügheimer

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PO Box 86782, Windhoek, Namibi

TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22

Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH10-1
Date of sampling	13 Dec 2021, 11h00
Test item number	I212234/11

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**658**	**mS/m**	D	150	300	400	
Turbidity	**0.50**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4100**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**410**	**mg/l**					
Total Hardness as $CaCO_3$	**1666**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**941**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**725**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1383**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.5**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**948**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**23**	**mg/l**	C	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**832**	**mg/l**	D	100	400	800	2000
Potassium as K	**34**	**mg/l**	A	200	400	800	
Magnesium as Mg	**176**	**mg/l**	C	70	100	200	500
Calcium as Ca	**377**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**<0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.2**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To:	**Digby Wells Environmental SA**		
	48 Grosvenor Road	Date received:	15/Dec/21
	Bryanston	Date analysed:	14 Jan - 8 Feb 2022
	2191	Date reported:	10/Feb/22
	South Africa		
Attn:	Megan Edwards	Client Reference no.:	AFT 7220
email:	megan.edwards@digbywells.com	Quotation no.:	QU-6835
Tel:	27117899495	Lab Reference:	I212234
		Enquiries:	Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH10-2
Date of sampling	13 Dec 2021, 19h00
Test item number	I212234/12

				Recommended maximum limits			
				Human consumption			**Livestock**
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**664**	**mS/m**	D	150	300	400	
Turbidity	**0.70**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4164**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**420**	**mg/l**					
Total Hardness as $CaCO_3$	**1655**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**939**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**717**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1360**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.6**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**981**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**27**	**mg/l**	C	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**866**	**mg/l**	D	100	400	800	2000
Potassium as K	**33**	**mg/l**	A	200	400	800	
Magnesium as Mg	**174**	**mg/l**	C	70	100	200	500
Calcium as Ca	**376**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.8**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22
Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH10-3
Date of sampling	14 Dec 2021, 05h00
Test item number	I212234/13

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.1**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**668**	**mS/m**	D	150	300	400	
Turbidity	**0.75**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4164**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**420**	**mg/l**					
Total Hardness as $CaCO_3$	**1634**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**901**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**733**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1383**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.6**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**964**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**26**	**mg/l**	C	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**874**	**mg/l**	D	100	400	800	2000
Potassium as K	**34**	**mg/l**	A	200	400	800	
Magnesium as Mg	**178**	**mg/l**	C	70	100	200	500
Calcium as Ca	**361**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
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Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
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Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
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South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22

Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH10-4
Date of sampling	14 Dec 2021, 20h00
Test item number	I212234/14

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**670**	**mS/m**	D	150	300	400	
Turbidity	**0.40**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4241**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**435**	**mg/l**					
Total Hardness as $CaCO_3$	**1631**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**919**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**712**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1406**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.6**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1002**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**23**	**mg/l**	C	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**894**	**mg/l**	D	100	400	800	2000
Potassium as K	**34**	**mg/l**	A	200	400	800	
Magnesium as Mg	**173**	**mg/l**	C	70	100	200	500
Calcium as Ca	**368**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.8**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms S. Rügheimer

Analytical Laboratory Services
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71 Newcastle Stree
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walvisbaylab@analab.com.n
Cell +264 81 122 158
Unit 16, Ben Amathila Ave
PO Box 86782, Windhoek, Namibi

Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA**
48 Grosvenor Road
Bryanston
2191
South Africa
Attn: Megan Edwards
email: megan.edwards@digbywells.com
Tel: 27117899495

Date received: 15/Dec/21
Date analysed: 14 Jan - 8 Feb 2022
Date reported: 10/Feb/22
Client Reference no.: AFT 7220
Quotation no.: QU-6835
Lab Reference: I212234
Enquiries: Ms Manuela Mayer

Sample details	Borehole samples
Location of sampling point	Uis, Afritin Mine
Description of sampling point	BH10-5
Date of sampling	15 Dec 2021, 12h00
Test item number	I212234/15

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**670**	**mS/m**	D	150	300	400	
Turbidity	**0.40**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4386**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**425**	**mg/l**					
Total Hardness as $CaCO_3$	**1642**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**921**	**mg/l**	C	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**721**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1429**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.6**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1002**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**52**	**mg/l**	D	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonia as N	**<0.02**	**mg/l**					
Sodium as Na	**892**	**mg/l**	D	100	400	800	2000
Potassium as K	**34**	**mg/l**	A	200	400	800	
Magnesium as Mg	**175**	**mg/l**	C	70	100	200	500
Calcium as Ca	**369**	**mg/l**	C	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.5**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.9**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**7.2**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

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Group C: low risk water
Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in clients' own bottle / in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
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Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH11-1
Date of sampling	2022/01/16; 15:00
Test item number	I220280/1

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**2190**	**mS/m**	D	150	300	400	
Turbidity	**0.35**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**14809**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**230**	**mg/l**					
Total Hardness as $CaCO_3$	**5093**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**2812**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**2281**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**5991**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**3131**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**70**	**mg/l**	D	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**3448**	**mg/l**	D	100	400	800	2000
Potassium as K	**110**	**mg/l**	A	200	400	800	
Magnesium as Mg	**554**	**mg/l**	D	70	100	200	500
Calcium as Ca	**1126**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.1**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.18**	**mg/l**	B	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.2**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.5**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**51.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms. Manuela Mayer

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Analytical Laboratory Services
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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
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For practical reasons, the guidelines are divided into four groups.
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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH11-2
Date of sampling	2022/01/17; 14:40
Test item number	I220280/2

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**2010**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**13410**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**235**	**mg/l**					
Total Hardness as $CaCO_3$	**5000**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**2797**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**2203**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**5530**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**2785**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**70**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**2891**	**mg/l**	D	100	400	800	2000
Potassium as K	**95**	**mg/l**	A	200	400	800	
Magnesium as Mg	**535**	**mg/l**	D	70	100	200	500
Calcium as Ca	**1120**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.1**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.19**	**mg/l**	B	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.2**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.5**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**45.6**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
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Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

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Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

Approved Technical Signatory
Ms. Manuela Mayer

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Analytical Laboratory Services
OUR QUALITY IS IN THE DETAIL

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH11-3
Date of sampling	2022/01/17; 14:20
Test item number	I220280/3

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1961**	**mS/m**	D	150	300	400	
Turbidity	**0.25**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**12764**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**235**	**mg/l**					
Total Hardness as $CaCO_3$	**5033**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**2797**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**2236**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**5185**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**2656**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**53**	**mg/l**	D	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**2787**	**mg/l**	D	100	400	800	2000
Potassium as K	**94**	**mg/l**	A	200	400	800	
Magnesium as Mg	**543**	**mg/l**	D	70	100	200	500
Calcium as Ca	**1120**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.1**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.49**	**mg/l**	B	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.2**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.5**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**42.9**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH11-4
Date of sampling	2022/01/18; 15:40
Test item number	I220280/4

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1938**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**12799**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**240**	**mg/l**					
Total Hardness as $CaCO_3$	**4917**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**2714**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**2203**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**5300**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**2670**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**56**	**mg/l**	D	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**2723**	**mg/l**	D	100	400	800	2000
Potassium as K	**91**	**mg/l**	A	200	400	800	
Magnesium as Mg	**535**	**mg/l**	D	70	100	200	500
Calcium as Ca	**1087**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.24**	**mg/l**	B	0.05	1.0	2.0	10
Iron as Fe	**0.97**	**mg/l**	B	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.2**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.5**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**42.8**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH11-5
Date of sampling	2022/01/18; 15:00
Test item number	I220280/5

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1910**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**12371**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**235**	**mg/l**					
Total Hardness as $CaCO_3$	**4986**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**2779**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**2207**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**4954**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**2656**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**54**	**mg/l**	D	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**2639**	**mg/l**	D	100	400	800	2000
Potassium as K	**90**	**mg/l**	A	200	400	800	
Magnesium as Mg	**536**	**mg/l**	D	70	100	200	500
Calcium as Ca	**1113**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.1**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.16**	**mg/l**	B	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.2**						
Langelier Index	**0.8**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.4**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**41.5**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

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Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
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Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

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Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH4-1
Date of sampling	2022/01/11; 17:00
Test item number	I220280/6

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**793**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4654**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**400**	**mg/l**					
Total Hardness as $CaCO_3$	**2178**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1099**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1079**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1659**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.9**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**959**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**12**	**mg/l**	B	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**994**	**mg/l**	D	100	400	800	2000
Potassium as K	**46**	**mg/l**	A	200	400	800	
Magnesium as Mg	**262**	**mg/l**	D	70	100	200	500
Calcium as Ca	**440**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.05**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**8.4**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms. Manuela Mayer

Analytical Laboratory Services
OUR QUALITY IS IN THE DETAIL

Windhoek:
info@analab.com.na
Tel +264 61 210 132
Cell +264 81 611 8843
71 Newcastle Street
Walvis Bay:
walvisbaylab@analab.com.na
Cell +264 81 122 1588
Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH4-2
Date of sampling	2022/01/12; 17:00
Test item number	I220280/7

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**798**	**mS/m**	D	150	300	400	
Turbidity	**0.25**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4719**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**380**	**mg/l**					
Total Hardness as $CaCO_3$	**2274**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1154**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1120**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1728**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.8**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**953**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**6.0**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1002**	**mg/l**	D	100	400	800	2000
Potassium as K	**47**	**mg/l**	A	200	400	800	
Magnesium as Mg	**272**	**mg/l**	D	70	100	200	500
Calcium as Ca	**462**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.8**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**9.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Group C: low risk water
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Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH4-3
Date of sampling	2022/01/13; 17:00
Test item number	I220280/8

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**798**	**mS/m**	D	150	300	400	
Turbidity	**0.25**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4843**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**385**	**mg/l**					
Total Hardness as $CaCO_3$	**2248**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1136**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1112**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1866**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.8**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**948**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**11**	**mg/l**	B	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**976**	**mg/l**	D	100	400	800	2000
Potassium as K	**47**	**mg/l**	A	200	400	800	
Magnesium as Mg	**270**	**mg/l**	D	70	100	200	500
Calcium as Ca	**455**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**9.4**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
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TEST REPORT

To:	**Digby Wells Environmental SA (Pty) Ltd.**		
	48 Grosvenor Road	Date received:	26/Jan/22
	Brtanston 2191	Date analysed:	8 February - 28 March 2022
	South Africa	Date reported:	29/Mar/22
Attn:	Ms Megan Edwards	Client Reference no.:	AFT-7220
e-mail:	megan.edwards@digbywells.com	Quotation no.:	QU-6835
Tel:	+27 11 789 9495	Lab Reference:	I220280
		Enquiries:	Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH4-4
Date of sampling	2022/010/13; 17:10
Test item number	I220280/9

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**803**	**mS/m**	D	150	300	400	
Turbidity	**0.75**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4917**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**385**	**mg/l**					
Total Hardness as $CaCO_3$	**2265**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1141**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1124**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1889**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.8**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**986**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**8.8**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**993**	**mg/l**	D	100	400	800	2000
Potassium as K	**48**	**mg/l**	A	200	400	800	
Magnesium as Mg	**273**	**mg/l**	D	70	100	200	500
Calcium as Ca	**457**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**9.6**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
6-10 mg/l nitrate as N: rare instances of methhaemoglobinaemia in infants; no effects in adults. Concentrations in this range generally well tolerated.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

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To: **Digby Wells Environmental SA (Pty) Ltd.**
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Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
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e-mail: megan.edwards@digbywells.com
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Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH4-5
Date of sampling	2022/01/13; 17:00
Test item number	I220280/10

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**805**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5074**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**380**	**mg/l**					
Total Hardness as $CaCO_3$	**2307**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1154**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1153**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1774**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.9**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1215**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**8.1**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1030**	**mg/l**	D	100	400	800	2000
Potassium as K	**48**	**mg/l**	A	200	400	800	
Magnesium as Mg	**280**	**mg/l**	D	70	100	200	500
Calcium as Ca	**462**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.03**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**9.9**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms. Manuela Mayer

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Cell +264 81 122 1588
Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
6-10 mg/l nitrate as N: rare instances of methhaemoglobinaemia in infants; no effects in adults. Concentrations in this range generally well tolerated.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH9-1
Date of sampling	2022/01/07; 20:00
Test item number	I220280/11

				Recommended maximum limits			
				Human consumption			**Livestock**
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.3**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**433**	**mS/m**	D	150	300	400	
Turbidity	**0.70**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**2490**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**395**	**mg/l**					
Total Hardness as $CaCO_3$	**760**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**390**	**mg/l**	B	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**371**	**mg/l**	B	290	420	840	2057
Chloride as Cl^-	**737**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**2.0**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**509**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**12**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**677**	**mg/l**	C	100	400	800	2000
Potassium as K	**29**	**mg/l**	A	200	400	800	
Magnesium as Mg	**90**	**mg/l**	B	70	100	200	500
Calcium as Ca	**156**	**mg/l**	B	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.04**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.8**						
Langelier Index	**0.5**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.2**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**4.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
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South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH9-2
Date of sampling	2022/01/07; 20:00
Test item number	I220280/12

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.3**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**428**	**mS/m**	D	150	300	400	
Turbidity	**0.25**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**2556**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**395**	**mg/l**					
Total Hardness as $CaCO_3$	**775**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**405**	**mg/l**	B	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**371**	**mg/l**	B	290	420	840	2057
Chloride as Cl^-	**830**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**2.1**	**mg/l**	C	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**504**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**12**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**650**	**mg/l**	C	100	400	800	2000
Potassium as K	**28**	**mg/l**	A	200	400	800	
Magnesium as Mg	**90**	**mg/l**	B	70	100	200	500
Calcium as Ca	**162**	**mg/l**	B	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.7**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.2**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**4.3**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Group A: excellent quality water
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Group C: low risk water
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Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
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Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
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Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH9-3
Date of sampling	2022/01/08; 20:00
Test item number	I220280/13

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.7**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**437**	**mS/m**	D	150	300	400	
Turbidity	**0.25**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**2583**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**365**	**mg/l**					
Total Hardness as $CaCO_3$	**748**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**365**	**mg/l**	A	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**383**	**mg/l**	B	290	420	840	2057
Chloride as Cl^-	**853**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**2.0**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**523**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**12**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**665**	**mg/l**	C	100	400	800	2000
Potassium as K	**29**	**mg/l**	A	200	400	800	
Magnesium as Mg	**93**	**mg/l**	B	70	100	200	500
Calcium as Ca	**146**	**mg/l**	A	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.8**						
Langelier Index	**0.9**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.9**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**4.8**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
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Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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PO Box 86782, Windhoek, Namibia

Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

Approved Technical Signatory
Ms. Manuela Mayer

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To:	**Digby Wells Environmental SA (Pty) Ltd.**		
	48 Grosvenor Road	Date received:	26/Jan/22
	Brtanston 2191	Date analysed:	8 February - 28 March 2022
	South Africa	Date reported:	29/Mar/22
Attn:	Ms Megan Edwards	Client Reference no.:	AFT-7220
e-mail:	megan.edwards@digbywells.com	Quotation no.:	QU-6835
Tel:	+27 11 789 9495	Lab Reference:	I220280
		Enquiries: Ms Manuela Mayer	

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH9-4
Date of sampling	2022/01/09; 20:00
Test item number	I220280/14

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.2**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**453**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**2605**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**395**	**mg/l**					
Total Hardness as $CaCO_3$	**856**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**444**	**mg/l**	B	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**412**	**mg/l**	B	290	420	840	2057
Chloride as Cl^-	**853**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**2.1**	**mg/l**	C	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**485**	**mg/l**	B	200	600	1200	1000
Nitrate as N	**13**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**662**	**mg/l**	C	100	400	800	2000
Potassium as K	**30**	**mg/l**	A	200	400	800	
Magnesium as Mg	**100**	**mg/l**	B	70	100	200	500
Calcium as Ca	**178**	**mg/l**	B	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.7**						
Langelier Index	**0.5**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.2**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**4.3**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH9-5
Date of sampling	2022/01/09; 21:00
Test item number	I220280/15

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.2**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**474**	**mS/m**	D	150	300	400	
Turbidity	**0.35**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**2864**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**385**	**mg/l**					
Total Hardness as $CaCO_3$	**908**	**mg/l**	C	300	650	1300	
Ca-Hardness as $CaCO_3$	**472**	**mg/l**	B	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**437**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**876**	**mg/l**	C	250	600	1200	1500-3000
Fluoride as F^-	**2.0**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**678**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**14**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.02**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**689**	**mg/l**	C	100	400	800	2000
Potassium as K	**31**	**mg/l**	A	200	400	800	
Magnesium as Mg	**106**	**mg/l**	C	70	100	200	500
Calcium as Ca	**189**	**mg/l**	B	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.7**						
Langelier Index	**0.5**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.2**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**5.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH3-1
Date of sampling	2022/01/06; 19:50
Test item number	I220280/16

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**899**	**mS/m**	D	150	300	400	
Turbidity	**0.35**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5505**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**410**	**mg/l**					
Total Hardness as $CaCO_3$	**2344**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1146**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1198**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2166**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.0**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1101**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**5.8**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1160**	**mg/l**	D	100	400	800	2000
Potassium as K	**55**	**mg/l**	A	200	400	800	
Magnesium as Mg	**291**	**mg/l**	D	70	100	200	500
Calcium as Ca	**459**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**10.3**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH3-2
Date of sampling	2022/01/7; 18:00
Test item number	I220280/17

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**888**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5416**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**400**	**mg/l**					
Total Hardness as $CaCO_3$	**2377**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1166**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1211**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2120**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.9**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1057**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**5.6**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1159**	**mg/l**	D	100	400	800	2000
Potassium as K	**53**	**mg/l**	A	200	400	800	
Magnesium as Mg	**294**	**mg/l**	D	70	100	200	500
Calcium as Ca	**467**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**10.2**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms. Manuela Mayer

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Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

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Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH3-3
Date of sampling	2022/01/09; 18:00
Test item number	I220280/18

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**884**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5434**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**400**	**mg/l**					
Total Hardness as $CaCO_3$	**2372**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1161**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1211**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2143**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.9**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1062**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**5.8**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1149**	**mg/l**	D	100	400	800	2000
Potassium as K	**54**	**mg/l**	A	200	400	800	
Magnesium as Mg	**294**	**mg/l**	D	70	100	200	500
Calcium as Ca	**465**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.03**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**10.3**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
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0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
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Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH3-4
Date of sampling	2022/01/10; 18:00
Test item number	I220280/19

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**881**	**mS/m**	D	150	300	400	
Turbidity	**0.55**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5447**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**400**	**mg/l**					
Total Hardness as $CaCO_3$	**2367**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1156**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1211**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2166**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.9**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1052**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**5.4**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1154**	**mg/l**	D	100	400	800	2000
Potassium as K	**53**	**mg/l**	A	200	400	800	
Magnesium as Mg	**294**	**mg/l**	D	70	100	200	500
Calcium as Ca	**463**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.03**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**10.4**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
0-1.0 mg/l fluoride: no adverse health effects or tooth damage occurs

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

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Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

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48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH3-5
Date of sampling	2022/01/10; 12:00
Test item number	I220280/20

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**883**	**mS/m**	D	150	300	400	
Turbidity	**0.40**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5408**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**395**	**mg/l**					
Total Hardness as $CaCO_3$	**2361**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1146**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1215**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2143**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**0.9**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1046**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**5.6**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1147**	**mg/l**	D	100	400	800	2000
Potassium as K	**55**	**mg/l**	A	200	400	800	
Magnesium as Mg	**295**	**mg/l**	D	70	100	200	500
Calcium as Ca	**459**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**10.4**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

Approved Technical Signatory
Ms. Manuela Mayer

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH12-1
Date of sampling	2022/01/11; 9:00
Test item number	I220280/21

Parameter	**Value**	**Units**	**Classification**	**Recommended maximum limits** Human consumption Group A	Group B	Group C	Livestock watering
p H	**7.1**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**838**	**mS/m**	D	150	300	400	
Turbidity	**0.25**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5262**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**385**	**mg/l**					
Total Hardness as $CaCO_3$	**2124**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1181**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**943**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1843**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.4**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1035**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**62**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.07**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1121**	**mg/l**	D	100	400	800	2000
Potassium as K	**52**	**mg/l**	A	200	400	800	
Magnesium as Mg	**229**	**mg/l**	D	70	100	200	500
Calcium as Ca	**473**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.8**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.5**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**9.6**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH12-2
Date of sampling	2022/01/11; 21:40
Test item number	I220280/22

				Recommended maximum limits			
				Human consumption			**Livestock**
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.1**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**812**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5022**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**285**	**mg/l**					
Total Hardness as $CaCO_3$	**2013**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1124**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**889**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1751**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.4**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1052**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**59**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.04**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1069**	**mg/l**	D	100	400	800	2000
Potassium as K	**51**	**mg/l**	A	200	400	800	
Magnesium as Mg	**216**	**mg/l**	D	70	100	200	500
Calcium as Ca	**450**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.03**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.8**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**12.5**	increasing corrosive tendency		Applies to water in the pH range 7-8			
				which also contains dissolved oxygen			
				ratios <0.2 no corrosive properties			
				ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH12-3
Date of sampling	2022/01/12; 9:20
Test item number	I220280/23

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.2**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**802**	**mS/m**	D	150	300	400	
Turbidity	**0.30**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5075**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**345**	**mg/l**					
Total Hardness as $CaCO_3$	**2012**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1126**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**885**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1751**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.4**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1062**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**58**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.05**	**mg/l**					10
Ammonium as N	**0.49**	**mg/l**					
Sodium as Na	**1081**	**mg/l**	D	100	400	800	2000
Potassium as K	**51**	**mg/l**	A	200	400	800	
Magnesium as Mg	**215**	**mg/l**	D	70	100	200	500
Calcium as Ca	**451**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.8**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**10.4**	increasing corrosive tendency		Applies to water in the pH range 7-8			

Applies to water in the pH range 7-8
which also contains dissolved oxygen
ratios <0.2 no corrosive properties
ratios >0.2 increasing corrosive tendency

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Remark: Overall classification of water, considering only constituents that have been tested for:
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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
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Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
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Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH12-4
Date of sampling	2022/01/12; 21:00
Test item number	I220280/24

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.2**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**3260**	**mS/m**	D	150	300	400	
Turbidity	**3.0**	**NTU**	B	1	5	10	
Total Dissolved Solids (calc.)	**22768**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**190**	**mg/l**					
Total Hardness as $CaCO_3$	**6597**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**2462**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**4134**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**9332**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**2.1**	**mg/l**	C	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**5449**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**12**	**mg/l**	B	10	20	40	100
Nitrite as N	**0.13**	**mg/l**					10
Ammonium as N	**0.44**	**mg/l**					
Sodium as Na	**5596**	**mg/l**	D	100	400	800	2000
Potassium as K	**232**	**mg/l**	B	200	400	800	
Magnesium as Mg	**1004**	**mg/l**	D	70	100	200	500
Calcium as Ca	**986**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.1**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**<0.1**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.8**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.5**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**99.2**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms. Manuela Mayer

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Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH12-5
Date of sampling	2022/01/13; 9:00
Test item number	I220280/25

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.2**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**785**	**mS/m**	D	150	300	400	
Turbidity	**0.60**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**4826**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**345**	**mg/l**					
Total Hardness as $CaCO_3$	**1876**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1049**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**828**	**mg/l**	C	290	420	840	2057
Chloride as Cl^-	**1728**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.4**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1002**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**49**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.06**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1000**	**mg/l**	D	100	400	800	2000
Potassium as K	**50**	**mg/l**	A	200	400	800	
Magnesium as Mg	**201**	**mg/l**	D	70	100	200	500
Calcium as Ca	**420**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.4**						
Langelier Index	**0.8**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**10.1**	increasing corrosive tendency		Applies to water in the pH range 7-8			
				which also contains dissolved oxygen			
				ratios <0.2 no corrosive properties			
				ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH6-1
Date of sampling	2022/01/15; 13:00
Test item number	I220280/26

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1152**	**mS/m**	D	150	300	400	
Turbidity	**0.35**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**7211**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**410**	**mg/l**					
Total Hardness as $CaCO_3$	**2781**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1229**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1552**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2857**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.4**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1593**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**7.8**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1526**	**mg/l**	D	100	400	800	2000
Potassium as K	**84**	**mg/l**	A	200	400	800	
Magnesium as Mg	**377**	**mg/l**	D	70	100	200	500
Calcium as Ca	**492**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.02**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.04**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**13.9**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
6-10 mg/l nitrate as N: rare instances of methhaemoglobinaemia in infants; no effects in adults. Concentrations in this range generally well tolerated.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
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South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH6-2
Date of sampling	2022/01/16; 13:00
Test item number	I220280/27

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1141**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**7048**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**410**	**mg/l**					
Total Hardness as $CaCO_3$	**2731**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1211**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1520**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2834**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.4**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1517**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**11**	**mg/l**	B	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1466**	**mg/l**	D	100	400	800	2000
Potassium as K	**81**	**mg/l**	A	200	400	800	
Magnesium as Mg	**369**	**mg/l**	D	70	100	200	500
Calcium as Ca	**485**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.02**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.04**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**13.6**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
10-20 mg/l nitrate as N: methhaemoglobinaemia may occur in infants. No effects in adults.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
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Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

Approved Technical Signatory
Ms. Manuela Mayer

Analytical Laboratory Services
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Unit 16, Ben Amathila Ave.

PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH6-3
Date of sampling	2022/01/16; 14:00
Test item number	I220280/28

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1178**	**mS/m**	D	150	300	400	
Turbidity	**0.60**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**7106**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**405**	**mg/l**					
Total Hardness as $CaCO_3$	**2813**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1224**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1590**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2857**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.4**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1552**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**6.3**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1465**	**mg/l**	D	100	400	800	2000
Potassium as K	**84**	**mg/l**	A	200	400	800	
Magnesium as Mg	**386**	**mg/l**	D	70	100	200	500
Calcium as Ca	**490**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.02**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.05**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.7**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**14.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
6-10 mg/l nitrate as N: rare instances of methhaemoglobinaemia in infants; no effects in adults. Concentrations in this range generally well tolerated.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH6-4
Date of sampling	2022/01/21; 6:00
Test item number	I220280/29

				Recommended maximum limits			
				Human consumption			**Livestock**
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1167**	**mS/m**	D	150	300	400	
Turbidity	**0.35**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**7387**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**405**	**mg/l**					
Total Hardness as $CaCO_3$	**2868**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1291**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1577**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2949**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1688**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**4.6**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1503**	**mg/l**	D	100	400	800	2000
Potassium as K	**82**	**mg/l**	A	200	400	800	
Magnesium as Mg	**383**	**mg/l**	D	70	100	200	500
Calcium as Ca	**517**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.02**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.04**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.6**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**14.6**	increasing corrosive tendency		Applies to water in the pH range 7-8			
				which also contains dissolved oxygen			
				ratios <0.2 no corrosive properties			
				ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH6-5
Date of sampling	2022/01/21; 18:00
Test item number	I220280/30

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1147**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**7132**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**405**	**mg/l**					
Total Hardness as $CaCO_3$	**2788**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1231**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1557**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2857**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1579**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**4.0**	**mg/l**	A	10	20	40	100
Nitrite as N	**<0.01**	**mg/l**					10
Ammonium as N	**<0.02**	**mg/l**					
Sodium as Na	**1482**	**mg/l**	D	100	400	800	2000
Potassium as K	**81**	**mg/l**	A	200	400	800	
Magnesium as Mg	**378**	**mg/l**	D	70	100	200	500
Calcium as Ca	**493**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.02**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**<0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.3**						
Langelier Index	**0.6**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**14.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
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0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
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South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH8-1
Date of sampling	2022/01/22; 22:00
Test item number	I220280/31

				Recommended maximum limits			
				Human consumption			**Livestock**
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.3**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**1107**	**mS/m**	D	150	300	400	
Turbidity	**5.8**	**NTU**	C	1	5	10	
Total Dissolved Solids (calc.)	**6924**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**200**	**mg/l**					
Total Hardness as $CaCO_3$	**2667**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1531**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**1137**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2650**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.2**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1444**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**73**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.61**	**mg/l**					10
Ammonium as N	**1.1**	**mg/l**					
Sodium as Na	**1439**	**mg/l**	D	100	400	800	2000
Potassium as K	**56**	**mg/l**	A	200	400	800	
Magnesium as Mg	**276**	**mg/l**	D	70	100	200	500
Calcium as Ca	**613**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.02**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**1.8**	**mg/l**	C	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**0.8**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.7**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**26.2**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

Approved Technical Signatory
Ms. Manuela Mayer

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PO Box 86782, Windhoek, Namibia

Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
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Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

Approved Technical Signatory
Ms. Manuela Mayer

Analytical Laboratory Services
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PO Box 86782, Windhoek, Namibia

Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH8-2
Date of sampling	2022/01/23; 9:40
Test item number	I220280/32

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**921**	**mS/m**	D	150	300	400	
Turbidity	**0.15**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5790**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**195**	**mg/l**					
Total Hardness as $CaCO_3$	**2115**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1209**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**906**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**2097**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1210**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**101**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.86**	**mg/l**					10
Ammonium as N	**1.4**	**mg/l**					
Sodium as Na	**1163**	**mg/l**	D	100	400	800	2000
Potassium as K	**50**	**mg/l**	A	200	400	800	
Magnesium as Mg	**220**	**mg/l**	D	70	100	200	500
Calcium as Ca	**484**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.05**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.6**						
Langelier Index	**0.4**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.2**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**21.6**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
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1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
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TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH8-3
Date of sampling	2022/01; 9:00
Test item number	I220280/33

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**6.9**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**885**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5537**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**185**	**mg/l**					
Total Hardness as $CaCO_3$	**2052**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1171**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**881**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1982**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1133**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**99**	**mg/l**	D	10	20	40	100
Nitrite as N	**0.91**	**mg/l**					10
Ammonium as N	**2.2**	**mg/l**					
Sodium as Na	**1139**	**mg/l**	D	100	400	800	2000
Potassium as K	**48**	**mg/l**	A	200	400	800	
Magnesium as Mg	**214**	**mg/l**	D	70	100	200	500
Calcium as Ca	**469**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.6**						
Langelier Index	**0.3**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.4**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**21.5**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
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Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
>20 mg/l nitrate as N: methemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults

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Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

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48 Grosvenor Road
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Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
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Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH8-4
Date of sampling	2022/01; 9:00
Test item number	I220280/34

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**884**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5143**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**185**	**mg/l**					
Total Hardness as $CaCO_3$	**2067**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1194**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**873**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1982**	**mg/l**	D	250	600	1200	1500-3000
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Nitrate as N	**10**	**mg/l**	A	10	20	40	100
Nitrite as N	**1.0**	**mg/l**					10
Ammonium as N	**2.1**	**mg/l**					
Sodium as Na	**1127**	**mg/l**	D	100	400	800	2000
Potassium as K	**48**	**mg/l**	A	200	400	800	
Magnesium as Mg	**212**	**mg/l**	D	70	100	200	500
Calcium as Ca	**478**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**<0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.02**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.6**						
Langelier Index	**0.4**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.3**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**21.5**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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pH: Optimum pH 6.5-8.
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Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

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Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
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Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	BH8-5
Date of sampling	2022/01; 9:00
Test item number	I220280/35

				Recommended maximum limits			
				Human consumption			Livestock
Parameter	**Value**	**Units**	**Classification**	**Group A**	**Group B**	**Group C**	**watering**
p H	**7.0**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**898**	**mS/m**	D	150	300	400	
Turbidity	**0.20**	**NTU**	A	1	5	10	
Total Dissolved Solids (calc.)	**5193**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**190**	**mg/l**					
Total Hardness as $CaCO_3$	**2094**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**1196**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**898**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**1982**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.3**	**mg/l**	A	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**1144**	**mg/l**	C	200	600	1200	1000
Nitrate as N	**9.8**	**mg/l**	A	10	20	40	100
Nitrite as N	**1.1**	**mg/l**					10
Ammonium as N	**2.2**	**mg/l**					
Sodium as Na	**1162**	**mg/l**	D	100	400	800	2000
Potassium as K	**49**	**mg/l**	A	200	400	800	
Magnesium as Mg	**218**	**mg/l**	D	70	100	200	500
Calcium as Ca	**479**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.01**	**mg/l**	A	0.05	1.0	2.0	10
Iron as Fe	**0.01**	**mg/l**	A	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.6**						
Langelier Index	**0.4**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**6.2**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**21.0**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.0-1.5 mg/l fluoride: slight mottling of dental enamel may occur in sensitive individuals. No other health effects are expected

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
6-10 mg/l nitrate as N: rare instances of methhaemoglobinaemia in infants; no effects in adults. Concentrations in this range generally well tolerated.

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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PO Box 86782, Windhoek, Namibia

TEST REPORT

To: **Digby Wells Environmental SA (Pty) Ltd.**
48 Grosvenor Road
Brtanston 2191
South Africa

Date received: 26/Jan/22
Date analysed: 8 February - 28 March 2022
Date reported: 29/Mar/22

Attn: Ms Megan Edwards
e-mail: megan.edwards@digbywells.com
Tel: +27 11 789 9495

Client Reference no.: AFT-7220
Quotation no.: QU-6835
Lab Reference: I220280
Enquiries: Ms Manuela Mayer

Sample details	borehole water
Location of sampling point	Uis, Afritin mine
Description of sampling point	K5-PIT
Date of sampling	2022/01; 12:00
Test item number	I220280/36

Parameter	Value	Units	Classification	Recommended maximum limits: Human consumption Group A	Group B	Group C	Livestock watering
p H	**7.5**		A	6-9	5.5-9.5	4-11	
Electrical Conductivity	**3270**	**mS/m**	D	150	300	400	
Turbidity	**4.8**	**NTU**	B	1	5	10	
Total Dissolved Solids (calc.)	**22763**	**mg/l**					6000
P-Alkalinity as $CaCO_3$	**0**	**mg/l**					
Total Alkalinity as $CaCO_3$	**133**	**mg/l**					
Total Hardness as $CaCO_3$	**6657**	**mg/l**	D	300	650	1300	
Ca-Hardness as $CaCO_3$	**2445**	**mg/l**	D	375	500	1000	2500
Mg-Hardness as $CaCO_3$	**4213**	**mg/l**	D	290	420	840	2057
Chloride as Cl^-	**9102**	**mg/l**	D	250	600	1200	1500-3000
Fluoride as F^-	**1.9**	**mg/l**	B	1.5	2.0	3.0	2.0-6.0
Sulphate as SO_4^{2-}	**5830**	**mg/l**	D	200	600	1200	1000
Nitrate as N	**1.4**	**mg/l**	A	10	20	40	100
Nitrite as N	**0.22**	**mg/l**					10
Ammonium as N	**1.2**	**mg/l**					
Sodium as Na	**5505**	**mg/l**	D	100	400	800	2000
Potassium as K	**236**	**mg/l**	B	200	400	800	
Magnesium as Mg	**1023**	**mg/l**	D	70	100	200	500
Calcium as Ca	**979**	**mg/l**	D	150	200	400	1000
Manganese as Mn	**0.21**	**mg/l**	B	0.05	1.0	2.0	10
Iron as Fe	**0.18**	**mg/l**	B	0.1	1.0	2.0	10
Stability pH, at 25°C	**6.5**						
Langelier Index	**1.0**	scaling		>0=scaling, <0=corrosive, 0=stable			
Ryznar Index	**5.5**	scaling		<6.5=scaling, >7,5=corrosive, ≥6.5 and ≤7.5=stable			
Corrosivity ratio	**142.3**	increasing corrosive tendency		Applies to water in the pH range 7-8 which also contains dissolved oxygen ratios <0.2 no corrosive properties ratios >0.2 increasing corrosive tendency			

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Remark: Overall classification of water, considering only constituents that have been tested for:
Group D: high risk or water unsuitable for human consumption

Interpretation based on guidelines for the evaluation of drinking water for human consumption, DWA, Namibia, April 1988 and
South African Water Quality Guidelines Volume 5: Agricultural water use: Livestock watering, Second Edition, 1996

For practical reasons, the guidelines are divided into four groups.
The highest group assigned to any of the constituents determines the classification of the water as a whole.
Group A: excellent quality water
Group B: good quality water
Group C: low risk water
Group D: high risk or water unsuitable for human consumption

Ideally water should be either Group A or Group B. If water is classified as Group C, the situation is not yet critical, but attention should be given to those constituents over the Group B limit. If however, the water is classified as Group D urgent and immediate attention is required to reduce the levels of the problem constituents in the water to suitable levels.

Sample acceptance: Sample was collected in bottles provided by the laboratory.
Sample was suitable for testing

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Assessment of water quality for human consumption

Naturally occurring chemicals that are of health significance in drinking water
Fluoride: Exposure to high levels of fluoride, which occurs naturally, can lead to mottling of teeth and, in severe cases, crippling skeletal fluorosis.
1.5-3.5 mg/l fluoride: the threshold for marked dental mottling with associated tooth damage due to softening of enamel is 1.5mg/L. Above this, mottling and tooth damage will probably be noticeable in most continuous users of the water. No other health effects occur.

Chemicals from agricultural activities that are of health significance in drinking water
Nitrate and nitrite: In water it has been associated with methaemoglobinaemia, especially in bottle-fed infants
0-6 mg/l nitrate as N: no adverse health effects

Some of the naturally occurring chemicals which occur in drinking water at concentrations below those at which toxic effects may occur.
Chloride: high concentrations of chloride give a salty taste to water. Concentrations in excess of 250 mg/l are increasingly likely to be detected by taste.
Hardness: Depending on the interaction of other factors, such as, pH and alkalinity, water with a hardness above approximately 200 mg/l may cause scale deposition in the pipe work and tanks. On heating, hard waters form deposits of calcium carbonate scale.
pH: Optimum pH 6.5-8.
pH does not exert direct health effects, but may exert indirect health effects via metal solubility.
Sodium: The average taste threshold for sodium is about 200 mg/l.
Sulphate: It is generally considered that the taste impairment is minimal at levels below 250 mg/l.
Magnesium: The average taste threshold for magnesium is about 70 mg/l
Total dissolved solids: The palatability of water with a TDS level of less than 600 mg/l is generally considered to be good; drinking water becomes significantly and increasingly unpalatable at TDS levels greater than about 1000 mg/l.

Turbidity is a measure of the light-scattering ability of water and is indicative of the concentration of suspended matter in water.
Microorganisms are often associated with turbidity, hence low turbidity minimises the potential for transmission of infectious diseases. Turbidity also affects the aesthetic quality of water.
Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles and organic matter.
Turbidity may also be associated with the presence of inorganic ions such as manganese(II) and iron(II).
The consumption of turbid water *per se* does not have any direct health effects, but associated effects due to microbial contamination or the ingestion of substances bound to particulate matter, do.
Aesthetic effects (appearance, taste, odour) of turbidity can be mitigated or removed by decantation or by filtration (or by both), accelerated, if necessary, by previous aeration

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Summary of test methods - Water Quality

Determinant	Unit	DL	Technique	Method reference
Absorbed oxygen	mg/l O_2	1	titrimetric	SANS 5220:2005
Acidity	mg/l $CaCO_3$	20	titrimetric	AWWA 2310 B
Alkalinity	mg/l $CaCO_3$	20	titrimetric	AWWA 2320 B
Ammonium	mg/l N	0.02	colorimetric	AWWA 4500-NH_3 F / modified Berthelot
Bicarbonate & Carbonate	mg/l $CaCO_3$	1	by calculation	
Biological oxygen demand, 5-day	mg/l O_2	2	electrometric	AWWA 5210 B
Biological oxygen demand, carbonacious	mg/l O_2	2	electrometric	AWWA 5210 B
Bromide & Iodide	mg/l Br^-	0.01	iodometric	P. Höfer
Chloride	mg/l Cl^-	1	argentometric	AWWA 4500-Cl^- B
Chlorine, free and total	mg/l Cl_2	0.05	colorimetric	AWWA 4500-Cl G
Chlorophyll a	µg/L	0.01	spectrophotometric	ISO 10260:1992 E
Chemical oxygen demand	mg/l O_2	1	colorimetric	AWWA 5220 D
Colour	Pt	10	colorimetric	AWWA Pt-Co-2120 B
Cyanide	mg/l CN	0.02	colorimetric	AWWA 4500-CN E
Density	mg/l g/ml	-	gravimetric	METH W 016
Dissolved oxygen	mg/l O_2	0.1	electrometric	AWWA 4550-O G
Electrical conductivity	mS/m	0.1	electrometric	AWWA 2510 B
Fat, oil & grease	mg/l	1	extraction/gavimetric	AWWA 5520 B
Fixed and volatile solids, ignited at 550°C	mg/l	1	gravimetric	AWWA 2540 E
Fluoride	mg/l F^-	0.1	electrometric	AWWA 4500-F C
Hardness	mg/l $CaCO_3$	1	by calculation	AWWA 2340 B
Hexavalent chromium	mg/l Cr	0.02	colorimetric	AWWA 3500-Cr B
Hydrolysable phosphates	mg/l P	0.01	digestion, PO4	AWWA 4500-P B.2 + E
Kjeldahl nitrogen	mg/l N	0.5	by calculation	
Molybdosilicate	mg/l SiO_2	0.4	colorimetric	AWWA 4500-Si C
Nitrate	mg/l N	0.5	colorimetric	Spectroquant / AWWA 4500-NO_3 E
Nitrite	mg/l N	0.01	colorimetric	AWWA 4500-NO2 B
Oxidation reduction potential (Redox)	mV	-	electrometric	AWWA 2580 B
pH		-	electrometric	AWWA 4500-H^+ B
Phenols	mg/l Phenol	0.05	colorimetric	ASTM D1783-01, B
Reactive phosphorous	mg/l PO_4	0.03	colorimetric	AWWA 4500-P E
Settable solids	mg/l	1	gravimetric	AWWA 2540 F
Sulfide	mg/l S^{2-}	0.05	colorimetric	AWWA 4500-S^{2-} D
Sulfite	mg/l SO_3^{2-}	2	iodometric	AWWA 4500-SO_3^{2-} B
Sulphate	mg/l SO_4	1	nephelometric / colorimetric	AWWA 4500-SO4 E / F
Total dissolved solids	mg/l	1	gravimetric	AWWA 2540 C
Total nitrogen	mg/l N	0.5	digestion, NO3	EN ISO 11905-1:1997
Total phosphorous	mg/l P	0.01	digestion, PO4	AWWA 4500-P B.5 + E
Total solids	mg/l	1	gravimetric	AWWA 2540 B
Total suspended solids	mg/l	1	gravimetric	AWWA 2540 D
Turbidity	NTU	0.05	nephelometric	AWWA 2130 B
UV absorbing organic constituents at 254nm	cm^{-1}	-	colorimetric	AWWA 5910 B

Aluminium	mg/l Al	0.01		AWWA ICP-3500-Al C
Antimony	mg/l Sb	0.01		AWWA ICP-3500-Sb C
Arsenic	mg/l As	0.01		AWWA ICP-3500-As D
Barium	mg/l Ba	0.01		AWWA ICP-3500-Ba C
Beryllium	mg/l B	0.01		AWWA ICP-3500-Be
Bismuth	mg/l Bi	0.01		AWWA ICP-3500-Bi
Boron	mg/l B	0.01		AWWA ICP-3500-B D
Cadmium	mg/l Cd	0.01		AWWA ICP-3500-Cd C

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Calcium	mg/l Ca	0.1		AWWA ICP-3500-Ca C
Chromium (total)	mg/l Cr	0.01		AWWA ICP-3500-Cr C
Cobalt	mg/l Co	0.01		AWWA ICP-3500-Co C
Copper	mg/l Cu	0.01		AWWA ICP-3500-Cu C
Gold	mg/l Au	0.01		AWWA ICP-3500-Au
Iron	mg/l Fe	0.01		AWWA ICP-3500-Fe C
Lead	mg/l Pb	0.01		AWWA ICP-3500-Pb C
Lithium	mg/l Li	0.01		AWWA ICP-3500-Li C
Magnesium	mg/l Mg	0.1		AWWA ICP-3500-Mg C
Manganese	mg/l Mn	0.01		AWWA ICP-3500-Mn C
Mercury	mg/l Hg	0.01		AWWA ICP-3500-Hg
Molybdenum	mg/l Mo	0.01		AWWA ICP-3500-Mo C
Nickel	mg/l Ni	0.01		AWWA ICP-3500-Ni C
Potassium	mg/l K	0.1		AWWA ICP-3500-K C
Rubidium	mg/l Rb	0.01		ICP-OES
Selenium	mg/l Se	0.01		AWWA ICP-3500-Se I
Silica	mg/l Si	0.01		ICP-OES
Silver	mg/l Ag	0.01		AWWA ICP-3500-Ag
Sodium	mg/l Na	0.1		AWWA ICP-3500-Na C
Strontium	mg/l Sr	0.01		AWWA ICP-3500-Sr C
Thallium	mg/l Th	0.01		AWWA ICP-3500-Tl C
Tellurium	mg/l Te	0.01		AWWA ICP-3500-Te
Tin	mg/l Sn	0.01		AWWA ICP-3500-Sn
Titanium	mg/l Ti	0.01		AWWA ICP-3500-Ti
Uranium	mg/l U	0.01		AWWA ICP-3500-U
Vanadium	mg/l V	0.01		AWWA ICP-3500-V C
Zinc	mg/l Zn	0.01		AWWA ICP-3500-Zn C

Lower reporting limit

These are estimated values only; accurate lower levels of detection (LLDs) (measurement as part of a method) and method detection levels (MDLs) (measurement for the whole method) still have to be established
Given the varied matrices submitted to the laboratory and divers quality needs method and/or reagent blanks, performance evaluation samples and duplicate results may be included to assist in appropriate use of laboratory data.

All submitted samples are initially run undiluted unless sample dilutions are required in order to reduce or eliminate known matrix / interference effects. When an analyte concentration exceeds the calibration or linear range, the sample is re-analysed after appropriate dilution. The analyst will use the least dilution necessary to bring the analyte within the range. In both cases, a loss of sensitivity is experienced. All sample dilutions result in an increase in the lower reporting limit by a factor equal to the dilution. The less than symbol "<" is used for qualified data below the lower reporting limit.

WATERLAB (Pty) Ltd

Reg. No.: 1983/009165/07 V.A.T. No.: 4130107891

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T0391

CERTIFICATE OF ANALYSES
GENERAL WATER QUALITY PARAMETERS

Date received: 2022-02-04 **Date completed:** 2022-02-11

Project number: 1000 **Report number:** 107136 **Order number:** AFT7220

Client name: Digby Wells Environmental **Contact person:** Ms. M Edwards

Address: Turnberry Office Park, 48 Grosvenor Rd, Bryanston, JHB 2191 **e-mail:** megan.edwards@digbywells.com

Telephone: 011 789 9498 **Facsimile:** 011 069 6801 **Mobile:**

Analyses in mg/ℓ (Unless specified otherwise)		Method Identification	Sample Identification: Rain 2
Sample Number			152421
Date\Time Sampled			N/A
Chloride as Cl	A	WLAB046	9

A. van de Wetering - Chemical Technical Signatory

A = Accredited N = Not Accredited S = Subcontracted
Tests marked “Not SANAS Accredited” in this report are not included in the SANAS Scope of Accreditation for this Laboratory.
Results marked “Subcontracted Test” in this report are not included in the SANAS Scope of Accreditation for this Laboratory.

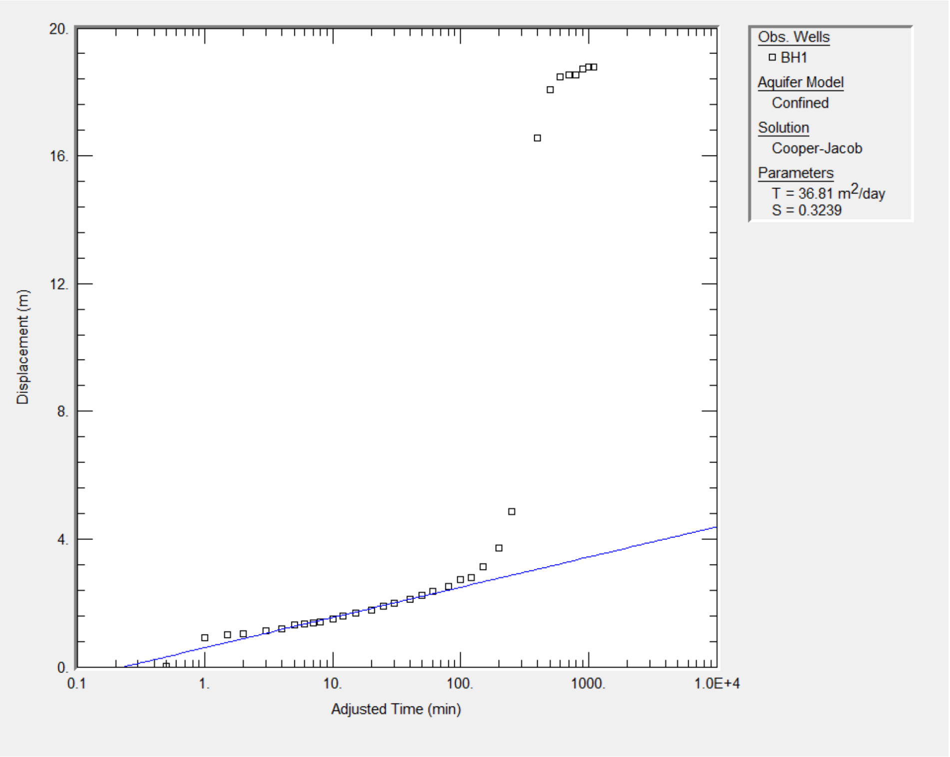
Sample condition acceptable unless specified on the report.

DIGBY WELLS ENVIRONMENTAL

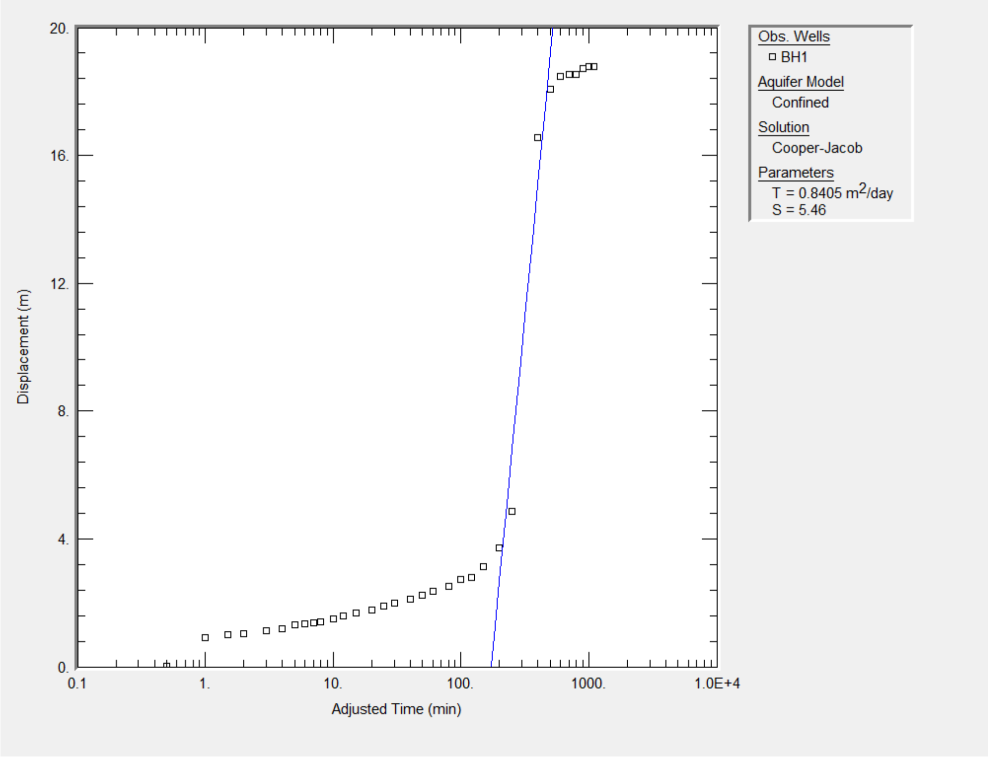
Appendix C: Aquifer Test Results

Observation Borehole Comments

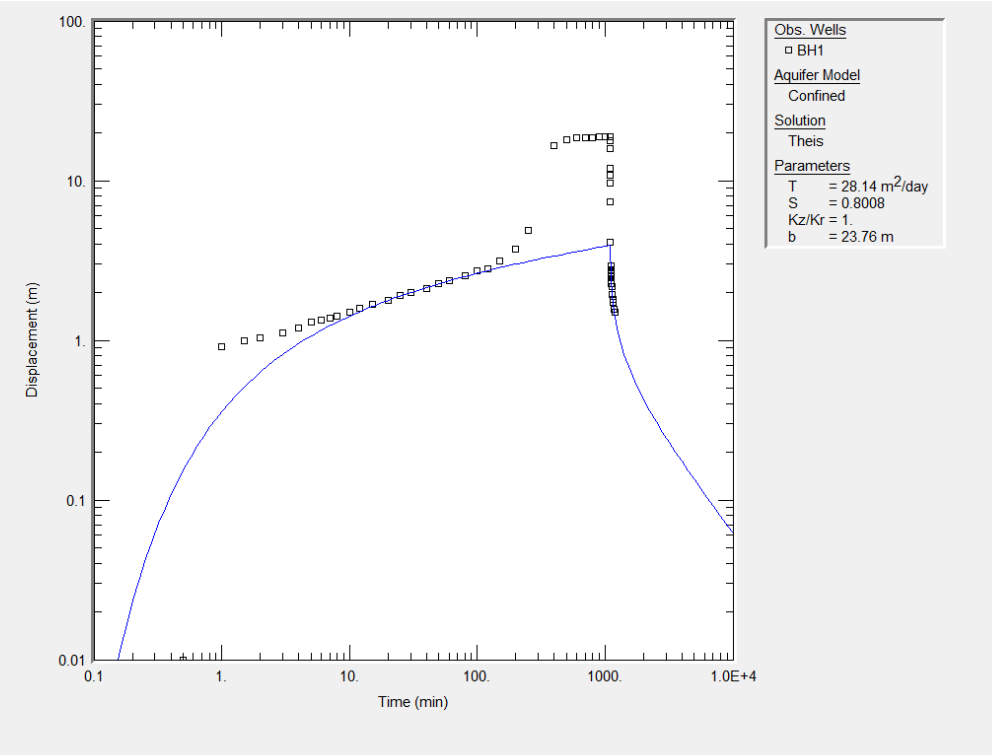
Aquifer Tested Borehole	Test	Observation Borehole	Comments
BH1	CDT1	BH2	Observation water levels decreased by 8 cm during the aquifer test
BH1	CDT1	BH10	Observation water levels were not affected during the CDT test
BH1	CDT2	BH2	Observation water levels decreased by 12 m during the aquifer test
BH1	CDT2	BH10	Observation water levels were not affected during the CDT test
BH2	CDT1	BH1	Observation water levels were not affected during the CDT test
BH2	CDT1	BH10	Observation water levels were not affected during the CDT test
BH3	CDT1	BH4	Observation water levels were not affected during the CDT test
BH3	CDT1	BH6	Observation water levels were not affected during the CDT test
BH3	CDT2	BH4	Observation water levels decreased by 20 cm during the aquifer test
BH3	CDT2	BH6	Observation water levels were not affected during the CDT test
BH4	CDT1	BH3	Observation water levels decreased by 21 cm during the aquifer test
BH4	CDT1	BH6	Observation water levels decreased by 3 cm during the aquifer test
BH6	CDT1	BH3	Observation water levels were not affected during the CDT test
BH6	CDT1	BH4	Observation water levels decreased by 7 cm during the aquifer test
BH6	CDT2	BH3	Observation water levels were not affected during the CDT test
BH6	CDT2	BH4	Observation water levels decreased by 5 cm during the aquifer test
BH6	CDT3	BH3	Observation water levels were not affected during the CDT test
BH6	CDT3	BH4	Observation water levels decreased by 61 cm during the aquifer test
BH8	CDT1	BH11	Observation water levels decreased by 21 cm during the aquifer test
BH9	CDT1	BH10	Observation water levels decreased by 30 cm during the aquifer test
BH9	CDT1	BH12	Observation water levels decreased by 3 cm during the aquifer test
BH10	CDT1	BH1	Observation water levels not measured
BH10	CDT1	BH2	Observation water levels not measured
BH10	CDT2	BH1	Observation water levels were not affected during the CDT test, water levels were recovering from abstraction pumping prior to the CDT test
BH10	CDT2	BH2	Observation water levels were not affected during the CDT test, water levels were recovering from abstraction pumping prior to the CDT test
BH11	CDT1	BH8	Observation water levels decreased by 18 cm during the aquifer test
BH12	CDT1	BH9	Observation water levels were not affected during the CDT, water levels were recovering from the CDT test



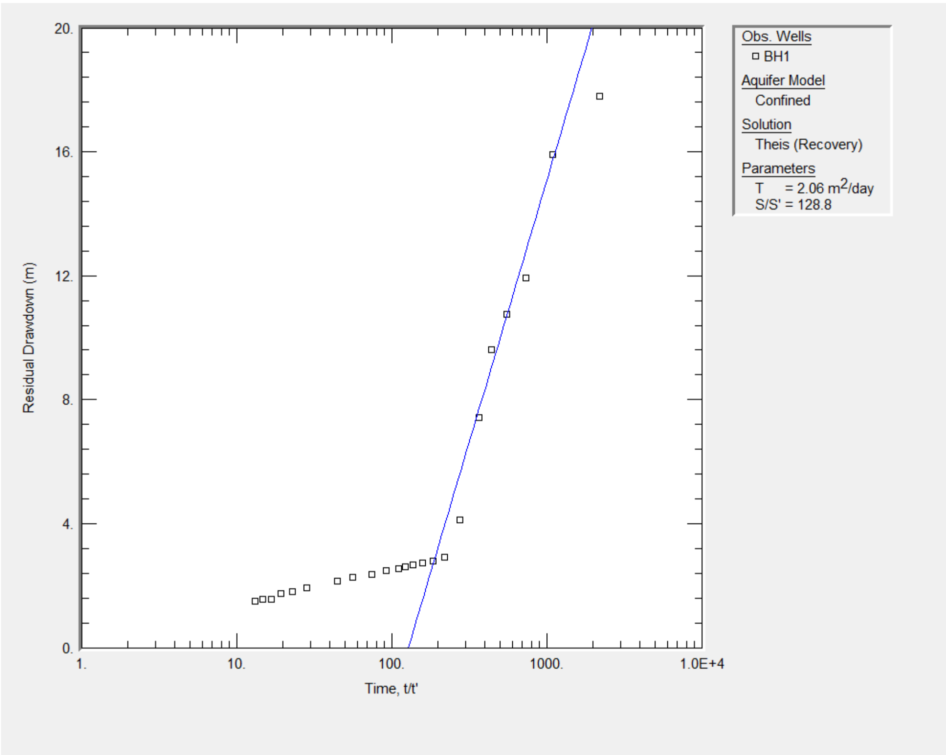
BH1 CDT1 Cooper-Jacob Early



BH1 CDT1 Cooper-Jacob Late



BH1 CDT1 Theis



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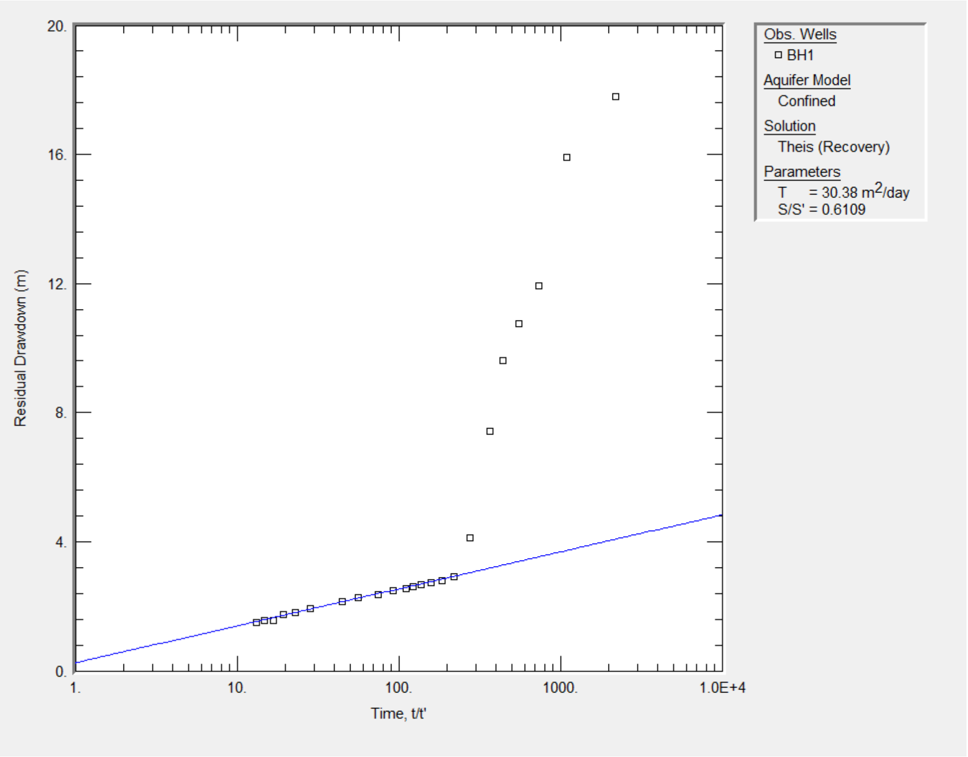

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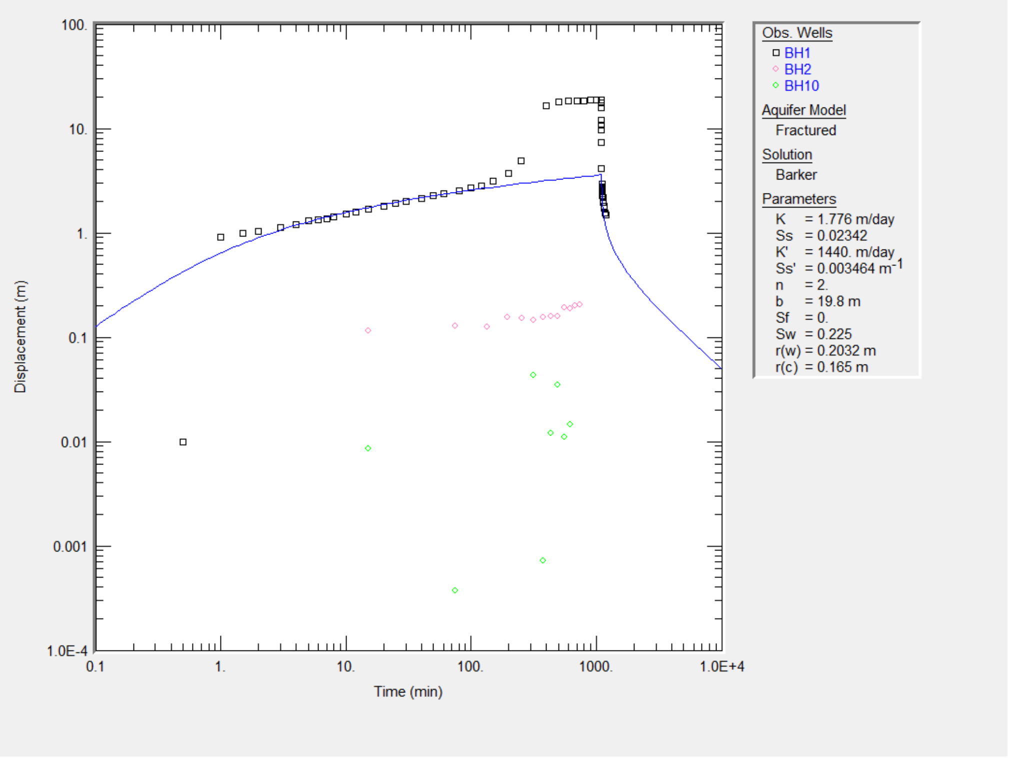

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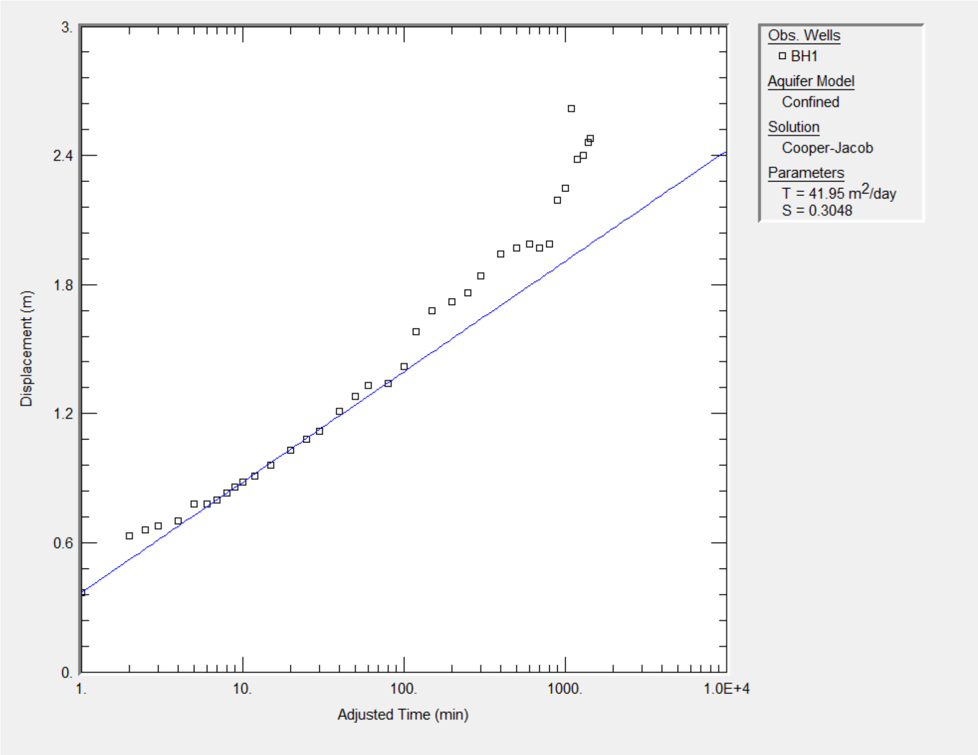

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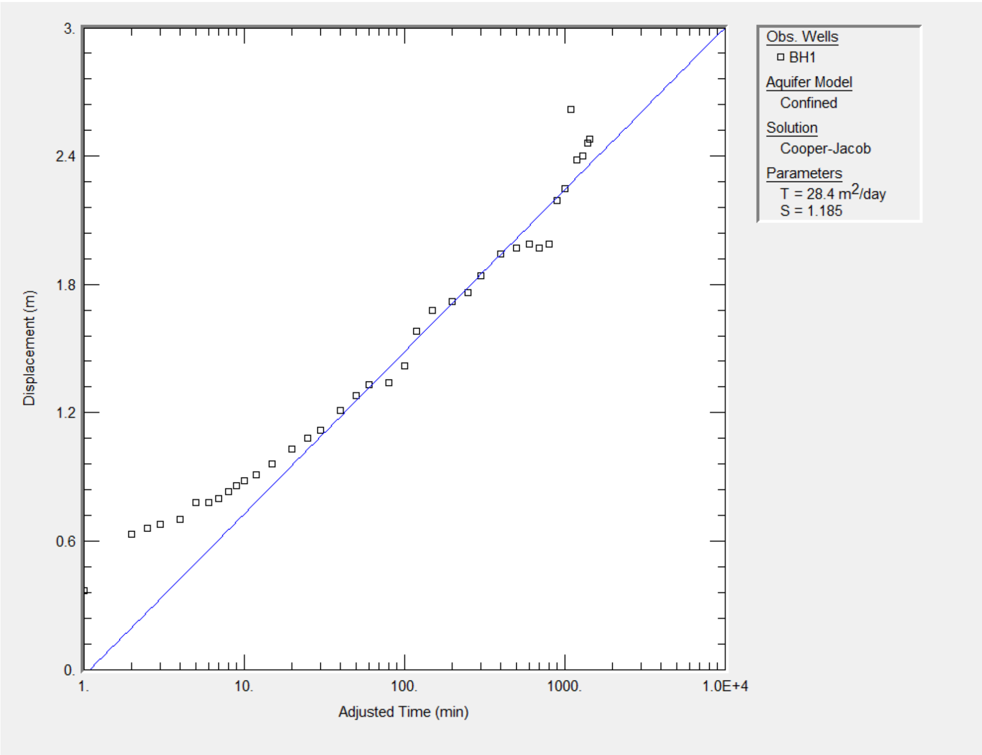

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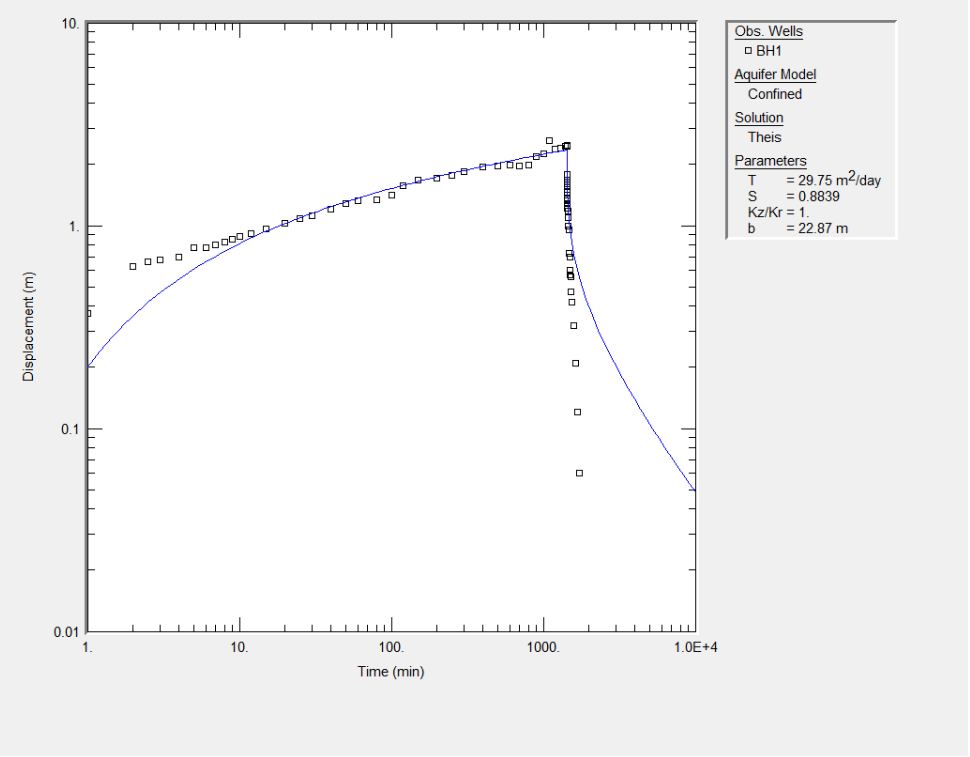

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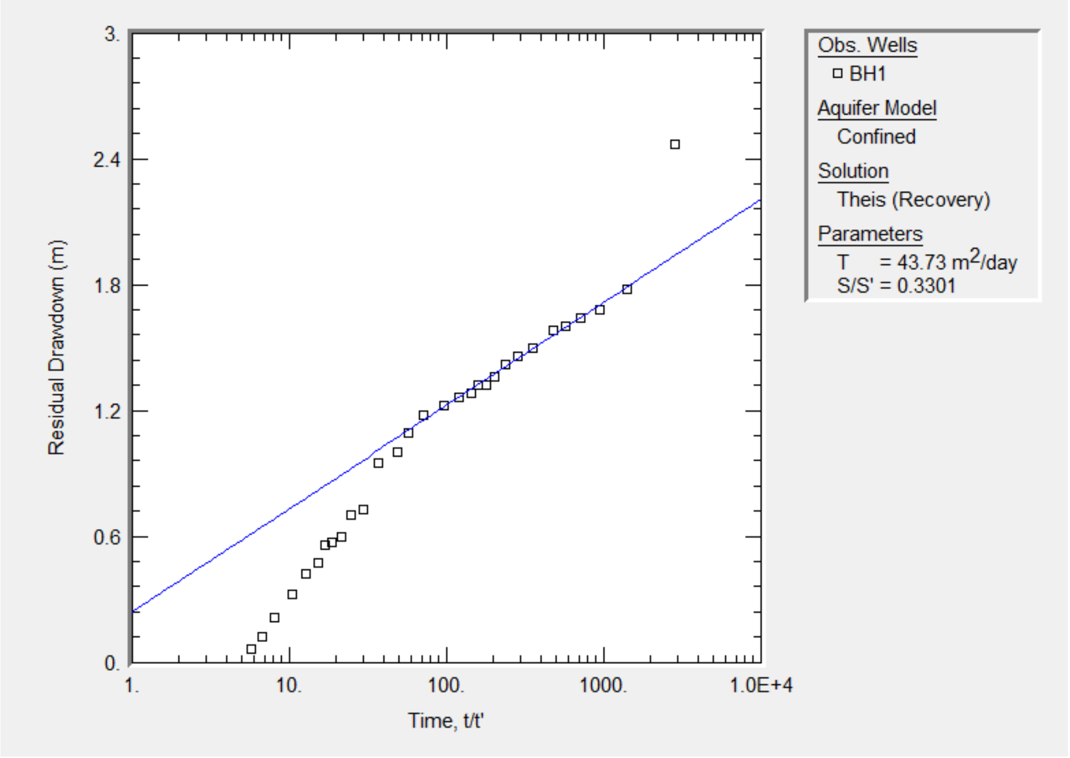

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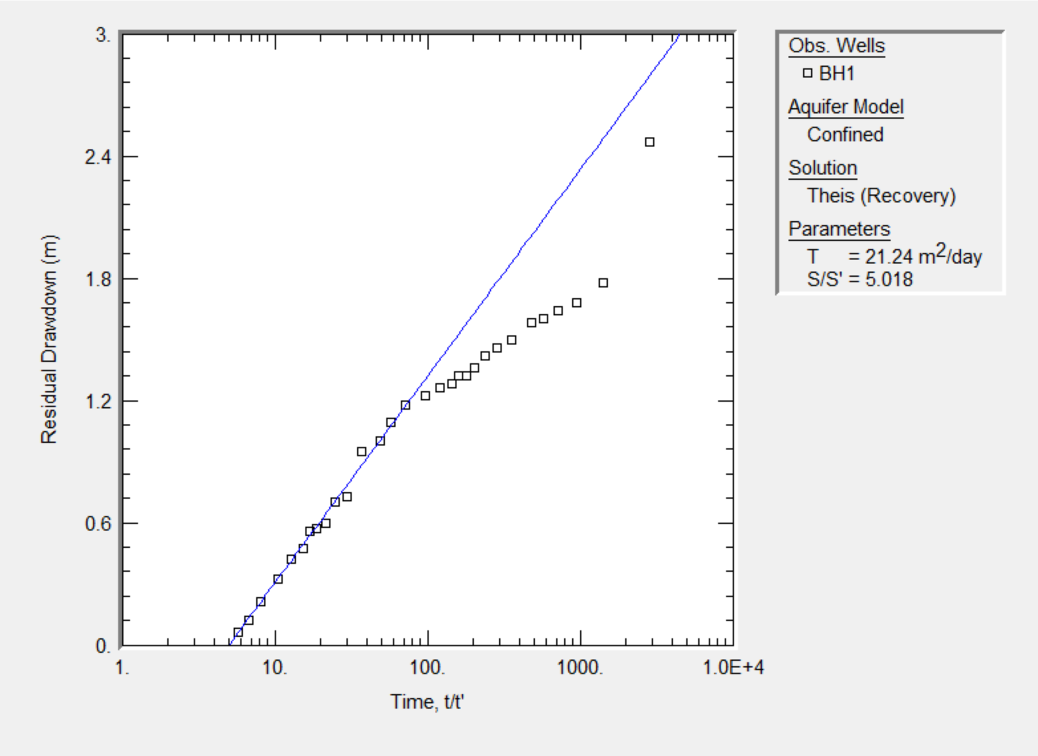

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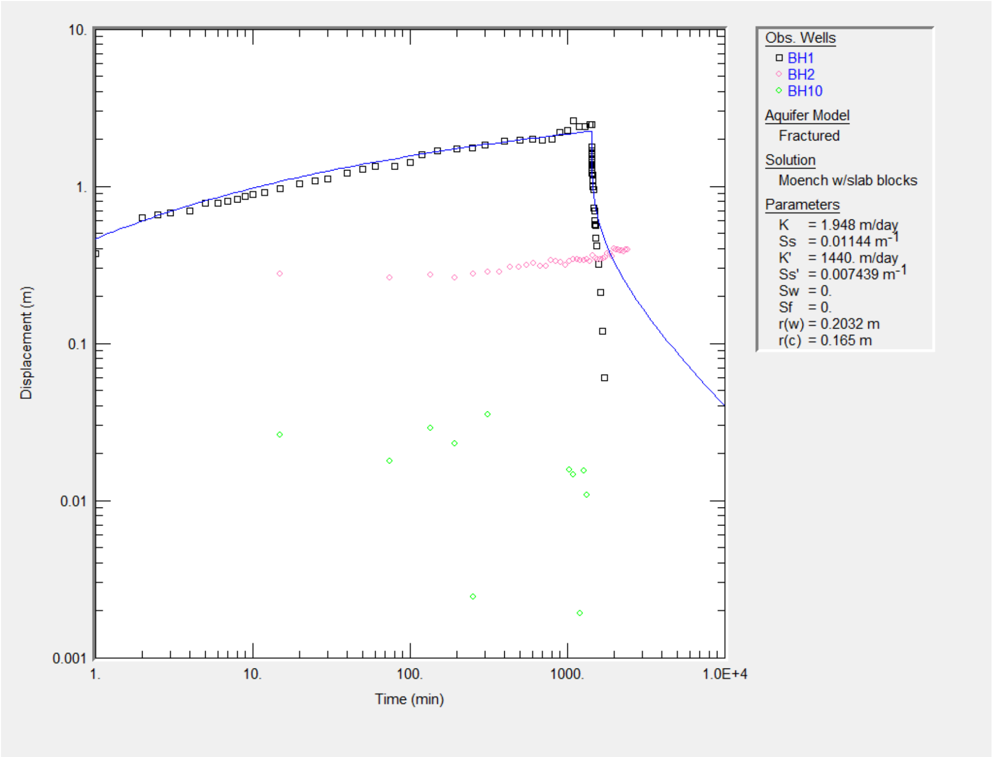

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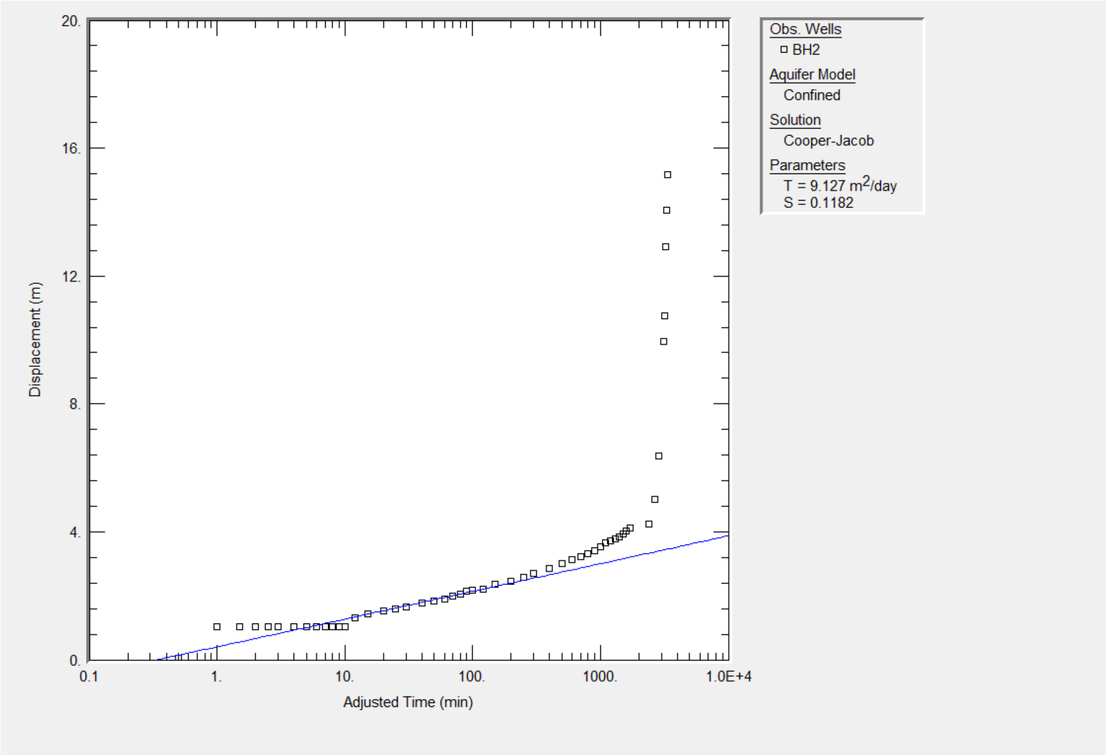

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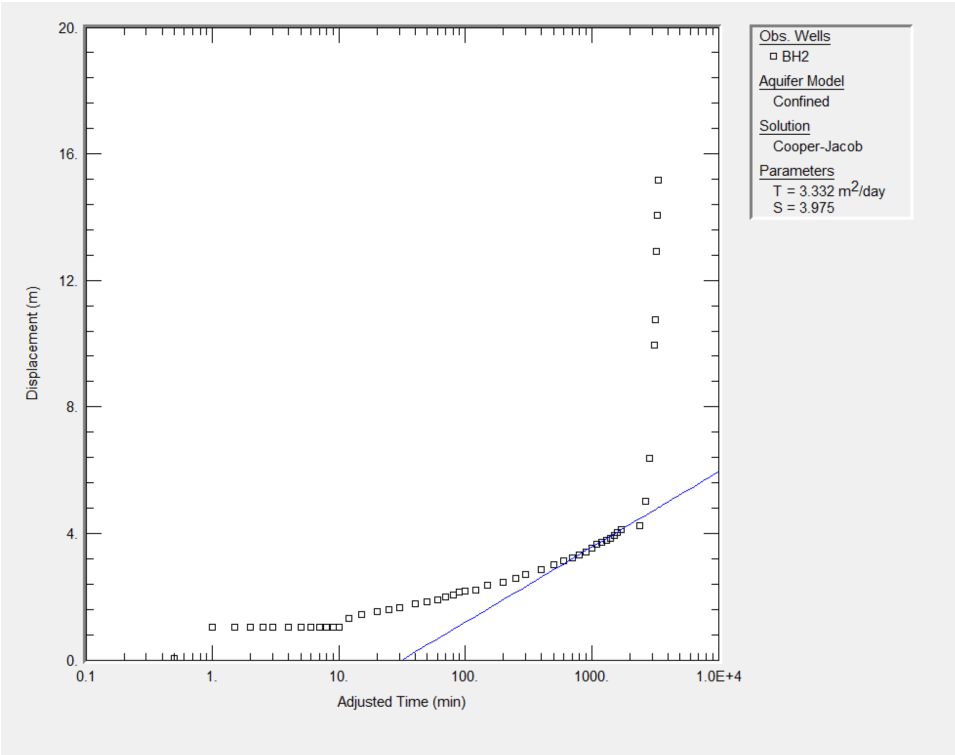

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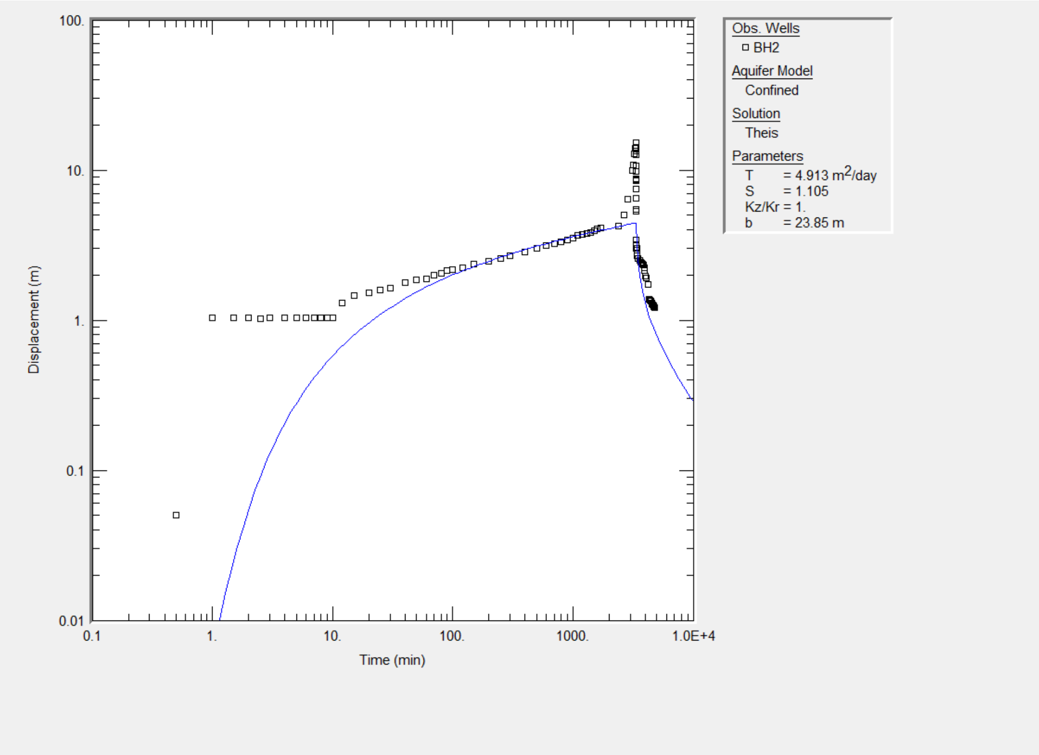

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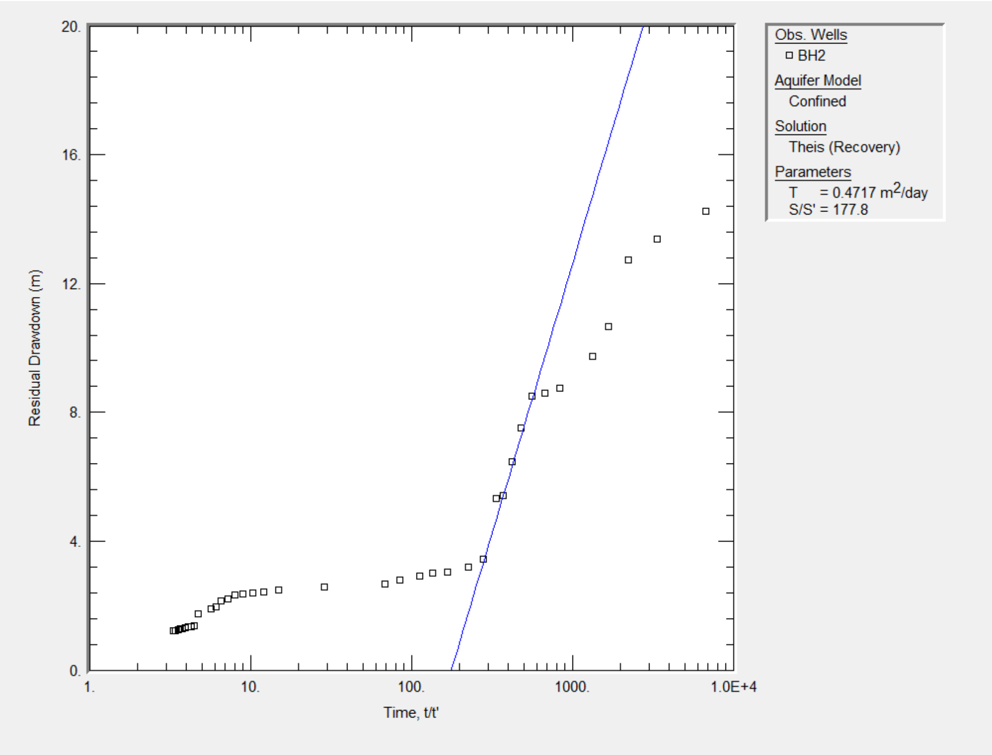

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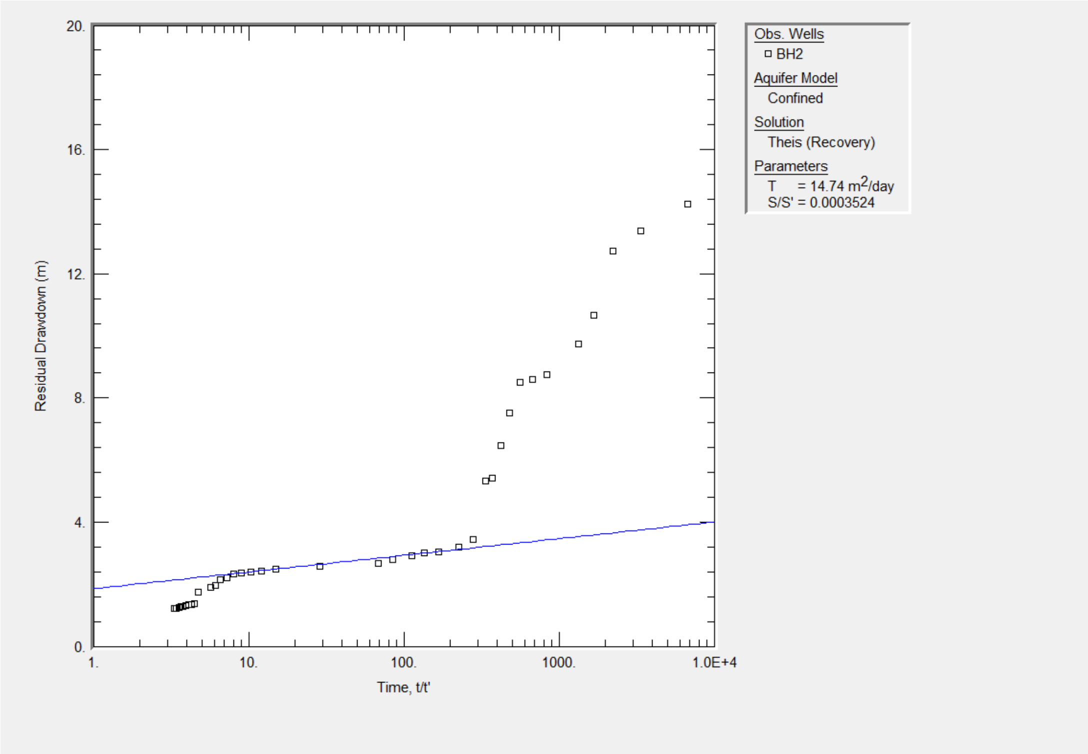

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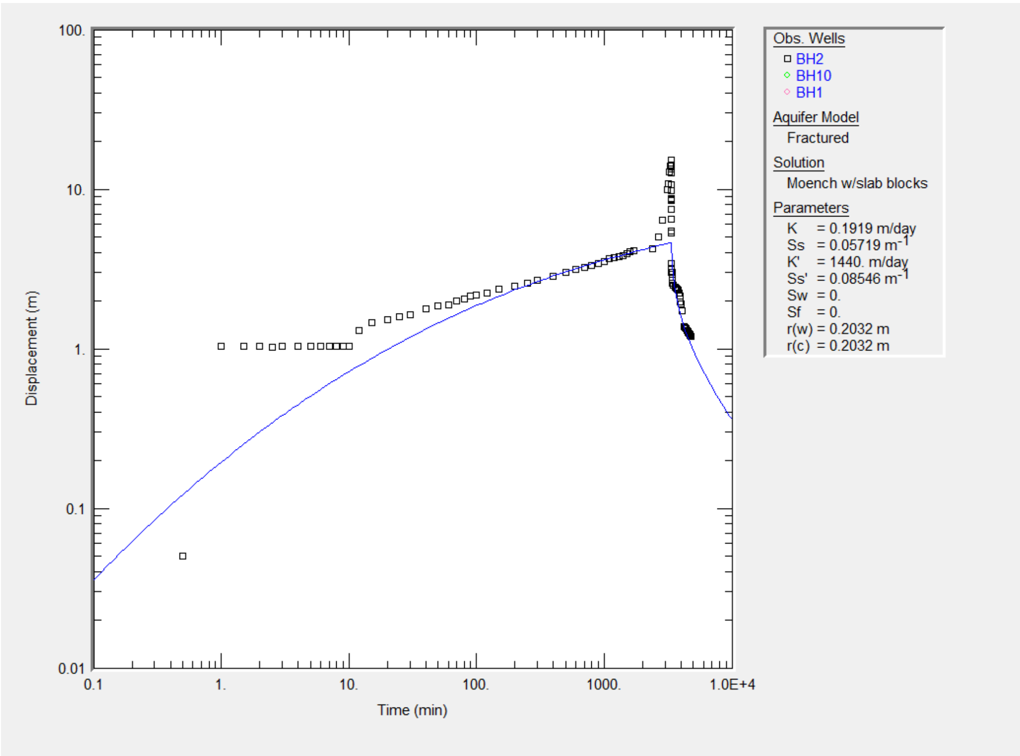

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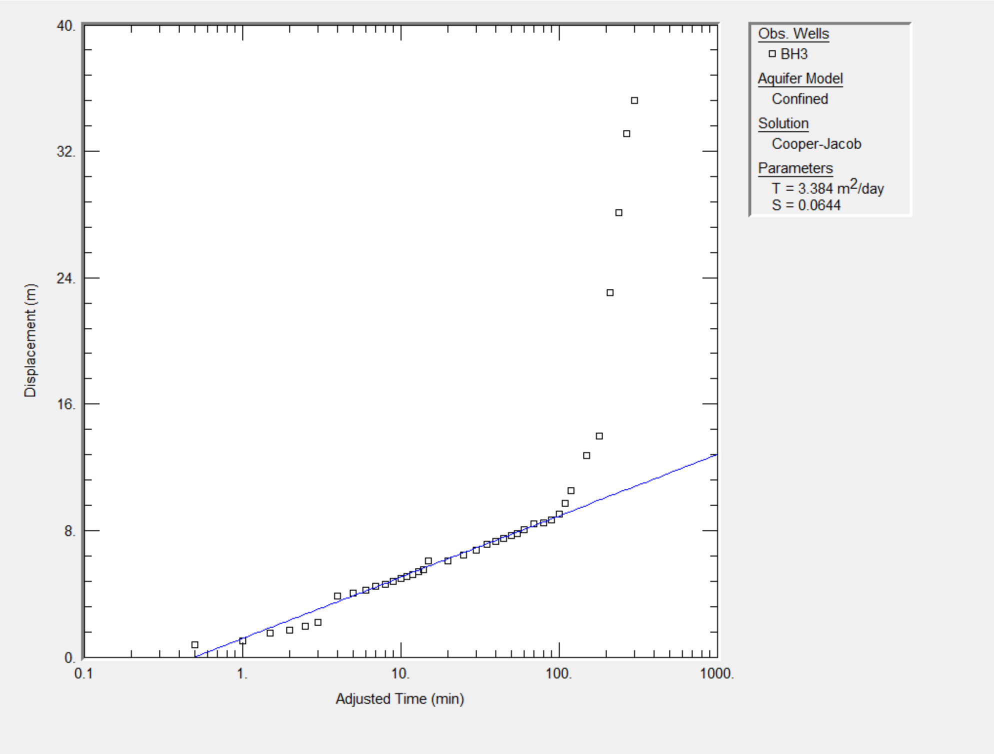

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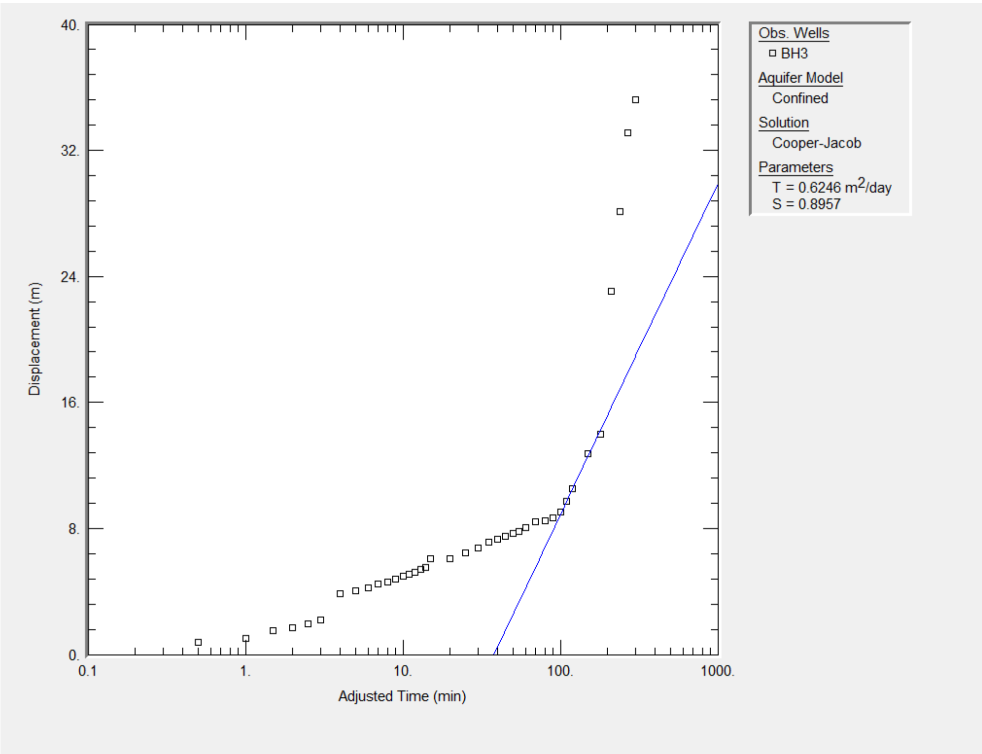

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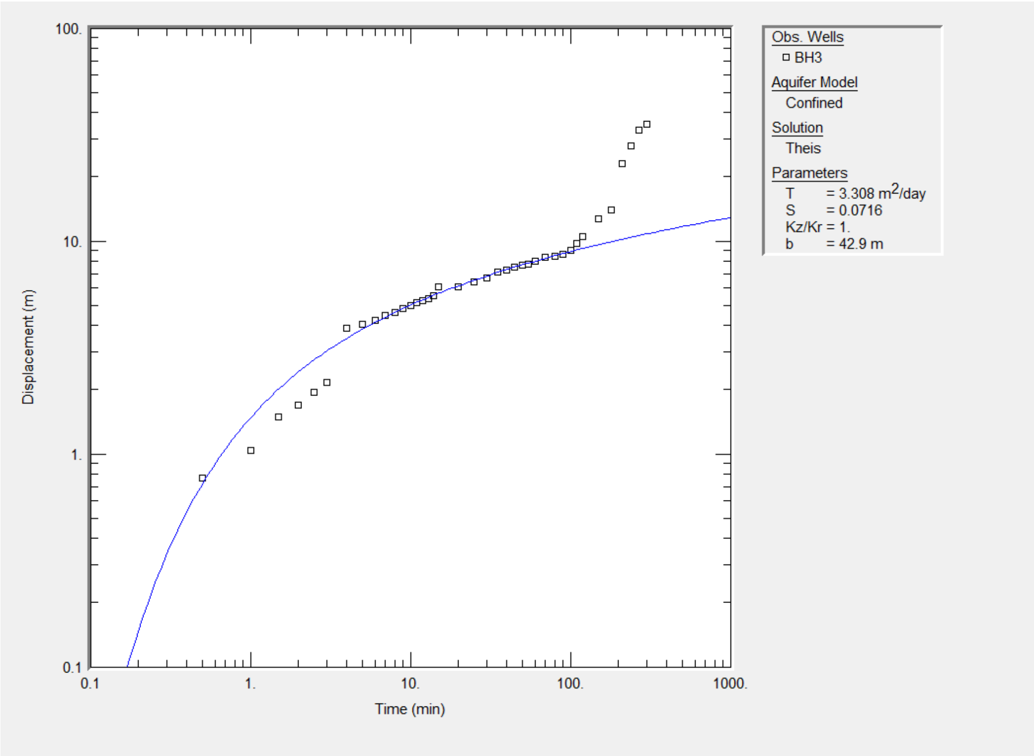

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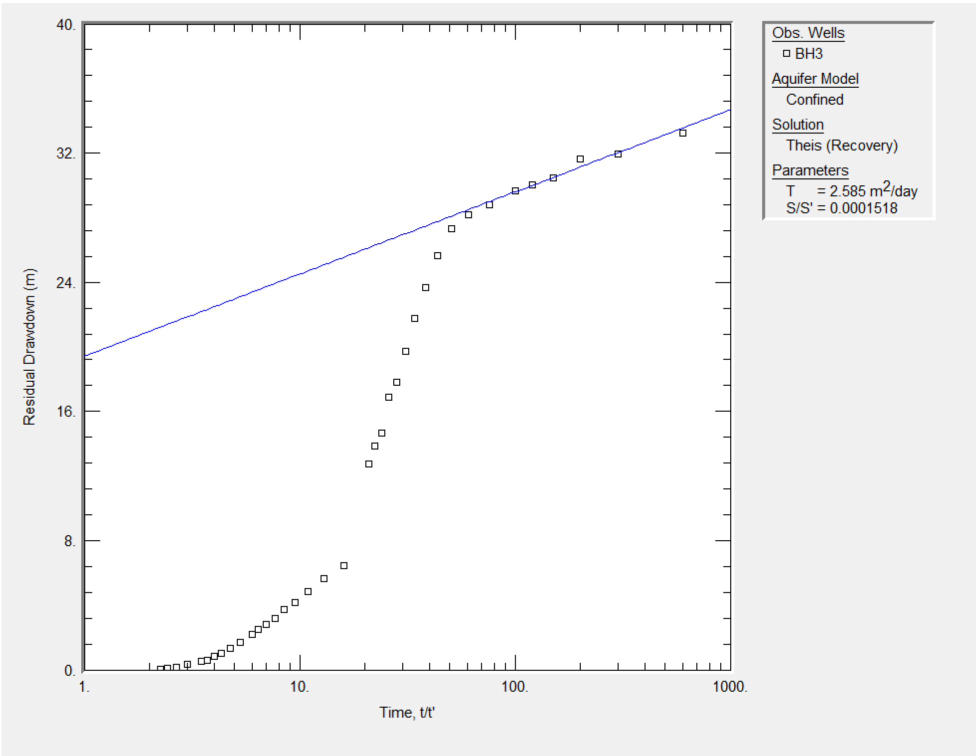

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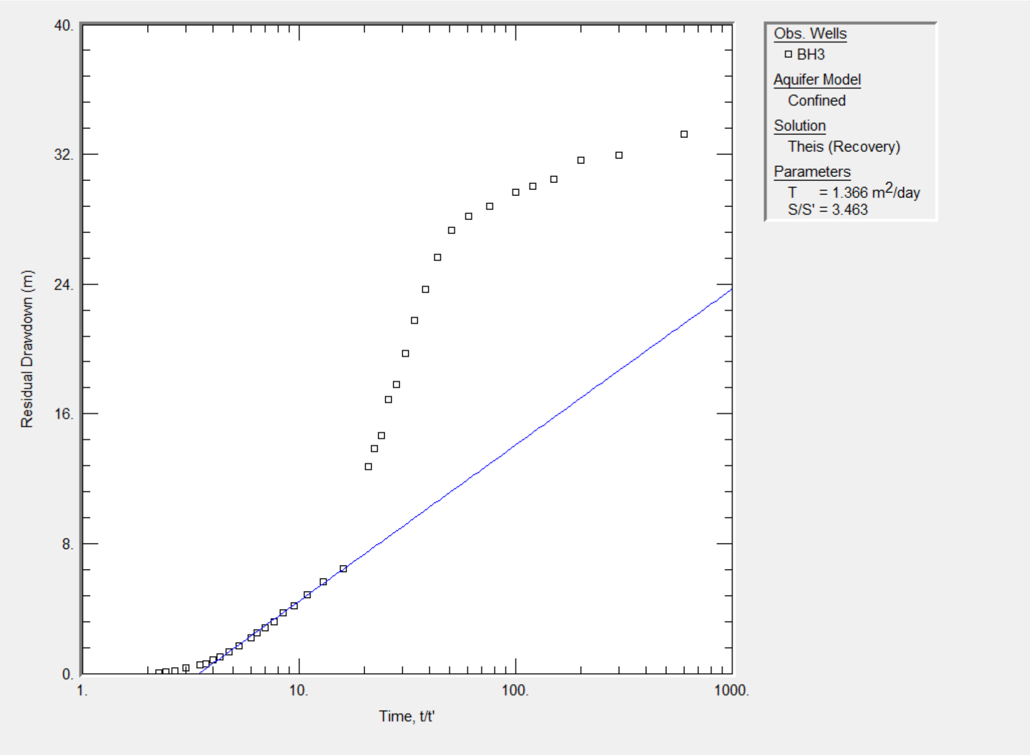

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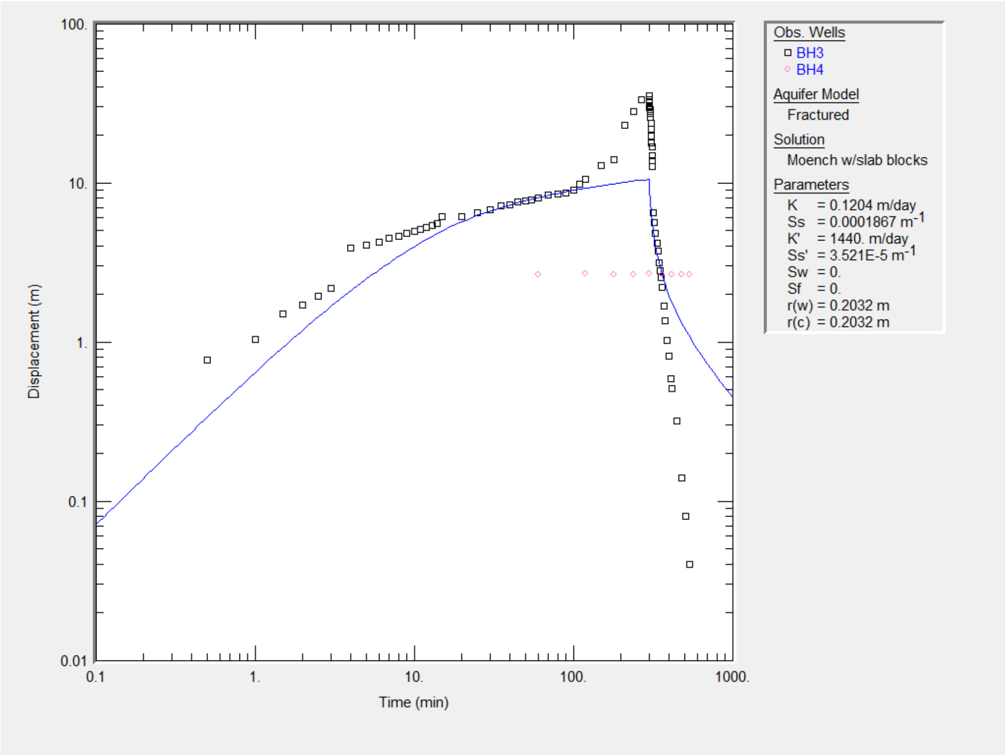

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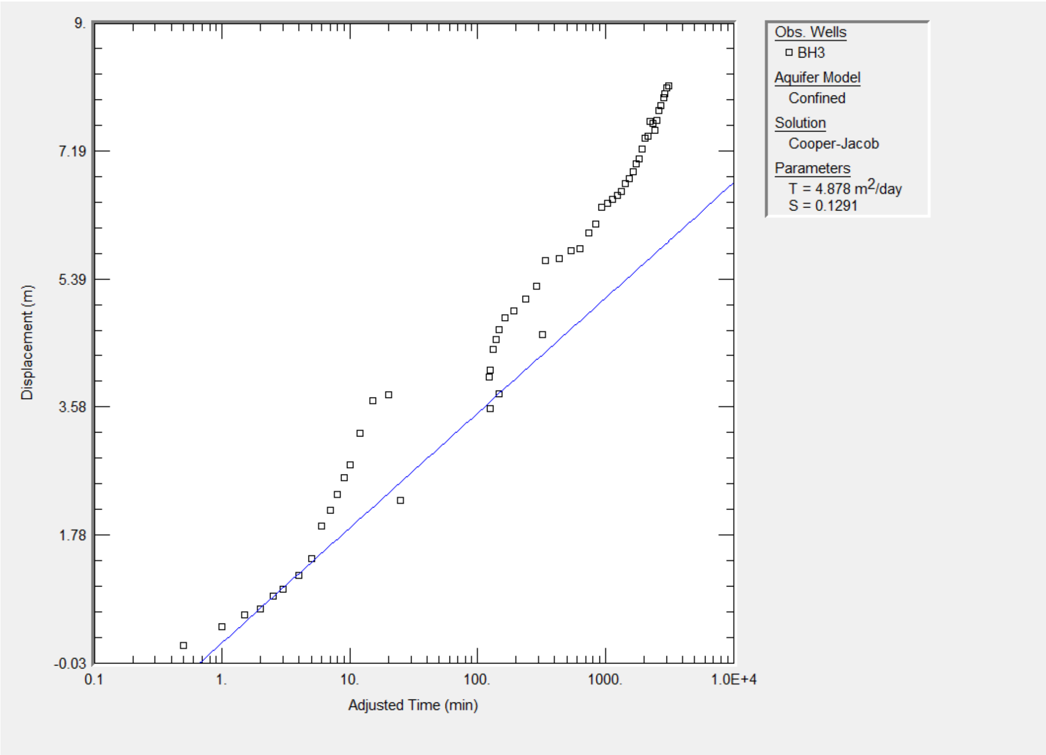

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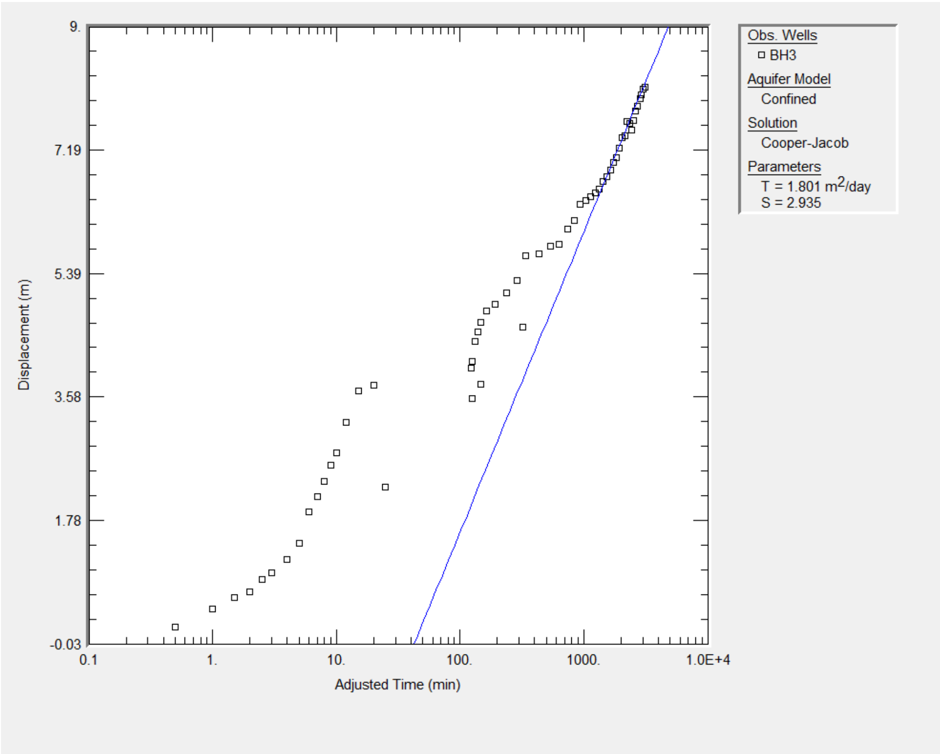

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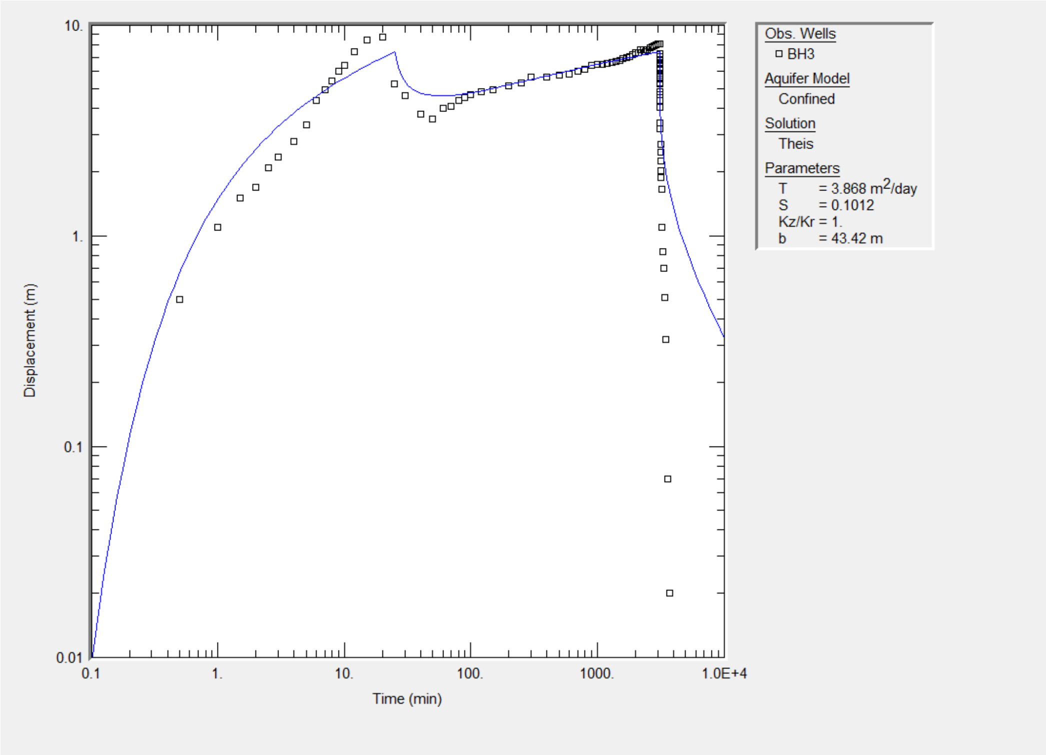

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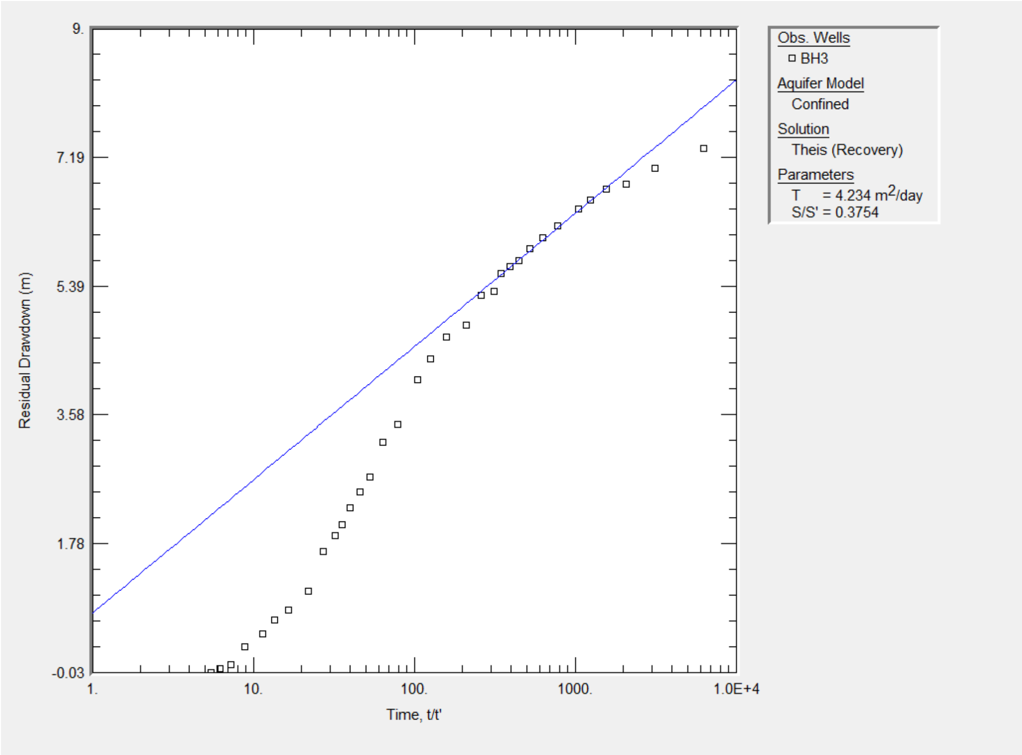

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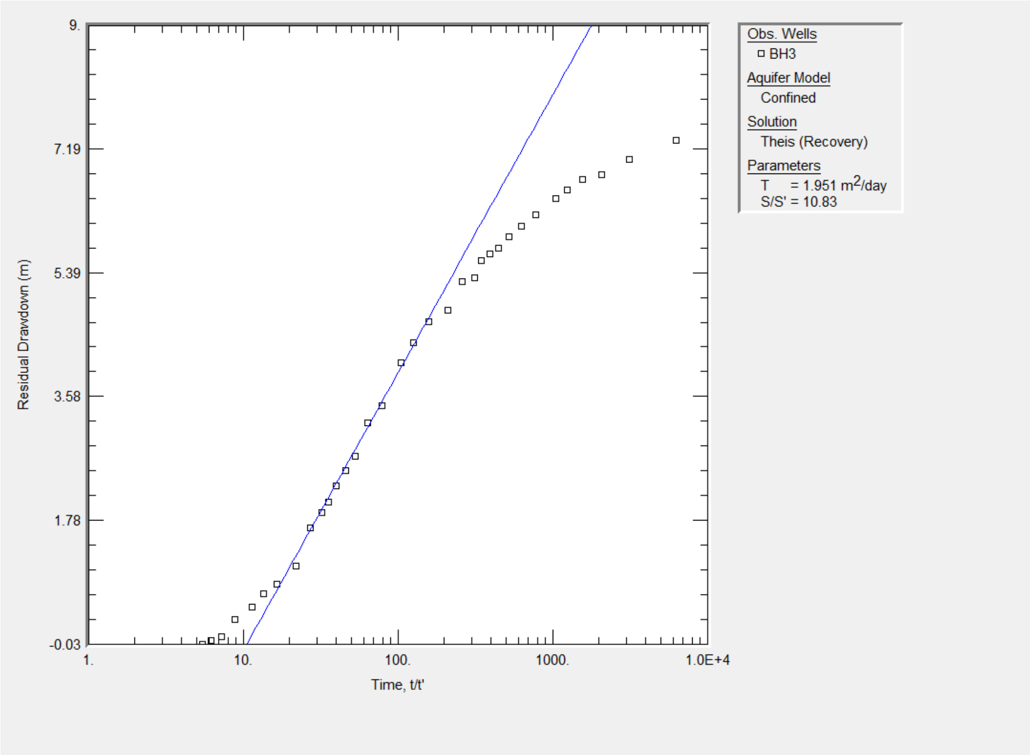

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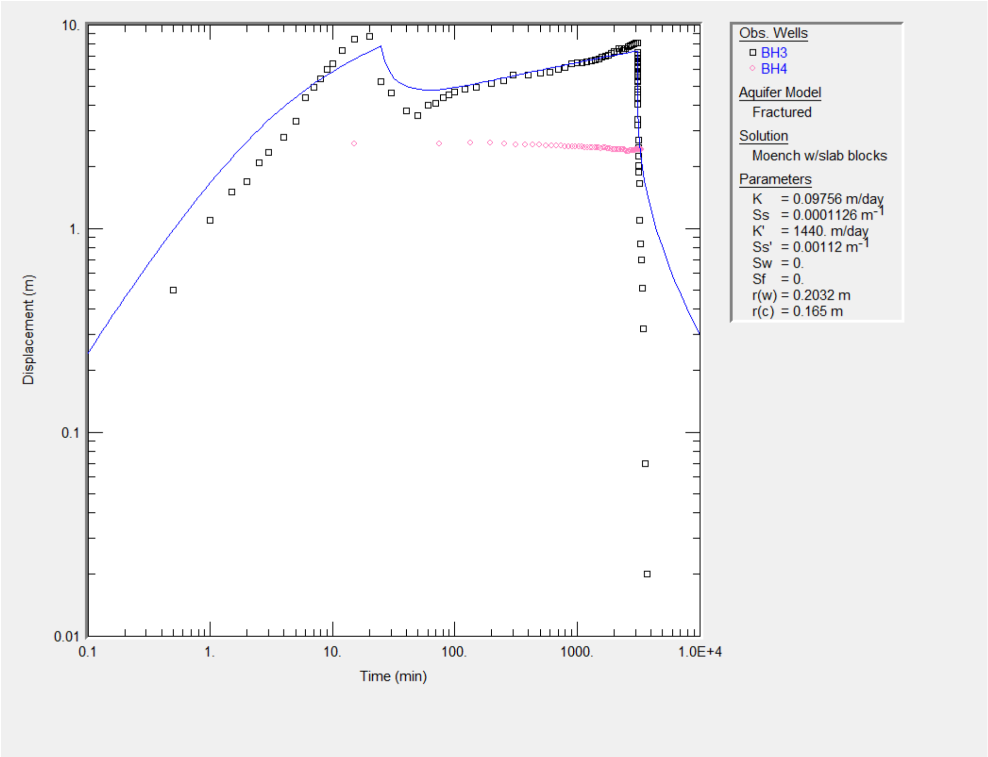

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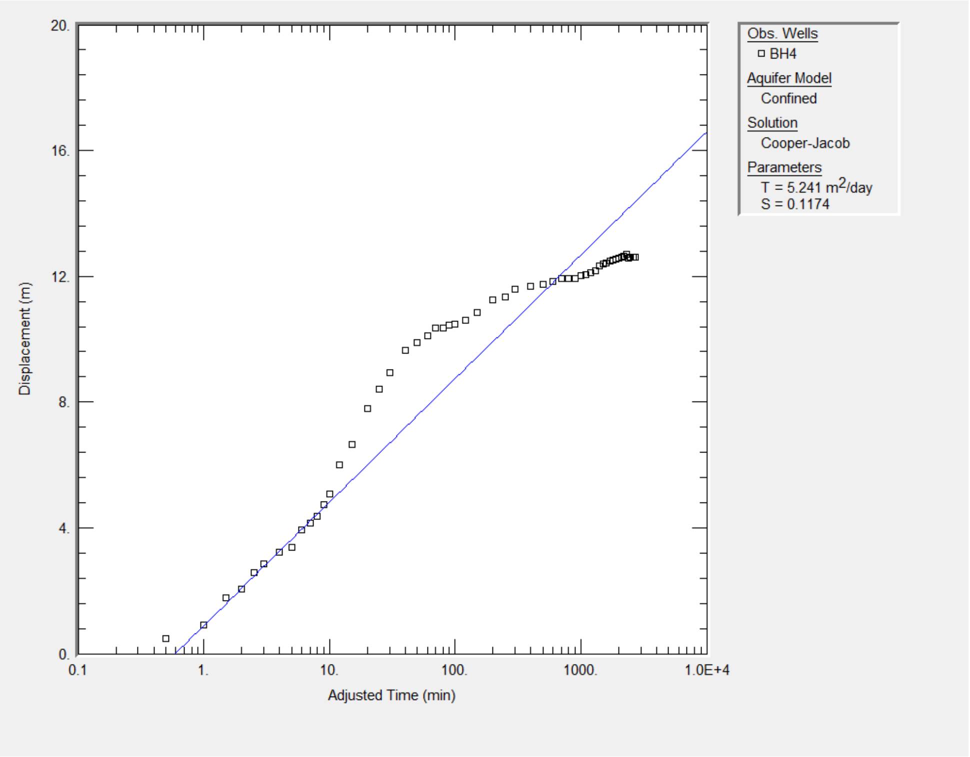

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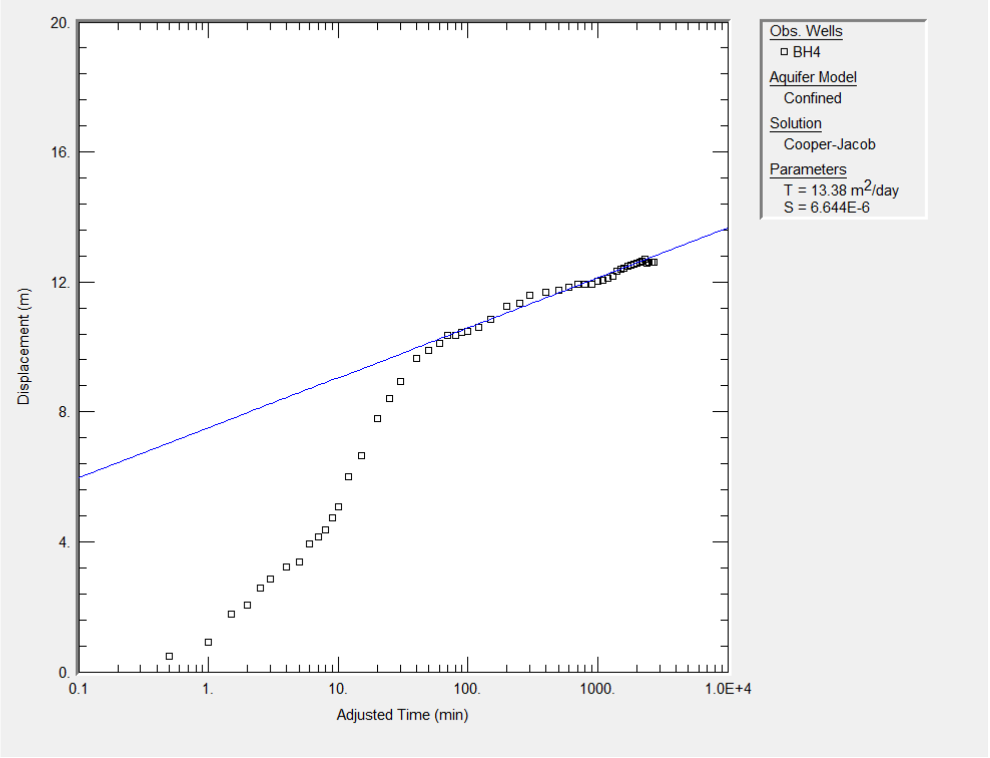

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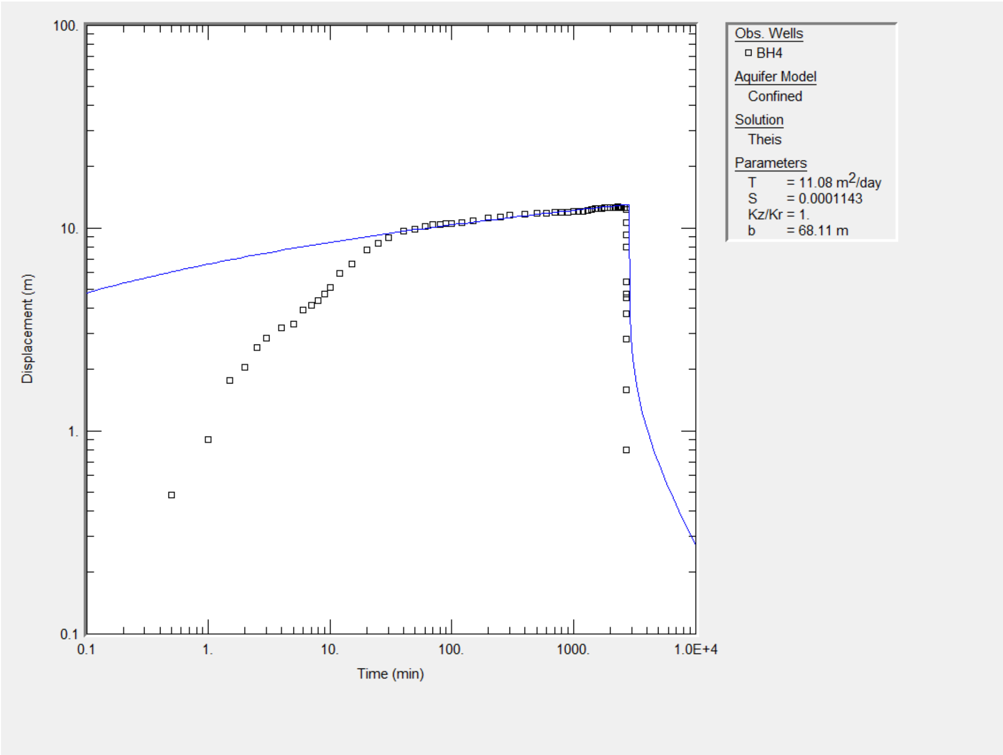

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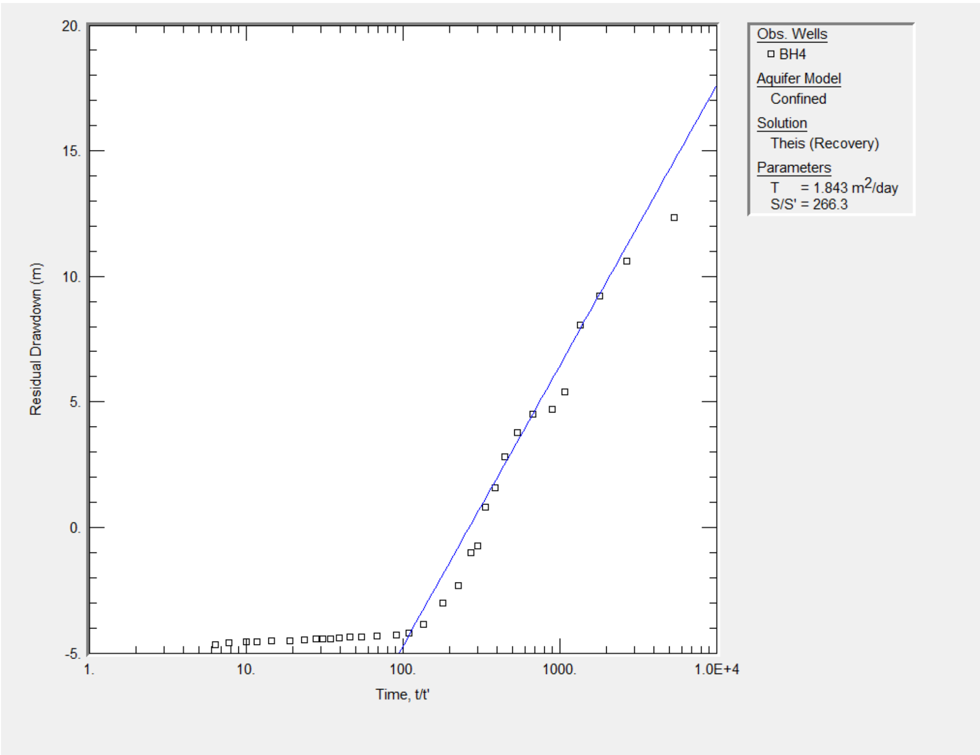

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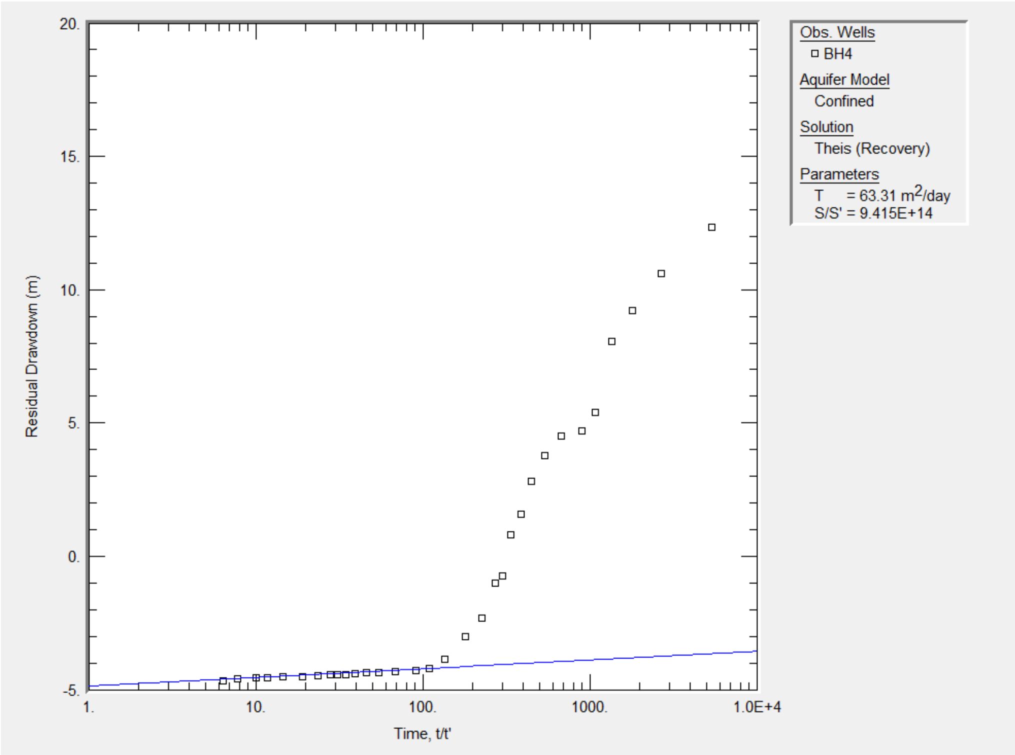

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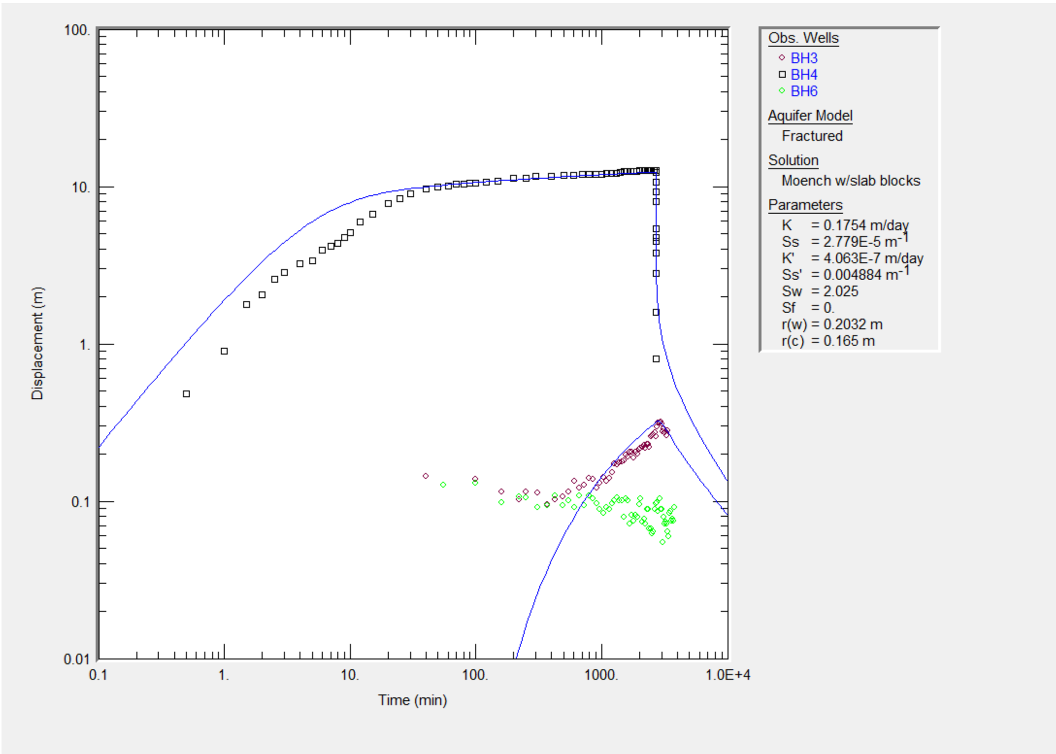

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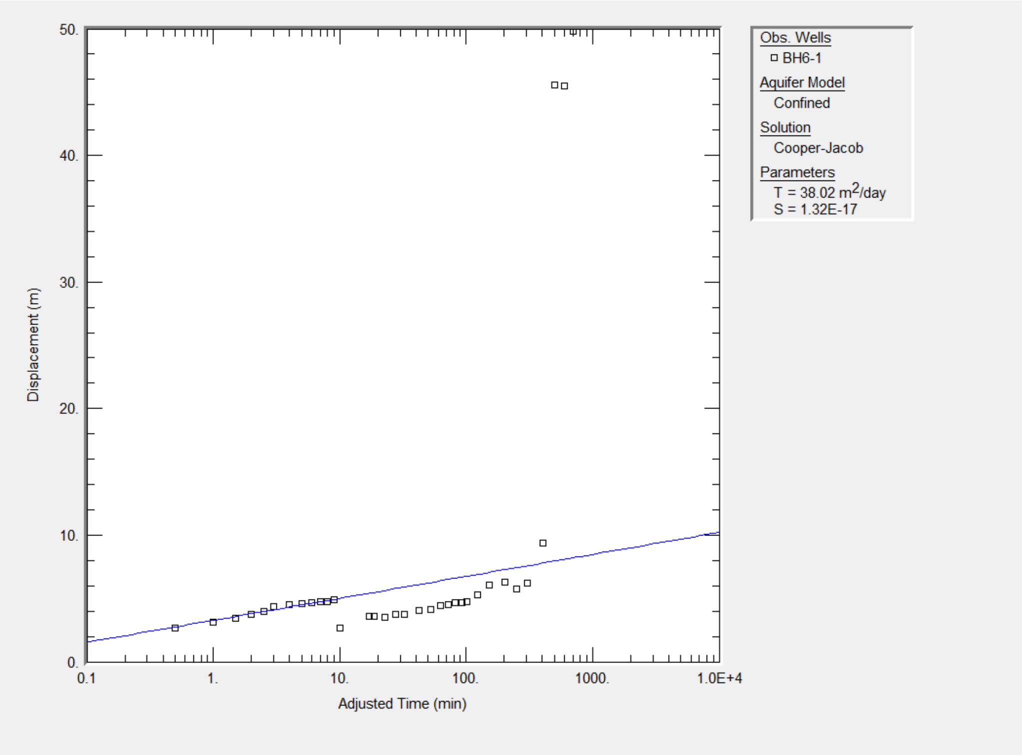
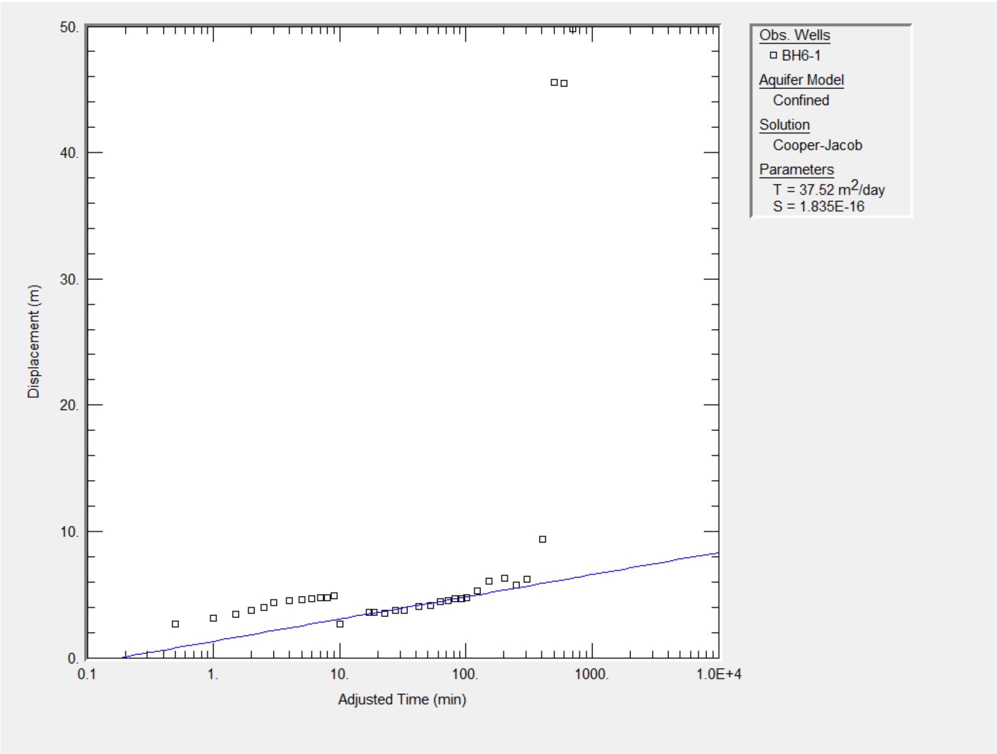


BH6 CDT1 Cooper-Jacob Early



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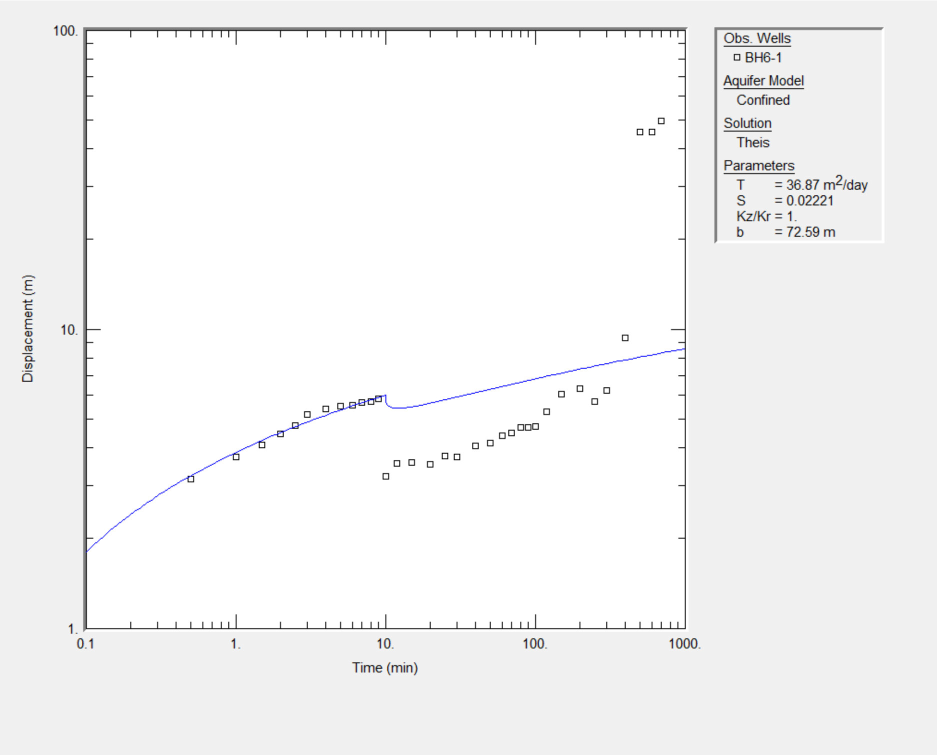

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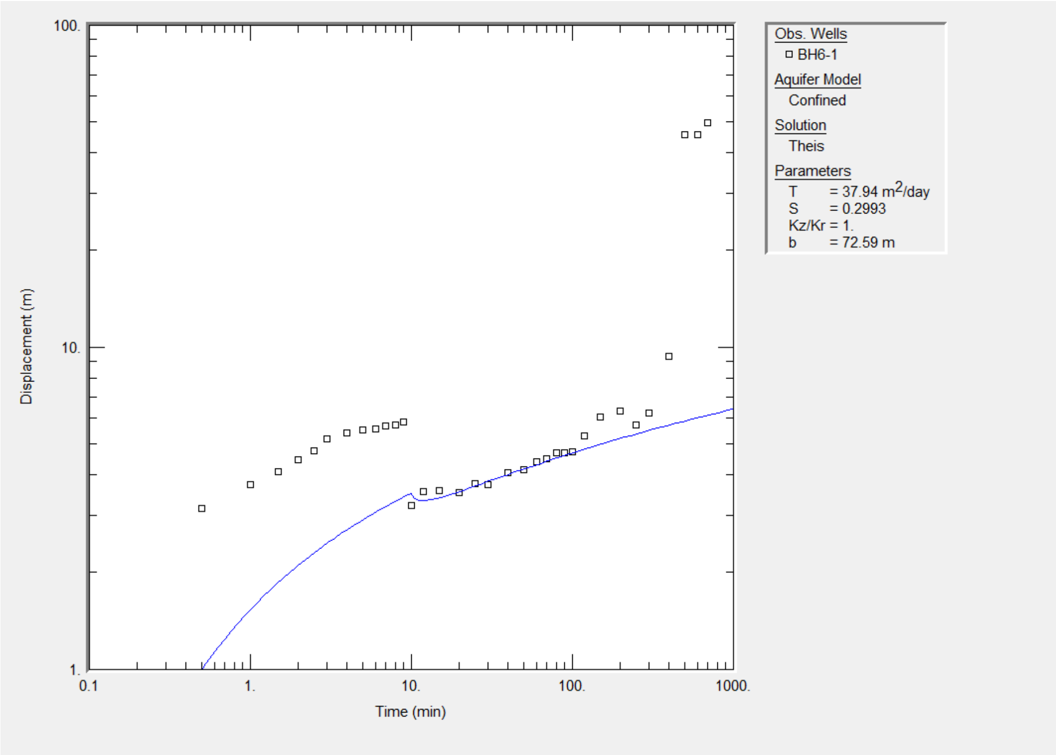

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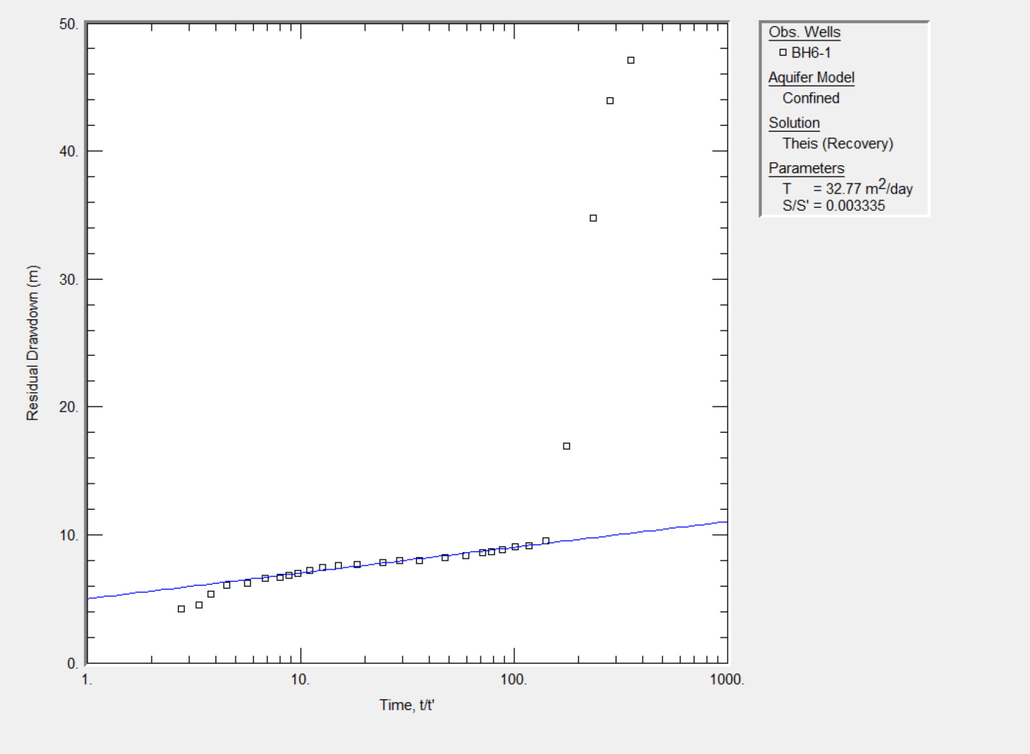

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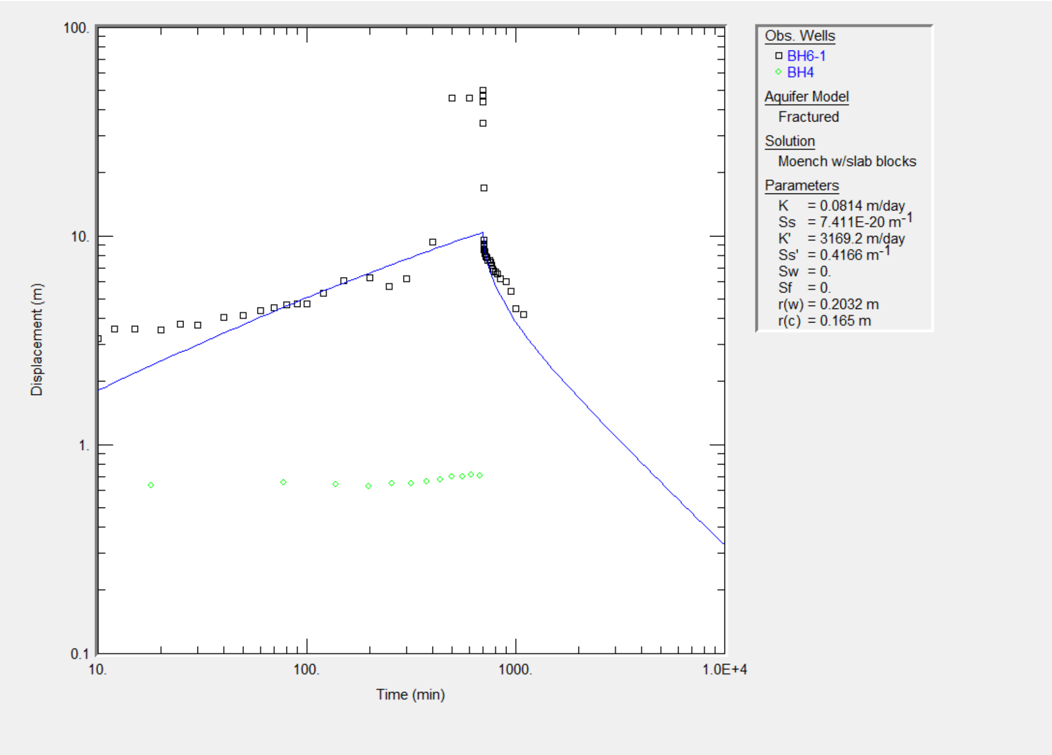

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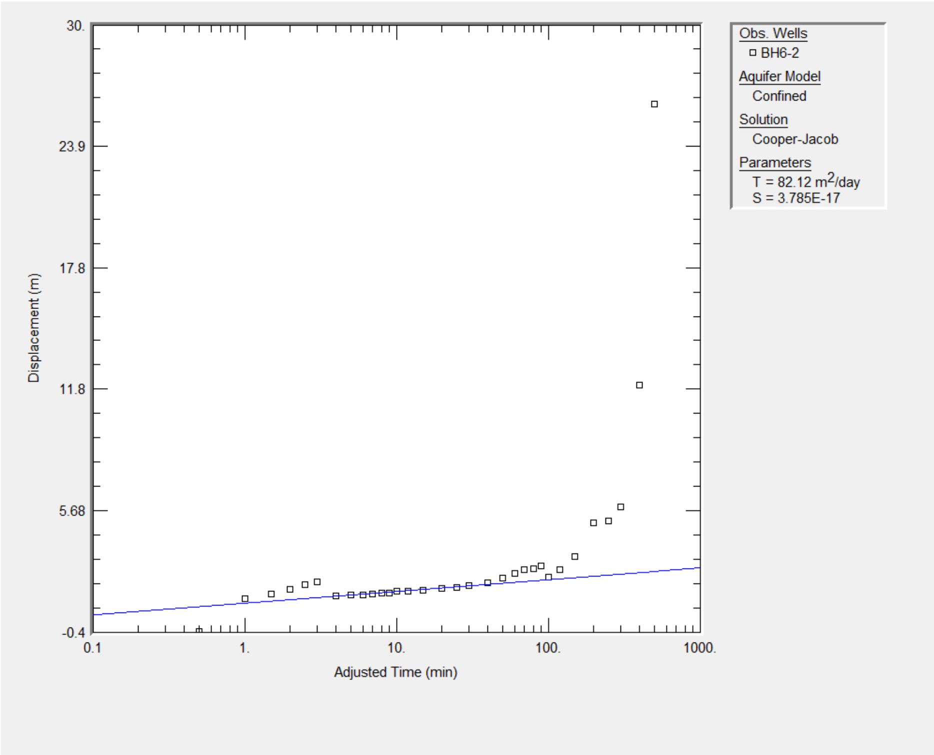
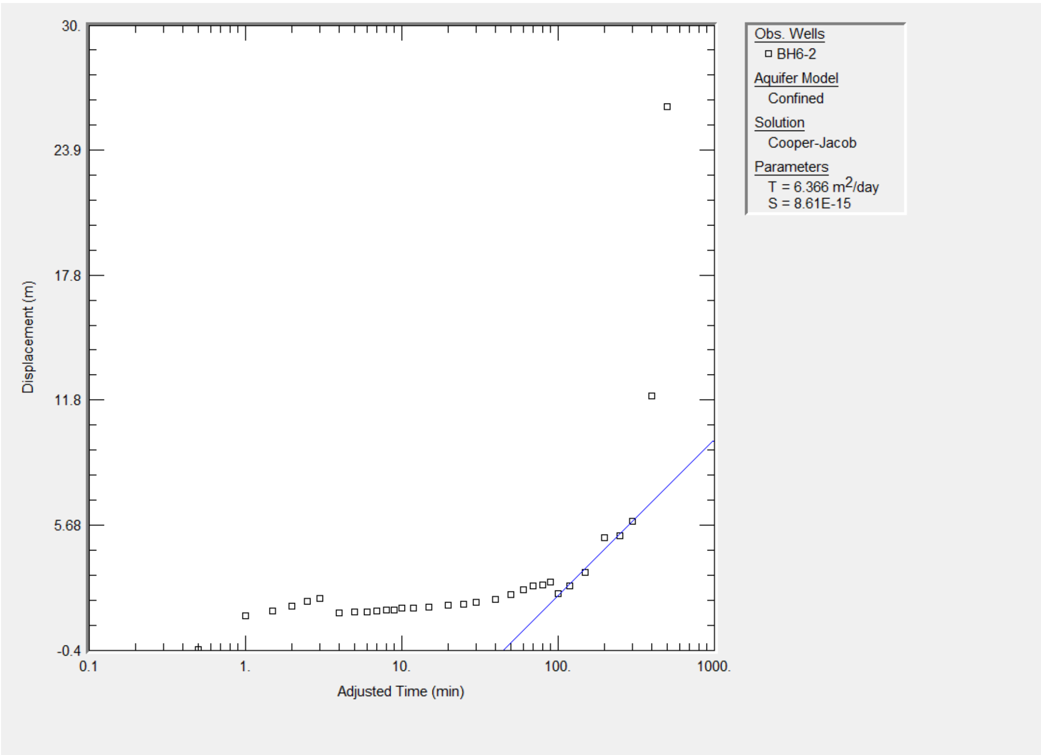


BH6 CDT2 Cooper-Jacob Early



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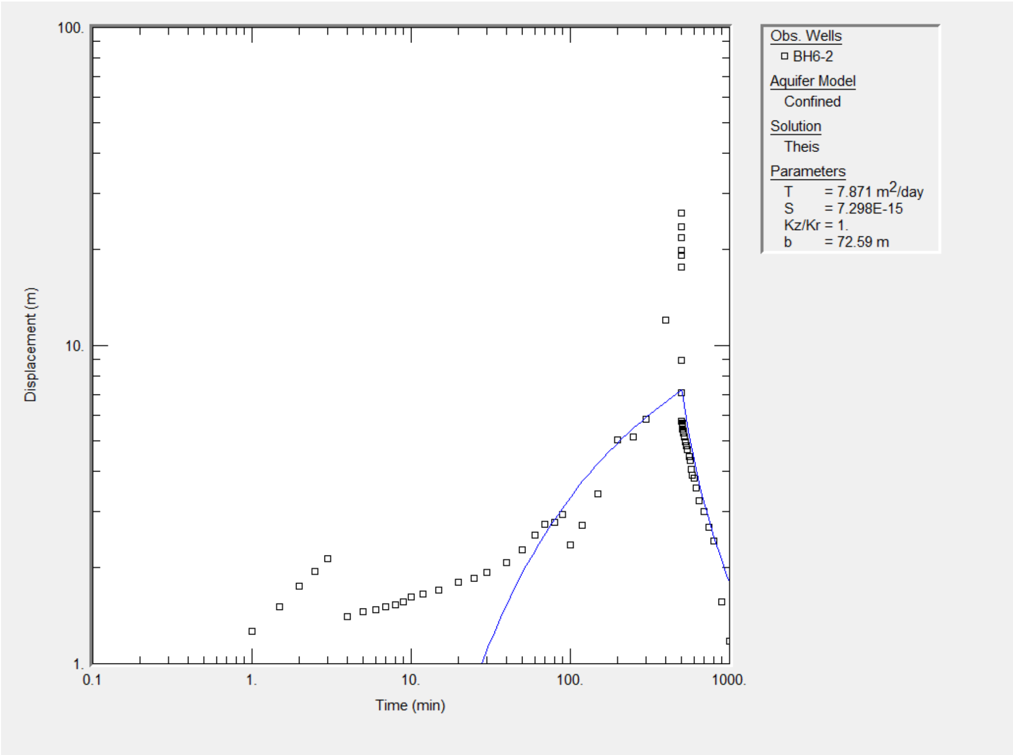

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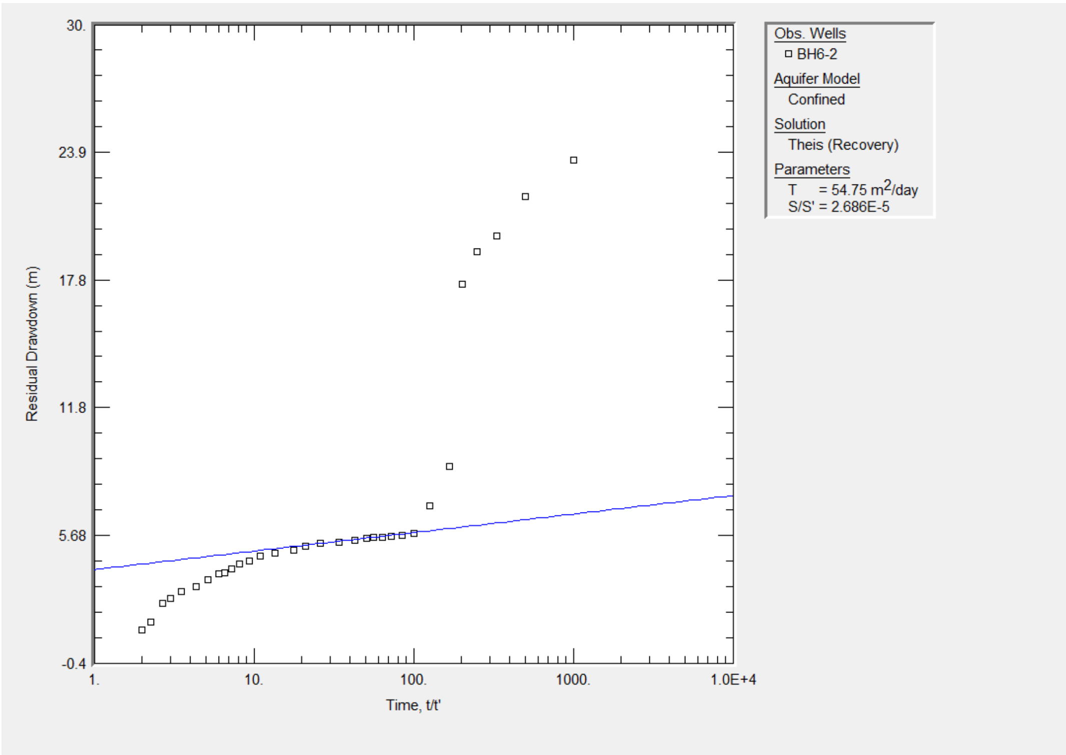

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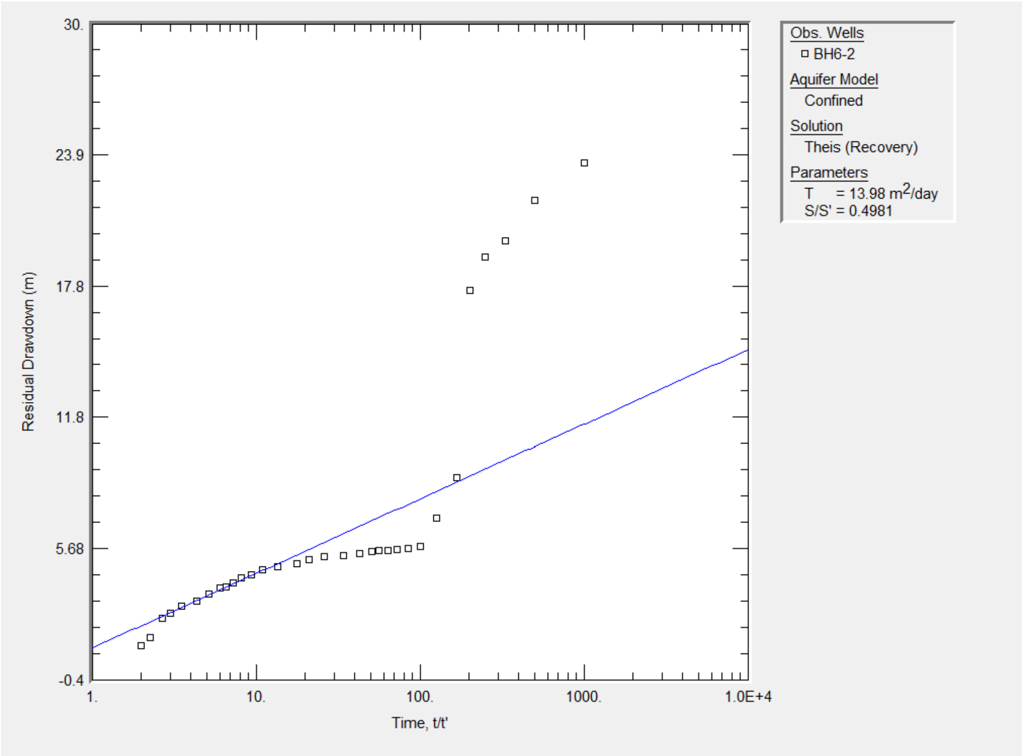

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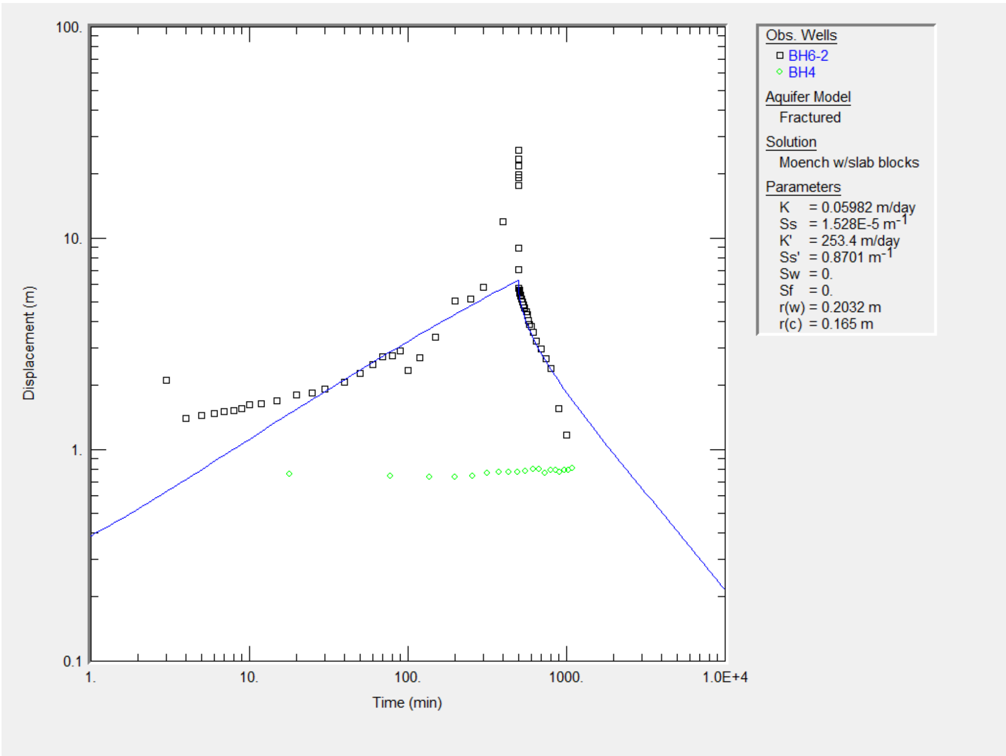

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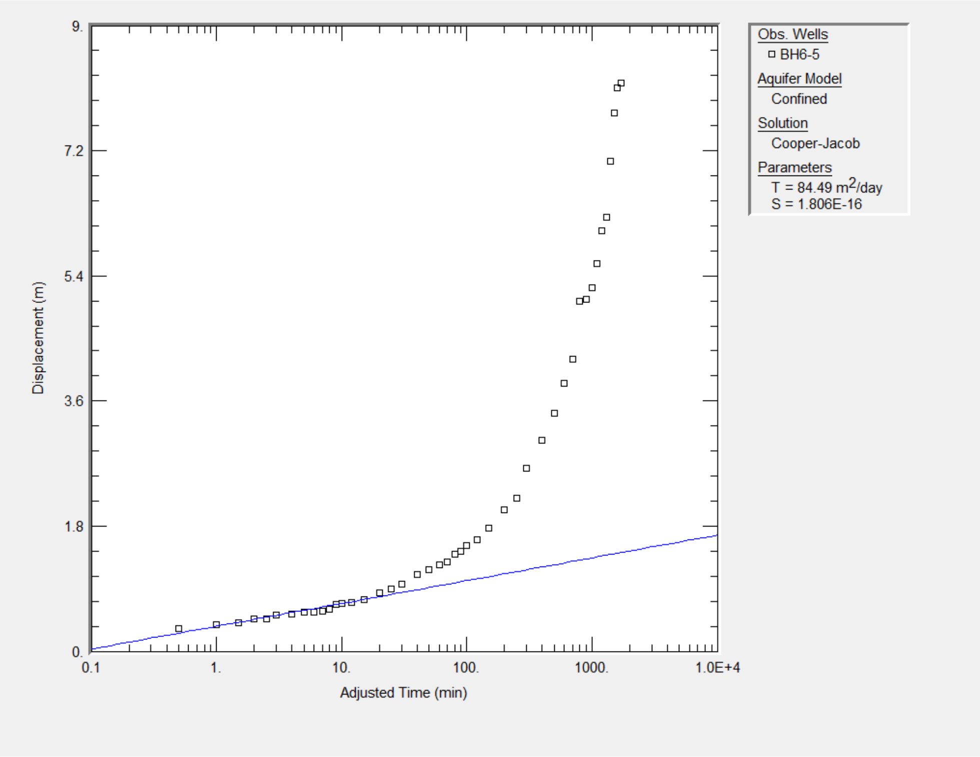

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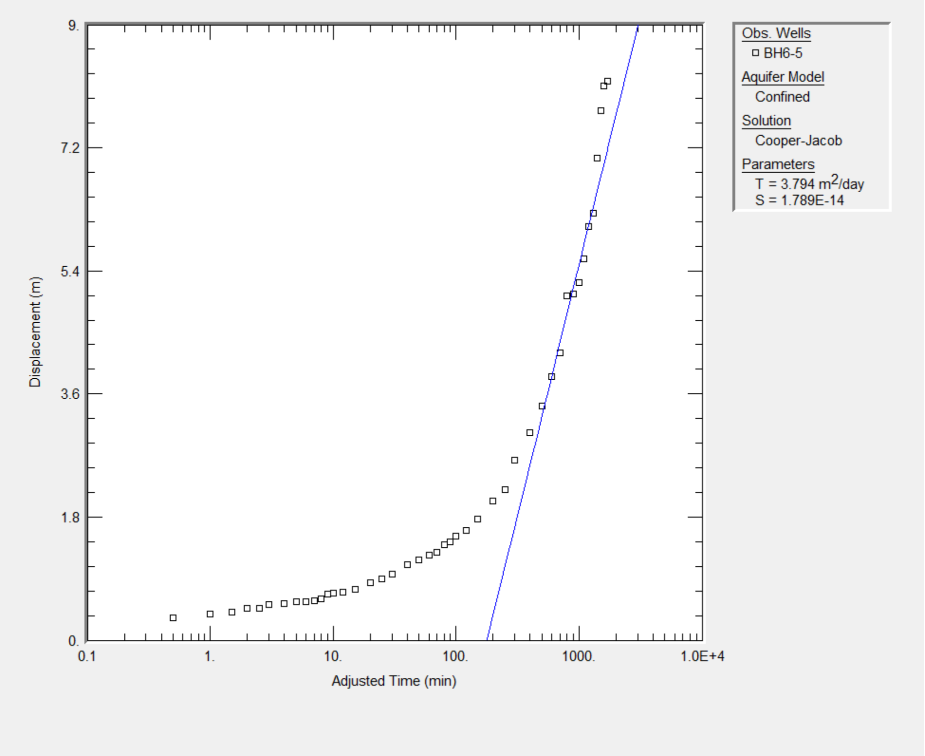

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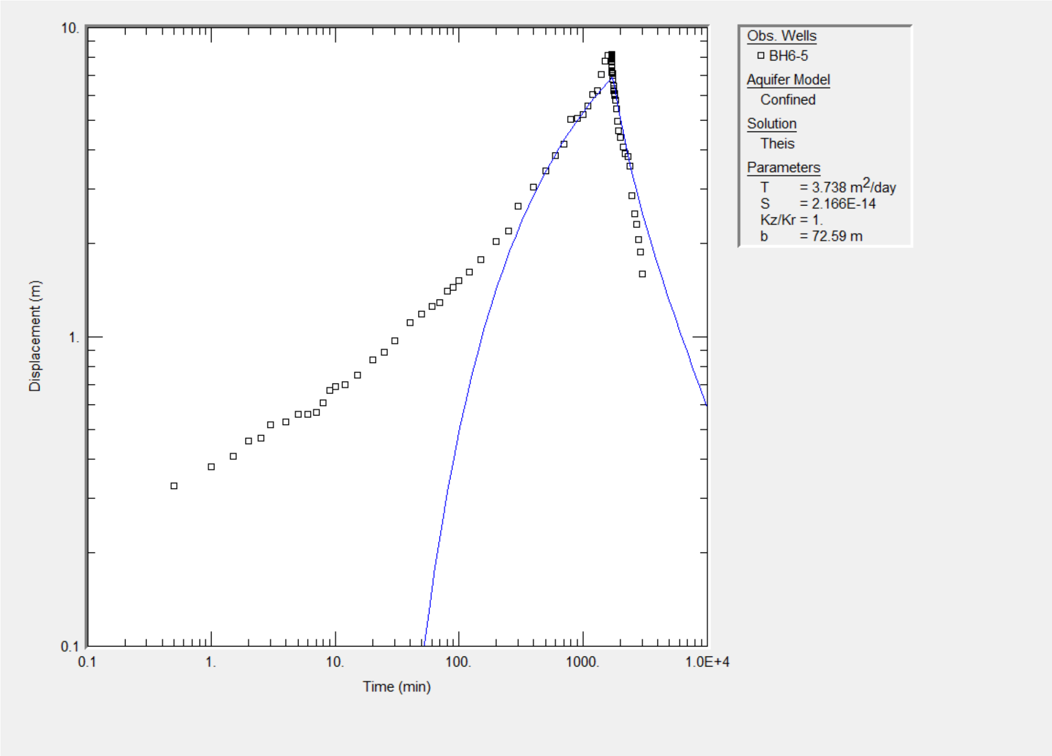

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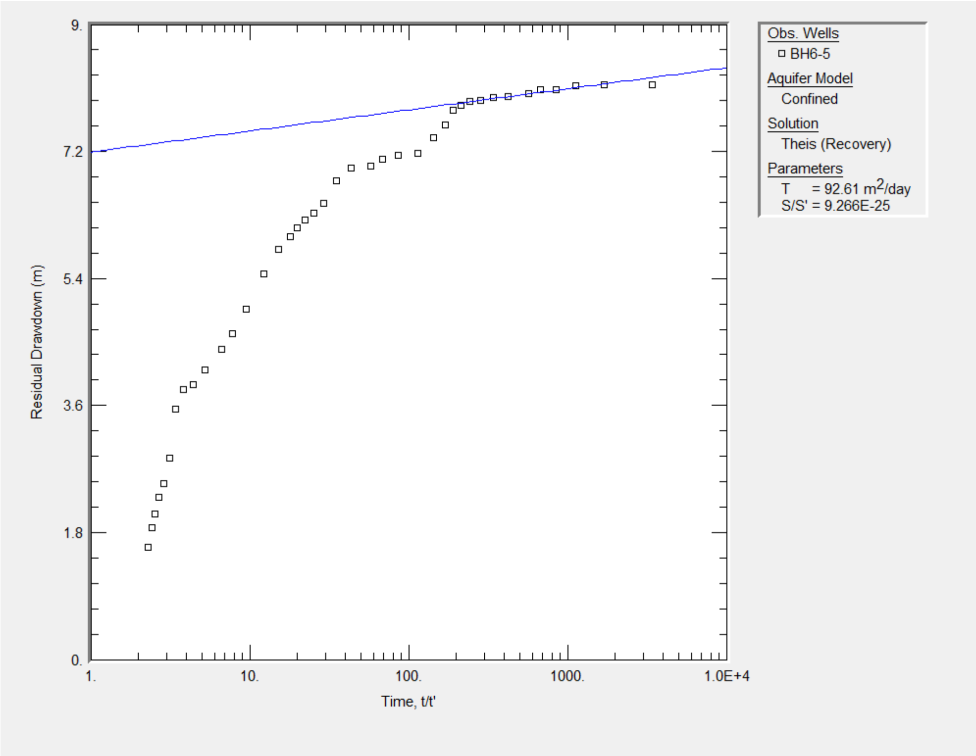

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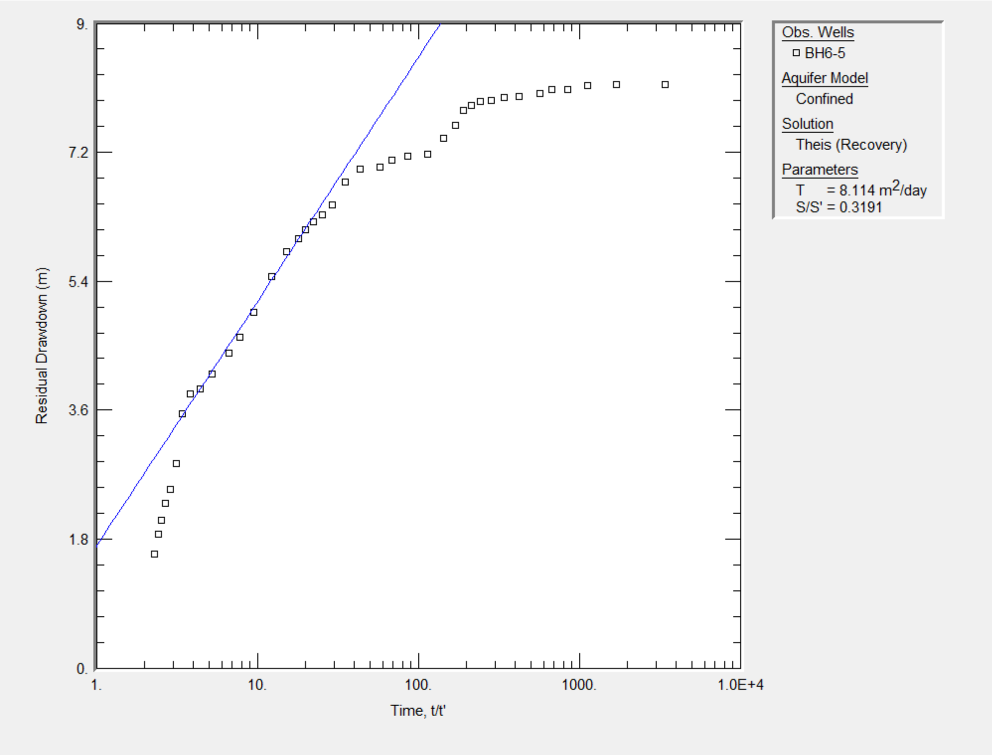

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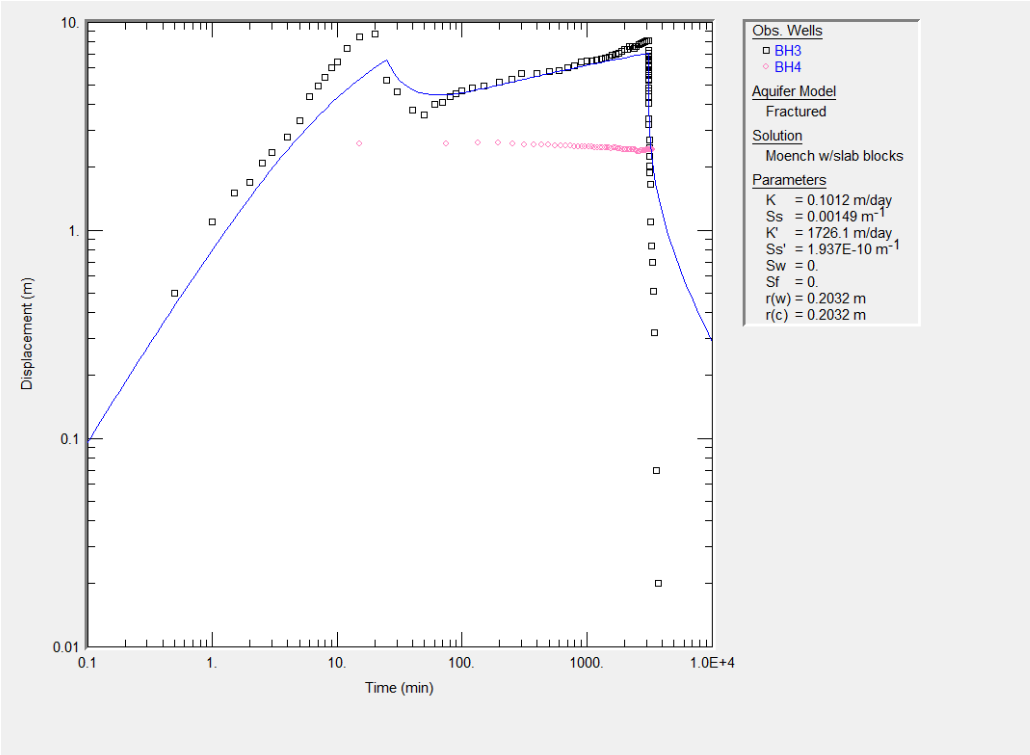

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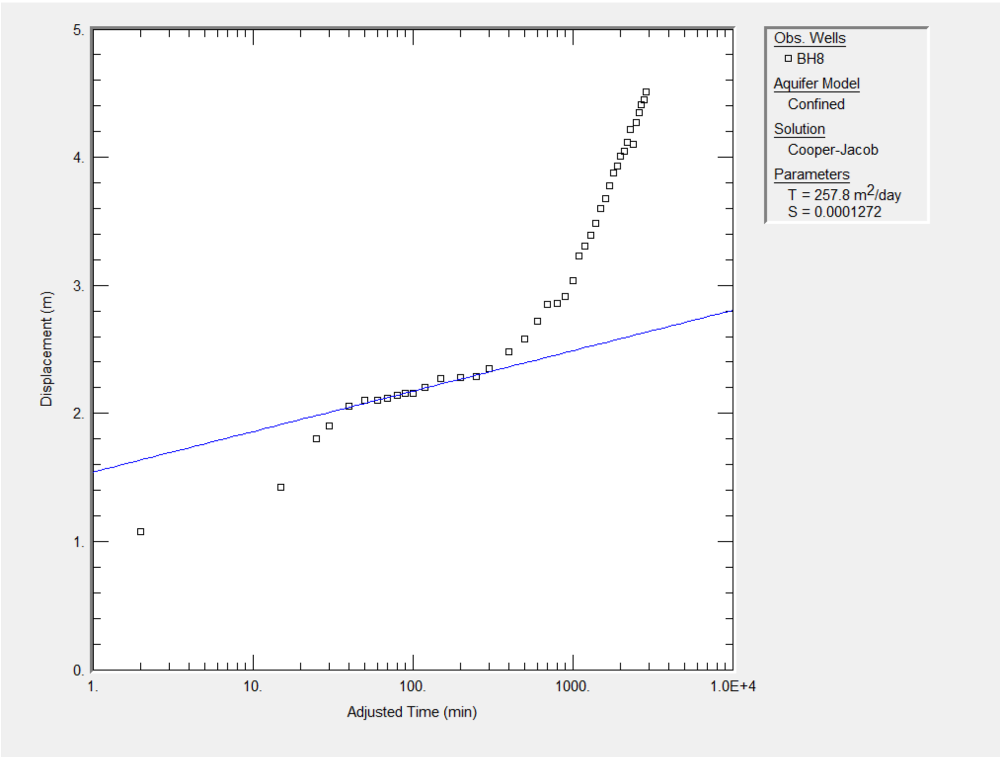
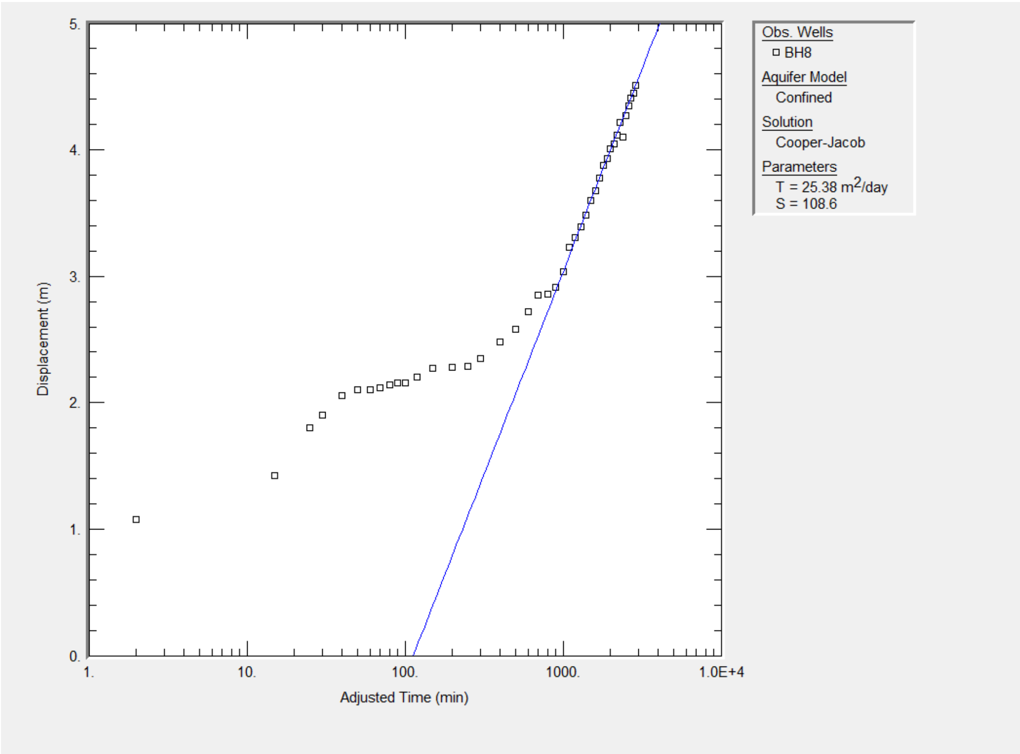


BH8 CDT1 Cooper-Jacob Early



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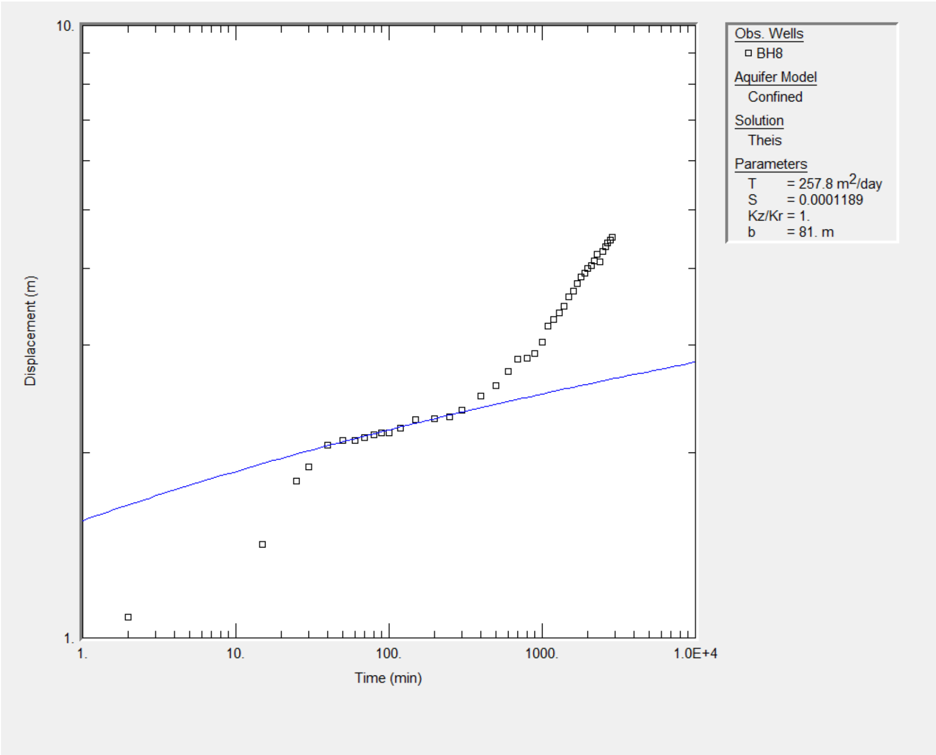

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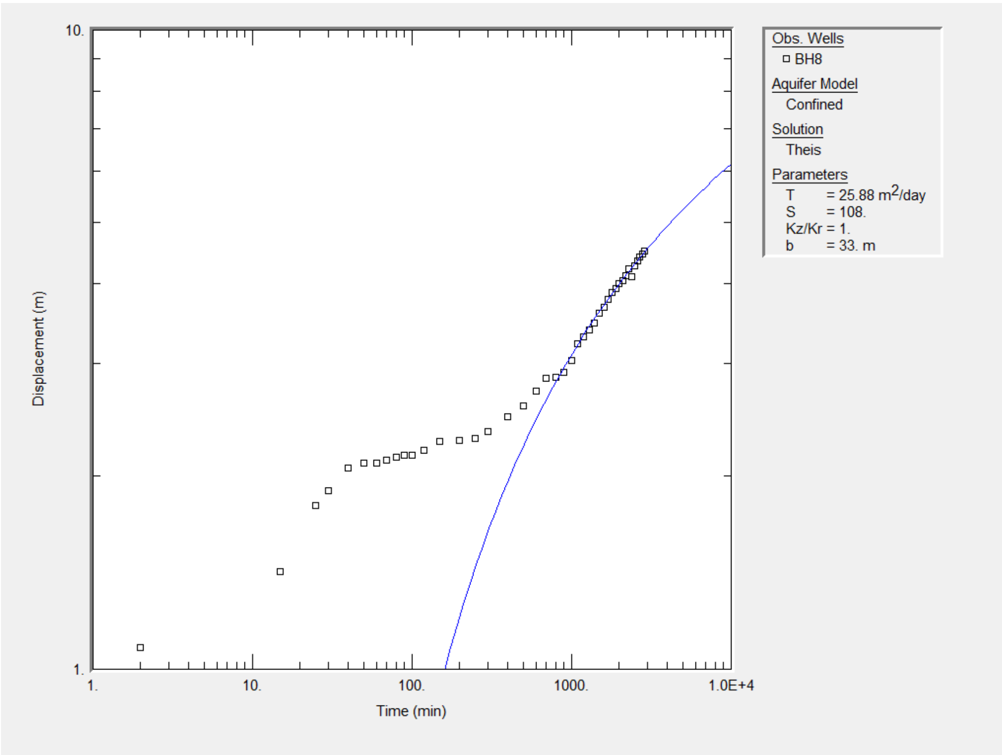

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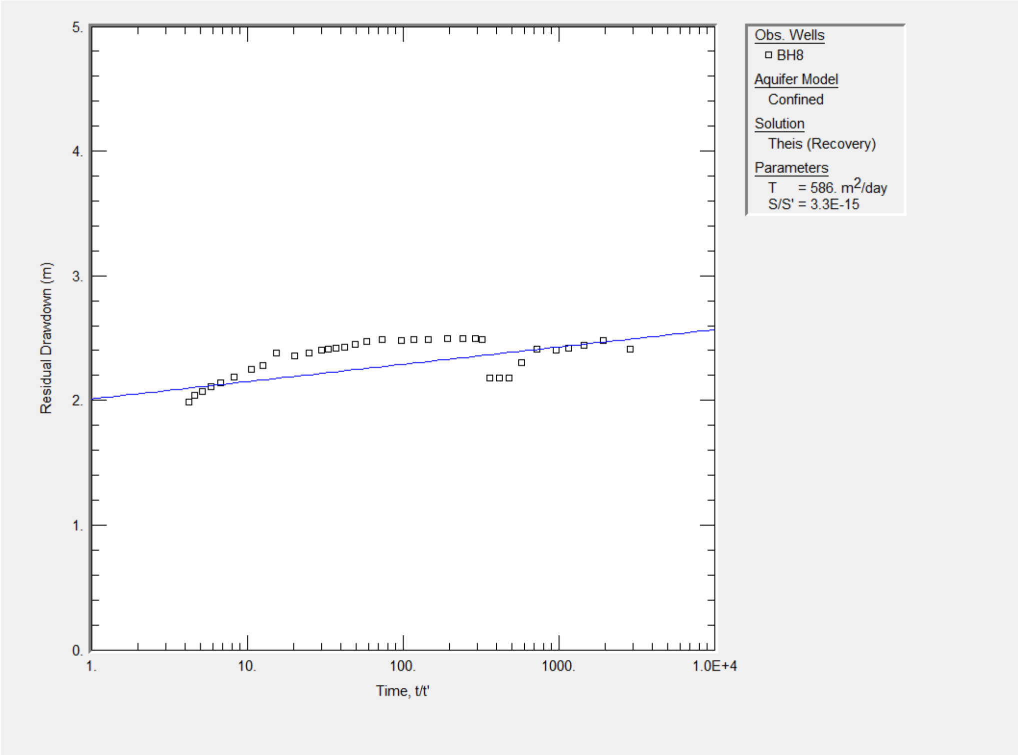

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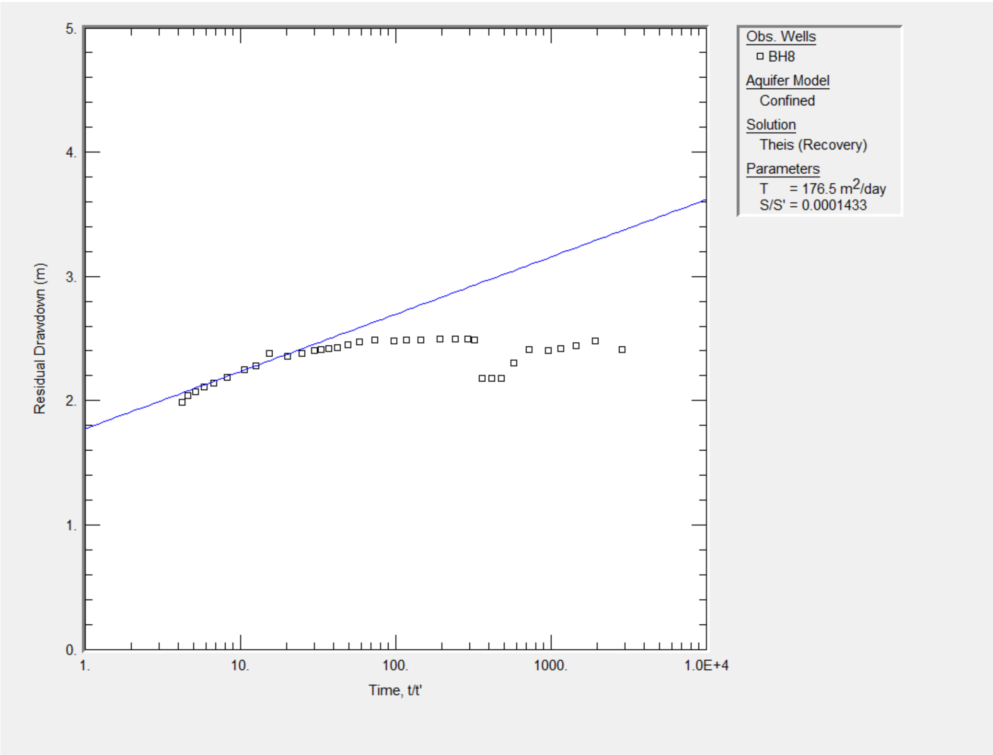

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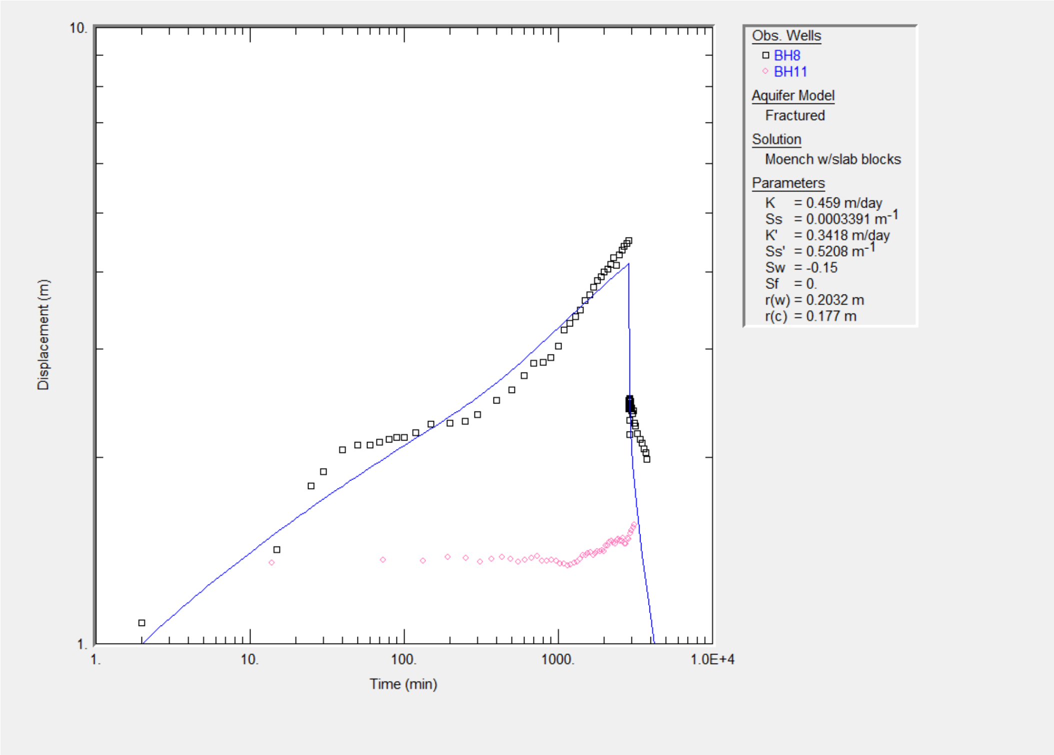

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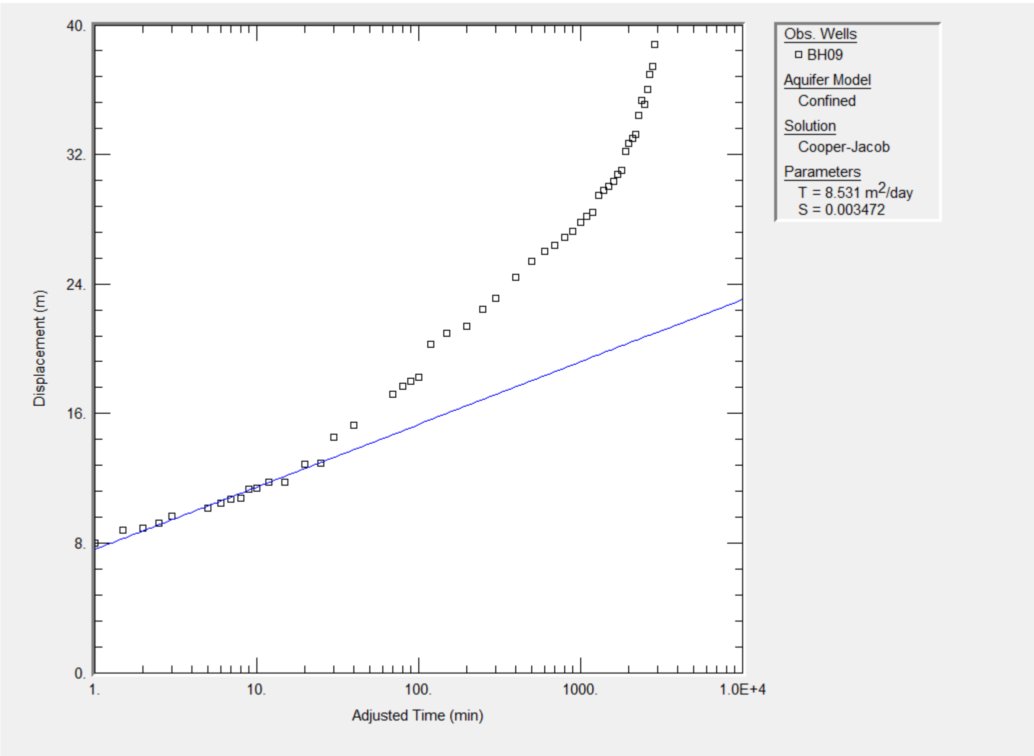
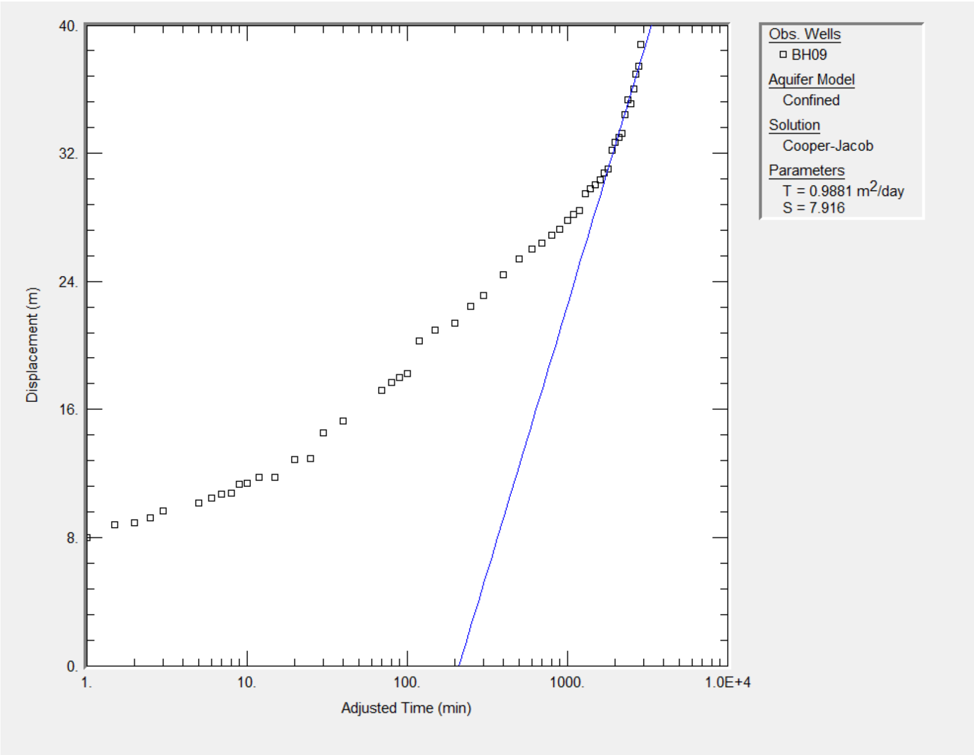


BH9 CDT1 Cooper-Jacob Early



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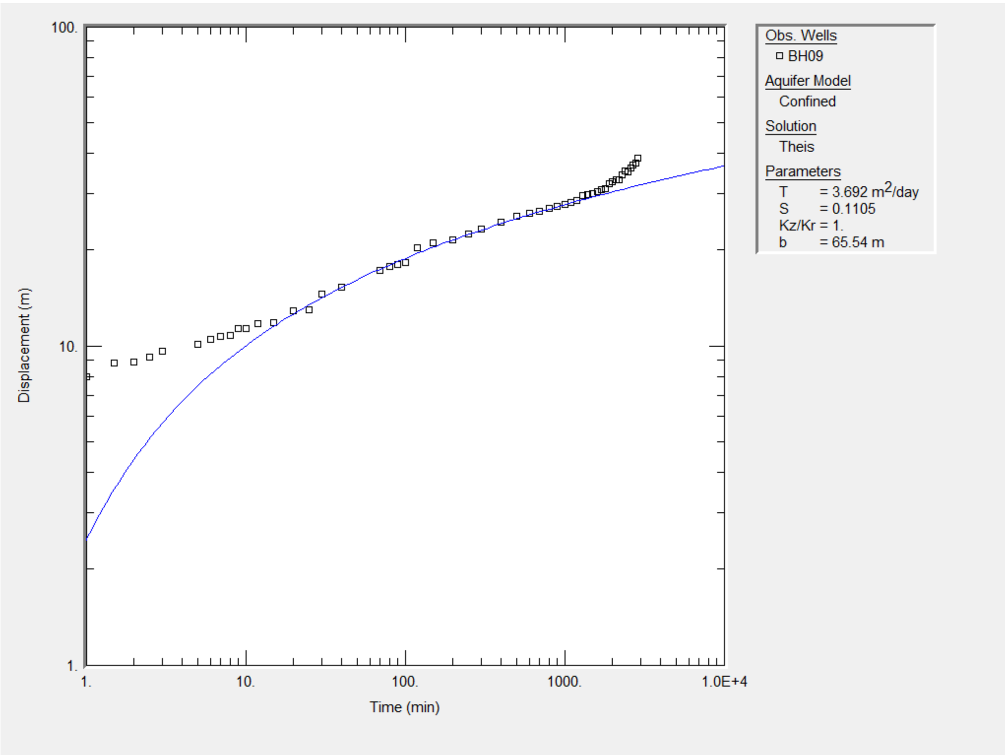

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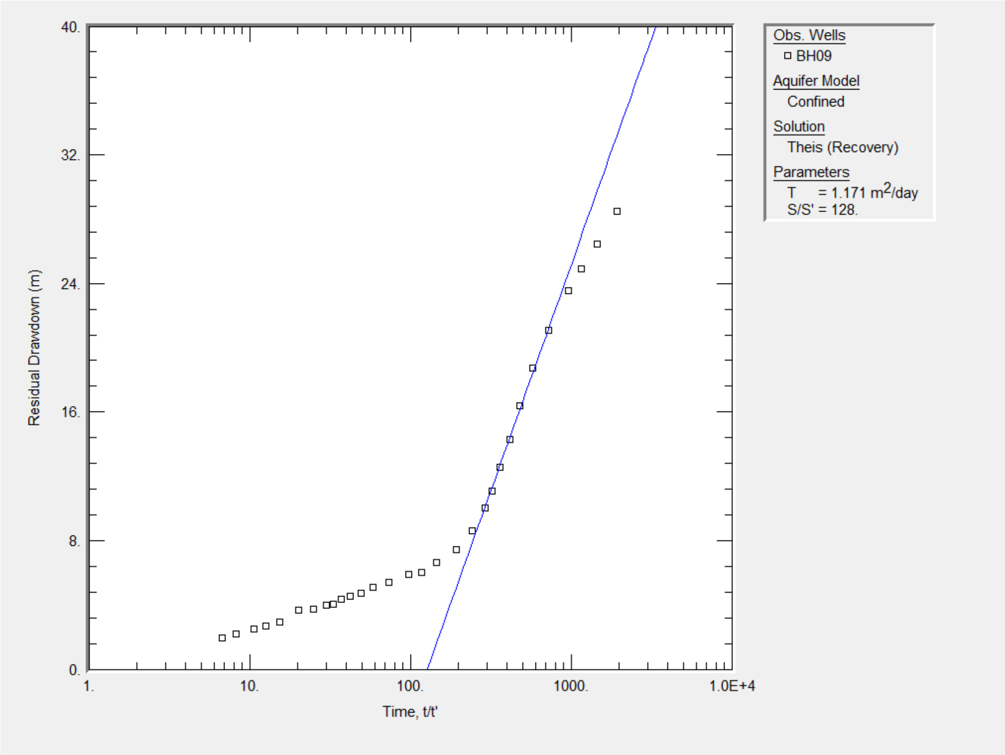

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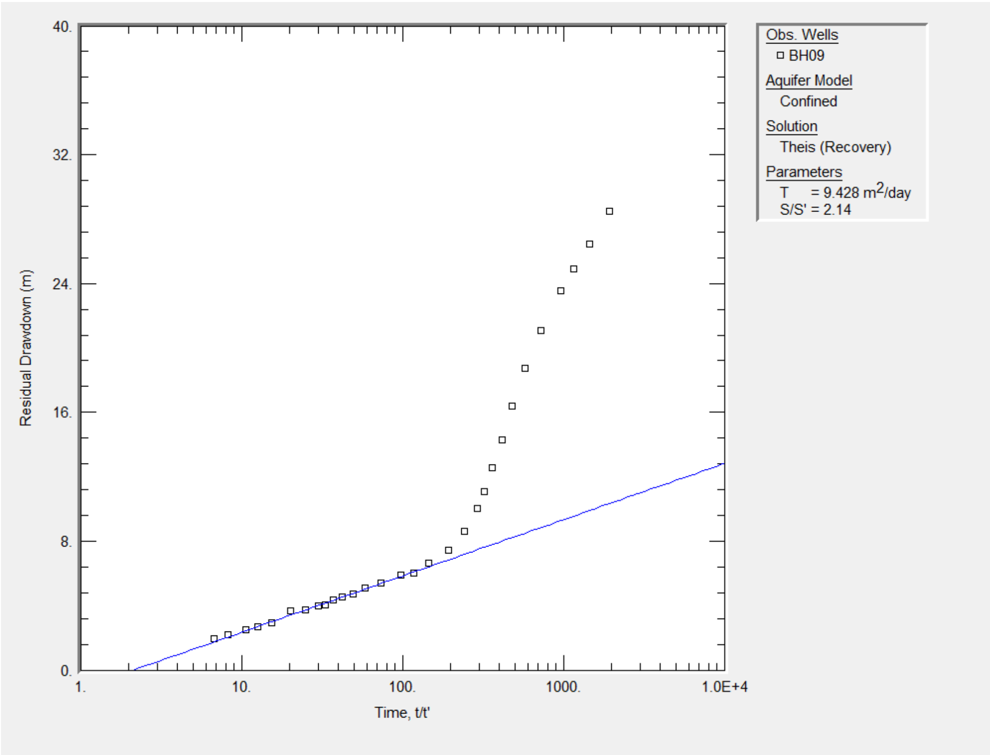

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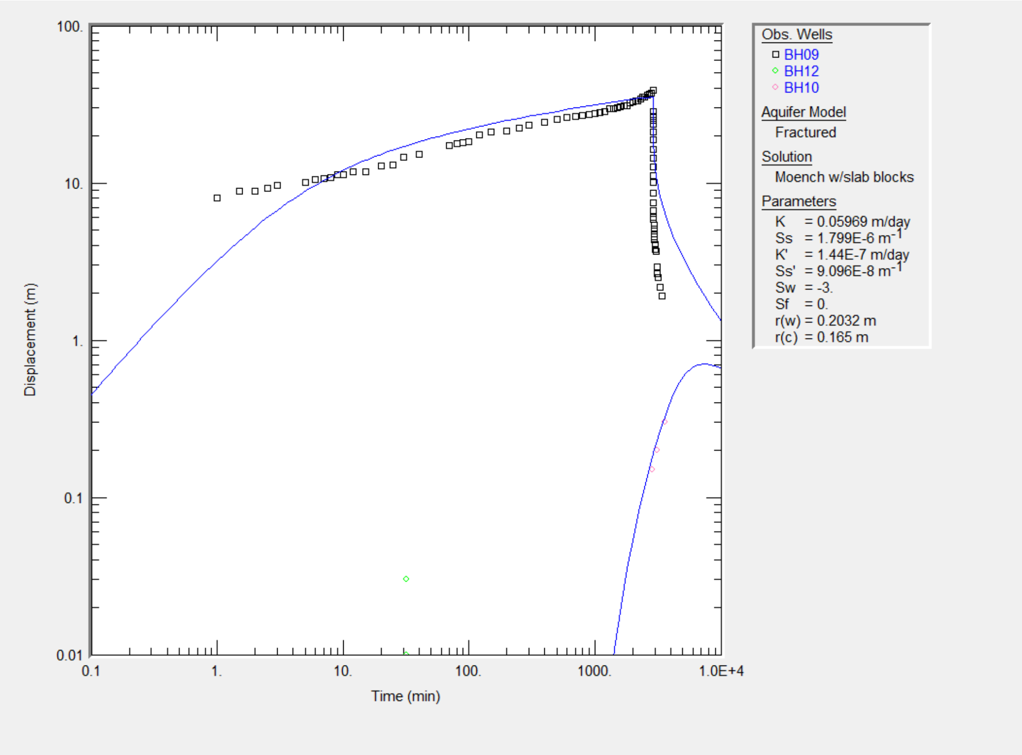

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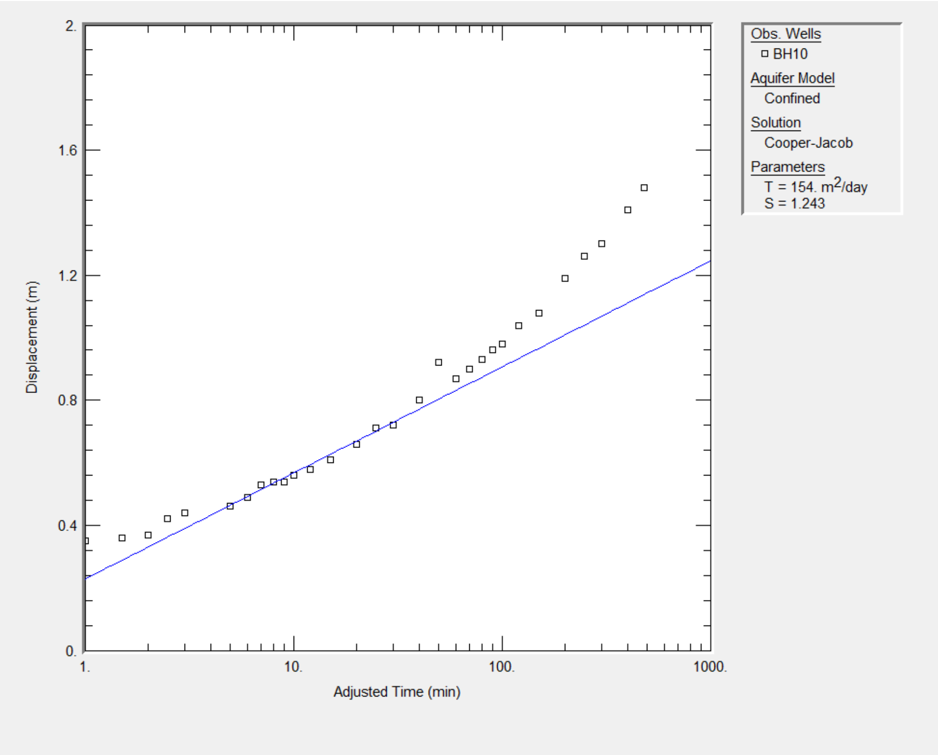

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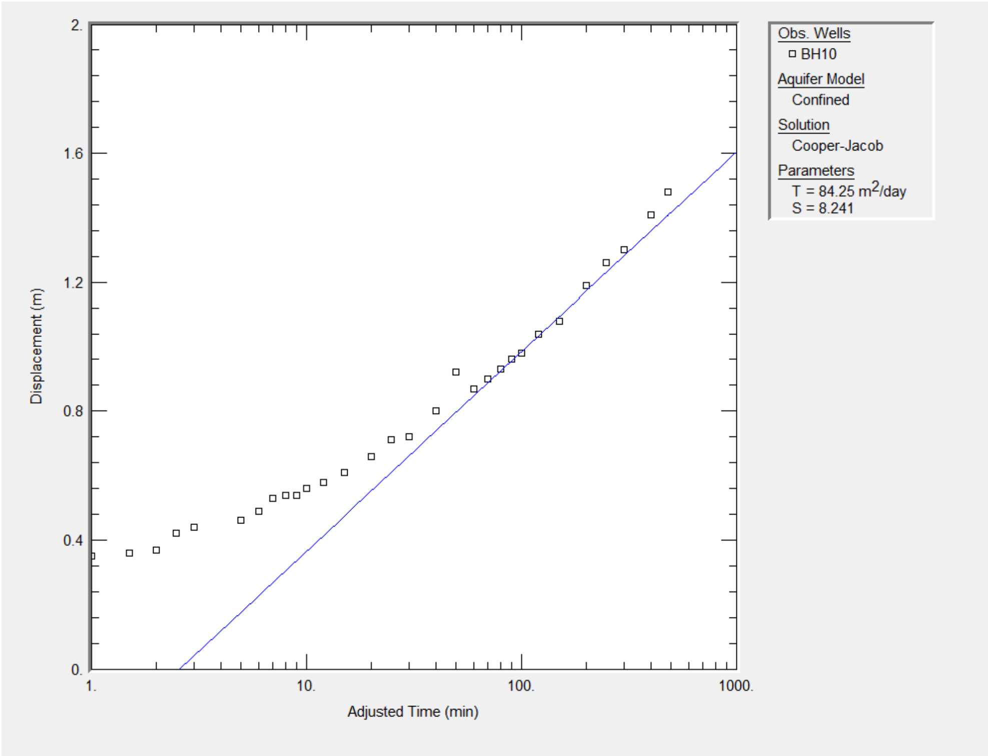

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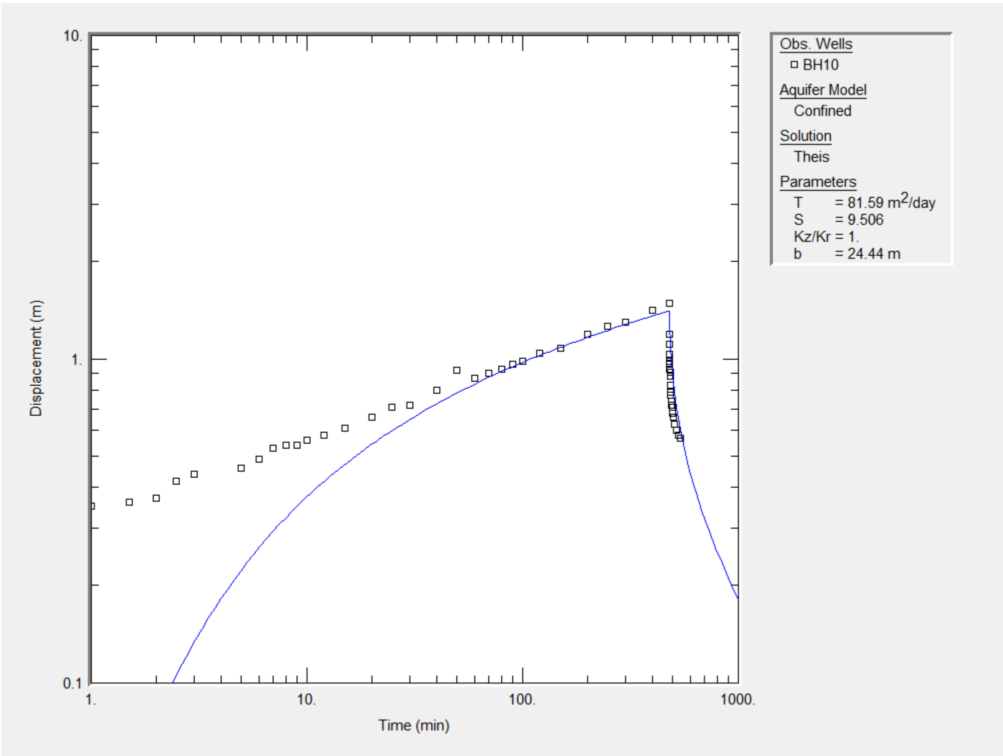

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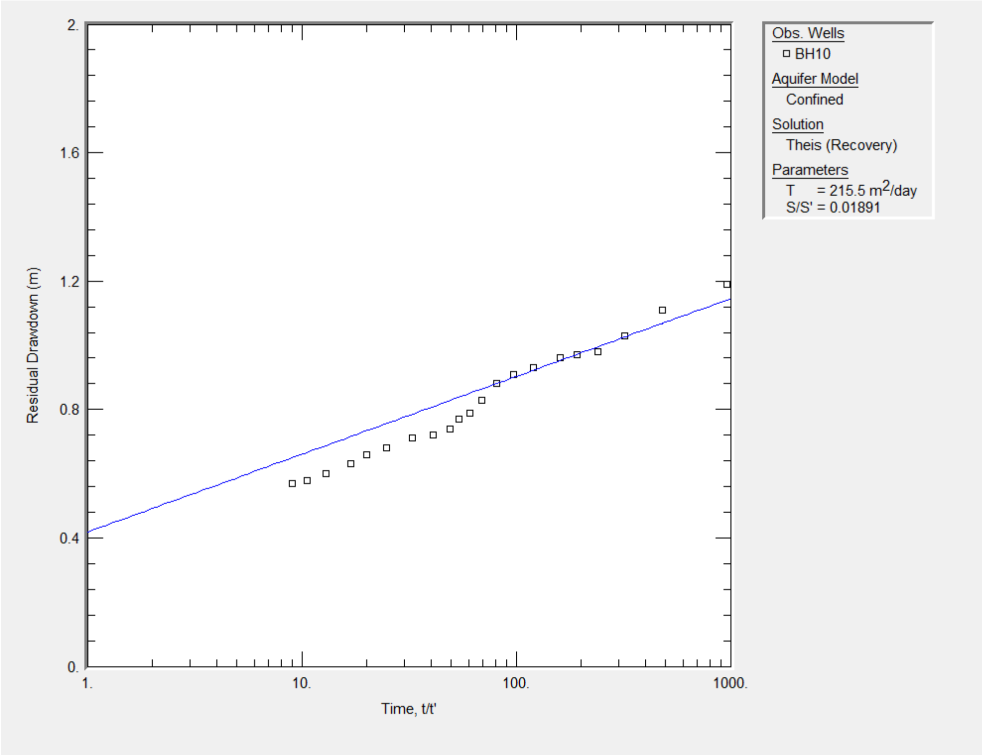

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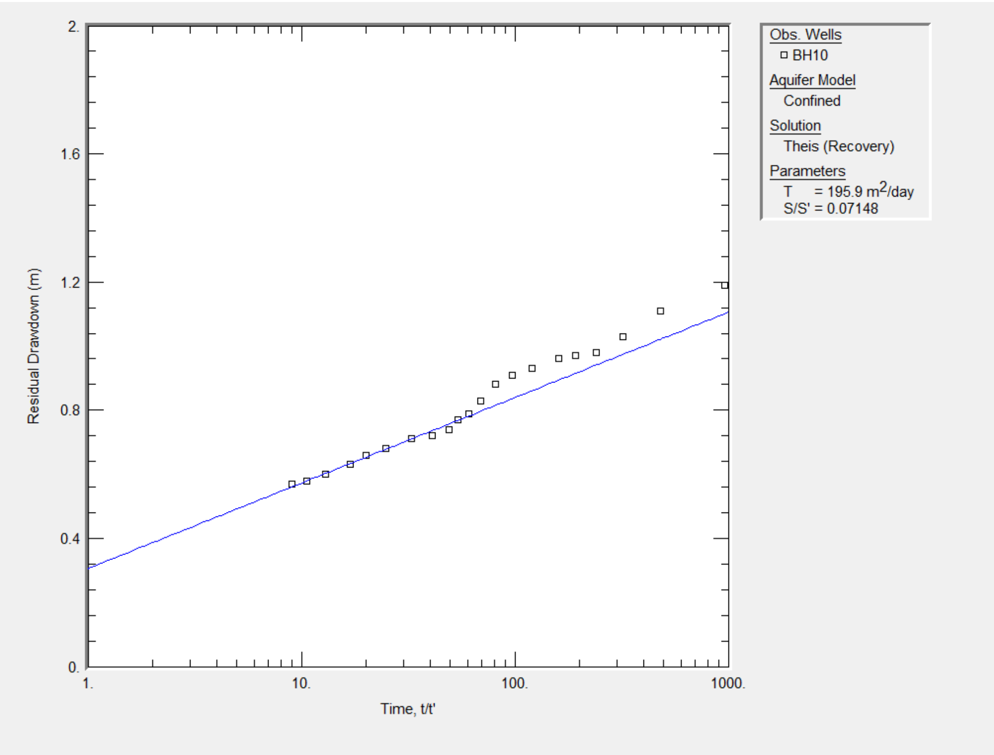

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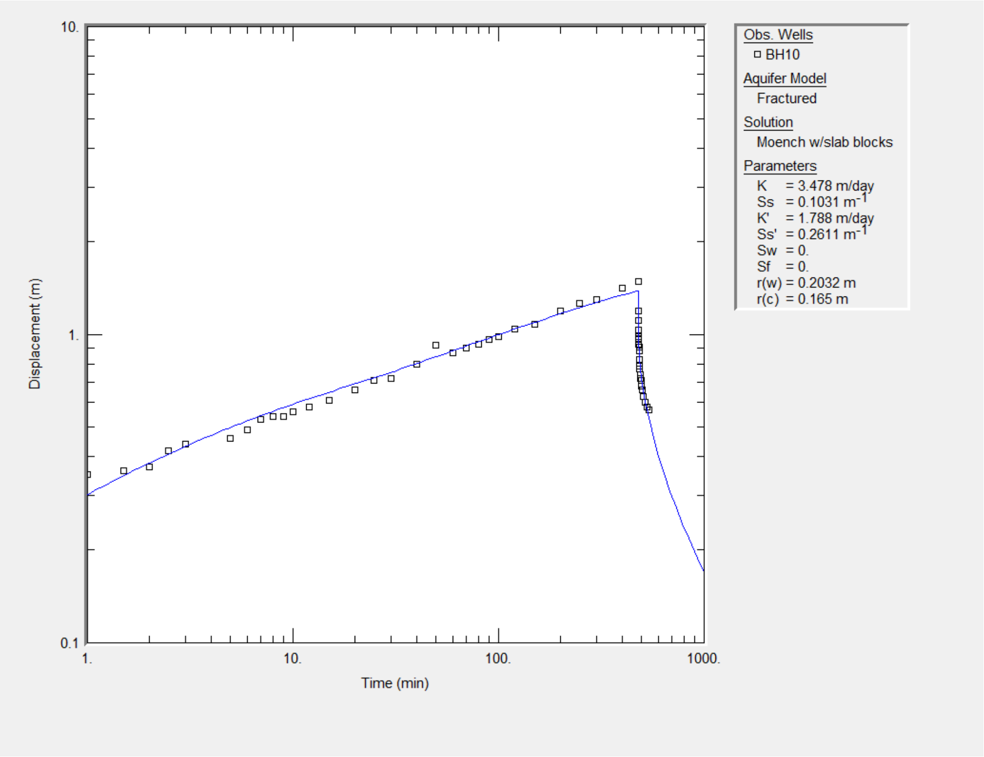

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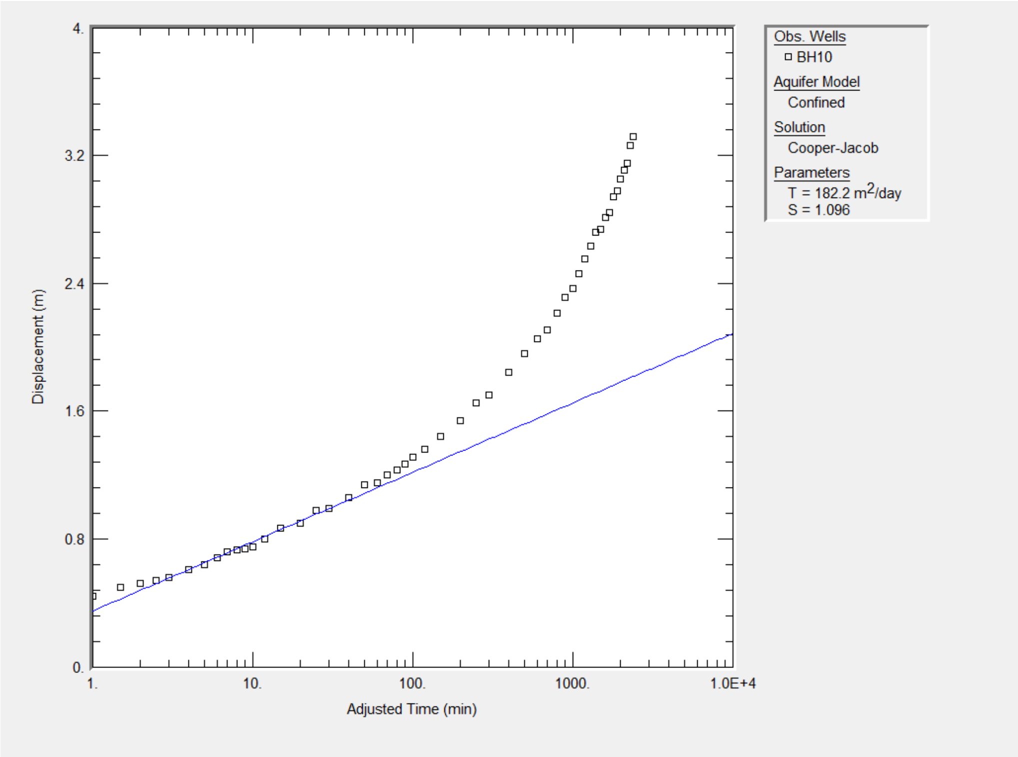

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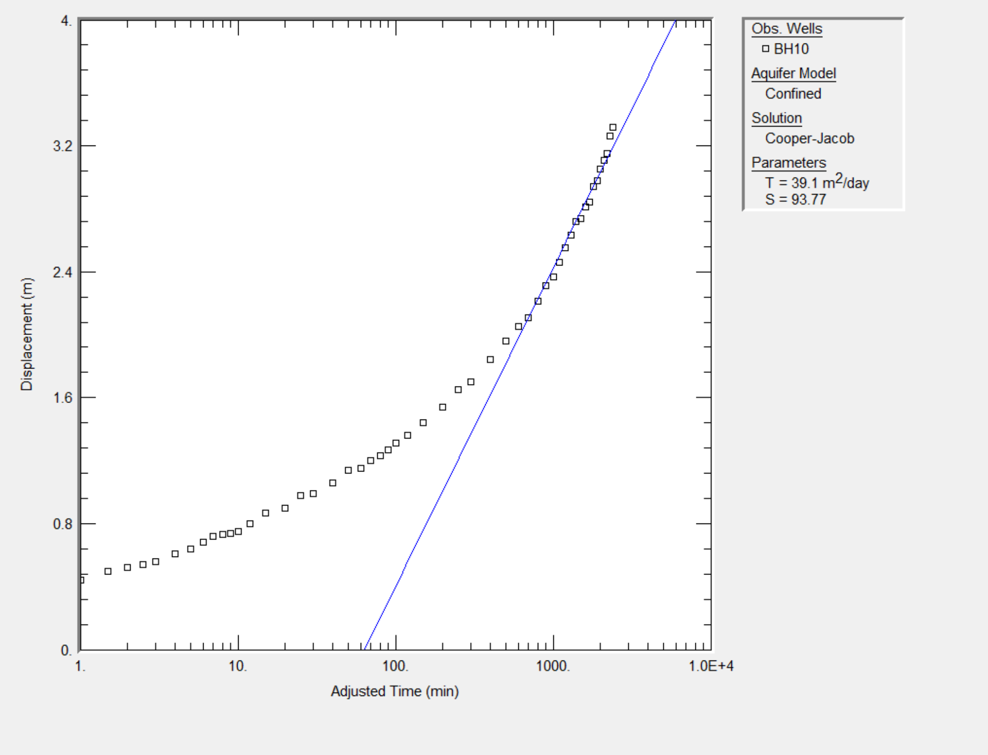

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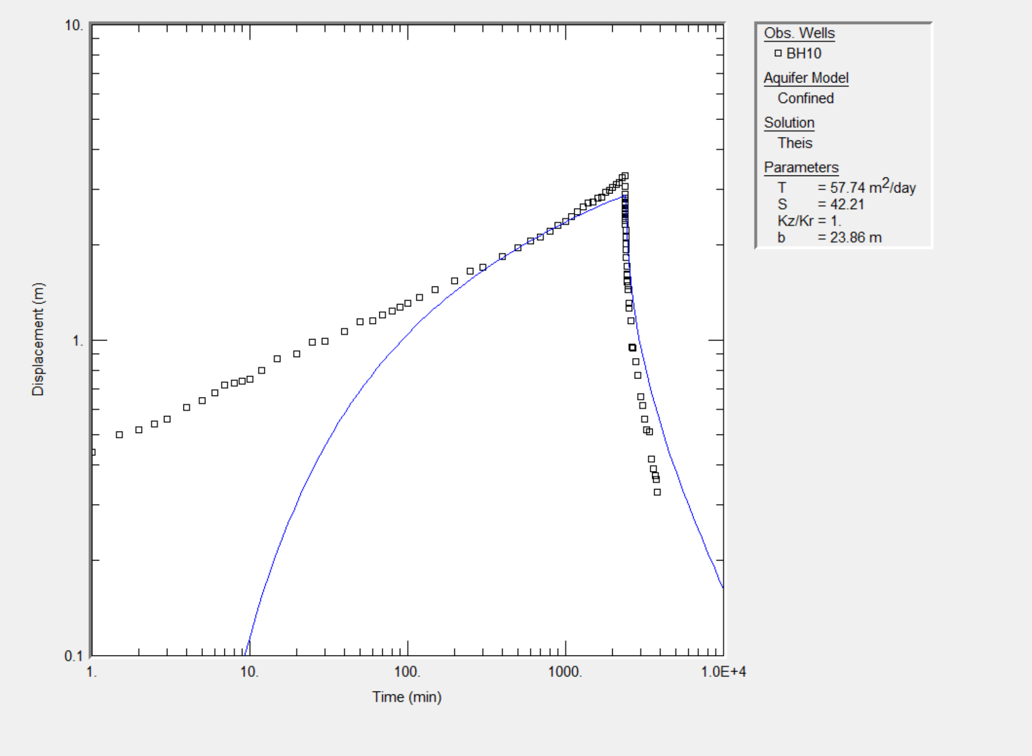

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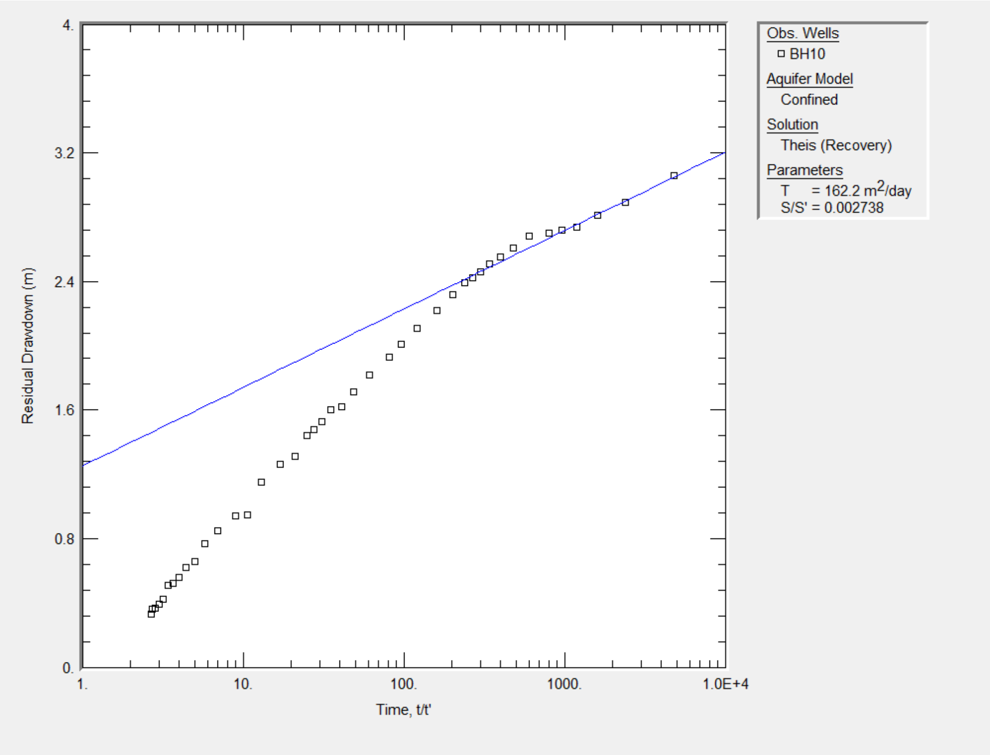

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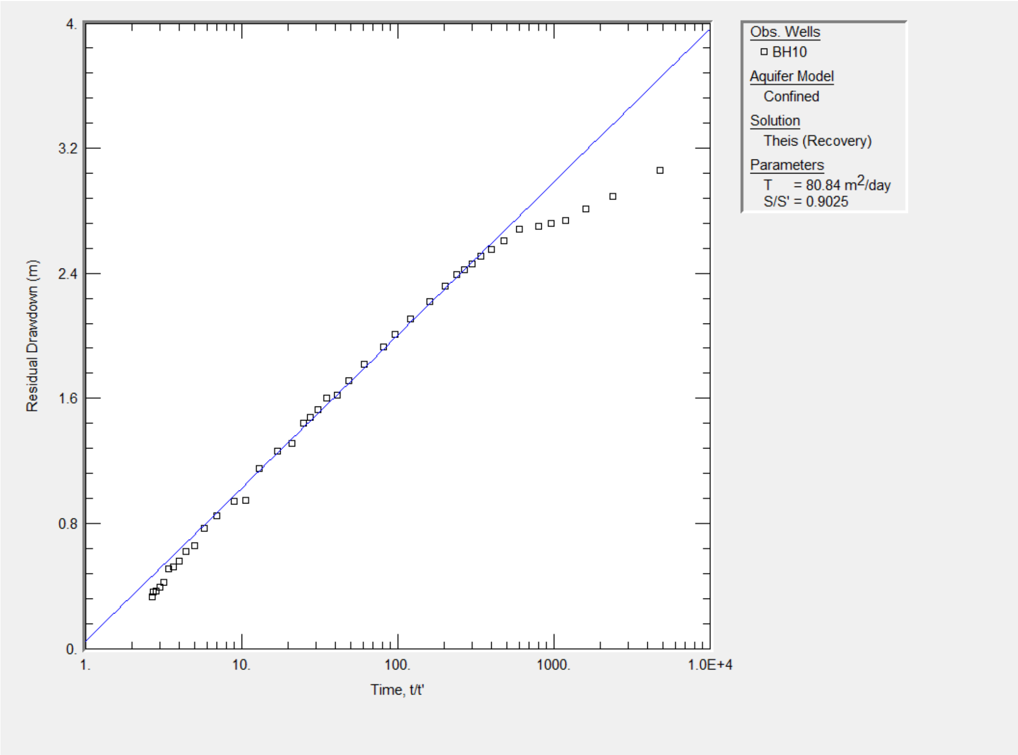

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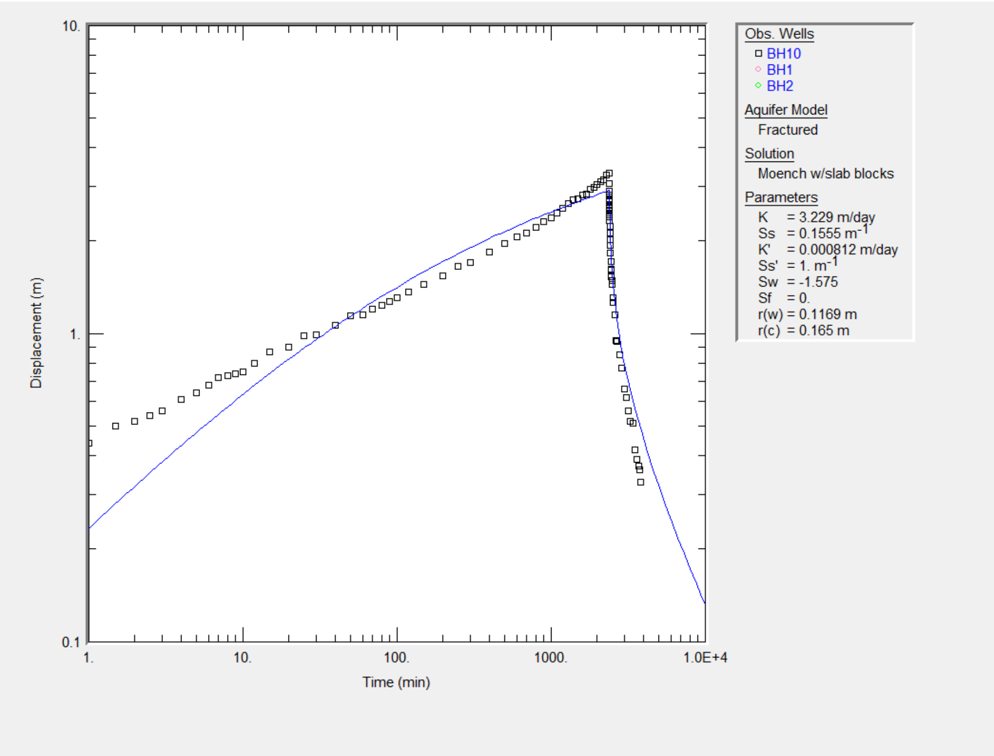

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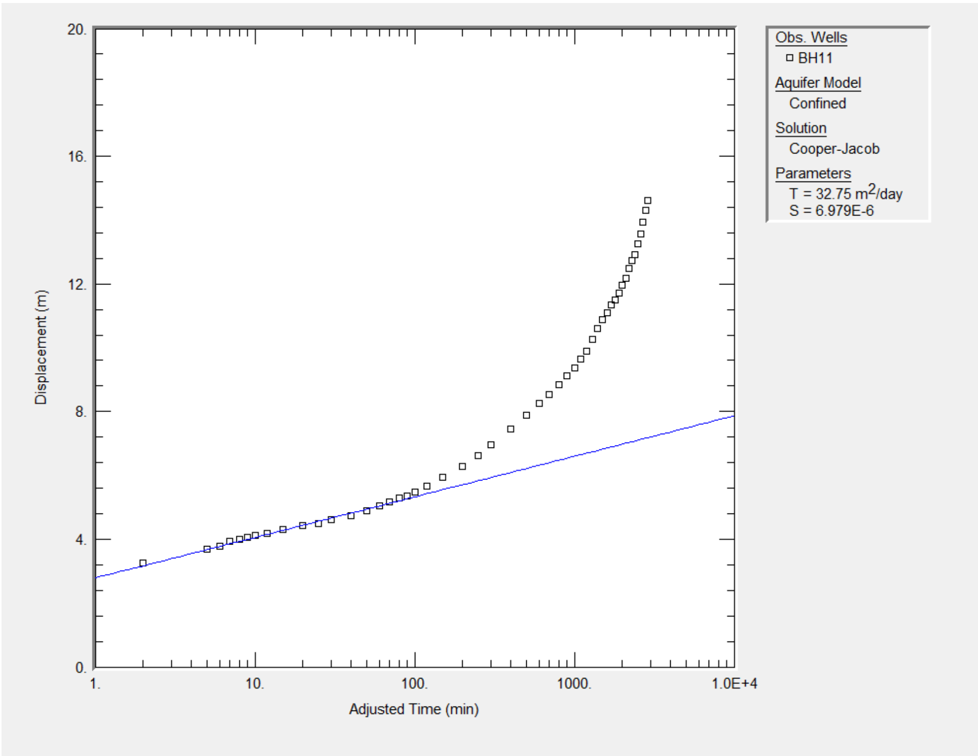

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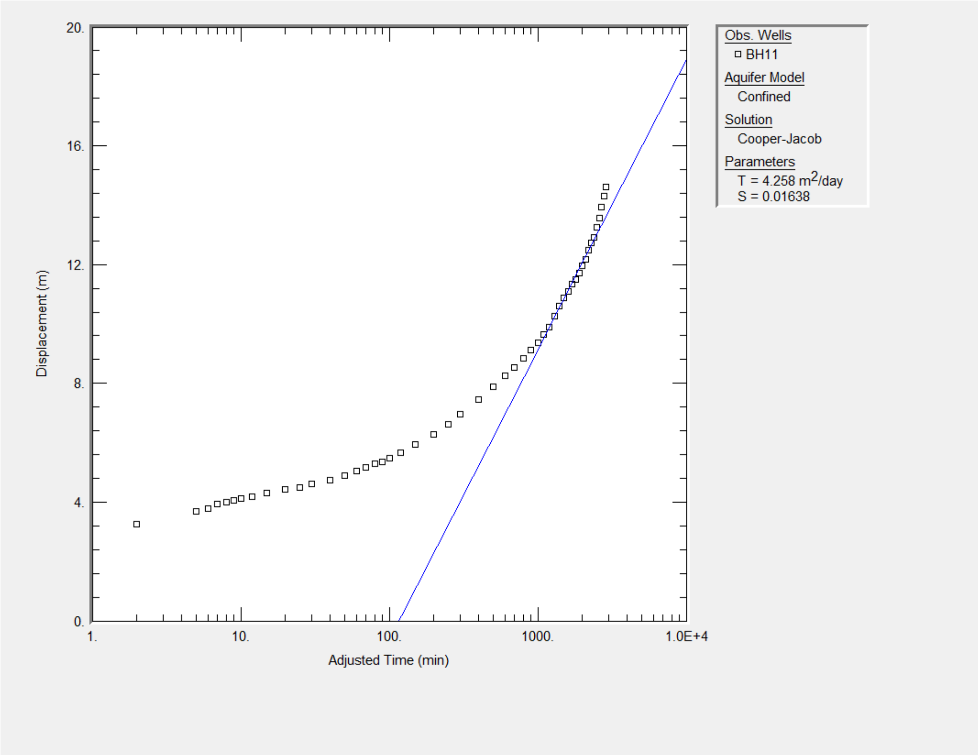

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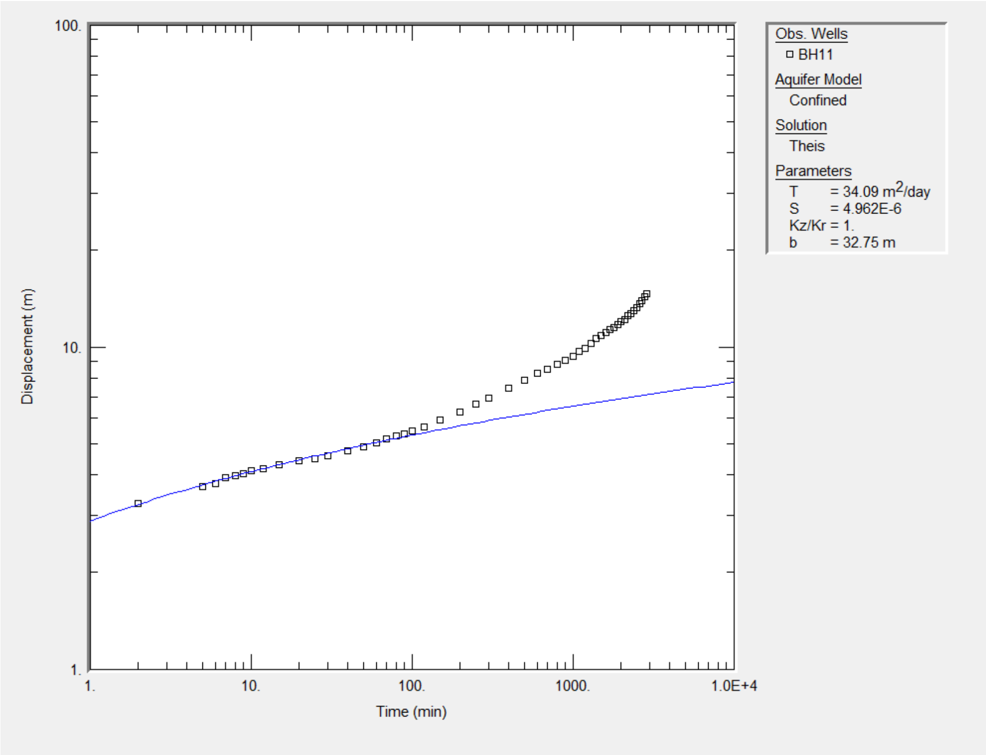

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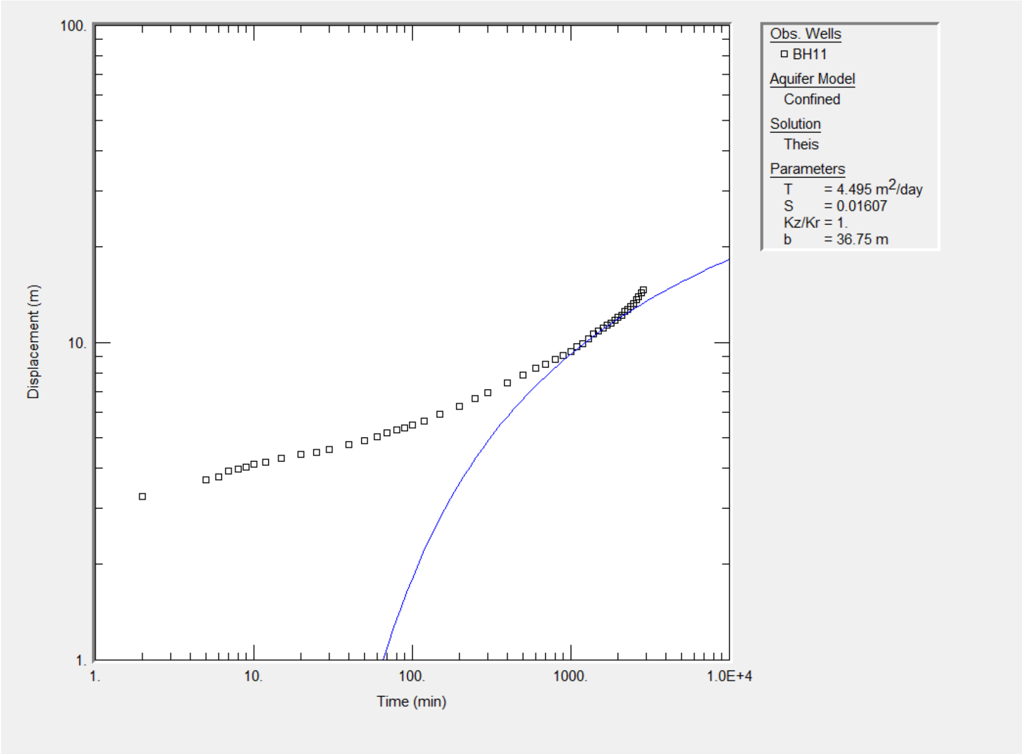

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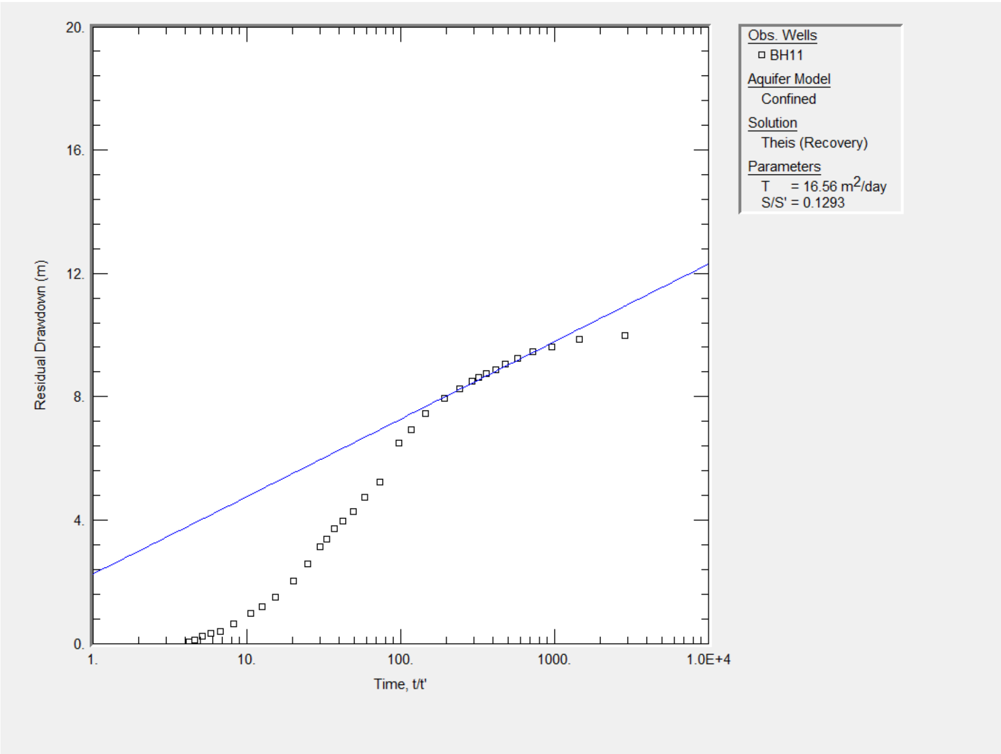

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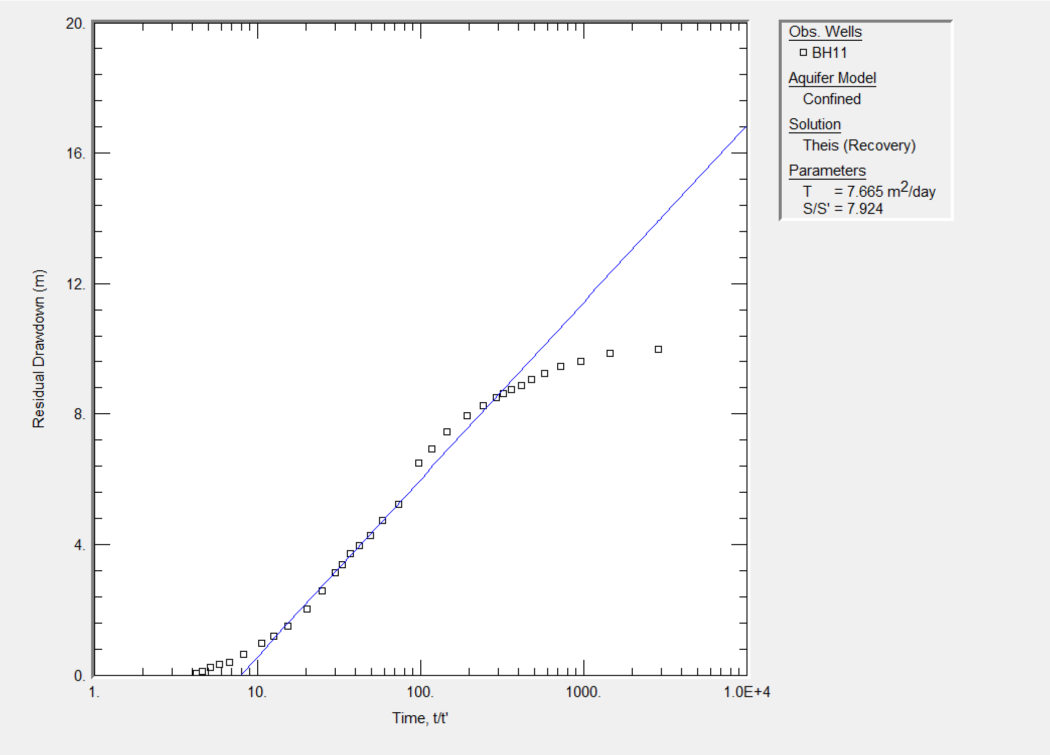

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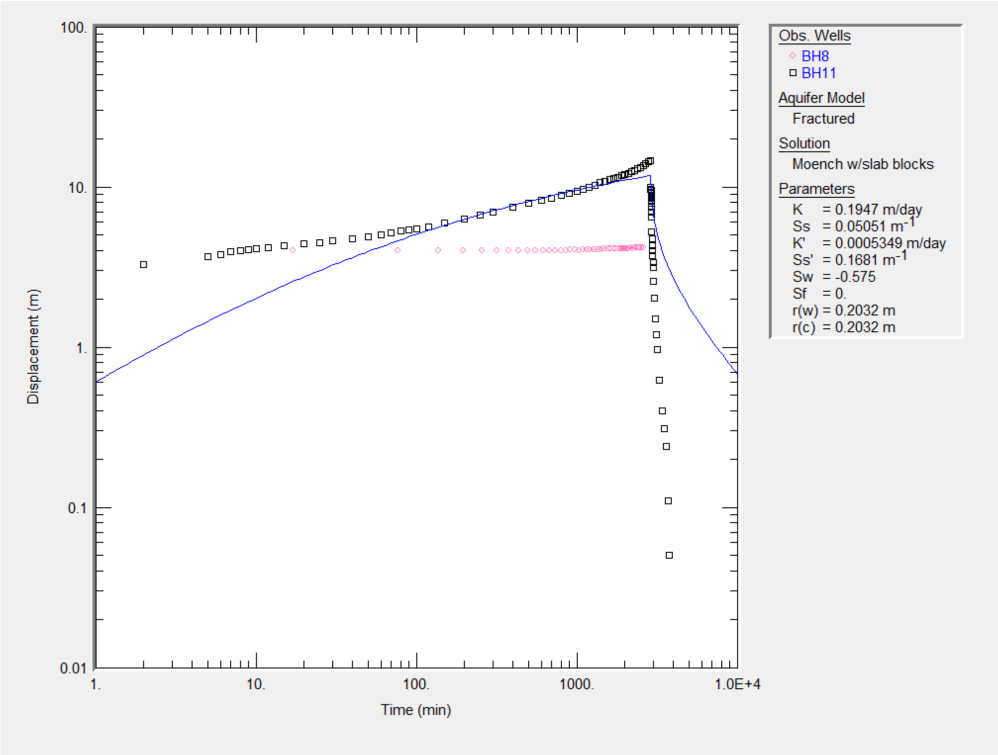

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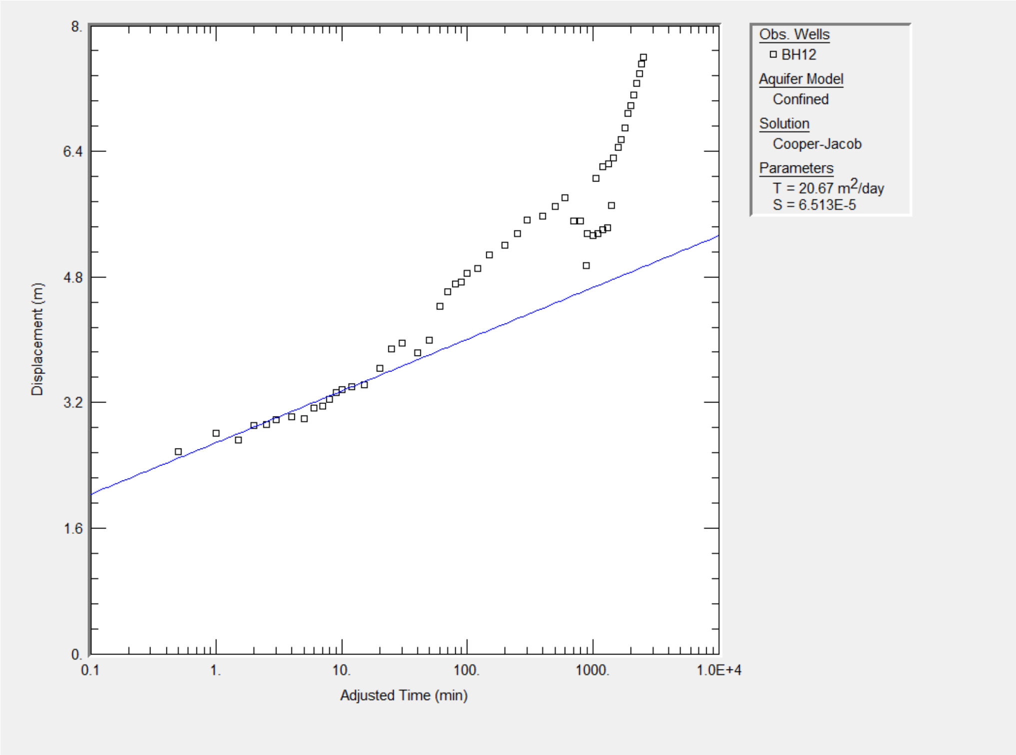

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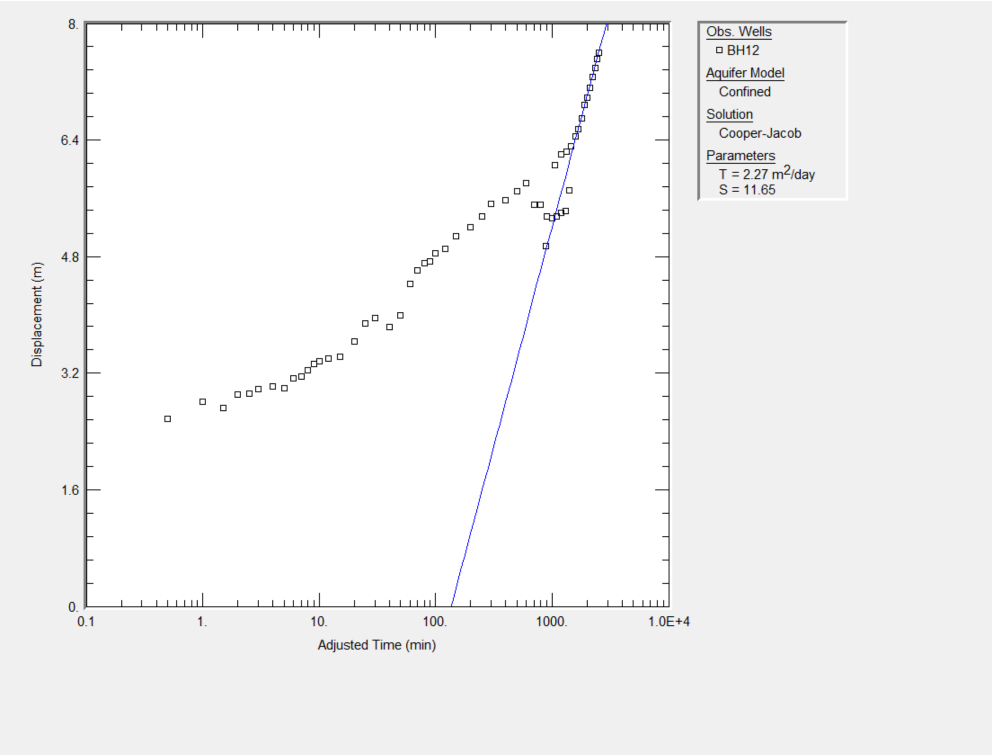

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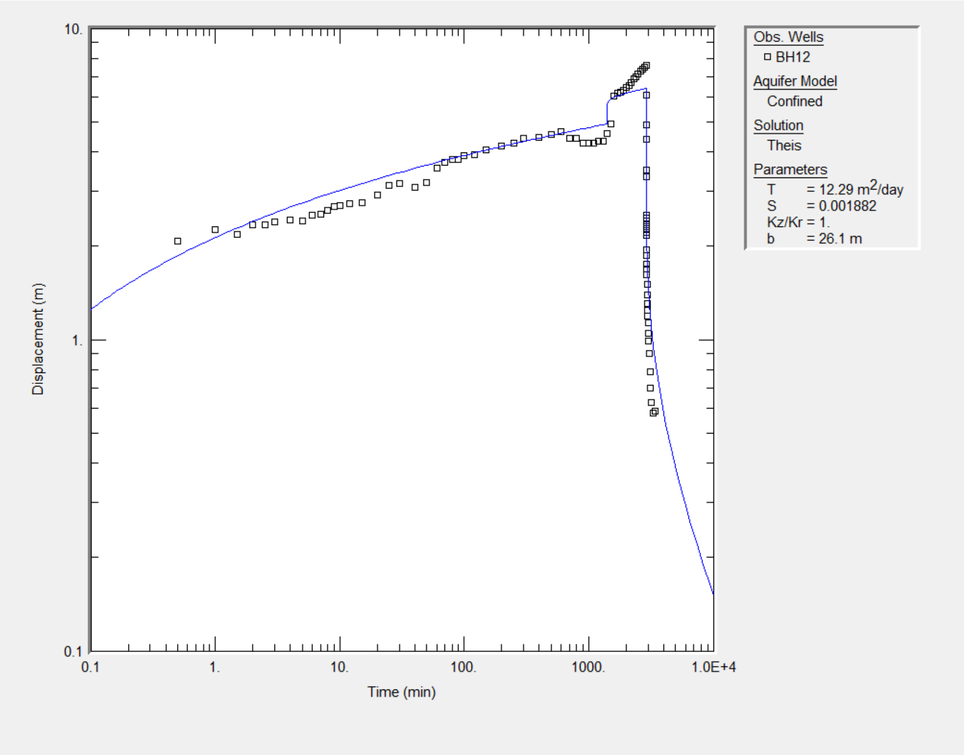

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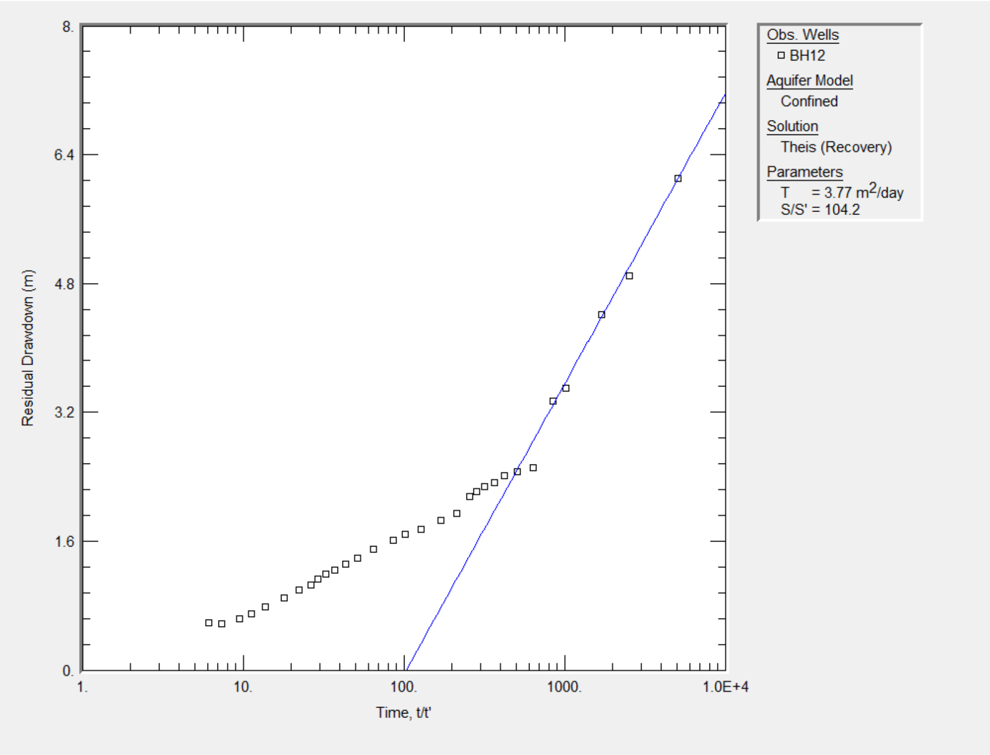

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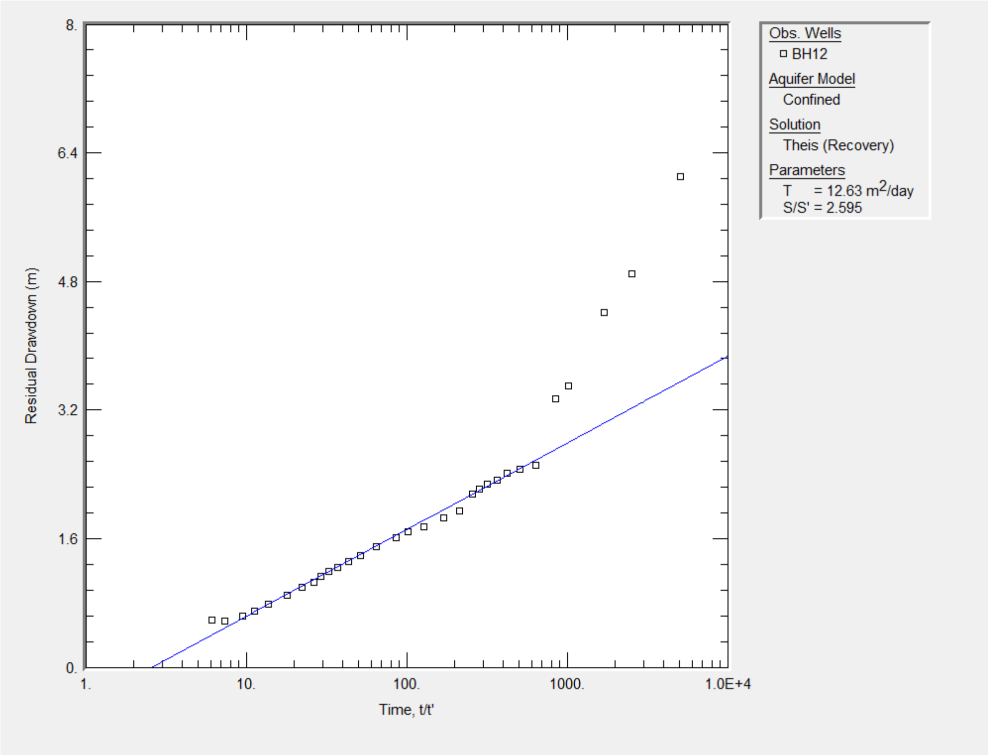

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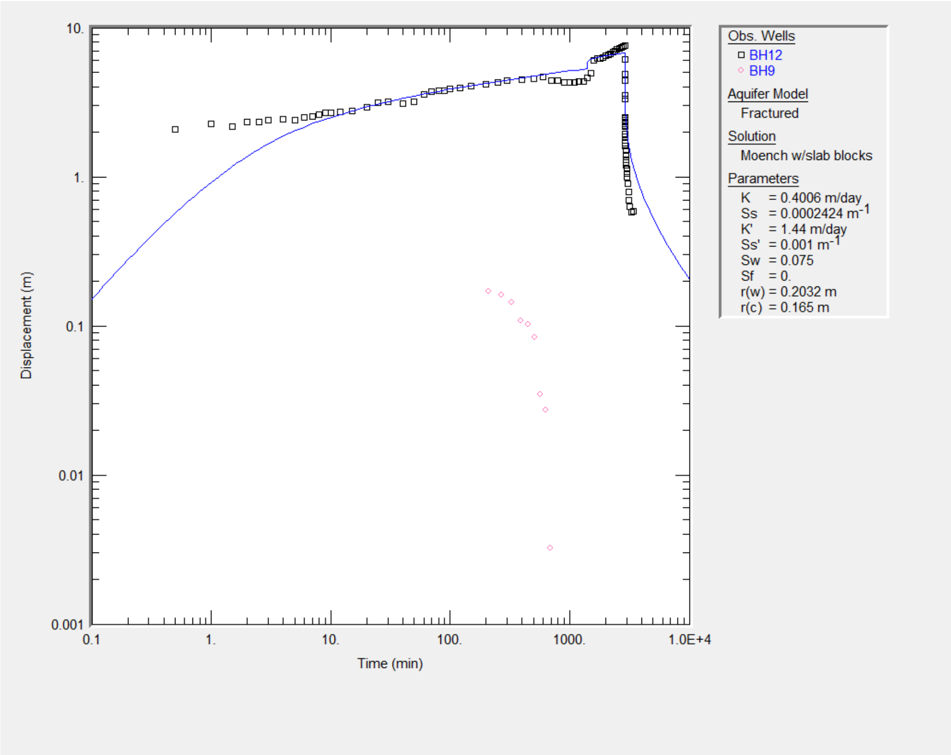

BH12 CDT1 - Moench

Appendix D: Impact Assessment Methodology

Impact Assessment Methodology

The impact assessment methodology that will be utilised during the EIA Phase for the Project consists of two phases namely impact identification and impact significance rating.

Impacts and risks have been identified based on a description of the activities to be undertaken. Once impacts have been identified, a numerical environmental significance rating process will be undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a particular environmental impact.

The severity of an impact is determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact is then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures were incorporated into the EMP.

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

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table B. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table C).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table A: Impact Assessment Parameter Ratings

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	**Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table B: Probability / Consequence Matrix

Significance

-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Consequence

Table C: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)