Dewatering and Settlement Report 2024

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DEWATERING & SETTLEMENT MONITORING REPORT 2024

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EXECUTIVE SUMMARY

This annual Dewatering and Settlement Monitoring Report is a requirement of the consent conditions for the Martha, Favona, Trio, Correnso and Project Martha mining projects, in Waihi, New Zealand.

Compliance monitoring and assessment of groundwater and settlement trends are reported in this document for the period 1 January 2024 to 31 December 2024. Such monitoring and reporting have been completed in accordance with the current Dewatering and Settlement Monitoring Plan that was approved by the Hauraki District Council (HDC) and Waikato Regional Council (WRC) in August 2023.

On 16 July 2017, the Correnso groundwater take permit 124860 was replaced by the Project Martha groundwater take permit 139551. This allows dewatering to a lower level (500 mRL cf. 700 mRL). The mine datum is set at 1,000m above sea level.

New settlement triggers were applied during 2020 following approval of the Project Martha consents. These current trigger levels are based on settlement estimates, which trigger a notification to council and review of the area and ongoing settlement trends. Exceeding settlement trigger limits alone does not represent an issue. Settlement can occur with no material effect at the surface. Tilt, which is differential settlement, has the potential to be problematic for residential properties or public infrastructure and can be caused by shallow settlement effects. Tilts are typically only potentially problematic if greater than 1 in 1000 and therefore this is the consented tilt trigger level. Shallow settlement effects can be linked to drawdown of the shallow water table and therefore monitoring of the piezometric levels is of importance.

The current settlement survey results indicate that 95.7% (330/345) of the marks were within the predicted ranges of settlement resulting from mining activities. Fifteen (15) marks triggered further investigation. Five of these triggered settlement marks were located above the Favona mining area.

The remaining ten (10) of the above fifteen (15) triggered marks are located in the wider Waihi area. Generally, no effects were observed at surface near these locations, measured tilts were less than 1 in 1000, and nearby shallow piezometers have not displayed any changes outside of normal seasonal trends.

Six marks in the Favona area have measured tilts greater than 1 in 1000. These marks are situated on farmland that is owned by the company and are located directly above the Favona workings, as such, this ground movement has no material effect on residential property.

Overall, the settlement and dewatering trends are within predicted expectations and no surface effects of concern have been identified to date.

Martha Open Pit

Dewatering from the Martha Pit was discontinued on 4 May 2015 after a slip on the north wall resulted in access and power supply to the dewatering pumps becoming limited. Dewatering from within the Correnso underground mine (still authorised under the original consents) was initiated on 18 May 2015. The Martha, Trio, Correnso and SUPA groundwater systems are hydraulically linked, and water levels are now controlled by the Martha Underground dewatering.

Generally, the groundwater level monitoring which has been completed to date indicates that the Martha Open Pit and Underground dewatering has:

- negligible effect on the shallow groundwater table,
- minor effect in the deeper younger volcanic groundwater pressures locally around the pit, and
- notable depressurisation or dewatering in the deep andesite.

As the drawdown effects are primarily deep and limited to within the andesite rock, no undesirable tilts have manifested at the surface. No new trends have developed during 2024.

Analysis of the relevant monitoring data has indicated that most settlement around Martha Pit had developed by the mid to late 1990s, but widespread small magnitude settlement has been ongoing and is likely to be related to dewatering of deeper structures within the andesite rock mass. Groundwater monitoring data does not show any widespread or significant dewatering of alluvium, or of the upper portions of the young volcanic materials which could lead to undesirable tilt at the surface.

Two property damage complaints attributable to mine dewatering or settlement in response to mine dewatering were reported during 2024. Compliance was achieved with the consent conditions granted for the Martha Extended Project.

Favona

At the Favona Mine the measured piezometer levels indicate continued dewatering of the vein system, with the groundwater level being maintained at approximately 800 mRL mine datum by the end of 2024. Water levels in the country rock surrounding the vein system stand higher and are either not responding or responding slowly to dewatering.

Five Favona marks exceed the settlement predictions set for Project Martha. A settlement trend exists over a 150 m wide area above the underground workings with a maximum total settlement of 390 mm (F18), of which up to 341 mm can be attributed to Favona mining activity. This is greater than the 80 mm initially predicted by URS (2002 Technical Report) to be due to dewatering. This settlement is attributed to a combination of depressurisation stress (primary consolidation) associated with drawdown in the andesite rock and relaxation of the country rock as mining proceeded. Primary consolidation (i.e. which occurs the first time a mine is dewatered) is greater than a second cycle (i.e due to subsequent dewatering activities). It is therefore worthy of note that the Favona Mine is outside of the Martha groundwater system; the Martha system was historically dewatered for a longer period and to greater depth and is currently undergoing a second period of dewatering.

Six tilt gradients attributable to Favona mining activity remain steeper than 1 in 1000. These locations are on farmland that is owned by the company and are south of the residential area along Barry Road. All of these locations have been recorded in previous surveying events.

The previous trigger levels which applied to the Favona piezometers have been removed. These have been superseded by the Waihi wide triggers that were introduced as part of the Correnso dewatering consent. The current trigger is a 15m water level change within a month. No Favona piezometer had such an increase or decrease. Compliance with the conditions of the Favona consents and Monitoring Plan was achieved.

Trio

The groundwater levels in this area are assessed to be controlled by the Martha Underground dewatering.

Correnso

The Correnso Underground Mine was granted consent and operations began on 20 December 2013.

The Correnso water take permit was activated in July 2017, allowing dewatering to lower the groundwater down to 700 mRL (WRC #124860, Schedule One – General Conditions, Condition 1), beyond the lowest level authorised for the mining of Trio.

New settlement trigger levels for Correnso were applied in 2017 and Project Martha superseded these in 2020. During 2024, no settlement mark in the Correnso Extensions Project Area (CEPA) displayed dewatering related settlement and no consent related groundwater trigger was activated. Compliance was achieved with the consent conditions granted for the Correnso Project.

SUPA

The Slevin Underground Project Area is essentially an extension of the Correnso mining area. Mining within the SUPA area began 16 January 2017. No new WRC consents were required for the activity which is covered by existing WRC consent conditions. The HDC dewatering and settlement related conditions are similar to the WRC conditions for Correnso. No new monitoring or reporting is required as the existing networks adequately encompass SUPA.

MDDP

The Martha Drill Drives Project (MDDP) was granted consent on 9 August 2017. Mining in the MDDP began 17 August 2017 and was completed during 2019. The project involved the construction of two underground drill drives from the SUPA area towards Martha Pit. No specific HDC conditions relate to dewatering and settlement, rather it is covered by existing WRC Correnso consent conditions. No new monitoring or reporting is required as the existing networks adequately encompass MDDP.

Project Martha

Consents for Project Martha were granted on 1 February 2019. Joint HDC and WRC consents were activated on 27 July 2019 when blasting began in the project area. The current Project Martha groundwater take permit (139551) was activated on 1 January 2020 and allows dewatering down to 500 mRL. New dewatering bores were installed during 2020 to progressively lower the water level to enable Project Martha activities. At the end of 2024, the water level was at approximately 636 mRL.

In June 2023, amendments were made to the Dewatering and Settlement Monitoring Plan to specifically address additional monitoring requirements as a result of the proposal to mine the Rex orebody to a higher elevation. This was approved by WRC and HDC in August 2023, and more focused monitoring of groundwater level/pressure along the strike of the Rex orebody began in October 2023. Six additional settlement marks were also installed.

A greater than 2m change in groundwater level was identified in two piezometers during 2024. A 2.75mRL decrease in water level was identified at piezometer P113A (74m deep). This level change occurred at a piezometer tip located in the Andesite and is therefore considered highly unlikely to have any effect on the surface groundwater system because it has not influenced the water levels in the two piezometers nearer the surface. A 2.93mRL decrease in water level was identified at piezometer P114 (55m deep) and was believed to be related to a water inflow event associated with unravelling of weak rock mass. The area was treated with resin injection through self-drilling anchors to decrease water inflow and stabilise the area. The water level has been stable since the telemetry issue was resolved near the end of 2024.

1 INTRODUCTION

This report is submitted to meet the requirements of the various consents which are currently held by Oceana Gold New Zealand Limited (OGNZL) that are related to mine-related dewatering and settlement. New consents have been issued for different projects as mining has progressed at Waihi with many having conditions and reporting requirements in common. A full list of the relevant conditions pertaining to dewatering and settlement are included in Appendix A. Consents for Martha, Favona, Trio, Correnso, SUPA, MDDP and Project Martha all require a dewatering and settlement monitoring plan. Below is a summary of the current common consent requirements:

The (annual monitoring report) report shall, as a minimum, provide the following information:

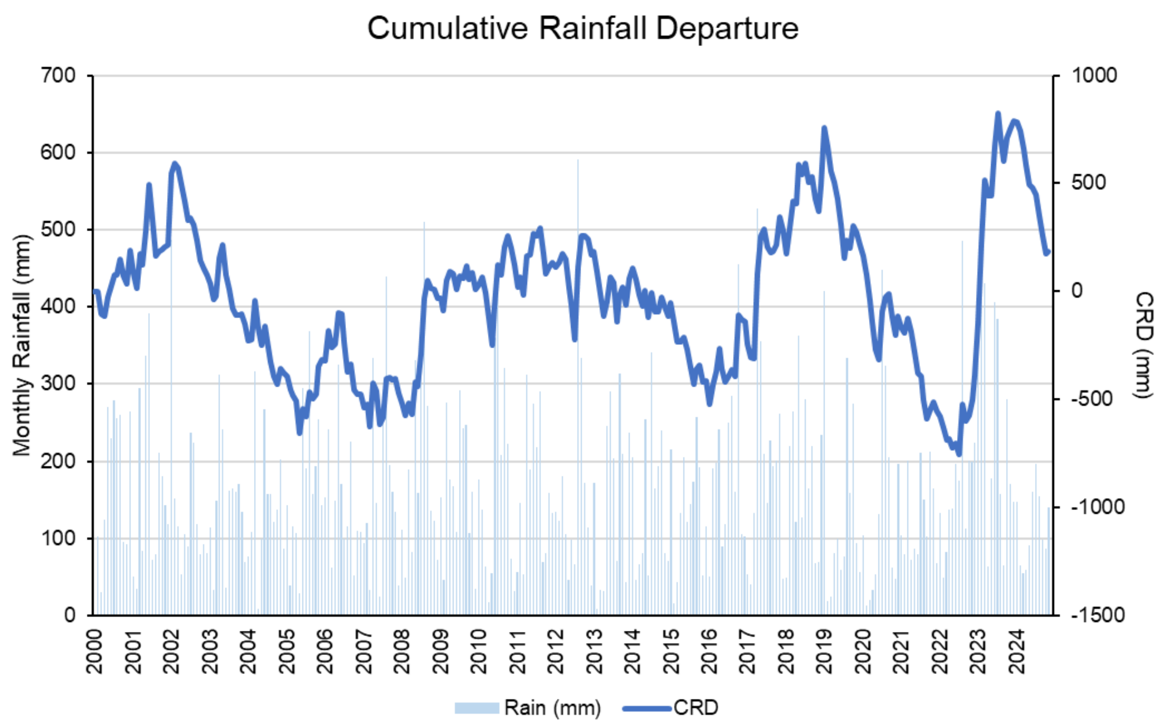
- *a)* The volume of groundwater abstracted;
- *b)* The data from monitoring undertaken during the previous year, including groundwater contour plans (derived from the data) in respect of the piezometer network;
- *c)* An interpretation and analysis of the monitoring data, in particular any change in the groundwater profile over the previous year, predictions of the future impacts that may arise as a result of any trends that have been identified including review of the predicted post closure effects based on actual monitoring data, and what contingency actions, if any, the consent holder proposes to take in response to those predictions, this analysis shall be undertaken by a party appropriately experienced and qualified to assess the information;
- *d)* Any contingency actions that may have been taken during the year;
- *e)* Comment on compliance with relevant resource consent conditions, including any reasons for non-compliance or difficulties in achieving conformance with the conditions.
- *f)* The report shall be forwarded in a form acceptable to the Councils.

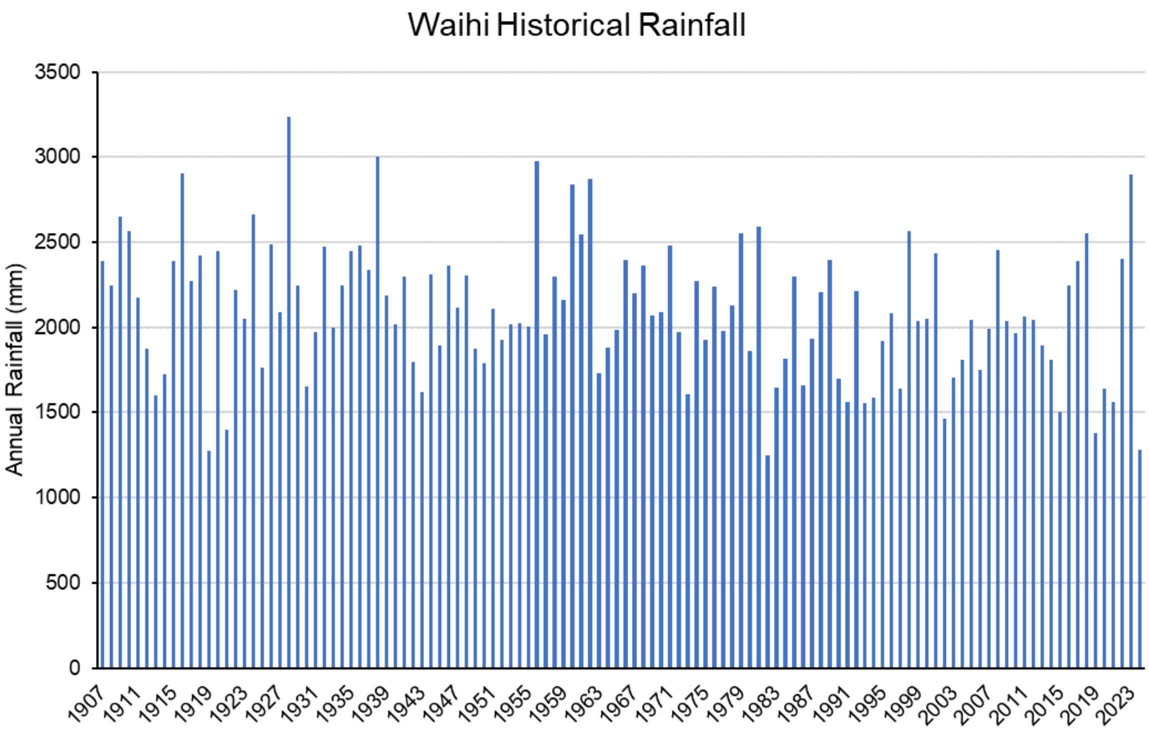
2 CLIMATE CONDITIONS

Historical rainfall data for Waihi has been collected since 1907, with annual measured rainfall ranging between 1249 and 3234 mm per annum.

Annual and seasonal rainfall trends are displayed in Figure 1. Cumulative Rainfall Departure (CRD) is a concept used to evaluate the temporal correlation of rainfall with surface water or groundwater levels. The CRD is calculated by determining the mean of the rainfall for the period in question, subtracting the mean from each data point to determine the departure from the mean, and accumulating the resultant departures. The CRD plot presents monthly long-term trends in rainfall since 2000, with a rising slope since July 2022 influenced predominantly by the cyclonic events in Jan-Feb 2023, followed by a rapid decline in 2024.

The 2024 annual rainfall (1279 mm) was significantly less than the previous year (2898 mm in 2023), less than 2022 (2403 mm), and 821 mm less than the historical average of 2100 mm. The month with the highest rainfall in 2024 was June (197 mm), followed by May (161 mm) and the driest month was February (55 mm) followed by March (59 mm).





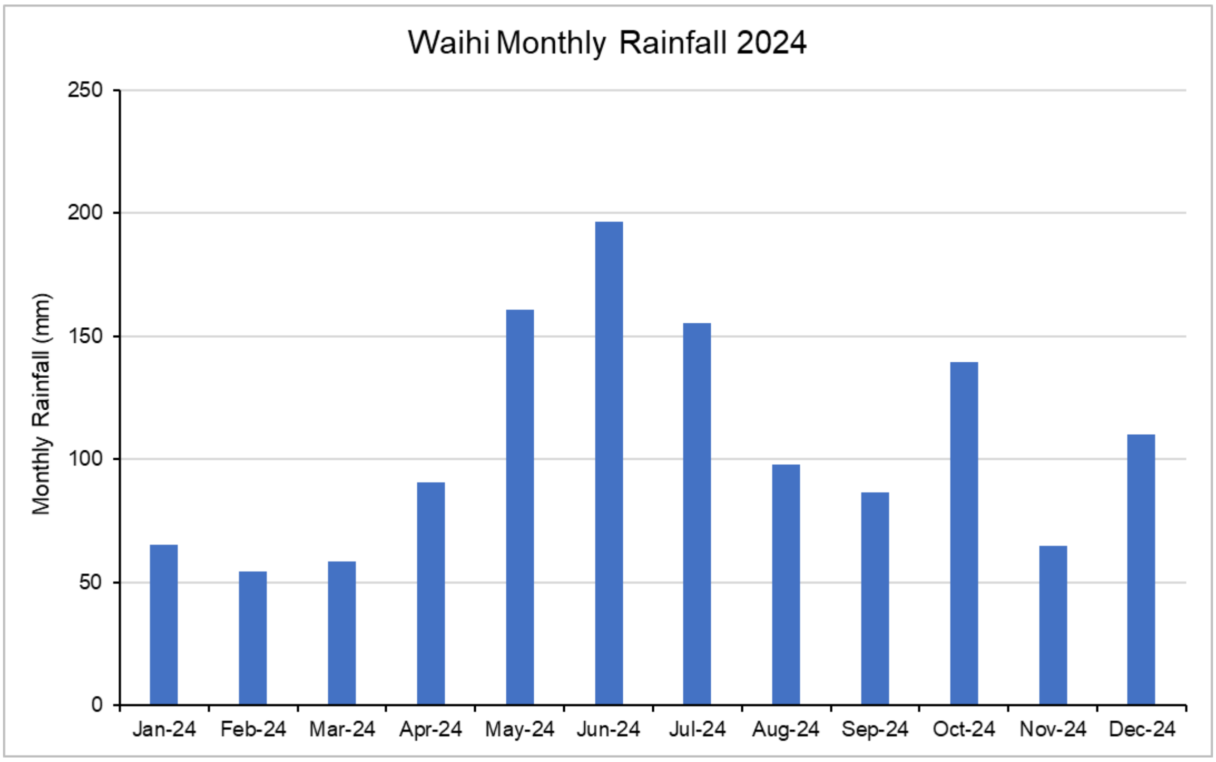


Figure 1. Annual and seasonal rainfall trends. A) CRD plot 2000–2024, B) Historical rainfall 1907–2024, C) Monthly rainfall 2024.

3 GEOLOGICAL SETTING

The mineralised veins of the Martha, Favona, Trio and Correnso gold deposits in Waihi are developed within Miocene age lava flows, intrusives and volcaniclastics of predominantly andesitic and minor dacitic composition (Figure 2). The andesites extend to depths greater than 600m below the surface and are extensively modified in places by weathering and hydrothermal alteration. The andesites are unconformably overlain by younger, unmineralised rhyolitic ignimbrites under much of the Waihi township. The ignimbrites drape over an eroded andesitic graben and horst landscape resulting in a volcaniclastic package that is highly variable in thickness (0 to >100m). Additionally, the ignimbrites exhibit variable textures, ranging from light weight, soft and pumice-rich horizons that are highly permeable to hard welded ignimbrites that appear less permeable. Paleosols (buried soils) and sedimentary deposits, such as alluvium and boulder alluvium (in places) mark the tops of successive eruption sequences.

There is a discontinuous layer of recent alluvium beneath the Waihi township that is located in areas where old streams and river channels cut into the ignimbrites and andesite units. These alluvial deposits are extensive to the east of Waihi where they are associated with the drainage systems of the Ohinemuri River catchment.

The most common effect of hydrothermal alteration on the andesitic host rocks surrounding the veins is the alteration of primary feldspars to illite and smectite clays and the introduction of pervasive potassic feldspar. Illite and smectite clays generally cause the host rocks to lose their internal strength forming weaker and usually more friable rock. The extent of clay alteration is highly variable and dependant on veining and the host rock type. In Waihi the strongly clay altered zones are usually concentrated within close proximity to the veins or faults (e.g. within the hanging wall of Favona) and within the vein zones themselves (e.g. Martha, Correnso and Trio). Potassic alteration on the other hand generally increases the overall strength of the host rocks which often results in the rocks surrounding the veins being more resistant to weathering and forming bluffs such as the Martha Hill (prior to mining of the Martha Open Pit) and Union Hill in Waihi. Paleo-weathering and hydrothermal alteration appear to have created an extensive low-permeability clay-rich horizon within the upper part of the andesite sequence. This horizon generally separates the andesites, hydro-geologically, from the younger overlying sequence of permeable rhyolitic ignimbrites. Exposure of the altered andesite in the southern wall of the Martha Pit indicates that the weathered clay horizon may extend up to 30m in thickness.

In the vicinity of the Martha vein zone the groundwater is largely concentrated within old underground mine workings, faults and veins where the historical mine workings act as effective conduits allowing inflow of groundwater water from the area surrounding the current Martha Open pit.

Principal veins and faults at both Martha and Favona dip to the south-east while the Correnso vein strikes north-north-west with an easterly dip. The Trio-Union-Amaranth veins are located on a paleotopographic high, informally referred to as the Union Horst that separates the Martha vein system from the Favona-Moonlight vein systems.

There is a hydrogeological connectivity between the Martha vein system and the Trio-Union-Amaranth vein system which is thought to be facilitated by the connecting Correnso structure. This was demonstrated historically by the rise and fall of ground water levels in the Union Hill shaft in unison with the rise and fall of water levels in the Martha Open Pit. There is only a very weak hydro-geological connectivity between the Martha system and the Favona system, shown by a lack of mutual response in the measured ground water levels. The zone of separation between the two groundwater systems is not well defined, but may be due to a fault boundary, either the No 9 fault or the Favona footwall fault, both of which are north to northeast trending and have a perceived strike extent exceeding 1km.

Groundwater inflow is predominantly controlled by infiltration from overlying layers and through outcrops of ignimbrite in the beds of streams and at the ground surface. The rhyolitic ignimbrite sequence is generally considered compressible and to date has accounted for most of the dewatering induced settlement around the mine site. This is indicated by settlement magnitude generally corresponding to the thickness of the rhyolitic ignimbrite and the magnitude of dewatering in these materials.

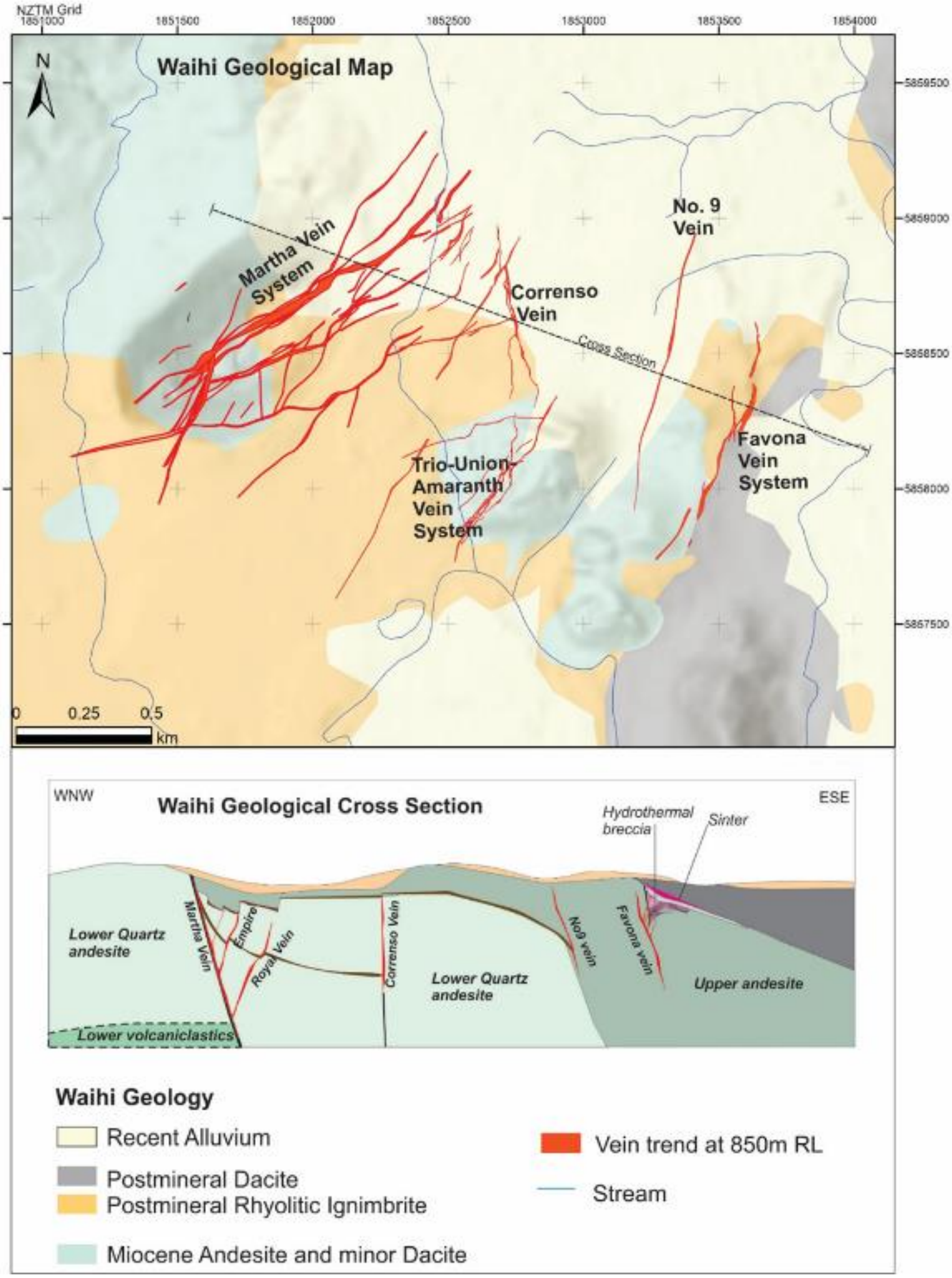


Figure 2. Geological map and cross section of the Waihi area showing the distribution of quartz veining and dominant geological rock units.

4 MINING ACTIVITIES

The main features of the mining activities during 2024 (in relation to dewatering and settlement) are described in the following sections.

4.1 Martha Open Pit

Access from the surface to the Martha Pit remained restricted during 2024 due to the north wall slip. No production works were undertaken in the pit during 2024. The pit remains in care and maintenance. In pit waste rock storage (from Martha Underground) continued.

4.2 Underground

4.2.1 Development & Production 2024

2024 saw development and production in the Martha mining area (Figure 3 & Figure 5), consisting mainly of declines, accesses, ore drives and stoping. Throughout 2024, 8,701m of development was completed. Approximately 181k tonnes of ore from development and 378k tonnes of ore from production was extracted over the period.

Limited mining activities were carried out in Correnso in 2024 (Figure 3 & Figure 4), with development blasting and drive rehabilitation. Backfilling in line with the land use consents continued.

4.2.2 Future Mining Activities

Mining activities for 2025 will focus on ore drives and stoping in Martha in the areas of Rex, Empire West, Empire, Edward and Royal East. It is planned to remove approximately 540k tonnes of ore and complete approximately 10,000m of development for the year. The reader should refer to the Annual Work Programme (WAI-200-REP-002) for a full description of the planned future mining activities.

4.2.3 Waste Rock Management

Waste rock is managed by underground stockpiling, backfilling into stopes, and placement on temporary stockpiles on the surface and within Martha Open Pit.

On the surface, a short-term stockpile is maintained immediately behind the mill area, enabling easy access for backloading. Larger or longer-term volumes will be stored at the Favona ‘Polishing Pond’ Stockpile (near the water treatment plant) and within the Martha Open Pit.

Waste rock placement at the Favona ‘Polishing Pond’ Stockpile started in early February 2007. The stockpile stopped receiving material in 2011 and was empty until 2020 when it began to store waste rock from the Martha Underground. Previously, the site has also been utilised for interim placement of Martha ore.

Waste rock placement within the Martha Open Pit started in August 2023 and will continue into 2025.

Before undertaking stockpile construction, the Favona Underground Mine Settlement, Dewatering and Water Quality Monitoring Plan was prepared, and approved by Waikato Regional Council (WRC). A separate Favona Water Quality Monitoring Report is prepared mid-year and will be submitted to WRC at the appropriate time.

4.2.4 Groundwater Inflows

During 2024, there were no anomalous water inflows in the Edward, Empire West and Empire declines which are used for accessing deeper ore bodies for Project Martha. One anomalous water inflow event was recorded in REX associated with unravelling of weak rock mass. P113A and P114 recorded a reduction in ground water levels. The area was treated with resin injection through self-drilling anchors to decrease water inflow and stabilise the area.

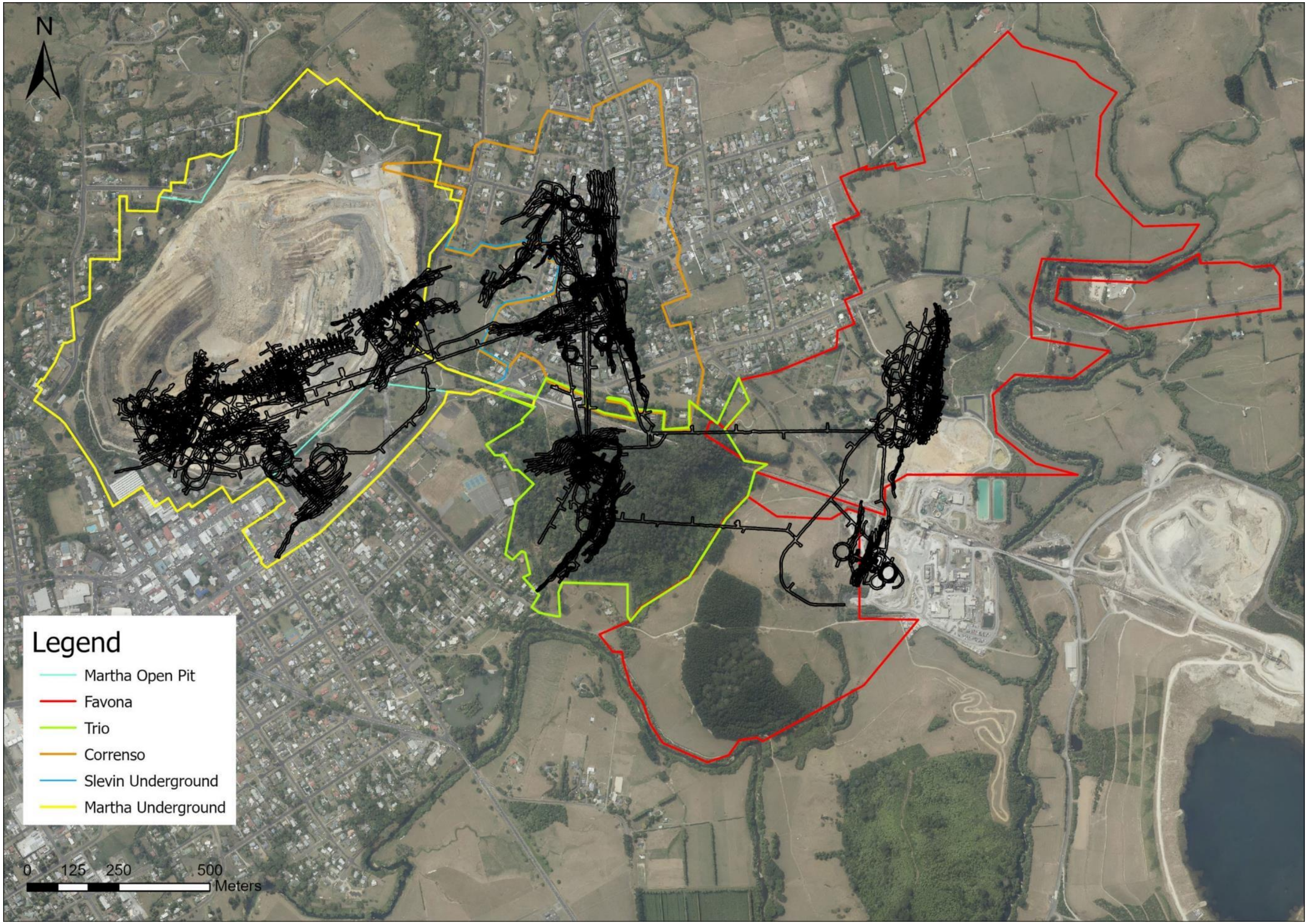


Figure 3. Current workings and boundaries.

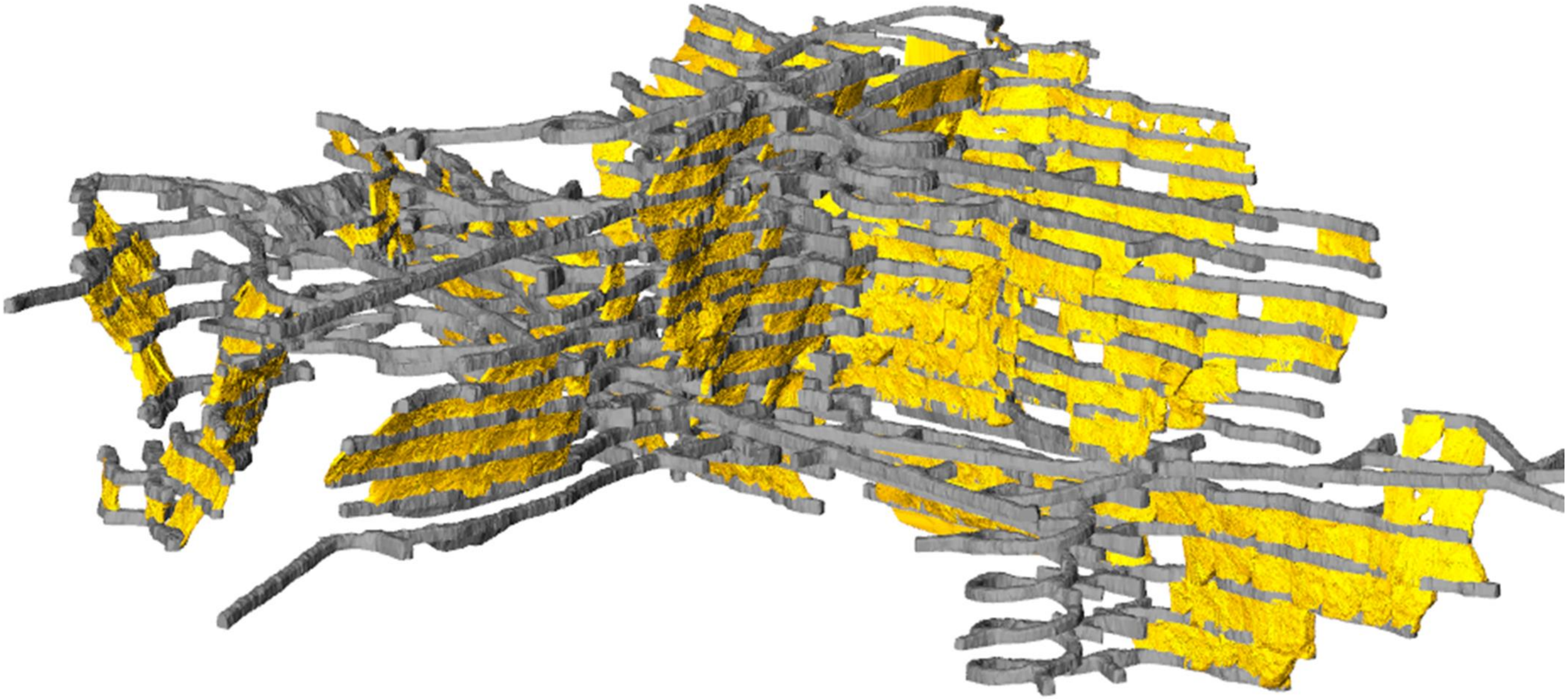


Figure 4 Oblique view of Correnso showing completed development (grey) and stoping (yellow) activities. View is looking northeast from above.

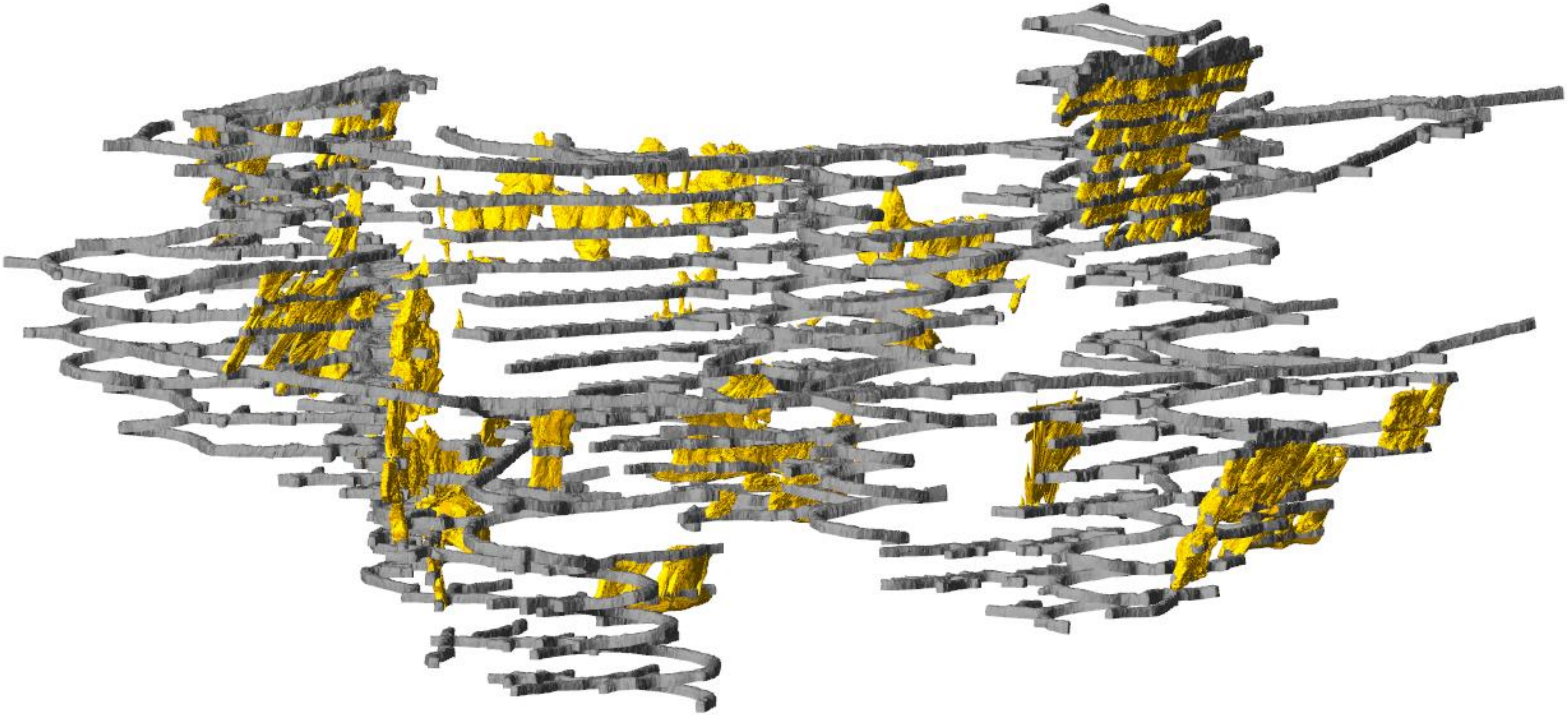


Figure 5. Oblique view of Martha Underground showing completed development (grey) and stoping (yellow) activities. View looking northeast.

5 DEWATERING

Table 1 shows the annual combined abstraction rate from Martha, Favona, Correnso and Trio. Figure 6 shows groundwater take rates and water levels, and Figure 8 & Figure 9 show the current pump arrangement for underground dewatering.

During 2020, four dewatering pumps were installed in two bores (800 PC1 and 800 PC2) from the 800 mRL level to lower the groundwater levels for the Project Martha development. Dewatering to 500 mRL is permitted under the Project Martha consent. Water from these bores is connected to the existing Correnso dewatering line. Water levels began to be drawn down using these pumps during 2021. At the end of 2024, groundwater levels were drawn to 636 mRL (Figure 7).

The mine datum is set at 1,000 m above sea level, which makes the Waihi township ground surface level around 1,120 mRL.

Table 1. Martha, Favona, Trio & Correnso Mines - Annual dewatering volumes and rates.

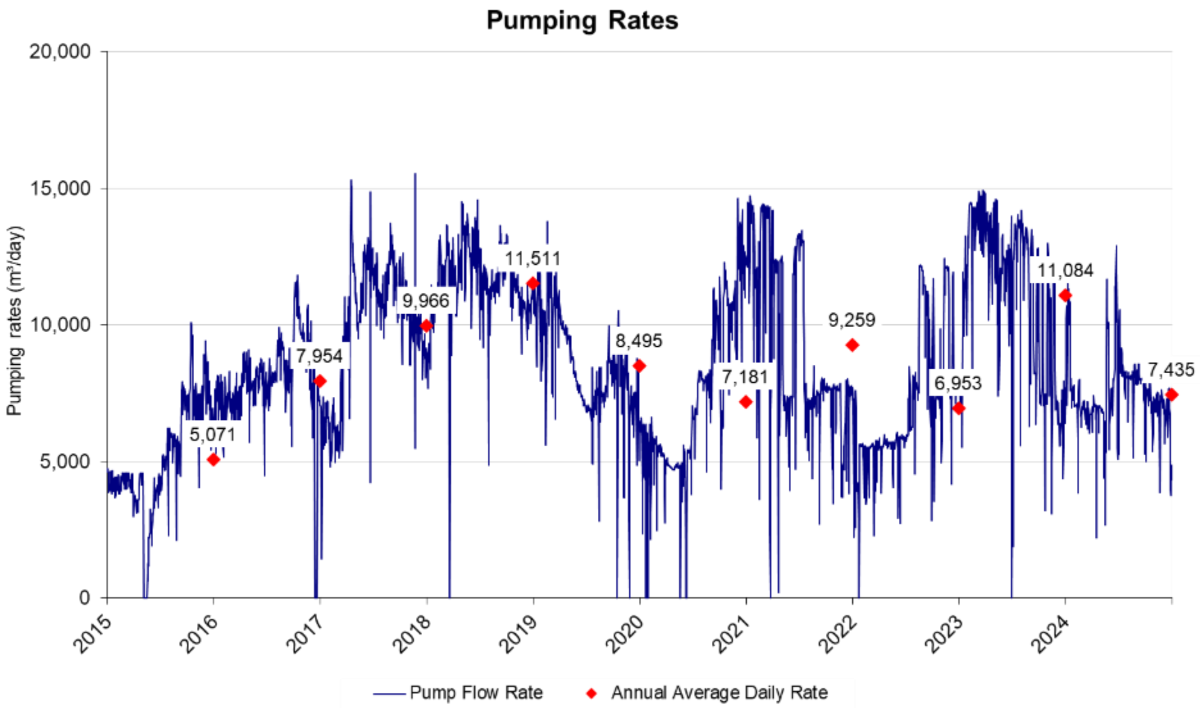
Year	Total mine take (m^3)	Average pump rate (m^3/day)	Service water pumped underground (m^3)	Total mine take minus service water (m^3)
2015 (18/05 onwards)	1,338,760	5,871	60,727 (23/09 onwards)	1,278,033
2016	2,911,046	7,954	181,466	2,729,580
2017	3,637,734	9,996	219,198	3,418,536
2018	4,285,048	11,511	262,227	4,022,821
2019	3,153,288	8,639	254,859	2,898,429
2020	2,687,124	7,342	173,290	2,513,834
2021	3,379,568	9,259	182,803	3,196,765
2022	2,537,964	6,953	198,999	2,338,965
2023	4,045,764	11,084	229,295	3,816,469
2024	2,721,100	7,435	227,393	2,493,707

Note: for continuity, Favona abstraction volumes are included in 'Total mine take' numbers reported in Table 1.

During December 2019, at the request of a peer reviewer, a standalone flow meter was installed for the Favona dewatering line. In 2021, the pump was removed as the area was dry.

5.1 Future Dewatering

The Project Martha dewatering consent allows dewatering to 500 mRL. Underground water levels were drawn to approximately 636 mRL in 2024. This will be progressively lowered during 2025, with a target pumping rate of 35 – 140 L/s, depending on rainfall and operational requirements. Water levels are projected to be lowered to approximately 600 mRL in 2025. Dewatering will be primarily from the drive and stope face as they mine below the dewatering bore levels. Ground water inflow into planned mine development will be pumped from the active mining front to the primary pump system.



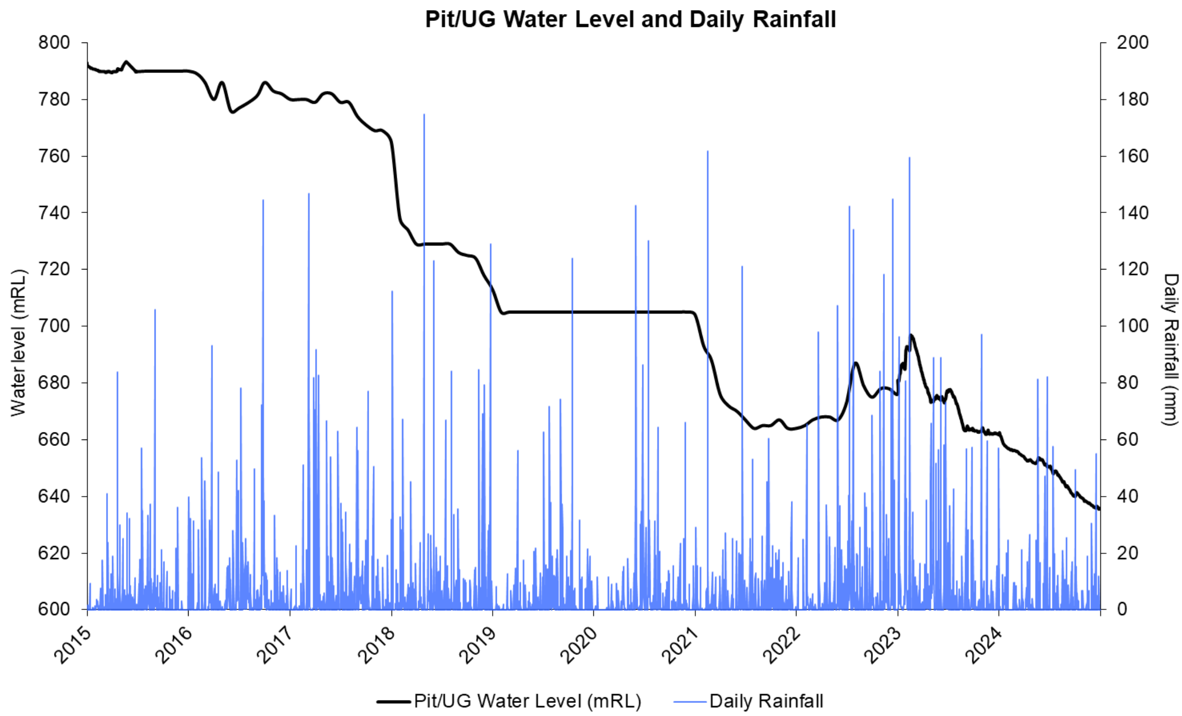
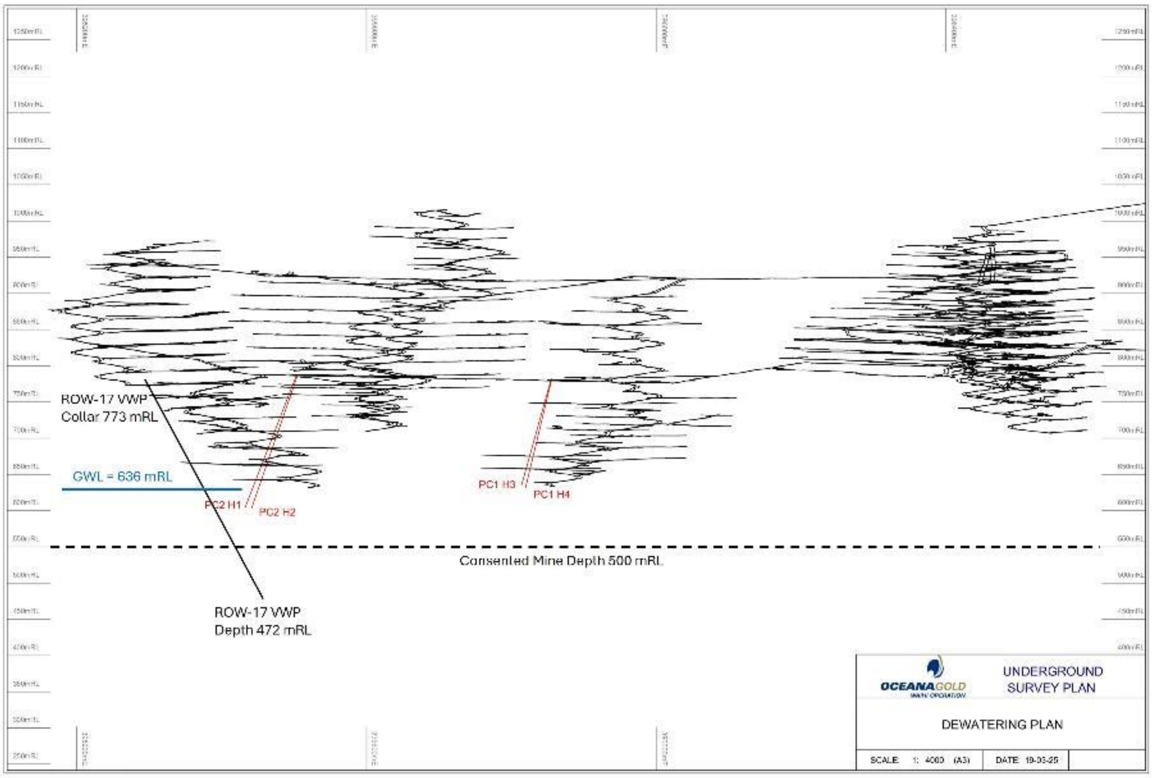


Figure 6. A) Underground dewatering pumping rates, B) Dewatering water level and rainfall.



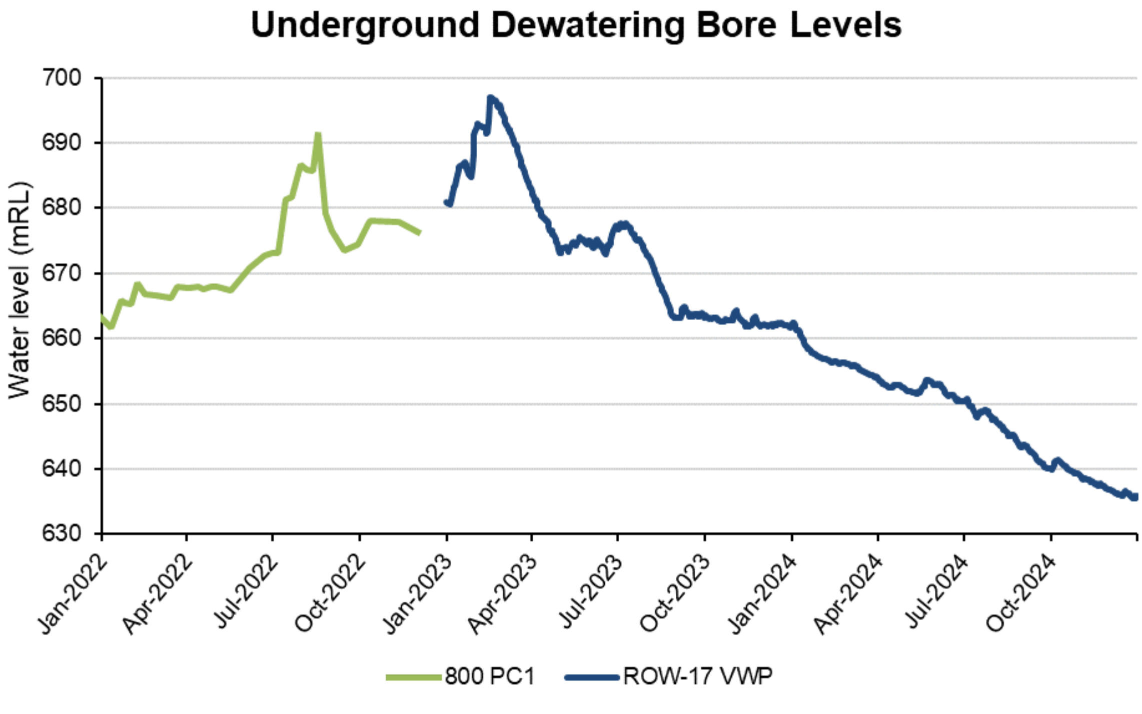


Figure 7. A) Project Martha dewatering bore locations, B) Underground dewatering bore levels.

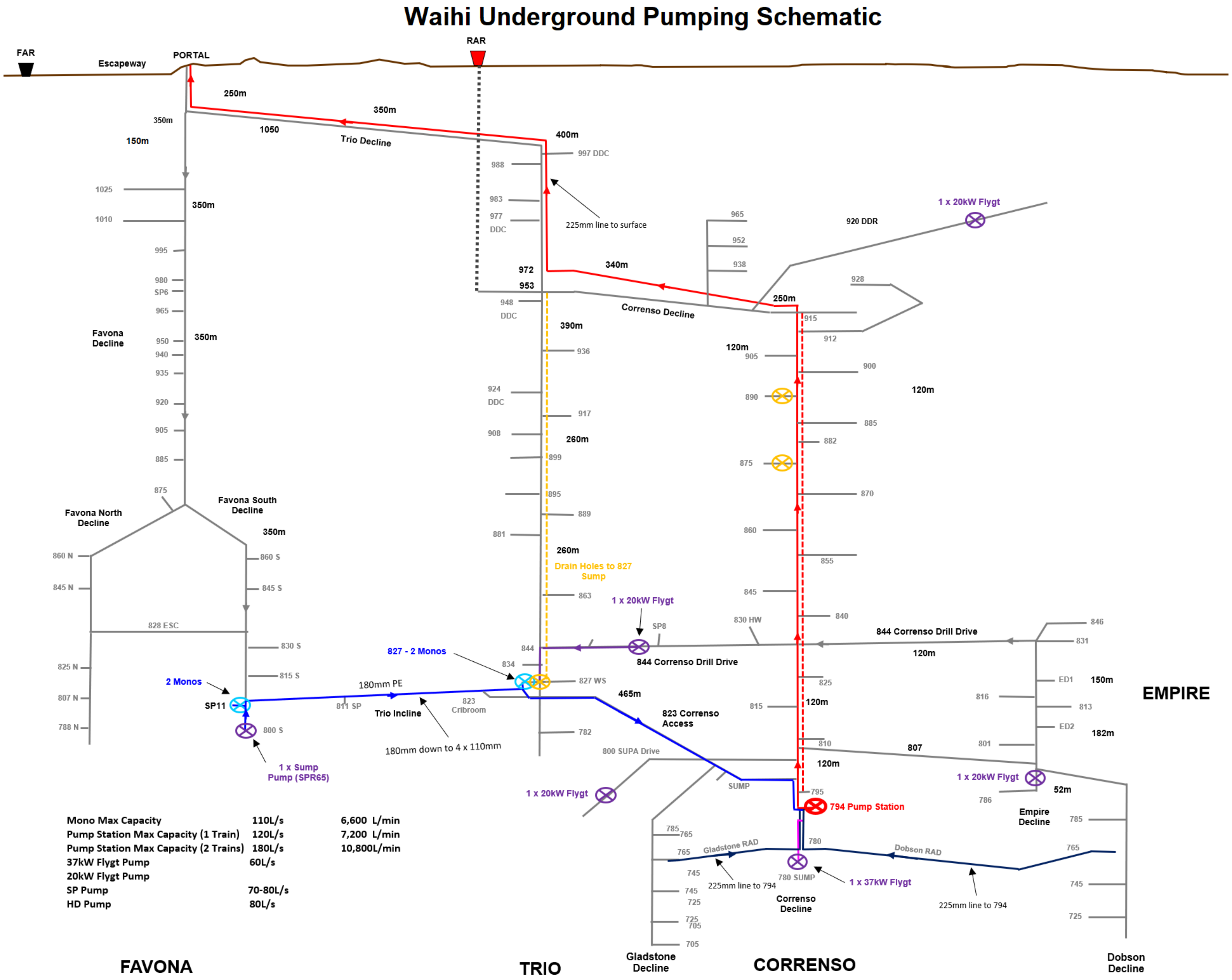


Figure 8. Correnso, Trio and Favona pumping schematic 2024.

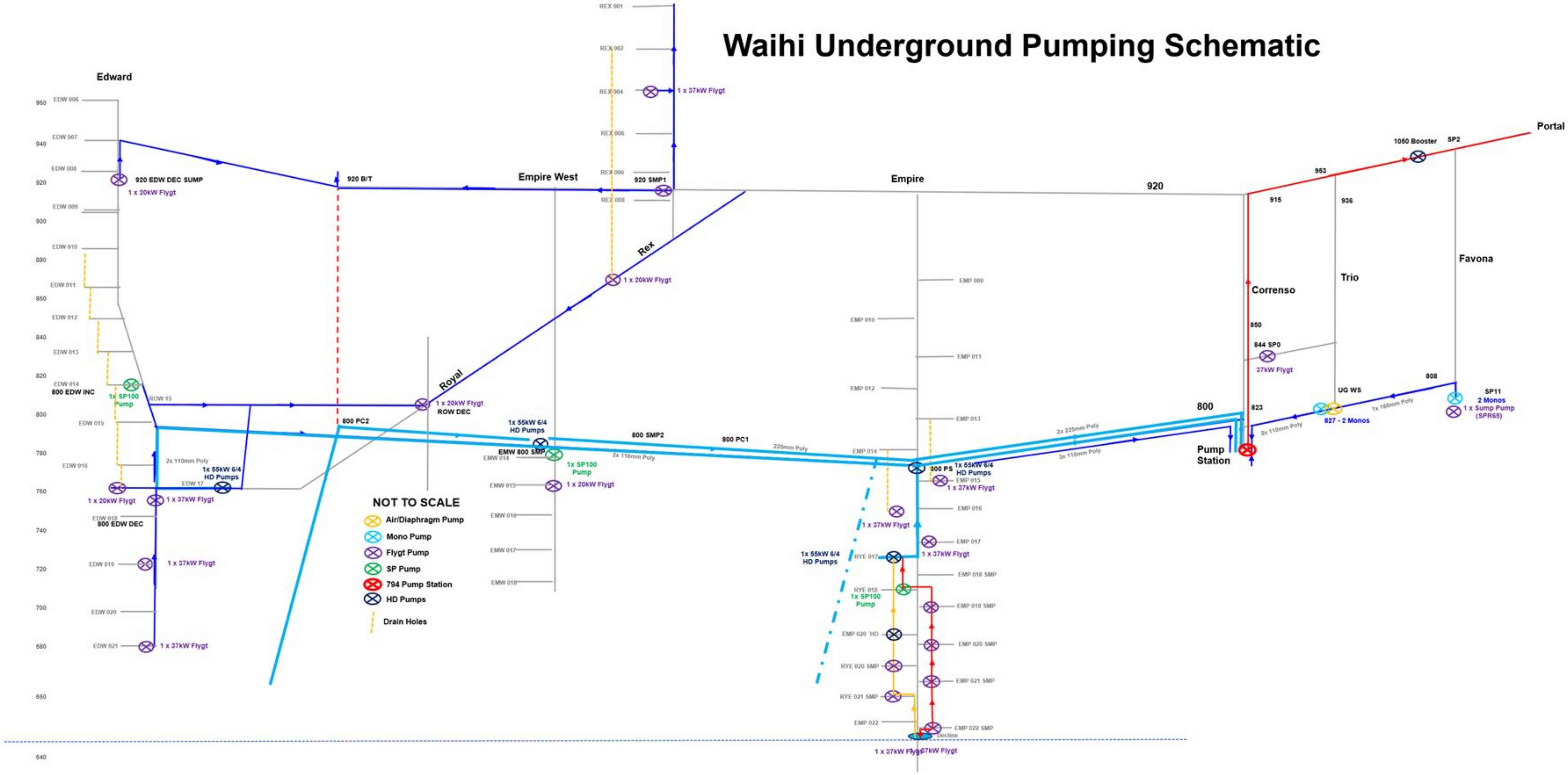


Figure 9. Martha Underground pumping schematic 2024.

6 GROUNDWATER MONITORING

This section is provided to meet Conditions 13a, b and c of the Martha Consent, Conditions 2a, 4b, and 4c, Schedule 2 of the Favona Consent, Conditions 6 (ii) and (iii) of the Trio Development Consent (referred to by the Trio Underground Mine Consent 6.1.1), Condition 35 of the Correnso Underground Mine Consent, Condition 29 of the SUPA Consent and Condition 22 of the Project Martha Consent. It includes:

- Data from monitoring undertaken during the previous year including groundwater contour plans (derived from the data) in respect of the piezometer network.
- Identification and interpretation of any environmentally important trends in dewatering behaviour or groundwater profile. Existing trends identified prior to 2024 will not be discussed in depth unless there has been a significant change or trigger reached.

6.1 Monitoring Network

OGNZL has maintained a piezometer network within and around Martha Mine since 1987 and Favona Mine since 2004. The following changes have previously been made to the network:

- Additional Correnso/SUPA piezometers were installed in 2011, 2014 and 2016.
- P106 was drilled northwest of Martha Pit and four vibrating wire piezometers (VWPs) installed in that drill hole during 2017.
- Seven Project Martha piezometers were added to the network during 2019 and three during 2021.
- Two new piezometers (P122 & P123, each connected to 4 VWPs) equipped with telemetry were added during December 2022 – January 2023.
- In 2023 there were a number of upgrades to the network to monitor response from shallow Rex orebody mining. P113 which was dry, was re-drilled in a nearby location, as P113A. P110, P111, P112, & P114 were upgraded to telemetry monitoring and water level loggers were installed in P110, P113 and P114.
- Also in 2023, a VWP (ROW-17) was installed in the Martha Underground Mine at 773 mRL with a single tip at 472 mRL.

Monitoring of BH8 was discontinued in May 2023 as this borehole likely collapsed and a replacement is not considered necessary given WC202 is at the same location.

All piezometers are monitored on a monthly basis as required by the consent conditions. The water levels are translated to the mine datum reference level to enable comparison between bores or areas. VWPs record values at daily intervals with the data downloaded monthly.

6.1.1 Current Monitoring Network

The Waihi town piezometer network currently has 53 standpipe piezometers and five pneumatic piezometers. An additional 53 vibrating wire piezometers are also included in monitoring Waihi East, south of the Martha Pit and northwest of the Martha Pit.

Monitoring of BH7 and P8-1 ceased in December 2024 due to inconsistent data. It was agreed with the HDC geotechnical reviewer (Peter Fuller), during the annual site visit on 19 November 2024, to stop monitoring BH7 and P8-1. Levels in BH7 are strongly influenced by the nearby stream and P8-1 has had unreliable readings since mid-2023, this bore has likely collapsed.

The current piezometer network locations are shown Figure 10, well depths and average 2024 water depths are shown in Table 2 below.

Table 2. Piezometer network water depths for 2024.

ALLUVIUM					
Well ID	**Depth (mRL)**	**2024 Average GWL (mRL)**	**Average Water Depth (m)**	**Piezometer Type**	**Comment**
P2-4	1101	1108	7	Standpipe	
P8-4	1112	1118	6	Standpipe	
P63-S	1113	1117	4	Standpipe	
P76-S	1109	1111	2	Standpipe	
P77-S	1111	1115	4	Standpipe	
P87-S	1110	1115	5	Standpipe	
P91-1	1113	1119	6	VWP	
P93-1	1105	1116	11	VWP	
P94-1	1114	1115	1	VWP	
P101-1	1102	1107	5	VWP	
P102-1	1109	1113	4	VWP	
WC201-4	1104	1111	7	Standpipe	
WC201-5	1110	1111	1	Standpipe	
WC203-4	1099	1102	3	Standpipe	
GLD004S	1080	1085	5	Standpipe	
YOUNG VOLCANICS					
P2-3	1073	1092	19	Standpipe	
P4-2	1048	1088	40	Standpipe	
P7-2	1039	1091	52	Standpipe	
P7-3	1081	1090	9	Standpipe	
P8-3	1093	1116	23	Standpipe	
P27-1	1074	1078	4	Standpipe	
P63	1070	1090	20	Standpipe	
P64-I	1086	1100	14	Standpipe	
P76-I	1073	1103	30	Standpipe	
P77-I	1046	1095	49	Standpipe	
P78-S	1110	1109	1	Standpipe	
P78-I	1066	1103	37	Standpipe	
P79-S	1091	1096	5	Standpipe	
P79-I	1061	1092	31	Standpipe	
P87-I	1070	1110	40	Standpipe	
P90-1	1100	1115	15	VWP	
P90-2	1020	1100	80	VWP	
P91-2	1097	1119	22	VWP	
P91-3	1011	1112	101	VWP	
P92-1	1096	1119	23	VWP	
P92-2	1000	1108	108	VWP	

YOUNG VOLCANICS cont.					
Well ID	**Depth (mRL)**	**2024 Average GWL (mRL)**	**Average Water Depth (m)**	**Piezometer Type**	**Comment**
P93-3	1015	1089	74	VWP	
P94-2	1094	1114	20	VWP	
P94-3	1016	1101	85	VWP	
P95-1	1091	1115	24	VWP	
P95-2	1031	1102	71	VWP	
P100-1	1066	1081	15	VWP	
P100-2	996	1052	76	VWP	
P101-2	1083	1107	24	VWP	
P101-3	1068	1094	26	VWP	
P102-2	1079	1092	13	VWP	
P102-3	1055	1088	33	VWP	
P107	1089	1111	22	Standpipe	
P108	1116	1121	5	Standpipe	
P109	1091	1096	5	Standpipe	
P110	1097	1104	7	Standpipe	
P111-1	1100	1107	7	VWP	
P112-1	1058	1058	0	VWP	Dry
P113	1062	1062	0	Standpipe	Dry
P113A-1	1090	1089	-	VWP	Dry
P113A-2	1069	1071	2	VWP	
P114	1054	1055	1	Standpipe	
P115	1072	1094	22	Standpipe	
P116	1045	1092	47	Standpipe	
P122-1	1092	1101	9	VWP	
P122-2	1060	1060	0	VWP	Dry
BH6	1053	1111	58	Standpipe	
BH7	1079	1061	-	Standpipe	Ceased Dec-24
BH9	1074	1096	22	Standpipe	
BH11	1075	1093	18	Standpipe	
BH12	1079	1106	27	Standpipe	
GLD004I	1065	1086	21	Standpipe	
WC202-2	1048	1072	24	Pneumatic	
ANDESITE					
P2-1	974	975	1	Standpipe	
P2-2	1035	1045	10	Standpipe	
P7-1	989	1003	14	Standpipe	
P8-1	976	1040	64	Standpipe	Ceased Dec-24
P9-1	1037	1118	81	Standpipe	

ANDESITE cont.					
Well ID	**Depth (mRL)**	**2024 Average GWL (mRL)**	**Average Water Depth (m)**	**Piezometer Type**	**Comment**
P69-S	1114	1132	18	Standpipe	
P69-D	1063	1091	28	Standpipe	
P75	979	1063	84	Standpipe	
P76-D	1056	1097	41	Standpipe	
P77-D	1031	1094	63	Standpipe	
P78-D	1053	1072	19	Standpipe	
P79-D	1048	1087	39	Standpipe	
P87-D	1025	1102	77	Standpipe	
P90-3	983	1084	101	VWP	
P91-4	971	1103	132	VWP	
P92-3	965	1102	137	VWP	
P93-4	975	1039	64	VWP	
P94-4	976	994	18	VWP	
P95-3	1001	1061	60	VWP	
P100-3	981	1044	63	VWP	
P100-4	956	989	33	VWP	
P101-4	1037	1037	0	VWP	Dry
P102-4	1027	1032	5	VWP	
P106-1	1100	1100	0	VWP	Dry
P106-2	1060	1060	0	VWP	Dry
P106-3	1010	1011	1	VWP	
P106-4	974	974	0	VWP	Dry
P111-2	1088	1088	0	VWP	Dry
P111-3	1055	1060	5	VWP	
P112-2	1035	1035	0	VWP	Dry
P112-3	998	998	0	VWP	Dry
P113A-3	1035	1059	24	VWP	
P122-3	1032	1032	0	VWP	Dry
P122-4	933	932	-	VWP	Dry
P123-1	1044	1107	63	VWP	
P123-2	1004	1003	-	VWP	Dry
P123-3	964	968	4	VWP	
P123-4	924	925	1	VWP	
WC201-1	1059	1107	48	Pneumatic	
WC201-2	1077	1109	32	Pneumatic	
WC201-3	1097	1111	14	Pneumatic	
WC202-1	1032	1073	41	Pneumatic	
GLD004D	1020	1086	66	Standpipe	

6.1.2 Inspection and Maintenance

The piezometer dip-meters are maintained in good working condition. Calibration against a reference tape is carried out annually by Hydrologic NZ Ltd. The dip-meter tape is replaced if the difference against the reference tape is more than 0.1%. Annual calibrations were completed in 2024.

The consent conditions require an inspection of the piezometer installations and appraisal of the piezometer network every two years. In effect, inspections of the piezometer network are undertaken more frequently, with the piezometer monitoring procedure requiring 6-monthly sounding to the bottom of all standpipe piezometers to identify any locations with excess accumulated sediment.

The piezometer designs have screens which allow water to flow into the pipe at specified depths. Piezometers that are most impacted by sediment are flushed as required. In November 2019 piezometers P4-1, P4-3, P8-2, P9-2, and P9-3 showed little change after multiple flushing attempts and are no longer monitored. Based on the most recent depth to bottom measurements only two piezometers require flushing, to be completed in 2025.

6.2 Groundwater Results

Groundwater contour plans have been updated for the three principal geological units: alluvium (plus shallow groundwater in weathered young volcanic materials), young volcanics (including ignimbrite), and andesite, based on the average groundwater depths in Table 2. The groundwater plans are presented in Figure 11, Figure 13 and Figure 17 respectively.

6.2.1 Shallow Groundwater

Figure 11 shows the inferred contours for shallow groundwater in alluvium and weathered young volcanic materials and shows the water level trends over time.

Figure 12 shows the trend plots for the piezos that were monitored in 2024. Note that GLD004 has been excluded as the 1085 mRL would compress the scale and WC203-4 has been excluded as there has only been one reading since 2015.The overall contour pattern and the trend plots demonstrate that the shallow groundwater system remains essentially unaffected by dewatering of the surface and underground mining operations. Shallow groundwater levels are controlled principally by rainfall infiltration, low surface soil permeability and natural and assisted drainage to surface water systems.

Contouring of the area southwest of Martha Mine has been impacted by the loss of access to WC206. For the purposes of completing the contour plan it was assumed that groundwater level in the alluvium at this location remained the same as in previous years.

Figure 10. Waihi piezometer network 2024.

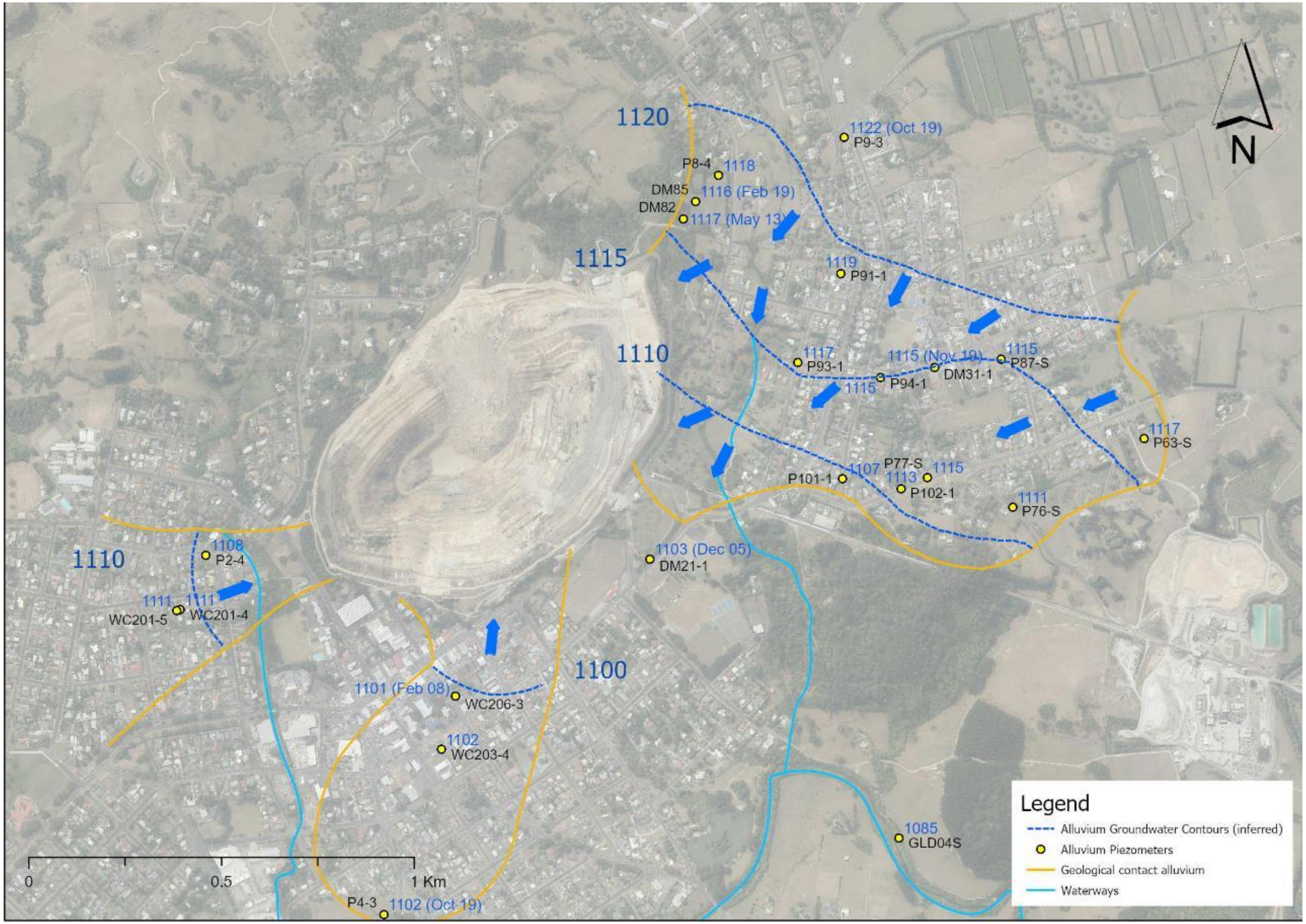


Figure 11. Alluvium water level contours.

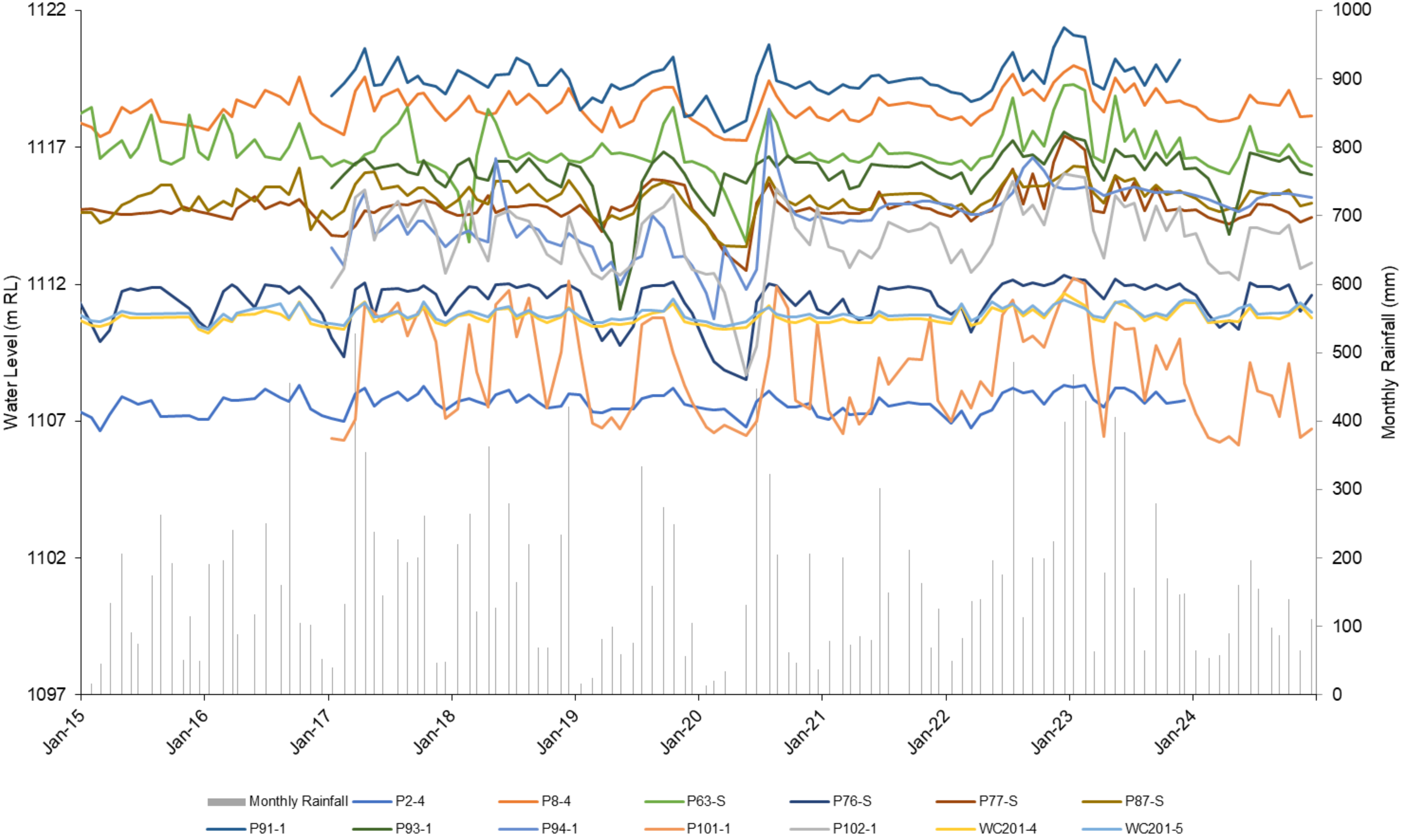


Figure 12. Groundwater level trends – shallow groundwater (alluvium & weathered contact of young volcanics).

6.2.2 Young Volcanics

Groundwater contours in the deeper portions of the young volcanic materials below the shallow groundwater system and groundwater level trends are shown on Figure 13, Figure 14, Figure 15 and Figure 16. As requested by the Peer Reviewer, P107-P110 & P113A-P116 have been removed from Figure 15 and placed in a separate chart (Figure 16). Refer to Appendix F for conceptual hydrogeologic sections relative to the interpreted groundwater flow systems.

The young volcanic materials infill topographic depressions in the surface of the andesite rock body in which the open pit and underground mines are constructed.

Groundwater level change and the associated consolidation of the varying thickness of these relatively compressible young volcanic materials are considered to be responsible for much of the settlement and for the settlement patterns around the Martha and Favona Mines. Noting, that dewatering of the deep andesites is also contributing to general settlements across Waihi.

The dewatering pattern in the young volcanics around Martha Mine indicates drainage towards the open pit. The limited groundwater discharge at the contact of the young volcanic materials with the underlying andesite in the pit (see Figure 13 & Figure 14) suggests drainage is affected by features other than the contact (which defines a paleo-valley in the andesite). The most likely additional drain point is a substantial block cave evident in the pit wall. This block cave, referred to as the Milking Cow, was active during historical (pre-1950’s) underground operations and resulted in substantial settlement of the ground surface, down-folding of fill and young volcanic strata, and close fracturing of the welded ignimbrite layers.

Prior to the start of dewatering at Martha Mine, groundwater levels in all rock units were similar. With the onset of mine dewatering, water levels in the veins and historic workings were drawn down. Groundwater levels in the various rock units below the shallow aquifer showed increasing vertical separation until the mid to late 1990’s. Thereafter, the water levels (other than in the veins and workings) stabilised and have remained stable since. This pattern is demonstrated in the monitoring wells at site P2, with piezometer P2-1 following the vein water levels until the water level dropped below the piezometer tip. P2-2 measures the upper andesite water levels, P2-3, the young volcanic rock water levels and P2-4 the alluvium (shallow aquifer) water levels.

The development of the settlement pattern has shown a similar behaviour with an initial higher rate of settlement followed by a much-reduced rate of settlement once groundwater levels in the upper rock layers stabilised. These patterns are discussed in the following sections.

BH11 and BH12 have been included in the young volcanics hydrograph. These were historically listed as andesite piezometers. The piezometer network was reviewed by GWS Limited as part of a wider assessment of the Waihi piezometer network. The findings of the GWS review resulted in the installation of two new Martha vibrating wire piezometers (VWP), P122 and P123. Note that P123 does not have any sensor tips in the Young Volcanics.

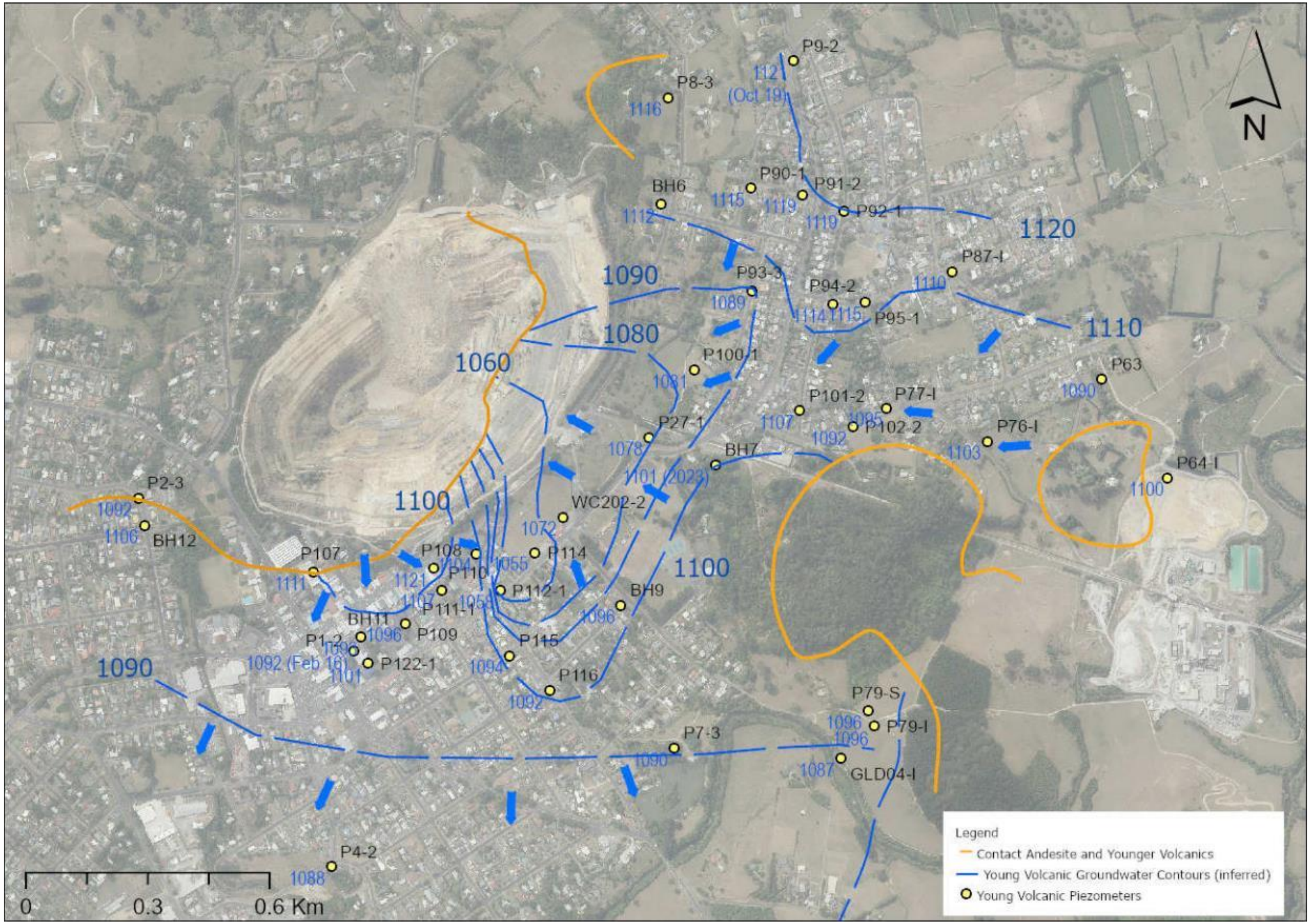


Figure 13. Deeper young volcanic water level contours.

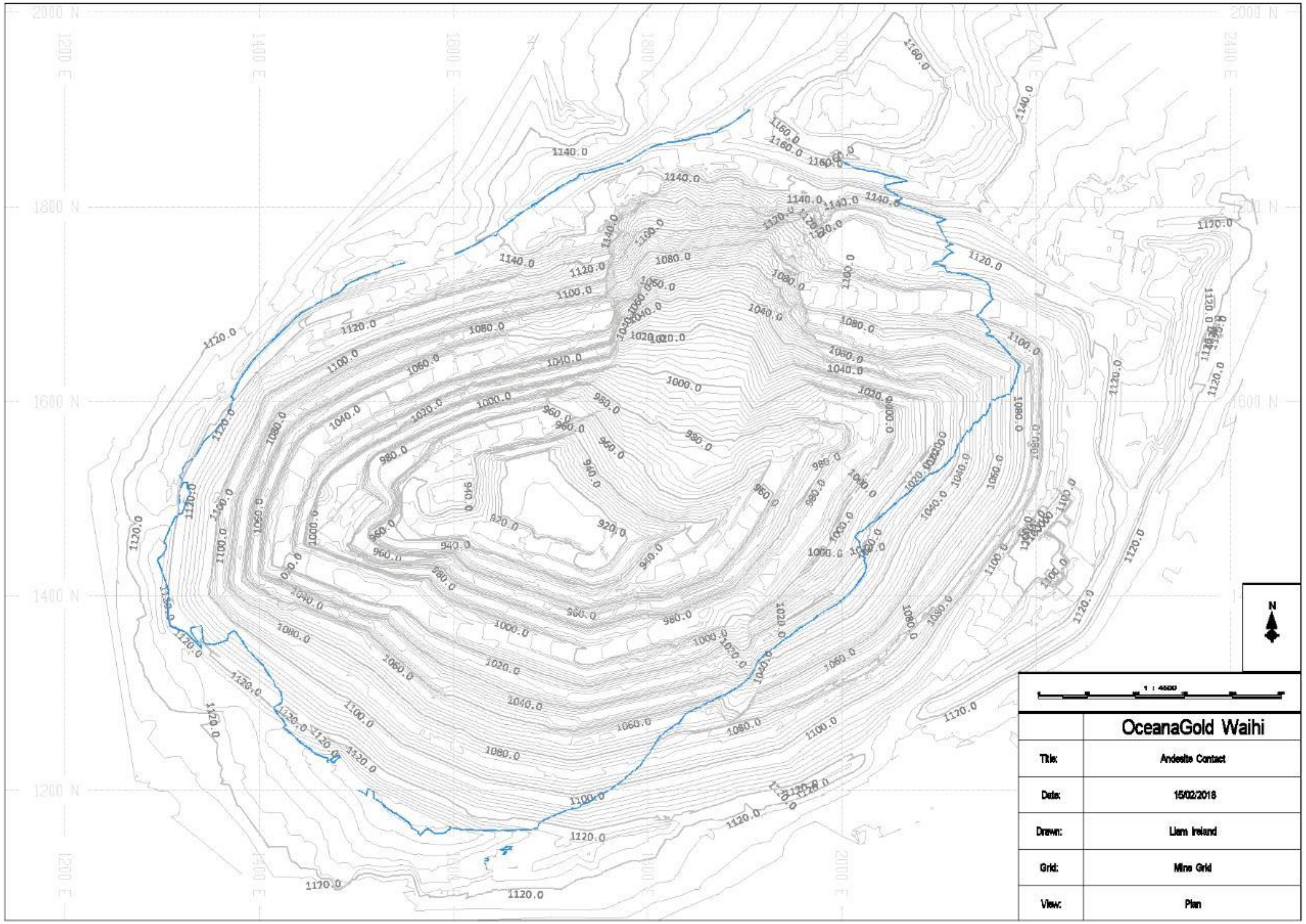


Figure 14. Groundwater level trends – deeper young volcanic materials.

Note: (blue line indicates contact of the young volcanics with the underlying andesite where seepage at the base of the young volcanics would occur).

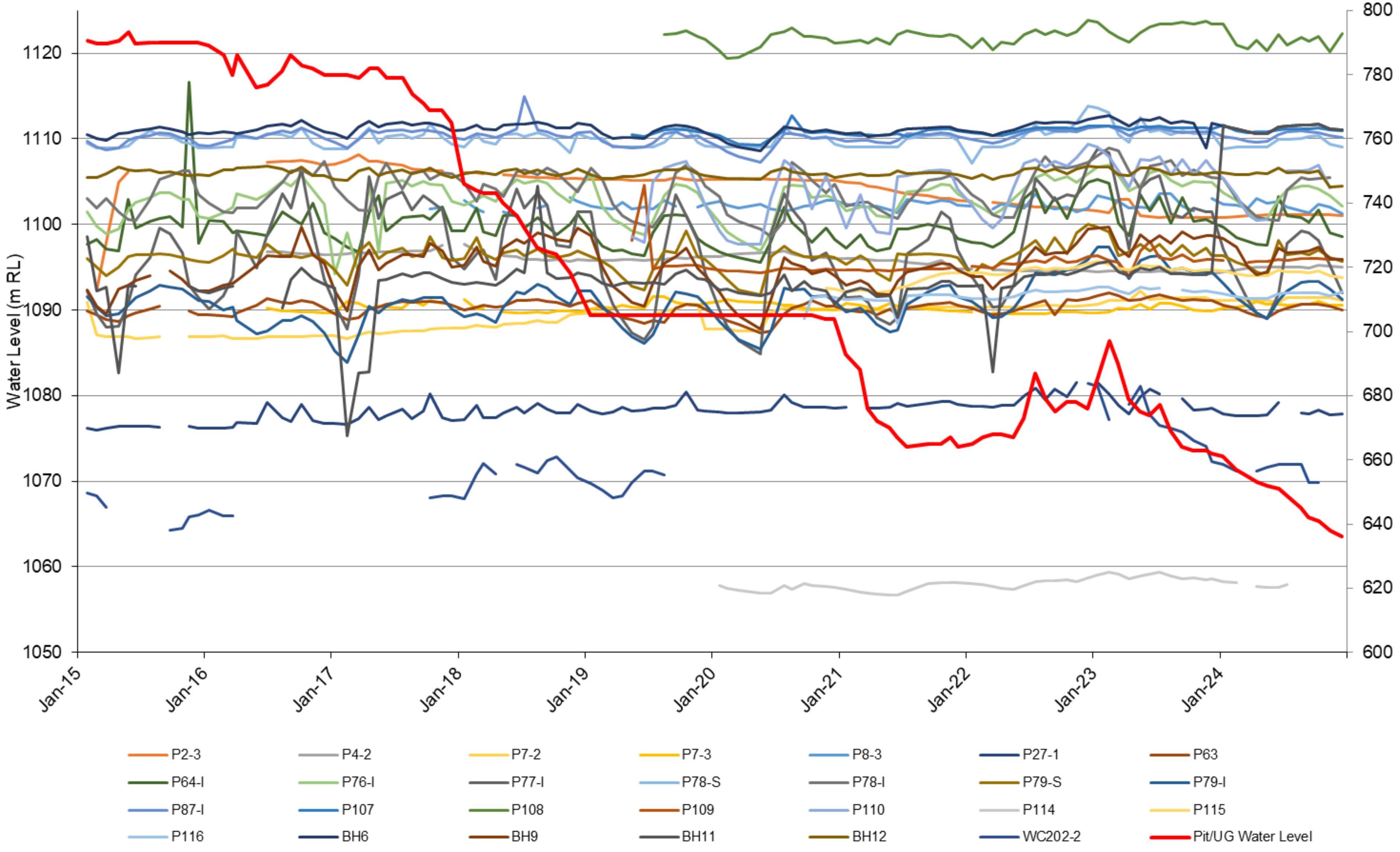


Figure 15. Groundwater level trends – deeper young volcanics near underlying andesite contact.

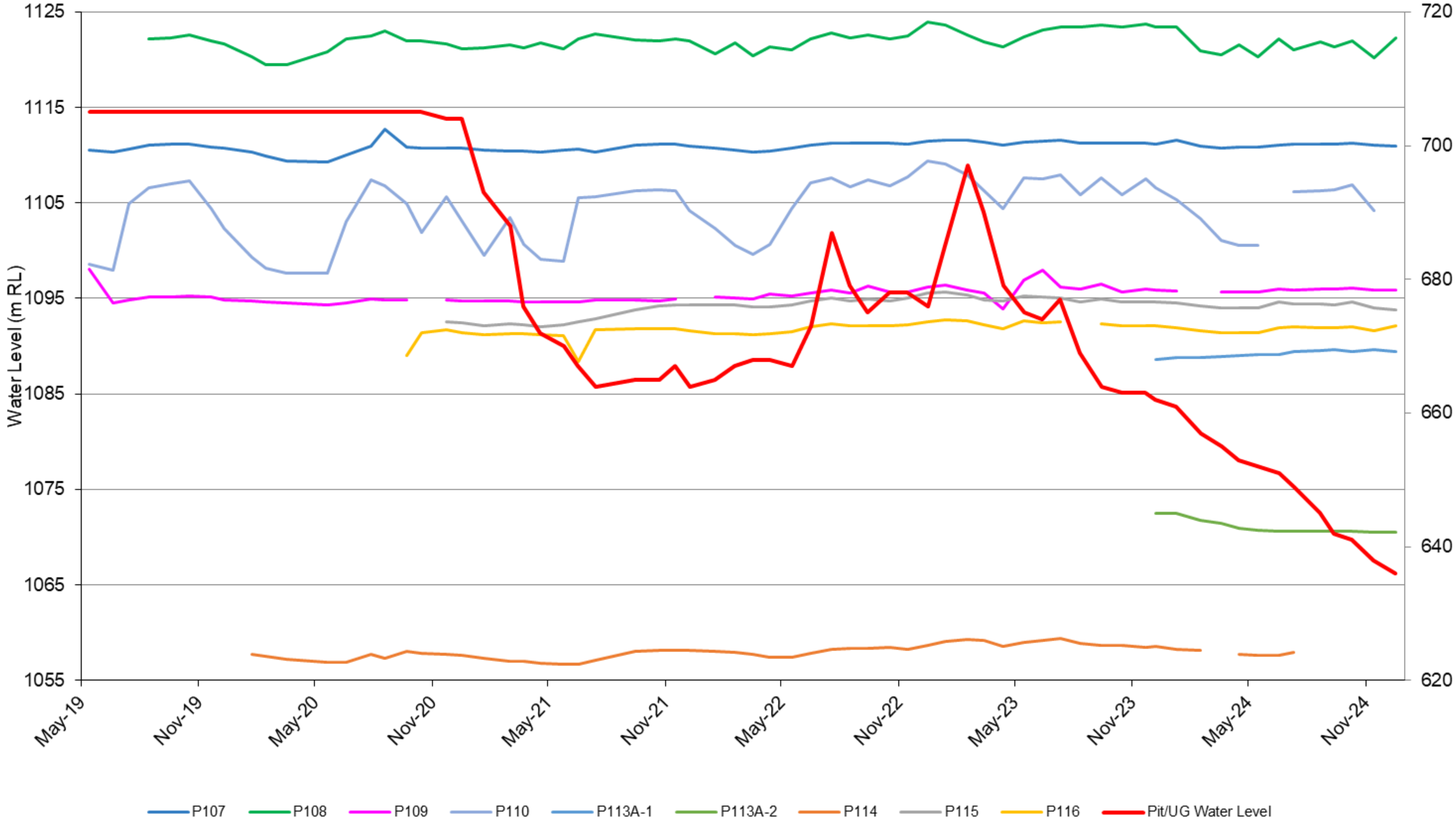


Figure 16. Groundwater level trends – P107-P110 & P113A-P116.

6.2.3 Andesite

Andesite rock forms the local basement rock body for the Waihi area and hosts the mineralisation which was being mined at Martha Pit and is currently mined in the Underground.

Figure 17 shows the extent of the dewatering effects in the andesite rock body as a result of dewatering. Data from the vibrating wire piezometer units have been included. Figure 18 provides the water level trends in the andesite rock body. While groundwater level data is available for the vein systems and the shallower andesite rock, no monitoring data is available for intermediate depths within the andesite rock mass outside of development areas. Hence, groundwater levels between the vein and the shallow rock mass have been interpolated. Refer to Appendix F for conceptual hydrogeologic sections relative to the interpreted groundwater flow systems.

Groundwater levels in the andesite vein systems have responded rapidly and substantially to mine dewatering along the strike of the Martha vein system, Trio vein system (beneath Union Hill), and Favona/Moonlight vein systems (Figure 17). An area of dewatering, indicated between Martha Mine and Trio/Correnso vein systems, suggests a relatively close linkage. Outside of these structures, the dewatering effect in the andesite rock is attenuated or absent. This is illustrated by the different responses shown on Figure 18.

The P123 monitoring data clearly shows that there is a saturated zone in the near surface resulting in water pressures of some 60 m head in the shallowest VWP tip located at 80 m depth (1044 m RL). The tips below that depth show little to no water pressure suggesting dewatering has occurred below 110 m depth (1015 m RL) to a depth of at least 200 m (925 m RL).

Review of the core photographs for P123 and the geologic model of the Martha Pit in that area shows a number of reasons why those conditions might exist. A summary of the geologic conditions near each VWP tip is summarised as follows:

- Tip 1 (80 m BGL - 1044 m RL): Andesite with argillic clay alteration and propylitic alteration.
- Tip 2 (120 m BGL – 1004 m RL): Andesite with argillic clay alteration with a silicified overprint. Fractured with calcite veining.
- Tip 3 (160 m BGL – 964 m RL): Andesite with argillic clay alteration with a silicified overprint. Massive quartz after calcite veining.
- Tip 4 (200 m BGL – 924 m RL): Andesite with silicified overprint. Some fracturing.

The Martha Mine geologic model shows that between an elevation of 1015 to 960 m RL along the northwestern pit face, there are a number of vein sets that dip back behind the pit wall. Those veins are generally at a similar elevation to those observed in the core for P123.

In summary, our interpretation is that rainfall infiltration, combined with the higher water holding capacity and lower permeability of clay altered andesite, results in water being retained in the circa. 110 m below the land surface.

Below that depth (circa 1014 m RL), the rock mass itself is silicified, with fractures and veins providing secondary permeability. That secondary permeability is higher than the permeability of the overlying clay altered andesite rock mass, resulting in the observed underdrainage effect. It is not clear how far that dewatering effect extends to the northwest. A lobe of dewatering extends to the southwest of Martha Mine and this is considered to be due to the drainage effect along the north-south Edward lode structure. Dewatering is shown to reduce eastwards along the Martha system but may extend further at depth as the host rocks are more deeply buried in that direction and no deep monitoring wells are available for confirmation.

Figure 17 also indicates the dewatering centralised on the Favona system with the restriction of connection between Favona and the Union systems. The geological model in Section 3 indicates an up-thrown block (Union Horst, Figure 17) between the Union and Favona systems. This structural hiatus is likely to account for the restricted groundwater interconnection between the Martha-Union and Favona systems.

The vibrating wire and Favona piezometers have been excluded from Figure 18 and are presented in Figure 19 to Figure 36.

The piezometer network was reviewed by GWS Limited as part of a wider assessment of the Waihi piezometer network. The findings of the GWS review resulted in the installation of two new Martha vibrating wire piezometers (VWP), P122 and P123. P123 has four sensor tips in the Andesite and is shown in Figure 17.

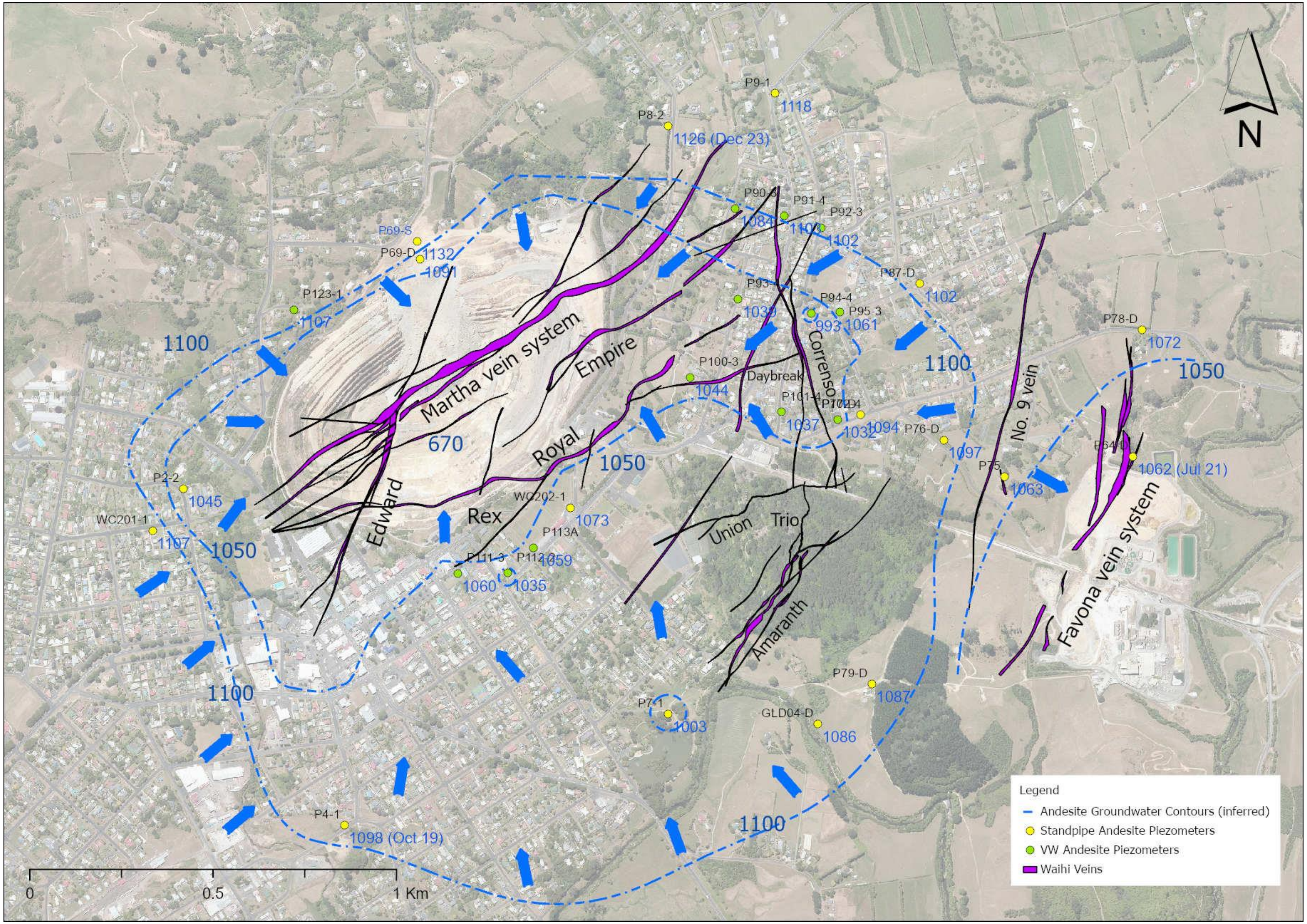


Figure 17. Upper andesite water level contours.

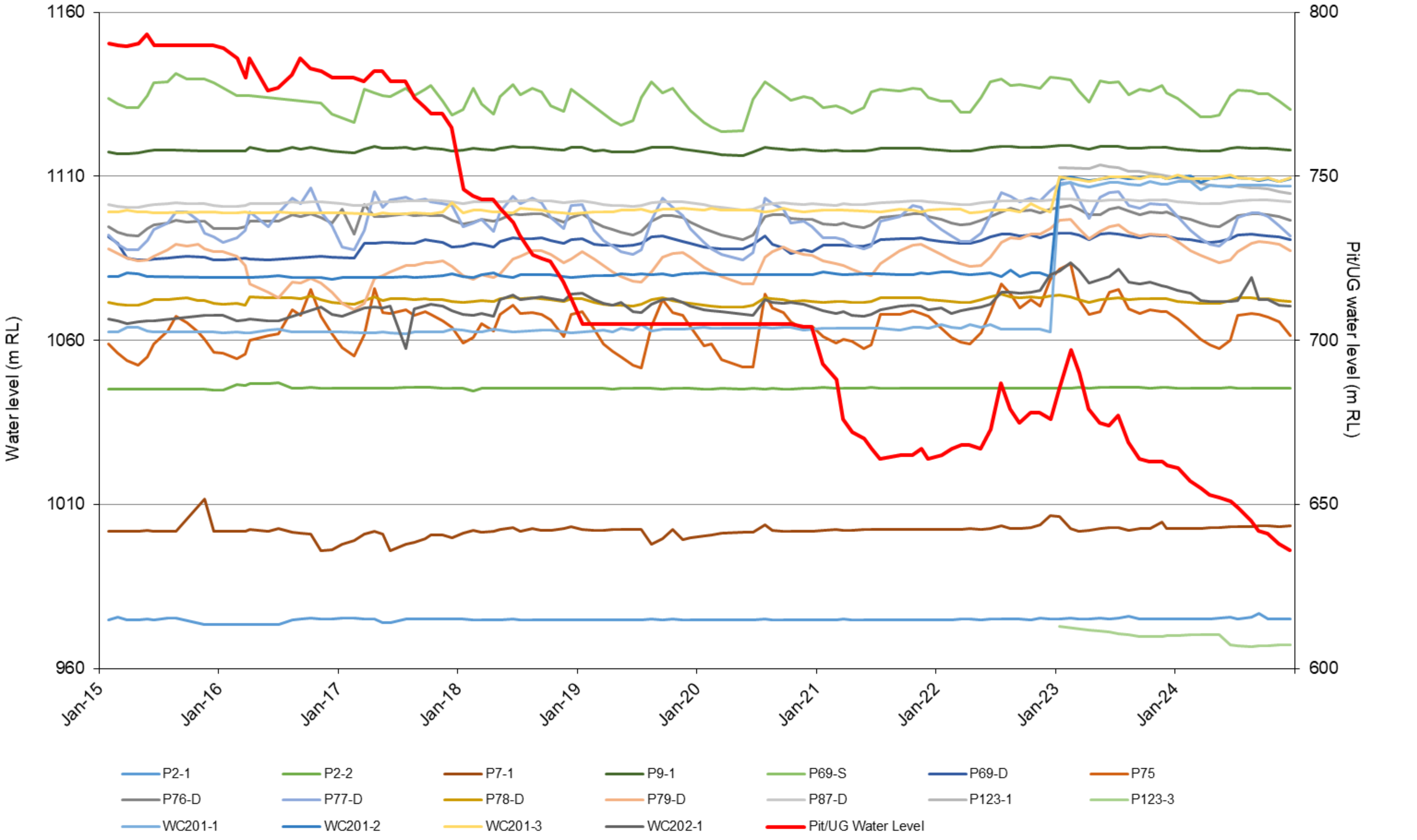


Figure 18. Andesite water level trends.

6.2.4 Martha Groundwater Assessment

The Martha groundwater levels remained relatively stable during the reporting period, following expected trends with an increase in piezometric levels in response to heavy rainfall in the first half of 2023 (

Figure 12, Figure 15, Figure 16, Figure 18). Two triggers were reached during the monitoring period and are discussed below. Many piezometers showed decreases in water level likely due to lower rainfall at the beginning of 2024. Groundwater levels recovered through winter, then declined again later in 2024.

Project Martha piezometers P107 to P110 and P113 to P116 are standpipes installed at varying ground elevations. Figure 16 shows these water levels have remained relatively stable. P113 has remained dry since installation.

Upper Rex Monitoring

In June 2023, amendments were made to the Dewatering and Settlement Monitoring Plan to specifically address additional monitoring requirements as a result of the proposal to mine the Rex orebody to a higher elevation. This was approved by WRC and HDC in August 2023, and more focused monitoring of groundwater level/pressure along the strike of the Rex orebody began in October 2023. Five Project Martha piezometers (P110, P111, P112, P113A & P114) were upgraded with telemetry, providing hourly water level data. In addition, standpipe piezometers P110, P113 and P114 are equipped with water level loggers.

Trigger responses were set for P111, P112, P113A and P114 at a change in water level greater than two metres in less than a one-month period as outlined in the Dewatering and Settlement Monitoring Plan (June 2023). If a response is triggered, this is considered a significant anomaly, and further action should be followed as per the Plan. Two triggers were reached for the piezometers monitoring groundwater levels in the upper Rex area. A 2.75mRL decrease in water level was identified at piezometer P113A (74m deep), for the period 25 September 2024 to 22 October 2024. This level change occurred at a piezometer tip located in the Andesite and is considered highly unlikely to have any effect on the surface groundwater system because it has not influenced the water levels in the two piezometers nearer the surface (refer to Figure 21). A 2.93mRL decrease in water level was identified at piezometer P114 (55m deep), for the period 23 October 2024 to 23 December 2024. This is a two-month period and was believed to be related to a water inflow event associated with unravelling of weak rock mass. The area was treated with resin injection through self-drilling anchors to decrease water inflow and stabilise the area. P114 is on telemetry and communications had been malfunctioning so it was not possible to determine if the decrease was over one month. The communications issue was subsequently repaired and the water level has been stable since.

Vibrating wire piezometer P111 (Figure 19) was installed with three tips, one in the young volcanics and two in the andesite layer. The young volcanic piezometer is measuring some water pressure at 1107mRL. The upper andesite piezometer appears to be dry with 2024 levels consistently recorded just above the tip level (1088.2 mRL to 1088.4 mRL), indicating this area may be previously affected by dewatering. The lower andesite piezometer is measuring around 5m of water pressure above the tip, at 1060mRL.

P112 is also a vibrating wire piezometer installed with three tips, one in the young volcanics and two in the andesite layer. The young volcanic piezometer (1058mRL) now appears to be dry, while both the andesite piezometers have been dry (1035mRL & 998mRL) since installation in July 2020 (Figure 20).

As the original P113 standpipe piezometer is considered dry, a new deeper monitoring bore was drilled to replace it. The new bore, P113A has three vibrating wire piezometers installed at 1090mRL, 1070mRL, and 1035mRL. The shallow tip (19mBGL) appears to be dry at 1090mRL, while water levels in the deeper tips have remained stable since installation in October 2023. The intermediate tip (39mBGL) did show a decreased level in October 2024 (as discussed above) but stabilised in November 2024. It is measuring around 2m of water pressure above the tip at 1071mRL, and the deep tip (74mBGL) is measuring around 24m of water pressure above the tip at 1069mRL (Figure 21).

The standpipe piezometers, P110 and P114 have telemetry installed, providing hourly water level data for closer monitoring of groundwater levels in the upper Rex area. Depths of these bores are at 1097mRL for P110, and 1054mRL for P114. Water levels in both of these are stable with P110 measuring around 7m of water pressure at 1104mRL, and P114 measuring around 1m of water pressure at 1055mRL. The other Project Martha standpipe piezometers remained stable during the reporting period, following expected seasonal trends, and continue to be dipped on a monthly basis.

The key to the lithology zone shading for hydrographs below (Figure 19 to Figure 23 and Figure 28 to Figure 36) is shown in Table 3.

Table 3. Lithology shading.

Lithology	
Alluvium	
Young Volcanics	
Andesite	

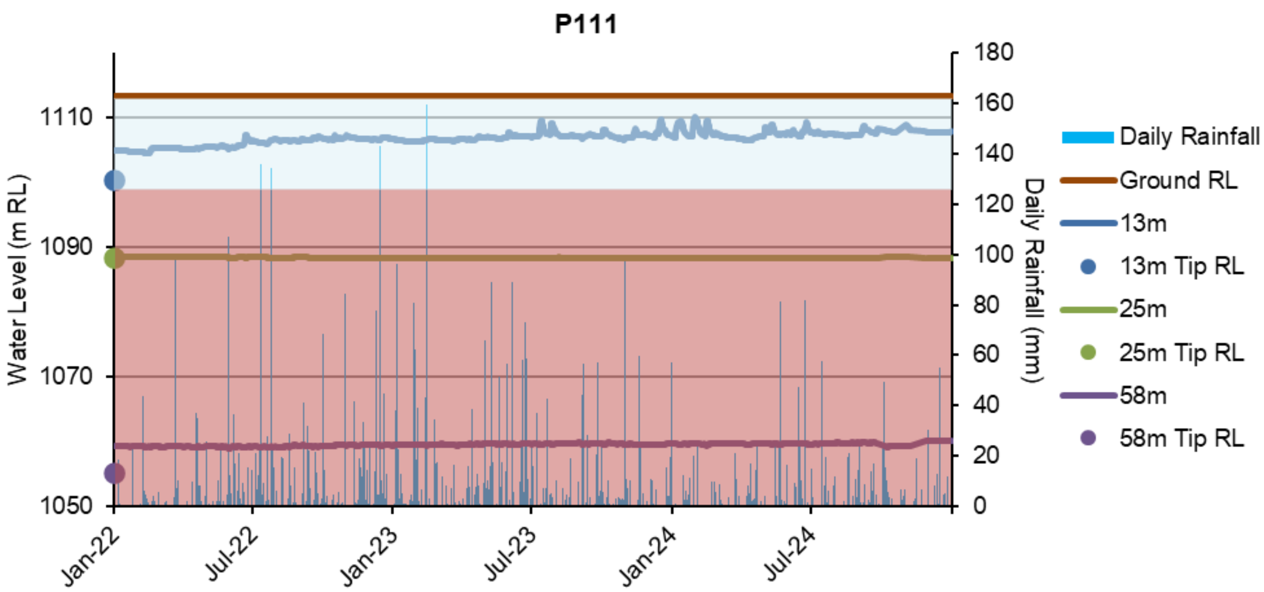


Figure 19. P111 vibrating wire piezometer.

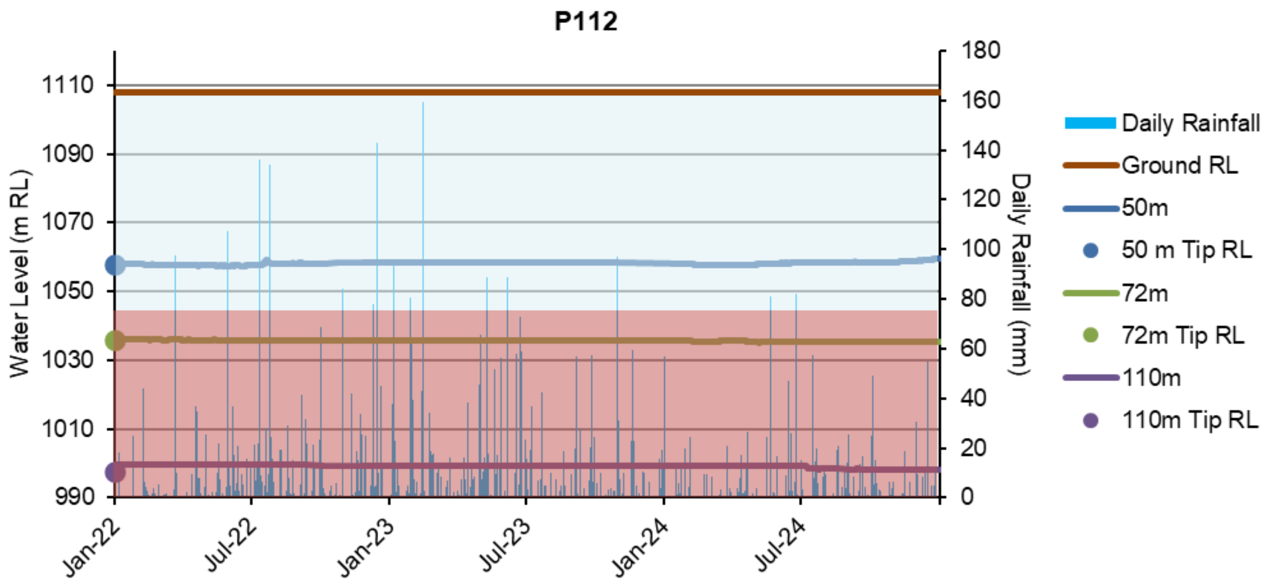


Figure 20. P112 vibrating wire piezometer.

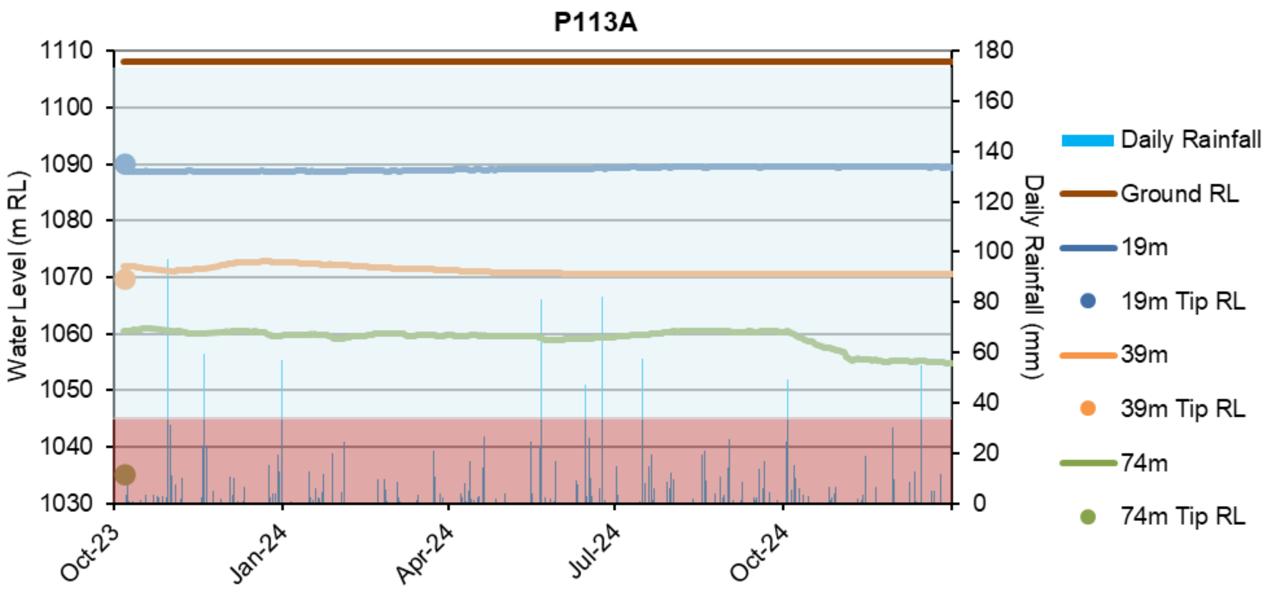


Figure 21. P113A vibrating wire piezometer.

Two new Project Martha piezometers were installed in 2022 – 2023. Locations and tip depths were advised by GWS and discussed with the hydrogeologic peer reviewer. Tip depths and average water levels for 2024 are shown in Table 4. Some tips show little water pressure, indicating dry conditions.

Table 4. Project Martha piezometer depths and water levels.

Piezometer	Target Material	Depth (mRL)	2024 Average GWL (mRL)	Average Water Depth (m)	Comment
P122-1	Upper young volcanics	1092	1101	9	
P122-2	Base young volcanics	1060	1060	0	Dry
P122-3	Upper andesite	1032	1032	0	Dry
P122-4	Lower andesite	933	932	-	Dry
P123-1	Upper andesite	1044	1107	63	
P123-2	Lower andesite	1004	1003	-	Dry
P123-3	Lower andesite	964	968	4	
P123-4	Lower andesite	924	925	1	

P122 was installed in January 2023 with four tips, one in the upper young volcanics, one in the base young volcanics, and two in the andesite layer. Water levels appear to have stabilised in the upper young volcanic piezometer tip with around 9m of water pressure measured at 1101mRL. The other three piezometers appear to be dry at 1060mRL, 1032mRL, and 933mRL (Figure 22).

P123 was installed in December 2022 with all four tips in the andesite layer and these seem to have now stabilised. The 1044mRL tip is measuring around 63m of water pressure above the tip at 1107mRL, the 1004mRL tip is measuring around 0m of water pressure at 1003mRL and is considered to be dry. The 964mRL tip is measuring around 4m of water pressure at 968mRL, and the 924mRL tip is measuring around 1m of water pressure at 925mRL (Figure 23).

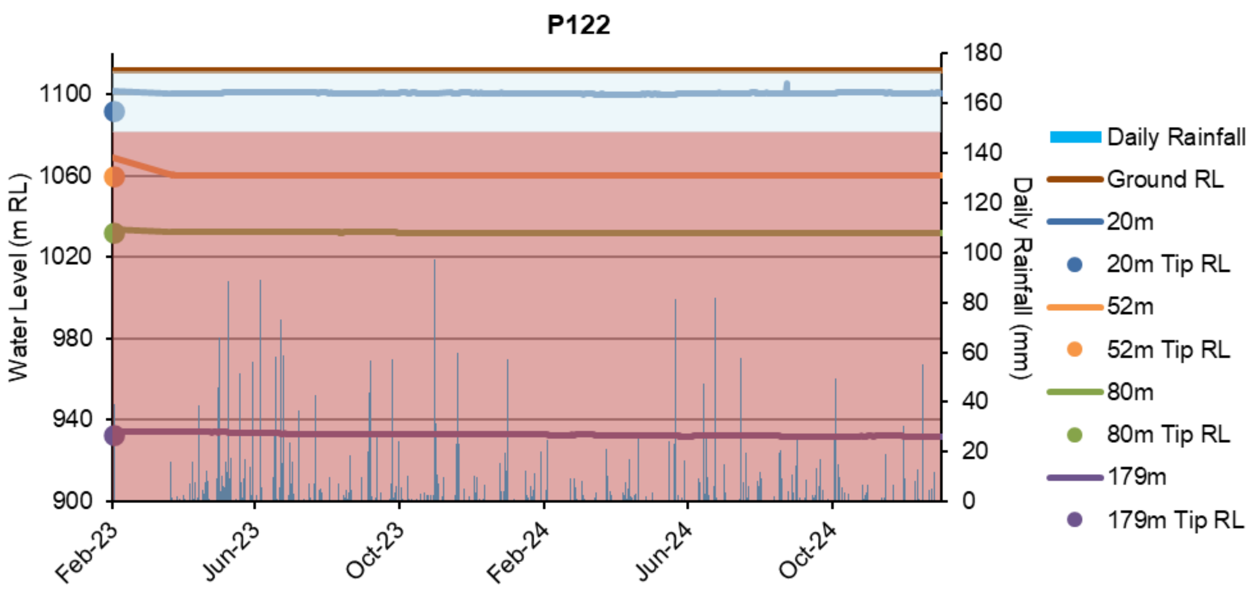


Figure 22. P122 vibrating wire piezometer.

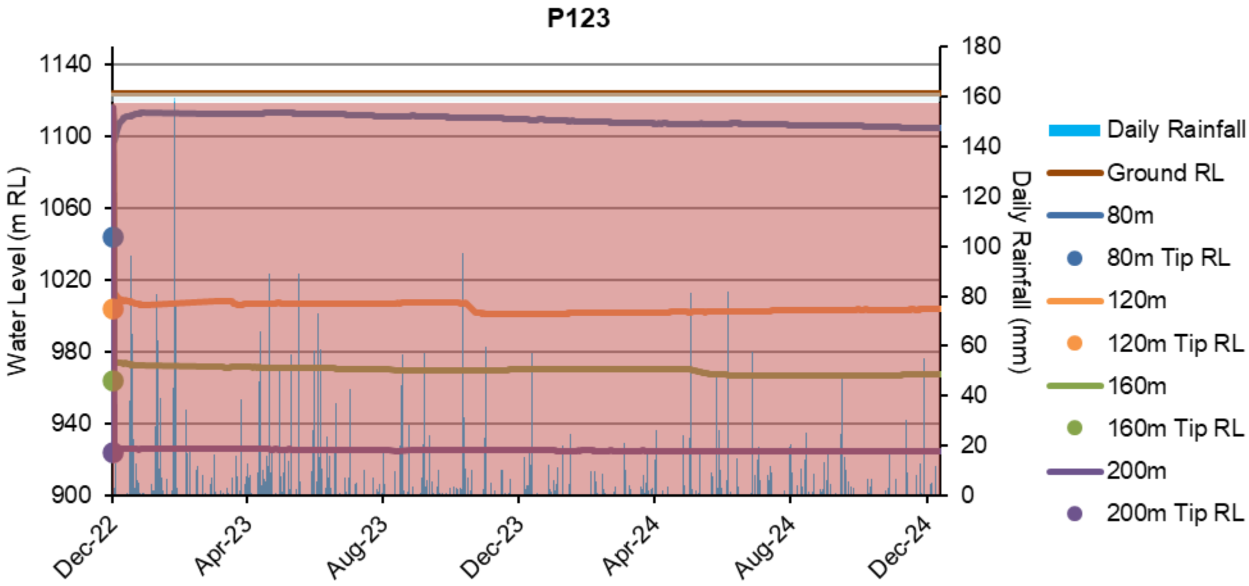


Figure 23. P123 vibrating wire piezometer.

Underground Piezometer ROW-17

In July 2022 a piezometer was installed in an existing exploration drill hole (Figure 24). The drill hole collar is in the Edward decline at 773 mRL and the piezometer tip is at 472 mRL. The hole length is around 350 m, however vertically it is 300 m. It terminates approximately under the Empire West orebody and is set in deep Martha andesite. Piezometer readings show the December 2024 water level at 636 mRL (Figure 25).

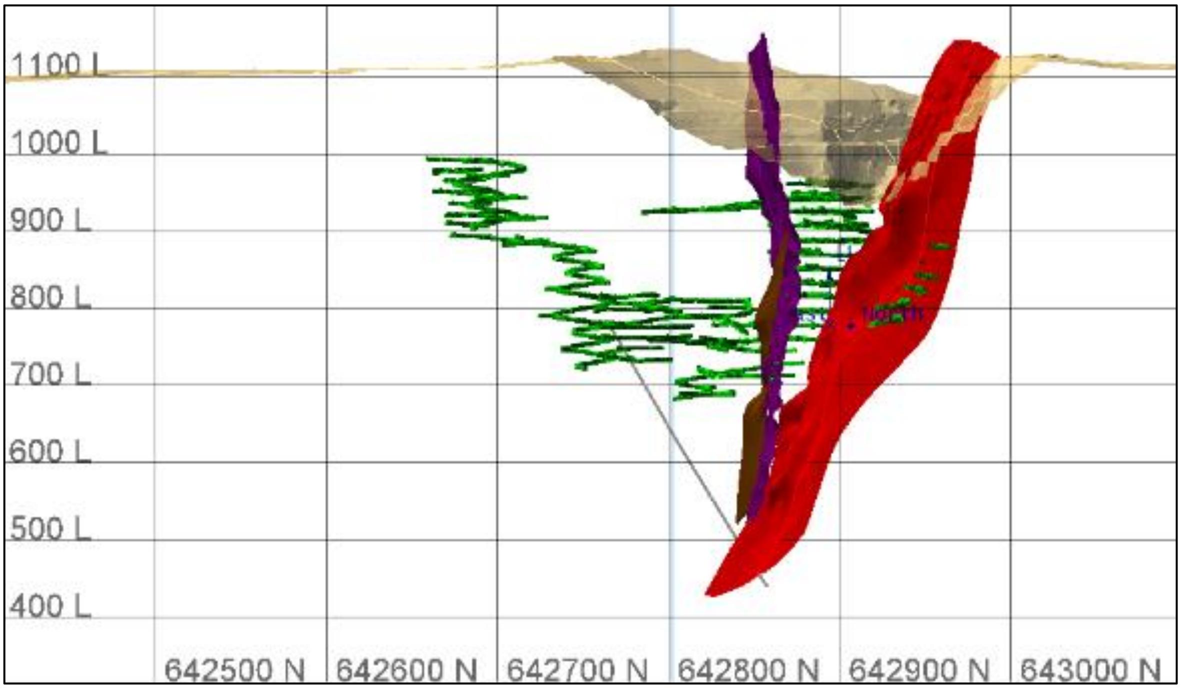


Figure 24. Underground piezometer cross section.

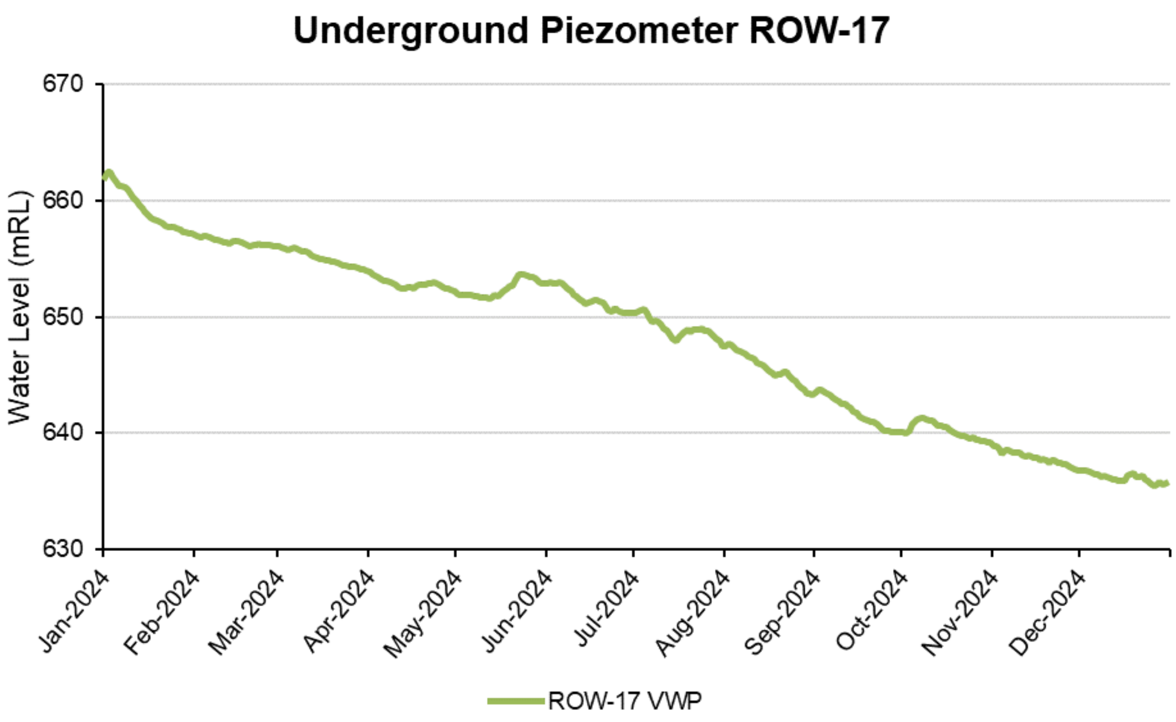


Figure 25. Underground piezometer water level.

Project Martha Water Chemistry

A review of existing piezometers suitable for baseline water chemistry sampling of shallow and deep aquifers of the mine area was undertaken by WWLA in May 2023 in order to demonstrate compliance with Project Martha Consent 139551. Due to limitations of sampling equipment (due to narrow bore diameter, bore depth and large purge volumes required) some of the suggested locations are unable to be sampled easily. Locations that can be sampled were added to the groundwater monitoring schedule, with two rounds of sampling undertaken in 2024. Results are provided in section 11.2.

6.2.5 Favona Groundwater Assessment

In the Favona Mine groundwater accumulates at the 800 level and this is the assumed groundwater level in this area. However, mine development links Favona to Trio and Correnso, which are both part of the Martha groundwater system. Figure 26 shows water level trends in the Favona andesite with the underground dewatering level and

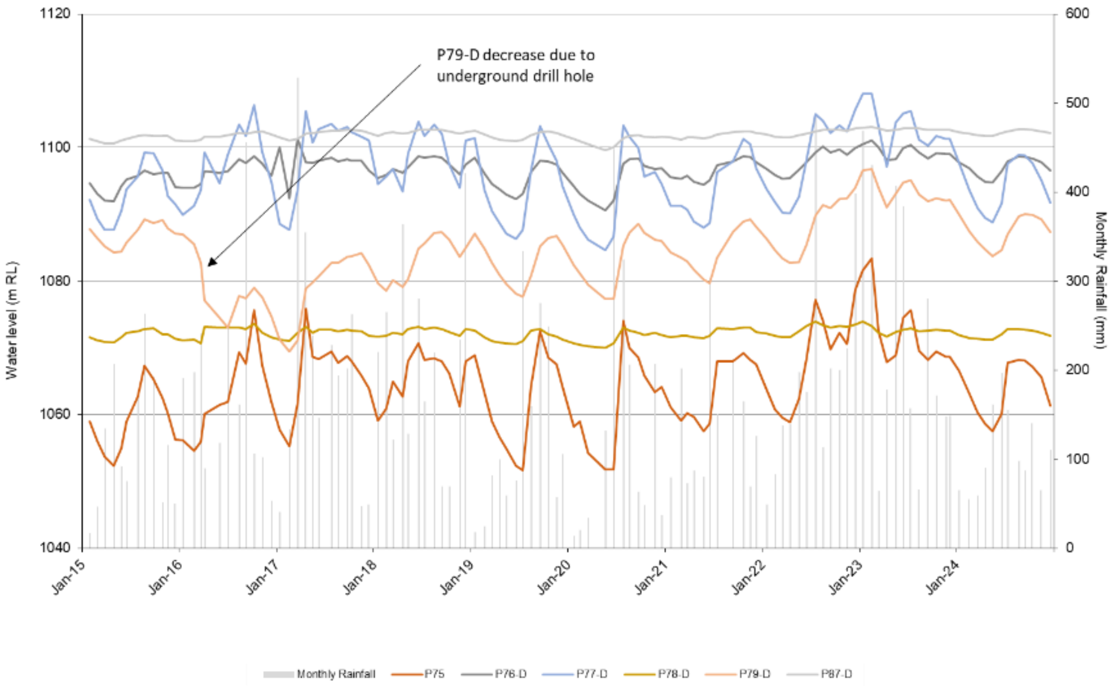


Figure 27 shows selected Favona andesite piezometers with rainfall. This demonstrates how water levels for most Favona wells are influenced by seasonal rainfall periods and not by Martha/Underground dewatering. The majority of the relevant piezometers have shown an increasing trend towards the end of 2022 and beginning of 2023 due to higher than usual rainfall. In 2024 a seasonal level increase occurred over winter, and then dissipated with the reduced rainfall coming into summer. P79-D has recovered to typical levels held prior to its depressurisation in 2016. A slight delayed response to rainfall and drier periods can be noted in four piezometers, with P78-D and P87-D less responsive. No well had a 15m (or greater) decrease during the reporting period.

The Dewatering and Settlement Monitoring Plan states the intentions of OGNZL for baseline groundwater quality sampling for assessment of post closure effects of groundwater movement between the Favona and Martha mineralised groundwater systems, and specifies sampling requirements for standpipe piezometers P76-D, P76-I, P77-D and P77-I. These locations were added to the groundwater monitoring schedule. However, they were not able to be sampled as the bore diameters are too narrow for efficient sampling.

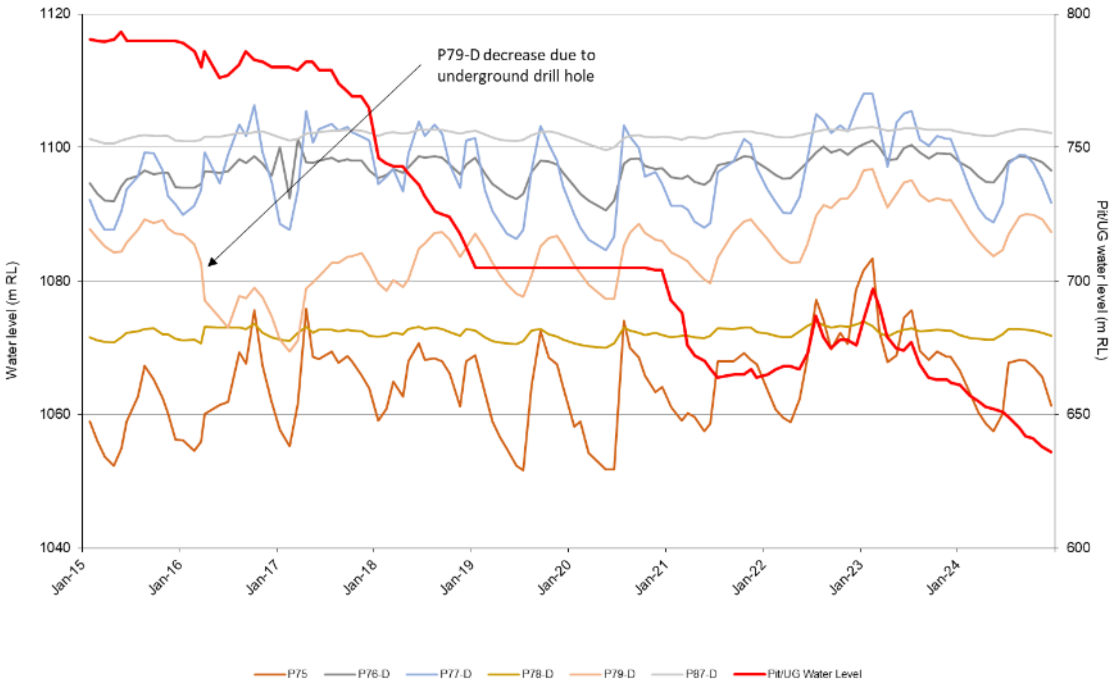


Figure 26. Favona andesite water level trends with underground dewatering level.

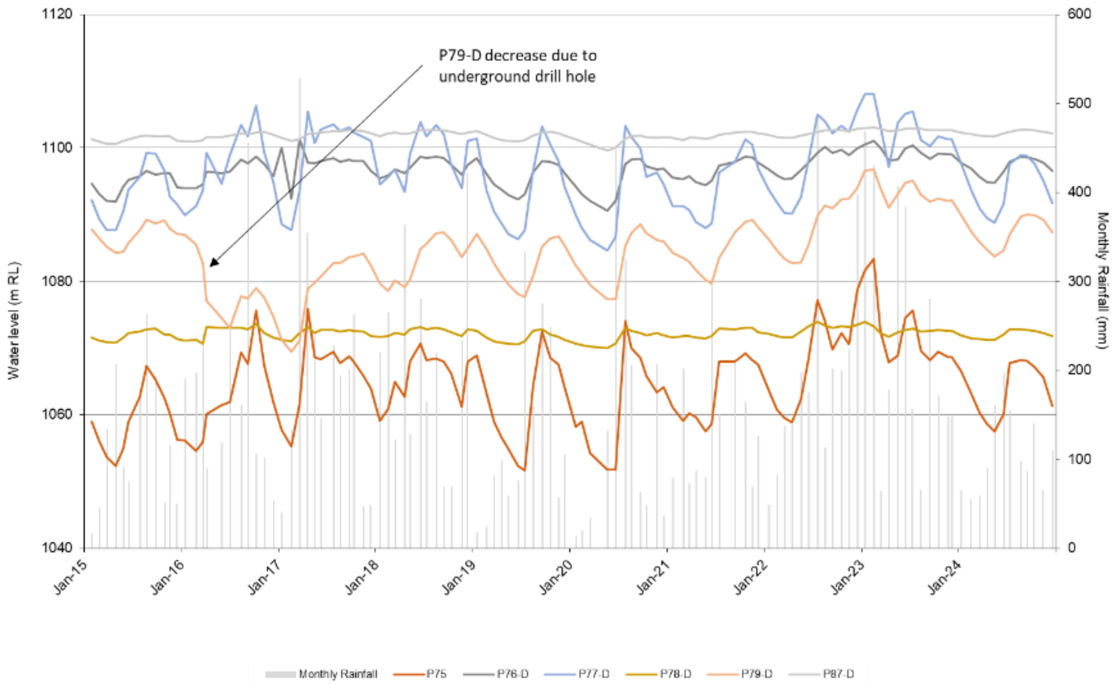


Figure 27. Selected Favona andesite piezometers with rainfall.

6.2.6 Waihi East – CEPA

Six boreholes were drilled between July – September 2011, each with three or four vibrating wire piezometer tips installed. These are located east of the Martha Pit to provide improved groundwater information in an area with few existing wells and in the vicinity of the Correnso Project. Two additional vibrating wire piezometers and 39 additional settlement markers were installed in early 2014. One further piezometer was installed in 2016 for monitoring related to the Daybreak/SUPA orebody.

The piezometers were located across and perpendicular to the Correnso vein system in three lines (P90, P91 and P92 forming one line, P93, P94 and P95 a second line and P100, P101 and P102 the third). Separation distance between the northern and southern lines is some 500m. The piezometers were constructed to intercept the shallow aquifer, young volcanics, and andesite rock (

Table 5).

Table 5. Summary of geological units and depths - Waihi East piezometers.

<table>
<tr><th rowspan="2">Bore</th><th rowspan="2">Shallow</th><th colspan="2">Young Volcanics</th><th rowspan="2" colspan="2">Andesite</th></tr>
<tr><th>Upper</th><th>Basal Zone</th></tr>
<tr><td>P90</td><td>-</td><td>20.0m</td><td>100.0m</td><td colspan="2">137.0m</td></tr>
<tr><td>P91</td><td>9.3m</td><td>25.5m</td><td>111.3m</td><td colspan="2">151.3m</td></tr>
<tr><td>P92</td><td>-</td><td>23.3m</td><td>121.3m</td><td colspan="2">156.3m</td></tr>
<tr><td>P93</td><td>12.3m</td><td>26.0m</td><td>100.0m</td><td colspan="2">143.0m</td></tr>
<tr><td>P94</td><td>6.0m</td><td>25.0m</td><td>104.0m</td><td colspan="2">144.0m</td></tr>
<tr><td>P95</td><td>-</td><td>35.0m</td><td>90.0m</td><td colspan="2">120.0m</td></tr>
<tr><td>P100</td><td>-</td><td>50.0m</td><td>120.0m</td><td>135.0m</td><td>160.0m</td></tr>
<tr><td>P101</td><td>12.8m</td><td>32.0m</td><td>47.0m</td><td colspan="2">78.0m</td></tr>
<tr><td>P102</td><td>8.0m</td><td>38.0m</td><td>62.0m</td><td colspan="2">90.0m</td></tr>
</table>

Figure 28 to Figure 36 present the records from the piezometers expressing water level as mRL. The charts also display the depth of the piezometer tips, lithology shading and daily rainfall. Separation between the shallow and deeper piezometers is evident in the records. The nine groundwater monitoring piezometers have indicated generally stable water levels in Waihi East. Exceptions are discussed below.

Note: In the following plots the gaps in the data are usually due to either brief logger malfunction issues or flat batteries in the unit. The exception to this is the data gaps in P90-2 which are due to the cable being severed by drainage works associated with nearby residential construction. This cable was repaired in February 2024.

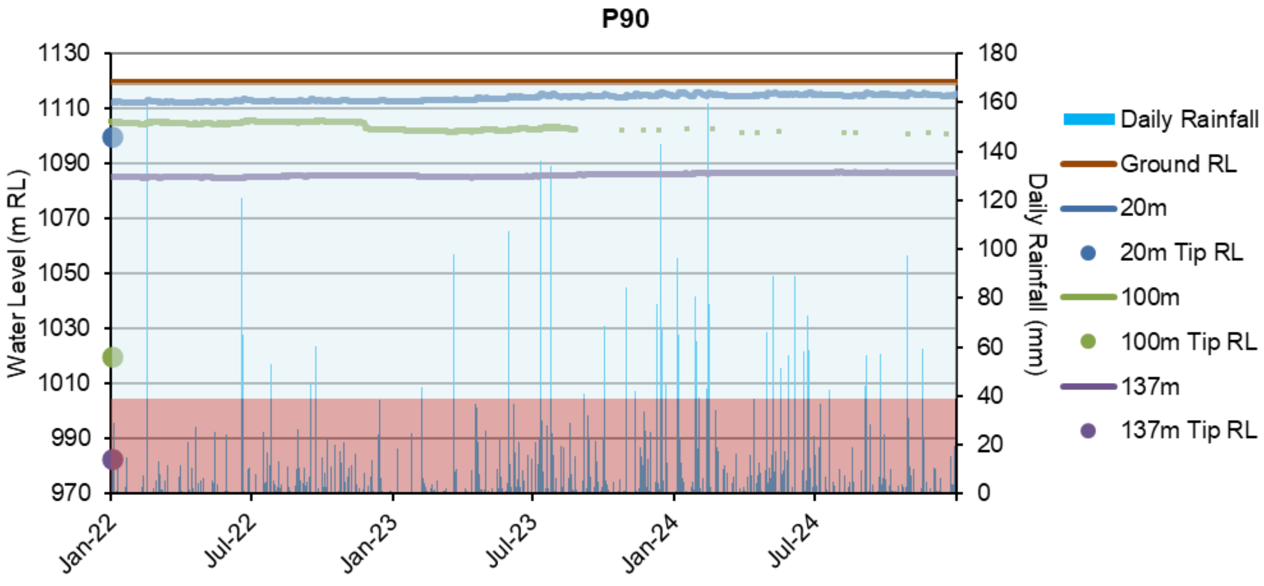


Figure 28. P90 vibrating wire piezometer.

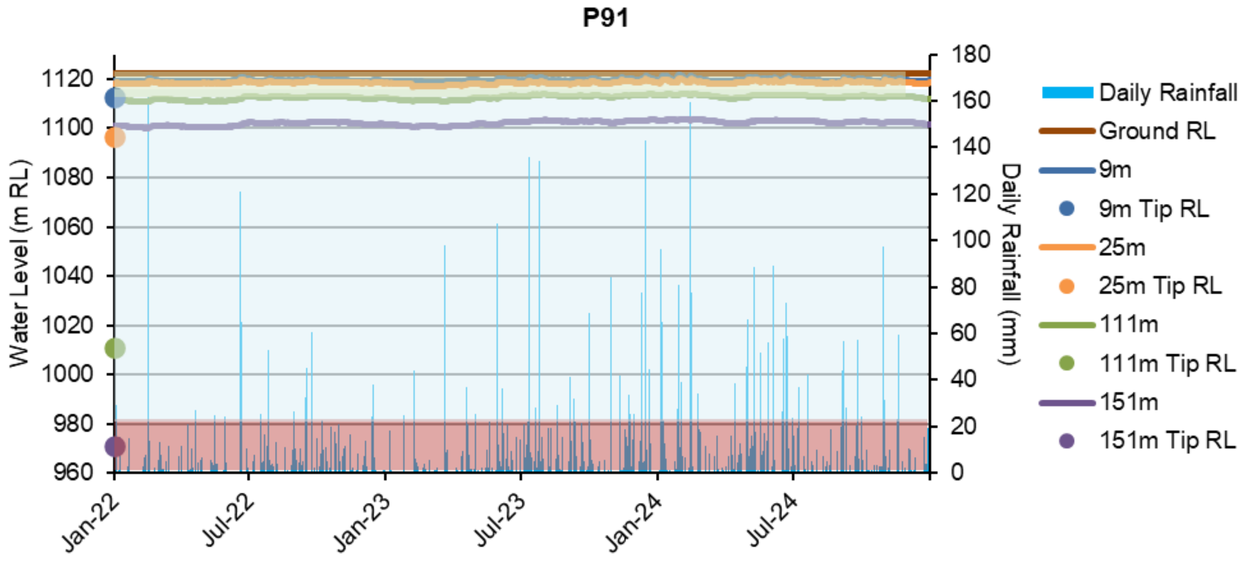


Figure 29. P91 vibrating wire piezometer.

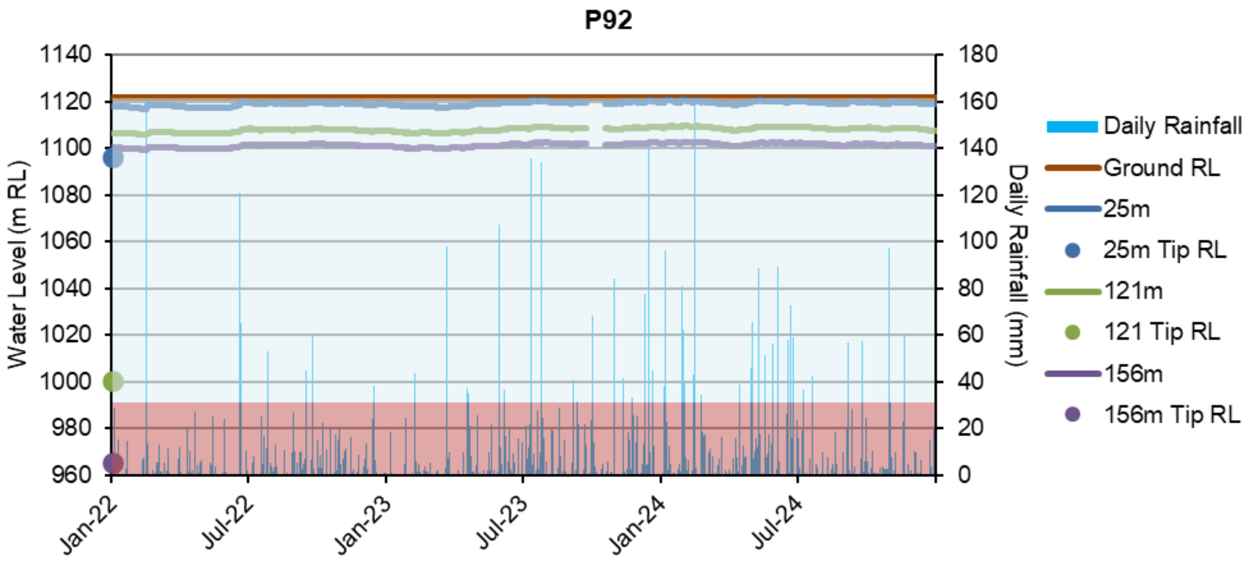


Figure 30. P92 vibrating wire piezometer.

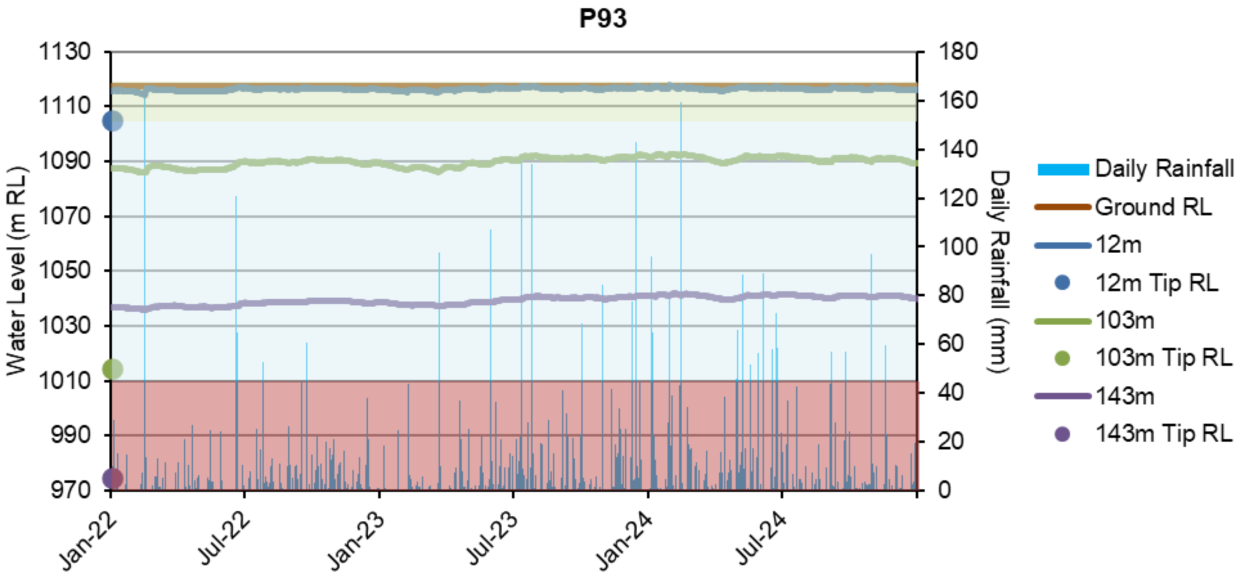


Figure 31. P93 vibrating wire piezometer.

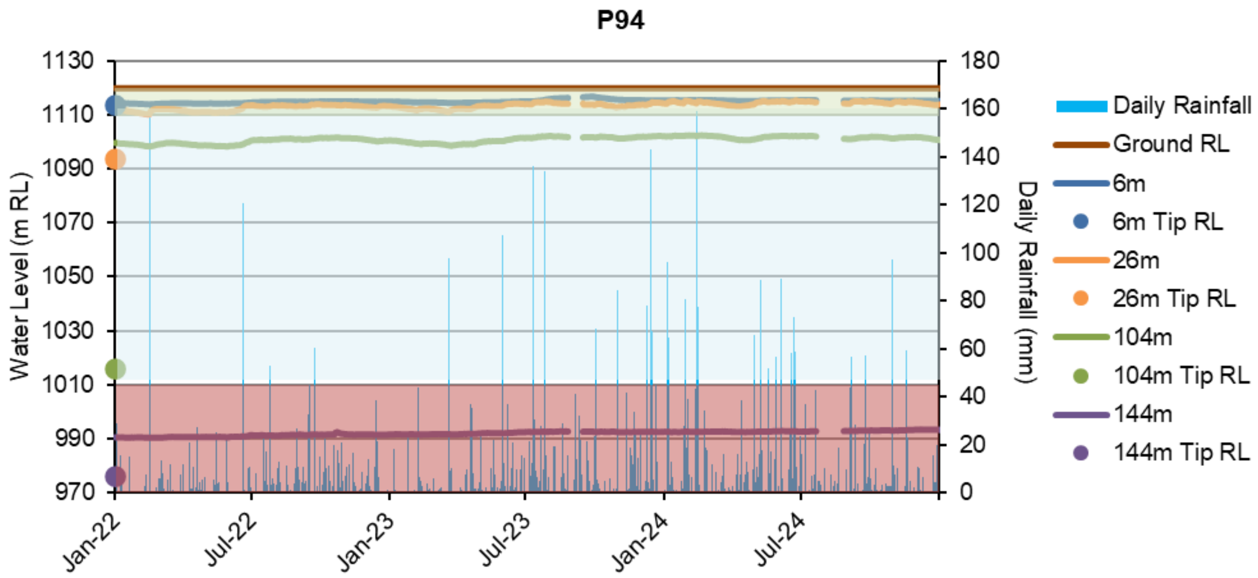


Figure 32. P94 vibrating wire piezometer.

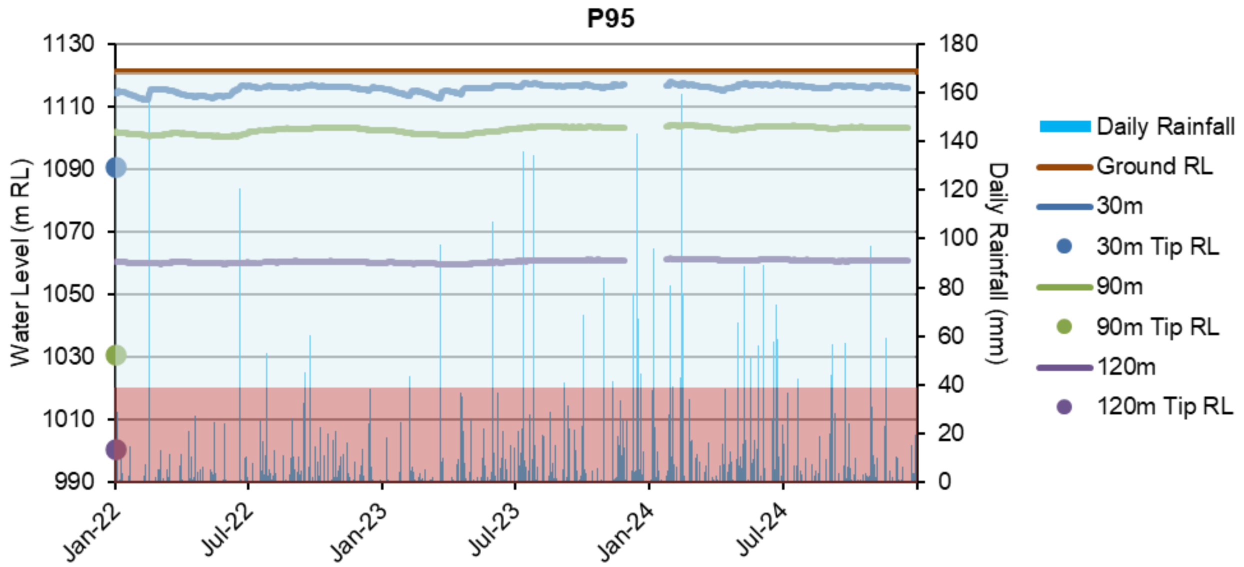


Figure 33. P95 vibrating wire piezometer.

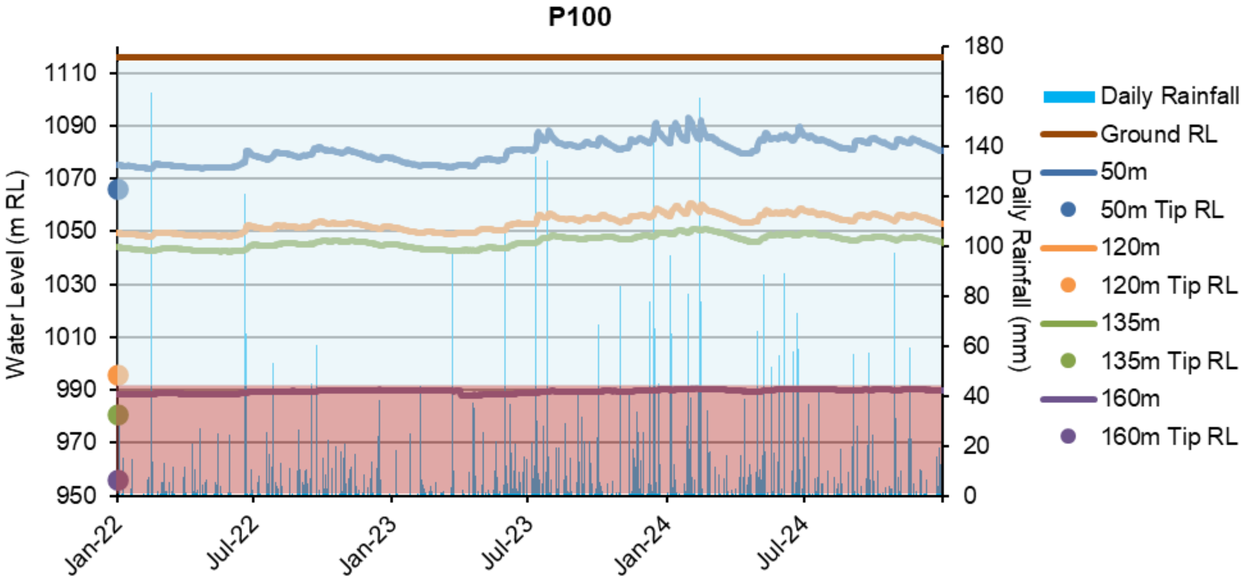


Figure 34. P100 vibrating wire piezometer.

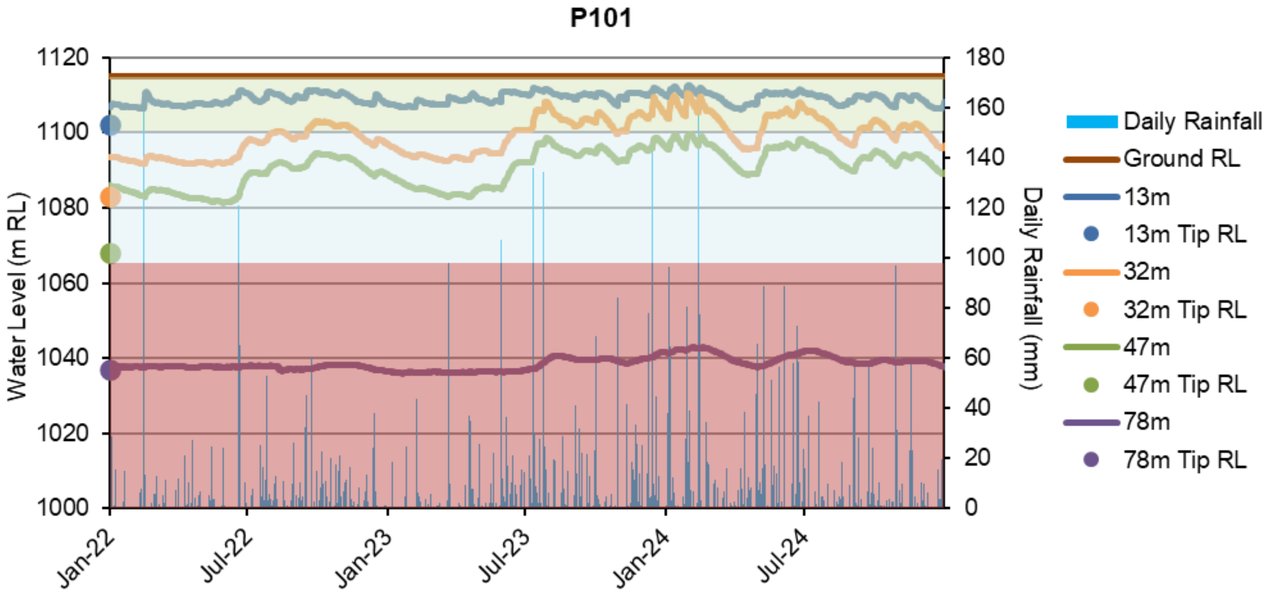


Figure 35. P101 vibrating wire piezometer.

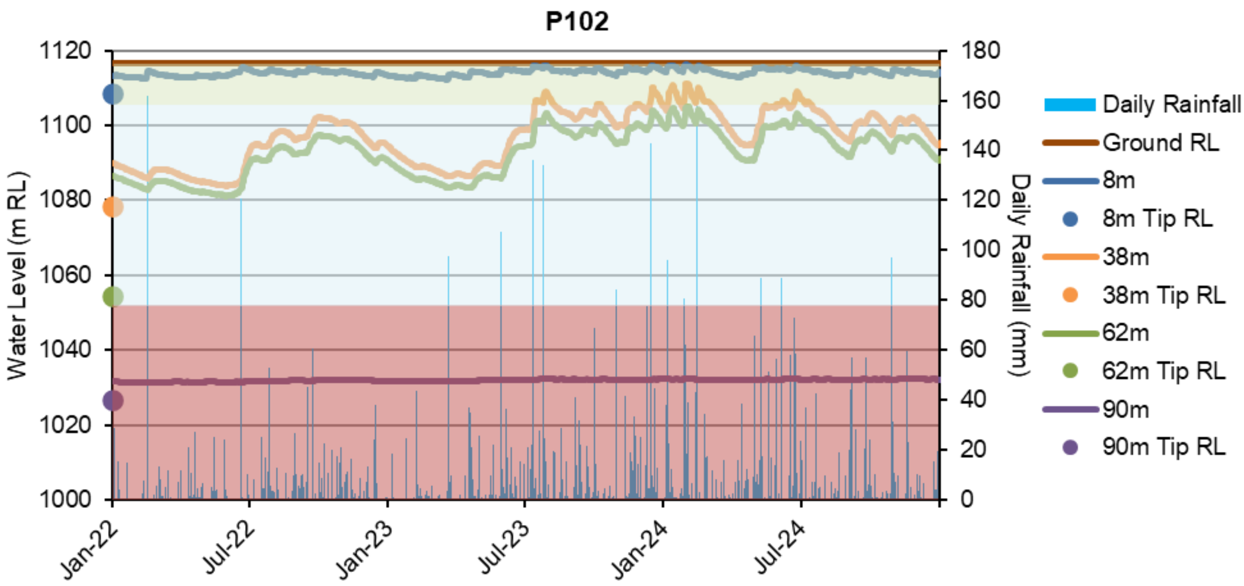


Figure 36. P102 vibrating wire piezometer.

Overall, through 2024, the measured groundwater levels have been generally stable and within historical ranges. Piezometric levels in the young volcanics have continued to show influence from rainfall. This is particularly evident at P101 and P102, which show seasonal response to rainfall.

P101-4, an andesite piezometer, appears to have little water pressure (Figure 35). The tip is at 1037 mRL and at the end of the 2024 monitoring period the measured groundwater level was at 1036 mRL. Therefore, it is considered to be dry.

6.2.7 Private Wells

The private wells are bores which are mainly used for water supply. They show seasonal fluctuations in groundwater levels and these levels can also be influenced by landowners using the bore. The Wharry Rd, Whangamata Rd and Mataura Rd bores can no longer be accessed. Two such access restrictions were due to health and safety concerns and the other due to the landowner not allowing OGNZL access. There is no previous indication of any influence in the bores from mine dewatering (Figure 37).

Due to the access restrictions discussed above, only the Black Hill Orchard private well was monitored in 2024. A well search has been undertaken and three wells identified (two northeast and one southwest of the Martha Pit, along strike of the Martha vein system) that OGNZL will investigate monitoring going forward, subject to access arrangements.

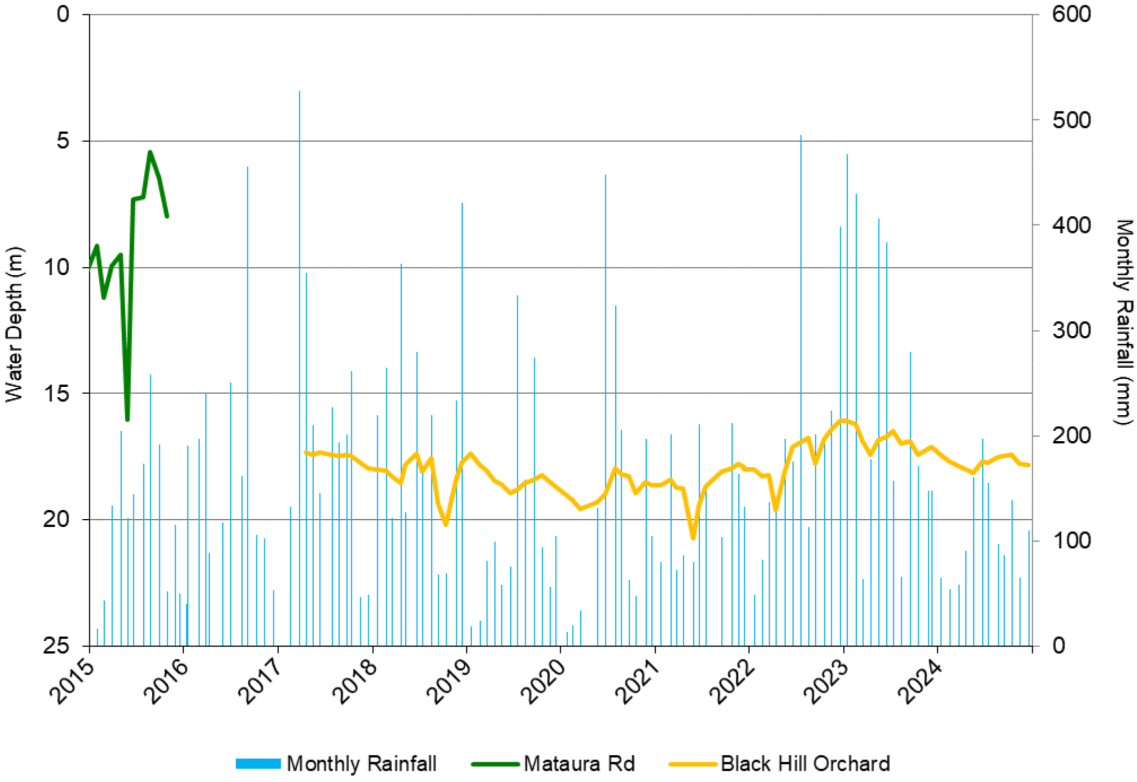


Figure 37. Private bore water levels.

7 SETTLEMENT MONITORING

Condition 13b of the Extended Martha Mine consent requires the identification of any environmentally important trends in settlement behaviour. Condition 13d of the same consent requires a comparison to be made between the settlement survey data and that predicted as part of the consent application.

A reassessment for the settlement prediction was conducted for the Trio Development Project (Engineering Geology, June 2010). This review assessed the effect of pumping from the Martha Pit to draw down the groundwater level progressively to 755mRL, which would also dewater the connected Trio system.

Another reassessment was conducted for the Correnso Underground project (Engineering Geology, 2012). The relevant report recommended new trigger levels for settlement based on additional depressurisation of the andesite layer.

Further reassessment was undertaken for Project Martha with dewatering to below 700 mRL authorised. New triggers were applied during the 2020 reporting period (Table 6).

A review of the settlement marker network was undertaken during 2019 by GWS Ltd. This resulted in the removal of erroneous and high-density settlement markers for settlement plotting and trigger assessments.

Seven settlements zones were defined around the Martha Mine pit in 1999, extending to the outskirts of Waihi. The zones were established based on the first ten years (pre-extension) of settlement history having regard to the then current knowledge of the thickness and composition of compressible materials (such as ash-soils, alluvium, sediments, and unconsolidated younger volcanic deposits) and the expected effect from Martha Mine dewatering. Table 6 provides the most recent update of the Settlement Zone trigger levels, approved in 2019 and applied following the commencement of Project Martha in 2020, to reflect the changed mining and dewatering conditions. Figure 38 shows the predicted settlement zones. These have also been updated with the commencement of Project Martha.

Table 6. Summary of predicted settlement zones and Project Martha trigger levels.

Zone	New Trigger Levels (mm) Project Martha (2020)
Settlement Zone 1	55
Settlement Zone 2	65
Settlement Zone 3	95
Settlement Zone 4	160
Settlement Zone 5	260
Settlement Zone 6	340
Settlement Zone 7	540

The settlement measured is an accumulation of all causes of settlement. Generally, this is considered to be the result of mine dewatering, but close to the mines and (in the case of Favona) overlying the mine areas, additional settlement may be the result of primary consolidation settlement (as opposed to reconsolidation settlement which is the process in the Martha groundwater system where historic dewatering resulted in groundwater levels dropping to lower elevations for a longer time period than is proposed for current mining activity). Nevertheless, it is the total settlement that is discussed in this report as settlement due to dewatering alone cannot be separated from other causes.

Comment is provided in relation to the predicted settlements given in Table 6 and these comments are expanded on where monitoring data show exceedance of the trigger values.

7.1 Method

The initial settlement survey network was established in 1980 during the exploration phase of the project and has been regularly monitored since December 1987. Over the course of the project, settlement survey marks have been added, removed or replaced, as required, to extend the network or to compensate for damaged sites. Figure 39 is a settlement contour map of raw, unadjusted survey data, that has been segregated from Figure 38 at the request of HDC. This allows easier interpretation of the contour lines.

Figure 40 shows the location of settlement marks monitored by OGNZL up to the end of 2024. Also, included on Figure 40 are the defined subsidence hazard zones related to historical underground mine stopes and shafts (IGNS, 2002). Figure 41 provides the settlement monitoring marks across the Favona Mine and shows the locations of the Favona Mine workings in relation to the marks. Figure 42 provides the marks identified as triggered during the November 2024 survey.

Settlement monitoring was undertaken in May/June and November/December 2024 across the settlement network surrounding Waihi Township (refer Appendix C) and also along the Favona network which is an extension of the Martha Mine survey network. Appendix B presents the two summary settlement monitoring reports. For simplicity this report refers to surveys as May and November 2024.

The raw data provided by the surveyors has been graphed and where changes in the record are apparent as a result of mark relocation or replacement, corrections have been applied using graphical projection so that total settlement over the life of mining can be assessed for each location. The correction process applied was as follows:

- Updating the time-history graph for all data from settlement markers with data up to 1/11/2024.
- Where changes in the time-history graph identified a datum change, a correction was arrived at by projecting the initial data visually on the graph to the time of the new datum and a correction calculated. A smooth settlement curve resulting after the correction was applied and similarity of curve shape to those of adjacent marks was taken as indicating an acceptable correction.
- Where marks were installed in May 1999, the previously determined settlement for that location from 1988 to 1999 was applied as a correction.
- Where marks were installed or changed other than in May 1999, the previously assessed settlement at the location as of May 1999 was used with a best fit trend line of settlement in time to correct the values to be consistent with the May 1999 value.
- For Favona marks, settlement values as at 1/12/2005 were assessed for each location and used to correct the new marks to account for settlement from 1988 to 2005.
- The corrected data has then been used to generate:
  - Settlement-time trend graphs for each zone.
  - Plans of total settlement.
  - Contours of total settlement.
  - Calculation of tilt.
  - Settlement-time trend graphs of specific areas.
- Where Favona development has affected settlement, a projection of the pre-Favona Mine settlement trend has been made as a means to estimate the current Martha Mine settlement and this settlement value has been subtracted from the total measured settlement to provide an estimate of the settlement due to the Favona Mine development.

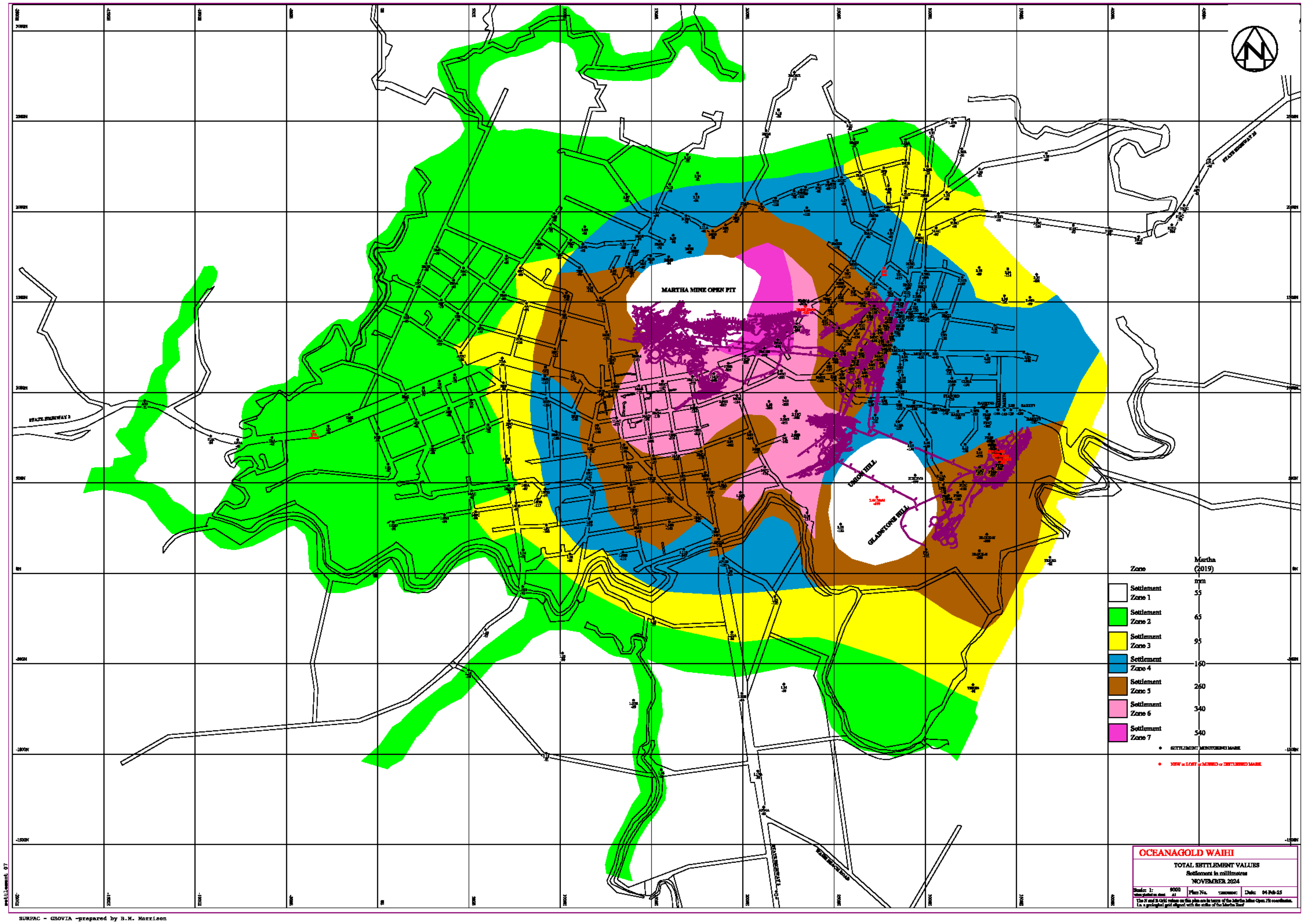


Figure 38. Total settlement zones – November 2024.

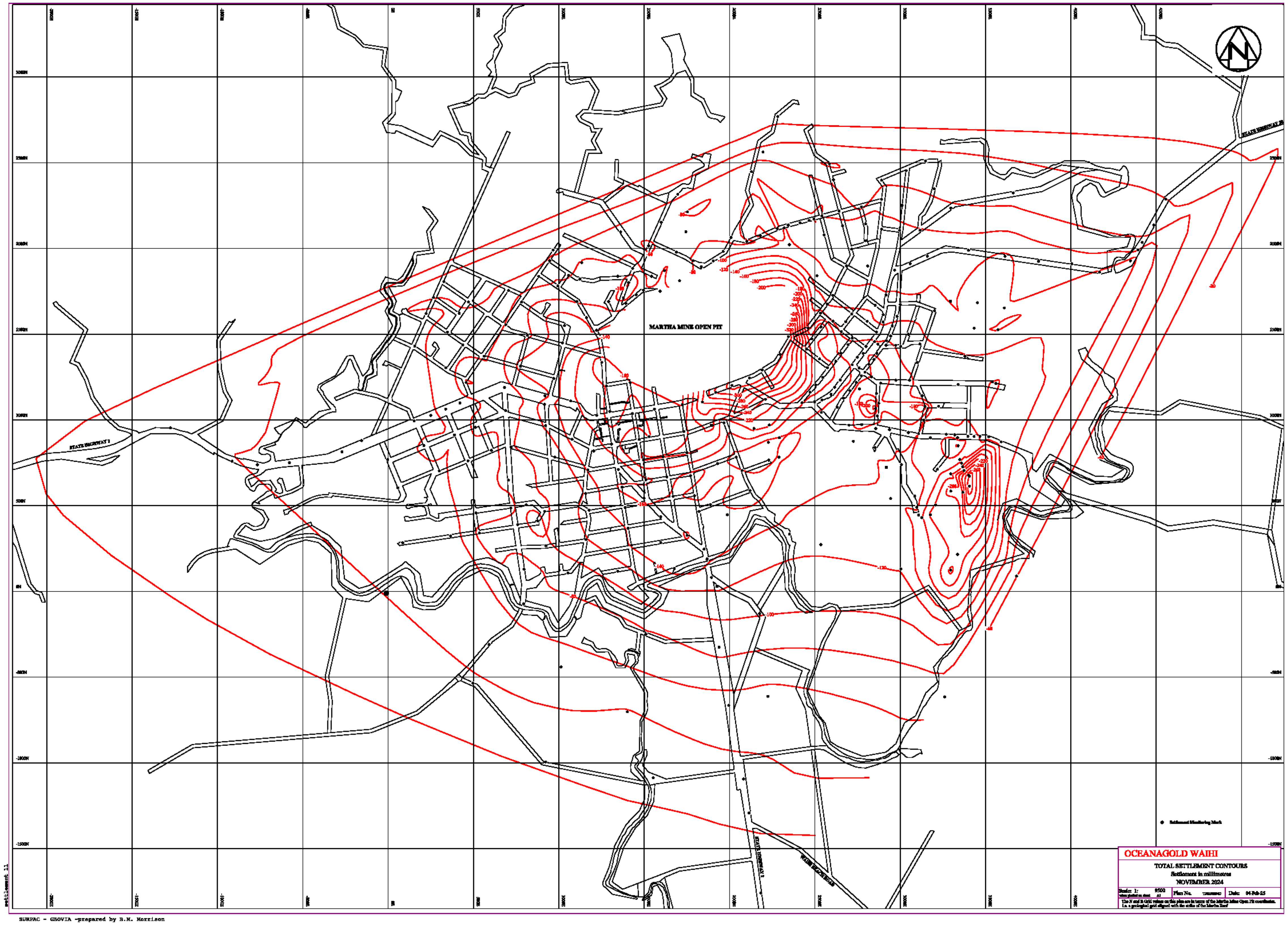


Figure 39. Total settlement contours – November 2024.

Figure 40. Settlement marker location plan, hazard zones, and recent underground activity.

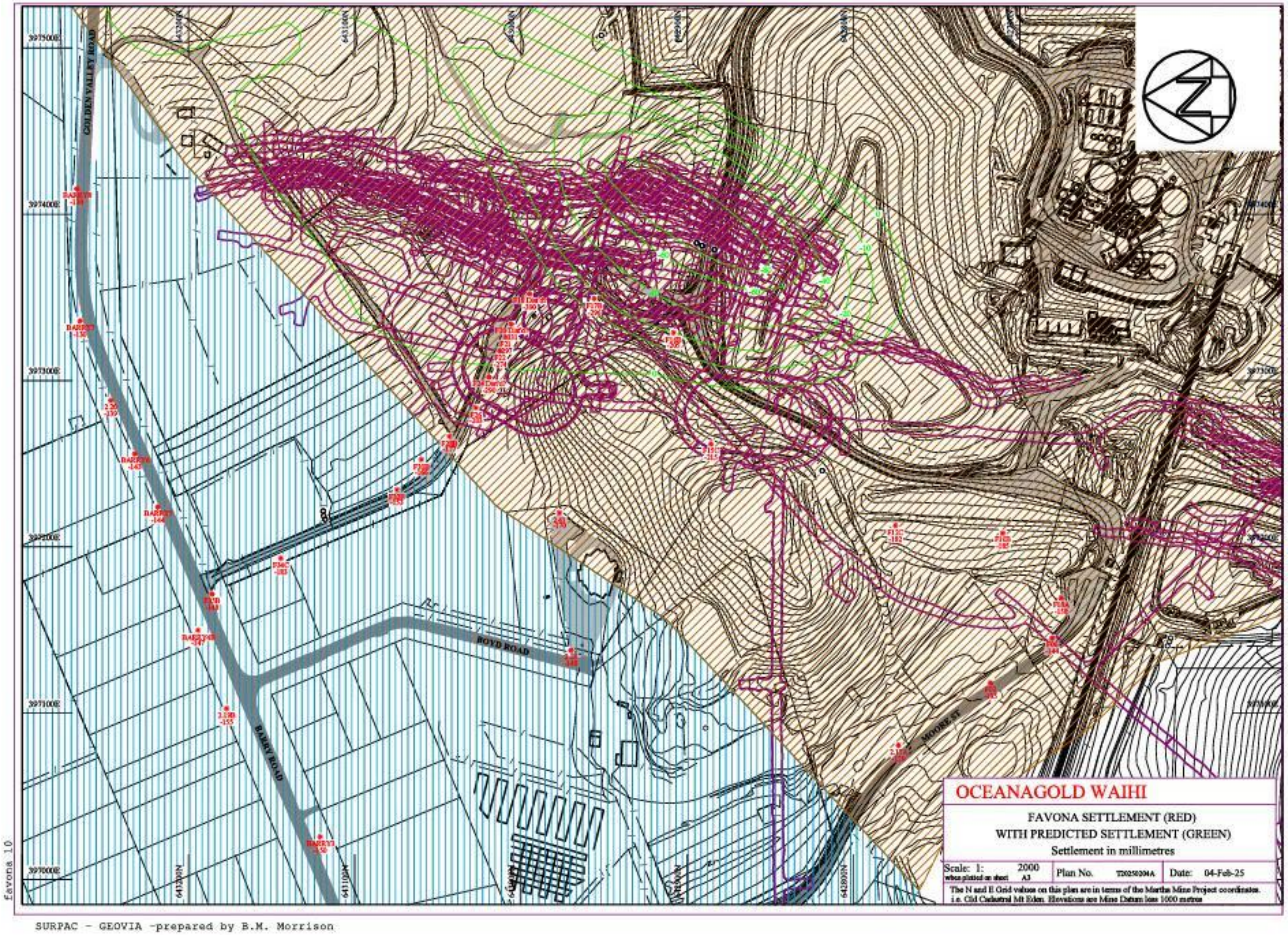


Figure 41. Favona settlement – November 2024.

Figure 42. Triggered settlement marks – November 2024.

7.2 Results

Appendix C presents plans showing the settlement mark locations, measured settlement values and inferred settlement contours.

Time-history plots of settlement survey data for each zone are presented in Appendix D. These plots also depict the zone settlement predictions (for the Martha Extended Project, Trio Development, Correnso Project and Project Martha) as horizontal lines on each set of graphs.

The projected trends and the maximum settlements are provided on the graphs in Appendix D. Key trends are described below.

95.7% (330/345) of the marks did not exceed the settlement trigger levels; 15 marks were triggered. This number is similar to 2023.

Figure 42 above shows the location of the ten settlement marks that are located beyond the influence of the Favona Underground that exceeded the trigger limits during the November 2024 survey. The other five marks that exceeded the trigger limits are located above the Favona Underground.

Some points in the time-history plots of settlement in Appendix D for May 2021 showed greater settlement compared to the general trends. This was due to a larger than normal survey mis-close associated with onboarding of new survey staff in May 2021. This was generally most notable to the north and east extents of the survey. The reason for this larger than normal mis-close was able to be identified and corrected for the November 2021 survey. The May 2021 survey data was reprocessed to remove the May 2021 mis-close. The November 2022 results follow the general settlement trends prior to the May 2022 survey.

A summary of the number of settlement survey marks that have been triggered within each of the settlement zones is presented below in Table 7. Further discussion regarding each of the triggered survey marks is provided in the following sections.

Table 7. Number of survey marks triggered in each settlement zone.

Zone	Triggered Marks
1	3
2	2
3	4
4	0
5	0
6	1
7	0
Favona	5
Total	**15**

7.2.1 ZONE 1 – Trigger 55mm

The Zone 1 time-history plot (Appendix D) shows three groupings, one showing a small but steady ongoing settlement after about 1999), another with little settlement until November 2015 and then a small ongoing settlement and another group with no settlement evident. To show these observations the marks for Zone 1 were re-plotted as groups namely:

- Zone 1 along Waihi-Whangamata Road has had a small steady ongoing settlement since 1999 which has reached between 22 and 58mm during this reporting period (Figure 45)
- Zone 1 south of Waihi has had a small steady ongoing settlement since 1999 which has reached between 17 and 82mm during this reporting period Figure 44)
- Zone 1 west of Waihi has had a very small amount of settlement (less than 12 mm) up to 2015 following which the settlement rate increased to a small steady ongoing settlement which has reached approximately 20mm during this reporting period (Figure 45)
- Zone 1 north of Waihi which has had no measurable settlement (Figure 46)

This grouping shows that the marks in Zone 1 with a slow ongoing settlement trend are located along the Waihi to Whangamata Road to the east of Waihi, and to the south of Waihi. A steady increase in settlement rate from about 1999 is also be observed in most marks in Zones 2 to 6, suggesting that there is a small and widespread effect occurring at depth. The one marked monitored in Zone 1 to the west of Waihi show little settlement until 2015 and then a small steady on-going settlement showing the widespread effects at depth have reached these markers.

The above observations suggest the following:

- Many Zone 1 marks and also the increasing settlement in Zones 2 to 6 marks is a response to the ongoing dewatering of the deeper structures in the andesite rock body (fracture depressurisation) as a result of mine dewatering. This is a broad effect and has negligible influence on differential tilt between marks.

The stable water levels in the wells monitoring the deeper younger volcanic materials and the upper andesite layers (Figure 15) indicate that the observed settlement behaviour is not related to on-going consolidation of these materials at these locations as no on-going dewatering is evident at these locations.

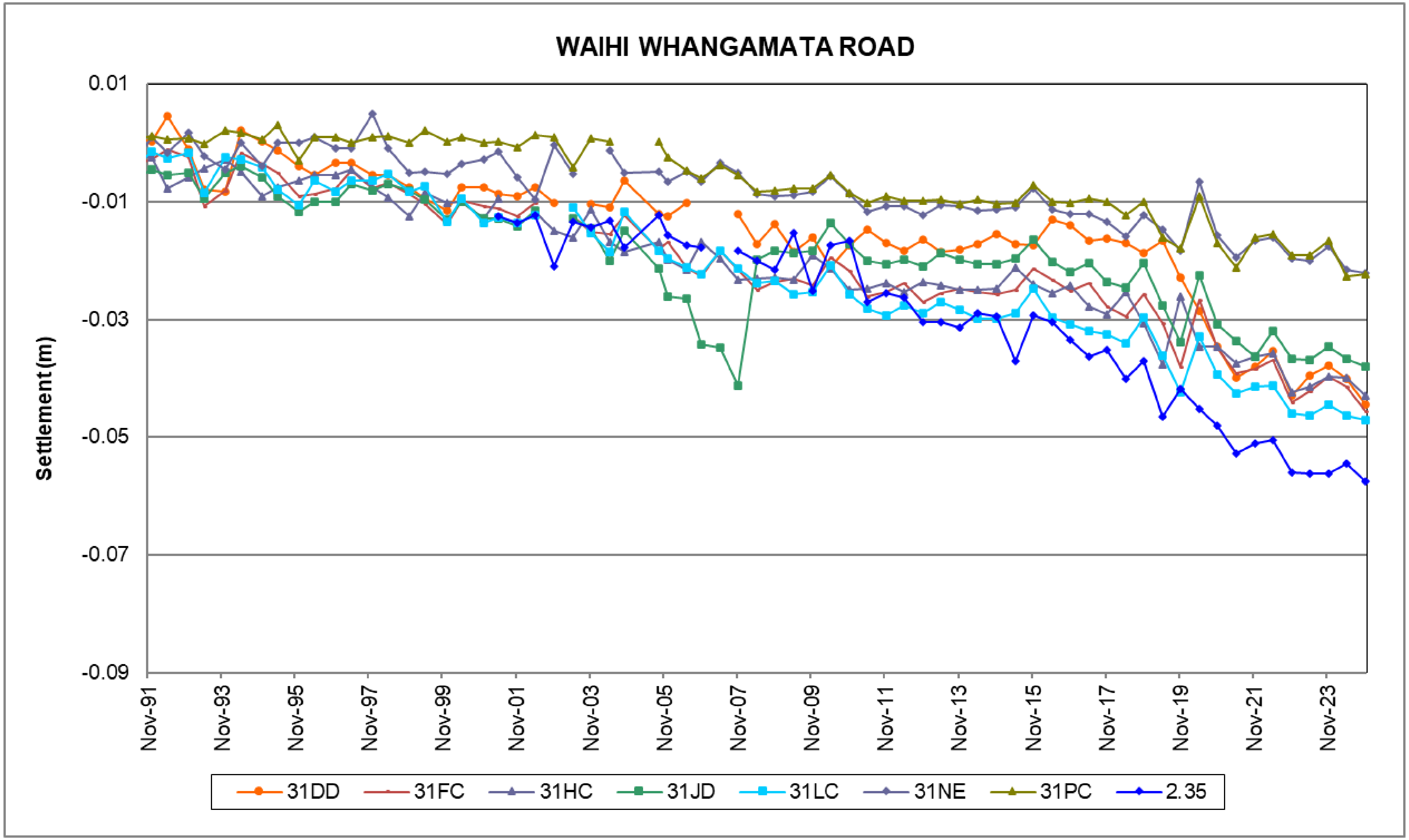


Figure 43. Zone 1 Waihi to Whangamata Road.

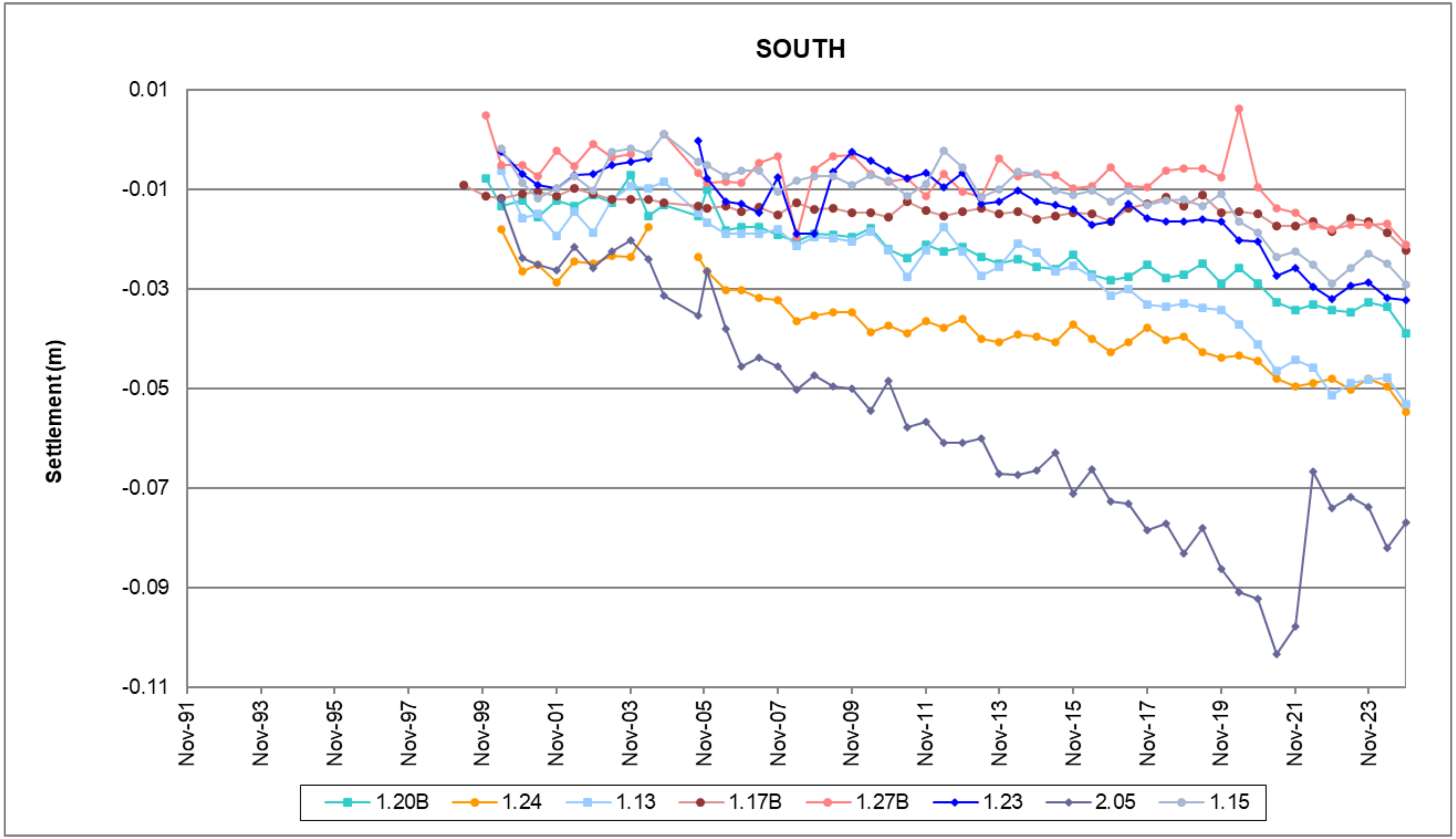


Figure 44. Zone 1 Waihi South.

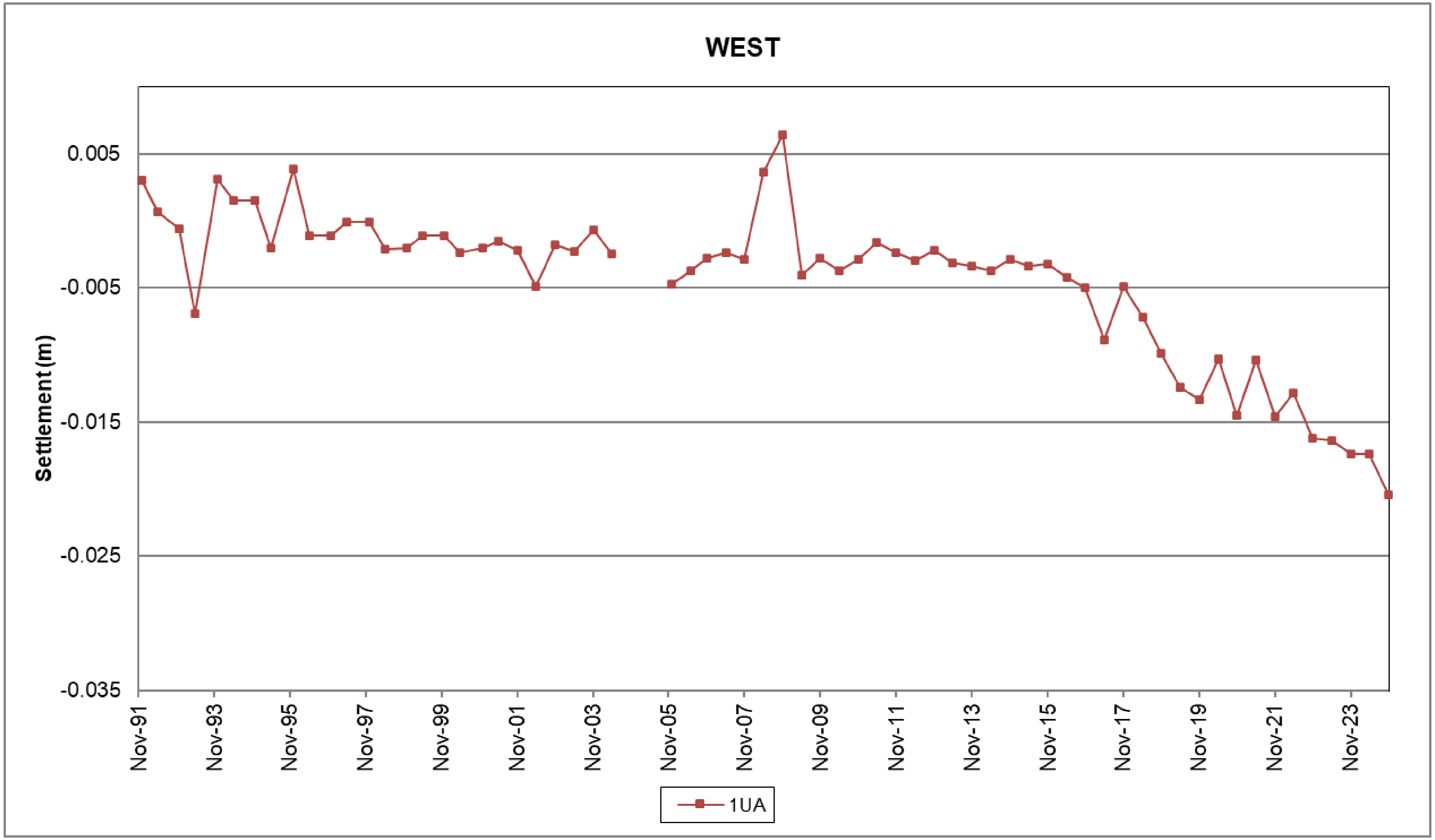


Figure 45. Zone 1 West of Waihi.

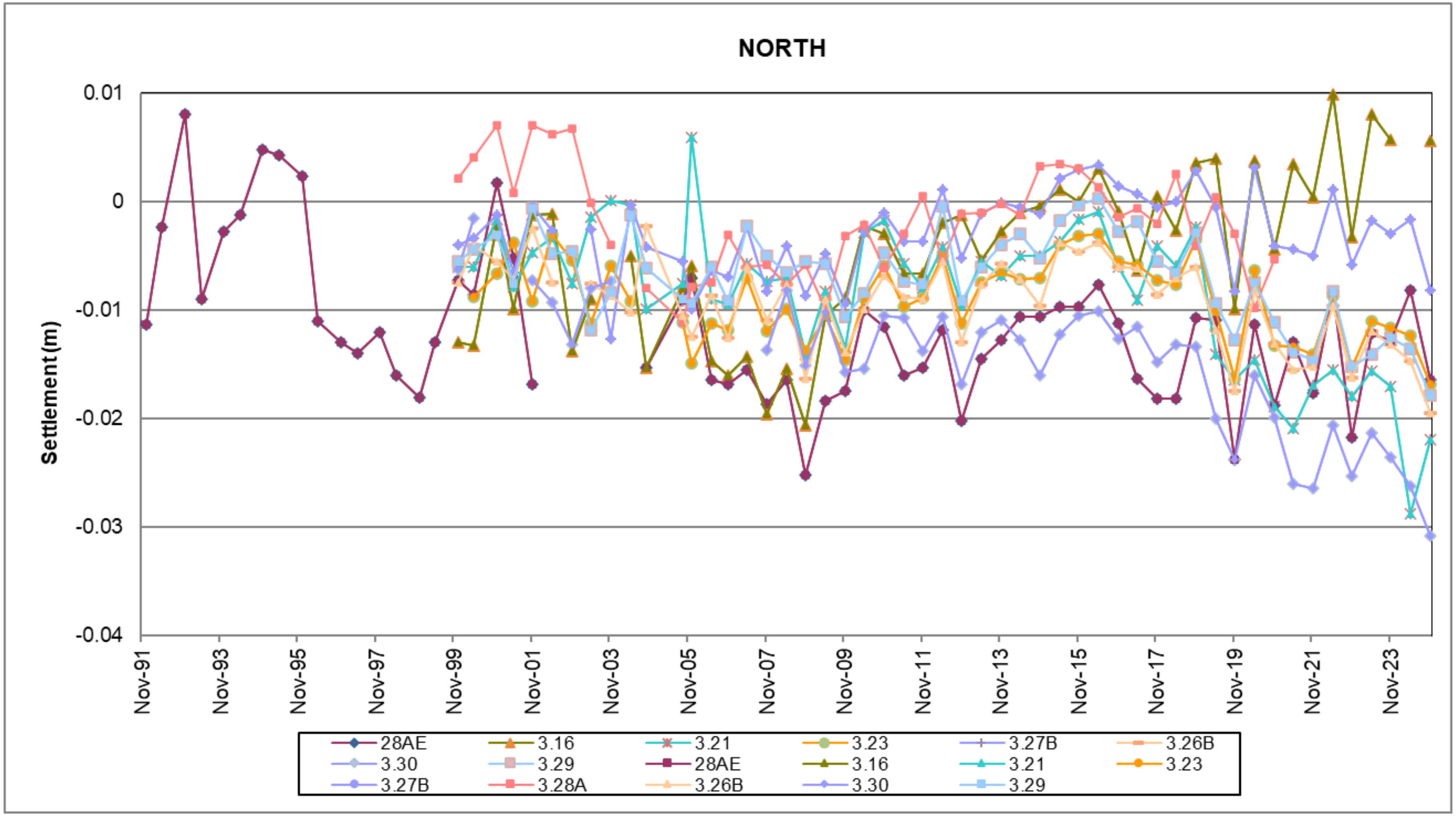


Figure 46. Zone 1 North of Waihi.

The monitoring results that exceed the trigger levels, as shown on the relevant Zone 1 time – history plots, are discussed below.

Three marks in Zone 1 showed settlement greater than the trigger levels: 2.05, 2.35, and 2.44

Mark 2.05 is near Winner Hill and was included in Zone 1 because it was an andesite outcrop. Dewatering of the andesite was originally thought to contribute less to settlements. Like other marks to the south of Waihi Mark 2.05 indicates ongoing settlement after 2003 due to deeper and more extensive dewatering of the andesite. Mark 2.05 is more representative of Zone 4 settlements.

Mark 2.35 is south of the Waihi to Whangamata Road and close to the Settlement Zone 3 boundary. The data suggests an acceleration of settlement after September 2005, however neighbouring marks in Zone 3 have similar settlement values indicative of a general trend in this area. This mark is northeast of Correnso and is not in close proximity to underground mine activities.

Mark 2.44 has been investigated in the past and the cause has been attributed to some localised surficial slope movement. This mark is listed as disturbed by the surveyor and will be removed from the monitoring programme.

7.2.2 ZONE 2 – Trigger 65mm

This settlement zone encompasses the western outskirts of Waihi township and some marks to the north and south of Waihi. The time-history plot for Settlement Zone 2 (Appendix D) shows all but two of the Zone 2 marks to be tracking less than the settlement trigger level. As with Zone 1 most of the marks have small settlements. Total settlements during this reporting period are between 9 and 80mm. Movements exceeding trigger levels are discussed below.

On review, the settlement in Zone 2 which is occurring at Mark 1.04, is assessed to be associated with ongoing dewatering for the Martha Underground (MUG) and likely shows the effect of the deep dewatering in the andesite. Piezometer P4, in the southern area of Waihi, indicates the overlying younger volcanics have not been dewatered. The settlements are relatively small, result in negligible tilt and are therefore not of concern at this point in time. Mark 1.12B continued to exceed the trigger limit by 15 mm in the November 2024 survey. Mark 1.12B will continue to be reviewed with subsequent monitoring surveys.

Mark 1.04 is located in the southern region of Waihi, near the Ohinemuri river. This mark has been triggered previously. The settlement at this mark is assessed to be unrelated to mining activities due to its distance from mining works. It should be further noted that this mark is located near the river and likely upon alluvial soils which are often susceptible to moisture related shrink and swell. Further, this mark may indicate slow natural settlement or ground creep towards the watercourse which is indicated via the measurement of gradual settlement over time.

7.2.3 ZONE 3 – Trigger 95mm

This zone includes areas to the east, south and west of Waihi town.

Review of the time-history plot for Zone 3 shows, as with Zones 1 and 2, most marks display ongoing steady settlement. Total settlements during this reporting period are between 14 and 113mm. Tilts between adjacent marks are well within acceptable limits.

Mark 2CE is located to the west of Waihi township and has showed an increased rate of settlement compared to nearby marks between 1991 and 1995. Thereafter, it has settled at a similar rate to nearby marks. This settlement pattern is similar to point 2BC in Zone 5. This increase settlement rate in the early 1990’s is associated with dewatering/depressurisation effects due to the development of Martha Pit. Steady ongoing settlements similar to the surrounding points indicates settlement associated with dewatering of the deeper andesite. This mark will continue to be reviewed, however, settlements are explainable and tilts are small, so not of concern.

Mark 1.07 is located in the southern region of Waihi. This mark has triggered in the past, and the observed settlement is not thought to be associated with mine dewatering. As with Mark 1.04 (in Zone 2) roadworks have occurred in this area and the mark is located near the Ohinemuri River where shrink/swell susceptible alluvial soils are likely to be present.

Mark 14DB is located near to Mark 1.07. This mark has also triggered in the past and the observed settlement is not thought to be related to mine dewatering. Roadworks have occurred in this area and the mark is located near the Ohinemuri River where shrink/swell susceptible alluvial soils are likely to be present.

Mark 2FC triggered for the first time since 2019 following the November 2024 survey event. The mark has shown a steady rate of settlement toward the trigger, but an increase in rate of settlement was evident in November 2024. Roadworks were noted nearby to the mark during the reporting period which may have affected settlement in this location. The surveyor noted this mark is located near the Zone 4 boundary. This settlement mark will be monitored closely in the following reporting periods and further investigations will be taken if the mark continues to trigger.

7.2.4 ZONE 4 – Trigger 160mm

The Zone 4 time-history plots (Appendix D) show relatively steady ongoing settlement since 1995 in response to mine dewatering. Total settlements during this reporting period are between 3 and 140mm. Tilts between adjacent marks are well within acceptable limits.

One mark, 23C, showed a sharp increase in settlement during the May 2020 survey. This mark is located near a drain and may have been influenced by drainage works nearby during the 2019/2020 period. No visual evidence of settlement effects on surrounding land have been identified to date and nearby piezometers have not shown any unusual changes. The settlement in all subsequent surveys continued at a steady rate with the other surrounding settlement monitoring marks. Due to the settlement at this location continuing at a rate in line with expected settlement, the large drop in settlement from the May 2020 survey has had a correction applied. As a result, this mark no longer exceeds the settlement trigger. Graphs showing the settlement rate for this mark are shown below prior to corrections being added (Figure 46) and after corrections were applied (Figure 47).

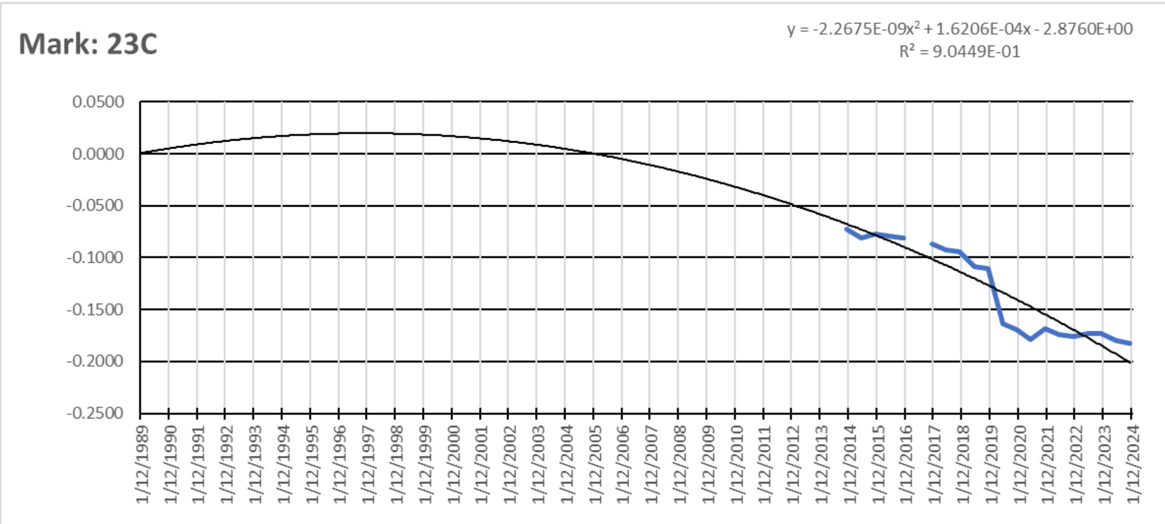


Figure 47. 23C Settlement records prior to correction.

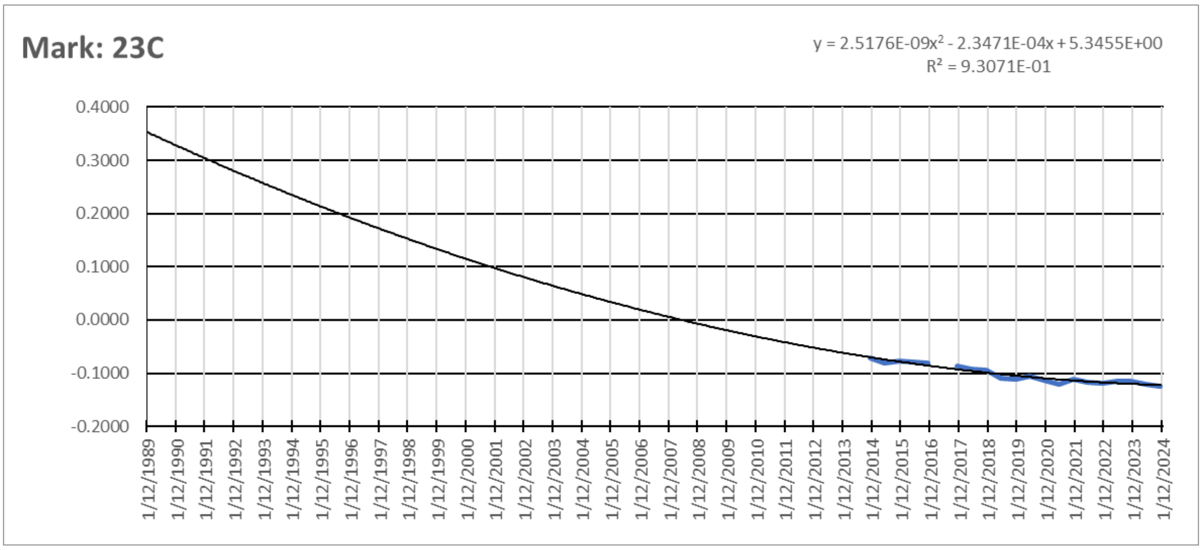


Figure 48. 23C Settlement records after the correction, no longer exceeding trigger limits.

7.2.5 ZONE 5 – Trigger 260mm

The data for the Zone 5 marks is provided on the relevant time-history plot in Appendix D. Total settlements during this reporting period are between 28 and 186mm.

No marks in Zone 5 that are located outside of the area over the Favona Underground exceeded the predicted maximum settlement for the zone.

7.2.6 ZONE 6 – Trigger 340mm

The settlement in this zone is shown on the relevant Zone 6 time-history plot in Appendix D. This settlement zone extends through the centre of the Waihi commercial area. Total settlements during this reporting period are between 6 and 406 mm.

One mark in this zone exceeded the maximum predicted settlement. This mark (mark BM20) has been noted as disturbed by the surveyor (Appendix B), however the settlement has been accumulated at a relatively constant rate. The larger settlements at BM20 (compared to the rest of Zone 6) are likely due to the local ground conditions and there is no private property in this area. This point will continue to be monitored and reviewed.

7.2.7 ZONE 7 – Trigger 540mm

The settlements which have been measured within Zone 7 are all less than the predicted maximum. (Zone 7 time-history plot, Appendix D).

Total settlements during this reporting period are between 307 and 320mm. Ongoing settlements are relatively constant and match the ongoing dewatering at depth within the andesite.

No new settlement trends are indicated by the latest monitoring results.

7.3 Favona Settlement

The measured settlement in the vicinity of the Favona Mine has a component of settlement due to Martha Mine dewatering as well as a component of settlement related to Favona Mine dewatering.

A separation of the measured total settlement into Martha and Favona settlement components has been undertaken by projecting the settlement evident before the commencement of the Favona Mine and accepting these projected settlements as Martha settlements. The difference between the projected (Martha) settlement and total measured settlement has been taken as the Favona component of settlement.

Table 8 sets out the total settlement, the settlement attributed to Martha dewatering and the settlement attributed to Favona Mine dewatering, as assessed for the Favona Mine settlement markers.

Table 8. Separation of settlement – Favona marks – November 2024.

Mark	Measured Total Settlement. (mm)	Estimated Martha Settlement. (mm)	Estimated Favona Settlement. (mm)
F02	105	50	55
F04	-	44	-
F06	115	40	75
F08A	124	44	80
F10B	136	44	92
F12C	136	39	97
F14C	-	60	-
F15C	174	55	119
F16B	168	55	113
F17B	300	55	245
F18	390	49	341
F20	328	44	284
F21	295	43	252
F22	271	42	229
F24	230	42	188
F26	199	45	154
F28B	173	49	124
F30B	159	52	107
F32B	129	49	80
F34C	117	58	59
F35B	108	61	47

The largest measured settlement at Favona Mine occurs where the markers overlie mine workings (i.e. marks F06 and F14C to F26). The maximum predicted settlement over the workings from dewatering was assessed as 80 mm for earlier projects, with mine dewatering related settlement not extending into the urbanised area. The actual total settlement and the extent of settlement exceeded the predictions for the dewatering settlement. The difference between the predictions and measured settlement was assessed to reflect depressurisation and consolidation of the andesite rock body, which was not considered in the initial settlement predictions. Andesite rock was considered to be a stiff material with negligible consolidation characteristics, but the long-term settlement observed in response to Martha Mine dewatering (in Zones 1 to 6, discussed above) suggests that some minor consolidation of the deeper andesite rock is occurring, possibly as a response to fracture depressurisation. In addition, some further relaxation of the rock mass towards the mine workings may be occurring, and this may be providing further volume reduction of the andesite rock mass in the vicinity of the mine.

Another potential influence is that the Favona andesite has been undergoing primary consolidation, as current water level monitoring data suggests that the Favona system was not dewatered to the same extent as the Martha groundwater system during historical mining in the early 1900's.

Consolidation predictions for Favona were made based on Martha's "reconsolidation" dewatering data. The amount of primary consolidation is greater for the first time of dewatering compared to the second or subsequent times of dewatering. This is because the first cycle of dewatering results in pre-consolidation and an increase in the stiffness of the ground, and subsequent recovery of the groundwater levels does not result in full rebound of the ground surface to its original levels.

Settlement predictions for Project Martha have been updated for the zone encompassing Favona marks to reflect the effects outlined above. Five Favona marks exceeded the maximum predicted settlement in the November 2024 survey: F17B, F18, F20, F21 and F22. All are located on company owned land above active underground workings. Marks F18 and F20 are noted by the surveyor as being disturbed (Figure 41, Appendix B).

7.4 Trio Underground

The only anomalous result in the vicinity of Trio Underground has been apparent settlement at mark 2.44 (located on a farm track between Union and Black Hill) with pronounced acceleration since the May 2010 survey. This was investigated and determined to be related to a shallow, likely pre-existing surficial landslide. It is now noted by the surveyor as being disturbed. The mark will removed from the monitoring programme.

7.5 Summary

The analysis of the relevant survey data to the end of 2024 continues to indicate that current slow settlements associated with Martha Mine are likely to be related to dewatering of the deeper structures within the andesite rock mass. Groundwater monitoring data does not show any widespread or significant ongoing dewatering of alluvium, younger volcanic materials or the upper layers of the andesite rock body.

Settlement triggers include modification to Martha Mine Extended Pit associated with the cutback projects; the extended duration of dewatering at Martha Mine; assumptions made in the Favona settlement predictions (fracture depressurisation, secondary rather than primary consolidation); and localised natural, induced and historic effects.

The area around Martha Mine of greatest settlement is adjacent to the eastern pit wall where the weaker younger volcanic rocks are thickest, and dewatering of this geological unit is greatest and most protracted. This is also an area that has historic underground workings which have not been backfilled.

The main area of noteworthy settlement at Favona overlies the underground workings. This area comprises Company owned farmland. Outside the Favona workings area the measured ground surface settlement is notably lower. The conditions giving rise to settlement at Favona differ from those in the Martha Groundwater System as the latter has been dewatered to a greater extent for a longer time than the current dewatering while the former has not been previously dewatered. While settlement has exceeded initial estimates at Favona, such estimates were based on Martha settlement data which was responding to reconsolidation rather than primary consolidation.

In relation to the Trio, Correnso and SUPA mines, these areas are located in the dewatered Martha Groundwater System and settlement (as described in this document) has already been developing in response to Martha Mine dewatering. Also, as these are linked to the Martha system, settlement will be based on additional consolidation and did not include settlement due to dewatering of the andesites.

8 TILT

As noted above, a full assessment and review of the Waihi settlement marker network and database was undertaken by GWS Limited in 2019. This review resulted in the removal of erroneous and high-density settlement marks and an updated settlement database with revised settlement marker corrections where appropriate. Revised settlement marker corrections have been applied in this reporting period. It should also be noted that there is some crossover of marks between adjacent Mining Permit boundaries.

The settlement and tilt assessments have been grouped into seven areas as follows:

- Favona
- Martha
- Rex
- North Wall
- Correnso
- Correnso South, and
- SUPA.

The assessment of tilt between adjacent settlement marks is summarised in Table 9.

The current assessment of tilt between adjacent settlement marks is summarised below in Tables 10a to 10g. In the following tables each tilt result is recorded next to the second of the two marks used in its calculation. An orange cell denotes the locations where tilt greater (steeper) than 1:1000 has been calculated and a green cell denotes a survey monitoring pin that is located above OceanaGold underground mine workings.

Table 9. Summary of Tilt calculations – November 2024 survey.

Table 9a: FAVONA

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
F02	3097.60	490.00		-0.1057	0.1057		
F06	3107.08	445.21	45.78	-0.1155	0.1155	0.0098	4656
F10B	3176.88	446.75	69.82	-0.1361	0.1361	0.0206	3389
F12C	3207.32	503.82	64.69	-0.1361	0.1361	0.0000	7207861
F15C	3297.17	585.32	121.30	-0.1745	0.1745	0.0384	3155
F16B	3367.38	578.70	70.52	-0.1679	0.1679	0.0066	10650
F17B	3405.48	613.91	51.88	-0.2998	0.2998	0.1319	393
F18	3423.83	648.30	38.98	-0.3894	0.3894	0.0895	435
F21	3405.99	672.00	29.66	-0.2948	0.2948	0.0946	314
F24	3388.13	690.85	25.97	-0.2301	0.2301	0.0646	402
F32B	3348.78	769.1	87.59	-0.1289	0.1289	0.1013	865
F34C	3339.49	849.57	81.00	-0.1171	0.1171	0.0117	6896
F35B	3336.68	896.06	46.58	-0.1079	0.1079	0.0092	5063

Table 9b: MARTHA

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
20BB	2533.26	1622.29		-0.1273	0.1273		
20AC	2461.04	1536.91	111.83	-0.1312	0.1312	0.0040	28158
BM20A	2345.50	1484.90	126.71	-0.2552	0.2552	0.1239	1022
20D	2482.07	1473.48	137.05	-0.1642	0.1642	0.0909	1507
19CB	2296.71	1381.40	206.97	-0.2996	0.2996	0.1354	1529
19BB	2191.56	1292.02	138.00	-0.3151	0.3151	0.0155	8906
BM19B	2117.17	1244.36	88.35	-0.3165	0.3165	0.0013	66068
17CB	2014.23	1201.01	111.70	-0.3200	0.3200	0.0035	31857
17BB	1919.52	1160.79	102.90	-0.2471	0.2471	0.0729	1412
17AB	1841.32	1104.80	96.18	-0.2123	0.2123	0.0348	2763
2.04B	1893.21	968.34	145.99	-0.1628	0.1628	0.0495	2950
34CB	1967.74	983.20	76.00	-0.1585	0.1585	0.0044	17458
34BE	1732.56	931.60	164.80	-0.1553	0.1553	0.0075	21984
BM17A	1724.44	1088.92	207.42	-0.1218	0.1218	0.0335	6187
10BC	1560.13	1062.92	216.74	-0.1474	0.1474	0.0256	8459
10AB	1430.61	1037.00	298.38	-0.1467	0.1467	0.0007	415534
BM16	1418.09	1218.03	210.32	-0.1453	0.1453	0.0014	147555
10DC	1279.04	1198.33	221.36	-0.1523	0.1523	0.0070	31596
16BC	1252.81	1336.47	203.34	-0.1474	0.1474	0.0049	41821
BM9B	1220.25	1523.29	330.23	-0.0845	0.0845	0.0629	5252

Table 9c: REX

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
R01	742707.14	495653.61		-0.0058	0.0058		
R02	742734.74	495695.37	50.06	-0.0067	0.0067	0.0009	55617
R03	742815.40	495715.92	83.23	-0.0092	0.0092	0.0025	33293
R04	742788.69	495771.35	61.53	-0.0077	0.0077	0.0015	41020
R05	742830.30	495814.32	59.81	-0.009	0.0090	0.0013	46009
R06	742899.61	495885.98	99.69	-0.0065	0.0065	0.0025	39877

Table 9d: NORTH WALL

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
27AB	2009.08	2064.33		-0.0090	0.0090		
26Q	1963.00	1982.71	93.73	-0.0342	0.0342	0.0251	3728
26PB	1834.84	1893.11	156.38	-0.0515	0.0515	0.0173	9034
26OB	1706.93	1812.27	151.31	-0.0059	0.0059	0.0456	3322
26NC	1641.16	1772.40	228.22	-0.0405	0.0405	0.0346	6600
26MB	1593.46	1750.66	122.11	-0.0494	0.0494	0.0136	8972
26JB	1495.71	1756.55	93.74	-0.0414	0.0414	0.0025	37877
BM26	1542.45	1837.81	100.98	-0.0389	0.0389	0.0105	9627
3.09	1618.51	1870.17	217.54	-0.0358	0.0358	0.0299	7272

Table 9e: CORRENSO

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
25E	2472.35	1162.01		-0.1660	0.1660		
25B	2497.67	1105.83	61.62	-0.1360	0.1360	0.0300	2052
25I	2537.20	1045.04	72.51	-0.1297	0.1297	0.0063	11490
24H	2630.70	1072.28	97.39	-0.1222	0.1222	0.0075	13015
24B	2667.67	1126.40	65.54	-0.1248	0.1248	0.0026	25649
24G	2705.96	1170.46	58.38	-0.1347	0.1347	0.0099	5884
24L	2761.67	1181.33	56.76	-0.1397	0.1397	0.0050	11309
24AC	2743.58	1218.90	41.70	-0.1380	0.1380	0.0017	24403
24F	2772.80	1257.27	48.23	-0.1273	0.1273	0.0107	4515
BM24	2794.55	1279.36	31.00	-0.1218	0.1218	0.0055	5611
24E	2758.43	1303.23	43.29	-0.1273	0.1273	0.0055	7837
24DC	2718.29	1323.13	44.80	-0.1241	0.1241	0.0032	13951
24I	2692.57	1269.71	59.29	-0.1294	0.1294	0.0053	11112
25H	2648.48	1232.96	57.40	-0.1397	0.1397	0.0102	5604
25CB	2615.91	1190.50	53.51	-0.1403	0.1403	0.0006	86962
25G	2594.60	1149.42	46.29	-0.1409	0.1409	0.0006	81134
25F	2542.53	1116.24	61.74	-0.1434	0.1434	0.0026	24138
25B	2497.67	1105.83	46.05	-0.1360	0.1360	0.0074	6207
BM25	2424.91	1100.25	72.97	-0.1529	0.1529	0.0169	4319
25E	2472.35	1162.01	77.88	-0.1660	0.1660	0.0131	5927
25A	2505.13	1203.77	53.09	-0.1633	0.1633	0.0028	19134
25D	2547.05	1248.02	60.95	-0.1645	0.1645	0.0013	47468
21DC	2573.96	1304.15	62.25	-0.1532	0.1532	0.0113	5511

21N	2623.25	1342.44	62.41	-0.1361	0.1361	0.0172	3639
Mark	**x**	**y**	**Distance (m)**	**Nov 2024 Δz (m)**	**Abs (m)**	**Δh (m)**	**Tilt (1:X)**
21C	2651.57	1389.82	55.20	-0.1221	0.1221	0.0140	3937
21M	2694.90	1439.65	66.03	-0.1126	0.1126	0.0095	6967
21BC	2719.27	1477.80	45.27	-0.0949	0.0949	0.0177	2559
21EB	2799.95	1429.09	94.24	-0.0989	0.0989	0.0040	23801
24K	2783.89	1387.72	44.38	-0.1167	0.1167	0.0178	2491
24J	2749.39	1365.76	40.89	-0.1104	0.1104	0.0063	6505
24DC	2718.29	1323.13	52.77	-0.1241	0.1241	0.0137	3852
22F	2815.91	1325.41	97.65	-0.1259	0.1259	0.0018	55201
22C	2846.39	1352.54	40.80	-0.1435	0.1435	0.0177	2308
22GB	2862.88	1387.97	39.08	-0.1168	0.1168	0.0268	1459
22BC	2916.75	1435.77	72.02	-0.1010	0.1010	0.0158	4555
22I	2918.98	1461.37	25.69	-0.0996	0.0996	0.0014	18703
22H	2869.25	1441.80	53.44	-0.0885	0.0885	0.0111	4812
21P	2849.17	1456.90	25.13	-0.0919	0.0919	0.0034	7285
21FB	2861.65	1512.21	56.70	-0.0715	0.0715	0.0204	2775
21Q	2899.60	1571.32	70.24	-0.0729	0.0729	0.0014	50823
21GC	2901.12	1614.05	42.76	-0.0750	0.0750	0.0021	20464
22KB	2981.80	1603.49	81.37	-0.0656	0.0656	0.0094	8652
2.29B	2953.39	1548.17	62.19	-0.0925	0.0925	0.0270	2306
22J	2944.47	1489.76	59.09	-0.0799	0.0799	0.0126	4693
22I	2918.98	1461.37	38.16	-0.0996	0.0996	0.0196	1943
22H	2869.25	1441.80	53.44	-0.0885	0.0885	0.0111	4812
21EB	2799.95	1429.09	70.46	-0.0989	0.0989	0.0104	6777
21BC	2719.27	1477.80	94.24	-0.0949	0.0949	0.0040	23801
BM21	2654.80	1515.40	74.63	-0.1052	0.1052	0.0103	7228
20F	2605.79	1575.98	77.92	-0.1147	0.1147	0.0095	8190
20E	2535.65	1542.67	77.65	-0.1765	0.1765	0.0617	1257
21C	2651.57	1389.82	191.83	-0.1221	0.1221	0.0544	3525

Table 9f: CORRENSO SOUTH

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
23F	2700.77	968.79		-0.1329	0.1329		
2.13	2725.42	874.95	97.03	-0.0750	0.0750	0.0579	1675
23E	2774.82	972.51	74.15	-0.1323	0.1323	0.0006	134767
2.14A	2853.28	838.67	132.91	-0.0646	0.0646	0.0104	12810
23B	2856.49	949.79	84.77	-0.1177	0.1177	0.0146	5791

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
BANK1	2866.21	1023.25	74.10	-0.1176	0.1176	0.0001	1096272
23C	2856.14	1068.01	45.88	-0.1823	0.1823	0.0647	710
2.25	2874.51	1097.26	34.54	-0.1207	0.1207	0.0616	561
23D	2861.42	1154.89	59.09	-0.1298	0.1298	0.0091	6482
2.24	2885.91	1215.47	65.35	-0.1319	0.1319	0.0021	31324
MATAURA 1	2831.84	1250.81	64.60	-0.1198	0.1198	0.0121	5357
BM24	2794.55	1279.36	46.96	-0.1218	0.1218	0.0019	24144

*Mark 23C has since been corrected at the time of this report. This mark no longer triggers settlement and the tilt reporting would reflect this. The data will be amended for the May 2025 Report.

Table 9g: SUPA

Mark	x	y	Distance (m)	Nov 2024 Δz (m)	Abs (m)	Δh (m)	Tilt (1:X)
BM25	2424.91	1100.25		-0.1529	0.1529		
34H	2233.59	970.56	231.14	-0.1338	0.1338	0.0191	12089
2.10	2143.92	950.39	91.91	-0.1179	0.1179	0.0159	5797
34CB	1967.74	983.20	179.21	-0.1585	0.1585	0.0405	4421
34GC	2211.33	1119.52	279.14	-0.2162	0.2162	0.0577	4835
19BB	2191.56	1292.02	173.63	-0.3151	0.3151	0.0989	1755
19CB	2296.71	1381.40	138.00	-0.2996	0.2996	0.0155	8906
21O	2527.37	1356.34	232.01	-0.1564	0.1564	0.1432	1620
20C	2450.61	1413.86	95.92	-0.1855	0.1855	0.0291	3298
20D	2482.07	1473.48	67.41	-0.1642	0.1642	0.0213	3171
BM20A	2345.50	1484.90	137.05	-0.2552	0.2552	0.0909	1507

Table Key:

(green)	Monitoring mark located above mine workings.
(orange)	Tilt greater than 1:1000 observed.

8.1 Favona

The locations surveyed in 2024 with tilt values between adjacent marks steeper than the 1:1000 criterion are highlighted in

Table 9 above. The locations of the marks in relation to the Favona mine workings are shown in Figure 49 and Figure 50 below.

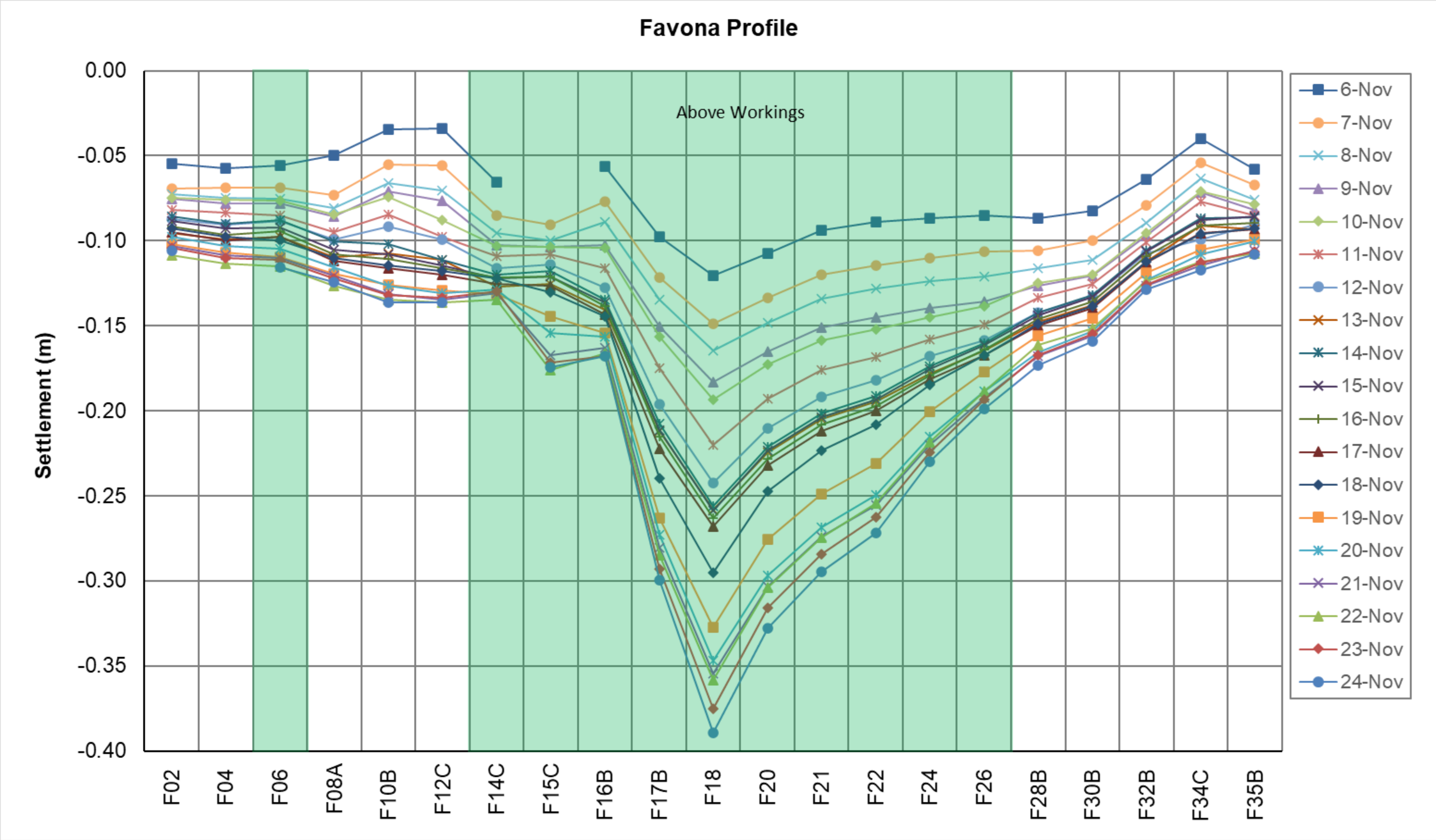


Figure 49. Favona settlement profile.

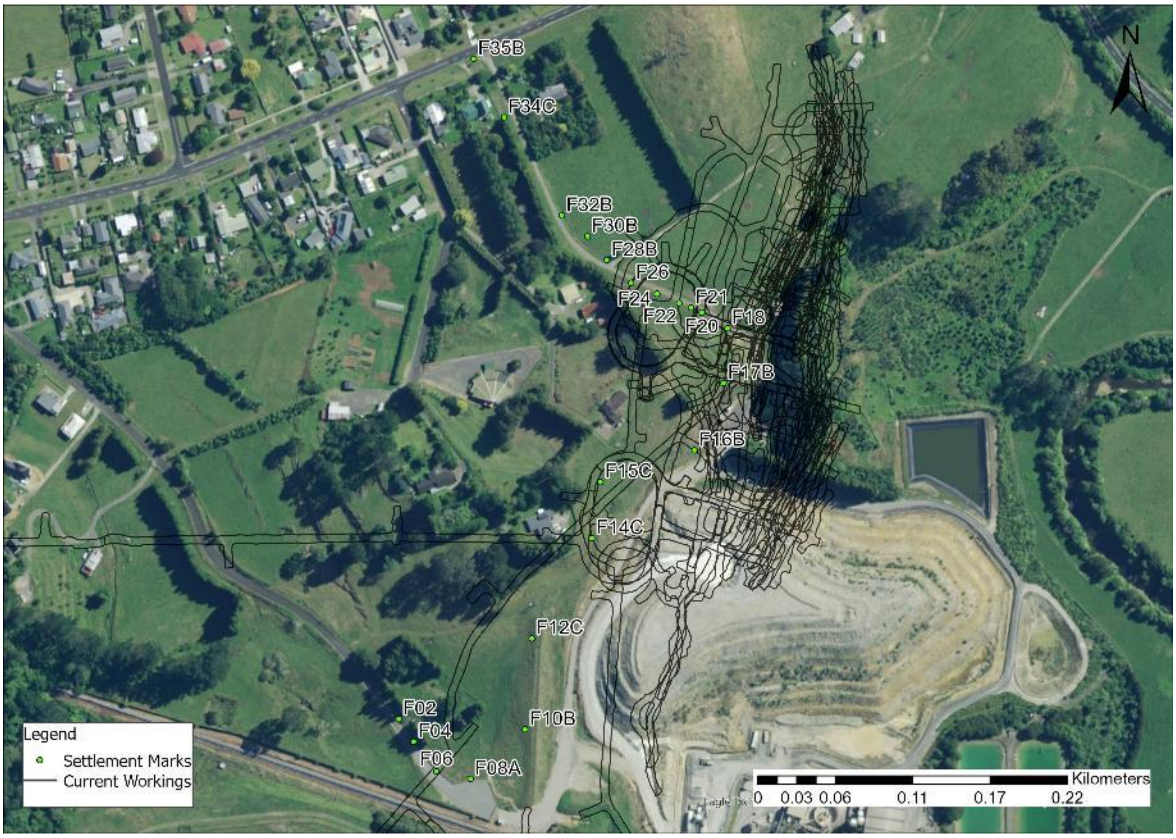


Figure 50. Favona settlement marks and workings.

Discussion – Favona Tilt

This area comprises farmland that is owned by the company. The footprint of this area is over 100m south of any non-company residences.

The tilt in this area has changed little since 2005, with small increases in tilt as the dewatered underground workings adjust compared to the adjacent land.

Tilt values greater than 1:1000 was previously assessed at six locations (F14C/F15C, F16B/F17B, F17B/F18, F18/F21, F21/F24 and F24/F32B). These are all located over or near underground workings.

The monitoring results for the survey marks above the Favona workings indicate no new tilt measurements in excess of 1:1000 since the May 2024 survey.

All Favona marks showed more settlement than the May 2024 survey, continuing the trend of slow settlement developing over time at this location.

Monitoring will continue, and this will determine any anomalous results that need to be addressed.

Note 1: *The Favona tilt is calculated from the total settlement at each mark, without separation of any Martha effect. While the calculated tilt may not precisely reflect the tilt due to Favona alone, the discrepancy is considered to be minor.*

Note 2: *Not all Favona settlement markers are included in the tilt calculations due to some being too close to one another. The minimum distance between the marks which are included in the tilt calculations is 25m.*

8.2 Martha/North Wall Tilt

No tilt calculations greater than 1:1000 have been identified in the Martha/North Wall area during the November 2023 survey.

Although no tilts have been identified in Slevin Park, the area is swampy, historically infilled with poor material and has a previous history of slumping/subsidence. Therefore, close monitoring of this area will continue. We understand that HDC is also undertaking regular monitoring of this area.

From November 2022 additional Martha marks have been added to the tilt calculations to extend this analysis in line with the mine expansion in this area.

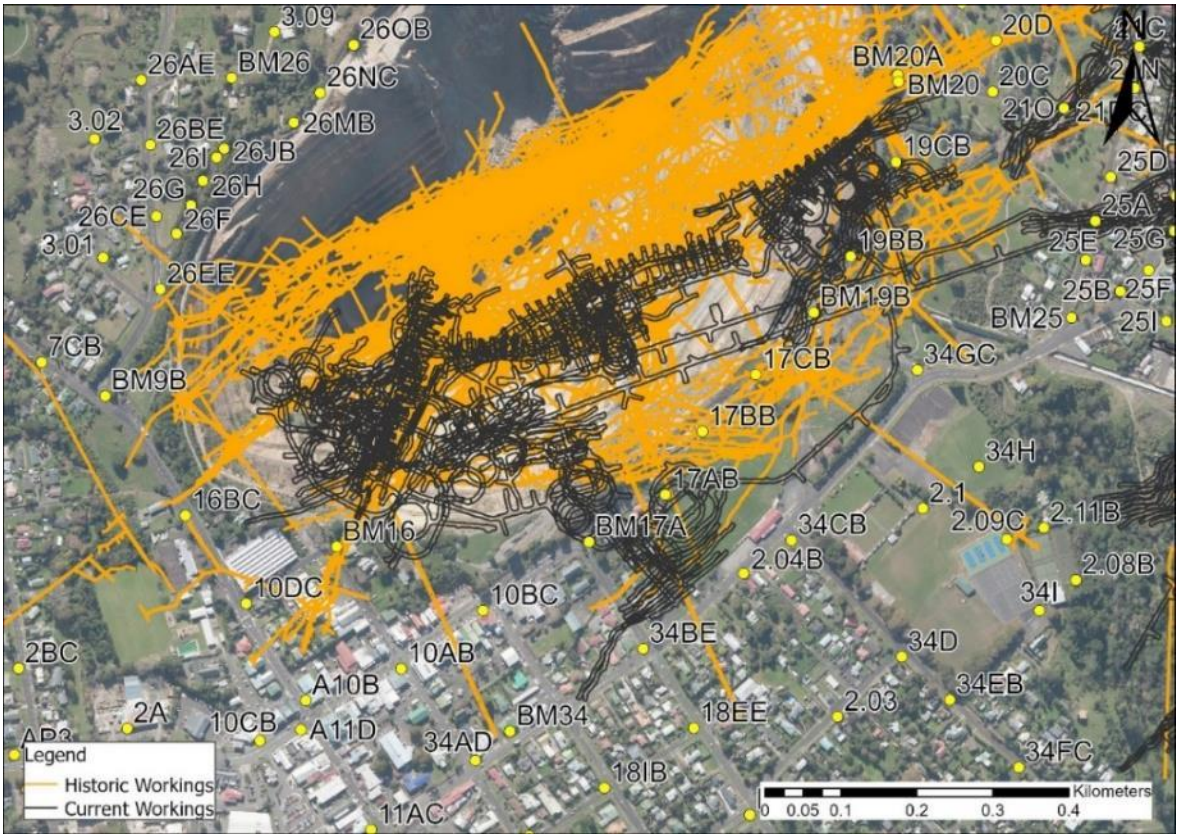


Figure 51. Martha/North Wall settlement marks and workings.

8.3 Rex

The marks above Rex underground were added at request of the HDC geotechnical reviewer Peter Fuller.

No tilt greater than 1:1000 has been identified within this area.

These marks will be added to the historic data in future reports as well as incorporated into the Martha tilt tables going forward. For now, these marks are reported as a separate network and are shown in red in Figure 52.

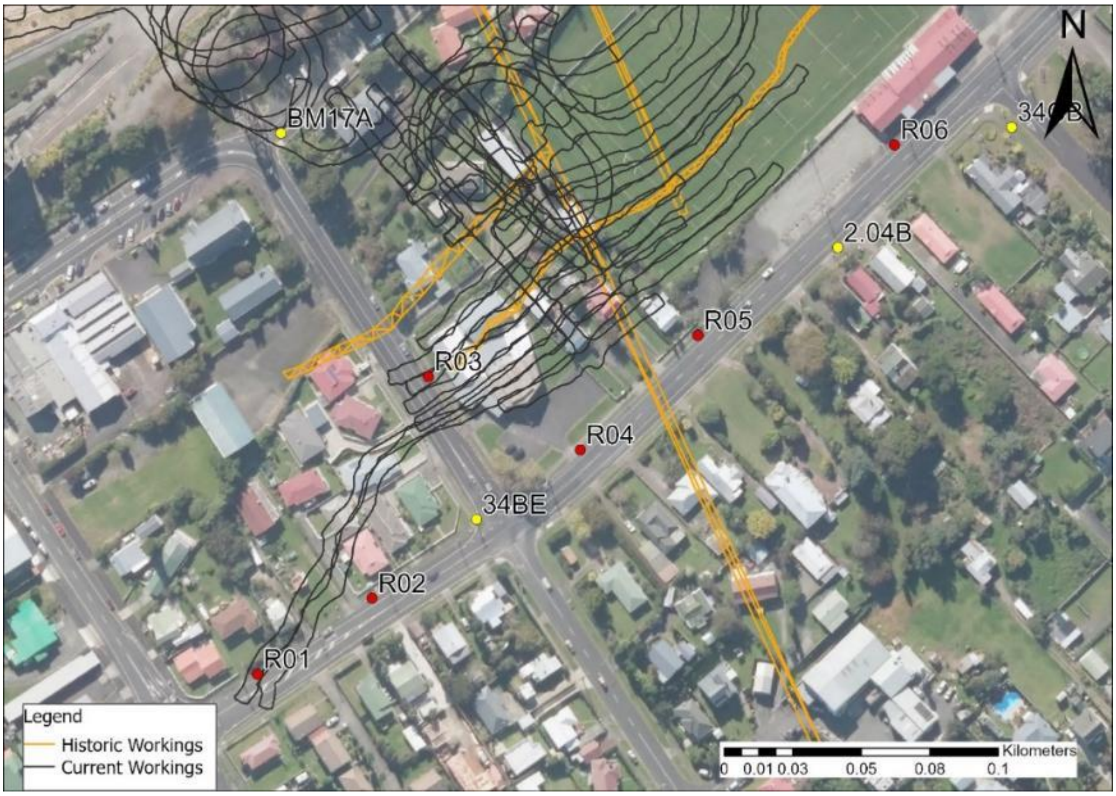


Figure 52. Rex settlement marks (in red) and workings.

8.4 Correnso

Tilt greater than 1:1000 was previously identified in the Correnso South area at two locations associated with Mark 23C. As stated in Section 7.2.4 above, due to the potential influence by drainage works, a correction has been applied to this mark. The tilts previously recorded between marks 23C/2.25 and 23C/BANK (Figure 53) are no longer considered to be greater than 1:1000.

Figure 53. 23C, 2.25 and BANK1 settlement marks and workings.

8.5 SUPA

No tilts greater than the 1:1000 trigger have been identified to date in the SUPA area.

8.6 Historic comparisons

The latest measurements at all survey marks are compared with their three previous survey readings to assess any trends are summarised below in Table 10. In the following tables an orange cell denotes the locations where tilt greater (steeper) than 1:1000 has been calculated and a green cell denotes a survey monitoring pin that is located above OceanaGold underground mine workings.

It should be noted that the tilt assessments are sensitive to the separation distance between the markers. Large, potentially misleading tilt numbers can sometimes be generated if the relevant marks are close together. Additionally, marks can be reviewed which can result in revised corrections. This will modify the tilt calculation.

Table 10. Comparison of historic tilt calculations – May 2023 to November 2024.

Table 10a: FAVONA

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
F02	N/A	N/A	N/A	N/A
F06	7230	6937	5069	4656
F10B	3035	3341	3490	3389

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
F12C	20927	35936	43383	7207861
F15C	3044	3184	3412	3155
F16B	9133	17200	17982	10650
F17B	446	414	397	393
F18	462	475	446	435
F21	332	326	319	314
F24	446	434	411	402
F32B	901	890	862	865
F34C	6561	6137	6161	6896
F35B	6560	7278	5480	5063

Table 10b: MARTHA

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
20BB	N/A	N/A	N/A	N/A
20AC	87956	49233	22494	28158
BM20A	1038	1025	1049	1022
20D	1359	1377	1543	1507
19CB	1430	1455	1573	1529
19BB	10077	10226	9587	8906
BM19B	336285	119836	372363	66068
17CB	74159	30138	53032	31857
17BB	1287	1311	1351	1412
17AB	3063	3005	3102	2763
2.04B	3793	3669	3067	2950
34CB	*	*	32296	17458
34BE	17354	14987	24610	21984
BM17A	4788	5031	5513	6187
10BC	7391	7599	7734	8459
10AB	69684	88228	16512540	415534
BM16	36735	56456	71895	147555
10DC	18438	24046	23287	31596
16BC	30987	40169	57084	41821
BM9B	5657	5470	5154	5252

* Tilt calculation added in May 2024 assessment due to regulator recommendation.

Table 10c: NORTH WALL

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
27AB	N/A	N/A	N/A	N/A
26Q	4103	4252	3655	3728
26PB	8183	8931	10148	9034
26OB	3336	3388	3571	3322
26NC	5213	5723	5852	6600
26MB	15837	9532	10892	8972
26JB	51364	45179	49998	37877
BM26	28136	10009	11896	9627
3.09	8362	7524	7760	7272

Table 10d: CORRENSO

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
25E	N/A	N/A	N/A	N/A
25B	2238	2145	2198	2052
25I	7705	9052	11311	11490
24H	32651	14150	14150	13015
24B	15049	16571	23879	25649
24G	5549	5884	3370	5884
24L	21166	696664	5105	11309
24AC	11000	20943	6826	24403
24F	8890	8005	5528	4515
BM24	3137	3015	3137	5611
24E	8132	7187	7982	7837
24DC	10638	15936	7844	13951
24I	5699	5736	2371	11112
25H	10296	11384	6655	5604
25CB	631972	128838	91521	86962
25G	69033	23489	43238	81134
25F	31537	33235	28614	24138
25B	5815	6207	7174	6207
BM25	4771	4451	4398	4319
25E	6363	6311	6808	5927
25A	24413	23340	31702	19134

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
25D	214594	125924	125924	47468
21DC	5189	4682	6355	5511
21N	6400	5136	3817	3639
21C	3187	3700	4023	3937
21M	5209	6184	5011	6967
21BC	3191	2849	3103	2559
21EB	21133	74827	34152	23801
24K	3036	2703	2410	2491
24J	15069	23863	8726	6505
24DC	6681	6283	4511	3852
22F	35266	145959	23999	55201
22C	2507	2335	2335	2308
22GB	1454	1577	1392	1459
22BC	4929	4830	4766	4555
22I	8359	7616	33205	18703
22H	10073	5450	4206	4812
21P	7976	15223	2631	7285
21FB	3253	3291	2137	2775
21Q	120674	89814	183843	50823
21GC	14303	15329	20464	20464
22KB	7531	8299	7673	8652
2.29B	2139	2169	2207	2306
22J	5798	5054	5327	4693
22I	3223	2127	1840	1943
22H	7120	5450	4206	4812
21EB	6910	8596	7267	6777
21BC	21133	74827	34152	23801
BM21	8178	8652	9073	7228
20F	8190	7704	7341	8190
20E	1398	1380	1302	1257
21C	4054	3962	3782	3525

Table 10e: CORRENSO SOUTH

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
23F	N/A	N/A	N/A	N/A
2.13	2179	2165	1658	1675
23E	12462	14980	12895	134767
2.14A	27244	24186	8174	12810
23B	19440	34451	5674	5791
BANK1	5422	5992	19668	1096272
23C	679	711	710	710
2.25	611	605	603	561
23D	12800	8543	11779	6482
2.24	8286	13945	14566	31324
MATAURA1	5270	4800	5024	5357
BM24	20026	25453	21893	24144

*Mark 23C has since been corrected at the time of this report. This mark no longer triggers settlement historically and the tilt reporting would reflect this. The data will be amended for the May 2025 Report.

Table 10f: SUPA

Mark	May 23 (1:X)	Nov 23 (1:X)	May 24 (1:X)	Nov 24 (1:X)
BM25	N/A	N/A	N/A	N/A
34H	9912	9955	11841	12089
2.10	2381	2764	15459	5797
34C	2784	2931	10901	4421
34GC	4635	4777	4721	4835
19BB	1825	1844	1816	1755
19CB	10077	10226	9587	8906
21O	1579	1607	1712	1620
20C	4751	3793	4049	3298
20D	3732	2910	3411	3171
BM20A	1359	1377	1543	1507

Table Key:

(green)	Monitoring mark located above mine workings.
(yellow)	Tilt greater than 1:1000 observed.

No anomalous trends were identified. Some marks have shown an overall trend of increasing tilt; however, none are currently of concern.

9 COMPLAINTS

The company maintains a complaints database in accordance with consent conditions. There were two complaints received during 2024 in relation to dewatering or settlement.

One complainant was concerned about ‘slumping’ at the back of their section. OGNZL personnel inspected the property and found a deteriorating retaining wall. Access was arranged from the neighbouring OGNZL property and the retaining wall was replaced.

The other complainant was worried about some cracking to the interior of their property and had noticed the ceiling was slumping. The property was inspected by a registered building inspector who advised that the damage was not mine related.

10 CONTINGENCY ACTIONS

As discussed in section 6.2.4, two triggers were reached for the piezometers monitoring groundwater levels in the upper Rex area.

A 2.75mRL decrease in water level was identified at piezometer P113A (74m deep), for the period 25 September 2024 to 22 October2024. This level change occurred at a piezometer tip located in the Andesite and is considered highly unlikely to have any effect on the surface groundwater system because it has not influenced the water levels in the two piezometers nearer the surface.

A 2.93mRL decrease in water level was identified at piezometer P114 (55m deep), for the period 23 October 2024 to 23 December 2024. This is a two-month period and was believed to be related to a water inflow event associated with unravelling of weak rock mass. The area was treated with resin injection through self-drilling anchors to decrease water inflow and stabilise the area. P114 is on telemetry and communications had been malfunctioning so it was not possible to determine if the decrease was over one month. The communications issue was subsequently resolved and the water level has been stable since.

11 WATER QUALITY RESULTS

11.1 Underground Water Quality

Underground dewatering water is sampled at the Water Treatment Plant. This is a combination of underground water from the Favona, Trio, Correnso, SUPA, and Martha Mine workings, and treated service water, but it gives a general indication of the underground water quality. Additionally, Environmental staff endeavour to collect quarterly water samples from four locations underground.

The only backfilled mine workings that are considered near its final closure state is the Favona underground mine. Separate sampling of Correnso and Favona underground water from sumps at the lowest accessible points in each mine began during 2018. Sampling from the two Martha Underground bores, PC1 and PC2, began in 2021.

During the reporting period, results from the composite underground dewatering had stable pH and EC values averaging 7.1 units and 262 mS/m respectively. Sulphate values averaged 1662 g/m^3, iron averaged 4.9 g/m^3 and manganese 9.3 g/m^3. Other metal concentrations were low (Appendix E).

Underground sites were sampled six times in 2024. These included:

- 800 level PC1 bore x4
- 800 level PC2 bore x2

The composite underground mine water was sampled monthly throughout the period.

Figure 54 to Figure show water quality results and Piper Diagrams for the various types of underground water. All water types have a similar make up of cation and anions. UG dewatering and Correnso and at times Favona are calcium sulphate waters, while PC01 and at times Favona, are calcium magnesium sulphate waters.

While elevated levels of some metals are noted, all underground water is currently pumped to the Water Treatment Plant.

Treated water is used as service water underground, as discussed in Section 5. Treated water quality is extremely consistent as it needs to comply with water quality parameters prior to river discharge. In 2024 service water made up 8% of the dewatering volume total and is unlikely to have any effect on groundwater quality. Water quality results are provided in Appendix E.

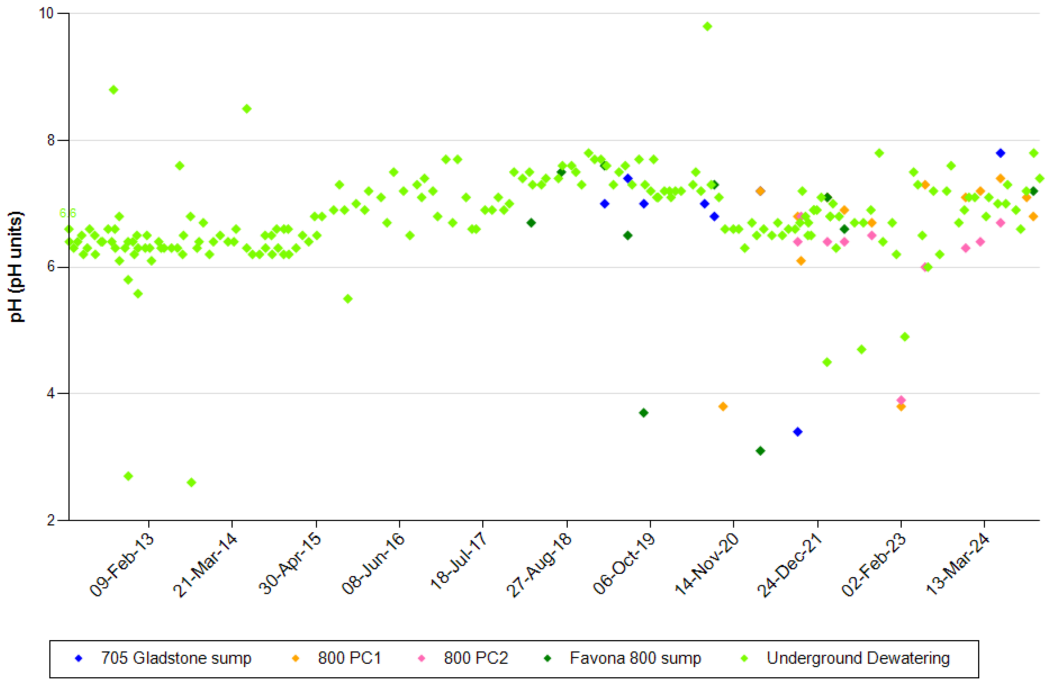


Figure 54. Underground sample sites – summaries of pH results.

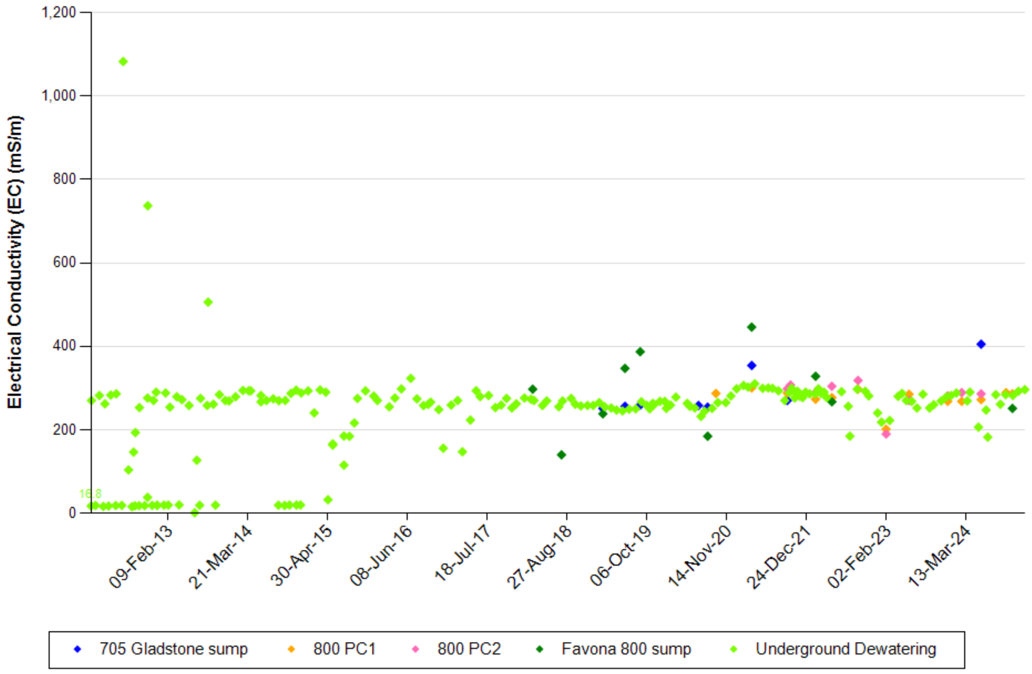


Figure 55. Underground sample sites – summaries of EC results.

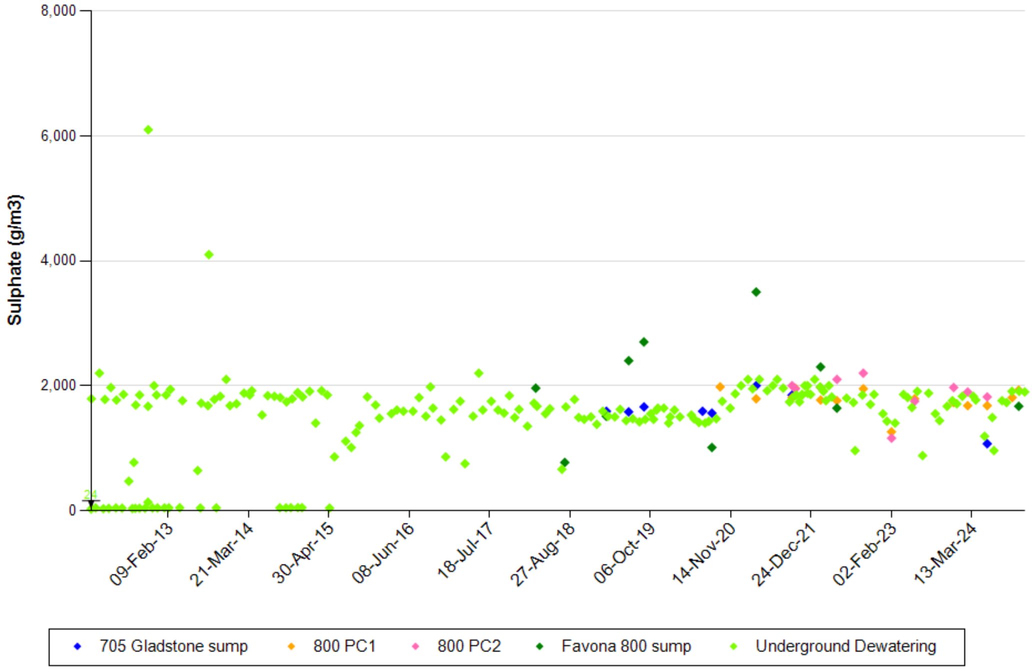


Figure 56. Underground sample sites – summaries of Sulphate results.

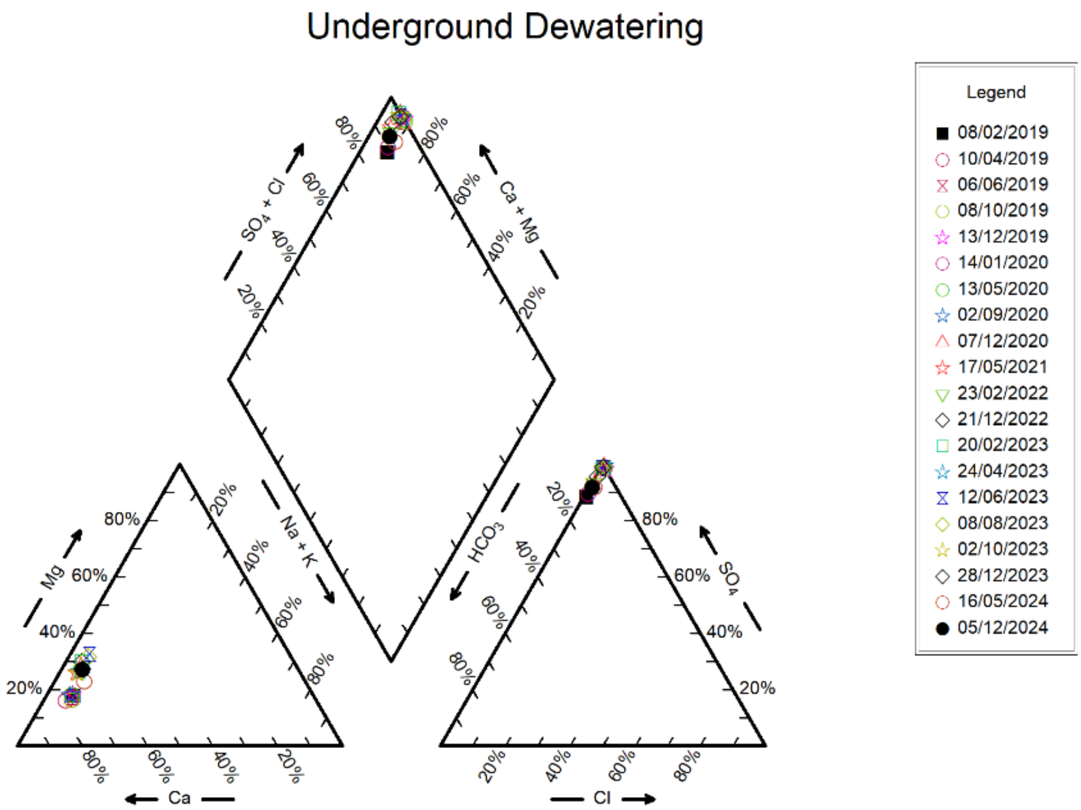


Figure 57. Martha Underground dewatering piper diagram.

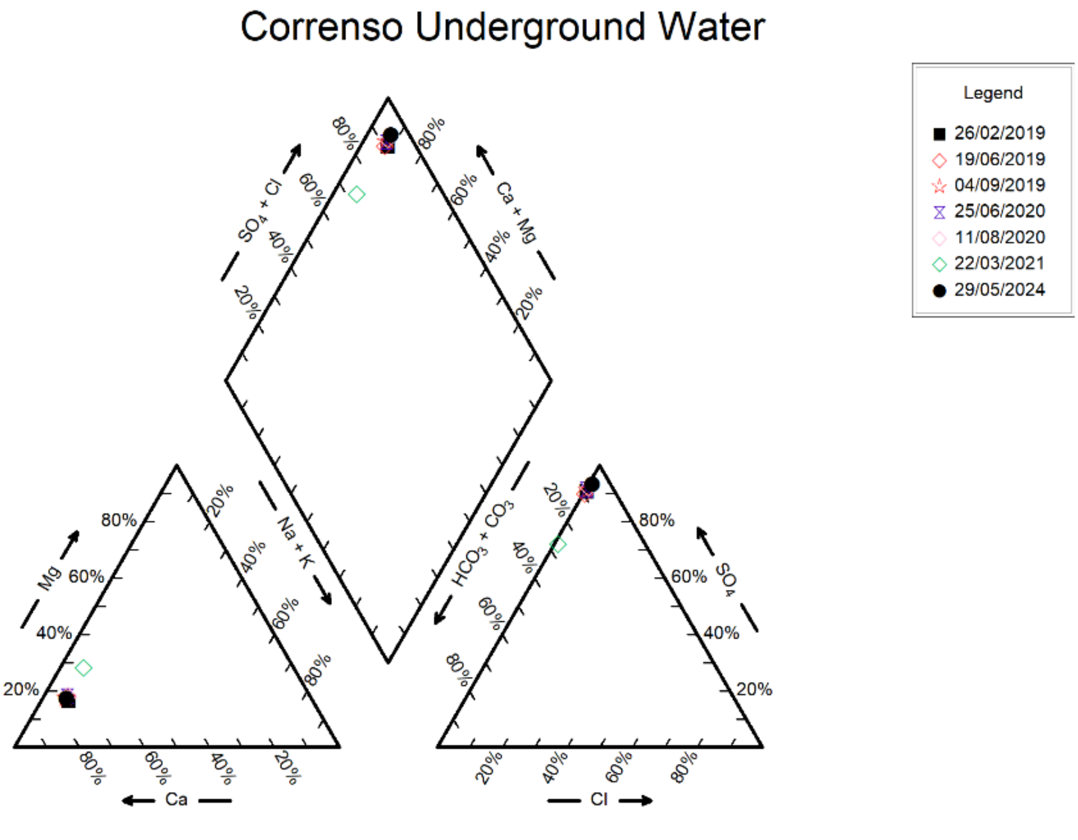


Figure 58. Correnso Underground piper trilinear diagram.

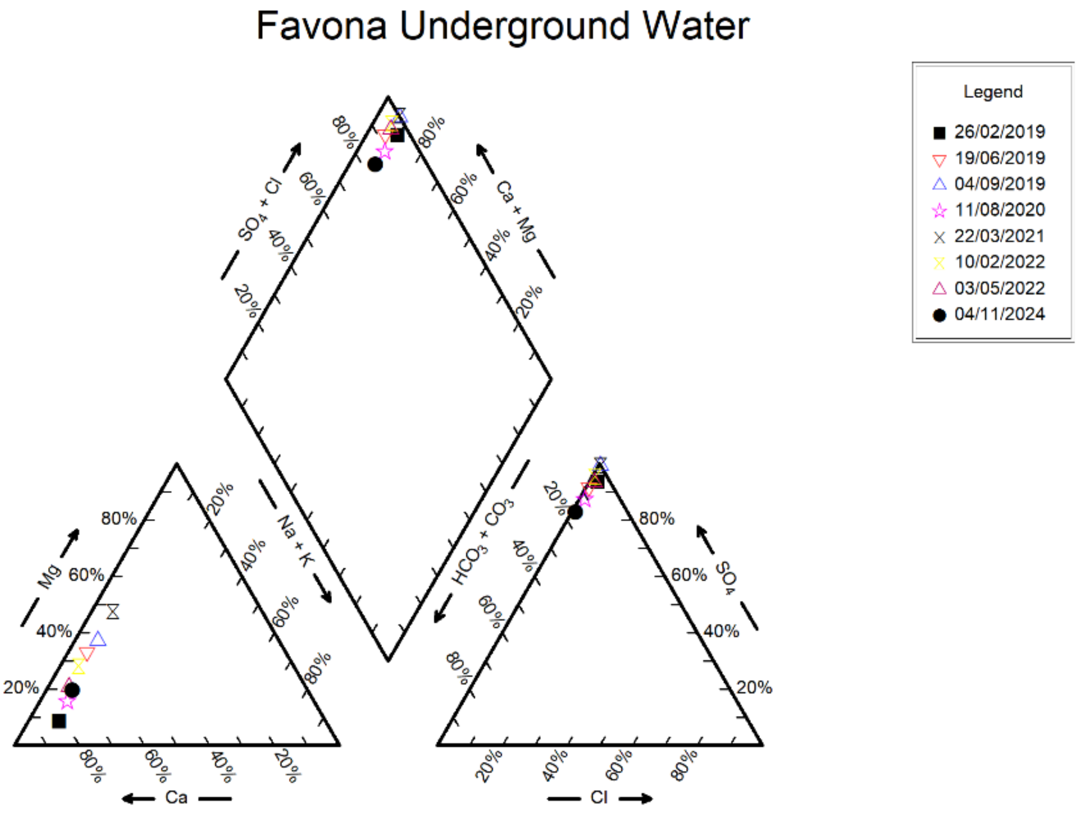


Figure 59. Favona Underground piper trilinear diagram.

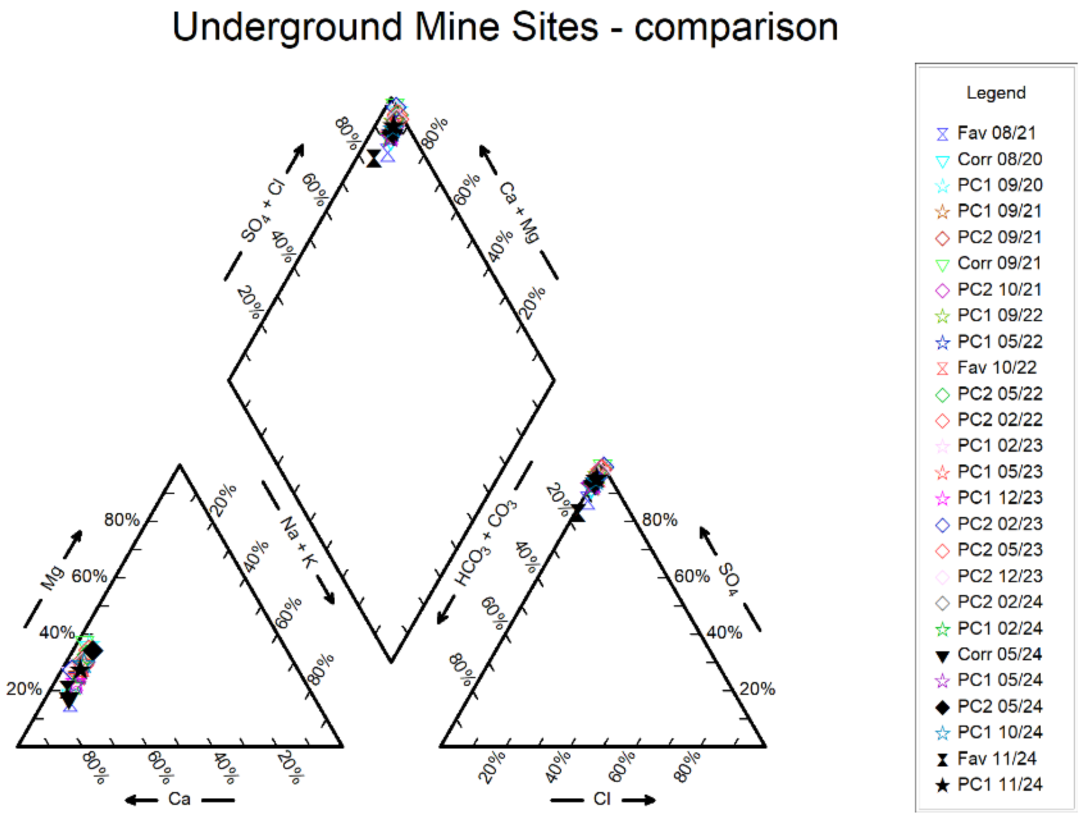


Figure 60. Underground comparison water piper trilinear diagram.

11.2 Martha Piezometer Water Quality

Two rounds of groundwater sampling (Autumn and Spring), from seven standpipe piezometers, were completed in 2024. The autumn results were included in the Shallow and Deep Aquifer Report 2024. Full results of groundwater quality will continue to be presented in this five-yearly report. Summarised results for 2024 are presented below in Table 11.

Table 11. Martha Standpipe Piezometer Water Quality Results 2024.

Well ID	Geological Unit	Number of Samples	Average pH	Average EC (mS/m)	Average SO_4 (g/m^3)	Average Fe (g/m^3)	Average Mn (g/m^3)
P2-4	Alluvium	2	7.8	22.3	6.5	0.03	0.131
P8-4	Alluvium	2	6.9	14.1	3.5	4.55	0.425
BH6	Younger Volcanics	3	6.7	12.5	2.3	0.75	0.420
BH7	Younger Volcanics	1	6.2	9.8	16.0	0.07	0.012
BH9	Younger Volcanics	2	5.8	6.3	5.5	0.02	0.038
BH11	Younger Volcanics	2	5.4	8.9	18.0	0.05	0.118
BH12	Younger Volcanics	2	7.2	17.7	21.5	0.10	0.302

12 FUTURE DEWATERING PREDICTIONS

During the 2021 peer review process it was identified that future dewatering predictions should be included in this report. As a result of this recommendation, OGNZL commissioned GWS Ltd to assess the pumped groundwater volume predictions.

The MUG dewatering model has been developed based on the historic mining records and is described in detail in the GWS (June 2022) report. The same analytical model has been used to provide updated water volumes. In summary, the peak dewatering requirements are from August 2024 to January 2026 with a pumping rate of 3,905 m3/d required to lower the groundwater level in the working by 100 m to 550 m RL. To hold the groundwater level at that elevation an ongoing dewatering rate of 2,100 m3/d would be required through to January 2029.

13 IMPROVEMENT ACTIVITIES

Works that have been undertaken at the site during 2024 to improve environmental monitoring performance include:

- Developed a closure related groundwater quality baseline monitoring program and commenced sampling.
- Further review of the Martha piezometer network to assess effectiveness.

Proposed improvement activities to be undertaken in 2025 include:

- Review and ground truth for suitability the monitoring wells recommended by WWLA for water quality sampling.
- Develop Conceptual and Numerical groundwater models to assist with predicting dewatering impacts post closure.
- Installation of a second underground piezometer to assist in identifying the extent of drawdown across the underground workings, and also provide a backup if the first underground piezometer (ROW17 VWP) fails.
- Installation of a new multilevel piezometer located to the southwest of the Martha Pit along strike of the Martha vein system.
- Investigate accessing three private wells (two northeast and one southwest of the Martha Pit along strike of the Martha vein system) for groundwater monitoring going forward.

14 REVIEW RECOMMENDATIONS 2024

This section summarises the review recommendations from the Peer Reviewer (David Whiting), Hauraki District Council (Peter Fuller), and Waikato Regional Council (Alan Pattle) on the 2023 report, and how they have been or are going to be addressed.

14.1 Peer Reviewer

Table 12. 2024 Peer Review preliminary comments and actions.

PR Ref	Report Ref	Comment	Action
2.1		Overall comment on report.	NA
2.2		“Introduction” – missing Section number	Updated to section 1.
2.3	s. 1	Suggest rewording the third sentence in second paragraph to the following to better define Cumulative Rainfall Departure. *“The CRD is calculated by determining the mean of the rainfall for the period in question, subtracting the mean from each data point to determine the departure from the mean, and accumulating the resultant departures.“* The cyclonic events in January – February 2023 influenced the high rainfall totals for these months and suggest this should have been stated in the text.	Updated with suggested wording.
2.4	s. 3.2	Figure 3 – Missing “Favona” boundary in legend. Suggest indicate that Favona is not current being mined in legend.	Figure 3 updated to include Favona boundary and current workings.
2.5	s. 4	General comment on Section 4 - Dewatering	NA
2.6	s. 4.1	General comment on Section 4.1 – Future dewatering	NA
2.7	s. 5.3	Section 5.3. “Groundwater Results” - Suggest update this section to include the real time logging of piezometers P111, P112, P113 and P114 to monitor response from shallow Rex orebody mining. Also suggest state the water level loggers equipped in standpipe piezometers P113 and P114.	Section 6.1, updated as suggested.
2.8	s. 5.3.2	In the text there is no reference to Figure 12 “Groundwater level trends – shallow groundwater”. There appears to be missing water level hydrographs of some of the active piezometers (for example: P93-1, P94-1, P101-1 and P102-1) on Figure 12. No reason has been provided for the selected piezometers shown on Figure 12. The Peer Reviewer assumes that piezometers that are not currently active have been removed from the Figure, as they contribute minimal information to current water level trend conditions, and they make the graph busy.	Figure 12 shows the piezos that were actively monitored in 2024. Text has been updated to state this.

PR Ref	Report Ref	Comment	Action
2.9	s. 5.3.3	Last paragraph. The piezometer P123 does not have VWP sensor tips within the young volcanics and should be excluded under this section heading as irrelevant.	Updated to make it clear that P123 has no sensor tips in the Young Volcanics.
2.10	s. 5.3.4	"In the fourth paragraph there is stated: *"The Martha Mine dewatering effect continues to be abruptly attenuated to the north of the mine and also to the west of the mine. This is considered to be the result of faulting which truncates the veining."* This section in the report needs to be amended to include deep depressurisation to the north – northwest of the pit as is evident by readings from the new multilevel piezometer P123. A desktop study by GWS Ltd a couple of years back did not find conclusive evidence of a major fault behind the north-northwest wall. The shallow sensor in P123 does not appear to show dewatering effects, however, the deeper VWP sensors show significant depressurisation. This depressurisation affect at depth maybe from drainage from historic workings, sub-horizontal drains, or along veining in the pit wall, or possible faults connected to the pit. The extent of this deep depressurisation to the north – northwest is unknown. The depressurisation at depth at the location of P123 is shown on the Conceptual Hydrogeological Sections 1 and 3 in Appendix F. In Section 5.3.4 you may need to refer to Section 5.3.5 "Martha Groundwater Assessment" for a more specific discussion of P123 sensor tip responses. The Peer Reviewer recommend in future to present two sensor tip responses (shallow P123-1 and deep P123-3) on Figure 17 "Andesite water level trends". The P123-4 sensor tip response has been excluded for presentation on Figure 17 as this would require rescaling the Y axis which would result in loss in graph resolution.	Updated commentary on the deep depressurisation to the north – northwest of the pit has been provided by WWLA. Figure 18 "Andesite water level trends" updated to include two sensor tip responses (shallow P123-1 and deep P123-3).
2.11	s. 6.3.5	The Peer Reviewer suggests including a separate Figure in this section which provides P107 to P110 and P113A – P116 water level hydrographs. It is difficult for the reader to discern the piezometer water levels on Figure 15 due to the number of piezometer plots.	New figure added
		The Peer Reviewer notes pressure readings of P112 VWP in the young volcanics is 1m above the sensor tip. The absence of a flat steady line for the time series data may indicate the sensor is not indicating dry conditions. The response shows subtle variations, which may be a very subdued delayed response from rainfall events. Nevertheless, there needs to be caution exercised with accepting the results as it may be possibly dry. If dry then the VWP sensor is not appropriate to be assigned a trigger level response for shallow Rex orebody mining.	The P112-1 level continues to be within 1m of the sensor tip and is considered to be dry.

PR Ref	Report Ref	Comment	Action
		Project Martha Water Chemistry: The Peer Reviewer understands there is work in progress to meet Project Martha Consent condition 139551, and there has been issues with sampling some standpipe piezometers. The Peer Reviewer requests OGNZL/WWLA provide a list/plan of the standpipe piezometers to be sampled for baseline water chemistry at this point in time and include information if additional standpipe piezometers need to be installed.	2024 groundwater quality results are presented in section 11.2. WWLA have proposed additional standpipe piezometers which will be reviewed for suitability in 2025. This includes two new proposed standpipes.
2.12	s. 5.3.6	General comment on Section 5.3.6 – Favona Groundwater Assessment	NA
2.13	s. 5.3.8	The peer reviewer requests a Figure showing the location of these landholder bores relative to the mining and TSF operations is included in future reports.	The single landholder bore that is currently monitored is shown in Figure 10.
2.14	s. 14	The Peer Reviewer notes for recommendations: 8.3 b), 8.3 c) and 8.10 which recommends additional piezometers to be installed that OGNZL query the necessity of these works and the HDC geotechnical reviewer is in agreement. Point 8.3 c) and 8.10 are referring to the same proposed piezometer location, so the Peer Reviewer was suggesting two additional piezometers. The reasons for these additional piezometers can be discussed during the site visit. The reasoning for these piezometers is to fill gaps in the current network and track depressurisation in andesite and potential dewatering occurring in the young volcanics.	Refer to Table 13 regarding installation of additional piezometers.
2.15	s. 15	The Peer Reviewer understanding that works towards meeting these outstanding consent conditions have been commissioned in 2023/2024 with work already started in defining and ground truthing the feasibility of sampling standpipe bores for water chemistry sampling of shallow and deep aquifers.	Refer to Table 13 regarding water chemistry, and prediction of future impacts and post closure effects.
2.16	App F	The Peer Reviewer queries the presentation of No 9 veining intersecting the Young Volcanics on Figure 4 “Section 1 P90 Series Conceptual Section”. This is incorrect and it should truncate at the top of the andesite as the timing of the young volcanics are post mineralisation.	Figure 4 updated
		Description under Figure 6 Section 2 “P100 Series Conceptual Hydrogeological Section” states the following “The groundwater flow direction is oblique to parallel to the section orientation with most of the flow moving towards the Martha Pit in the west or Favona in the east.” Suggest rewording as follows:	Section text updated

PR Ref	Report Ref	Comment	Action
		"The groundwater flow direction is oblique to parallel to the section orientation with most of the flow in the Andesite moving towards underground workings and Martha Pit in the west or Favona underground workings in the east. Groundwater flow in the young volcanics is towards the Martha Pit in the west and also downward leakage."	
		The term "*overlying post mineralisation Andesite*" in the descriptive text implies the upper Andesite formed after mineralisation. Is this correct? From Figure 2 in the D&S report (see below) it appears that mineralisation does not occur in the upper Andesite in the west but occurs in the upper Andesite to the east associated with the Favona orebody. This requires to be clarified in the descriptive text accompanying the Conceptual Hydrogeological Sections.	Section text updated

Table 13. 2024 Peer Review Report recommendations and actions.

PR Ref	Report Ref	Recommendation	Action
8.3	NA	Additional piezometers to be installed to improve network coverage. These piezometers are listed in order of priority:	
		a) A second underground piezometer located below Empire orebody to track underground dewatering.	To be installed in 2025
		b) One multilevel piezometer located to the southwest of the Martha Pit along strike of the Martha vein system where there is an absence of groundwater monitoring infrastructure.	To be installed in 2025
		c) One multilevel piezometer in the andesite north of the Martha Pit.	OGL query the necessity. HDC geotechnical reviewer in agreement.
8.4	NA	Develop a numerical groundwater model for Martha Underground dewatering predictions and closure recovery predictions.	WWLA commissioned to develop a conceptual groundwater model as the first step in developing a numerical groundwater model. Both to be completed in 2025.
8.5	NA	Address editorial comments provided in the preliminary comments deliverable.	Addressed – refer to previous table.