Annexure 4:

Responses to s92 requests prepared by GHD in respect of surface and groundwater matters

Your ref: 999859517-10396
Our ref: 12644380

26 September 2024

Oceana Gold NZ Ltd
22 MacLaggan Street
Dunedin

Response to Section 92 request for further information – Macraes Phase IV

To whom it may concern,

GHD provides this letter in response to Otago Regional Council's request for further information letter under Section 92(1) of the Resource Management Act for consent application number RM.24.184.

We provide our response to selected questions pertaining to GHDs workscope in Table 1.

Table 1 Response to S92 Questions

Item	Question / Response
1.15	**Based on the data in the GHD reports and any other relevant information, please provide an assessment of the adverse effects of the MP4 proposal upon groundwater quality, and the effects upon current and future users of groundwater. Only a surface water assessment is provided (Ryder) with the application. Groundwater is also a resource and effects on this resource should be considered directly, not just in terms of its function as a conduit for contaminants to migrate into surface water.**
	The zone of influence (in terms of groundwater drawdown and groundwater contamination) is limited to areas within the mine footprint. *Monitoring and modelling results (Section 4 – in GHD reports) indicate that groundwater drawdown (from current & proposed mine activities) is shown to be limited to areas immediately adjacent the current pits and drawdown over a wider area (as a result of mining activities – current and/or proposed) is considered unlikely.* *The modelling shows groundwater contamination (represented by sulphate as a conservative indication of groundwater plume development due to its elevated nature – in the discharge, and low ability to attenuate within the groundwater system) is largely contained to areas immediately surrounding mine facilities and structures (i.e. waste rock stacks, tailings facilities and open pits). (Refer to Figures A3-A7 in Appendix A).* *Appendix A Figure A-1 shows the location of existing and proposed bores (data from ORC's database) owned by Oceana Gold (blue) and not owned by Oceana Gold (red).It has been assumed that any bores located within the OGC land ownership and mining permit areas that are not named are owned by Oceana Gold. There is one bore located just within these areas (I42/00086) that has the name of a private landowner and two bores just outside the OGC ownership boundary which area also named as private owners (I42/00088 and I42/00092).* *Appendix A Figure A-2 shows the existing and proposed groundwater take consents. sourced from Otago Maps. Consented groundwater takes within the mining permit and OGC property areas are all owned by Oceana Gold. The nearest consent not owned by Oceana Gold is located 3 km east of the OGC ownership boundary.* *Appendix A Figure A-3 shows the consented groundwater takes overlain onto the site wide model plume extent. All consented takes occurring within the plume are owned by Oceana Gold.* *Appendix A Figure A-4 shows all existing and proposed bores with the 400-year plume extent in model layer six for the* ***site wide model.*** *The results show that no private neighbouring bores occur within the contaminant plume.*

Item	Question / Response
	Appendix A Figure A-5 and Figure A-6 show the maximum plume extents after 400 years for the Coronation model. The results show that no private neighbouring bores occur within the contaminant plume. *Appendix A Figure A-7 shows the maximum plume extent from Golden Bar after 400 years. There are no private bores located within the plume.* *Based on the estimated limited plume extent, the proposed activities are not expected to have an adverse effect upon current and/or future users of groundwater.*
1.29	**Please provide a maximum rate of take for the groundwater dewatering. Please identify whether any additional bores need to be drilled to facilitate this dewatering.**
	Groundwater is proposed to be taken passively from the Golden Bar Pit via the pit sump where it will be combined with surface water. *The estimated maximum average rate of groundwater inflow into Golden Bar Pit, as derived from the Groundwater Model is 1.8 L/s (see Macraes Phase IV, Golden Bar – Surface and Groundwater Assessment pgs. 26-27). Given that dewatering of Golden Bar Pit will be via the pit sump (which captures both groundwater and surface water inflow) it will not be possible to isolate the groundwater and surface water components. Ultimately the rate of the take (from the pit) will be constrained by discharge requirements and/or pump capacity. A combined maximum rate of 200 L/s is proposed to align with existing constraints for pit dewatering at the site. Additional dewatering bores will not be required.*
1.30	**With regard to the take and use of surface water to dewater the existing pit [Golden Bar] lake, please clarify whether one of the intended uses of the pit lake water includes the discharge into surface waterbodies (as is implied by the application for discharge permits) and whether the pit lake water may also be discharged into another open pit or the FTSF.**
	Appendix B of the GHD Report "Macraes Phase IV. Golden Bar – Surface and Groundwater Assessment. 26 March 2024" (Appendix 12 of the AEE) details an assessment of pumping and discharge of the pit lake dewatering within Golden Bar Pit to the nearby surface water bodies. It is GHD's understanding that the preferred option is to discharge the Golden Bar Pit water in this manner (where the receiving water bodies have sufficient base flow to receive the water and compliance at NB03 is maintained). In the event that pit lake contaminant concentrations are elevated (e.g arsenic concentrations in the lower depths of the pit lake), receiving surface water conditions (flow and/or arsenic levels) limit the ability to discharge the existing pit lake over the required timeframe, and/or the mine water management system needs supplementary water, pumping and discharge of water to Frasers Pit will be considered.
1.39	**Consent is sought for the passive discharge of contaminants from the base and toe of the Golden Bar waste rock stack into water in the Clydesdale silt pond. The EGL Golden Bar WRS Design Report states that gullies beneath the WRS will be infilled with course rockfill to ensure good drainage. The GHD Golden Bar Report states that the majority of seepage is expected to move laterally within the weathered schist and be captured in silt ponds, the pit sump and/or report to the receiving surface water catchment. I interpret this to mean that gullies beneath the WRS will provide a flow path for seepage to surface waterbodies other than constructed silt ponds. Please explain how this seepage will be managed and whether it is taken into account within the Ryder assessments.**
	To illustrate the WRS hydraulics and how seepage on site is managed, consider that the existing Golden Bar WRS is predominantly constructed within a gully and the Clydesdale silt pond is constructed at the toe of this WRS, which is also the lowest point of the gully infilled by waste rock. Rainfall that infiltrates into the relatively permeable WRS is expected to seep vertically to the point that in-situ (or undisturbed) rock is encountered which is significantly less permeable. From this point it largely follows the pre-mining topography towards the toe of the WRS. Some of this flow may infiltrate into or out of the in-situ schist, however the ground water modelling indicates that the amount of flow into the in-situ schist (which ultimately becomes groundwater recharge) is relatively low. The result is that most of the water infiltrating through the WRS presents as discharge at the toe of the WRS and is routed through the silt pond and other parts of the treatment system before discharging to surface water bodies. This is conservatively represented in the water balance modelling by assuming all infiltration through the WRS discharges to the surface water body via the silt pond along with the corresponding contaminant mass load due to seepage water quality deteriorating as it passes through the WRS. *The proposed expanded Clydesdale WRS also includes areas which will not be constructed within the gully reporting to the silt pond. For these areas the seepage water and corresponding contaminant mass loading is routed directly to the down gradient surface water body and is represented in the next node*

Item	Question / Response
	downstream in the water balance model (i.e. not all seepage is routed via silt ponds but is represented in the receiving surface water body). *Both sources of seepage (captured and uncaptured) are taken into account within the GHD surface assessments. The groundwater modelled contaminant flux entering the receiving surface water bodies is cross referenced with the estimated contaminant flux from the surface water model to provide consistency in estimates and account for uncaptured seepage flux within the surface water modelling / estimates. The resultant water quality at modelled surface water nodes (which takes into account all seepage) has been provided to Greg Ryder for the assessment of aquatic ecology effects.*
4.3	**The Hyde-Macraes shear zone is said to have increased hydraulic conductivity. What is the impact of not considering this on the models?**
	The Hyde-Macraes Shear Zone (HMSZ) trends northwest to southeast (approximately north-south on the local mine grid). *Within the HMSZ the schist has been disrupted with no apparent well-defined fractures. Evaluation of packer test results undertaken by Golder Associates (2010, 2011) concluded that the permeability of the rock mass within faulted schist lies within the range of permeabilities for the unfaulted schist. Therefore, due to the small differences in hydraulic conductivity values we consider that it would have a negligible effect in the modelling results if it was incorporated in the model as a discrete layer.*
4.4	**Steady state calibration from the groundwater models results in lower conductivity layers (Table 4.1) than expected based on the hydraulic testing summary. Please discuss the calibration achieved when using the test results as per Table 3.1 and the justification for the variation.**
	None of the historical or recent models use the exact same hydraulic conductivity values presented in Table 3.1. The GHD 2024 model generally used lower hydraulic conductivity values compared to those listed in Table 3.2 from CD Smith although there is an overlap in values for the moderately and slightly weathered material in model layers 1 and 2. Previous work undertaken by Kingett Mitchell and Golder Associates reported in Appendix B of the GHD Report "Macraes Phase IV. Stage 3 - Surface and Groundwater Assessment. 26 March 2024" (Appendix 13 of the AEE) show hydraulically conductivity decreasing with depth as a result of decreased weathering. This has been confirmed by recent drilling (2022) undertaken in the GPUG area and reported by WSP (WSP, 2023. Golden Point Underground Mine (GPUG), GPUG Extension Hydrogeological Assessment. 26 April 2023). Figure 4 from this report is reproduced here (Figure 1) and shows the relationship between K and vertical depth in the GPUG area. The values used in the GHD model are consistent with, and within the ranges of values presented by other authors as shown in 'Appendix B- Table A-1 Summary of Hydrogeological properties applied in previous groundwater models' based on site testing results and model calibration. Values used in the modelling consider some reduction in hydraulic conductivity with depth. This is considered to fit better with the site conceptual model.

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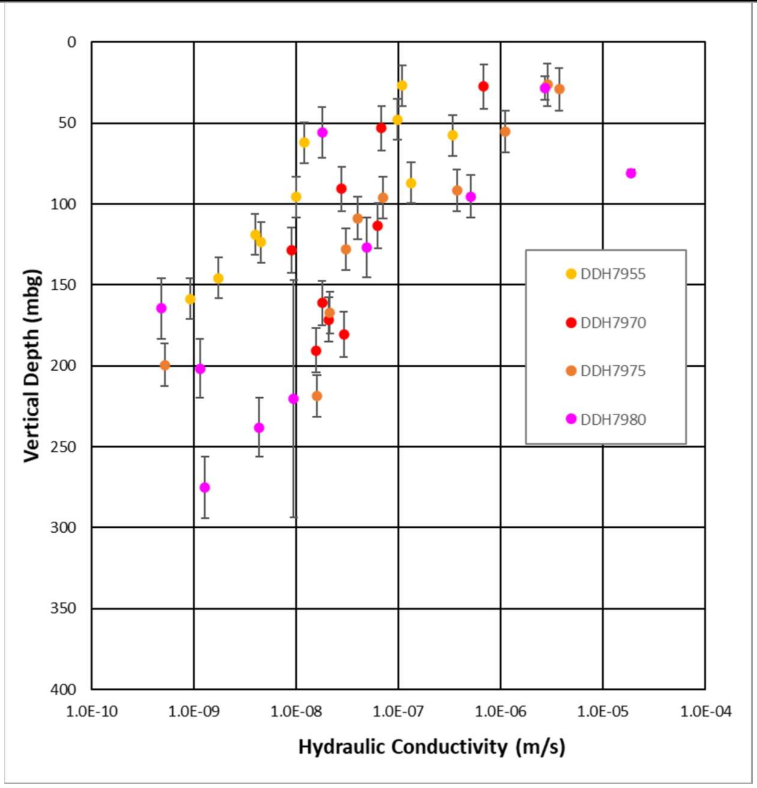

<p>Figure 1. Hydraulic Conductivity testing – GPUG Area (from WSP, 2023)</p>
<p>CDM Smith (2016) undertook a review of the available hydrogeological data on site and an interpreted summary is presented in Table 3.1. Therefore Table 3.1 is a summary of test results undertaken over the years as detailed in Appendix B. The modelling undertaken by CDM Smith in 2016 undertook a simpler approach and used one value to represent the hydraulic conductivity of schist throughout the whole model i.e. their adopted k values do not differentiate between fresh and unweathered schist, even though these materials are expected to have some differences.</p>
<p>As discussed in the Appendix 11 of the AEE (GHD (2024a)), GHD also tested the approach undertaken by CDM Smith by lumping layers 2 – 8, rather than splitting them out to show a decreasing hydraulic conductivity with depth (although this was tested). The calibration of this second model was slightly better but overall, the results from both models were similar.</p>
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<tr><td>4.5</td><td>What sensitivity analysis has been completed for the models for K values? What testing has been completed on the hydraulic conductivity of waste rock stacks? What is the likelihood of preferential pathways?</td></tr>
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<p>The hydraulic conductivity of the schist rock mass, has been defined through a combination of hydraulic and packer testing, and through calibration of the site-wide groundwater model. While there are localised variations in permeability depending on the weathering as well as the degree and connectedness of fractures, at the scale of the groundwater model, the permeability of the schist mass as a whole does not vary substantially across the site.</p>
<p>The sensitivity of the vertical decrease in hydraulic conductivity with depth on the model calibration was tested by assuming that majority of layers (2 - 8) have the same hydraulic conductivity values (i.e. the effect of weathering and relative changes in hydraulic conductivity with depth (below 30 m bgl – the approximate extent of the weathered material) have not been taken into account).</p>
<p>As discussed in our response to Q 4.4, results were not significantly different.</p>
<p>The waste rock is typically well graded (poorly sorted) in nature (gravel to boulders <1.5 m in diameter) and angular, due to the blasting process used to break down the schist. It is typically stacked and compacted in 15 to 20 m lifts. As shown in Appendix 11 of the AEE (Appendix B - Table A-1 Summary of Hydrogeological properties applied in previous groundwater models), modelling undertaken to date has consistently used a value of 1E-06m/s for the WRS hydraulic conductivity. It is likely to have preferential flow paths in a WRS however these are expected to be impersistent and localised within the WRS until it</p>
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Item	Question / Response
	reaches the in-situ schist. Results are not expected to be significantly different to those presented in these reports.
4.6	**Why has there been no calibration or validation of any of the transient groundwater models under current conditions? Can you please provide further information regarding the groundwater levels used to calibrate the models? Has any further analysis of seasonal variation of groundwater levels been completed to understand the impact of steady state calibration to these levels?**
	A rigorous calibration of the 3D regional groundwater model has not been undertaken largely due to the paucity of hydrogeological data and insufficient historical records from the operating mine site. Available long-term piezometric head records at the site are scarce. Nonetheless, some nearby bores around the Round Hill Pit have ~20years of data. Observations from these bores reveal there has been a small impact from the mining activities at Round Hill Pit and Golden Point Pit. This behaviour aligns with the expectations for materials with low hydraulic conductivity and with model predictions that mining-induced depressurisation remain localised around the pit areas. *A transient model calibration check was undertaken for the main site model by comparing modelled discharge rates from FRUG to actual pumping data from FRUG.* *Groundwater levels used in calibration are provided in Appendices C&D of the reports (Appendies11-13 of the AEE). For the piezometers with continuous data water levels have been plotted against rainfall and some small variations as a response to rainfall are observed for the relatively shallow bores. Some of these graphs are presented in Appendix A of this response.*
4.7	**There is very limited groundwater level or quality data to support the Golden Bar groundwater model. Given the paucity of data, is this model realistic?**
	We concur that the groundwater level data is limited to an area immediately adjacent the open pit with the exception of a single bore hole located approximately 2 km to the North West of the Golden Bar pit (RCH3004). However, estimates of groundwater inflow during pit flooding (based on the model calibration achieved) have been used within the water balance model which has achieved a close calibration between observed and modelled pit lake water levels during a period in 2010 and 2011 (Appendix A-3 in the GHD Report "Macraes Phase IV. Golden Bar – Surface and Groundwater Assessment. 26 March 2024" – Appendix 12 of the AEE. Based on this, it is considered that the groundwater calibration achieved for Golden Bar is adequate for the purposes of this assessment.
4.8	**What is the effect of modelling the TSF as constant head boundaries, given that pooling was not actually occurring on the TSF?**
	Modelling the TSF as constant head boundary is a common practice in hydrogeological modelling to represent a relative constant water level. Even when pooling is not evident on the surface this approach leads to more conservative results as this assumption is more likely to lead to an overestimation of the hydraulic head in the TSF (rather than an underestimation), which in turn may lead to an overprediction of seepage rates and therefore increase the potential for contaminants to migrate.
4.9	**There have been compliance exceedances for sulphate at DC08 over the summer, and large increases in sulphate during summer low flows over the past few years. How does this information compare with projected exceedances?**
	Flows in Deepdell Creek have been very low between January and May of 2024. Rainfall for the 12 months preceding May 2024 is 333.2 mm based on the Golden Point rain gauge, which is the lowest for the available record since 2010. This is also low compared with the theoretically modelled range of rainfall and is considered to be at or near the driest modelled rainfall sequence. *There was a measured sulphate concentration (1310 g/m^3) at DC08 on 22/02/2024 at which time the Deepdell Creek flow gauge was indicating no flow. This is outside of the range of modelled sulphate concentrations during the mining period, though below the estimated peak concentration of 1,500 g/m^3 noted in Section 5.11.4 (Macraes Phase IV Stage 3 – Surface and Groundwater Assessment, GHD (2024)). Throughout this period there has been discharge observed from the historic Golden Point Adit, which has elevated sulphate concentrations, and it is expected that this discharge contributes a relatively significant load to Deepdell Creek that has not been represented in the modelling and alternative management of this source will be required.* *Electrical conductivity and flow readings taken on the 21st March 2024 indicate that at Deepdell Creek, the identified adit contributed approximately three quarters of the measured sulphate load.*

Item	Question / Response
	Prior to the most recent summer period, the concentrations recorded at DC08 align with the modelling of the mining phase, without the additional dilution measures.
4.10	**Are the modelled flow rates from WRS and pit lakes supported by current flow regimes within the creeks?**
	Currently the only pit lake with an established overflow is the Golden Bar pit. The flow regimes from this lake have not been directly recorded, however, the lake development has been used as a calibration input to the model and based on this it is expected that the lake discharges will suitably represent current flow conditions if modelled with current rainfall. *Seepage flows from the WRS's are based on groundwater recharge rates and site measurements of WRS seepage flows. A statistical variation is applied to these seepage rates to capture the uncertainty in the stochastic model, however, the data available to date is not sufficient to assess how seepage flows respond to changes in rainfall and climate patterns (e.g. reductions in flow due to long term dry periods). Between the immediate seepage discharges and downstream receiving environment nodes, the modelling looks to capture physical influences that would affect the flow regimes, including flow through and discharge from silt ponds, and pond evaporation. Detailed flow monitoring beyond cumulative seepage discharges is not available to confirm how accurately these flow regimes are represented, however, the hydraulics applied in the modelling are considered suitable for the purposes of this study.*
4.11	**At which point in each stream is the reduction in flows due to dewatering calculated?**
	Stream flow reduction due to dewatering has been included at node DC07 within Deepdell Creek within the WBM. No other notable reductions are expected in other receiving surface water bodies as a result of the proposed activities.
4.12	**Why is Maori Hen silt pond independent of the Coronation pit in the water balance model? Similarly, why is Coronation North SP independent of Coronation North Pit?**
	Coronation Pit does not discharge to Maori Hen silt pond and Coronation North Pit does not discharge to Coronation North silt pond. These silt ponds receive surface runoff and seepage from WRSs adjacent to these pits. *Figure 5.1 in GHD Report "Macraes Phase IV. Coronation – Surface and Groundwater Assessment. 26 February 2024" is not a complete reflection all connections that exist within the Water Balance Model, but rather illustrates the modelled nodes and pathways for concentrated surface waters. Surface catchments are not shown in this figure, but are represented in detail for each node in the model.* *The Maori Hen Silt Pond will receive surface water runoff and seepage water from Coronation North WRS upon mine closure. The future discharge from the Coronation Pit will be to Camp Creek (then Deepdell Creek) via an unnamed tributary. There will also be seepage from Coronation Pit to Trimbles Silt Pond via the Trimbles WRS once the lake level has risen sufficiently (this seepage route is shown on the model schematic figure for clarity given it was discussed in the report). The Coronation North Silt Pond will receive runoff and seepage from the Coronation North WRS upon mine closure. The intention is for the Coronation North Pit to be backfilled, hence on closure it is represented as a WRS catchment with associated surface and seepage water discharges (which discharges to the Coal Creek tributaries).*
4.13	**Can you please provide an analysis of historical groundwater quality monitoring and its implications for the model? Is there any evidence for preferential pathways that should be considered?**
	Groundwater quality monitoring data from throughout and surrounding the site has been collated and presented in Appendix B of this response. The data are in agreement with the modelled predictions in that elevated sulphate concentrations (in groundwater) are largely restricted to locations within close proximity to the site infrastructure (WRSs and TSFs). As discussed above, seepage is likely to have preferential flow paths in WRSs, however these are expected to be localised within the WRS until it reaches the in-situ schist surface which then determines the flow pathway(s). There is no evidence for preferential flow paths in the in-situ schist to be considered.

4.14	**Can you please provide more information regarding the water quality datasets used to derive the water quality source terms for the surface water quality modelling?**
	Water quality sampling has been undertaken at the site since 1990. This study considered data through to April 2022, when works commenced on the modelling. This data set includes 50 surface water sites and 87 mine water sites where more than 5 samples are available. Sites are typically sampled monthly or quarterly as required by existing consent conditions or as per the site water management plan. In general terms the following key water types are considered in the modelling: *Natural Catchments (not influenced by mining) – Water quality derived from control points (e.g. DC01) and earlier data sets where mining influences were reduced.* *Unrehabilitated WRS Runoff – Water quality derived from silt pond WQ measurements in the early phases of WRS development where the major source of water is considered to be surface runoff from surfaces that have not been grassed.* *WRS Runoff – Water quality measurements from silt ponds where contributing surfaces have been rehabilitated (grassed), with consideration given to seepage water contributions.* *WRS Seepage – Derived by relationship to WRS average heights (MWM, 2023 – Waste rock Stack Seepage Quality. Report prepared for Oceana Gold New Zealand Ltd, 23 February 2023.)* *Pit Lake Water Quality – Based on specific pit lake models (MWM 2022 - Frasers Open Pit Tailings Co-Disposal: Geochemistry) or MWM 2024 -Macraes Phase 4 FRIM Pit Lake Model) or poxy data from existing pit lakes waters.*
4.15	**The GHD (2024a) report regarding Coronation assumes that water quality of the overflow from the Coronation Pit Lake through the Trimbells WRS remains consistent and does not deteriorate further before entering the Trimbell silt pond and ultimately Trimbells Gully. Can you please quantify the effect of further water quality deterioration along this flow path?**
	Any deterioration of pit lake water draining through the Trimbells WRS (above the stated assumptions in terms of seepage water quality) has the potential to impact water quality in the receiving surface water environment and compliance limits at both MB01 and MB02 (MB02 compliance exceedance could potentially be mitigated with the addition of dilution water from the consented Coal Creek Dam if constructed). The extent of the impact in terms of receiving water quality and compliance, will be dependent on the flux of sulphate (and other potential contaminants of concern) reporting and spilling from Trimbells Silt Pond (and the control of this discharge during low flow conditions). *Potential engineering solutions that could be considered to reduce the risk and/or prevent / limit either the volume of seepage water and/or the deterioration of the seepage water are:* *-Saturation of the Trimbells WRS toe, reducing oxygen ingress.* *-Construction of a low permeability / impermeable barrier on the upstream face of the Trimbells WRS.* *-Collection and treatment of the seepage water within Trimbells Silt Pond* *are potential options.* *The modelling assumes appropriate measures are in place to prevent the deterioration of the through flow water quality.*
4.17	**Please provide an updated monitoring proposal for the activities including relative elevations of monitoring sites (screen intervals for monitoring bores) and discussion regarding catchments and pathways monitored by those locations to ensure that these monitoring points are meaningful?**
	Monitoring is ongoing in relation to established facilities in accordance with the existing compliance and monitoring schedules associated with the existing resource consents. Existing resource consents include provision for monitoring requirements to be amended via review of the Water Quality Management Plan. Similar conditions can be expected on any new discharge permits. Therefore, development of surface and groundwater monitoring plans are expected to be a condition of the consent once granted. As with existing consents, these plans would be developed by a suitably experienced person and be submitted to Otago Regional Council for approval prior to the consents being exercised.
5.2	**Please update Appendix F of Appendix 13 to include summaries of current state (as has been done in Table 5.8 and 5.9 of Appendix 11). If the information requested above reveals an increase in nitrate from current, please assess the potential impacts on periphyton growth in the receiving environments (noting that this is identified as an issue in Appendix 22).**
	An update to Appendix F of Appendix 13 has been included as Appendix D of this response. This included 'current' water quality statistics based on data captured between May 2020 and May 2024. In

some cases the 'current' data can be considered to have a comparable basis to the 'mining phase' data, though the following should be noted:

The data samples are limited so the statistical spread of current data is generally not as wide as the modelled data.

Modelled values at NBRRF, NB03 and MC02 for the mining phase include the described mitigation measures which are not currently in place.

The 'current' statistics presented are significantly influenced by lower detection limits for some constituents.

5.3 **The water quality data contained in Appendix F suggests there is a high probability of copper causing significant adverse effects at MC02 and more than minor effects at NB03 during closure and after closure. To what extent does the current proposal contribute to long-term copper concentrations (i.e., what are the modelled concentrations under a scenario where the proposed activities do not occur)?**

On review of this question and question 5.10 it was found that a model error specific to the relationship between copper and sulphate at the Clydesdale WRS caused elevated copper concentrations in the WRS seepage (approximately an order of magnitude above the expected concentrations for the height-based relationship as developed by MWM (2023)). This affected the GB01, MC02 and NB03 copper concentrations modelled downstream of the Clydesdale WRS

The following tables provide revised numbers for copper concentrations presented in Appendix F-3 of Appendix 13

Table F-5 Predicted Water Quality Statistics for MC02 (Selected Mitigation)

Constituent	Statistic	Phase (g/m^3)		
		Mining	Closure	Long Term
Copper	Median	0.0010	0.0011	0.0011
	95th %	0.0012	0.0013	0.0013
	Maximum	0.0013	0.0015	0.0015

Table F-6 Predicted Water Quality Statistics for NB03 (Selected Mitigation)

Constituent	Statistic	Phase (g/m^3)		
		Mining	Closure	Long Term
Copper	Median	0.0010	0.0016	0.0017
	95th %	0.0012	0.0034	0.0035
	Maximum	0.0024	0.0048	0.0048

The following tables provide revised numbers for copper concentrations presented in Section 5.9.5 of Appendix 12

Table 2 Predicted GB01 Water Quality Statistics

		Mining (2026 - 2027)	Closure (2045-2050)	Long-term (2125 - 2130)	Long-Term + CC (2125 - 2130)	Current (2022 - 2025)
GB01	Copper Median*	0.0010	0.0016	0.0016	0.0016	0.0016
	Copper 95 percentile*	0.0012	0.0023	0.0024	0.0024	0.0023
	Copper Max*	0.0017	0.0029	0.0029	0.0030	0.0030

[#]All results in mg/L

These results indicate compliance with the consented unadjusted (for hardness) cooper standard (0.009 g/m^3) and now better represent the range seen in the current monitoring data at these locations. Considering these corrections and the proposed consented activities within the Waikouaiti River North

Branch, it is not expected that the proposed changes will raise the copper concentrations above the statistical distribution expected for current consented activities.

5.4

Section 4.2.6 of Appendix 13 notes that "the proposed dewatering [of Frasers, Golden point and Innes Mills open pits] may reduce the total base flow of local creeks/streams by less than 8%". It then goes on to state "modelled reductions in seepage discharges to creeks are expected to have negligible impacts on creek and river flows through summer low flow periods". This is reinforced in Appendix 22 which states there will be "no material changes to the hydrological character of the receiving waters". However, little evidence is provided for this statement in relation to Deepdell Creek and the ecological effects are not considered further. Please provide an assessment of potential impacts on (Deepdell) stream flows in terms of % reduction in naturalised MALF or, if more relevant, duration of drying. Based on this assessment additional comment may be needed on whether flow augmentation is needed to mitigate hydrological effects as well as water quality effects.

Activities associated with Coronation open pit

Relevant reports

- **Appendix 11: GHD – Water quality and balance modelling; and**
- **Appendix 20: Ryders - Water quality and ecology assessment**

The modelled baseflow reduction is largely already realised within the current conditions in Deepdell Creek (ie. flows in Deepdell Creek are already affected by base flow loss as a result of the existing GPUG, Golden Point and to a lesser extent Frasers Pit and FRUG).

Furthermore, the baseflow reductions reported in the groundwater modelling compare the difference between a steadystate scenario (average conditions) that does not include effects from the Frasers Underground (FRUG) and/or Golden Point Underground (GPUG) Mines with the proposed MPIV developments. I.e. any effects (from the current FRUG and GPUG developments) are conservatively not included in the current steadystate scenario.

Hence, the 8% base floss (as reported) assumes GPUG and FRUG have not been developed and flow conditions are average long term hydraulic conditions, In reality, surface water baseflow is more reflective of long-term dry conditions.

The GHD Report (GHD 2023 - Golden Point Underground Extension – Analytical Assessment of Effect on Deepdell Creek 12 October 2023) reported that the GPUG Extension development was expected to reduce baseflow conditions by 5-9% - based on the WSP / Golder report (WSP Golder 2022. Golden Point Underground Mine (GPUG) GPUG Extension Hydrogeological Assessment. PS130025-003-RRev0), this reduction is applied to the mining state scenarios within the WBM.

Therefore the Water Balance Modelling undertaken does consider this reduction in baseflow.

In terms of calculating low flow statistics (ie. MALF), it should be noted that the WBM is not well calibrated to the extreme end of the observed flows within Deepdell where observations suggest that the flow currently goes to zero during extreme dry periods (the WBM assumes a WRS seepage discharge at all times that prevents the modelled flow going to zero).

Bearing in mind the above, the relative modelled change in calculated baseflow between current phase (model years 2020 to 2024) to the mining phase (model years 2026 to 2028) is balanced by the inclusion of the Camp Creek dilution reservoir (when assumed operational), changes in seepage flows associated with the waste rock stacks (seepage from WRSs is modelled to increase with time), as well as minor changes to operational controls and surface water catchment areas. The modelled calculated MALF (taking into account all the model realisations) is provided in Table 3 and shows no relative change between current and the mining scenario when Camp Creek is not utilised.

Table 3 Calculated MALF

Model Phase	MALF (L/sec)
	8.2
	8.3
	18.6

5.6	**Appendix 11 notes the Coal Creek dilution dam has not been assumed as it is not needed to remain within existing compliance standards. However, that ignores the previously identified issues around those compliance standards. Please model this scenario or describe why it is not feasible to do so (e.g., cost, time > 3 days, etc.).**
	There have been significant updates to the Macraes Water Balance Model (in terms of flow and water quality assumptions), groundwater seepage estimates, seepage water quality estimates (based on revised waste rock stack area, height and age relationships) as well as the proposed infilling of Coronation North Pit, expansion and partial backfilling of Coronation Pit and recalculation of runoff and seepage drainage pathways since previous modelling was undertaken in support of consenting the Coronation North project. The results provided in the GHD Report "Macraes Phase IV. Coronation – Surface and Groundwater Assessment. 26 February 2024" are therefore not directly comparable to previous estimates used to inform AEEs for the existing suite resource consents predating MPIV. *The consented Coal Creek dilution dam is still available to OCG and provides a contingency option if required.*
5.13	**Please provide a (short) assessment of the potential for sediment discharges from the Northern Gully silt pond to generate adverse effects such as conspicuous changes in visual clarity or significant adverse effects on aquatic life.**
	There will be fresh sediment discharges to the Northern Gully Silt pond resulting from the proposed re-disturbance of the Northern Gully WRS. The Northern Gully Silt Pond becomes the key mitigating feature and, assuming it is appropriately sized for the contributing area, is expected to result in appropriate discharge water quality. If required further mitigation measures are available at this location, including flocculants to improve sediment removal, or pumping waters from the pond to other storage reservoirs on site. GHD understands that these are standard operational controls for physical water quality management as outlined in the sites Erosion and Sediment Control Plan.

Limitations Statement

This report: has been prepared by GHD for Oceana Gold NZ Ltd and may only be used and relied on by Oceana Gold NZ Ltd for the purpose agreed between GHD and Oceana Gold NZ Ltd.

GHD otherwise disclaims responsibility to any person other than Oceana Gold NZ Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Oceana Gold NZ Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.
Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Project name	Macraes PhIV Post Lodgement
Document title	Response to Section 92 request for further information – Macraes Phase IV | Section 92 Responses – Surface and Ground Water
Project number	12644380
File name	12644380-GHD-LET-REVB_MPIV Post Lodgement S92 Responses.docx

Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S4	RevA	Jeff Tuck Dora Avanidou	Tim Mulliner		Tim Mulliner		26/09/2024
[Status code]							
[Status code]							
[Status code]							
[Status code]							

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Appendices

Appendix A

Bores and consented groundwater takes

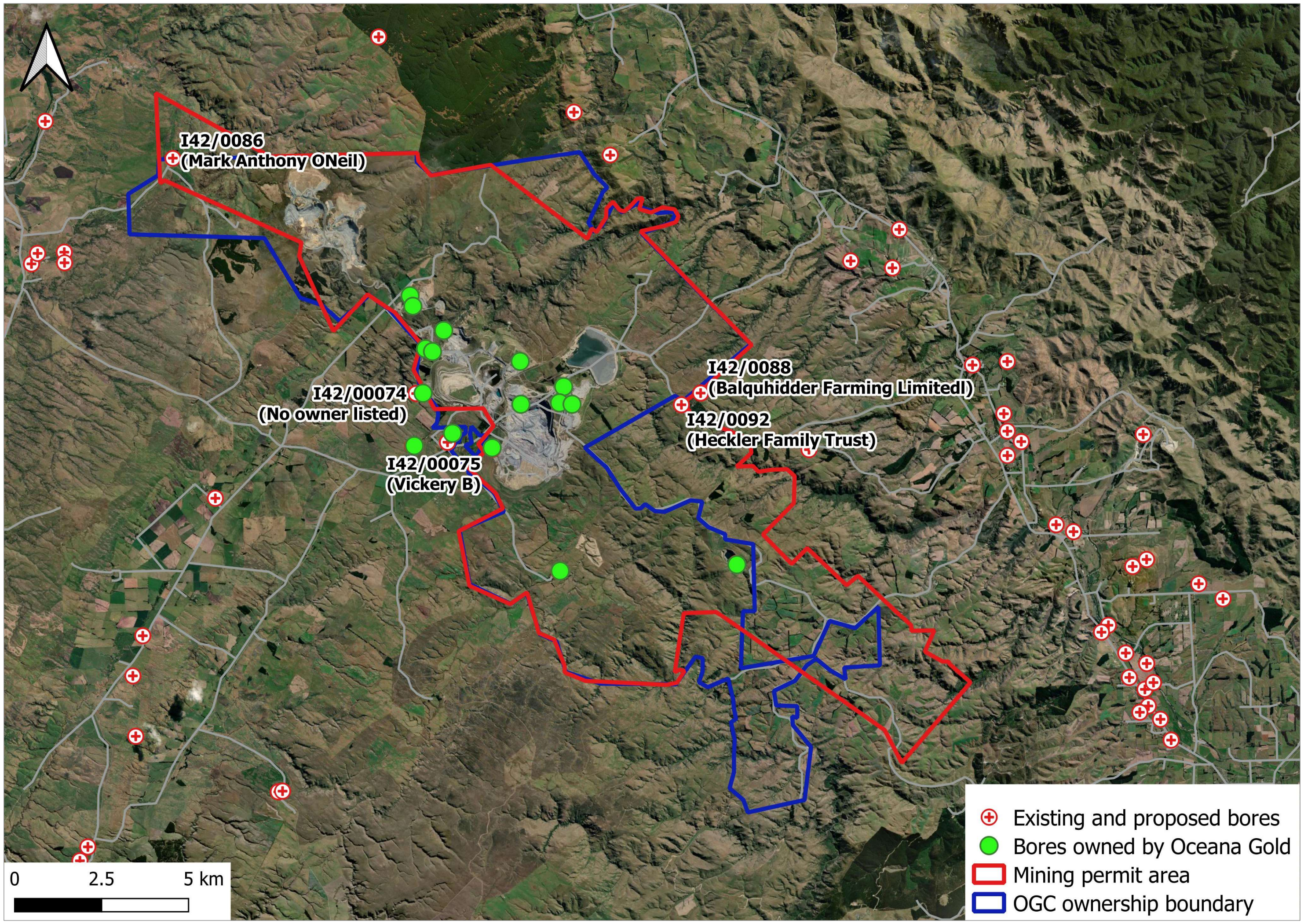


Figure A.1 Existing and proposed bore locations

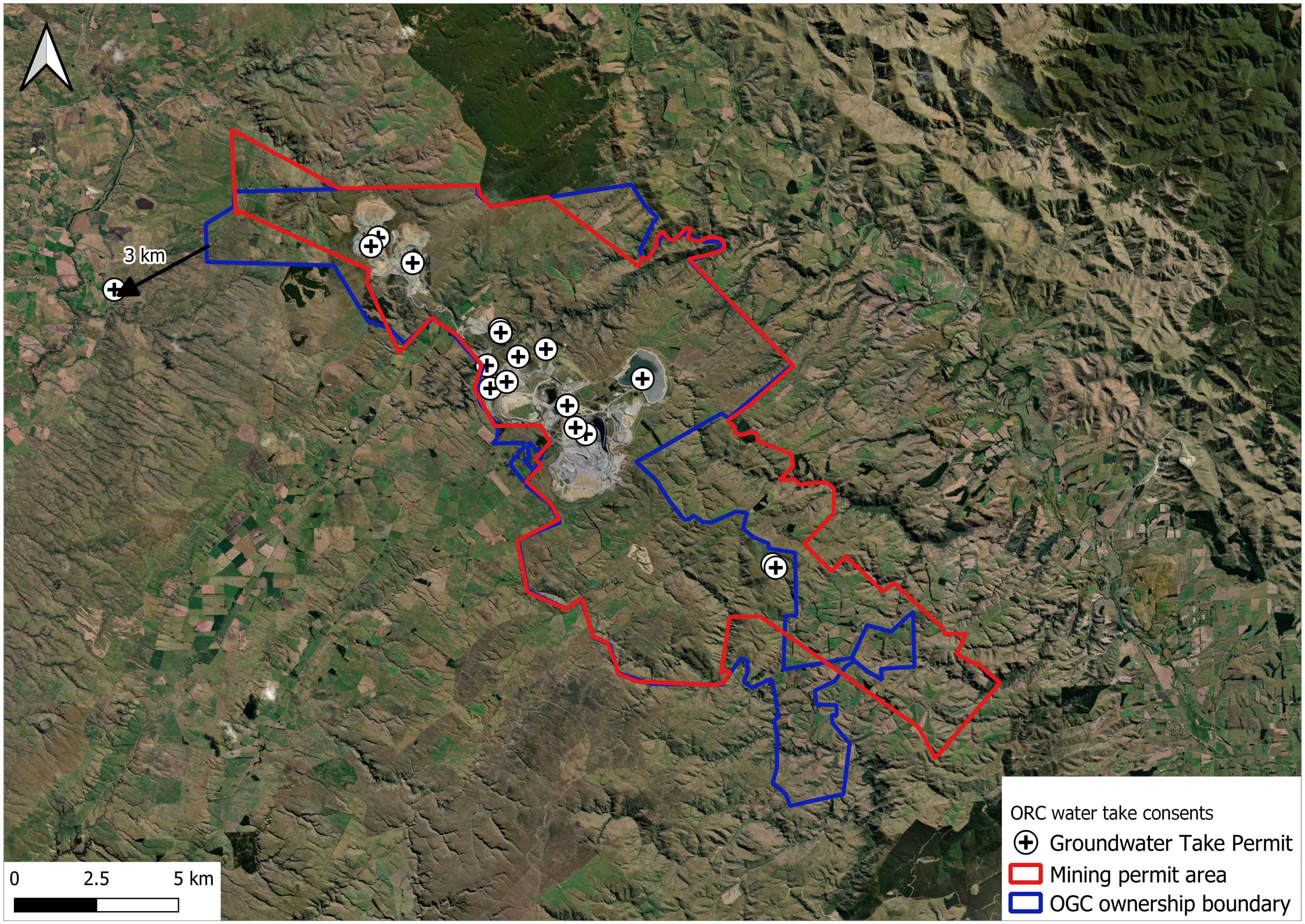


Figure A.2 Current groundwater take consents

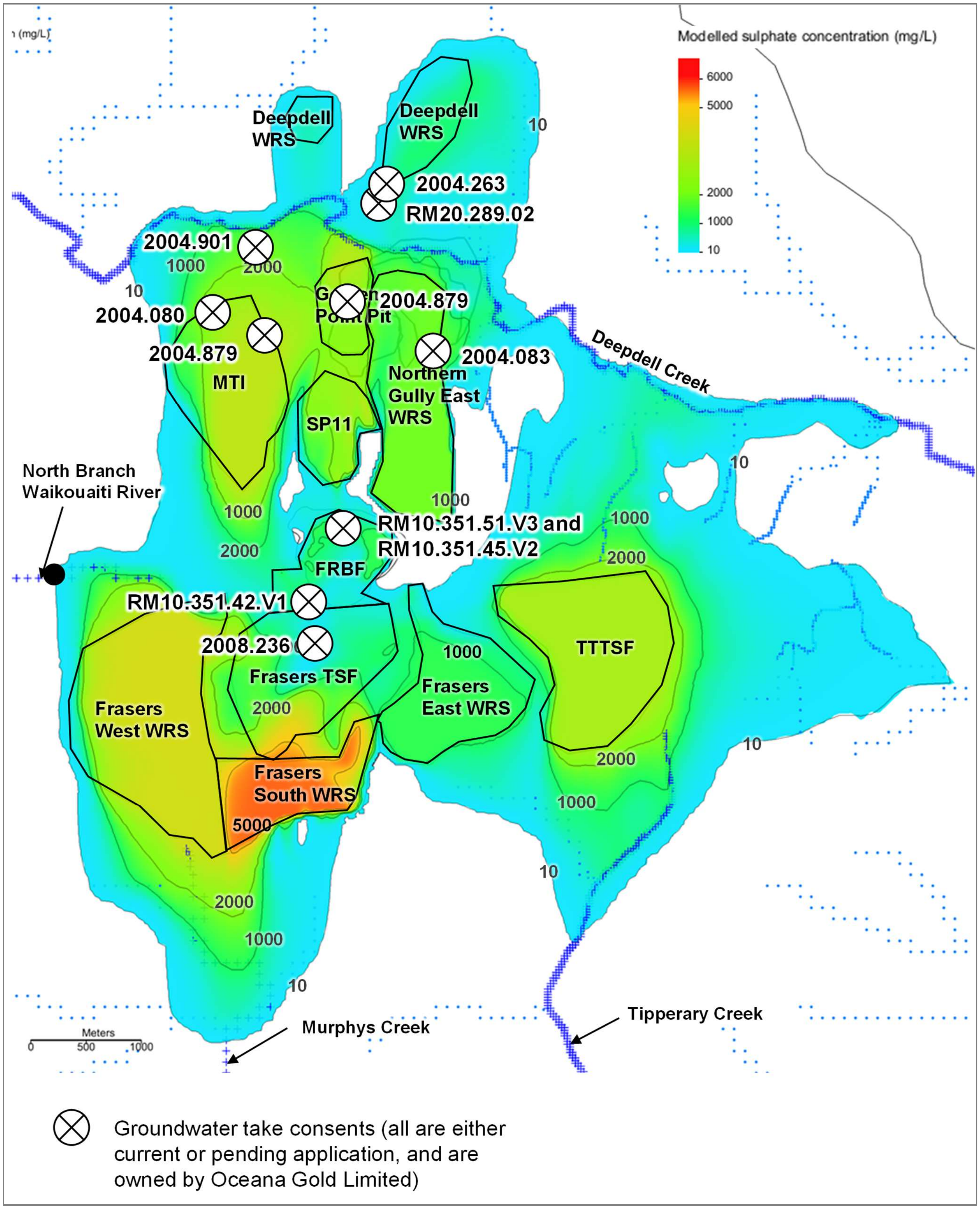


Figure A.3 *Groundwater take consents (existing and proposed) and maximum plume extent in model layer 6 after 400 years. Plume extent from Macraes Phase IV, Stage 3 – Surface and Groundwater Assessment – site wide model*

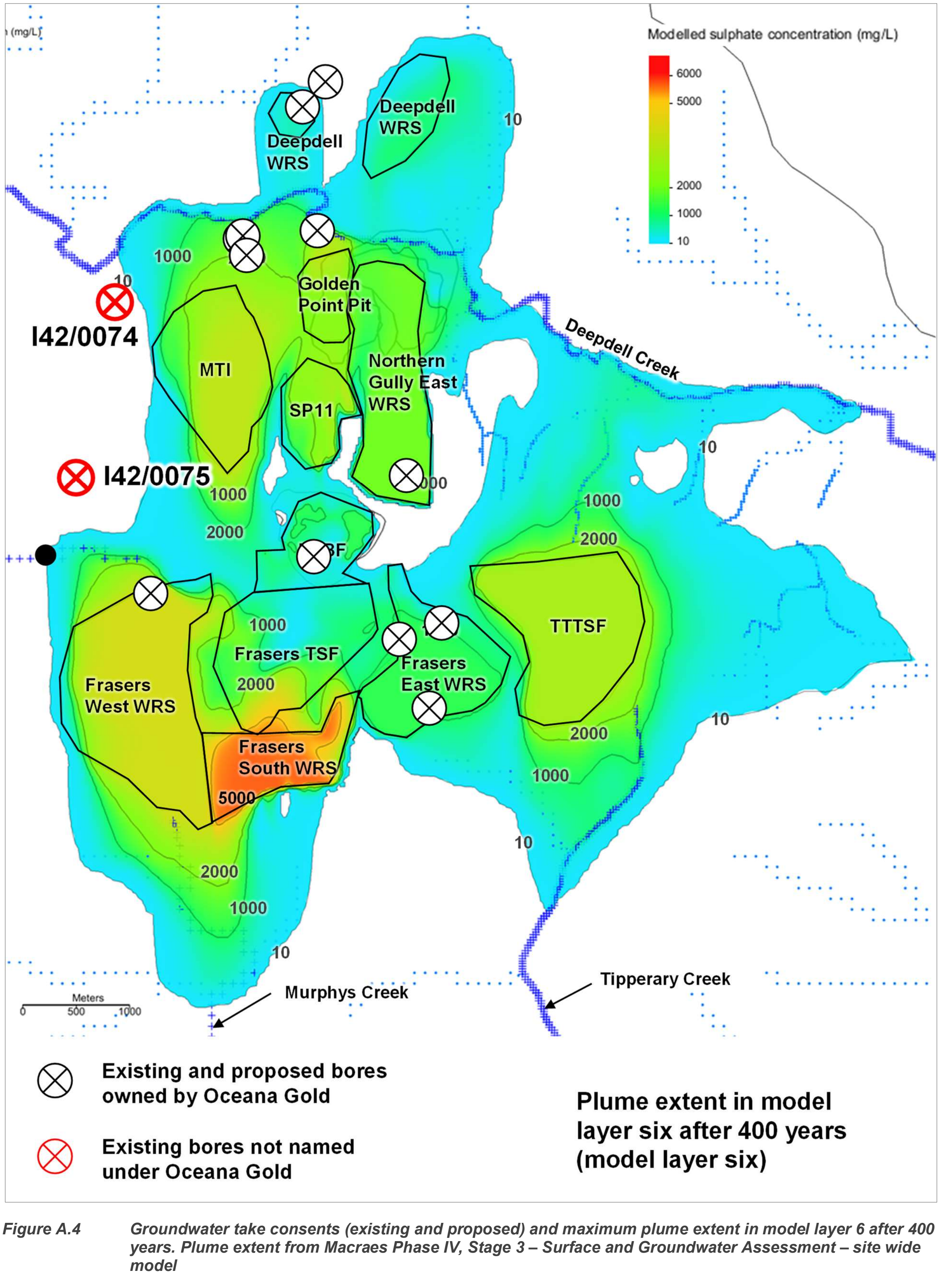


Figure A.4 *Groundwater take consents (existing and proposed) and maximum plume extent in model layer 6 after 400 years. Plume extent from Macraes Phase IV, Stage 3 – Surface and Groundwater Assessment – site wide model*

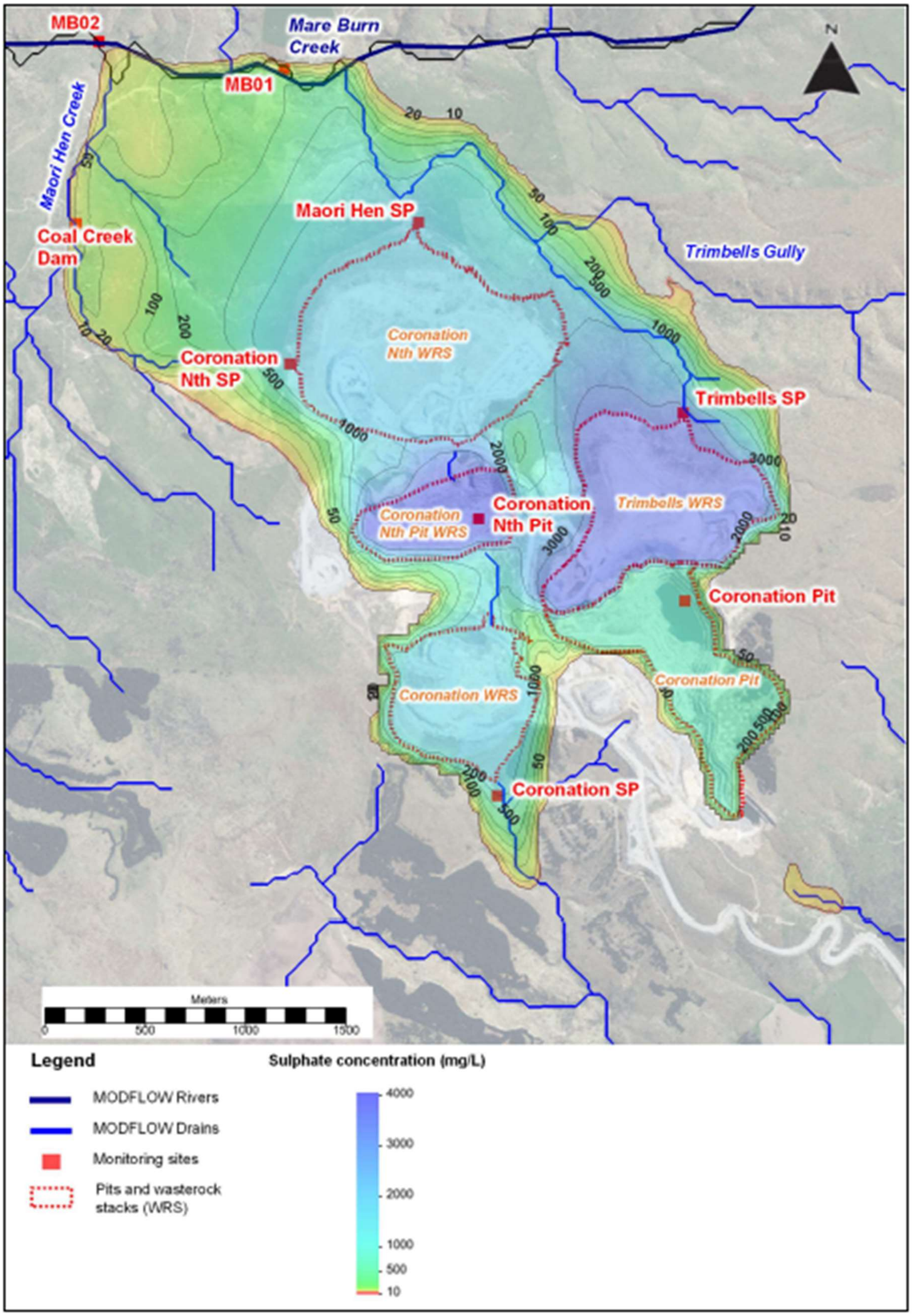


Figure A.5 *Groundwater plume extent after 400 years in model layer 1 – Coronation Stage Three Final report*

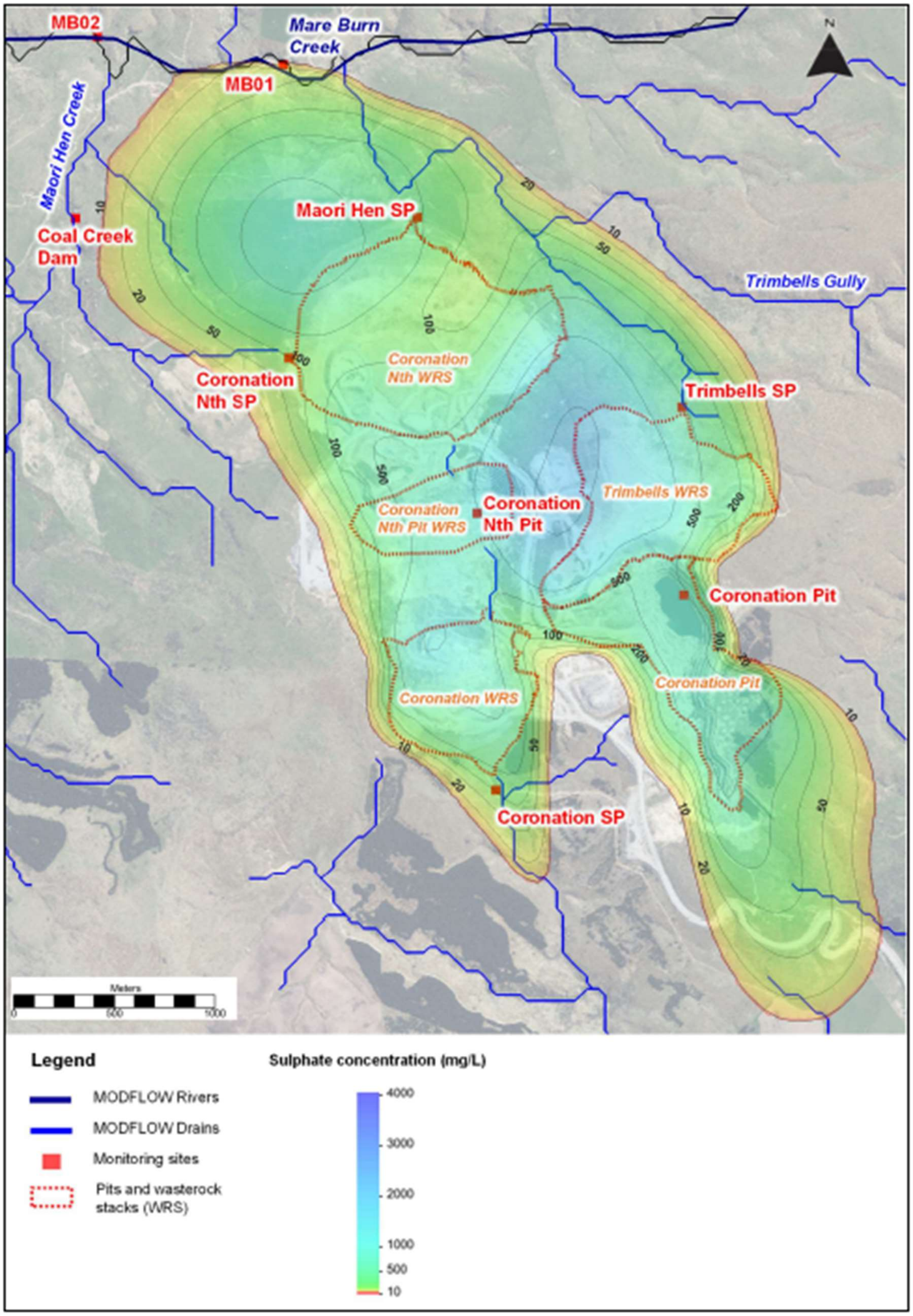


Figure A.6 Groundwater plume extent after 400 years in model layer 1 – Coronation Stage Three Final report

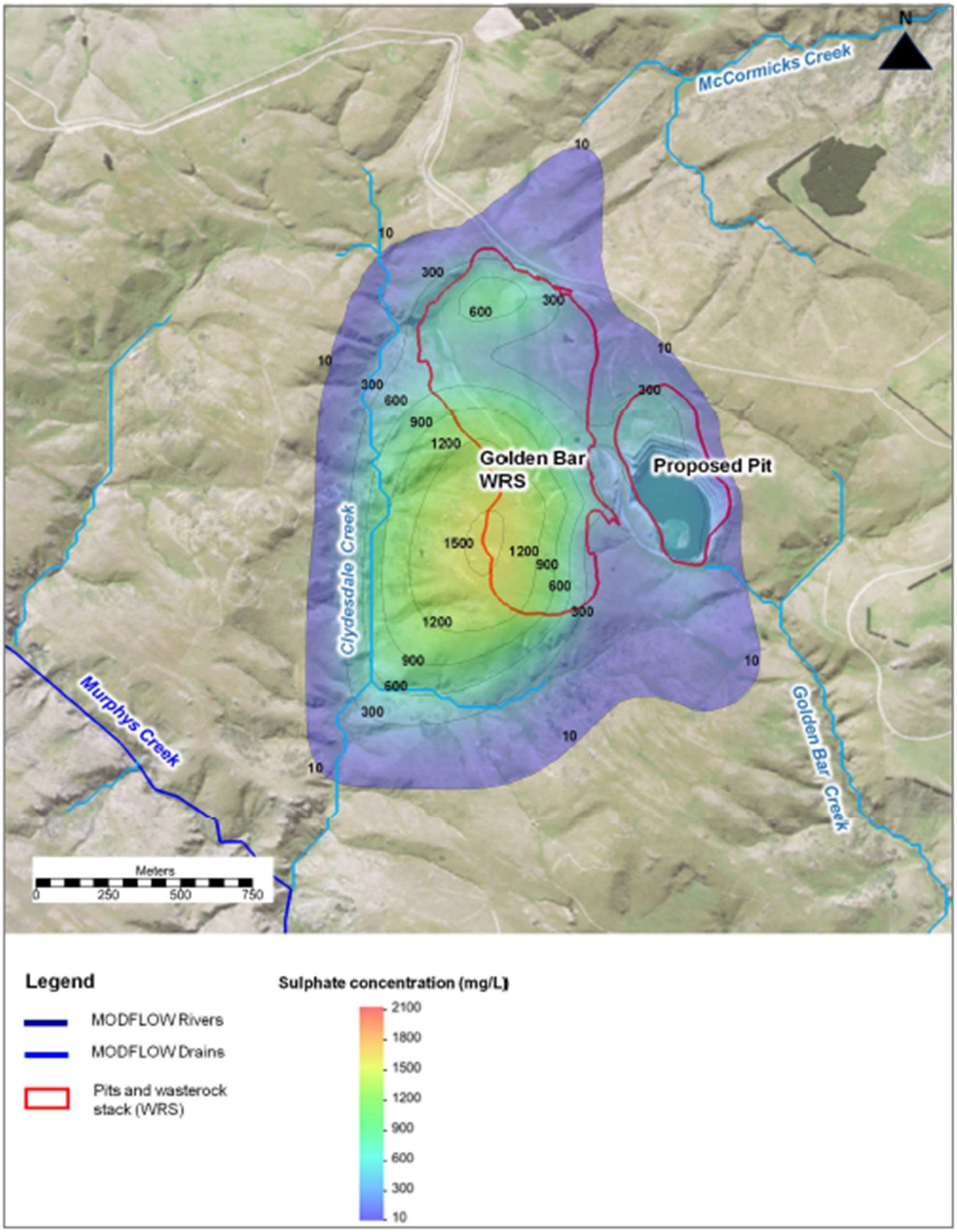
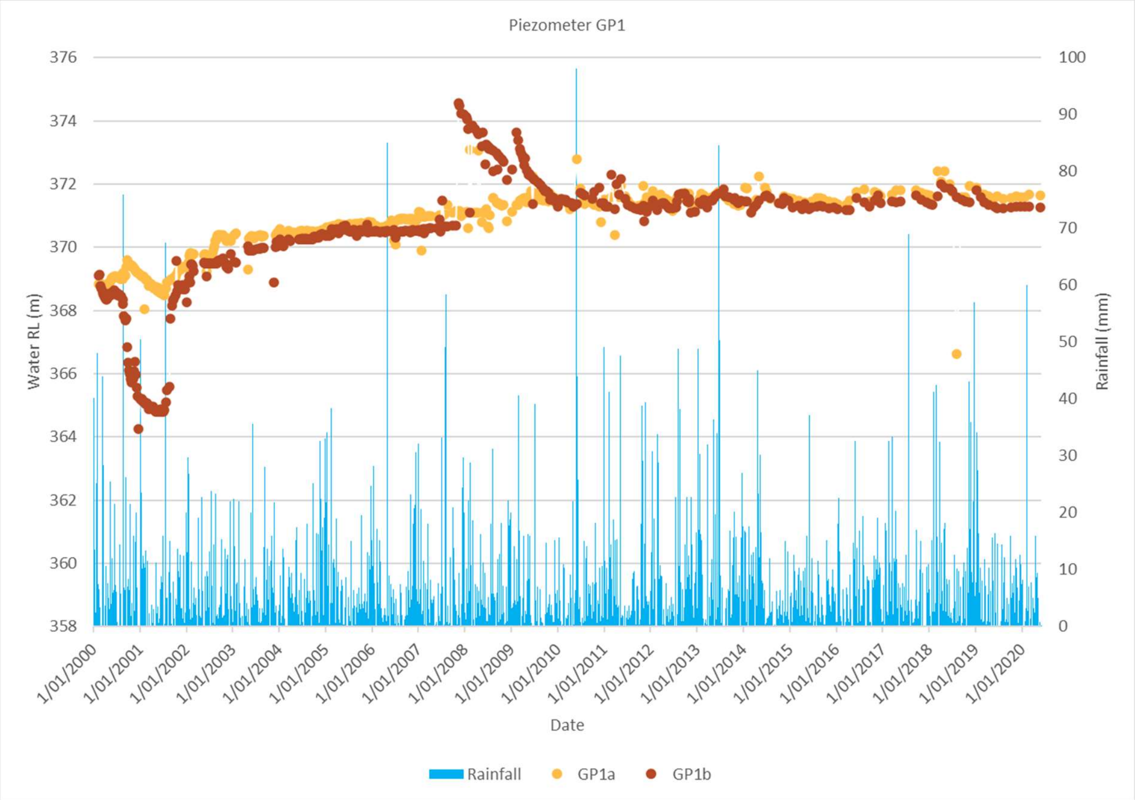
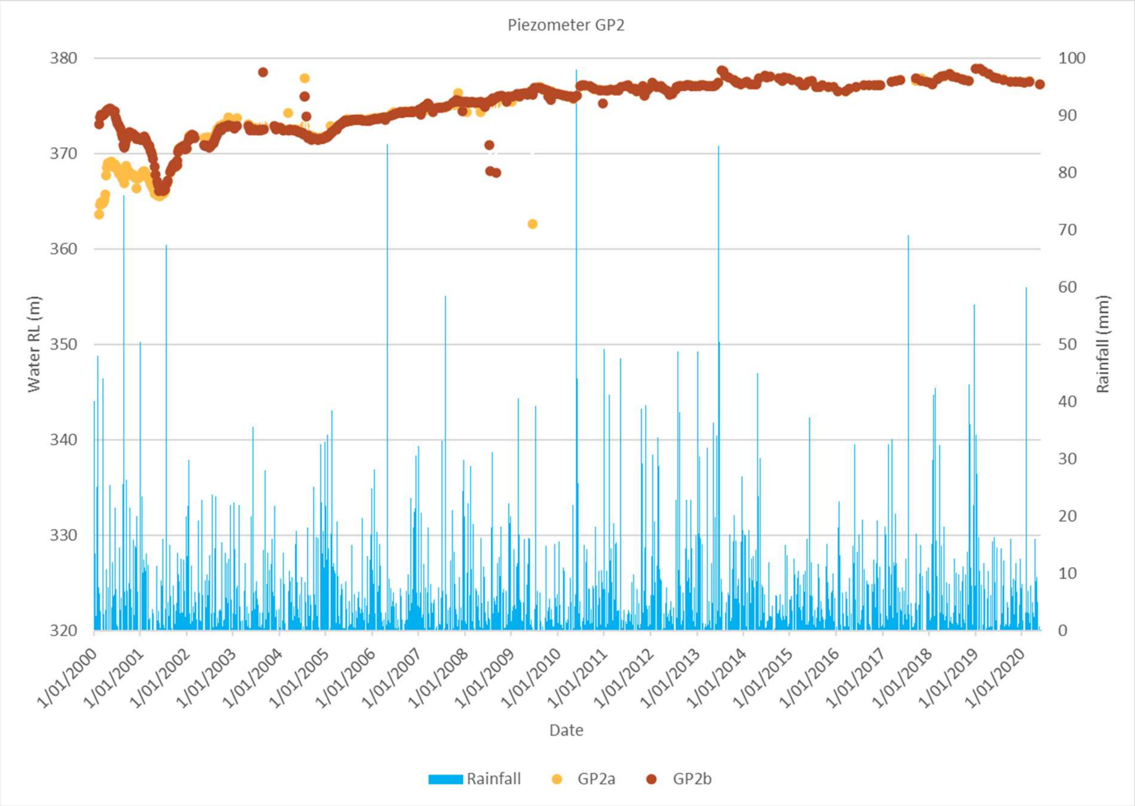


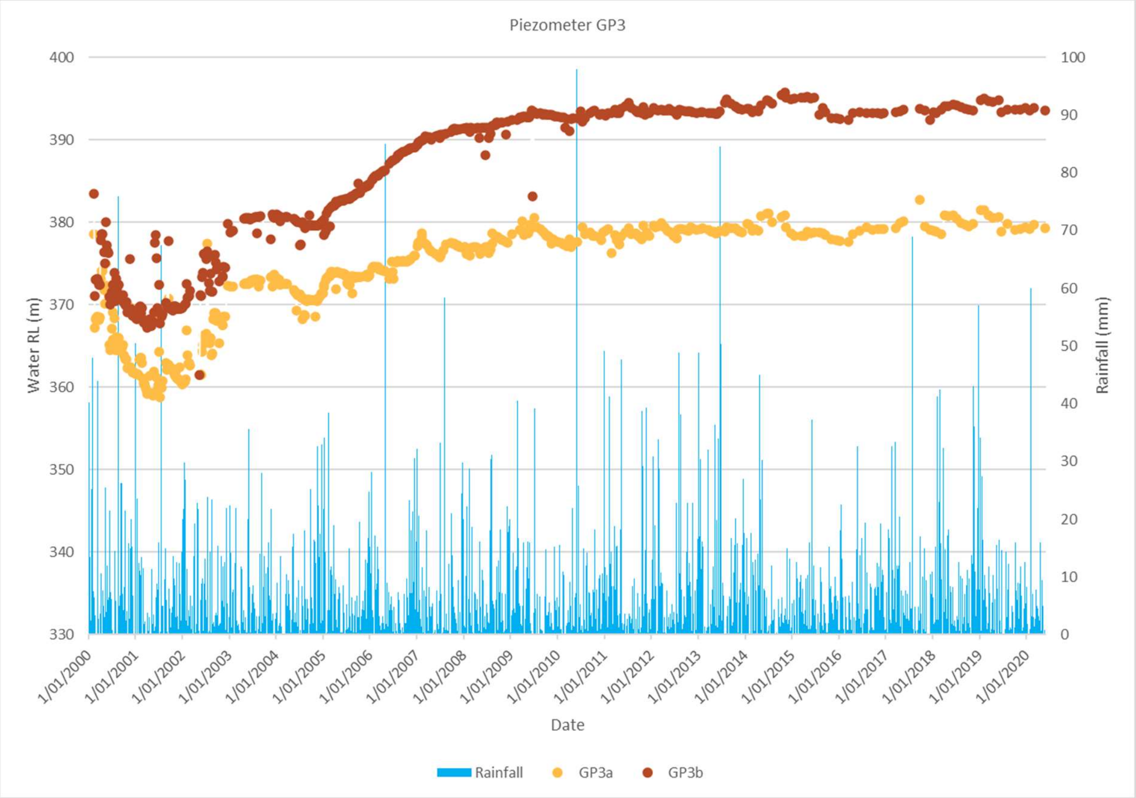
Figure A.7 Sulphate plume extent in model layer 4 after 400 years – Golden Bar

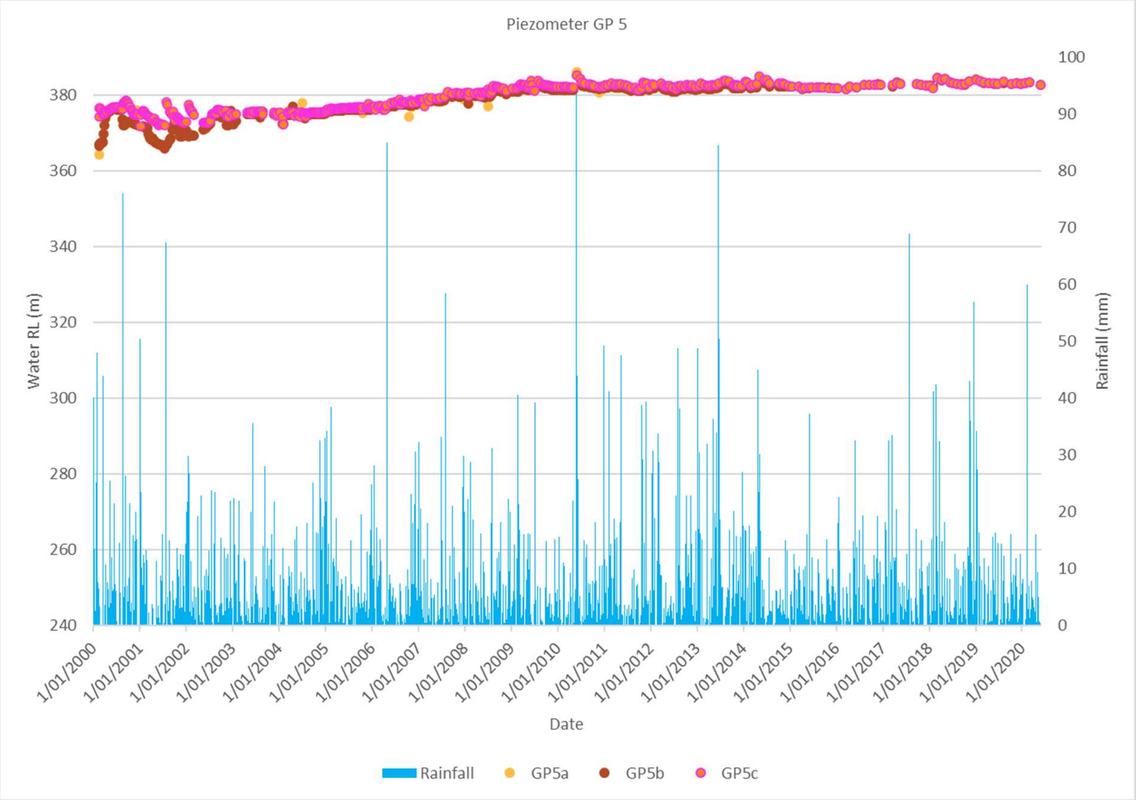
Appendix B

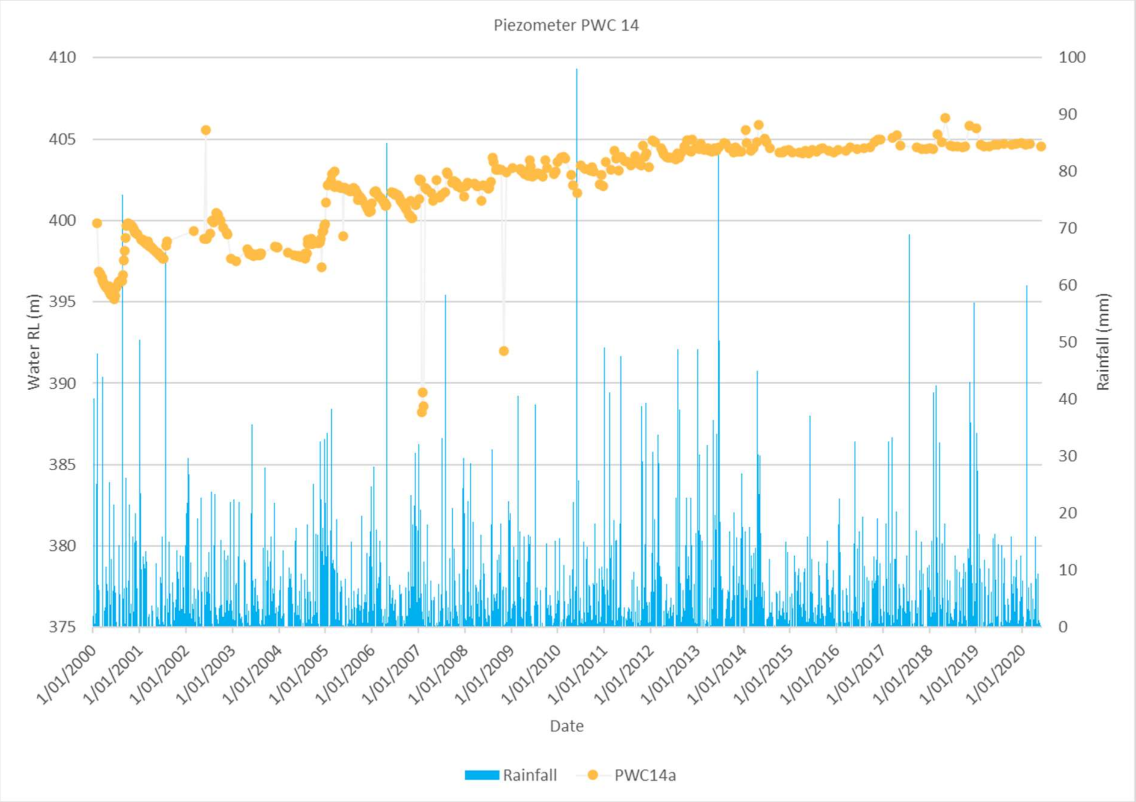
Groundwater Levels

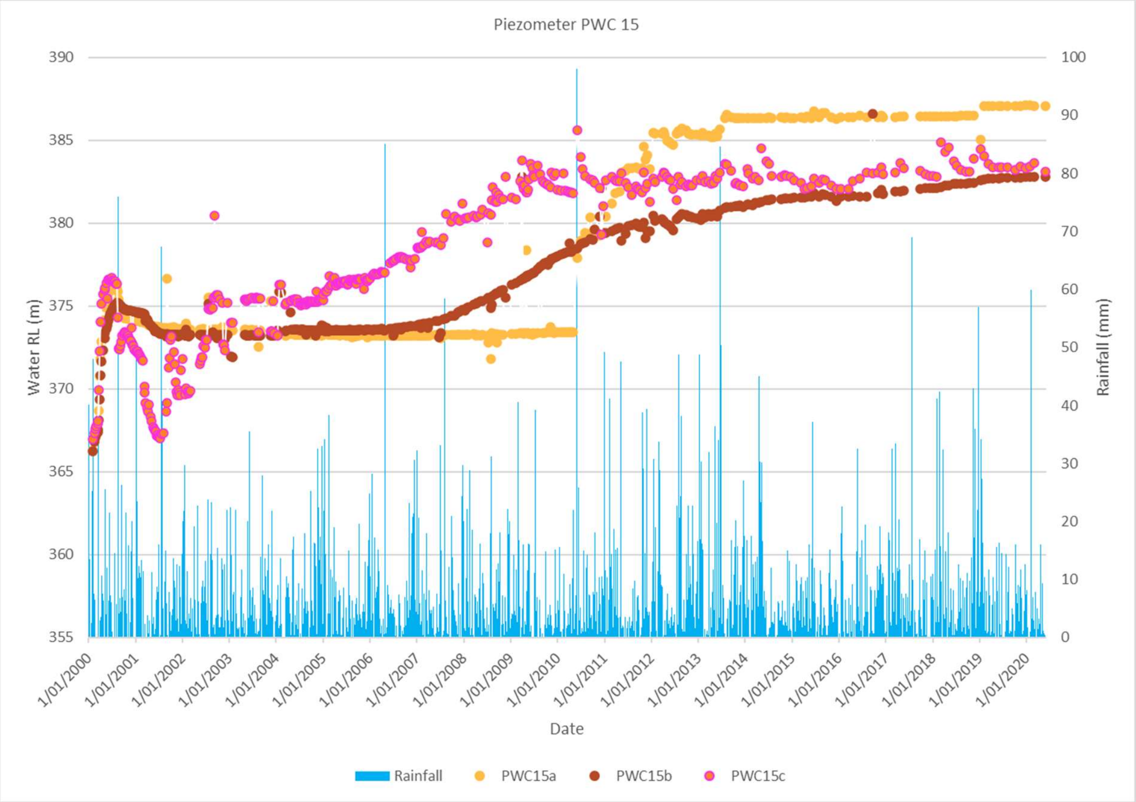

Piezometer GP1
Water RL (m)
376
374
372
370
368
366
364
362
360
358
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
GP1a
GP1b

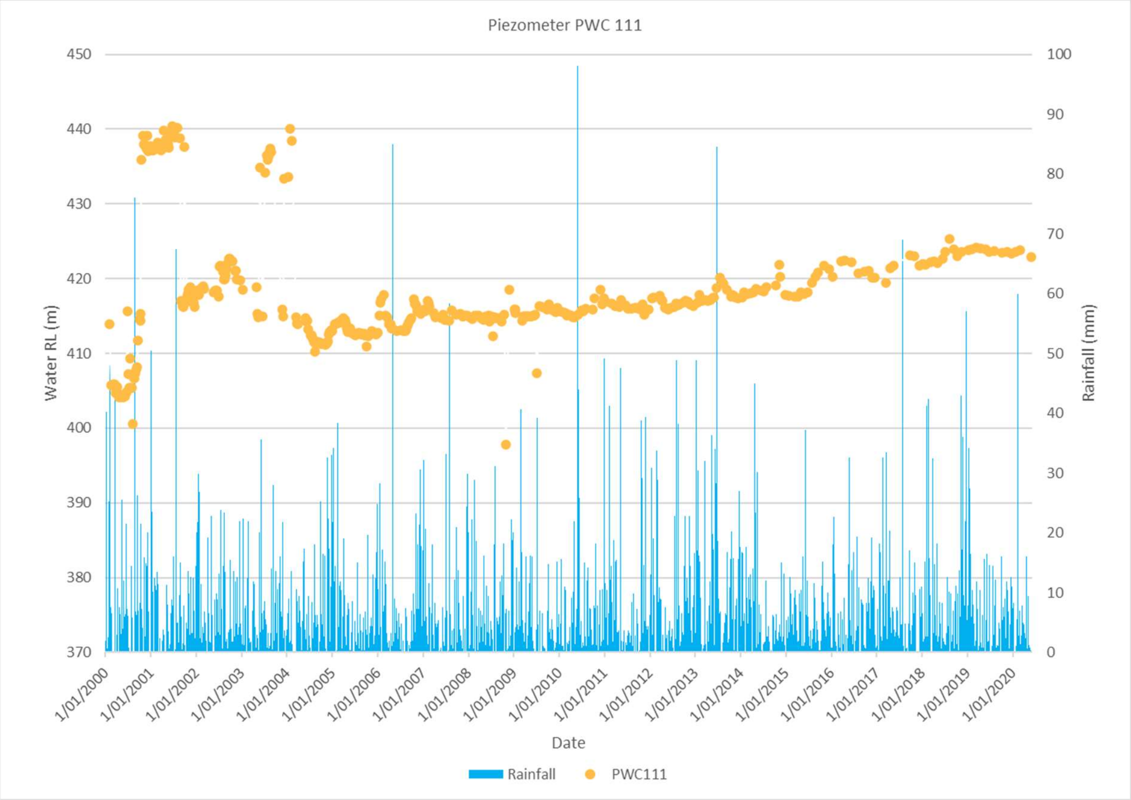

Piezometer GP2
Water RL (m)
380
370
360
350
340
330
320
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
GP2a
GP2b


Piezometer GP3
Water RL (m)
Rainfall (mm)
400
390
380
370
360
350
340
330
100
90
80
70
60
50
40
30
20
10
0
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
GP3a
GP3b


Piezometer GP 5
Water RL (m)
Rainfall (mm)
380
360
340
320
300
280
260
240
100
90
80
70
60
50
40
30
20
10
0
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
GP5a
GP5b
GP5c


Piezometer PWC 14
Water RL (m)
410
405
400
395
390
385
380
375
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
PWC14a


Piezometer PWC 15
Water RL (m)
390
385
380
375
370
365
360
355
Rainfall (mm)
100
90
80
70
60
50
40
30
20
10
0
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
PWC15a
PWC15b
PWC15c


Piezometer PWC 111
450
440
430
420
410
400
390
380
370
Water RL (m)
100
90
80
70
60
50
40
30
20
10
0
Rainfall (mm)
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
PWC111

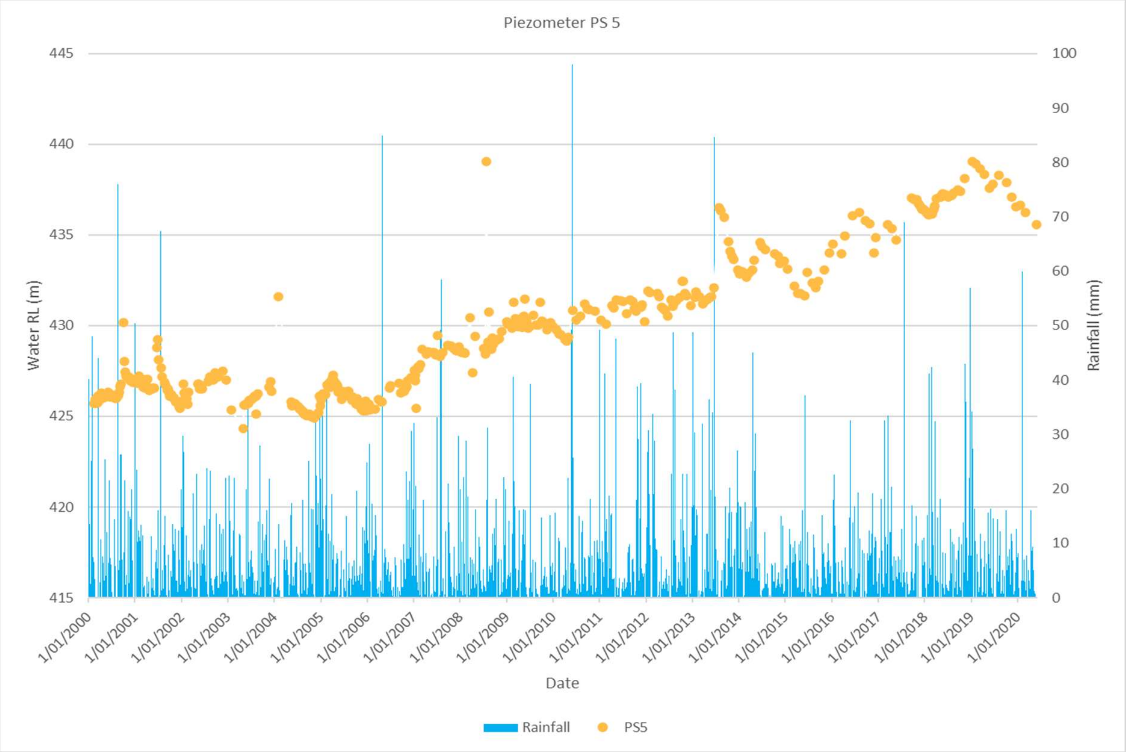
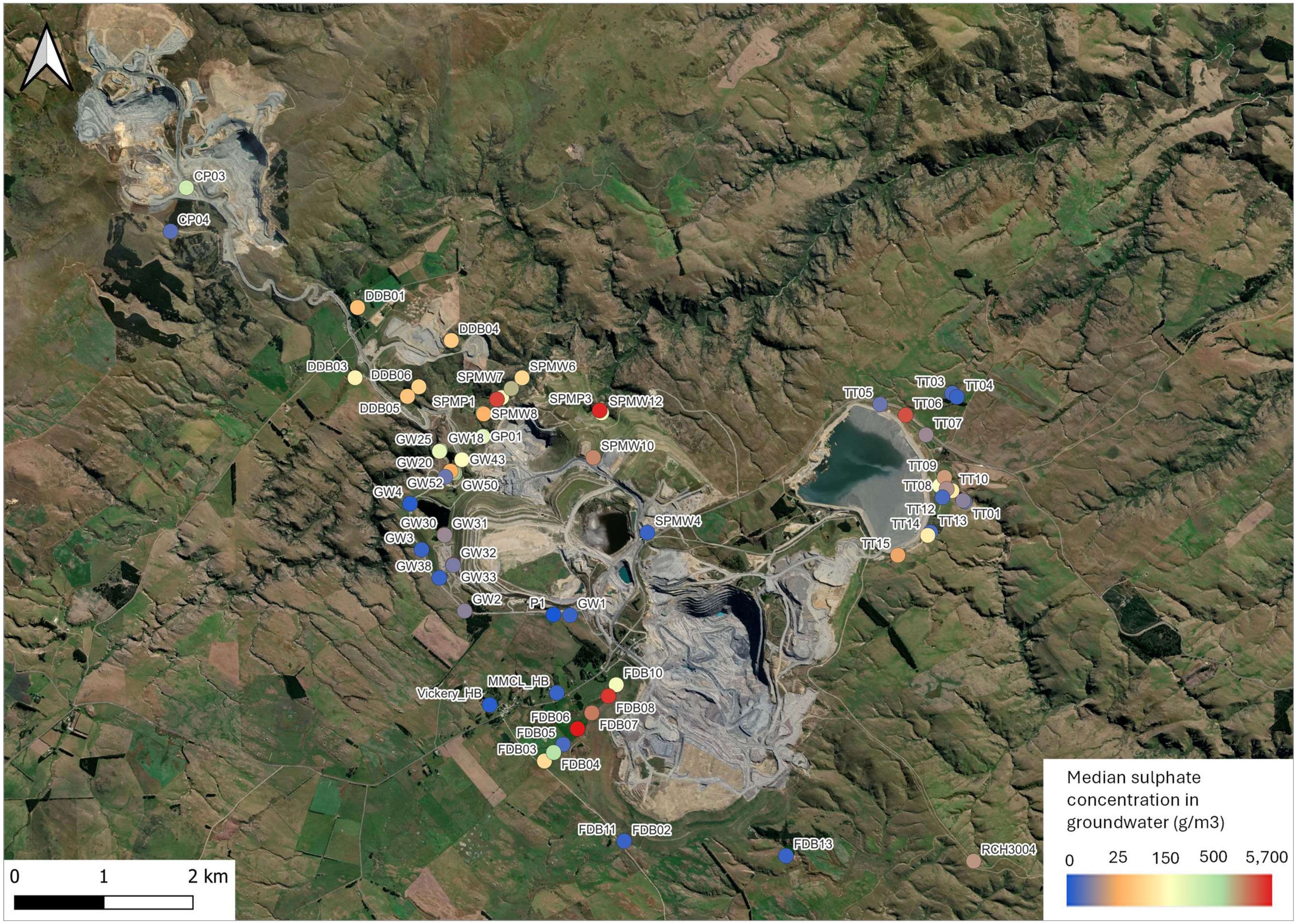

Piezometer PS 5
445
440
435
430
425
420
415
Water RL (m)
100
90
80
70
60
50
40
30
20
10
0
Rainfall (mm)
1/01/2000
1/01/2001
1/01/2002
1/01/2003
1/01/2004
1/01/2005
1/01/2006
1/01/2007
1/01/2008
1/01/2009
1/01/2010
1/01/2011
1/01/2012
1/01/2013
1/01/2014
1/01/2015
1/01/2016
1/01/2017
1/01/2018
1/01/2019
1/01/2020
Date
Rainfall
PS5

Table 4 Summary of borehole locations

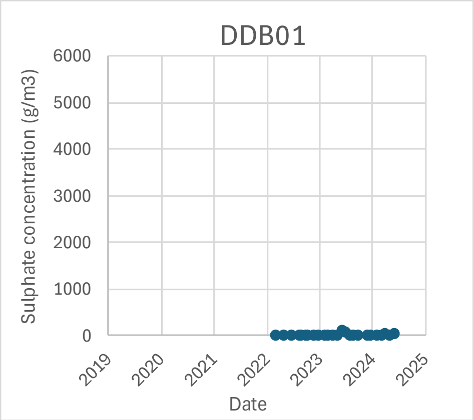
Name	NZTM East	NZTM North
GP1a	1398506	4974291
GP1b	1398672	4974250
GP 02 A	1398817	4974105
GP 02 B	1398866	4974026
GP 03 A	1398570	4974170
GP 03 B	1398570	4974170
GP 05 A	1399258	4973637
GP 05 B	1398815	4974253
GP 05 C	1398960	4974125
PWC 014 A	1398517	4974114
PWC 111 A	1399006	4973653
PS 05	1398744	4973715

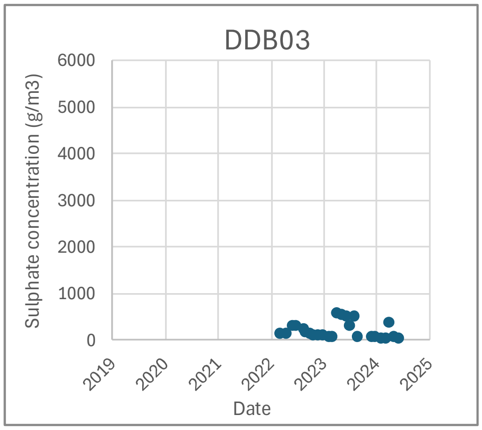
Appendix C

Groundwater Water Quality


CP03
CP04
DDB01
DDB04
DDB03
DDB06
DDB05
SPMW6
SPMW7
SPMP1
SPMW8
SPMP3
SPMW12
GP01
GW25
GW18
GW43
GW20
GW52
GW50
GW4
SPMW10
GW30
GW31
GW3
GW32
GW38
GW33
GW2
P1
GW1
SPMW4
TT03
TT04
TT05
TT06
TT07
TT09
TT10
TT08
TT01
TT12
TT13
TT14
TT15
FDB10
MMCL_HB
Vickery_HB
FDB08
FDB06
FDB07
FDB05
FDB03
FDB04
FDB11
FDB02
FDB13
RCH3004
0
1
2 km
Median sulphate concentration in groundwater (g/m3)
0
25
150
500
5,700


Median sulphate concentration in groundwater (g/m3)
0
25
150
500
5,700
GW22
GW23
GW18
GW24
GW19
GW25
GW20
GW21
GW43
GW46
GW52
GW47
GW48
GW51
GW50
GW49
0
25
50 m


DDB01
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


DDB03
Sulphate concentration (g/m3)
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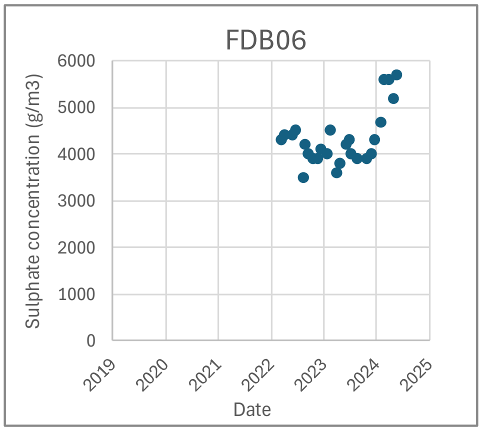
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


FDB06
Sulphate concentration (g/m3)
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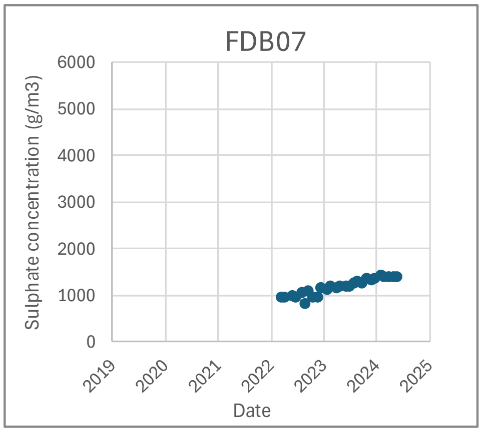
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


FDB07
Sulphate concentration (g/m3)
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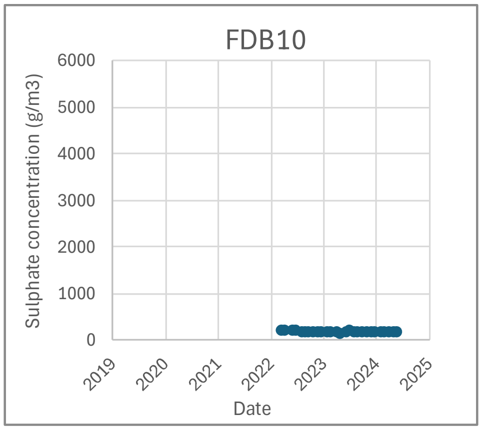
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


FDB10
Sulphate concentration (g/m3)
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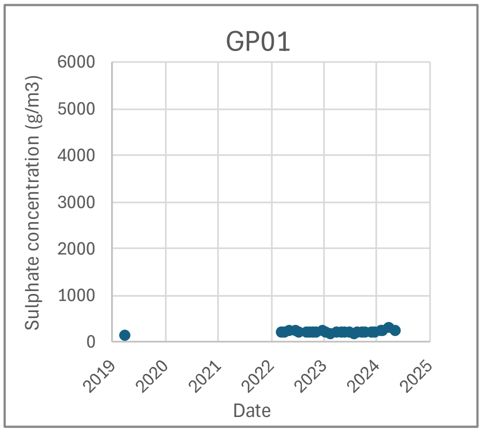
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GP01
Sulphate concentration (g/m3)
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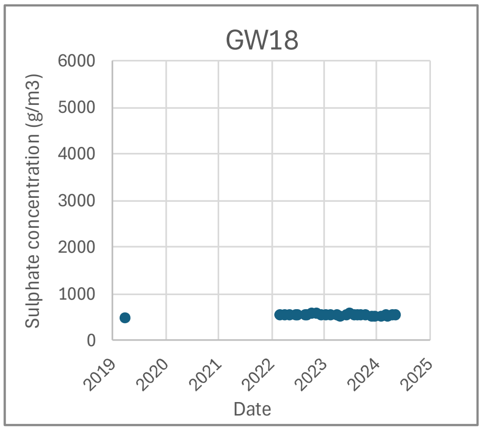
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW18
Sulphate concentration (g/m3)
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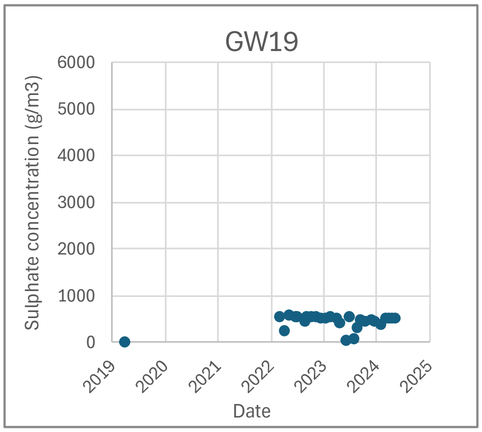
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW19
Sulphate concentration (g/m3)
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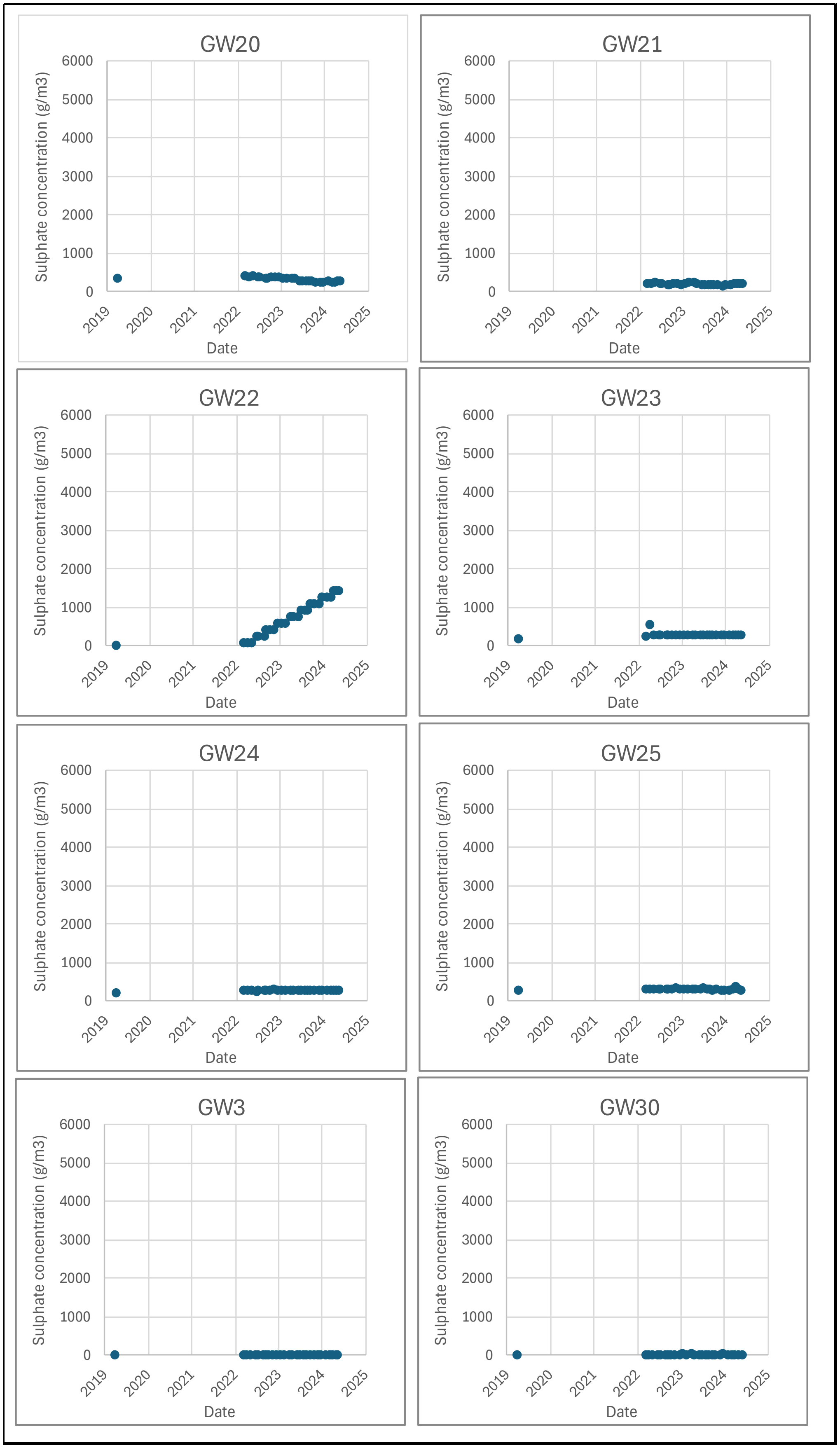
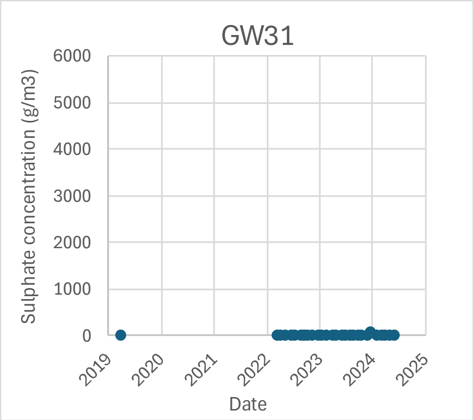
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW20
GW21
GW22
GW23
GW24
GW25
GW3
GW30
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW31
Sulphate concentration (g/m3)
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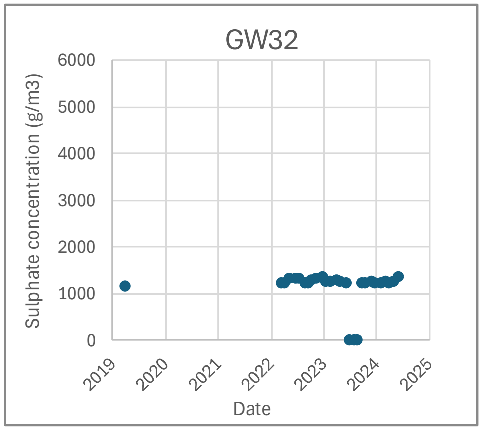
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW32
Sulphate concentration (g/m3)
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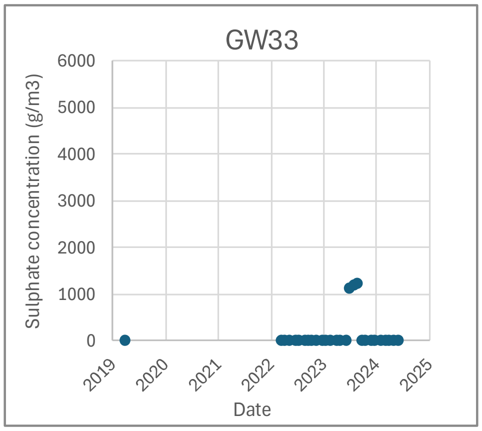
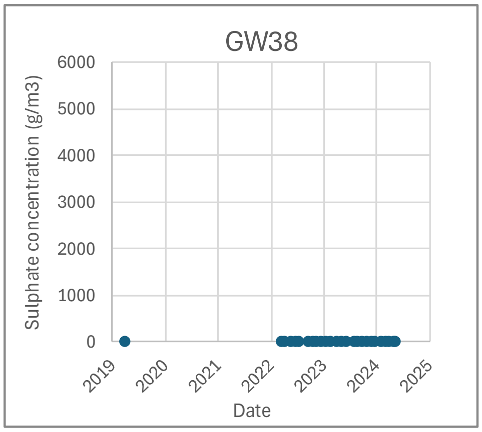
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW33
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW38
Sulphate concentration (g/m3)
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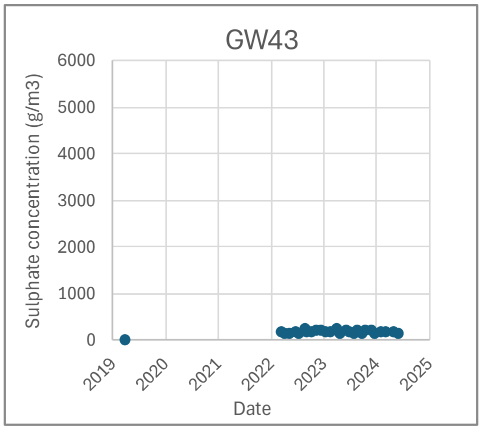
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


GW43
Sulphate concentration (g/m3)
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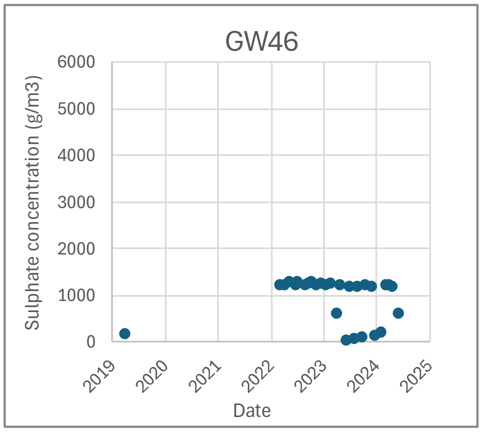
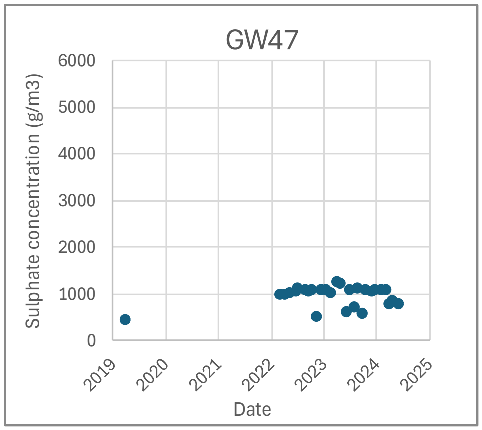
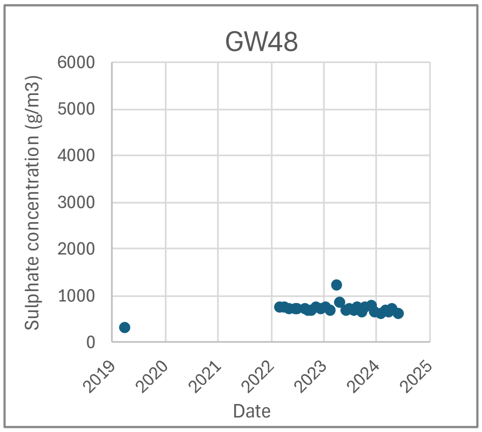
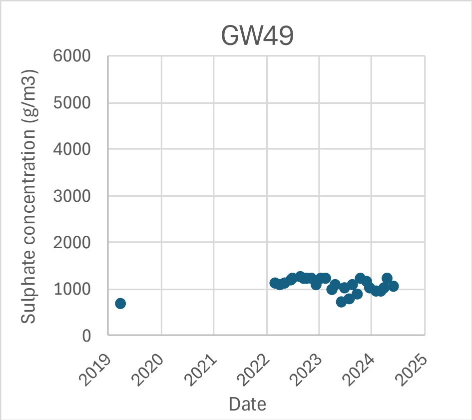
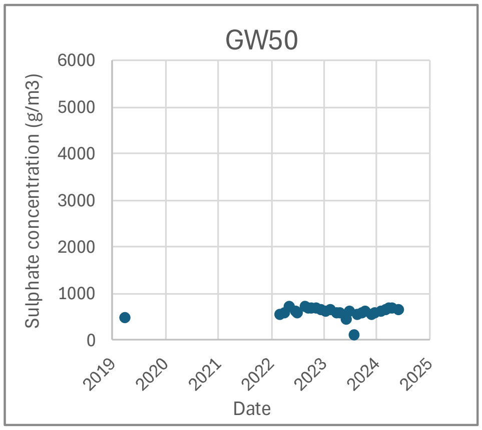
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

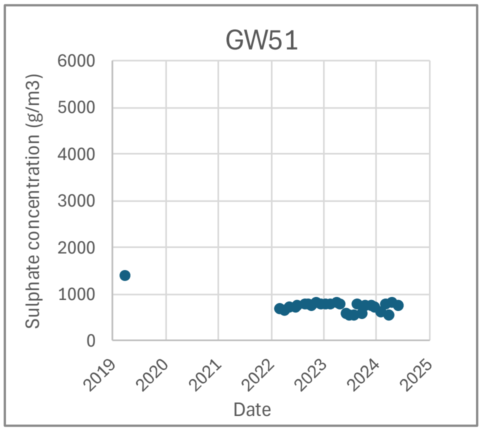

GW46
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

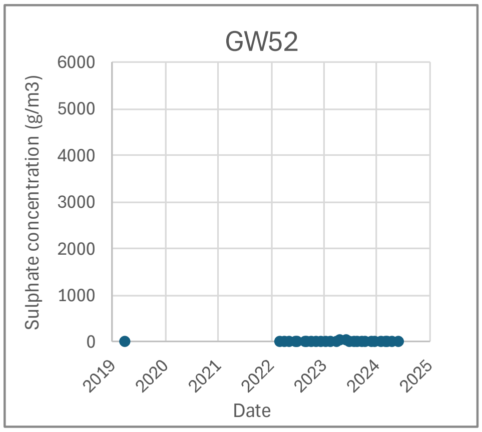

GW47
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

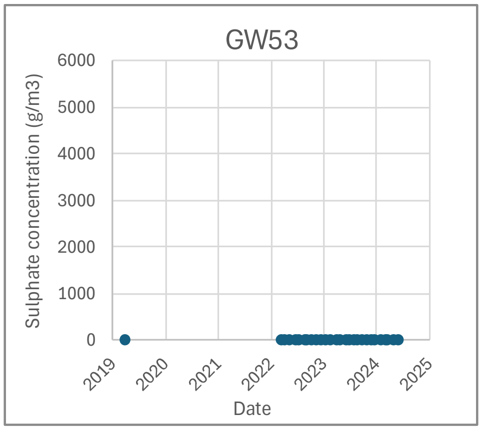

GW48
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

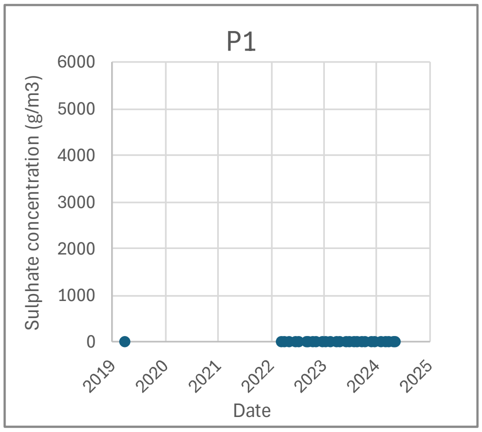

GW49
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

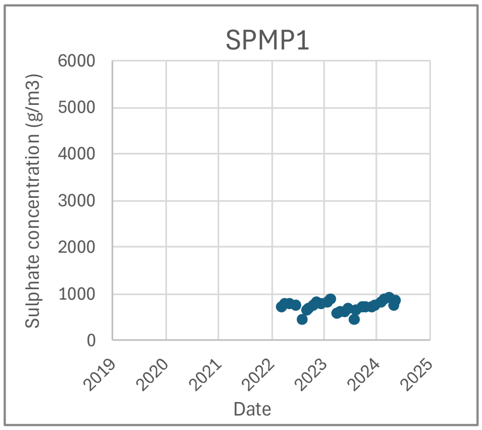

GW50
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

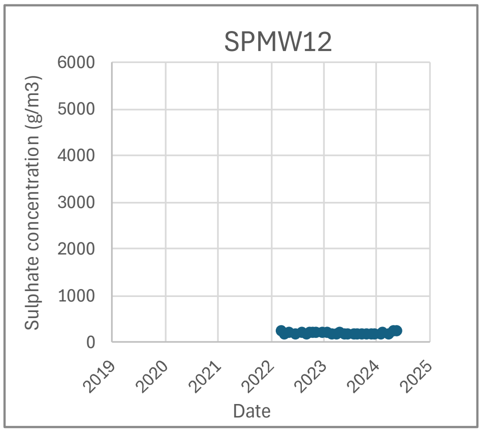

GW51
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

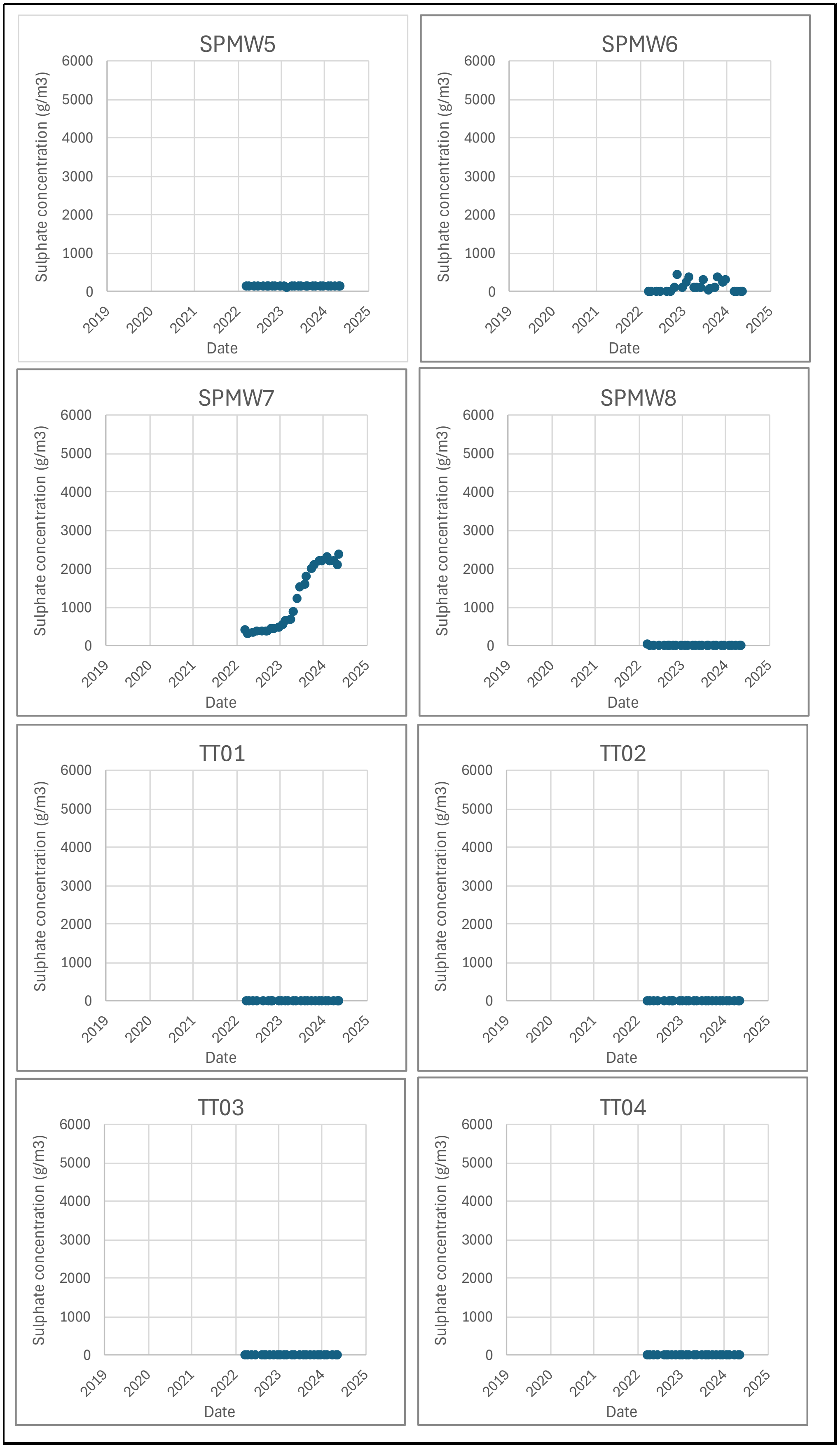

GW52
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

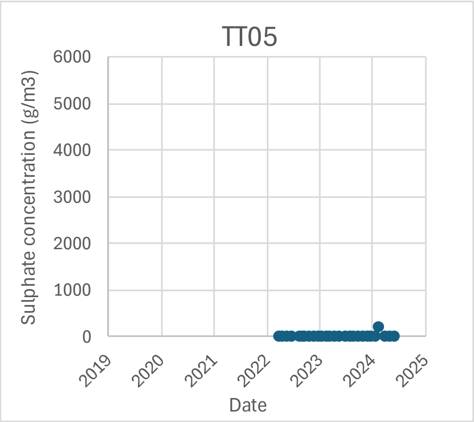

GW53
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

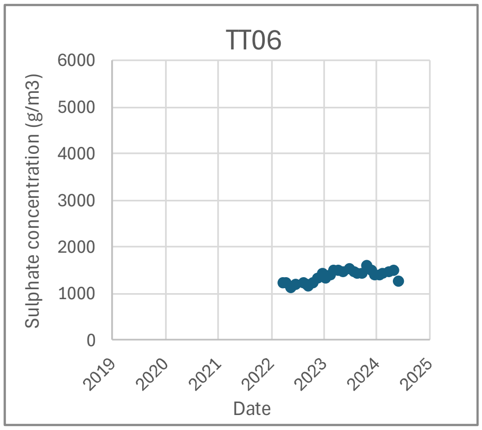

P1
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

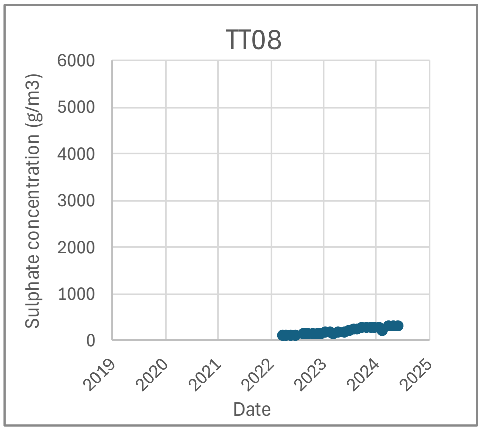

SPMP1
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

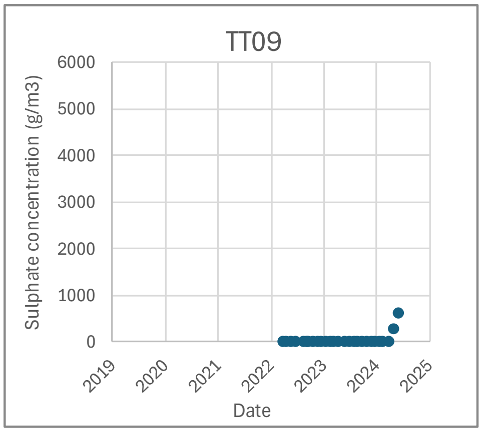

SPMW12
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

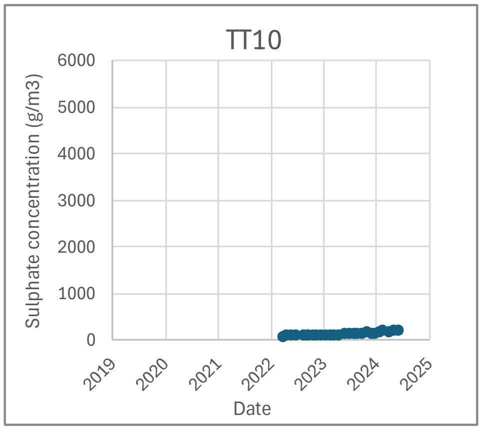

SPMW5
SPMW6
SPMW7
SPMW8
TT01
TT02
TT03
TT04
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

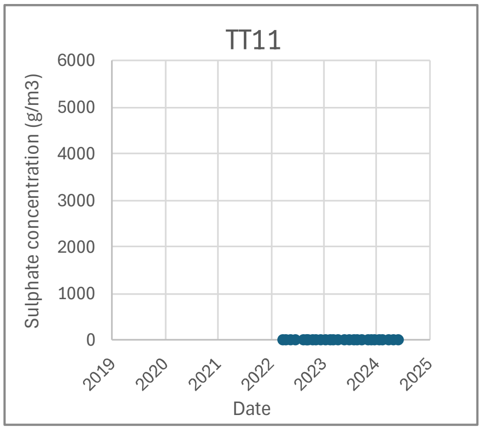

TT05
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

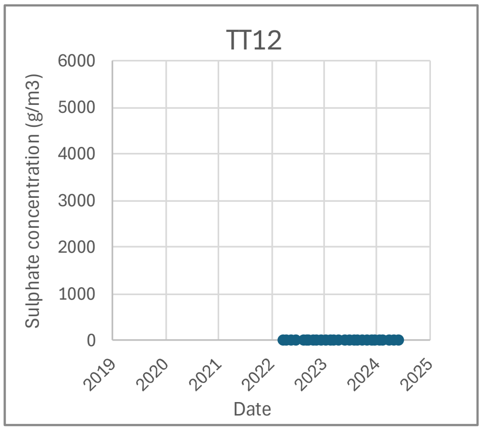

TT06
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

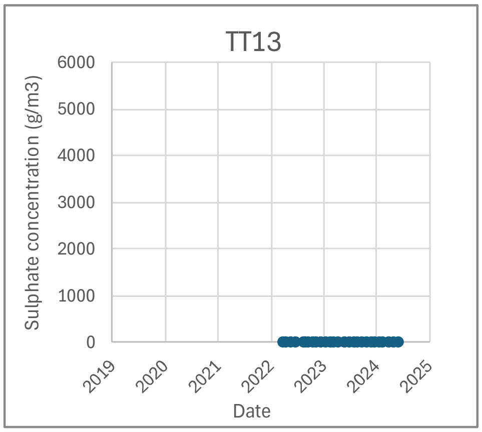

TT08
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

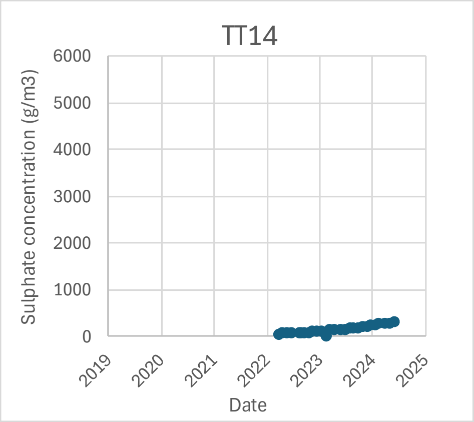

TT09
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

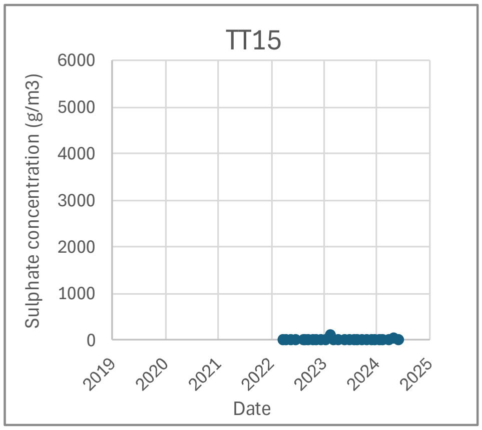

TT10
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


TT11
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


TT12
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


TT13
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


TT14
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date


TT15
Sulphate concentration (g/m3)
6000
5000
4000
3000
2000
1000
0
2019
2020
2021
2022
2023
2024
2025
Date

Appendix D

Current Water Quality Statistics – Revision to Appendix F of Appendix 13

The following tables are provided from Appendix F from Appendix 13. The ‘current’ water quality statistics are added to these as per RFI 5.2, and these are summarised for the four years to May 2024.

Table 5 Predicted Water Quality Statistics for DC07

Constituent	Statistic	Phase (g/m^3)						Current (May 2020 - May 2024)
		Camp Creek Dilution Dam			No Camp Creek Dilution Dam			
		Mining	Closure	Long Term	Mining	Closure	Long Term	
Sulphate	Median	110	100	110	110	100	110	180
	95th %	390	330	360	510	550	560	620
	Maximum	1090	930	920	1090	1080	1150	660
Nitrate-N	Median	0.73	0.63	0.67	0.74	0.63	0.68	0.09
	95th %	2.5	1.5	1.6	3.4	3.3	3.3	1.31
	Maximum	7.6	3.6	3.8	7.6	8.1	8.7	1.87
Ammoniacal-N	Median	0.014	0.013	0.013	0.014	0.013	0.013	0.01
	95th %	0.028	0.02	0.02	0.031	0.022	0.023	0.21
	Maximum	0.21	0.044	0.044	0.21	0.044	0.044	0.40
Arsenic	Median	0.003	0.0032	0.0036	0.0032	0.0034	0.0042	0.012
	95th %	0.012	0.0083	0.011	0.015	0.0093	0.012	0.022
	Maximum	0.25	0.023	0.024	0.25	0.022	0.024	0.023
Copper	Median	0.001	0.001	0.001	0.001	0.001	0.001	0.0006
	95th %	0.0012	0.0011	0.0012	0.0012	0.0012	0.0012	0.0014
	Maximum	0.0013	0.0012	0.0013	0.0014	0.0014	0.0014	0.0014
Iron	Median	0.19	0.19	0.19	0.19	0.18	0.18	0.06
	95th %	0.23	0.22	0.22	0.23	0.22	0.22	0.19
	Maximum	0.82	0.24	0.24	0.82	0.24	0.24	0.20
Lead	Median	0.00016	0.00016	0.00016	0.00016	0.00016	0.00016	0.0001
	95th %	0.00019	0.00018	0.00018	0.0002	0.0002	0.0002	0.0001
	Maximum	0.00026	0.00022	0.00022	0.00026	0.00027	0.00027	0.0001
Zinc	Median	0.0023	0.0021	0.0022	0.0023	0.0021	0.0022	0.002
	95th %	0.0045	0.0034	0.0035	0.0057	0.0055	0.0055	0.004
	Maximum	0.011	0.0059	0.0062	0.011	0.011	0.012	0.006

Table 6 Predicted Water Quality Statistics for DC08

Constituent	Statistic	Phase (g/m^3)						Current (May 2020 - May 2024)
		Camp Creek Dilution Dam			No Camp Creek Dilution Dam			
		Mining	Closure	Long Term	Mining	Closure	Long Term	
Sulphate	Median	99	94	100	100	95	100	173
	95th %	360	310	330	460	510	520	773
	Maximum	1040	900	920	1040	990	1070	1310
Nitrate-N	Median	0.68	0.59	0.63	0.69	0.59	0.63	0.01
	95th %	2.3	1.5	1.6	3.1	3	3	0.34
	Maximum	7.3	3.4	3.6	7.3	7.5	7.9	0.46
Ammoniacal-N	Median	0.014	0.012	0.013	0.014	0.012	0.013	0.01
	95th %	0.026	0.019	0.02	0.029	0.021	0.022	0.02
	Maximum	0.18	0.044	0.044	0.18	0.044	0.044	0.10
Arsenic	Median	0.003	0.0032	0.0036	0.0031	0.0034	0.0041	0.018
	95th %	0.011	0.0079	0.011	0.015	0.0089	0.011	0.034
	Maximum	0.22	0.023	0.024	0.22	0.022	0.024	0.037
Copper	Median	0.001	0.001	0.001	0.001	0.001	0.001	0.0007
	95th %	0.0012	0.0011	0.0011	0.0012	0.0012	0.0012	0.0016
	Maximum	0.0013	0.0012	0.0012	0.0013	0.0014	0.0014	0.0050
Iron	Median	0.19	0.19	0.19	0.19	0.18	0.18	0.03
	95th %	0.23	0.22	0.22	0.23	0.22	0.22	0.20
	Maximum	0.74	0.24	0.24	0.74	0.24	0.24	0.27
Lead	Median	0.00016	0.00016	0.00016	0.00016	0.00016	0.00016	0.0001
	95th %	0.00019	0.00018	0.00018	0.0002	0.0002	0.0002	0.0001
	Maximum	0.00025	0.00022	0.00022	0.00026	0.00026	0.00027	0.0010
Zinc	Median	0.0022	0.0021	0.0022	0.0022	0.0021	0.0022	0.001
	95th %	0.0043	0.0033	0.0035	0.0053	0.0051	0.0052	0.002
	Maximum	0.011	0.0056	0.006	0.011	0.01	0.011	0.010

Table 7 ***Predicted Water Quality Statistics for Shag River at Loop Road***

Constituent	Statistic	Phase (g/m³)						Current (May 2020 - May 2024)
		Camp Creek Dilution Dam			No Camp Creek Dilution Dam			
		Mining	Closure	Long Term	Mining	Closure	Long Term	
Sulphate	Median	21	21	22	20	20	21	25
	95th %	56	69	74	56	70	74	73
	Maximum	450	610	750	440	610	750	95
Nitrate-N	Median	0.21	0.21	0.21	0.21	0.21	0.21	0.02
	95th %	0.44	0.45	0.48	0.45	0.46	0.48	0.43
	Maximum	1.6	1.5	1.6	1.6	1.5	1.6	0.70
Ammoniacal-N	Median	0.011	0.011	0.01	0.011	0.01	0.01	0.01
	95th %	0.013	0.013	0.013	0.013	0.013	0.013	0.01
	Maximum	0.055	0.039	0.037	0.055	0.039	0.037	0.02
Arsenic	Median	0.0027	0.0027	0.0028	0.0027	0.0027	0.0028	0.002
	95th %	0.0039	0.0036	0.0039	0.004	0.0036	0.004	0.003
	Maximum	0.053	0.019	0.02	0.053	0.019	0.02	0.010
Copper	Median	0.001	0.001	0.001	0.001	0.001	0.001	0.0006
	95th %	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0014
	Maximum	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013	0.0050
Iron	Median	0.2	0.2	0.2	0.2	0.2	0.2	0.02
	95th %	0.24	0.24	0.24	0.24	0.24	0.24	0.10
	Maximum	0.31	0.26	0.26	0.31	0.26	0.26	0.20
Lead	Median	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.0001
	95th %	0.00018	0.00018	0.00018	0.00019	0.00018	0.00018	0.0002
	Maximum	0.00021	0.00019	0.00021	0.00021	0.0002	0.00021	0.0010
Zinc	Median	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.001
	95th %	0.002	0.002	0.002	0.002	0.002	0.002	0.003
	Maximum	0.0037	0.0032	0.0034	0.0037	0.0034	0.0034	0.010

Table 8 Predicted Water Quality Statistics for Shag River at McCormicks

Constituent	Statistic	Phase (g/m³)						Current (May 2020 - May 2024)
		Camp Creek Dilution Dam			No Camp Creek Dilution Dam			
		Mining	Closure	Long Term	Mining	Closure	Long Term	
Sulphate	Median	26	23	27	25	23	27	23
	95th %	67	65	73	68	66	73	47
	Maximum	280	560	600	280	550	600	82
Nitrate-N	Median	0.21	0.21	0.21	0.21	0.21	0.21	0.05
	95th %	0.42	0.41	0.44	0.42	0.42	0.44	0.65
	Maximum	1.4	1.3	1.5	1.4	1.4	1.5	1.15
Ammoniacal-N	Median	0.021	0.01	0.01	0.021	0.01	0.01	0.01
	95th %	0.052	0.012	0.012	0.053	0.012	0.012	0.02
	Maximum	0.17	0.036	0.031	0.17	0.036	0.031	0.06
Arsenic	Median	0.0064	0.0029	0.003	0.0064	0.0029	0.003	0.002
	95th %	0.017	0.0037	0.0039	0.017	0.0037	0.0039	0.003
	Maximum	0.057	0.018	0.016	0.057	0.017	0.016	0.080
Copper	Median	0.0016	0.001	0.00099	0.0016	0.001	0.00099	0.0006
	95th %	0.0035	0.0012	0.0012	0.0036	0.0012	0.0012	0.0013
	Maximum	0.011	0.0013	0.0013	0.011	0.0013	0.0013	0.0050
Iron	Median	0.24	0.2	0.2	0.24	0.2	0.2	0.05
	95th %	0.33	0.23	0.23	0.34	0.23	0.23	0.20
	Maximum	0.72	0.25	0.25	0.72	0.25	0.25	0.49
Lead	Median	0.00016	0.00015	0.00015	0.00016	0.00015	0.00015	0.0001
	95th %	0.00019	0.00018	0.00018	0.00019	0.00018	0.00018	0.0001
	Maximum	0.00027	0.00019	0.0002	0.00027	0.00019	0.0002	0.0010
Zinc	Median	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.001
	95th %	0.002	0.002	0.002	0.002	0.002	0.002	0.006
	Maximum	0.0034	0.003	0.0032	0.0034	0.0031	0.0032	0.010

Table 9 ***Predicted Water Quality Statistics for NBWRRF (Selected Mitigation)***

Constituent	Statistic	Phase (g/m³)			Current (May 2020 - May 2024)
		Mining	Closure	Long Term	
Sulphate	Median	38	130	130	112
	95th %	170	280	280	508
	Maximum	760	550	640	880
Nitrate-N	Median	0.21	0.43	0.44	0.00
	95th %	0.44	0.82	0.82	0.13
	Maximum	1.6	1.5	1.5	0.53
Ammoniacal-N	Median	0.011	0.013	0.013	0.01
	95th %	0.014	0.017	0.017	0.03
	Maximum	0.037	0.024	0.024	0.23
Arsenic	Median	0.0026	0.0027	0.0026	0.002
	95th %	0.0032	0.0032	0.0033	0.008
	Maximum	0.0054	0.0056	0.0058	0.199
Copper	Median	0.0011	0.0012	0.0012	0.0005
	95th %	0.0013	0.0015	0.0015	0.0011
	Maximum	0.002	0.002	0.002	0.0050
Iron	Median	0.2	0.19	0.19	0.21
	95th %	0.24	0.24	0.23	0.50
	Maximum	0.26	0.25	0.26	1.01
Lead	Median	0.00015	0.00016	0.00016	0.0001
	95th %	0.00019	0.0002	0.0002	0.0001
	Maximum	0.00022	0.00023	0.00024	0.0010
Zinc	Median	0.0017	0.0022	0.0022	0.001
	95th %	0.0022	0.0032	0.0032	0.004
	Maximum	0.0052	0.005	0.005	0.010

Table 10 Predicted Water Quality Statistics for MC02 (Selected Mitigation)

Constituent	Statistic	Phase (g/m³)			Current (May 2020 - May 2024)
		Mining	Closure	Long Term	
Sulphate	Median	12	290	300	186
	95th %	23	450	440	1236
	Maximum	140	580	570	1320
Nitrate-N	Median	0.15	0.85	0.88	0.31
	95th %	0.19	1.3	1.3	0.96
	Maximum	0.33	1.6	1.6	1.24
Ammoniacal-N	Median	0.01	0.01	0.01	0.01
	95th %	0.012	0.012	0.012	0.02
	Maximum	0.016	0.013	0.013	0.10
Arsenic	Median	0.0026	0.0026	0.0026	0.002
	95th %	0.0032	0.0032	0.0032	0.005
	Maximum	0.0053	0.0062	0.0061	0.010
Copper	Median	0.001	0.003	0.0033	0.0006
	95th %	0.0013	0.0096#	0.0098#	0.0042
	Maximum	0.0054	0.014#	0.014#	0.0350
Iron	Median	0.2	0.18	0.18	0.11
	95th %	0.24	0.22	0.22	0.23
	Maximum	0.25	0.24	0.24	0.24
Lead	Median	0.00015	0.00019	0.00019	0.0001
	95th %	0.00018	0.00023	0.00023	0.0008
	Maximum	0.00019	0.00026	0.00027	0.0016
Zinc	Median	0.0015	0.0035	0.0036	0.001
	95th %	0.0018	0.0052	0.0052	0.005
	Maximum	0.0028	0.0067	0.0068	0.010

Table 11 ***Predicted Water Quality Statistics for NB03 (Selected Mitigation)***

Constituent	Statistic	Phase (g/m³)			Current (May 2020 - May 2024)
		Mining	Closure	Long Term	
Sulphate	Median	19	120	120	73
	95th %	68	190	190	280
	Maximum	260	320	340	340
Nitrate-N	Median	0.17	0.42	0.42	0.00
	95th %	0.27	0.61	0.61	0.19
	Maximum	0.7	0.95	0.97	0.78
Ammoniacal-N	Median	0.011	0.011	0.011	0.01
	95th %	0.015	0.012	0.012	0.02
	Maximum	0.032	0.015	0.016	0.04
Arsenic	Median	0.0029	0.0026	0.0039	0.002
	95th %	0.0097	0.0029	0.0083	0.009
	Maximum	0.03	0.0045	0.017	0.012
Copper	Median	0.001	0.0016	0.0017	0.0005
	95th %	0.0012	0.0034	0.0035	0.0012
	Maximum	0.0024	0.0048	0.0048	0.0050
Iron	Median	0.19	0.19	0.19	0.09
	95th %	0.21	0.22	0.22	0.23
	Maximum	0.23	0.24	0.24	0.30
Lead	Median	0.00015	0.00016	0.00016	0.0001
	95th %	0.00017	0.00018	0.00018	0.0001
	Maximum	0.00019	0.00021	0.00021	0.0010
Zinc	Median	0.0016	0.0022	0.0023	0.001
	95th %	0.0018	0.0029	0.003	0.003
	Maximum	0.0027	0.004	0.0042	0.010