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Waihi North Project

Water Management Studies (WAI-985-000-REP-LC-0011_Rev3)

Oceana Gold New Zealand Ltd.

17 February 2025

→ **The Power of Commitment**

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Executive Summary

Oceana Gold NZ Ltd (OGNZL) is in the process of developing a new open pit and a new underground mining opportunity which is collectively referred to as the Waihi North Project (WNP). The project consists of several components including the Wharekirauponga Underground Mine (WUG) and the Gladstone Open Pit (GOP). Associated with the project are several new facilities including the Willows Access Tunnel, connecting tunnel to the processing plant area (WUG Access Tunnel), the Willows Rock Stack (WRS), the GOP TSF, TSF3 and the Northern Rock Stack (NRS) as well as associated collection ponds and infrastructure.

This report comprises the following studies which inform the Waihi North Project:

- Water balance analysis – covering estimation of quantities and quality of water for the Life of Mine (LOM) requiring treatment including additional water from the development of the new areas associated with the Waihi North Project combined with the current operations, the MOP4 cutback and Martha Underground (MUG);
- Baseline flow and water quality characterisation for the Mataura Stream and Wharekirauponga Stream catchment areas;
- Investigation of the cumulative effect on the receiving water quality in the Ohinemuri River and other potentially impacted catchments.

A water balance model (WBM) constructed in the software Goldsim has been utilised to assess how water gains change over the LOM and to inform the design of the proposed infrastructure for conveyance, storage and treatment. The WBM has been in use for some time at the site (since 2012) and as a result there is confidence that it does represent well the quantities of water generated from the different water sources that require treatment for both current and future operations. Additional inputs into the model are considered conservative and therefore the predictions outlined (in terms of both water volume and quality) are also conservative estimates based on the Waihi North Project projections.

Based on the water balance analysis completed, it is predicted that the Waihi North Project can be implemented using the existing WTP functionality and within the current consent discharge and receiving environment conditions subject to renewal of those consents for an appropriate term. The capacity of the current WTP facilities will require upgrading throughout the project's lifetime to cope with the expected volume of water requiring treatment.

The estimated volume of water from WUG has a significant impact on the total volume of water requiring treatment at OGNZLs Baxter Road facilities and there is a modelled risk to the inundation of deeper stopes in MUG during the LOM as WUG water treatment requirements increase. This could impact mine scheduling. Dewatering MUG in advance (before the critical period) could reduce the risk of this inundation. Assumptions relating to WUG groundwater inflow rates and water quality will be validated well in advance of the critical period.

Due to discharge restrictions during low river flow periods, there is a modelled risk of excess water requiring treatment during summer dry periods once WUG is developed. These flows can be managed operationally by one or more of the following measures:

- Excess flows sent to the operational TSF

- Dewatering of MUG/WUG temporarily suspended
- Mine scheduling amendments / changes
- Potential future alternative discharge options

The storage available within the collection ponds and TSFs at the Waihi operations is shown to be adequate to contain predicted water gains without overflow within their design criteria.

Water quality predictions for the LOM are largely compliant with discharge and receiving environment consent conditions. Some minor modelled exceedances are noted however they are considered a reflection of the conservative nature of some of the modelled inputs / assumptions. The utilisation of the reverse osmosis (RO) plant to further reduce concentrations of elevated trace elements is a contingency that could be utilised in the event that predicted discharge concentrations are higher than predicted. However, the use of the RO plant is not included in the assessment.

In summary, the results presented are considered conservative and the modelling undertaken supports the viability of the project in terms of both water balance and water quality.

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1 INTRODUCTION

1.1 Project Description

The current Waihi life of mine (LOM) plan is to complete production by 2030. Study work conducted by Oceana Gold NZ Ltd. (OGNZL) has identified a new open pit and a new underground mining opportunity. The understanding of this opportunity has advanced to a point OGNZL is ready to lodge resource consent applications for its next project, the Waihi North Project (WNP), which comprises:

- A new underground mine, the Wharekirauponga Underground Mine (WUG), located approximately 11km north-west of the current processing plant under land administered by the Department of Conservation (DOC) (Coromandel Forest Park). Site infrastructure supporting the mine will be located within the Willows Surface Facilities Area (WSFA) on OGNZL-owned farmland located at the end of Willows Road, with only minimal surface features within the forest park, in the form of fenced vent raises on a legal road reserve owned by the Hauraki District Council;
- The mining of a new open pit near the existing processing plant, centred over Gladstone Hill, the Gladstone Open Pit (GOP). This pit will be converted to a tailings storage facility (GOP TSF) once mining is complete;
- A new tailings storage facility to the east of existing TSF1A, called TSF3;
- New rock stack (the Northern Rock Stack or NRS) at the Northern Stockpile area adjacent to the existing TSF2;
- New temporary rock stack (the Willows Rock Stack or WRS) adjacent the Wilows Access Tunnel Portal;
- Reconsenting of the existing water treatment plant (WTP) treated water discharge consent to cover the project timeframe;
- Upgrading of the existing WTP to double the water treatment capacity (to the existing discharge permit limit);
- Modifications to the existing overland and load out conveyors to allow rock loading and conveying to and from the NRS (return of rock to use for backfilling); and
- Upgrading of the existing Waihi processing plant to enable ore processing up to 2.25 million tonnes per annum (MTPA), up from 1.25 MTPA currently.

The assessment assumes the following:

- Martha Underground (MUG) will run in parallel with the WNP;
- Martha Open Pit 4 (MOP4) will be mined in parallel with the WNP;
- Continued operation of the current treated water discharge regimes (A-E) (Resource Consent (RC): AUTH971318.01.13). It is assumed that this and any related consents are extended to cover the LOM period;

- TSF1A is constructed to a crest height of 182 mRL[1]; and
- TSF2 is constructed to a crest height of 159.5 mRL.

The main components of the project as they relate to water management are outlined in Figure 1, Figure 2 and Figure 3.

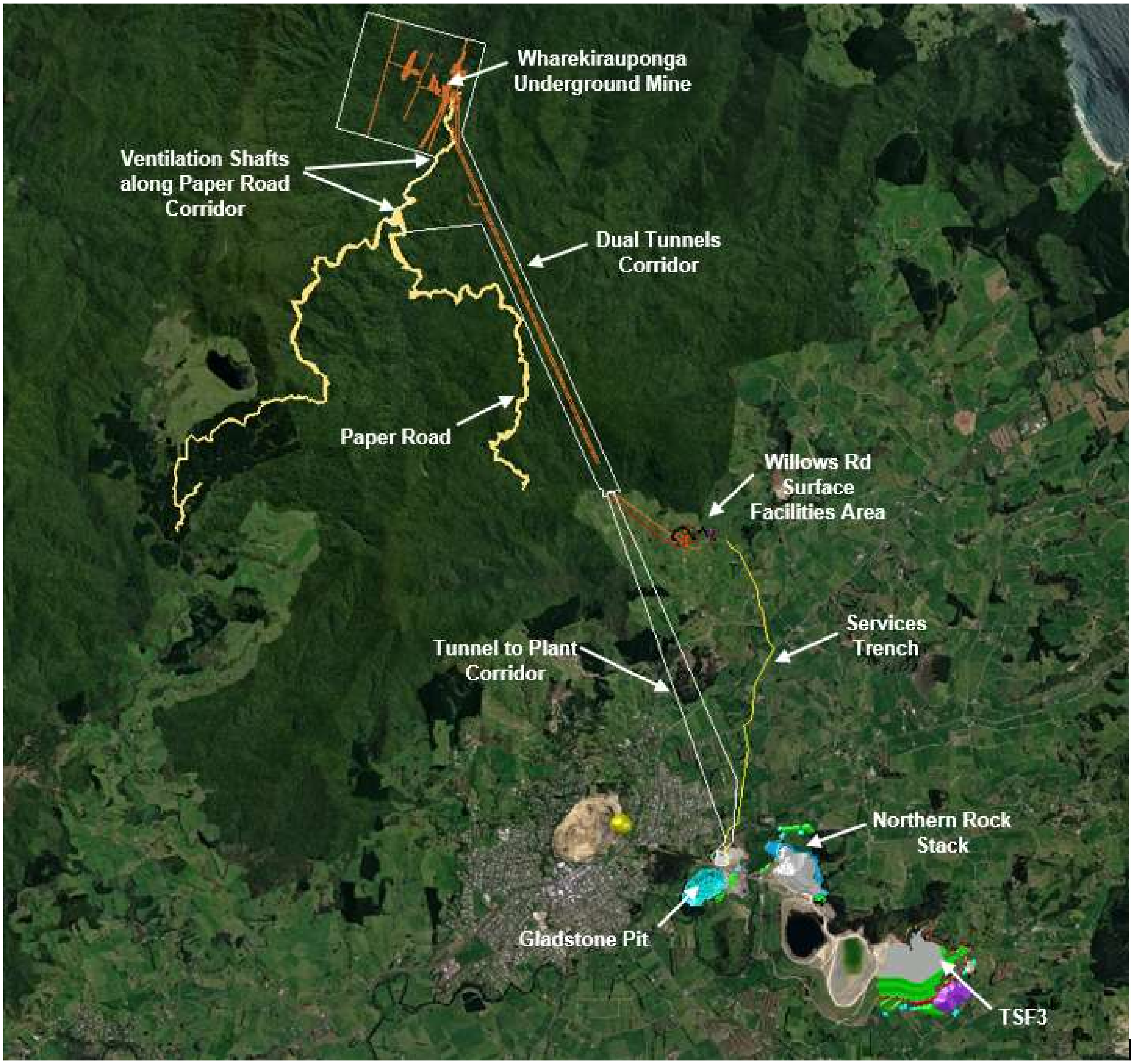

Figure 1 Waihi North Components (Overview)

[1] Based on a pre-1949 geodetic datum that is approximately 2.5m lower than the current NZGD2000 datum. The datum is used across the existing Waihi mining facilities.

Figure 2 Waihi North Components (Baxter Road Facilities)

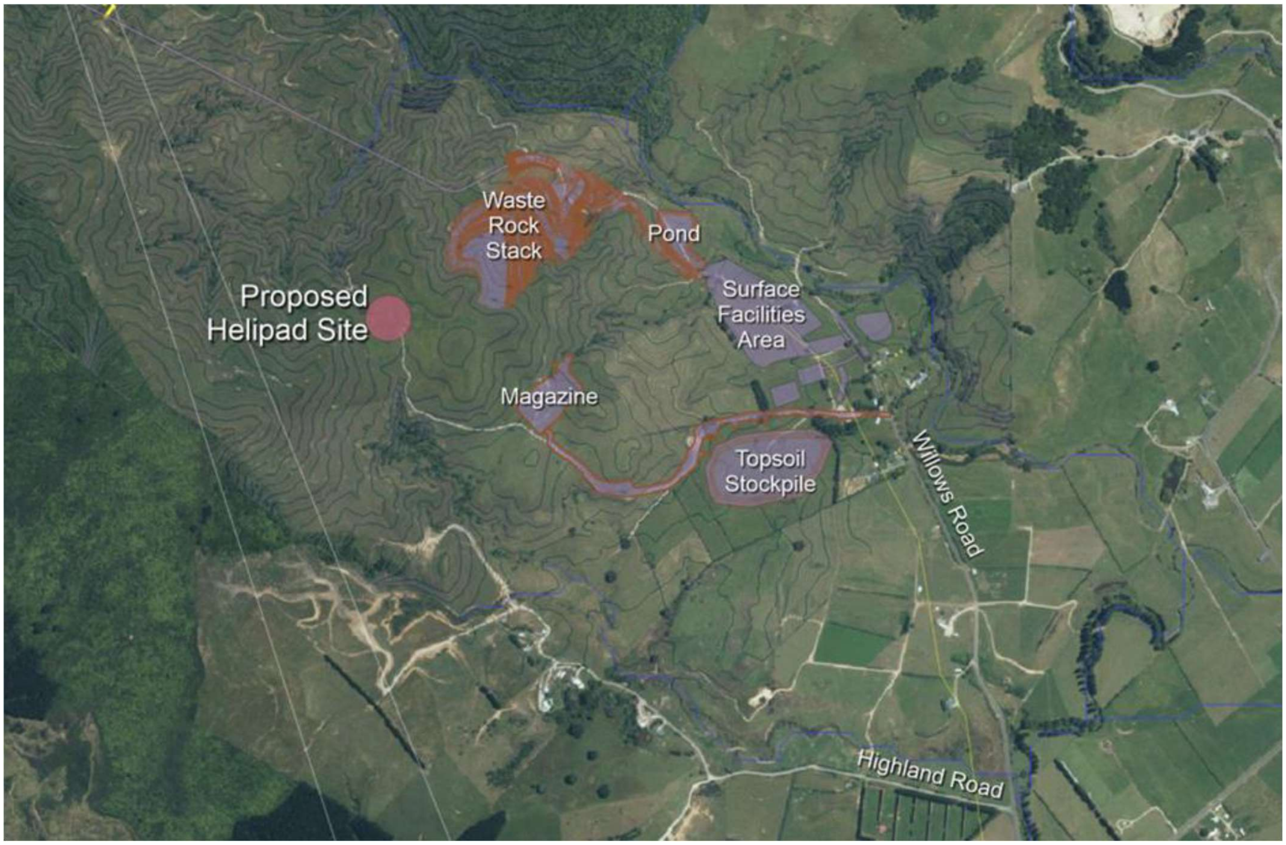

Figure 3 Waihi North Components (Willows Facilities)

1.2 Scope

GHD was commissioned by OGNZL to deliver the following studies relating to site water management for the WNP:

- Water balance analysis – covering estimation of quantities and quality of water for the LOM requiring treatment; considered in relation to available site storage, treatment and discharge constraints. A key objective of this study is to assess whether additional water from the development of the new areas associated with the WNP including WUG, TSF3, NRS, WRS, GOP and GOP TSF, combined with the MOP4 cutback and deeper underground mining and dewatering at the existing MUG can be managed within existing physical and consent constraints, or whether additional treatment capacity and/or amended consent requirements need to be incorporated into the design.
- Provide baseline flow and water quality characterisation for the Mataura Stream and Wharekirauponga Stream catchment areas which have the potential to be impacted by the current proposed works.
- Investigate the cumulative effect on the receiving water quality in the Ohinemuri River and other potentially impacted catchments.

This report also provides an overview of the current approach taken by OGNZL to site water management to provide context.

1.3 Limitations

This report: has been prepared by GHD for Oceana Gold New Zealand Ltd. and may only be used and relied on by Oceana Gold New Zealand Ltd. for the purpose agreed between GHD and Oceana Gold New Zealand Ltd. as set out in section 1 of this report. GHD otherwise disclaims responsibility to any person other than Oceana Gold New Zealand Ltd. arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

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

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The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report. Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

GHD has not been involved in the preparation of the Assessment of Environmental Effects (AEE), prepared by Mitchell Daysh and has had no contribution to, or review of the AEE other than in this technical report for water management. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of the AEE. The GHD document containing the disclaimer is to be included in any other document, the entirety of GHD's report must be used (including the disclaimers contained herein), as opposed to reproductions or inclusions solely of sections of GHD's report.

1.4 Key Assumptions

There are a number of assumptions applied to the work undertaken and these are listed throughout the document. The following key assumptions apply to all of the work presented in this document:

- The rewatering model utilised within the water balance model (WBM) is as outlined in GHD, 2018 (Appendix D)
- The conditions of the current WTP discharge consent, which provides for up to 52,000 m^3/day of treated water to be discharged to the Ohinemuri River, apply.
- Cyanide treatment is doubled from current capacity of 6,000 m^3/day to 12,000 m^3/day to account for the higher production rates and multiple operational TSFs.
- WUG Mine and all related access tunnel groundwater inflows are based on the figures as provided by WWLA, 2025.

2 BACKGROUND INFORMATION

2.1 Water Management Approach

OGNZL's water treatment plant (WTP) is consented to treat water from mining activities in any part of the Waihi Epithermal District. Areas that currently generate water requiring treatment associated with OGNZL's Waihi operations are:

- Martha Open Pit – stormwater runoff and groundwater
- Martha Underground (and previous underground mines) – groundwater dewatering
- Processing plant and WTP area runoff
- Decant pond water – currently from TSF1A
- Collection pond water – stormwater runoff from rock storage areas
- Seepage – from TSF1A and TSF2 including embankment structures

Cyanide is used in the gold recovery process and is present in the tailings that are pumped to the active TSF. TSF decant water thus contains cyanide as does seepage from the TSFs; there is also potential for cyanide content in the ponds that collect stormwater runoff from the process area. Water sources containing cyanide are referred to as "cyanide water".

Water sources that do not have any contact with cyanide can require treatment due to contact with potentially acid forming (PAF) rock. Rock is extracted to gain access to the mineralized ore containing the gold and silver and is comprised of non-acid forming (NAF) and PAF rock types. When PAF rocks are exposed to oxygen, low pH conditions can develop and water contacting the material can give rise to elevated sulphate and trace elements (soluble metals). Water pumped from the underground workings, and water captured in the collection ponds can contain runoff water and contact water from PAF rock (but no cyanide) and is referred to collectively as "minewater".

Decant water from TSF2 has not been treated since October 2007 when testing showed that the pond water quality was suitable for direct discharge to the Ohinemuri River. Tailings deposition to TSF2 ceased in July 2005 and the TSF2 decant pond currently discharges to the river through an unnamed tributary to the north of the Waste Disposal Area under RC 971323. Figure 4 provides a schematic representation of the current water management system, its sources, pathways and discharges and Figure 5 provides an aerial image of OGNZL's Waihi operations with TSF2 and TSF1A visible to the right, Martha Open Pit to the left and the processing plant area (including the WTP) located in the centre of the image. The Ohinemuri River runs immediately to the right of the processing plant area.

Minewater, cyanide water and potentially impacted runoff water are treated at the WTP before discharge to the Ohinemuri River at two locations (E1 and E2) via multi-port diffusers (refer Figure 6). Treated water is stored in Polishing Ponds prior to discharge allowing it to be tested for compliance with the relevant discharge criteria in advance of being discharged. The volumes and water quality of the various minewater and cyanide water sources prior to treatment are heavily dependent on a number of environmental and operational variables. The primary controlling variables are rainfall, ore and rock geochemistry, processing rate and type, dewatering rate, river flow rate, and tailings facility rehabilitation.

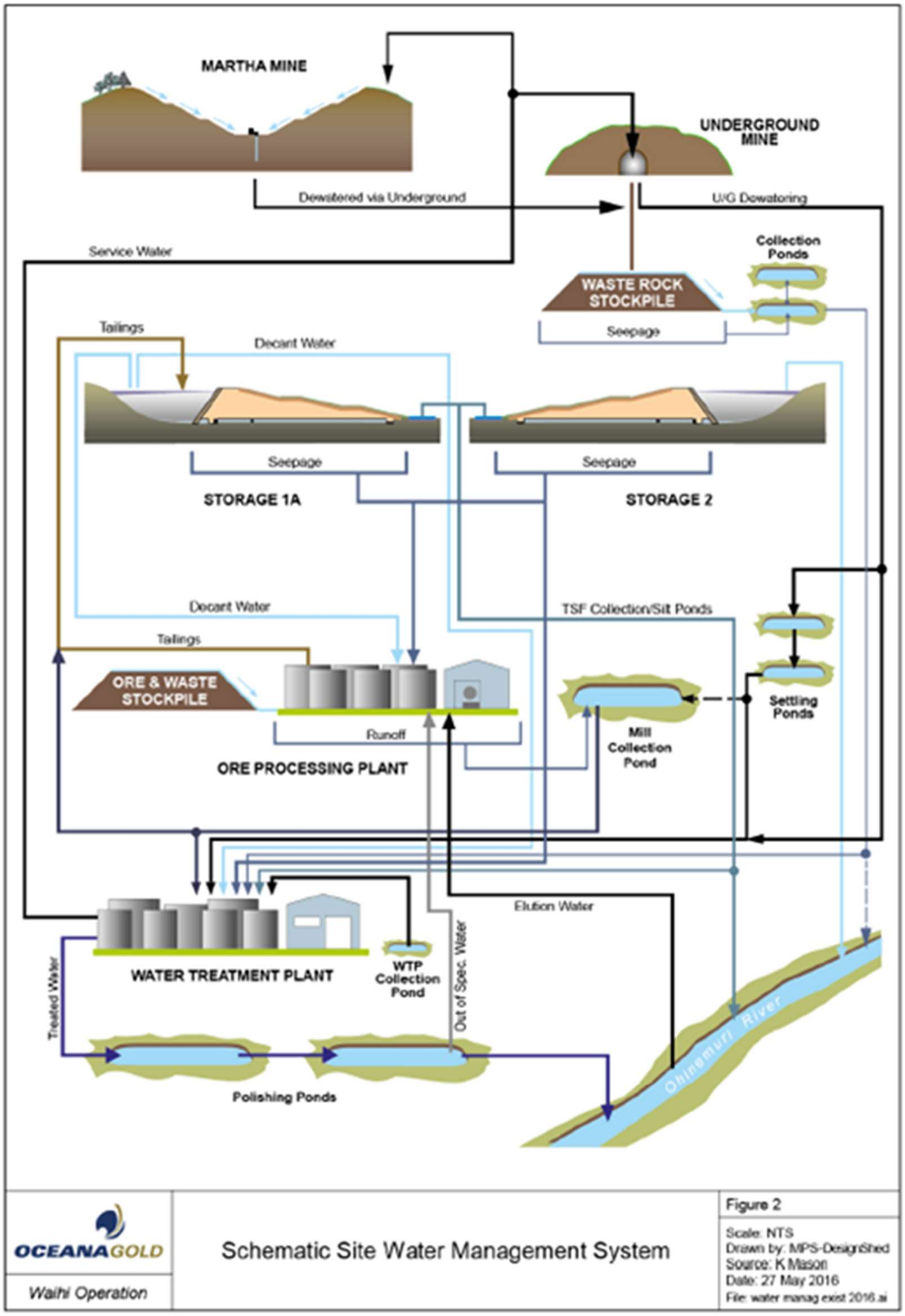


Figure 4 Schematic Site Water Management System

Figure 5 Aerial overview of OceanaGold's current Waihi Operations

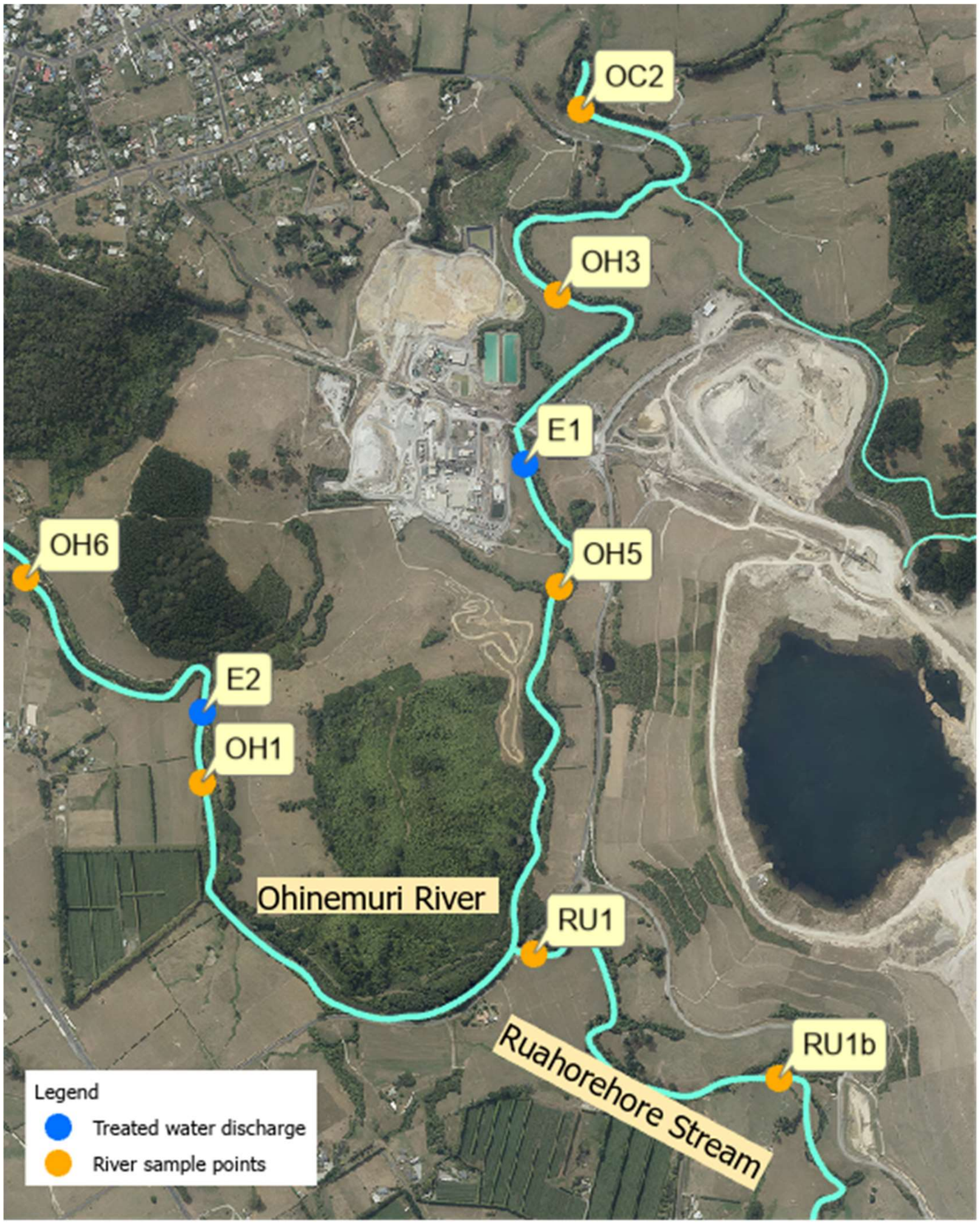


Figure 6 Ohinemuri River receiving environment and key locations

2.2 WTP Description

The WTP has been in operation since 1988 and has been subject to upgrades in 1999 and 2011. A reverse osmosis (RO) plant was built and commissioned in 2008 to provide an additional treatment option for trace elements removal. The WTP has performed consistently well with only infrequent and minor recorded non compliances with consent conditions.

The WTP currently incorporates four parallel streams with three of these dedicated to trace elements removal only. The fourth stream has two phases of treatment; oxidation of cyanide to destroy the cyanide complexes followed by trace elements precipitation and removal.

- Cyanide oxidation is achieved using a combination of hydrogen peroxide, copper sulphate and lime. A series of tanks are used for reagent mixing followed by retention to provide time for chemical reaction. Hydrogen peroxide in the presence of copper destroys free cyanide through chemical oxidation. Weak acid dissociable (WAD) cyanide is also oxidised during the process. On oxidation, cyanide yields simple carbon and nitrogen compounds.
- Lime and ferric chloride are added to all four existing water streams to facilitate trace elements precipitation and removal. Trace elements tend to occur in a soluble form when the pH of water is low. Raising the pH with lime in the presence of ferric chloride results in insoluble hydroxides and carbonates forming. Following mixing and retention, a polyelectrolyte (flocculant) is added along with more lime to form flocs that can be settled out.

Clarifiers at the end of the treatment process allow the suspended solids and precipitated trace elements to be removed from the water. The suspended solids and precipitated trace elements fall to the bottom of the clarifiers forming a slurry. The slurry is pumped to the tailings pond via a thickener. Carbon dioxide is added to the clean water overflow from the clarifier to reduce the pH of the water to meet the compliance limits. The RO plant can be utilised (if required) in order to further reduce concentrations of trace elements to very low levels utilising a partially permeable membrane.

It is proposed that the WNP will see the WTP upgraded to incorporate six parallel streams dedicated to trace elements removal and two parallel streams for the destruction of cyanide complexes followed by trace elements precipitation and removal. The proposed upgraded water management system is illustrated in Figure 7 and the proposed upgrade WTP including the various waste streams is presented in Figure 8.

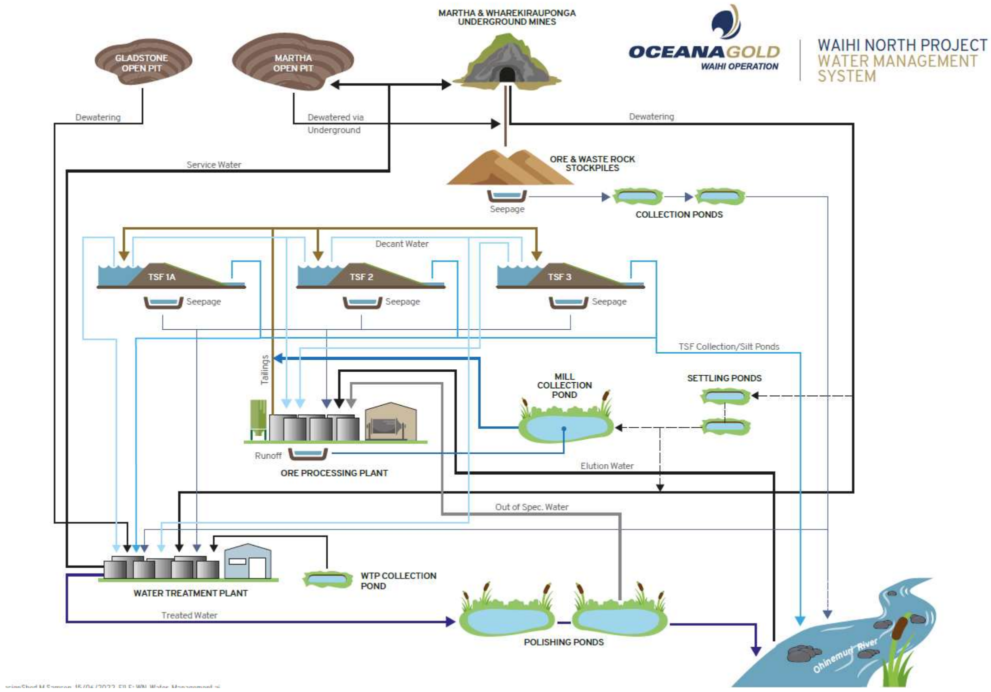


Figure 7 Proposed Waihi North Water Management System

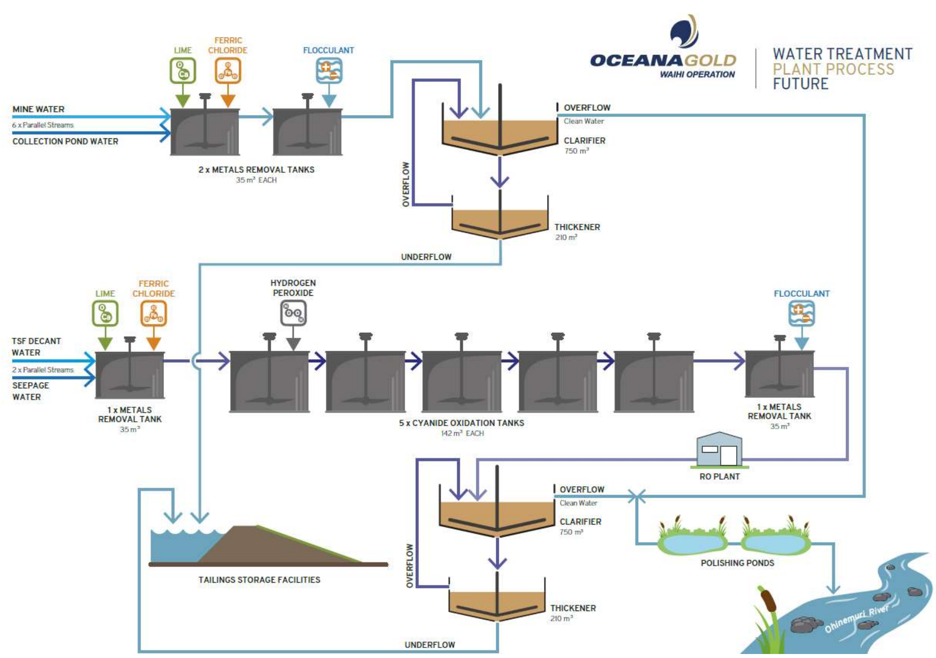


Figure 8 Proposed WTP Flow and Treatment Infrastructure

There are two polishing ponds that currently hold the treated water for approximately 18 hours prior to discharge via multi-port diffusers to the river. This provides time for the treated water to be tested, and the results to be received and checked for compliance prior to the water discharging to the Ohinemuri River. If the water does not meet the discharge criteria, it is recycled back through the plant, used in processing, or pumped back to the TSF.

2.2.1 Operating Regimes and Discharge

There are currently five consented operating regimes (RC AUTH971318.01.13). Each operating regime has a range of discharge quality limits that enable compliance with in-stream water quality criteria.

Table 1 summarises the current WTP operating regimes included in RC AUTH971318.01.13.

Table 1 WTP discharge under various operating regimes

Criteria	Operating Regime A	Operating Regime B	Operating Regime C	Operating Regime D	Operating Regime E
Daily Discharge	20,000 m^3/d	26,000 m^3/d	5,200 m^3/d	26,000 m^3/d	52,000 m^3/d
Discharge Rate	235 l/sec	301 l/sec	60 l/sec	301 l/sec	602 l/sec
Percentage of river flow	15%	20%	10%	40%	60%

2.3 WTP Performance

The consented operating regimes combined with the performance of the WTP provide OGNZL with flexibility to operate over a large range of both environmental and operational conditions. The recent (2019-2020) performance of the WTP has been summarised in Table 2 for reference (in both removal of trace elements and achieving the consented regime and in-stream concentrations). In summary, the WTP operates well within the consented criteria ensuring that there is minimal impact on the receiving surface waters within the Ohinemuri River.

2.3.1 Trace Element Removal Rates

Trace element removal rates at the WTP have been calculated by assessing the inflow sources (both flow and concentrations) compared to the outflow rate and water quality. As not all parameters are measured daily, the median measured concentrations have been utilised together with the proportion of inflow water source to calculate the WTP inflow concentrations. Where the measured concentration is below the laboratory method detection limit (mdl), half the mdl has been applied to this representative sample in order to derive a representation of actual and assumed trace element removal rates.

The calculated removal efficiencies show high removal rate for the majority of the trace elements (>90% in most instances). For mercury, all recent inflow and outflow water quality was measured at below the mdl. Water quality data spanning a period between 2005 and 2007 (when the RO plant was non-operational and WTP inflow mercury concentrations were above the mdl) has been utilised to calculate the mercury removal efficiency.

For some elements (e.g. mercury, chromium, antimony, cadmium and silver), the lower calculated removal rates are largely a function of low inflow and/or outflow concentrations at or near the mdl. Even iron, for which the calculated removal efficiency is high (0.990) is affected by concentrations in the outflow below the mdl. The actual removal efficiency for these elements is likely higher than that stated.

It is noted that inflow and outflow concentrations are derived from dissolved trace element analysis where applicable. No specific process for ammoniacal nitrogen removal is present within the WTP and this is reflected in the lower (0.61) calculated removal rate (based on the measured inflow/outflow concentration data).

Utilisation of the RO plant would result in increased removal rates for most of the trace elements presented. OGNZL also has the ability to increase the removal rate of antimony through an existing sulphuric acid dosing system. The utilisation of both the RO plant or the sulphuric acid dosing system to improve discharge water quality has not been considered in this assessment, however both are available contingency options that could be utilised if required.

Table 2 Calculated WTP Inflow Concentrations and Removal Rates (2019-2020)

WTP (2019 / 2020)	Inflow Source	Minewater	Decant Water	Silt Pond	Seepage	Calculated Inflow Concentration	Actual Outflow Concentration	Calculated Removal Efficiency
	Inflow Volume (m^3 total)	5,728,816	1,199,326	-	-			2019/2020
	Inflow Ratio	0.83	0.17	-	-			
CN (WAD)		0.01	0.79	0.002	0.01	0.15	0.01	0.93
Fe		5	0.04	<0.02	3.4	4.1	0.04	0.99
Mn		8.5	0.76	0.3	7.1	7.2	0.01	0.99
Cu		0.001	1.3	0.0009	0.0005	0.23	0.004	0.98
Ni		0.018	0.058	0.0059	0.06	0.03	0.001	0.96
Zn		0.28	0.079	0.0081	0.035	0.25	0.002	0.99
Ag		<0.0002	0.0044	<0.0001	<0.0001	0.001	<0.0002	0.88
Sb		0.0069	0.007	<0.0002	<0.0002	0.007	0.004	0.44
As		0.01	0.005	<0.001	<0.001	0.009	0.002	0.78
Se		0.0021	0.070	<0.001	<0.001	0.014	0.002	0.86
Hg		<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	0.63#
Cd		0.00043	0.00037	<0.0001	<0.0001	0.0004	<0.0001	0.76
Cr		<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	-
Pb		0.0003	0.022	<0.0001	<0.0001	0.004	0.0002	0.95
TSS		970	19	11	5	810	2	0.99
Ammoniacal N		0.3	13	0.025	1.7	2.5	0.98	0.61

*Trace element concentrations are dissolved and based on filtered samples.

#Mercury removal rate is based on data from 2005 to 2007

2.3.2 Regime Compliance

Table 3 and Table 4 summarise WTP discharge water quality for regimes B and D from January 2019 – December 2020. Regimes A, C and E were not utilised during this period. The tables show that the WTP is currently operating within the compliance criteria as outlined in RC 971318. In most instances the mean (and maximum) concentrations from the monitoring data are well below the compliance values.

Table 3 Regime B Discharge Water Quality

	Range of Concentration		Consented Water Quality	
Chemical Parameter	**Mean**	**Max**	**Normal Compliance**	**Maximum Compliance**
pH	8.7	8.9	6.5 – 9.5	
Cyanide (g/m^3)	0.029	0.06	0.2	0.56
Iron (g/m^3)	0.036	0.04	0.8	5
Manganese (g/m^3)	0.011	0.019	0.8	1
Copper (g/m^3)	0.023	0.066	0.055[1] (0.114)[2]	0.10[1] (0.258)[2]
Nickel (g/m^3)	0.0014	0.0021		0.94[1] (2.13)[2]
Zinc (g/m^3)	0.002	0.003		0.61[1] (1.41)[2]
Silver (g/m^3)	0.00034	0.0007	0.017[1] (0.056)[2]	0.024[1] (0.127)[2]
Antimony (g/m^3)	0.0069	0.012	0.1	0.18
Arsenic (g/m^3)	0.0016	0.002		1.14
Selenium (g/m^3)	0.0088	0.021	0.12	0.2
Mercury (g/m^3)	<0.00008[3]	<0.00008[3]		0.0005
Cadmium (g/m^3)	0.00008	0.0001		0.007[1] (0.014)[2]
Chromium VI (g/m^3)	<0.01	<0.01		0.06
Lead (g/m^3)	0.00018	0.0002		0.018[1] (0.064)[2]
TSS (g/m^3)	3	3	8	40
Ammoniacal N (g/m^3)	3.04	3.40	1.13 – 18.00[4]	4.98 –209.98[4]

*Trace element concentrations are acid-soluble and based on unfiltered samples

1. Based on a hardness concentration of 530 g/m^3 $CaCO_3$. Actual compliance concentrations for these elements vary depending on the recorded hardness in the discharge.
2. Based on the mean and maximum recorded hardness concentrations of 1253 and 1500 g/m^3 $CaCO_3$ over the given period.
3. Mercury has a mdl of 0.00008 mg/l therefore the actual mercury concentration is less than given.
4. Dependent on discharge pH and temperature. Consent refers to Total Ammonia

Table 4 Regime D Discharge Water Quality

	Range of Concentration		Consented Water Quality	
Chemical Parameter	**Mean**	**Max**	**Normal Compliance**	**Maximum Compliance**
pH	8.6	8.9	6.5 – 9.5	
Cyanide (g/m^3)	0.016	0.02	0.11	0.32
Iron (g/m^3)	0.039	0.06	0.5	3.1
Manganese (g/m^3)	0.014	0.051	0.5	0.6
Copper (g/m^3)	0.0013	0.0029	0.033[1] (0.112)[2]	0.06[1] (0.264)[2]
Nickel (g/m^3)	0.0009	0.0012		0.55[1] (2.04)[2]
Zinc (g/m^3)	0.0018	0.003		0.36[1] (1.36)[2]
Silver (g/m^3)	0.00018	0.0003	0.01[1] (0.080)[2]	0.014[1] (0.203)[2]
Antimony (g/m^3)	0.006	0.013	0.06	0.1
Arsenic (g/m^3)	0.0018	0.002		0.66
Selenium (g/m^3)	0.0032	0.018	0.07	0.12
Mercury (g/m^3)	<0.00008[3]	<0.00008[3]		0.0005
Cadmium (g/m^3)	0.00009	0.0001		0.004[1] (0.013)[2]
Chromium VI (g/m^3)	<0.01	<0.01		0.04
Lead (g/m^3)	0.00017	0.0002		0.011[1] (0.079)[2]
TSS (g/m^3)	3.1	5	8	40
Ammoniacal N (g/m^3)	1.13	2.70	1.13 –18.00[4]	4.98 – 209.98[4]

*Trace element concentrations and acid-soluble and based on unfiltered samples

1. Based on a hardness concentration of 315 g/m^3 $CaCO_3$. Actual compliance concentrations for these elements vary depending on the recorded hardness in the discharge.
2. Based on the mean and maximum recorded hardness concentrations of 1359 and 1610 g/m^3 $CaCO_3$ over the given period.
3. Mercury has a mdl of 0.00008 mg/l therefore the actual mercury concentration is less than given.
4. Dependent on discharge pH and temperature. Consent refers to Total Ammonia.

2.3.3 In-stream Compliance

Table 5 summarises Ohinemuri River in-stream water quality at two sampling locations, OH5 and OH6, over the period January 2019 – March 2021. The tables show that the Ohinemuri River water quality is currently within the compliance criteria for all relevant parameters.

Table 5 Ohinemuri in-stream water quality at sample locations OH5 and OH6

	OH5		OH6		Consented Receiving Water Quality	
Chemical Parameter	**Mean**	**Max**	**Mean**	**Max**	**Hardness 20 g/m³ $CaCO_3$**	**Hardness 100 g/m³ $CaCO_3$**
pH	7.3	8.8	7.1	8.5	6.5 – 9.5	
Temperature (°C)	17.0	24.3	16.9	24.2	<3°C Rise	
Cyanide (g/m^3)	0.002	0.005	0.002	0.002	0.093	0.093
Iron (g/m^3)	0.09	0.23	0.08	0.21	1.0	1.0
Manganese (g/m^3)	0.01	0.05	0.02	0.08	2.0	2.0
Copper (g/m^3)	0.001	0.012	0.001	0.010	0.003	0.011
Nickel (g/m^3)	< 0.0005	< 0.0005	0.0005	0.0010	0.04	0.160
Zinc (g/m^3)	0.002	0.005	0.003	0.008	0.027	0.100
Silver (g/m^3)	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.00025	0.00284
Antimony (g/m^3)	0.001	0.004	0.001	0.003	0.030	0.030
Arsenic (g/m^3)	< 0.001	< 0.001	< 0.001	< 0.001	0.19	0.190
Selenium (g/m^3)	0.001	0.005	0.001	0.005	0.02	0.020
Mercury (g/m^3)	< 0.00008	< 0.00008	< 0.00008	< 0.00008	0.000012	0.000012
Cadmium (g/m^3)	0.00005	0.00005	0.00005	0.00005	0.0003	0.001
Chromium VI (g/m^3)	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.01
Lead (g/m^3)	0.0001	0.0002	0.0001	0.0003	0.0004	0.0025
TSS (g/m^3)	5	220#	5	230#	+10 g/m^3 compared to upstream where upstream < 100 g/m^3 or <10% increase	
Ammoniacal N (g/m^3)	0.2	1.0	0.2	0.7	0.189 – 3.0[1]	
Major Cations / Anions						
Ca^{2+}	71	160	81	169	N/A	
Mg^{2+}	7	15	8	21	N/A	
Na^{+}	18	36	21	50	N/A	
K^{+}	4	7	4	9	N/A	
SO_4^{2+}	206	410	244	520	N/A	

*Trace element concentrations are dissolved

*Where all samples of the monitoring period were below the mdl, the concentration is given as <mdl. Otherwise the mdl is used as the concentration for the specific sample

#Values are reflective of high sediment load upstream of the site discharge

1. Dependent on temperature and pH. Refer to Table 2 of RC 971323 (and RC 971285, 971311, 971312, 971303-971306). Consent refers to Total Ammonia.

2.4 Collection and Contingency Ponds

2.4.1 Background

At the time the collection pond design criteria were devised in 1996, the potential for low pH and elevated trace elements content in the pond discharge water was a key consideration since there had been instances of pond water quality exhibiting these characteristics in earlier years of operation (1993/94). This was due to contact of runoff with PAF rock. Collection ponds were designed with large volumes to retain runoff from exposed PAF areas, the collected water pumped for treatment except under large rainstorm events when significant dilution flows occurred in the receiving water (Ohinemuri River and Ruahorehore Stream).

In response to pond water quality, and in addition to the introduction of collection ponds, the site changed PAF rock management practises; in particular through the use of limestone addition during conveying of PAF rock and in placement. This change in practise in combination with progressive rehabilitation of catchment areas has resulted in gradual improvement in collection pond water quality.

Over time a number of collection ponds have been reclassified as “silt ponds” and allowed to discharge directly to either the Ohinemuri River or Ruahorehore Stream when water quality and river flow parameters are met.

All of these modifications have been subject to review of long-term water quality datasets, continuous monitoring of pH and turbidity, flow monitoring, and approval from Waikato Regional Council. Continuous monitoring of discharge water quality applies to check for any changes in water quality that would result in redirection of pond water to the WTP.

A number of contingency ponds are located in the processing plant/WTP area including the Mill Contingency Pond (MCP), Tailings Contingency Ponds (TCP, TCP2, TCP1A) and WTP Contingency Pond (WTPCP). These ponds collect runoff from the ore stockpiles and conveyor, while also providing containment of any chemicals used for processing ore and water treatment in the event of spillage. These ponds will remain active until mine closure.

Figure 9 shows the locations of existing collection and contingency ponds and associated catchment areas, and Table 6 summarises the current status of collection ponds in relation to direct overflow.

Table 6 Collection Ponds and Status

Collection Pond	Direct Overflow Allowed	From Period
Northern Collection Pond (NCP)	No	NA
Western Silt Pond (WSP)	Yes	January 2006
Collection Pond S1	Yes[1]	July 2014
Collection Pond S3	Yes[1]	July 2014
Collection Pond S4	Yes[1]	July 2014
Collection Pond S5	Yes[1]	July 2014
Mill Contingency Pond (MCP)	No	NA
WTP Contingency Pond (WTPCP)	No	NA
Tailings Contingency Ponds (TCP, TCP2, TCP1A)	No	NA
Favona Portal Contingency Ponds (FSPCP, FSPCP2)	No	NA

1. Reclassification of a number of collection ponds to silt ponds was approved on 17 July 2014.

In accordance with condition 13 of Resource Consent 971312, direct discharges from S3, S4 and S5 to the Ohinemuri River and Ruahorehore Stream was approved; with discharge consent being transferred and covered by Resource Consent 971311 (subject to condition 8b) from that time. In applying for this, the Applicant (OGNZL's predecessor) proposed the following controls:

- In order for the collection ponds to be classified as silt ponds and allowed to direct discharge, the water quality within the individual ponds must have pH in the range of 6.5 to 9, and turbidity must be less than or equal to 110 NTU (equivalent to 100 g/m^3 suspended solids).
- Flow from S3, S4 and S5 either individually (if discharged one at a time) or in combination will be managed such that it does not exceed 13% of the flow measured at the Ruddock's flow gauge in the Ruahorehore Stream.
- Provided the above two conditions are met, the Silt Pond Discharge Consent 971311 will apply, and the conditions of that consent (which includes the receiving water standards) will be complied with.
- If the ponds do not meet these conditions then they will be classified as collection ponds and the conditions of the Collection Ponds consent 971312 will apply.
- A monitoring regime was also agreed at that time and since the direct discharge has been underway, modifications to this have been made progressively. This has included a change from reliance on sample collection during direct discharge events, to the use of automatic monitoring data (pH, turbidity) which was approved in June 2016.

2.4.2 Design Criteria

Collection ponds are currently designed to contain rainfall volumes equivalent to a 10 year return period, 72 hour duration event. The large volume of storage provided for by these design criteria was intended to provide containment for all but high rainfall conditions. The criteria also recognised that the catchment response for the Ohinemuri River differs to the smaller catchments. The intent of the design was to time overflow from the collection ponds to coincide with peak flows in the receiving water, thus maximising the opportunity for dilution of the overflow water.

2.4.3 Waihi North Project

The Waihi North Project will introduce TSF3 in the upper reaches of the Ruahorehore Stream catchment, and new collection ponds (S6 and S7) are proposed to collect runoff generated on associated embankments. There are also new collection ponds proposed to collect water generated from the NRS and WRS. Due to the nature of the surface water discharge environments for ponds associated with TSF3 and the WRS (into the Ruahorehore and Mataura River, respectively), it is considered that a design criteria to contain rainfall volumes equivalent to a 10 year return period, 24 hour duration event is appropriate. The reduced duration design event (compared with existing facilities at Waihi) reflects the shorter response time (in terms of peak flow) of these relatively smaller receiving surface waters following high rainfall events (refer Section 5).

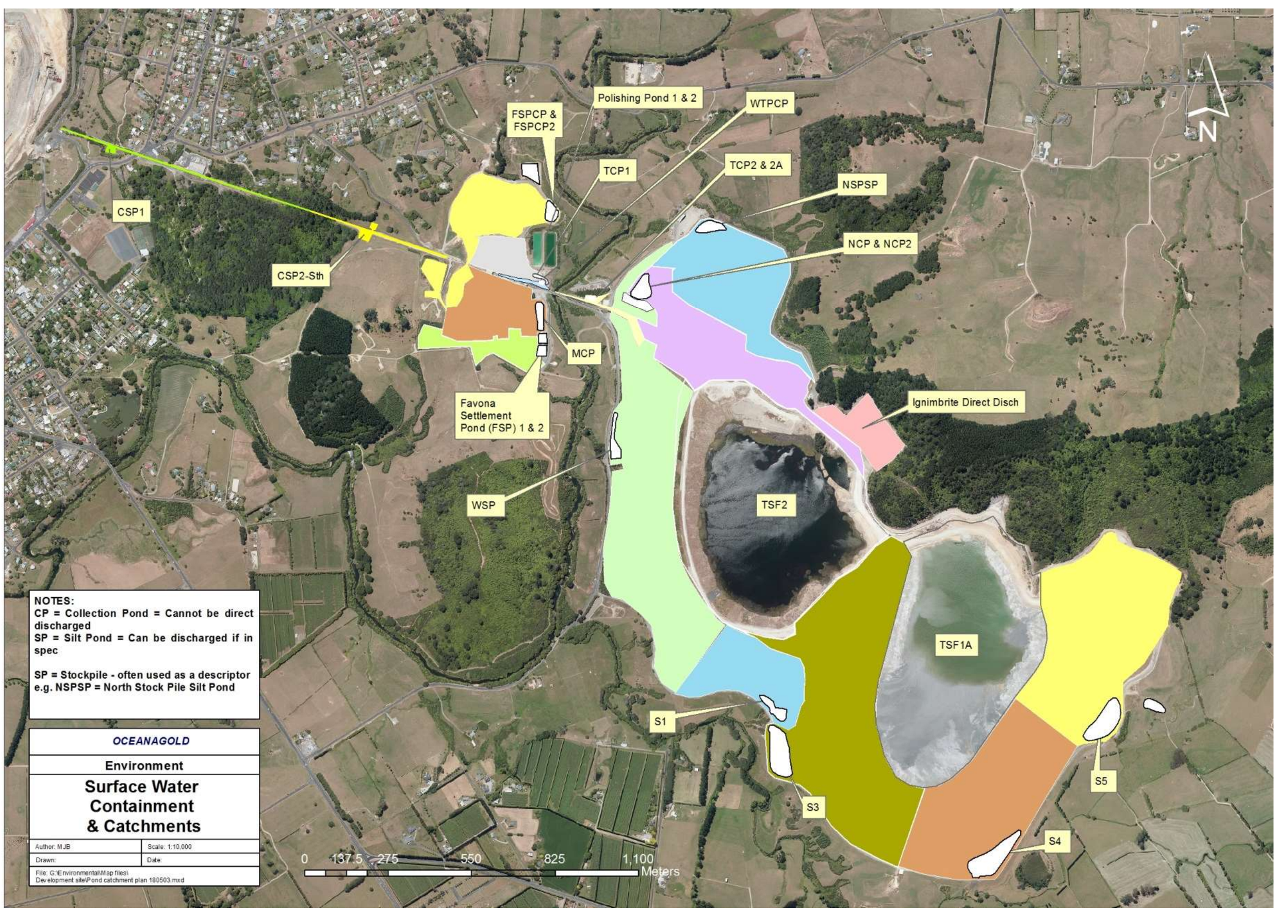


Figure 9 Existing Collection and Contingency Pond Locations

2.5 Mine Dewatering

Minewater from the Martha Pit and Underground is made up of surface runoff and groundwater which is removed continuously to keep the mines dewatered. Experience has shown that once groundwater levels have been initially reduced, pump rates tend to stabilise until further drawdown is required.

Mine dewatering is currently undertaken with pumps located in the underground Correnso mine. The Martha Pit is hydraulically linked to the underground workings. Although mining in the pit has been on hold, the pit has not filled with water because it is connected to the underground workings, and the pumping of water to keep the water level in the Correnso and MUG workings down has the effect of preventing the accumulation of water in and below the base of the pit.

The Project Martha consents allow for dewatering to 500 mRL. GWS Ltd completed a study on Project Martha (GWS 2018) that showed that an average dewatering rate of 15,500 m^3/d needs to be achieved from January 1 2020 through to early 2026 to dewater from an assumed starting level of 700 mRL to the final target level of 500 mRL. To date, the dewatering groundwater level reduction has been quicker than anticipated.

There are constraints on the rate treated water can be discharged when flows in the Ohinemuri River are low under conditions in the current resource consent (971318). To compensate for this, it is proposed that dewatering will be undertaken at higher than the average rates where the operating regimes defined in Table 1 allow. This will allow MUG dewatering to be ahead of schedule and provide contingency during constrained periods.

A water balance model was used to assess the pumping rate required to meet groundwater level targets over the LOM taking into account treated water discharge constraints and variable rainfall conditions. This analysis is summarised in section 6.3.1.

2.6 Tailings Storage Facilities

2.6.1 General

The current TSF embankments (TSF1A and TSF2) are constructed in stages making use of rock from the Martha pit. Careful planning of material quantities is undertaken to ensure that the storage available in the active TSF (i.e., embankment height above tailings level) is sufficient to contain planned tailings deposition.

In addition, a freeboard approaching 3 m above the tailings is provided at all times to conservatively provide for storage of an extreme rainfall event without overflow. The freeboard provides for the Probable Maximum Precipitation (PMP) plus 1 m contingency.

There have been no overflows from an active TSF since the mine has been in operation. Decant water is pumped to the processing plant for re-use or to the WTP. As part of the WTP operation, the storage available in the active TSF is monitored and if necessary, decant water treatment is prioritised to ensure freeboard is maintained.

2.6.2 Process Water Recycle

Process water requirements are based on ore processing rates. Tailings slurry consists of approximately 16% tailings solids by volume and the water component is made up primarily of recycled decant, with small amounts of river water (elution water) and seepage water. Collection pond or minewater is used for top-up when needed.

2.6.3 Seepage

An extensive seepage collection system exists beneath both TSFs. This system is designed to capture upwelling groundwater, seepage from tailings, and leachate from the rock used to construct the TSF embankments. The term “seepage” describes the combined flows from these sources.

The characteristics of seepage depend on the source, quality and quantity of the individual flows as follows:

- **Tailings underdrains** collect seepage from the tailings as well as upwelling groundwater. During the initial period of tailings placement in TSF2 and TSF1A, the flow from tailings was relatively high and contained elevated levels of cyanide and soluble trace elements. As the tailings volume has increased, the permeability of the tailings mass has reduced significantly, resulting in a decrease in flow and an improvement in quality. The characteristics of the underdrain flows now approaches those of natural groundwater.
- **Upstream cutoff drains** collect tailings seepage and groundwater at the upstream toe of the TSF embankments. Experience has shown that tailings liquor concentrations in these drains are highest when decant pond water is standing against the embankment, and reduce as tailings levels rise and consolidate to provide a low permeability barrier. The source of tailings liquors in the drains is typically from the areas adjacent to the embankment abutments where water levels are highest and tailings levels are low.
- **Leachate drains** collect seepage from rock placed in the TSF embankments, much of which is PAF and contains elevated concentrations of metal sulphides. Flows depend on the rainfall volumes that fall on the embankment between the time that the rock is placed and capped. As the embankments are completed, and capping is constructed reducing the exposed areas open to rainfall infiltration, the volume of leachate from this source reduces. Over time, with the completion of capping, air will be excluded from the rock mass reducing sulphide oxidation and an improvement in leachate quality is expected. This has been confirmed based on observations from TSF2.
- **Toe drains** carry mainly groundwater that wells up below the embankment structure, but may contain some rock seepage. Initial toe drains pick up seepage from the starter embankment.

Seepage flows from all drains are pumped to the WTP in a single pipe, hence it is the water quality of the mix of different drain types that is important in determining required treatment.

Seepage flows from TSF1A and TSF2 are used in the processing plant or treated for trace element and trace ion removal at the WTP prior to discharge to the Ohinemuri River.

3 HYDROLOGICAL AND CLIMATIC DATA

3.1 Rainfall

3.1.1 Mataura Stream and Wharekirauponga Stream catchments

For both the Mataura catchment in the vicinity of the proposed Willows portal and infrastructure development and the upper Wharekirauponga catchment area above the Wharekirauponga orebody, surface water and flood modelling have utilised a derived rainfall record utilising rainfall data from a rainfall gauge located within the Wharekirauponga catchment (2019-2024) and the long term Waihi rainfall data record (refer Section 3.1.2). GHD (2025b) provides information on how the long term Wharekirauponga rainfall record has been derived. The Wharekirauponga rainfall gauge is located within the steeper, more elevated area of the Coromandel Range and is thought to better represent rainfall falling in the WSFA.

3.1.2 Waihi Operations

A rain gauge has been in operation in Waihi since 1907. The location of the current Waihi Town rain gauge is shown on Figure 10 (Labelled ‘Met station’). Table 7 provides a summary of annual rainfall data and Figure 11 shows annual rainfall depths measured over time.

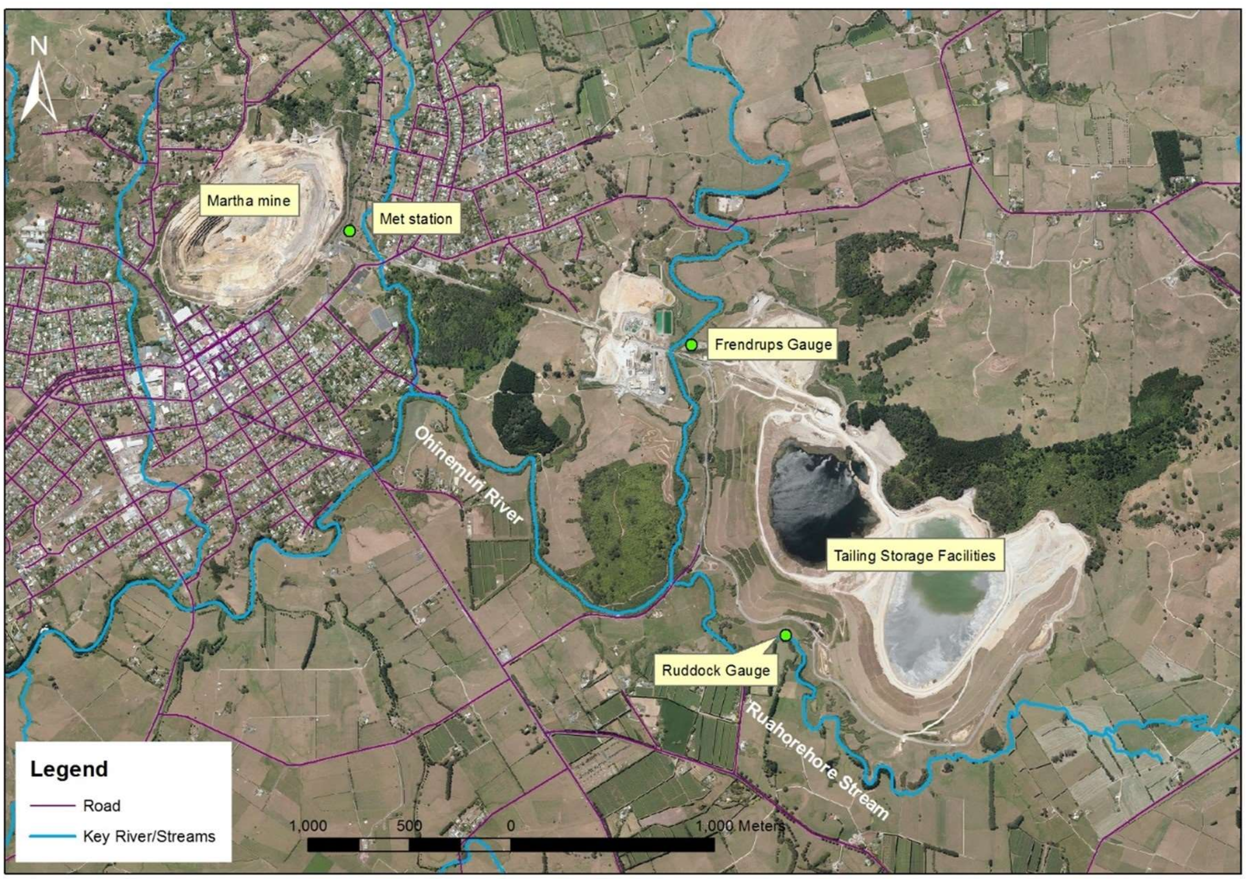


Figure 10 Ohinemuri River and Tributaries in the vicinity of Waihi

Table 7 Waihi Annual Rainfall

Condition	Annual Rainfall (mm)	Year
Mean	2120	-
Minimum	1276	1919
Maximum	3235	1928

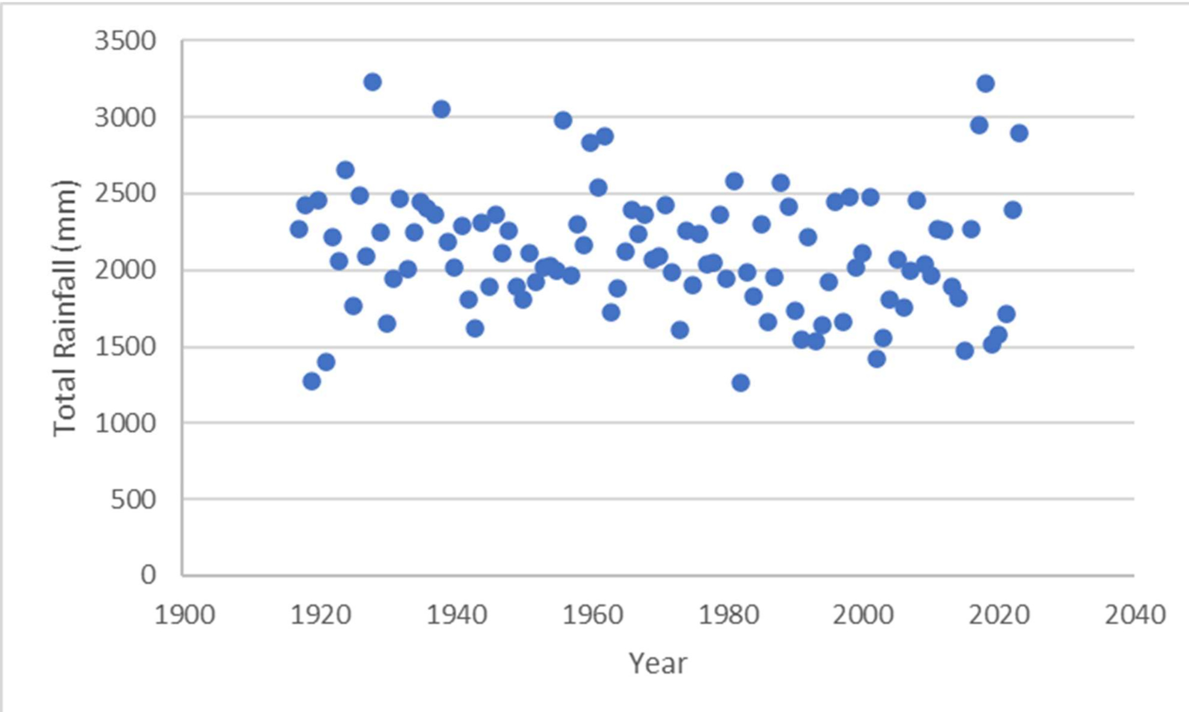


Figure 11 Annual Measured rainfall Depths for Waihi

3.2 Hydrology

3.2.1 Mataura Stream

The proposed Willows Portal location near the WSFA is positioned in the Mataura Stream catchment north of the Waihi township. The Mataura Stream is a tributary to the Ohinemuri River which can be seen in Figure 12.

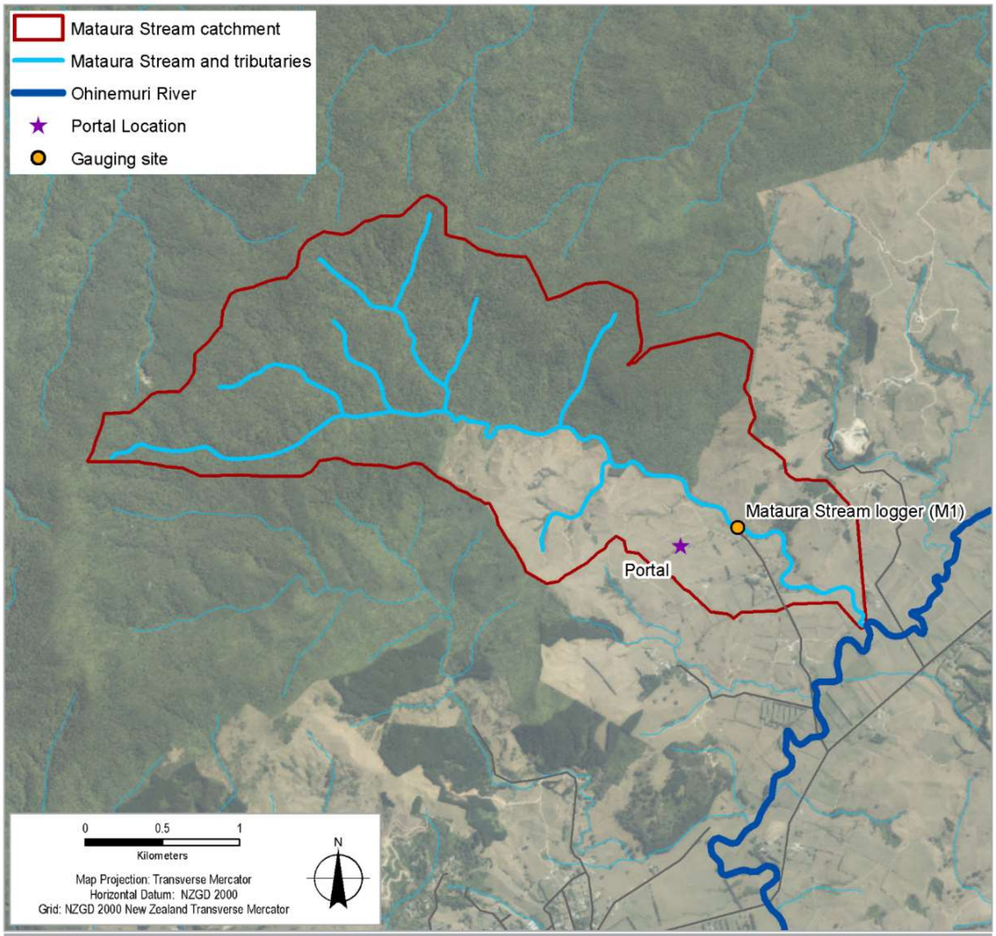


Figure 12 Mataura Stream and the Ohinemuri River

The Mataura Stream catchment has a total area of 5.6 km^2 with 85% of this being upstream of the proposed WSFA. The catchment can be described as steep and rugged with the majority of its coverage being native vegetation. The Mataura Stream has a number of small tributaries and flows southeast to join the Ohinemuri River.

Baseline flow data for the Mataura Stream has been collected between 2020 and 2024. This data (to date) includes manual flow measurement and the installation of pressure transducers in order to enable collection of continuous flow data. Details on data collection and manual measurements are provided in WWLA, 2024a and GHD, 2025b.

A synthetic rainfall record for the Mataura Stream catchment was generated based on the rainfall gauge located at Golden Cross. This record was extended based on the observed relationship with the longer Waihi rainfall record. The rainfall data was used to generate a synthetic flow record for the Mataura Stream catchment using an Australian Water Balance Model (AWBM).

The manual flow gauging events detailed in WWLA 2024a as well as continuous pressure readings from the installed transducers were used to calibrate the AWBM. Results of the calibration can be seen in Figure 13 and show that the synthetically generated flow record is a fair representation of actual flow over the period of data available.

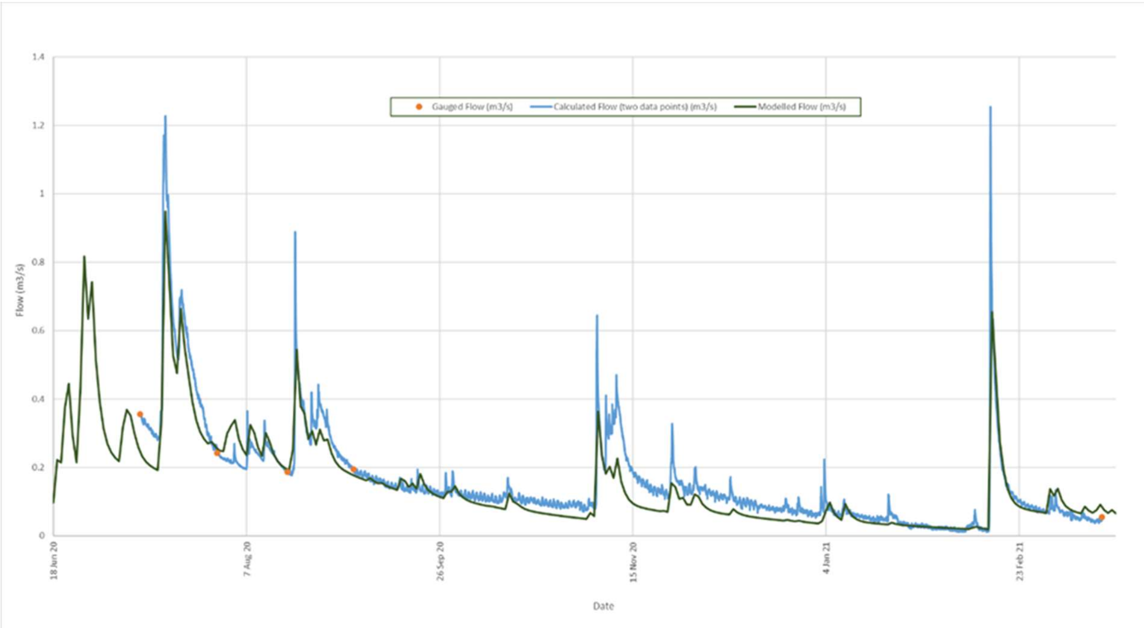


Figure 13 Mataura Stream AWBM synthetic stream flow compared with M1 flow gauging data

The effects on the flow in the Mataura Stream as a result of the proposed development at the WSFA are expected to be minimal. The footprint of the facilities is small compared to the total catchment area. The footprint of the WRS and associated access road and portal area (9.26 Hawill be removed from the catchment during peak development and runoff will be collected and diverted to the WTP. This is not expected to have a noticeable effect of the Mataura Stream flow.

All land disturbing activities carried out onsite will be in accordance with the Waikato Regional Council's Erosion and Sediment Control Guidelines for Soil Disturbing Activities (WRC, 2009). Due to the size of the WKP portal infrastructure footprint, a number of sediment ponds will be required to manage sediment laden runoff to protect Mataura Stream from excessive sedimentation. Details of these ponds including operational stormwater management are detailed in the erosion and sediment control assessment report (Southern Skies, 2025). Clean stormwater from the site will be discharged in its 'current state' through appropriate diversion and is detailed in BECA (2025).

3.2.2 Wharekirauponga Stream

The Wharekirauponga Stream catchment area has an approximate total area of 15.4 km^2 (WWLA, 2024a). The catchment is steep and covered in native bush, and has several small tributaries discharging into the Wharekirauponga Stream, including: Edmonds Stream, Adams Stream, Thompson Stream, and multiple unnamed streams.

Baseline flow data for the Wharekirauponga Stream was collected between 2019 and 2024 and is detailed in GHD 2025b. The data includes manual flow gauging and continuous flow data recorded by automated pressure transducers (monitoring locations shown in Figure 14). The continuous flow data was corrected using a two-point correction to calibrate the continuous level data to the gauged flows, which is displayed in Figure 13.

The predicted change in the natural flow regime in the Wharekirauponga Stream, Adams Stream, Teawaotemutu Stream, Edmonds Stream and Thompson Stream is outlined in GHD (2024b) and model results suggest that at established flow monitoring locations a small decrease in flow (relative to baseflow) is expected and that large decreases in flow (relative to existing and predicted low flow events) are unlikely.

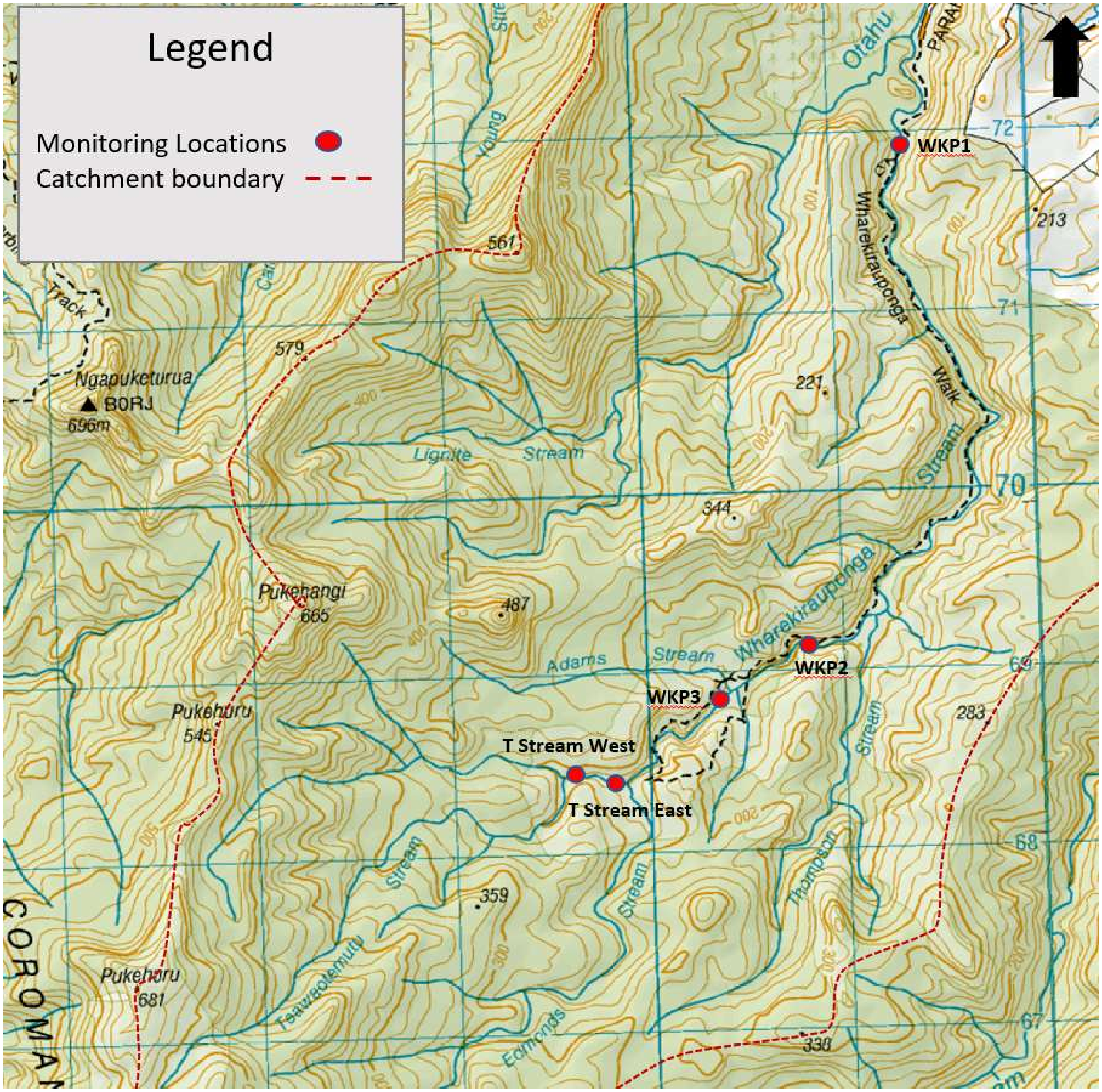


Figure 14 Approximate locations of permanent monitoring locations

3.2.3 Ohinemuri River

The Waihi township is located in the upper catchment of the Ohinemuri River. This is also the location of existing mining infrastructure, with TSFs to the east of the Ohinemuri River and plant areas and mines to the west of the river. The Ohinemuri River has a total catchment area of 290 km^2. The upper catchment to the east consists of the predominantly flat farmland of the Waihi Plains. Numerous tributaries join the river as it flows west – one of which is the Ruahorehore. The upper catchments are steep and forested. The Ohinemuri River flows through the narrow Karangahake Gorge prior to joining the Thames/Waihou River in the west. Figure 15 shows the Ohinemuri River catchment.

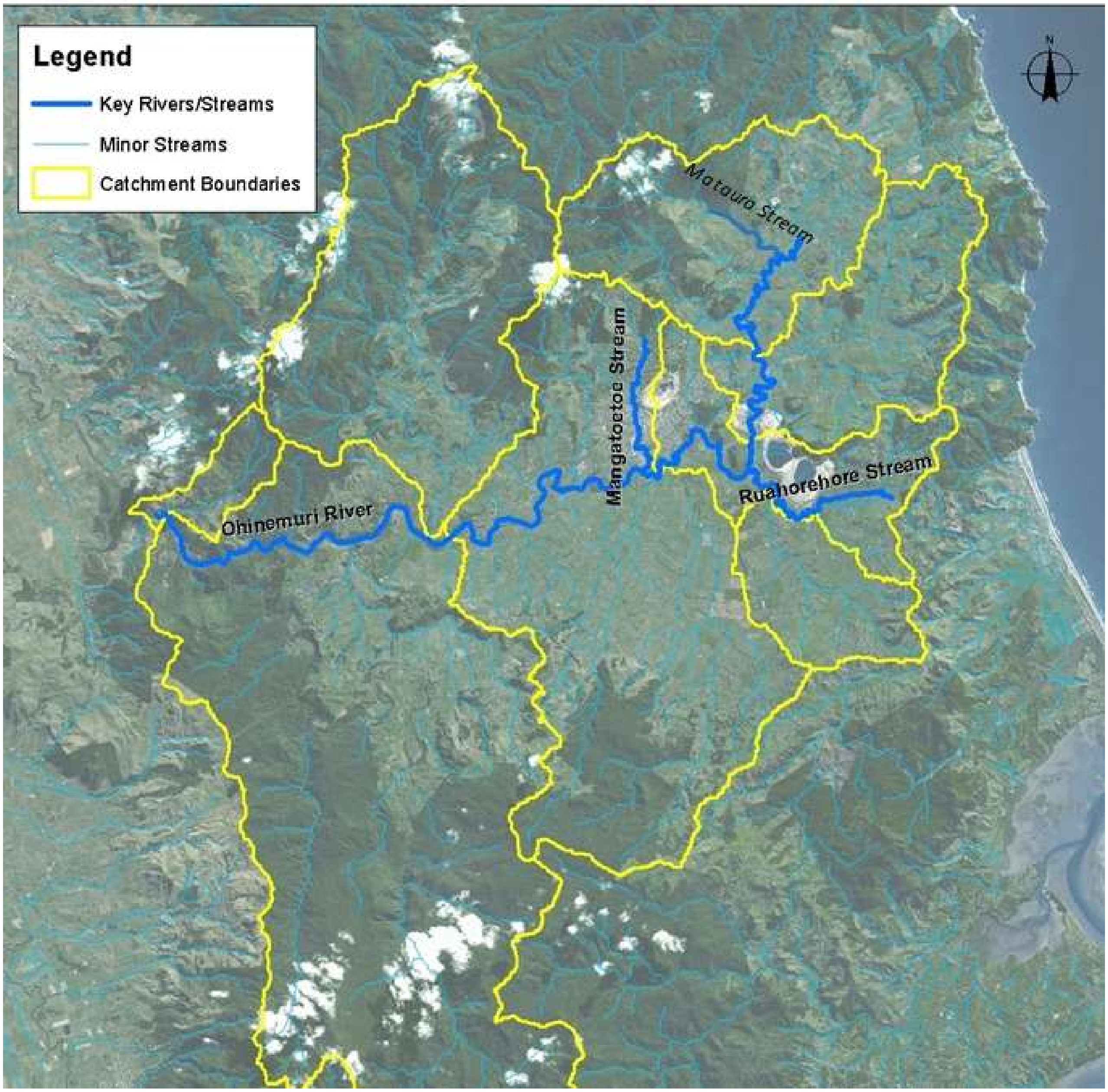


Figure 15 Ohinemuri River Sub-catchments

Existing discharges from the site at Waihi are all to the Ohinemuri River or its tributary the Ruahorehore Stream. Figure 10 shows the river in relation to the existing TSFs, the open pit and Waihi town.

Figure 10 also shows the locations of the two flow gauges used for water management studies; the OGNZL gauge located upstream of the Ruahorehore Stream confluence and in the vicinity of the processing plant area (Frendrups) and the Ruddock gauge located in Ruahorehore Stream.

The Waikato Regional Council gauge at Queen's Head is also considered in this study and is located in the Ohinemuri River downstream and west of the mapped area shown on Figure 10.

3.3 River Flood Analysis

River flood modelling is undertaken for Mataura Stream and Ohinemuri River to identify the risk to proposed infrastructure during storm events and potential changes to catchment hydrology. The Mataura Stream drains from a relatively small catchment allowing a flood model to be developed based on Henderson and Collins (2018) flood statistics for small streams, and this modelling is presented in Section 3.3.1. The Ohinemuri River passing the key areas of mine infrastructure services a larger catchment and the same flood statistics cannot be applied. In this case a Mike21[2] model with a derived rainfall hydrograph is applied for the purpose of flood flow estimation and is presented in Section 3.3.2.

3.3.1 Mataura Stream

A flood model was developed using HEC-RAS[3] modelling software to determine a 100 year ARI flooding extent and flooding levels in the Mataura Stream. The results of the analysis were then compared to the location of the proposed WSFA to evaluate flood risk for the site.

The HEC-RAS model features a single river reach which represents the section of the Mataura Stream adjacent to the proposed portal infrastructure. Model cross section geometries are based on drone LiDAR surveyed by Aerial Surveys in 2019. The model also features a farm ford which crosses the Mataura Stream close to the proposed portal infrastructure. Manning's coefficient was assumed to be 0.04 for the main channel and 0.05 for overbanks. The upstream and downstream model boundary conditions were set to normal depth with a slope 0.02 and 0.01 respectively.

100-year ARI flow estimates for the Mataura Stream were derived using NIWA's NZ Flood Statistics GIS layer (Henderson Collins V2 layer, 2018). An example of the NIWA NZ Flood Statistics is shown in Figure 17. A climate change factor of 1.2 was applied to the flow estimates as recommended by Hauraki District Council. Table 9 shows a summary of the flood flow estimates that were utilised within the HEC-RAS model.

[2] DHI Software. Mike 21 Hydrodynamic Module.

[3] US Army Corps of Engineers. Hydrologic Engineering Center's (CEIWR-HEC) River Analysis System (HEC-RAS)

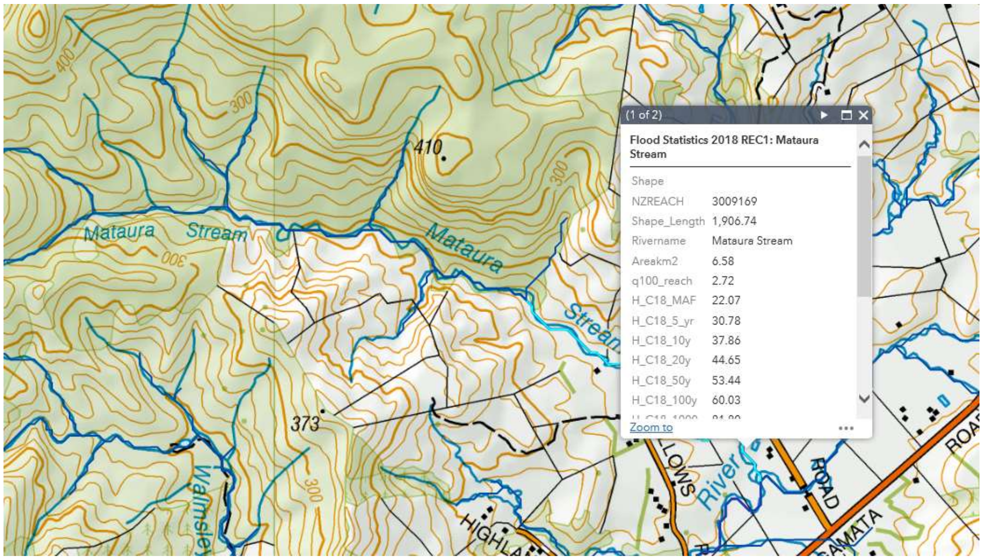


Figure 16 Mataura Stream shown in the NZ Flood Statistics Henderson Collins V2 Layer

Table 8 Estimation of 100 year ARI flood flow in Mataura Stream adjacent to proposed portal infrastructure

Catchment	Model X-Section	Area (km^2)	NIWA	NIWA Adjusted for Climate Change
1	12252	4.08	45.6	54.8
2	5139	5.66	54.8	65.7
3	3861	6.58	60.0	72.1

3.3.1.1 Results

Flooding extent from the model can be seen in Figure 17. Flood levels adjacent to proposed WSFA are summarised in the Table 9. The model result indicates overbank flooding in some locations however there is no modelled flooding risk present for a 100 year ARI event to infrastructure positioned in the General Site Layout Plan shown in Appendix A.

Table 9 Flood levels in the Mataura Stream adjacent to proposed portal infrastructure

Location	Water level (mRL)	Model cross section chainage (m)
Willows Rock Stack Initial Silt Pond	155.5	5,139
Willows Collection Pond	152.6	4,632
Surface Infrastructure Area	148.5	3,861
Willows Infrastructure Silt Pond	144.5	3,000

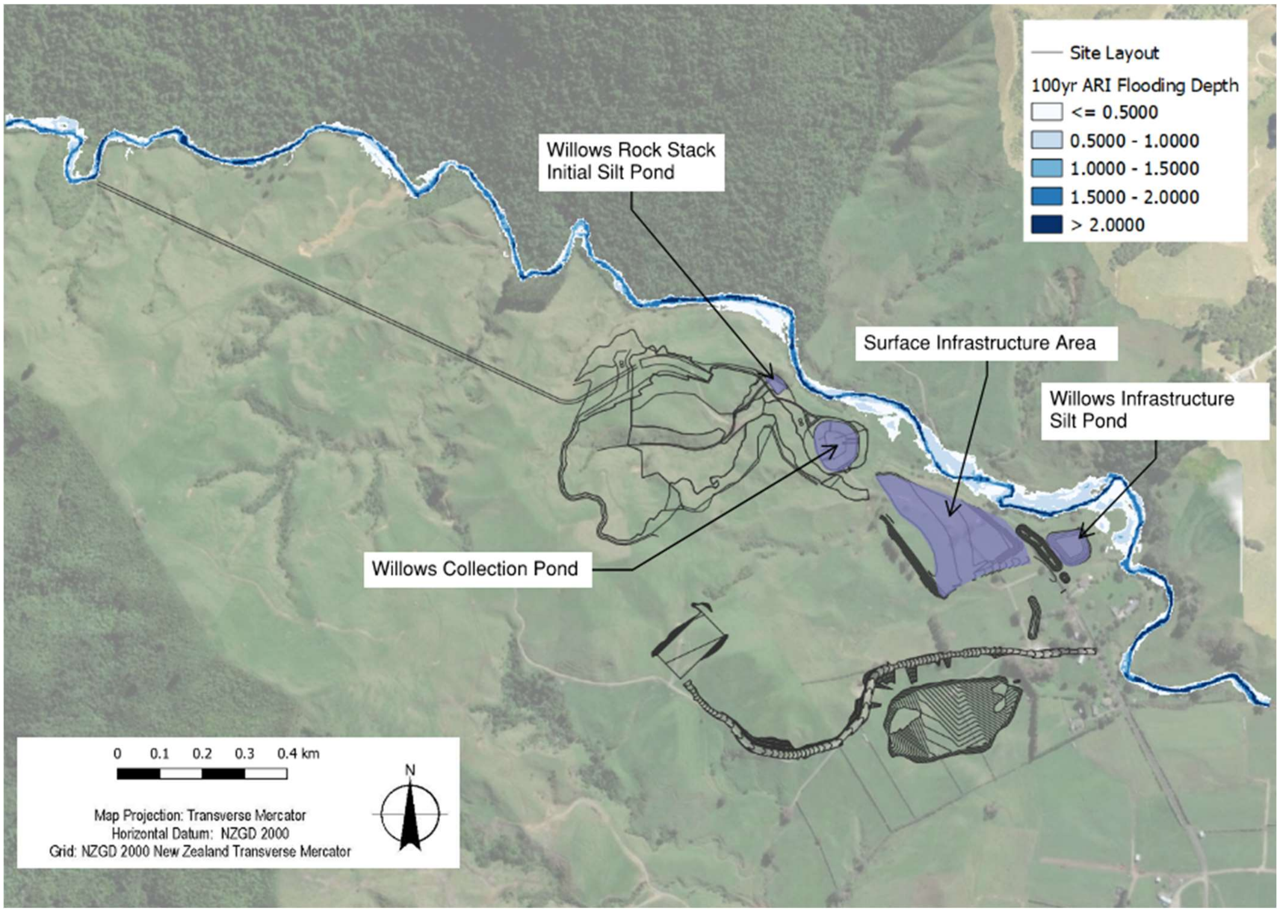


Figure 17 Mataura Stream flooding depth 100 Year ARI flood

3.3.2 Ohinemuri River

A hydraulic model of the Ohinemuri River was developed with the software MIKE 21 in order to develop inundation maps for a range of floods in the vicinity of the mine site and town.

The maps were developed in order to assess whether proposed new areas of development are at risk of flooding and also to check that flood levels upstream or downstream will not be increased due to the proposed site development. As can be seen in Figure 18, the NRS is located close to the Ohinemuri River.

Overall modelling shows that there is minimal infringement on the natural flood plain with no impacts on upstream or downstream flood levels due to the WNP.

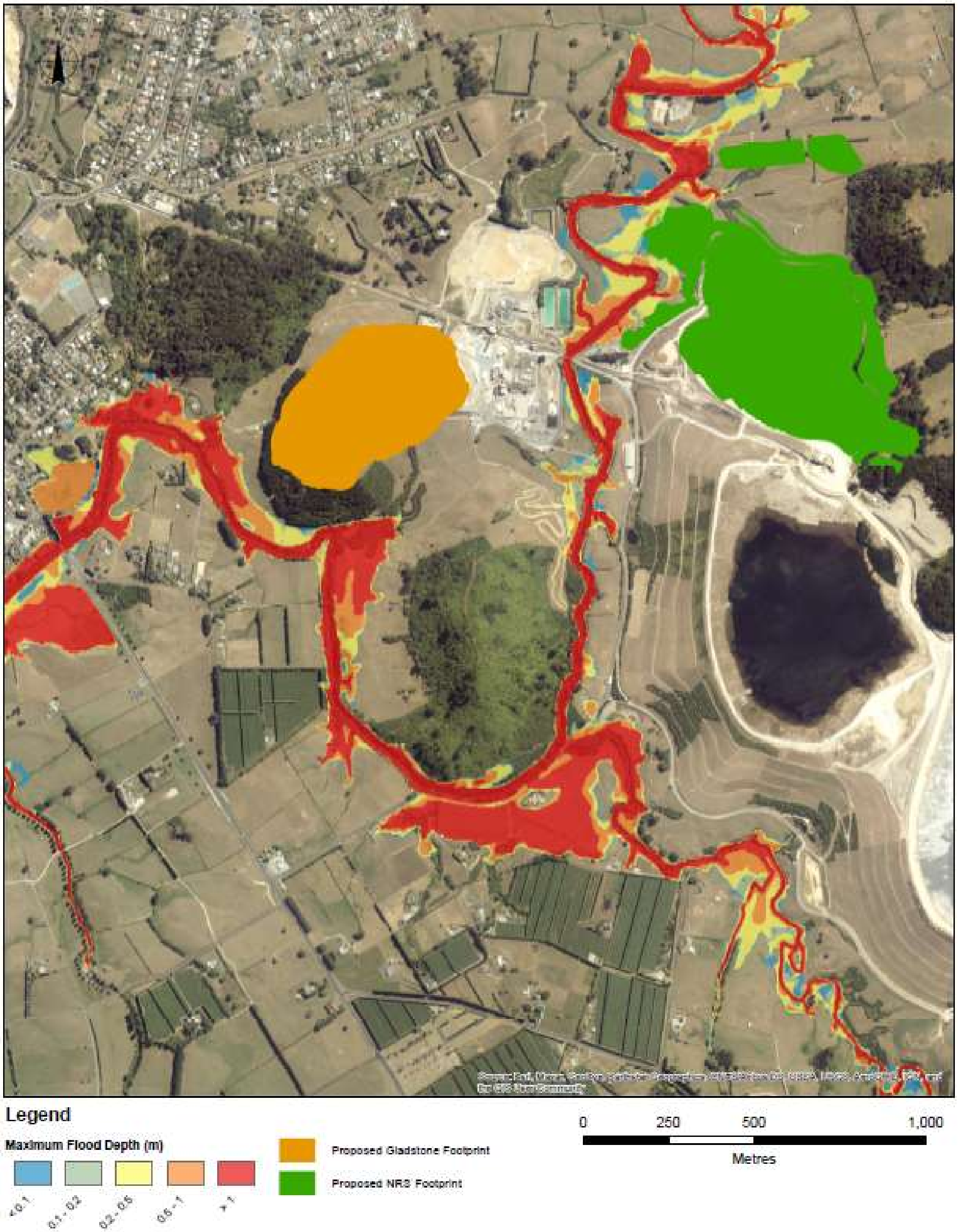


Figure 18 Ohinemuri and Ruahorehore 100 year flood plain

4 WATER QUALITY

4.1 Background

4.1.1 Mataura Stream

Baseline water quality has been collected from a site adjacent to the main infrastructure area (M12) over a period stretching 2006 to 2024, from a location further up catchment (M10) and the main tributaries within the WSFA footprint (R12 and R11) during 2020 to 2024 (Figure 19).

Figure 19 Mataura Stream Water Quality Sampling Locations (from WWLA, 2024a)

Baseline water quality data suggests the catchment is relatively un-impacted with low concentrations of dissolved trace elements and sulphate. Some elevated trace element concentrations are potentially the result of exposed mineralisation within the catchment. Minor elevated concentrations of nitrate suggest an agricultural influence on water quality on site. The summarised baseline water quality data is provided in Appendix B.

4.1.2 Wharekirauponga Stream

Baseline water quality data from the Wharekirauponga Stream has been collated for the key monitoring data stations T Stream West, T Stream East, WKP01, WKP02 and WKP03 (Figure 14). Data for 2020 to 2024 has been collated as representative of current conditions and is provided in Appendix B. Baseline water quality data suggests the catchment is relatively un-impacted with low concentrations of dissolved trace elements and sulphate. Some elevated trace element concentrations are potentially the result of exposed mineralisation within the catchment.

4.1.3 Ohinemuri River

Baseline water quality data from the Ohinemuri River has been collated for the key monitoring data stations OH3 (upstream of the WTP discharge), OH5, OH6 (downstream of the WTP discharge locations) and from RU1 located on the Ruahorehore tributary (Figure 6). Data for 2019 and 2020 has been collated as representative of current conditions and is provided in Appendix B. Average values are utilised within the cumulative assessment (Section 6.3.6).

4.2 Current and Predicted Source Water Quality Summary

Table 10 provides a summary of “typical” water quality characteristics of the various water sources associated with the TSFs, processing areas, and dewatering water.. The presented data is considered a conservative estimate for the application of modelling future site treatment requirements and to assess the potential impact on the receiving environment. The data is sourced from operational water quality monitoring results and geochemical assessments, as outlined in AECOM, 2025 and GHD, 2025a.

AECOM (2025) has completed a study on the geochemistry of the materials that will be encountered within GOP and concluded that rock material from the GOP is elevated in mercury, antimony, and arsenic relative to the historic dataset. AECOM outline a rock management strategy that provides appropriate control measures and management practices to limit the effect of placement of this material to the receiving environment. Furthermore, the geochemical assessment concluded that geochemical controls and processes will likely result in WTP inflow water quality that is similar in nature to the current mine operation.

GHD (2024) has completed a study on the geochemistry of the materials that will be encountered within the WUG tunnelling and mining activities. The assessment outlines predicted leachate and tunnel inflow water quality based on whole rock geochemistry and column leachate data. These predicted water qualities are utilised within the WBM as outlined in Section 6.

Table 10 *WBM Assumed Water Quality Inputs*

Area	Dewatering Groundwater Quality[1]					Wharekirauponga Tunnel Dewatering Groundwater Quality[2]					Collection Ponds - Embankment / RS Runoff[1/4]					Contingency Ponds - Process Runoff[1]				
Data Source	**Martha dewatering data**					**GHD 2025a**					**WSP / NSPSP / NCP1 / S3 / S4 / S5 data**					**WTPCP/CSP01/CSP2S/FSPCP data**				
Parameter	*Min*	*Med*	*95th %ile*	*Max*	*n (last 3 years)*	*Min*	*Med*	*95th %ile*	*Max*	*n (last 3 years)*	*Min*	*Med*	*95th %ile*	*Max*	*n (last 3 years)*	*Min*	*Med*	*95th %ile*	*Max*	*n (last 3 years)*
pH	6.6	7.3	7.7	7.8	41			7.7			6.5	7.2	7.9	8.4	21	4	6.7	7.38	7.5	13
TSS	83	1200	7500	10400	41			7500			3	18	52	55	21	3	9	33.4	40	13
Ni	0.0085	0.0196	0.0794	0.106	15			0.0794			0.1	0.1	0.194	0.2	7	0.0021	0.0086	0.083	0.096	11
Cd	0.0001	0.00052	0.001928	0.0026	15			0.0019			0.00005	0.00005	0.000144	0.00017	14	0.00005	0.0001	0.00093	0.0015	11
Se	0.002	0.0094	0.0094	0.0094	41			0.0094			0.0002	0.001	0.001	0.001	14	0.001	0.001	0.004	0.007	11
Cu	0.001	0.001	0.0109	0.027	15			0.0109			0.0005	0.0008	0.0014	0.0019	14	0.0005	0.0023	0.013	0.017	11
As	0.004	0.01	0.0358	0.04	15			0.05			0.001	0.001	0.001	0.001	14	0.001	0.001	0.0017	0.002	11
Pb	0.0002	0.0002	0.00458	0.005	15			0.0046			0.0001	0.0001	0.0001	0.0001	14	0.0001	0.00015	0.0047	0.0076	11
Sb	0.0035	0.0067	0.01068	0.0139	15			0.0107			0.001	0.001	0.001	0.001	14	0.0002	0.0002	0.0034	0.0062	11
Al	0.008	0.022	0.0455	0.056	15			0.046			0.018	0.103	0.1858	0.193	5	0.013	0.098	2.188	2.9	9
Hg	0.00008	0.00008	0.00008	0.00008	15			0.00008			0.00008	0.00008	0.00008	0.00008	14	0.00008	0.00008	0.00073	0.00086	11
CN_Tot	0.001	0.02	0.073	0.08	15			-			0.001	0.002	0.02	0.02	21	0.001	0.001	0.062	0.08	7
Zn	0.055	0.32	1.211	1.61	15			1.21			0.001	0.006	0.021	0.025	14	0.014	0.114	2.14	2.8	11
SO4	660	1550	1780	2200	41			1780			20	93	492	570	14	18	99	922	1680	11
Fe	6.2	27	62.1	109	15			62			0.02	0.02	0.07	0.08	14	0.02	0.12	0.57	0.58	11
Mn	4.4	8.5	10.18	11.3	15			10.2			0.0148	0.35	1.7	2	14	0.105	0.58	2.7	3.3	11
Na	41	59	66	75	41			66			4.2	7	33	41	7	1.44	5.6	50	79	9
Mg	35	73	108.1	120	40			108			2.2	16.25	30	31	14	1.43	3.2	21	34	11
K	7.3	9	12.12	13.9	39			12			2.1	3.7	7.8	8.8	7	1.01	1.65	9.2	13.2	9
Co	0.0028	0.0118	0.0574	0.079	13			0.057			0.0004	0.003	0.011	0.0118	7	0.0014	0.0048	0.032	0.042	9
Ca	291	510	594	615	37			594			8.1	88	171	186	14	15	30	260	470	11
NH_3-N[6]	0.093	0.87	8	11.6	13			8			0.01	0.025	0.074	0.121	21	0.01	0.021	0.88	2	13

Notes:

0.00615	Greyed out cells signify data is utilised within WBM
95th %ile	Conservative estimates for Wharekirauponga Component of WBM

1 Based on site monitoring data

2 Conservative estimate based on Waihi dewatering data

3 Median numbers modelled reflective of the NRS, maximum numbers are conservatively assumed for RS1 and RS2 at Willows Farm

4 Median numbers modelled reflective of the NRS, Waihi TSF embankments, 95%ile numbers are conservatively assumed for RS1 and RS2 at Willows Farm

5 Median numbers modelled reflective of the Waihi TSF embankments, 95%ile numbers are conservatively assumed for RS1 and RS2 at Willows Farm

6 Ammoniacal N numbers not provided in the AECOM assessment. Numbers used based on monitoring data from TSF1A

Area	Gladstone Pit Sump					WUG RS Seepage[5]					NRS Leachate (Development)[3]				
Data Source	**AECOM 2025**					**LD06, LD07, LD08, LD09, LD10, LD11, LD12, LD13, LD14, LM02, LM05**					**AECOM 2025**				
Parameter	*Min*	*Med*	*95th %ile*	*Max*	*n (last 3 years)*	*Min*	*Mean / Med*	*95th %ile*	*Max*	*n (last 3 years)*	*Min*	*Med*	*95th %ile*	*Max*	*n (last 3 years)*
pH	2.5	4.0	-	4.4	na	4.6	6.3	7.1	8.6	2243	4.54	4.61	-	7.9	na
TSS	-	-	-	-	na	<3	3	37	13000	1557	-	-	-	-	na
Ni	0.02	0.13	-	0.43	na	0.0005	0.004	0.3	4.33	1498	0.0027	0.777	-	1.36	na
Cd	0.0001	0.0006	-	0.0018	na	<0.0001	0.0001	0.001	0.006	1374	0.00005	0.007	-	0.012	na
Se	0.0003	0.0012	-	0.0035	na	<0.005	0.001	0.005	0.14	1724	<0.001	0.002	-	0.005	na
Cu	0.03	0.16	-	0.51	na	<0.003	0.001	0.003	2.700	1720	0.0005	0.027	-	0.36	na
As	0.042	0.23	-	1.2	na	<0.005	0.001	0.003	0.013	1368	<0.001	0.002	-	0.068	na
Pb	0.0001	0.0004	-	0.0011	na	<0.0005	0.0001	0.0004	0.060	1450	<0.0001	0.0002	-	0.0007	na
Sb	0.0001	0.0001	-	0.0002	na	0.00	0.0002	0.01	0.28	1384	0.0002	0.0021	-	0.003	na
Al	13	77	-	234	na	<0.015	0.006	0.33	31.9	1023	0.003	11.8	-	25	na
Hg	0.00003	0.00003	-	0.00004	na	0.000	0.0001	0.001	0.002	1261	<0.00008	0.00008	-	0.0005	na
CN_Tot	-	-	-	-	na	0.0	0.001	0.5	3.2	1964	-	-	-	-	na
Zn	0.04	0.22	-	0.71	na	0.00	0.02	0.19	4.96	1498	0.0025	1.24	-	2.81	na
SO4	180	785	-	2470	na	3	194	2400	4230	2122	198	1,440	-	2,400	na
Fe	2.5	45	-	150	na	<0.1	0.04	19.2	38.8	1556	0.02	300	-	470	na
Mn	0.06	0.33	-	1.1	na	0.0005	0.6	48	312	1721	0.3	15.55	-	61	na
Na	-	-	-	-	na	5	23	126	560	1972	11.7	101	-	159	na
Mg	1.4	2.3	-	2.3	na	1	15.15	250	459	1990	15.4	115	-	280	na
K	-	-	-	-	na	1.1	8.1	18.4	73	1972	3.7	13.7	-	22	na
Co	0.055	0.3	-	1	na	0.00	0.02	0.14	0.71	1382	0.0002	1.86	-	3	na
Ca	32	46	-	85	na	1.1	34	560	644	2023	31	480	-	590	na
NH_3-N[6]	0.01	0.025	0.054	0.058	11	<0.01	0.01	2.6	21.2	2011	<0.01	0.01	2.6	21.2	387

Notes:

0.00615	Greyed out cells signify data is utilised within WBM
95th %ile	Conservative estimates for Wharekirauponga Component of WBM
1	Based on site monitoring data
2	Conservative estimate based on Waihi dewatering data
3	Median numbers modelled reflective of the NRS, maximum numbers are conservatively assumed for RS1 and RS2 at Willows Farm
4	Median numbers modelled reflective of the NRS, Waihi TSF embankments, 95%ile numbers are conservatively assumed for RS1 and RS2 at Willows Farm
5	Median numbers modelled reflective of the Waihi TSF embankments, 95%ile numbers are conservatively assumed for RS1 and RS2 at Willows Farm
6	Ammoniacal N numbers not provided in the AECOM assessment. Numbers used based on monitoring data from TSF1A

Area	Predicted Decant TSF1a		Predicted Decant TSF2		Predicted Decant TSF3		Predicted Decant GOP		Predicted Seepage TSF1a		Predicted Seepage TSF2		Predicted Seepage TSF3		Predicted Seepage GOP	
Data Source	**AECOM 2025**		**AECOM 2025**		**AECOM 2025**		**AECOM 2025**		**AECOM 2025**		**AECOM 2025**		**AECOM 2025**		**AECOM 2025**	
Parameter	*Mean*	*95th %ile*	*Mean*	*95th %ile*	*Mean*	*95th %ile*	*Mean*	*95th %ile*	*Mean*	*95th %ile*	*Mean*	*95th %ile*	*Mean*	*95th %ile*	*Mean*	*95th %ile*
pH	8.09	7.52	7.66	7.20	8.09	7.60	8.09	7.60	6.69	11.4	6.15	7.27	6.69	7.60	6.69	7.60
TSS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ni	0.08	0.358	0.002	0.005	0.022	0.1	0.015	0.067	0.013	0.018	0.004	0.01	0.004	0.005	0.002	0.003
Cd	0.0003	0.001	0.0002	0.0002	0.0003	0.001	0.00002	0.00004	0.0003	0.0003	0.0002	0.0002	0.0003	0.0003	0.0001	0.0001
Se	0.05	0.05	0.001	0.001	0.06	0.12	0.12	0.23	0.004	0.006	0.001	0.001	0.005	0.007	0.005	0.008
Cu	1.77	6.98	0.001	0.003	0.450	1.780	0.49	1.94	0.002	0.01	0.002	0.008	0.001	0.002	0.001	0.003
As	0.0001	0.044	0.00002	0.00003	0.002	0.023	0.003	0.03	0.006	0.008	0.004	0.012	0.033	0.088	0.033	0.087
Pb	0.021	0.012	0.003	0.003	0.003	0.01	0.0021	0.0072	0.002	0.008	0.003	0.003	0.003	0.007	0.002	0.005
Sb	0.047	0.073	0.0003	0.0004	0.038	0.059	0.038	0.059	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Al	0.015	0.032	0.027	0.051	0.019	0.040	0.019	0.039	0.007	0.008	0.012	0.01	0.009	0.01	0.009	0.01
Hg	0.0002	0.0004	0.0001	0.0001	0.0002	0.001	0.00014	0.00038	0.0001	0.0001	0.0002	0.001	0.0002	0.0002	0.0001	0.0001
CN_Tot	0.74	2.70	0.74	2.70	0.74	2.70	0.74	2.70	0.020	0.126	0.020	0.126	0.020	0.126	0.020	0.126
Zn	0.268	0.887	0.002	0.006	0.01	0.033	0.0098	0.032	0.026	0.064	0.004	0.01	0.001	0.002	0.001	0.002
SO4	1,275	2,350	116	179	1,070	1,970	1,020	1,880	541	592	120	342	450	490	450	490
Fe	0.050	0.101	0.021	0.020	0.031	0.064	0.029	0.059	20.4	23.2	5.06	10.51	12.9	14.7	11.9	13.5
Mn	1.09	4.34	0.064	0.271	0.265	1.057	0.2	0.8	8.19	9.46	3.48	8.22	1.99	2.3	1.3	1.5
Na	207	227	91.1	248	244	268	252	277	207	227	91.1	248	240	270	250	280
Mg	15.4	43.8	7.29	10.4	3.51	9.97	2	7	25.8	28.6	8.51	15.3	5.87	6.50	3.46	3.83
K	50.7	77.4	2.74	3.63	41.9	63.9	46	70	15.5	17.5	7.588	10	12.8	14.5	13.3	15.1
Co	0.077	0.215	0.0004	0.001	0.023	0.064	0.015	0.042	0.153	0.187	0.095	0.253	0.046	0.056	0.027	0.033
Ca	269	480	35.0	47.6	121	216	127	226	48.9	52.9	19.8	51.3	22.0	23.8	21.9	23.7
NH_3-N[6]	11	38	11	38	11	38	11	38	1.8	2.2	1.8	2.2	1.8	2.2	1.8	2.2

Notes:

0.00615	Greyed out cells signify data is utilised within WBM
95th %ile	Conservative estimates for Wharekirauponga Component of WBM
1	Based on site monitoring data
2	Conservative estimate based on Waihi dewatering data
3	Median numbers modelled reflective of the NRS, maximum numbers are conservatively assumed for RS1 and RS2 at Willows Farm
4	Median numbers modelled reflective of the NRS, Waihi TSF embankments, 95%ile numbers are conservatively assumed for RS1 and RS2 at Willows Farm
5	Median numbers modelled reflective of the Waihi TSF embankments, 95%ile numbers are conservatively assumed for RS1 and RS2 at Willows Farm
6	Ammoniacal N numbers not provided in the AECOM assessment. Numbers used based on monitoring data from TSF1A

4.3 Decant Water Treatment

The quality of the decant water and its treatment requirements change depending on the active status of tailings deposition and length of time following this.

An assessment of monitoring data from TSF2 has been compiled with key water quality parameters represented in Figure 20. The dataset is representative of the period immediately prior to the final tails deposition date and encompasses data from 2004 to current. This dataset therefore represents decant water quality during tailings deposition through to closure (i.e., decant direct discharge) and enables an assessment of the required treatment requirements and timeframes post deposition. Raw data includes reported pipe failure events in 2008 and 2009 which resulted in tails discharge to TSF2. This data has been excluded as it is not considered representative of decant water quality from the closed facility.

Following cessation of tailings deposition in July 2005, the decant total cyanide concentration exhibits a rapid decrease (Figure 20). Based on this observed trend, cessation of treatment for cyanide removal can occur 1.5 years after the final deposition of tailings occurs. Likewise, the decant copper, chromium, antimony, selenium and zinc concentrations are shown in Figure 20. As per the cyanide trend, an obvious decrease in concentrations of trace elements is visible post final tails deposition. The cut-off for all treatment has been calculated as 2.5 years after the final deposition of tailings occurs. Once the requirement for treatment is past, the water in the TSF ponds is of sufficient quality to directly discharge to the Ohinemuri River. It is assumed that all TSFs utilised as part of the Waihi North Project (TSF1A, TSF2, TSF3 and GOP TSF) will require treatment for this observed duration following final tailings disposal.

The actual water quality of the decant also differs depending on the ore being processed. Applied decant water quality in the WBM reflects current derived decant water quality as per AECOM, 2025 and assumes both Martha Ore, WUG Ore and Gladstone Ore are being processed simultaneously.

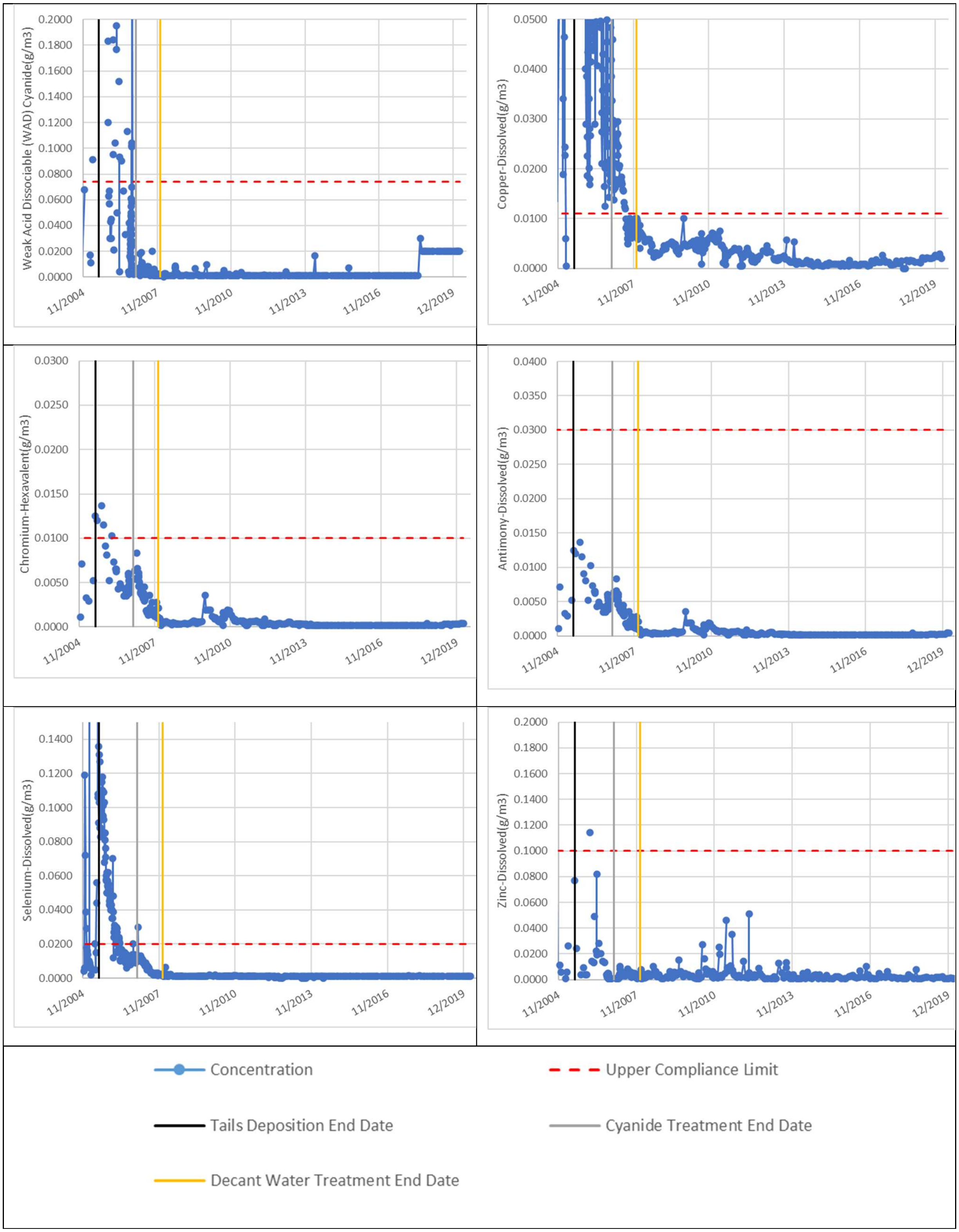


Figure 20 TSF2 Decant Water Quality

5 COLLECTION PONDS

As outlined in Section 2.4, collection ponds and pump systems to date have been sized to contain the 10-year, 72 hour return period event in order to delay any discharge to be approximately coincidental with the peak flood flow in the Ohinemuri River.

It is proposed that for new facilities draining directly to the main branch of the Ohinemuri (i.e. the NRS), that the same 10-year 72 hour duration storm event is still the appropriate design principal. For facilities draining to tributaries of the Ohinemuri (i.e., TSF3 to the Ruahorehore and the WRS to the Mataura Stream) it is proposed that this design principal be adjusted such that overflow events coincide with high stream flows.

5.1 Willows Rock Stack Collection Pond

The location of the proposed collection pond to service the WRS is shown on Figure 21.

As with the existing and proposed NRS and TSF3 collection ponds, the design criterion for the WRS collection pond is that the potential for overflow in a 10-year storm event be avoided until high flow rates within the Mataura Stream are realised. Given the size of the catchment and short time of concentration, a reasonable basis for design is recommended to be retention of the 10-year 24 hour storm event.

The collection pond sizing is based on a 9.8 Ha catchment (inclusive of WRS, portal area and access road). A runoff analysis is undertaken using the rational method (EGL, 2024) calculated the equivalent total required volume equates to 15,512 m^3 which is less than the design volume below the spillway (18,435 m^3).

The collection pond water will be pumped to the WTP at Waihi for treatment until the water is of suitable quality to allow direct discharge to the Mataura Stream. Ultimately upon removal of the WRS, the collection pond will be either deconstructed or repurposed.

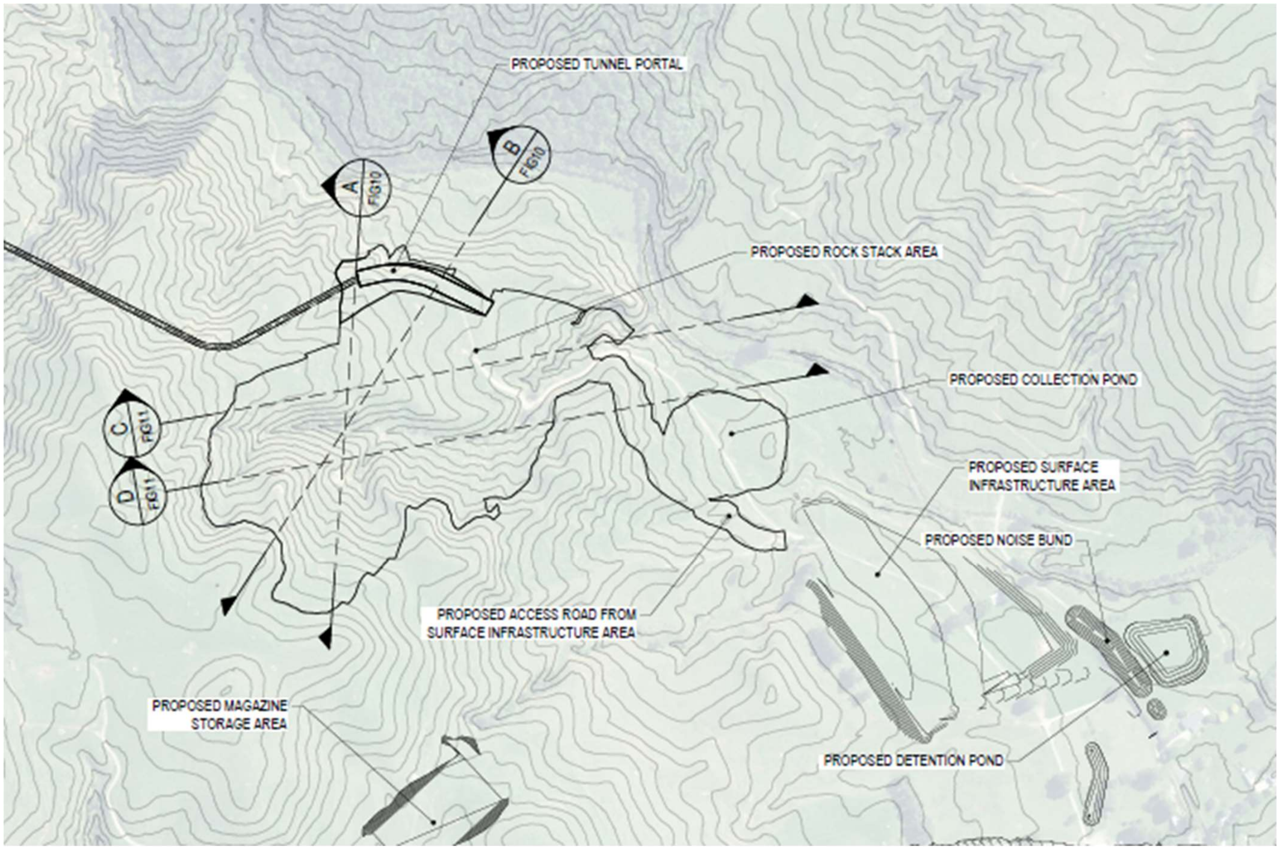


Figure 21 Willows Rock Stack Collection Pond Location (EGL, 2025a)

5.2 TSF3 Collection Pond (S7)

The location of the proposed collection pond (S7) to service TSF3 is shown on Figure 22. Collection pond S6 replaces the existing collection pond S5 and will receive runoff from TSF1A embankment.

For the new ponds, a consideration for the design criteria is that the discharge will be to the Ruahorehore Stream. Based on analysis of flow records, the stream responds quickly to rainfall with peak flows occurring within about 30 minutes of rainfall. As a result, the approach applied for Ohinemuri River discharges (to coincide with peak flows) is not considered appropriate.

The collection pond water will be pumped to the WTP for treatment until water quality allows for direct discharge. The pond needs to be of a sufficient volume that the WTP operators have some flexibility to store or treat water, and when the pond is eventually converted to a silt pond, there must be sufficient retention to remove suspended solids before discharge.

Taking all factors into account, it is recommended that a retention volume equivalent to the 10-year 24 hour storm event is a reasonable basis for design (Figure 23).

The S7 collection pond sizing is based on a 37 Ha embankment. A runoff analysis is undertaken using the rational method and NIWA's High Intensity Rainfall Design System (HIRDS V4) with climate change scenario RCP8.5 for the period of 2031-2050. Runoff is represented through conservatively applying a coefficient of 1.0 based on saturated ground conditions during an extended storm event. The total required volume equates to 87,000 m^3 (Figure 23), assuming a pump rate of zero, which is reflective of a pump failure event.

A section of the Ruahorehore Stream will need to be realigned to accommodate the new collection ponds at TSF3. The design of this realignment should take into account the maintenance of current stream characteristics as far as practical (slope/cross-section, fish passage etc.).

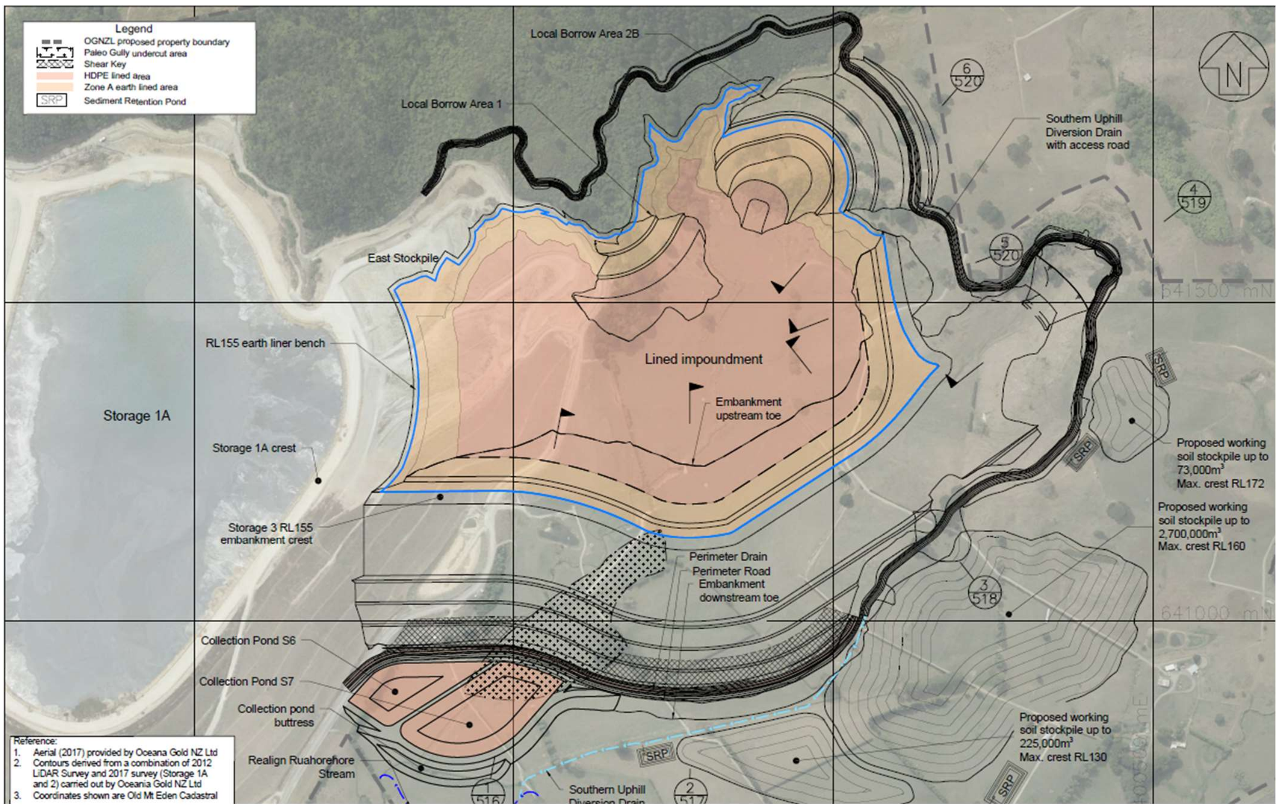


Figure 22 Proposed TSF3 Collection Pond (EGL, 2025b)

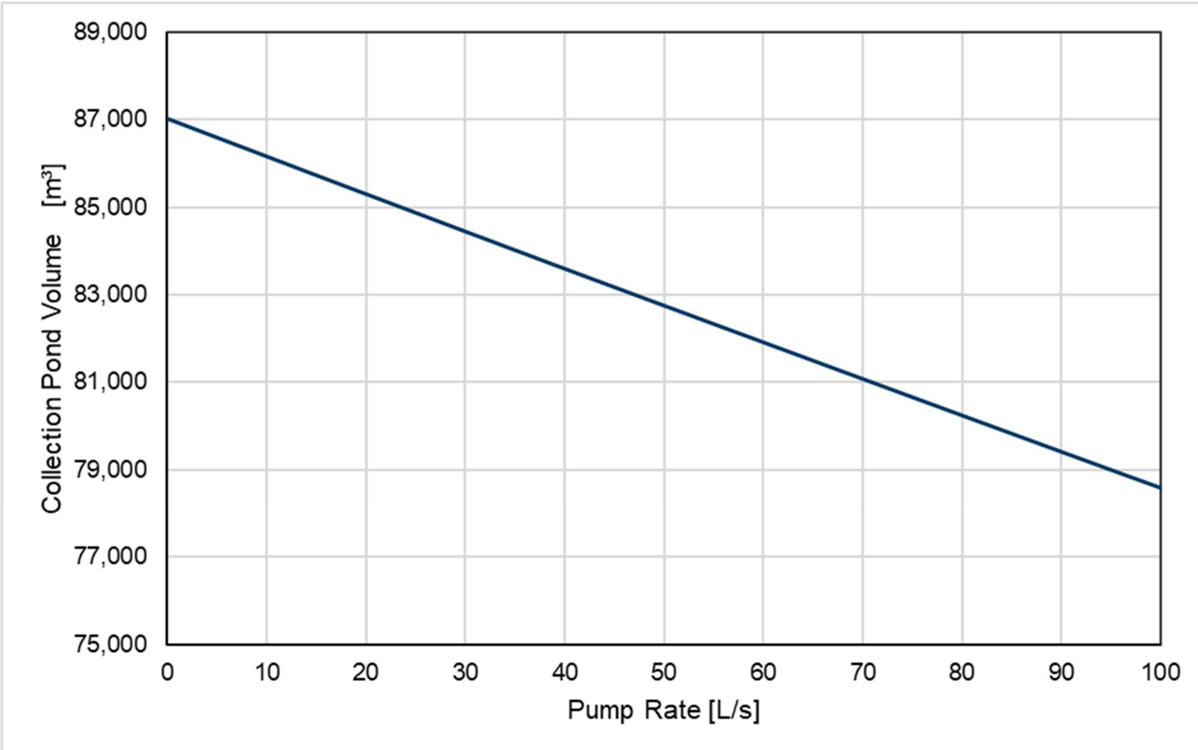


Figure 23 TSF3 collection pond, minimum collection pond sizing (24 Hour event, C=1)

6 SITE WATER BALANCE

6.1 Model Overview

A WBM was used to assess how water gains change over the life of the mine to check that proposed infrastructure for conveyance, storage and treatment will be adequate and to inform the design of the proposed infrastructure. This is carried out using the GoldSim (refer www.goldsim.com) software package which is designed to run Monte Carlo simulations for probabilistic analysis of dynamic systems.

The WBM was first developed in 2012 for the Waihi mines as an initiative of the site environmental team. The objective of building the model was to have a tool to forecast storage requirements in the TSFs and as an ongoing check that the site water management infrastructure as a whole had capacity for ongoing mine development. The model was also used to predict water treatment requirements post closure as a component of annual bond calculations.

The WBM was further developed to represent Project Martha and now also includes the components of the Waihi North Project. The model aims to capture all significant water movements across the site affected by mine operations. The model is run as a probabilistic analysis based on 100 years of measured rainfall data, corresponding combined Ohinemuri River and Ruahorehore Stream flow rates, and the projected mine plan for the Waihi North Project. A full description of how the Waihi North Project is represented in the WBM is given in Appendix C.

A calibration of the WBM was completed with measured river flow data and recorded operational data from the WTP and existing mine site. This calibration is summarised in Appendix C. Given the model has been calibrated against the site water balance and in use for some time there is confidence that it is representative of the quantities of water generated from the different water sources that require treatment.

Overall, the model is considered to provide a good representation of site conditions and, based on the calibration, is conservative.

6.1.1 Wharekirauponga Operations

A standalone element within the WBM aims to assess the infrastructure required to manage water gains resulting from the proposed WUG Access tunnel, WUG Mine and WRS runoff and seepage (denoted as WUG in Figure 27). The model has also been used to generate a synthetic flow record for Mataura Stream. A diagram of the WUG model showing the key elements and controls is provided in Figure 24. The WTP depicted is the WTP element within the main Waihi WBM.

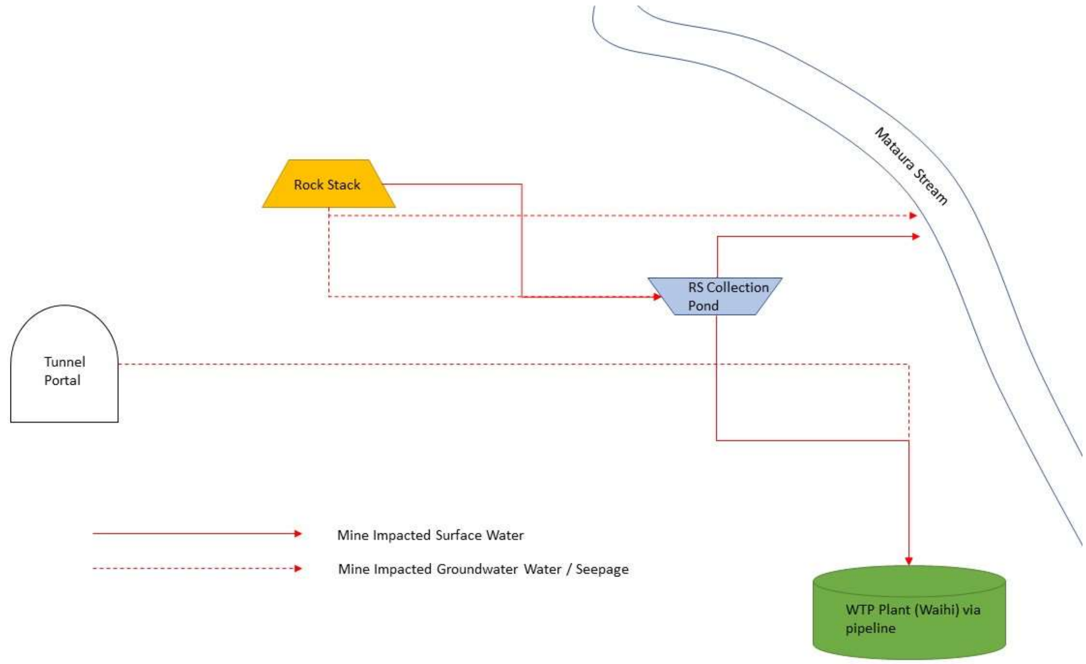


Figure 24 WSFA Flow Diagram

6.1.1.1 Willows Rock Stack Development

The WRS totalling a footprint of 9.26 Ha inclusive of the access roads and portal area (9.8 Ha including the collection pond footprint) will be required to be constructed to store rock (from predominantly the WUG Access Tunnel) at WSFA throughout the LOM. The WRS is assumed to be progressively built over the duration of the tunnelling activities.

The WBM assumes the area of the WRS is in parallel with the rock produced. Eventually the rock within the WRS is returned to the stope for backfilling.

It is assumed that collected runoff and seepage from the WRS is directed to the WRS collection pond prior to treatment. Figure 25 illustrates the assumed WRS development that has been applied to the WBM.

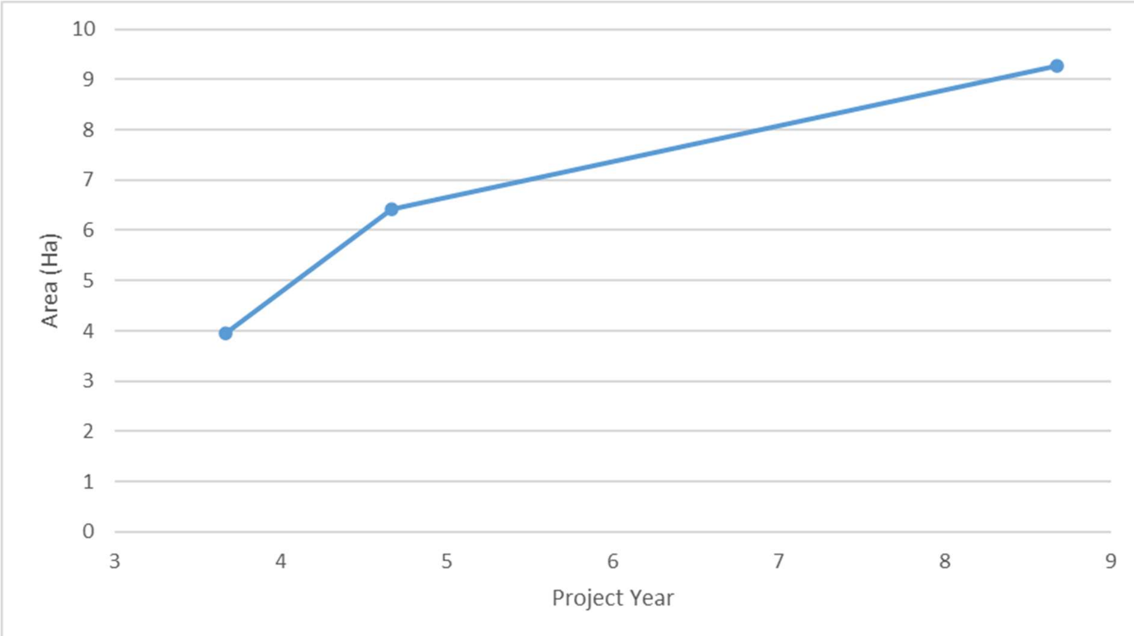


Figure 25 Willows Rock Stack Development

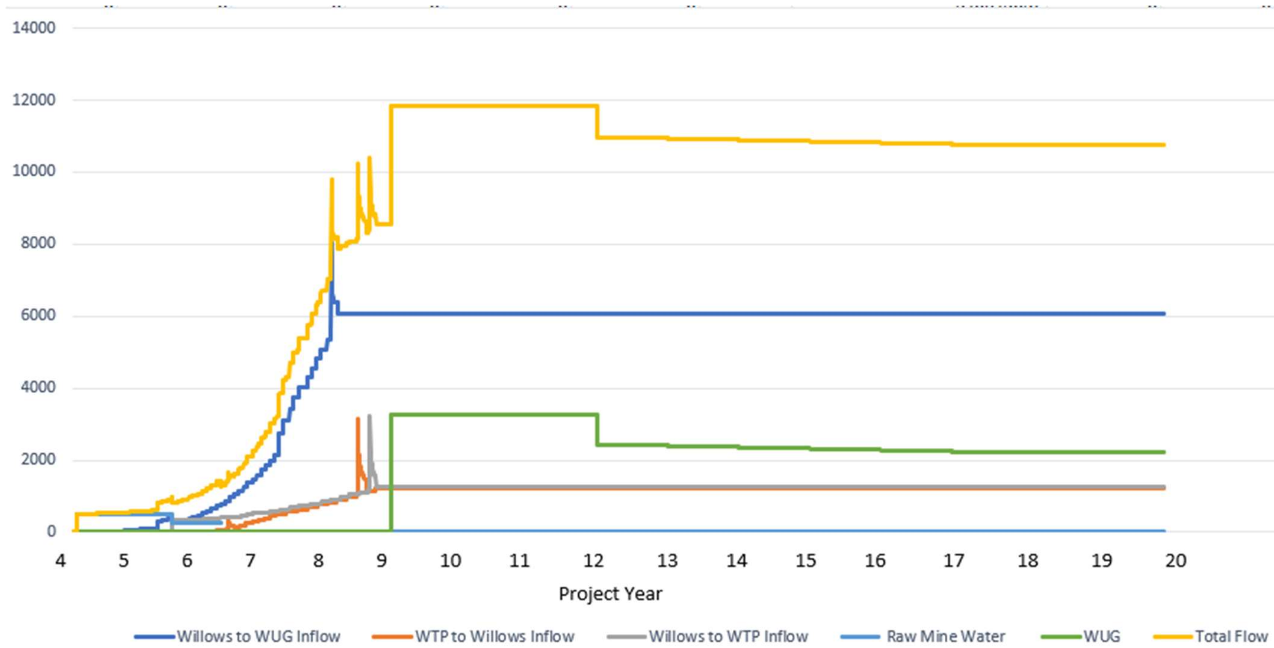
6.1.1.2 WUG Groundwater Inflow

The volume of groundwater flow entering the WUG access tunnel has been provided in WWLA, 2025. In addition, volumes of groundwater inflow for the WUG Mine, shafts and ore transport tunnel have also been provided. This data has been summarised into expected daily inflow volumes which have been adopted within the WBM to assess the likely groundwater inflows and resultant treatment requirements. Given the peak WUG flows are not expected until year eight of development, assumptions relating to groundwater inflow rates will be validated well in advance.

The total assumed groundwater inflow within the WBM includes the following components:

- WUG access tunnel from the Willows Portal to the WUG orebody and WUG Mine (up to 6,071 m^3/day)
- WUG ore transport tunnel to Waihi (up to 2,471 m^3/day)
- WUG Mine (up to 3,283 m^3/day)

The summarised assumed flows as utilised within the WBM are represented in Figure 26.



*The inflow to the WUG ore transport tunnel to Waihi includes the 'WTP Ore Access Tunnel' and the 'WSF Ore Access Tunnel'

#'Raw Mine Water' includes provision for return water utilised in the early stages of access tunnel development (ie. not sourced from inflow)

Figure 26 Predicted WUG Inflow

6.1.2 Waihi Operations

The Waihi operations within the model are depicted in Figure 27 and include the main components of the existing mine (TSF2, TSF1A, underground dewatering, WTP,processing plant and area, rock storage areas and the receiving Ohinemuri River) with the addition of the specific Waihi North Project components (WUG, WRS, GOP, GOP TSF, TSF3 and the NRS).

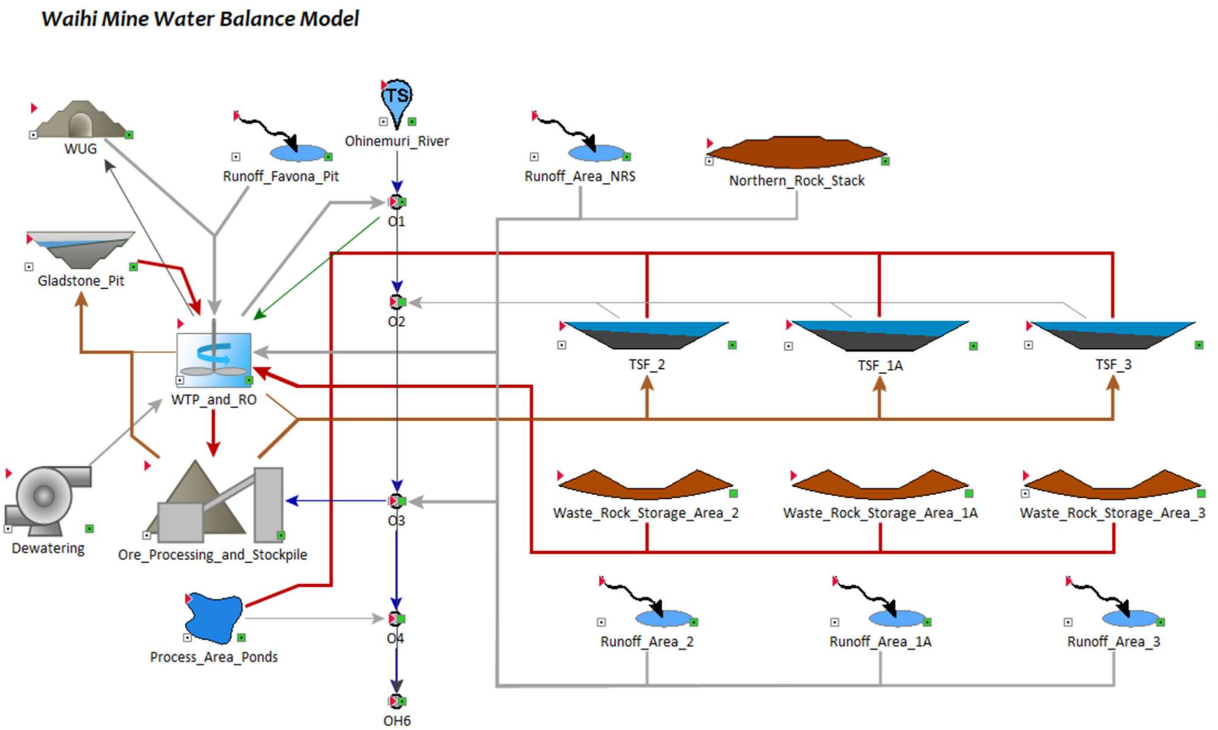


Figure 27 Waihi WBM Outline

The cumulative component of the WBM is detailed in Appendix D and accounts for the following:

- Background water quality and flow
- WTP discharge water quality and flow
- Uncaptured mass loads from the existing operations
- Predicted uncaptured mass loads from WRS, NRS, TSF3 and GOP TSF

The additional contaminant loads that are predicted to report to the Ohinemuri via groundwater have been quantified in the Hydrogeological assessment (GHD, 2025c) and are included within the cumulative assessment for the following facilities:

- WRS Seepage
- TSF3 Seepage
- NRS seepage
- Gladstone seepage*

* Changes to the Ohinemuri River water quality as a function of the Gladstone TSF discharge, even when excluding potential attenuation of contaminants during migration to the river, is predicted to be negligible (GHD, 2025c).

Existing and additional loads used the assessment are provided in Table 11.

Table 11 Additional Ohinemuri Loading (kg/day)

	Baseline	WRS	Gladstone Pit*	NRS	TSF3
Al	-	<0.01	-	1.2	<0.01
As	<0.01	<0.01	-	<0.01	<0.01
Ca	<0.01	1.2	-	47	1.0
Co	<0.01	<0.01	-	0.2	<0.01
Cu	<0.01	<0.01	-	<0.01	<0.01
Fe	<0.01	0.04	-	29	0.6
Hg	<0.01	<0.01	-	<0.01	<0.01
K	<0.01	0.04	-	1.4	0.6
Mg	<0.01	0.6	-	11	0.3
Mn	0.8	0.1	-	1.6	0.09
Na	<0.01	0.3	-	10	11
Ni	<0.01	<0.01	-	0.08	<0.01
Pb	<0.01	<0.01	-	<0.01	<0.01
SO_4	2000	5	-	140	20
Sb	<0.01	<0.01	-	<0.01	<0.01
Zn	<0.01	<0.01	-	0.1	<0.01

*All Gladstone seepage is assumed captured and treated

The assessment undertaken is considered conservative as mass loads are calculated on fully built facilities and do not take into account attenuation which will likely result in co-precipitation of trace elements.

6.2 WUG WBM Outputs

6.2.1 WRS and Groundwater Inflow Water

Based on the operational capacities outlined in Section 5, the WRS collection pond is modelled to determine the return flows to the WTP.

The modelled volume of water from the collection pond (via pipe to the Waihi WTP) is provided in Figure 28 and shows the seasonal fluctuation and impact of increasing the active area of the WRS. During initial development, WUG groundwater inflow water may be discharged to the WRS collection pond before transfer to the WTP via pipe. However it is generally assumed that WUG water is piped and pumped through the tunnels directly to the WTP without surfacing at the WSFA during peak development.

The combined calculated median water volumes requiring treatment (WUG groundwater inflow and collection pond water (containing WRS seepage and runoff)) are provided in Figure 29. Treatment requirements increase largely in line with the progression of the WUG Access Tunnel and extent of underground development and are largely driven by the volume of groundwater entering the access tunnels based on the estimated inflow. Currently it is assumed that the groundwater inflow is constant and as it is the dominant water source requiring treatment, there is little difference between estimated minimum and maximum flows – the minimum flow simply being the maximum flow less the collection pond decant rate. The WBM reflects a gradual removal of the WRS from year 9 but no reduction in WUG groundwater inflow due to backfilling. The post WUG mining predictions (last ore is scheduled during year 18) are therefore not considered an accurate reflection of water treatment requirements as the installation of bulkheads will result in a large reduction in groundwater inflow.

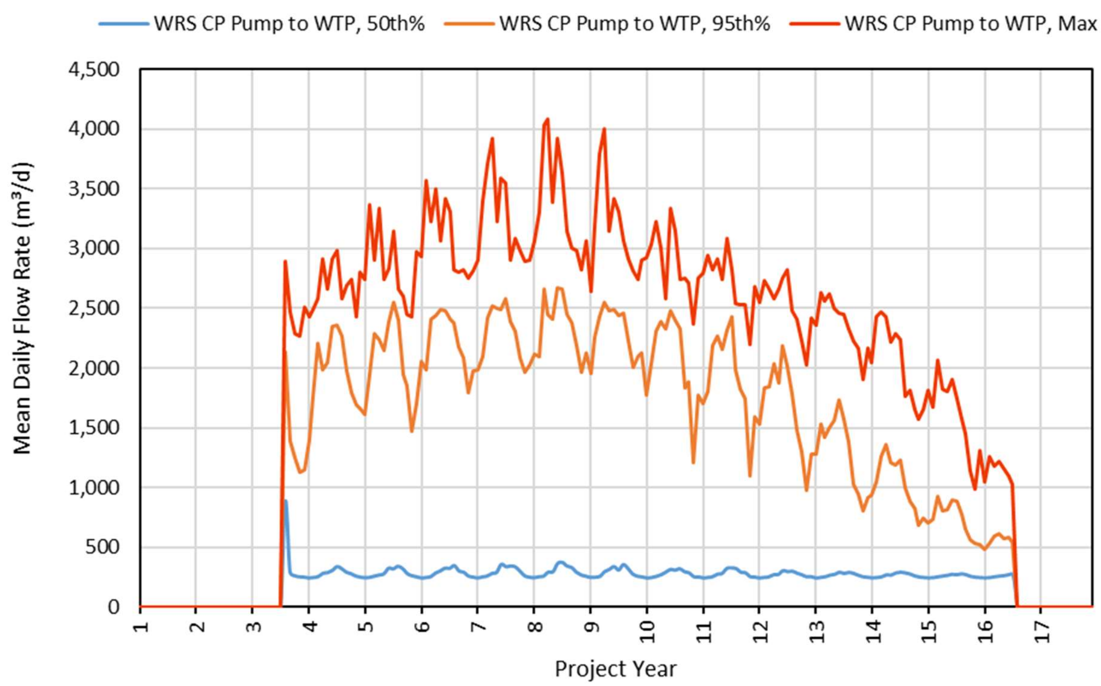


Figure 28 Modelled WRS Collection Pond to Waihi WTP

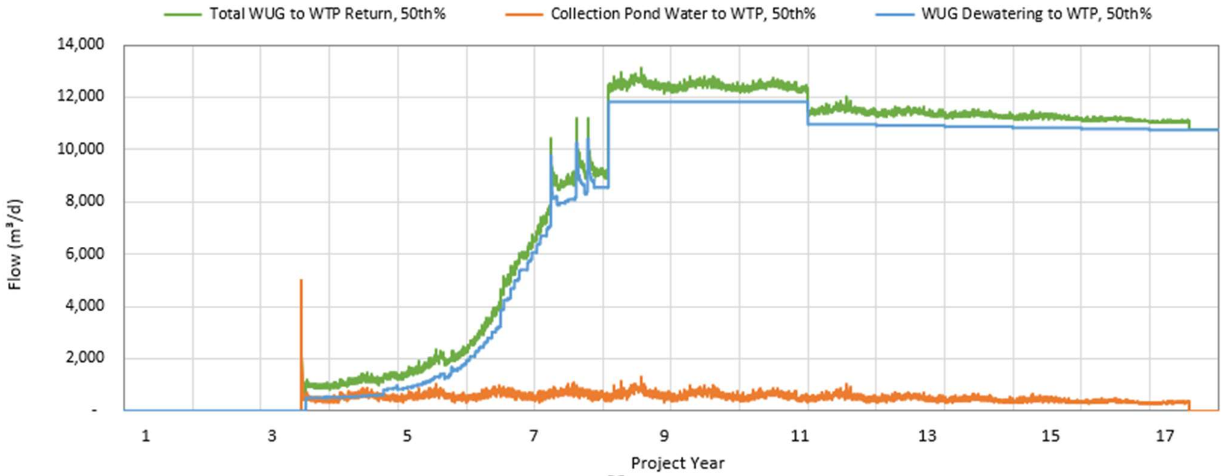


Figure 29 Modelled Median Total Flow to Waihi WTP

It has been calculated that the combined storage and pump capacity for the collection ponds are insufficient to manage the pond water levels when the WRS increases in size to an area of approximately 9.3 Ha. In these circumstances overflow is possible, however where the modelled 24 hr rainfall records are applied, overflow events from the collection pond are predicted to occur only during the most extreme rainfall events (with an approximate return period of 10 years). Untreated water will discharge directly to the Mataura Stream.

6.2.2 Mataura Stream Water Quality

The Mataura Stream is considered to form the primary environmental receptor within the WSFA. No mine water impacts (except a small volume of uncaptured WRS seepage) are expected based on the assumed infrastructure within the WSFA. WUG groundwater will be pumped and piped directly to the WTP at Baxter Road and collected runoff and seepage from the WRS will undergo similar transport via storage in the WRS collection pond.

The predicted impact is detailed in GHD (2025c) and is conservatively based on the maximum constructed height and extent of the WRS, with no groundwater dilution or attenuation. The results are presented in Table 12 and illustrate an expected minimal impact on receiving water quality.

Table 12 Mataura Stream water quality

	Mataura (Existing)	Mataura (Modelled Data)		Consented Receiving Water Quality#	
Chemical Parameter	**Median**	**Median**	**Max**	**Hardness 20 g/m³ $CaCO_3$**	**Hardness 100 g/m³ $CaCO_3$**
Iron (g/m³)	0.04	0.04	0.06	1.0	1.0
Manganese (g/m³)	0.003	0.0085	0.056	2.0	2.0
Copper (g/m³)	< 0.0005	< 0.0005	< 0.0005	0.003	0.011
Nickel (g/m³)	< 0.0005	< 0.0005	0.0008	0.04	0.160
Zinc (g/m³)	0.002	0.002	0.002	0.027	0.100
Antimony (g/m³)	< 0.0002	< 0.0002	< 0.0002	0.03	0.030
Arsenic (g/m³)	< 0.001	< 0.001	< 0.001	0.19	0.190
Mercury (g/m³)	< 0.00008	< 0.00008	< 0.00008	0.000012	0.000012
Cadmium (g/m³)	< 0.0001	< 0.0001	< 0.0001	0.0003	0.001
Chromium VI (g/m³)	< 0.001	< 0.001	< 0.001	0.01	0.01
Lead (g/m³)	< 0.0001	< 0.0001	< 0.0001	0.0004	0.0025
Major Cations / Anions					
Ca^{2+}	2.4	2.4	3.0	N/A	
Mg^{2+}	1.4	1.4	1.7	N/A	
Na^{+}	7.0	7.0	7.1	N/A	
K^{+}	1.2	1.2	1.2	N/A	
SO_4^{2+}	9.0	9.3	11.6	N/A	

#Consented values are based on the current OGNZL RC 971323 (and RC 971285, 971311, 971312, 971303-971306) for OH5 / OH6. They have been presented here for comparison as a basis for assessing the impact within the Mataura Stream

*Trace element concentrations are dissolved

6.3 Waihi WBM Outputs

6.3.1 MUG Mine Dewatering

The WBM was used to predict the dewatering rate that can be achieved under the current consented WTP discharge conditions and capabilities. The available dewatering rate is limited by treatment plant capacity after Priority One (comprising process area runoff, seepage, WUG minewater and collection pond water) waters have been treated and any restrictions of discharge volumes during low flow periods.

The WBM was used to assess the MUG minewater dewatering rate requirements to meet dewatering targets over the LOM (based on the work presented in WWLA, 2024b); which accounts for periods when minewater treatment may be constrained by the need to prioritise treatment of water from other sources.

Figure 30 shows the predicted pump rates over time required to meet dewatering targets. The 50th percentile results typically operate at the nominated peak capacity of 15,500m$^{3/}$d through to year 11 to achieve the target drawdown.

Figure 31 demonstrates the total volume of the deficit with results showing that in general the deficit is small with a small increase during years 8-10 after which the WBM predicts a sudden decreease. This deficit is tied to the increasing volume of water from WUG which the model prioritises for treatment over MUG minewater. The predicted underground water elevation in relation to the MUG underground stopes is provided in Figure 32.) The majority of the stopes throughout the LOM show a low risk of inundation. However, during years 8 through to year 10 the model shows a modelled risk of inundation within the lower stopes. Operationally, this risk could be reduced by additional advanced dewatering efforts prior to year 8 (currently the model limits advanced dewatering to 8 m below the target level on groundwater rebound). By utilising capacity within the WTP and discharge prior to year 8, there will be less risk to the lower MUG stopes. If dewatering targets are not met, the impact will be on MUG mine development.

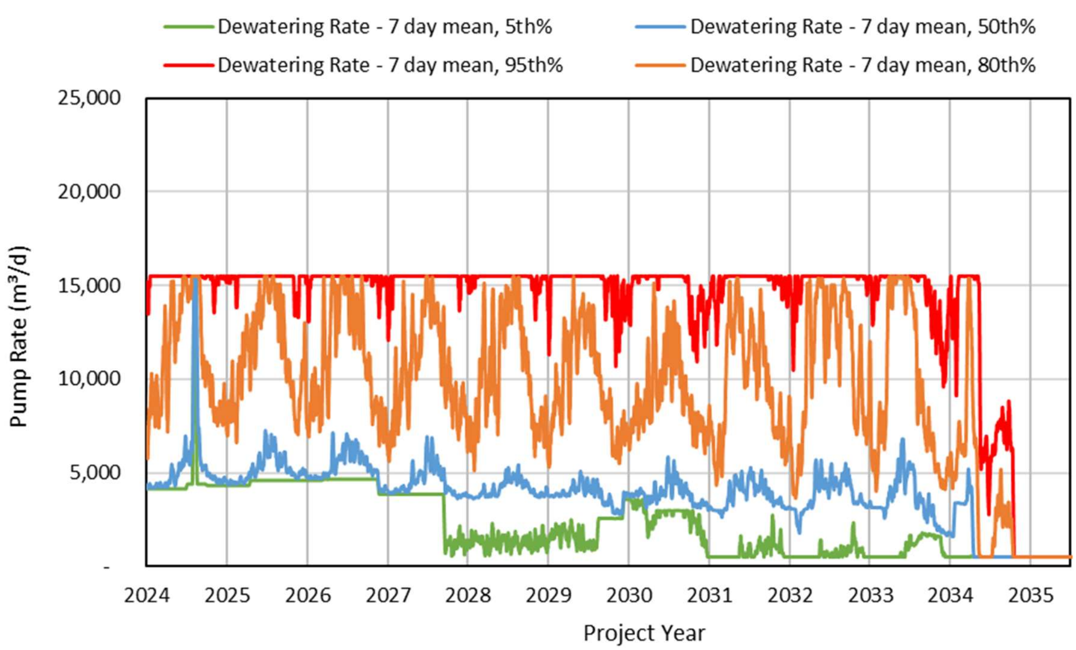


Figure 30 Dewatering pump rates, based on a maximum pump capacity of 15,500 m^3/day

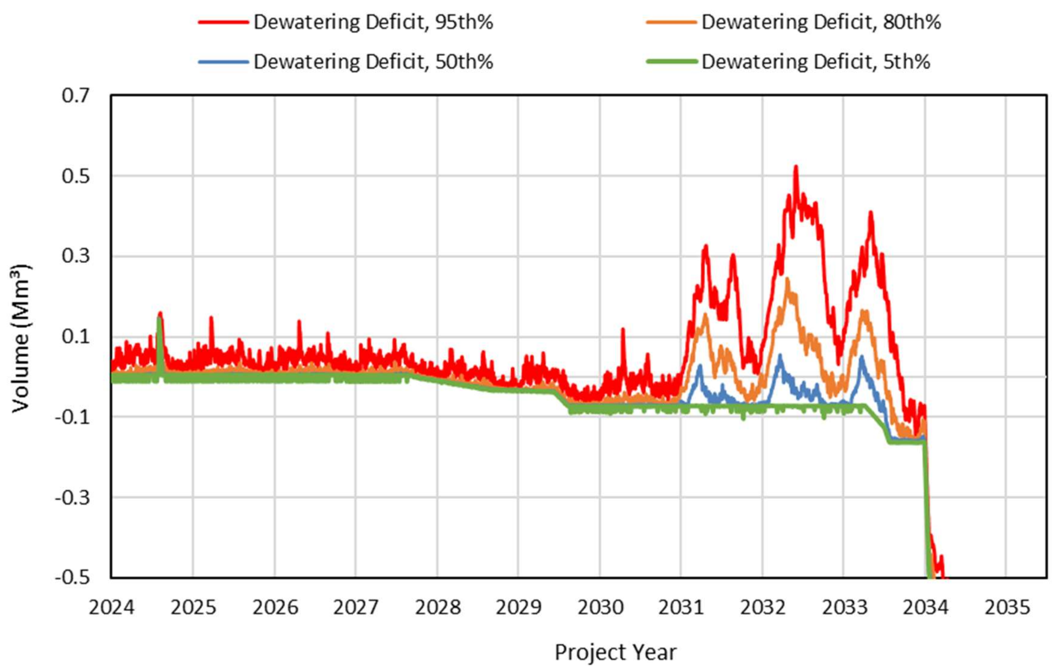


Figure 31 Dewatering deficit from target, based on a maximum pump capacity of 15,500 m^3/day

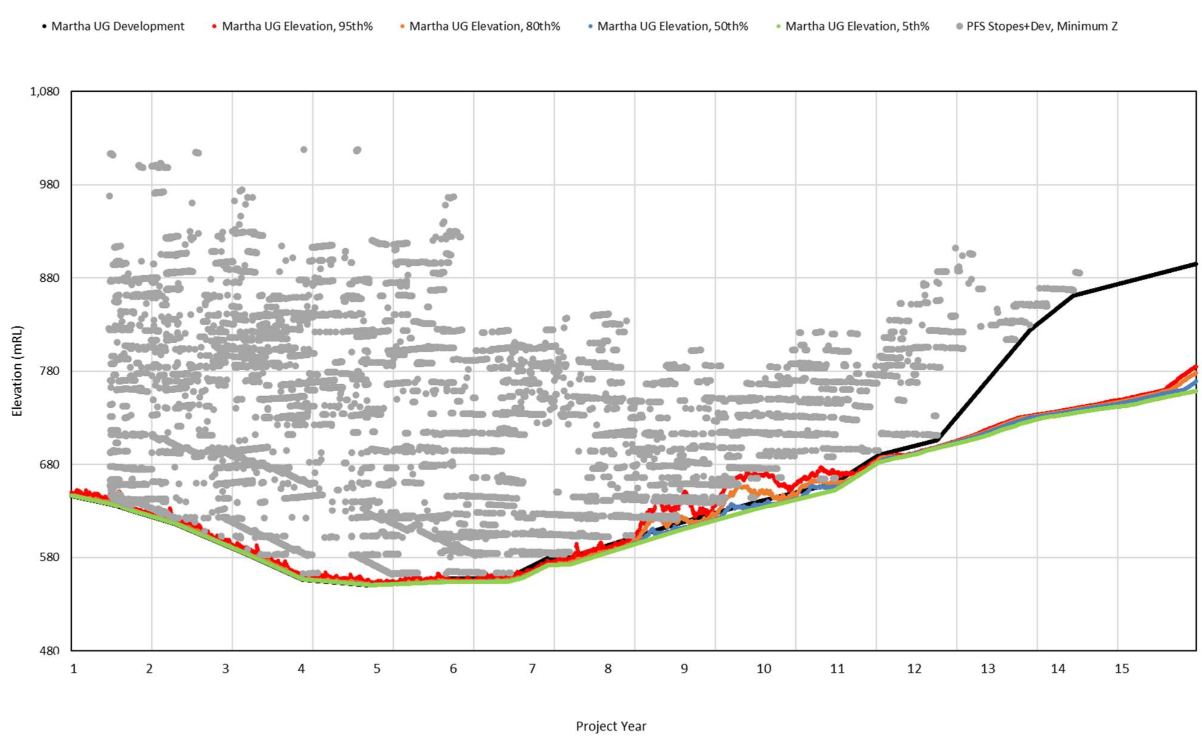


Figure 32 Predicted underground water elevation

6.3.2 Quarterly Water Balance

A forecast of water gains for each year of mining is summarised from the daily model data. These gains have been compared to the allowable discharge and based on this comparison the upgraded WTP has sufficient capacity to treat and discharge water gains from the Waihi North Project for all years of mining. Given that peak treatment requirements do not occur until year 8, assumptions relating to the various input sources (most notably the groundwater inflow rates from WUG) will be validated well in advance and importantly, OGNZL will have time to adapt their water management approach in advance of the critical period.

The volumes of water requiring treatment will be greater than currently experienced and as predicted for Project Martha, operators will need to maximise opportunity to treat and discharge water when river flows are high.

Figure 33 shows the allowable discharge against water treatment requirements predicted over the life of the mine. The difference between the mean treatment requirement and the mean WTP discharge allowance indicates spare capacity and allowance for WTP operational efficiency. The key periods during the LOM shown on Figure 33 include:

- high treatment requirements through years 8 to 10 as dewatering of MUG is still required and increasing groundwater inflows from the WUG component are realised;
- reduced minewater treatment requirements from year 11 as stoping at the lower levels of the MUG is completed and dewatering requirements are reduced; and
- increase in cyanide water treatment from year 8 as multiple TSFs are operational. For modelling purposes it has been assumed that excess Priority One flows are also directed to the operational tailings facility, however other options for this water may be considered (refer Section 6.3.3).

Overall, the projected gains of water requiring treatment on site are within the assumed WTP capacity and can be managed within assumed discharge constraints. The estimated mean daily volumes (by source) and mean mass loads (of consented elements) reporting to the WTP on an annual basis are provided in Appendix H.

Figure 34 shows the same data over year 9 which will likely be one of the more challenging years in terms of allowable discharge. During this period the discharge volume is constrained during low flow events over the summer period.

Based on the predicted cumulative tailings deposition (refer Figure 35), the use of tailings storage facilities will generally be staged to limit periods where treatment is required of decant from more than one TSF. TSF2 will be activated near the middle of year 4 after TSF1A is completed. TSF3 will come online during year 5 and GOP TSF will be available from year 8. It is noted that based on current designs and mine scheduling, both TSF2, TSF3 and GOP TSF have additional capacity available for surplus tailings storage is required. The increasing volume of water sourced from WUG mine will result in the proportion of cyanide water compared to non-cyanide mine water remaining low and the discharge will be able to be operated at Regime E most of the time.

The RO plant is available as backup mitigation to increase the quality of treated water discharge through these periods if needed, however it has not specifically been utilised in this assessment and should be regarded as contingency.

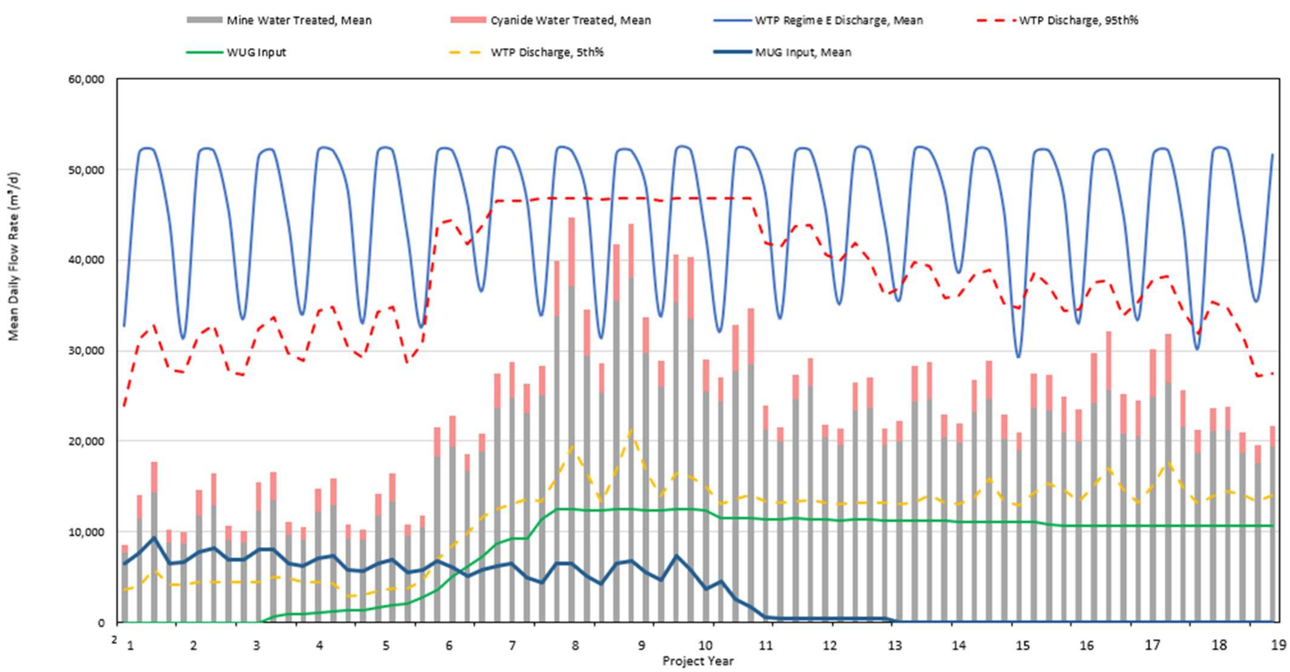


Figure 33 Quarterly Water Treatment Summary

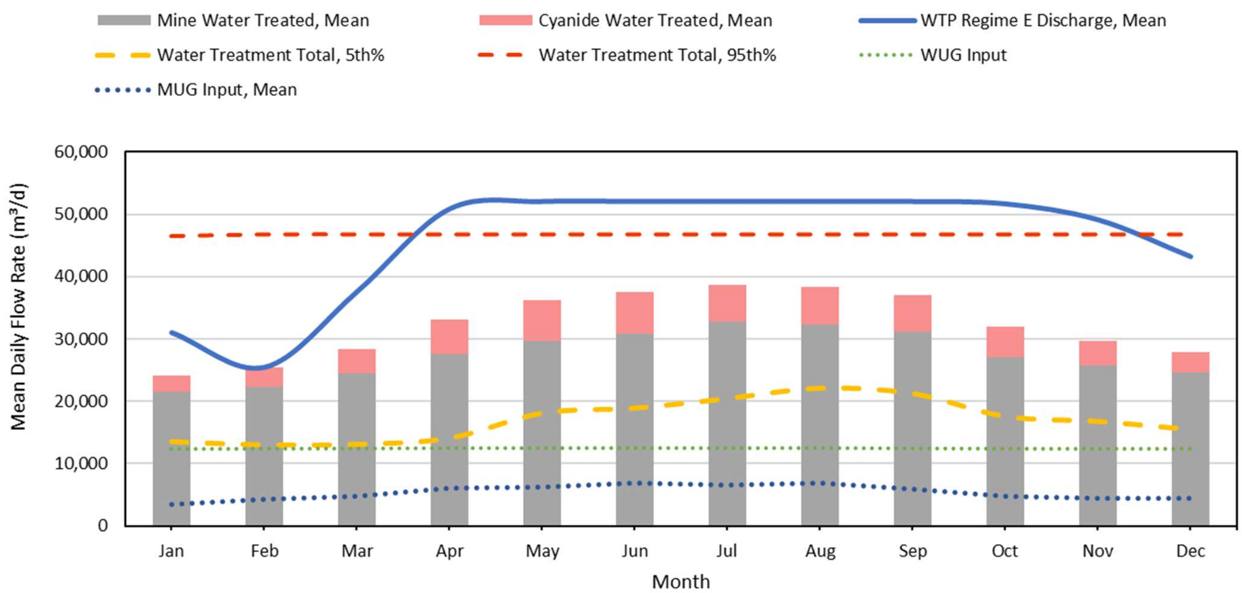


Figure 34 Monthly Water Treatment Summary – Year 9

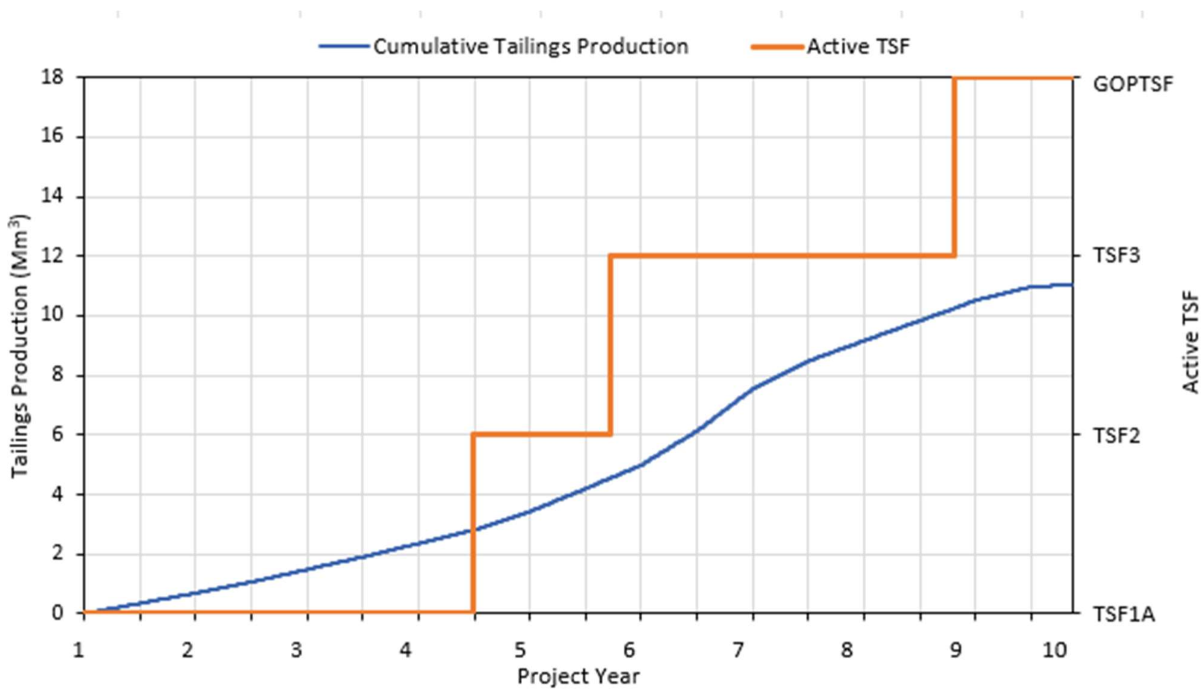


Figure 35 Tailings Production and TSF Allocation

6.3.3 Modelled Excess Flows

Figure 36 shows the excess monthly averaged Priority One flows, where the Priority One water sources are those with little buffering capacity within the water management system. These sources include processing plant (and WTP) area runoff, groundwater inflows from the WUG, and seepage / RS runoff (via collection ponds).

The model identifies periods from year 8 onwards where excess flows are unable to be discharged under the existing consented regimes due to low flow restrictions in the Ohinemuri River which predominantly occur during the summer months. The frequency and volume of these excess flows is tied closely to the development of the WUG Mine. In this regard, the key reason for the modelled excess is the assumed rates for dewatering of the WUG Mine. The actual rates of dewatering will be better understood well in advance of year 8 before the potentially critical period (as modelled) is reached.

The WBM model currently directs these excess flows to the active TSF ponds for storage. Alternative operational solutions could consist of one or a mixture of the following operational options:

- Excess flows sent to the operational TSF (default option presented in the WBM)
- Dewatering of MUG/WUG temporarily suspended
- Scheduling changes or amendments
- Potential future alternative discharge options

In addition, the reduction in the treatment of collection pond water may also be possible by year 8 – associated with upstream catchment rehabilitation and conversion to silt ponds as has occurred historically. None of these options (apart from direction of the excess flows to the operational TSF) are explicitly modelled here. To decrease the risk of excess Priority One waters during peak development and low summer flow periods, the WTP operation will need to maximise the treatment of non-Priority One waters when the WTP capacity and river flows allow.

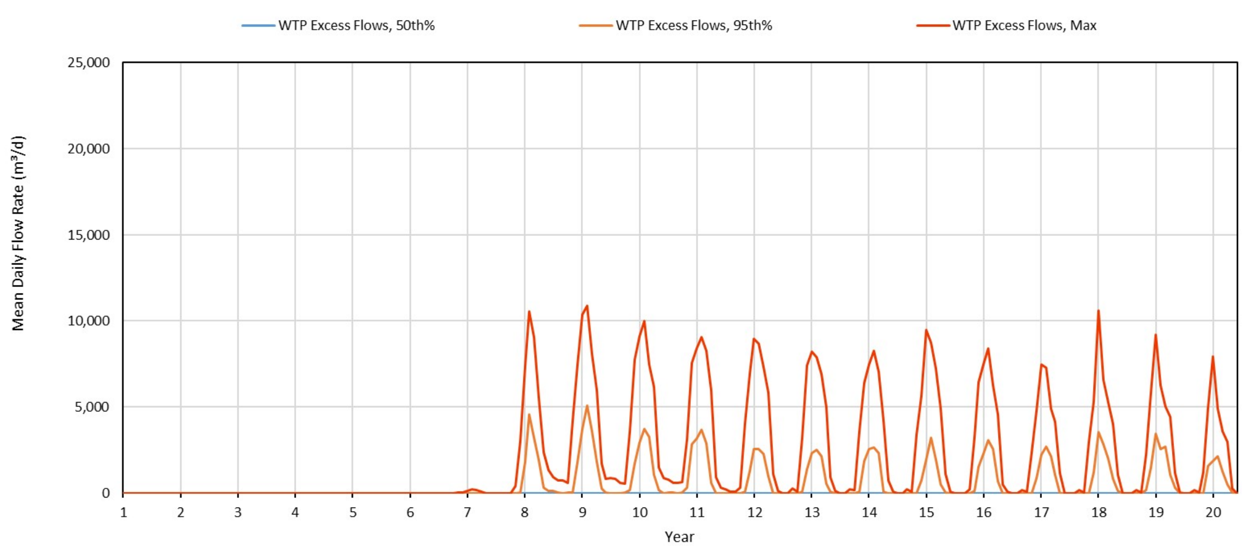


Figure 36 WTP Mean Monthly Excess Flow

6.3.4 TSF Overflow Potential

The tailings storage ponds are designed with a freeboard allowance that must contain the probable maximum rainfall event with an additional 1 m contingency above the normal operating levels to avoid any potential for overflow. The minimum crest level is set to 182 mRL for TSF1A, 159.5 mRL for TSF2, 155 mRL for TSF3, and 107 mRL for GOP TSF providing a freeboard of 2.6 m, 3.12 m, 3.46 m and 4.0 m respectively. The site water balance model has been used to test the compliance with these levels with acceptable results.

Figure 37 to Figure 40 show the projected live water surface elevations for TSF1A, TSF2, TSF3 and GOP TSF respectively. TSF1a, TSF3 and GOP TSF all show additional capacity above the required freeboard and contingency allowance based on the proposed mine schedule and stage volume (for water / tailings storage) design relationships. The peak water levels from the statistical model predict a low probability of incursion into the required freeboard where modelled peak water levels are within the lower levels of the freeboard. These volumes assume Priority One excess flows (refer Section 6.3.3) are directed to the active tailing's facility. These excess flows typically occur during low flow periods where the WTP discharge is constrained by low flows in the Ohinemuri River so are unlikely to coincide with potential PMP events.

The presented results do not take into account adaptive management procedures (such as prioritisation of decant pumping and treatment and/or increasing cyanide treatment capacity) that could be implemented to maintain compliant water levels, and assume maximum pumping rates of 12,000 m^3/day to both the processing plant and WTP respectively. Additional volumes of water could also be accommodated by a corresponding lower tails level or advanced embankment raise if required increasing the available water storage volume. Increased pumping capacity and optimisation of treatment and discharge when the discharge volumes can be maximised could also potentially process increased volumes of tailings pond water if required.

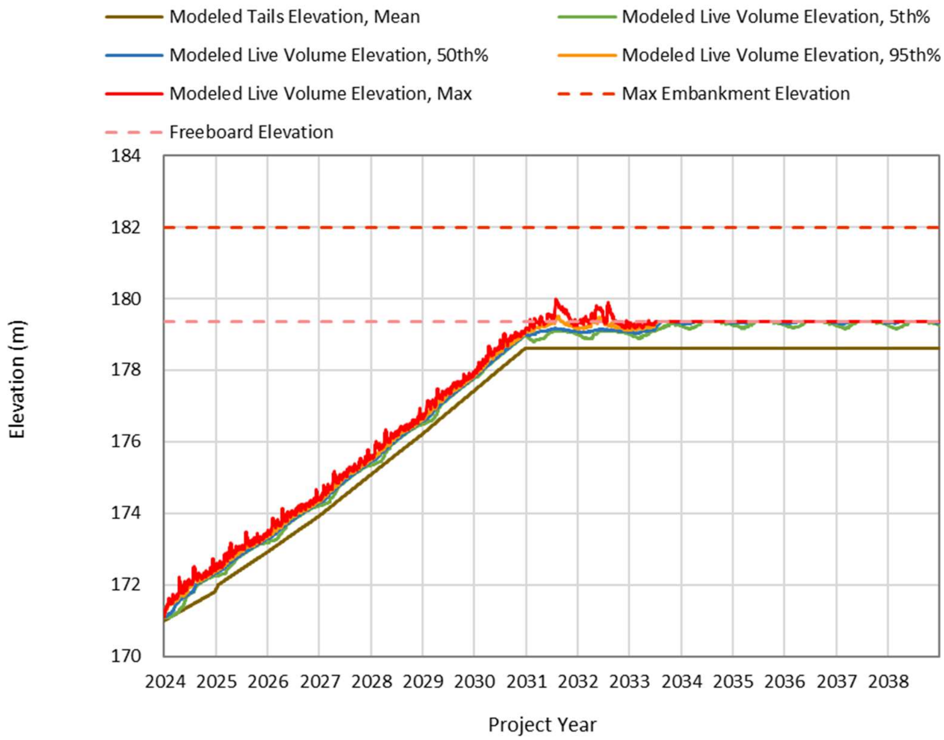


Figure 37 TSF1A Water and Tailings Elevations

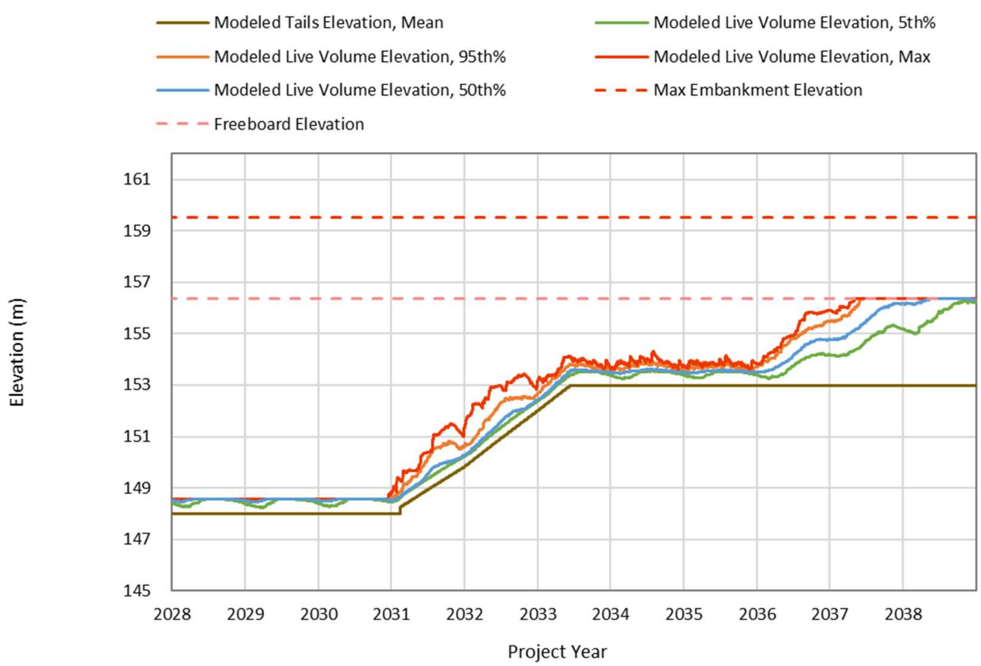


Figure 38 TSF2 Water and Tailings Elevations

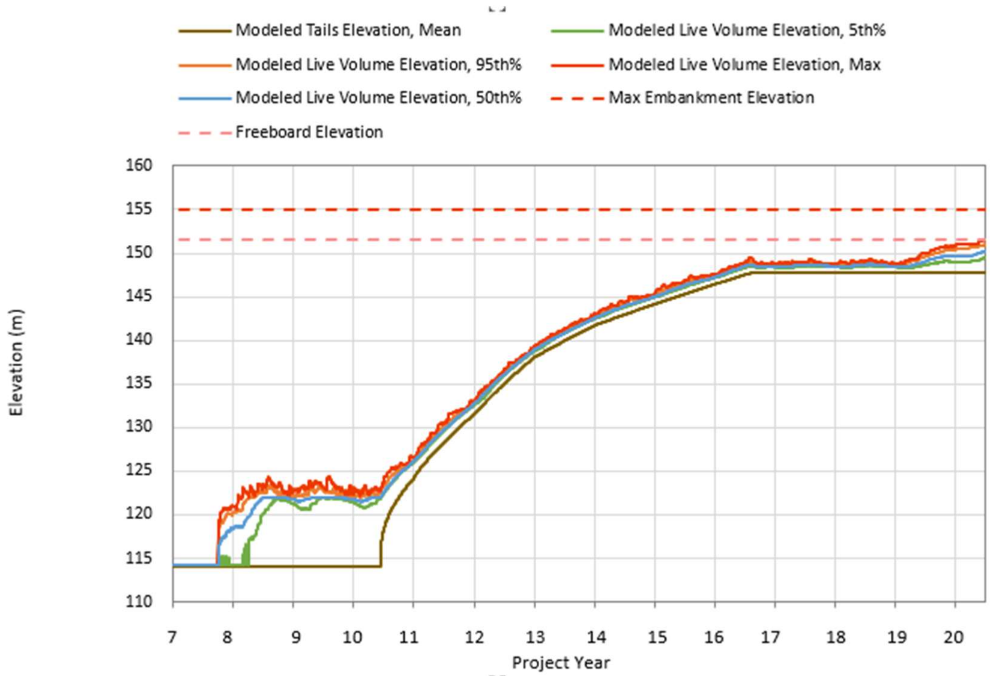


Figure 39 TSF3 Water and Tailings Elevations

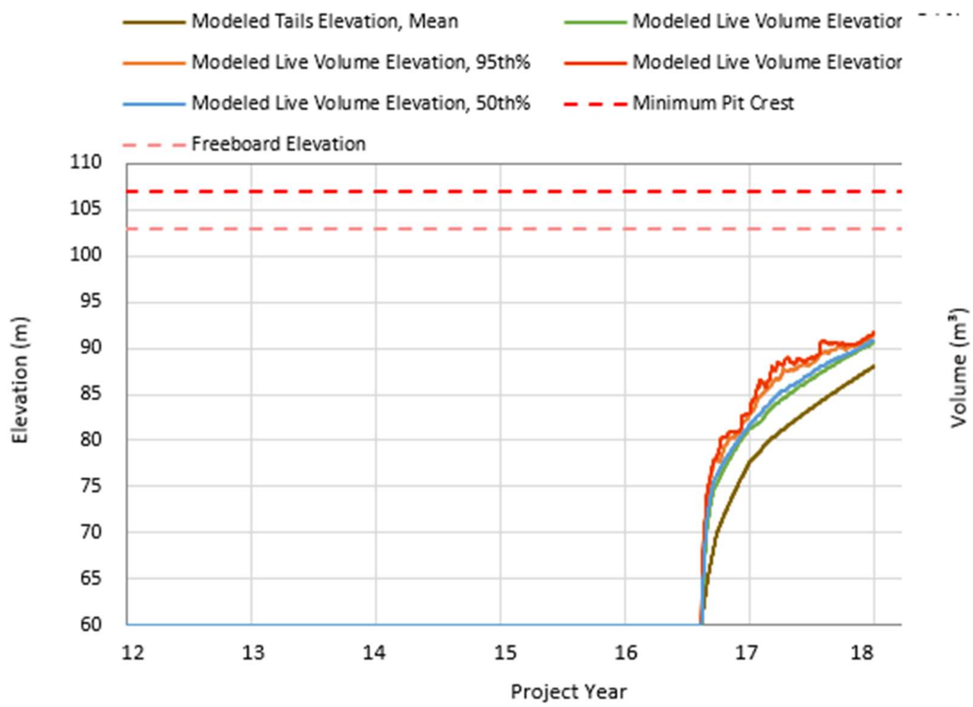


Figure 40 Gladstone TSF Water and Tailings Elevations

6.3.5 WTP Discharge Water Quality

The modelled discharge water quality results over the LOM are illustrated in Table 13.The average and maximum values presented are calculated across all model simulations and for the complete LOM.

The model does not predict pH, dissolved oxygen or TSS within the discharge or receiving environment. These constituents are considered unsuitable to be accurately modelled within the mass balance model.

pH is considered easily controlled within the discharge water by the current practice of using CO_2 onsite to reduce the pH where necessary. The consented receiving water pH can therefore be maintained during high discharge events via operational controls.

There is little recent data on dissolved oxygen concentrations in the WTP discharge. Data collected over the period between 2004 to 2010 shows a reasonably consistent discharge dissolved oxygen concentration of between 7 and 11 g/m^3. These concentrations are in line with measured upstream concentrations over the same time period and therefore suggest that the WTP discharge has very little impact (if any) on receiving surface water dissolved oxygen levels.

TSS is largely removed through the treatment process and monitoring data shows WTP discharge TSS concentrations typically below the mdl.

A greater predicted volume of discharged treated water (under Waihi North) is unlikely to have a significant impact on the either the TSS, pH or dissolved oxygen.

The modelled results comply within the existing bounds of the relevant regime discharge consent conditions. Most of the modelled elements are expected to have concentrations well below the relevant compliance standards.

The mass loads for individual elements are all within the implied mass load limits of the existing consent. In the event that discharge concentrations approach the consented concentrations for the operational regime, the RO plant can always be utilised to further improve the treatment process and is a contingency measure available to OGNZL.

For hardness related trace elements, compliance values are likely to be higher than those stated in the existing discharge permit, because the treated water hardness is typically higher (typically above 1,000 g/m^3) than the value used to derive these compliance values.

Table 13 Modelled Discharge Water Quality

	Range of Concentration Operational		Consented Water Quality	
Chemical Parameter	**Modelled 97%ile of Daily Mean**	**Modelled Maximum of Daily Mean**	**Normal Compliance**	**Maximum Compliance**
pH[1]	Not modelled	Not modelled	6.5 – 9.5	
Total Suspended Solids (g/m^3)[1]	Not modelled	Not modelled	8	40
Cyanide, WAD (g/m^3)	0.014	0.023	0.09 – 0.36	0.25 – 1.02
Iron (g/m^3)	0.75	1.60	0.1 – 1.0	0.3 – 6.7
Manganese (g/m^3)	0.01	0.32	0.1 – 1.0	0.4 – 1.3
Copper (g/m^3)[2]	0.013	0.067	0.07 – 0.055	0.05 – 0.13
Nickel (g/m^3)[2]	0.02	0.14		0.42 – 1.2
Zinc (g/m^3)[2]	0.01	0.02		0.27 – 0.8
Silver (g/m^3)[2]	<0.0001	<0.0001	0.007 – 0.02	0.011 – 0.03
Antimony (g/m^3)	0.03	0.06	0.05 – 0.1	0.08 – 0.33
Arsenic (g/m^3)	0.008	0.008		0.02 – 1.45
Selenium (g/m^3)	0.007	0.015	0.05 – 0.22	0.09 – 0.38
Mercury (g/m^3)	0.000	0.003		0.0005
Cadmium (g/m^3)[2]	0.001	0.003		0.003 – 0.008
Chromium VI (g/m^3)	<0.01	<0.01		0.03 – 0.08
Lead (g/m^3)[2]	0.0007	0.0013		0.0006 – 0.02
Ammoniacal N (g/m^3)[3]	6.5	14.1	0.50 – 33.00	2.21 – 384.97

1. Refer to previous note regarding expected pH and TSS
2. Based on a minimum required discharge hardness of between 243 and 670 g/m^3 $CaCO_3$ (dependent of operating regime) to achieve in river hardness of 100 g/m^3. Actual compliance concentrations for these elements vary depending on the recorded hardness in the discharge.
3. Based on discharge pH and temperature. Consent refers to Total Ammonia.

6.3.6 Ohinemuri River Water Quality Compliance

The modelled maximum daily mean and modelled maximum concentrations of the consented trace elements within the Ohinemuri River are provided in Table 14.

OH6 results included within the GoldSim cumulative assessment are representative of downstream water quality and assume full mixing of the WTP discharge and the Ohinemuri River. OH5 farther upstream of OH6 also has to adhere to the same consent conditions as OH6. The results show that water quality within the Ohinemuri River is predicted to be within the consented limits for all consented constituents throughout the LOM. There is one exception in the modelled data with iron modelling a maximum concentration of 1.28 mg/L compared to the consented maximum limit of 1.0 mg/L. This modelled exceedance is considered a low risk and is primarily a function of the conservative source term for WUG inflow water (Fe @ 66 mg/L) and assumed unattenuated and uncaptured mass load from the fully built NRS (29 kg/day). Optimisation of the treatment plant and control of the discharge (ie. limiting discharge during times of elevated iron) should enable long term compliance (if such concentrations are realised) which is not replicated in the modelling undertaken or presented here.

Most modelled parameters model a mean and maximum concentration at least one order of magnitude below the consented limits ensuring there is significant buffer available to account for the underestimation of discharge concentrations.

Based on the results presented it is considered that the receiving environment will be compliant with the consented water quality conditions.

Table 14 Ohinemuri in-stream water quality and modelled water quality at sample location OH6 (modelled years 1 through to year 18)

	OH6 (Modelled Data)		Consented Receiving Water Quality	
Chemical Parameter	**Maximum Daily Mean**	**Max**	**Hardness 20 g/m³ CaCO₃**	**Hardness 100 g/m³ CaCO₃**
pH	Not Modelled		6.5 – 9.5	
Temperature	22.3	26.8	<3°C Rise	
Cyanide, WAD (g/m^3)	0.005	0.025	0.093	0.093
Iron (g/m^3)	0.78	1.28	1.0	1.0
Manganese (g/m^3)	0.054	0.12	2.0	2.0
Copper (g/m^3)	0.0008	0.0029	0.003	0.011
Nickel (g/m^3)	0.0074	0.032	0.04	0.160
Zinc (g/m^3)	0.0052	0.0078	0.027	0.100
Silver (g/m^3)	< 0.0001	< 0.0001	0.00025	0.00284
Antimony (g/m^3)	0.0031	0.012	0.03	0.030
Arsenic (g/m^3)	0.0029	0.0063	0.19	0.190
Selenium (g/m^3)	0.0009	0.0023	0.02	0.020
Mercury (g/m^3)	< 0.00008	< 0.00008	0.000012	0.000012
Cadmium (g/m^3)	0.0002	0.0007	0.0003	0.001
Chromium VI (g/m^3)	< 0.01	< 0.01	0.01	0.01
Lead (g/m^3)	0.0001	0.0004	0.0004	0.0025
TSS (g/m^3)	Not Modelled		+10 g/m^3 compared to upstream where upstream < 100 g/m^3 or <10% increase	
Ammoniacal N (g/m^3)	0.78	2.10	0.189 – 3.0[1]	
Major cations / Anions				
Ca^{2+}	301	1337	N/A	
Mg^{2+}	68	300	N/A	
Na^{+}	60	238	N/A	
K^{+}	11	45	N/A	
SO_4^{2+}	469	999	N/A	

*Trace element concentrations are dissolved

*Where all samples of the monitoring period were below the mdl, the concentration is given as <mdl. Otherwise the mdl is used as the concentration for the specific sample

1. Dependent on temperature and pH. Refer to Table 2 of RC 971323 (and RC 971285, 971311, 971312, 971303-971306). Consent refers to Total Ammonia.

6.3.7 Seasonal Ohinemuri River Water Quality

The predicted water quality fluctuates seasonally. As a large proportion of the mass going through the WTP is from the WUG operations and is modelled as constant throughout the year, in-stream concentrations increase over the summer months (while remaining compliant) as the dilution of the treated water becomes less. This is illustrated for manganese and zinc in Figure 41 and Figure 42 respectively for the modelling year 8. A similar pattern is evident in most of the consented trace elements.

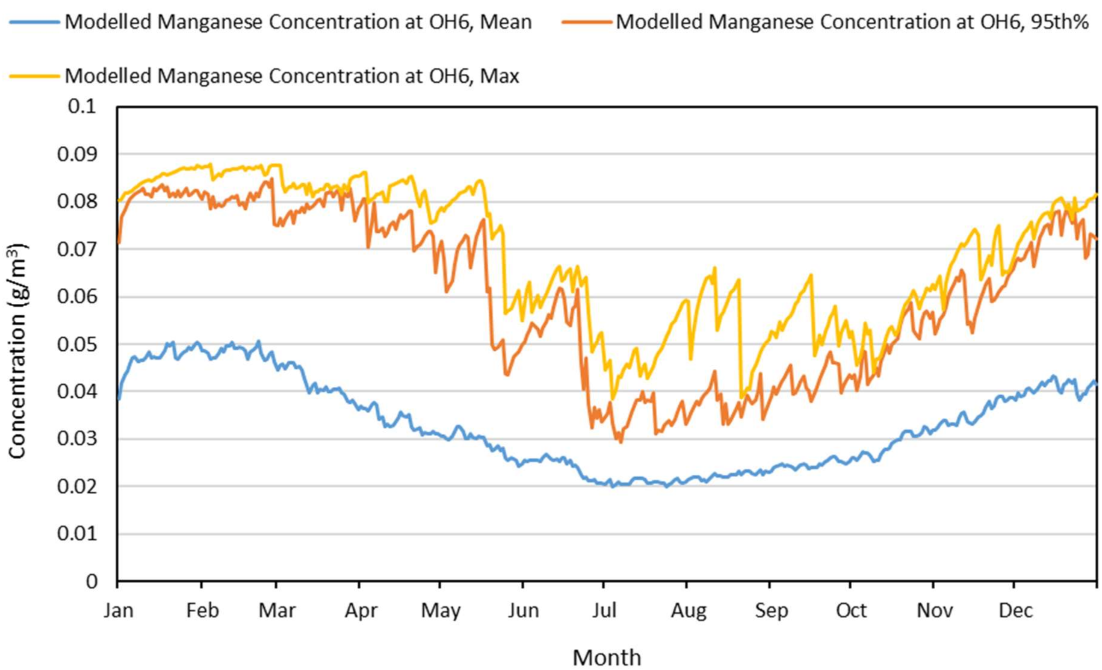


Figure 41 Predicted manganese concentrations at OH6 over year 8

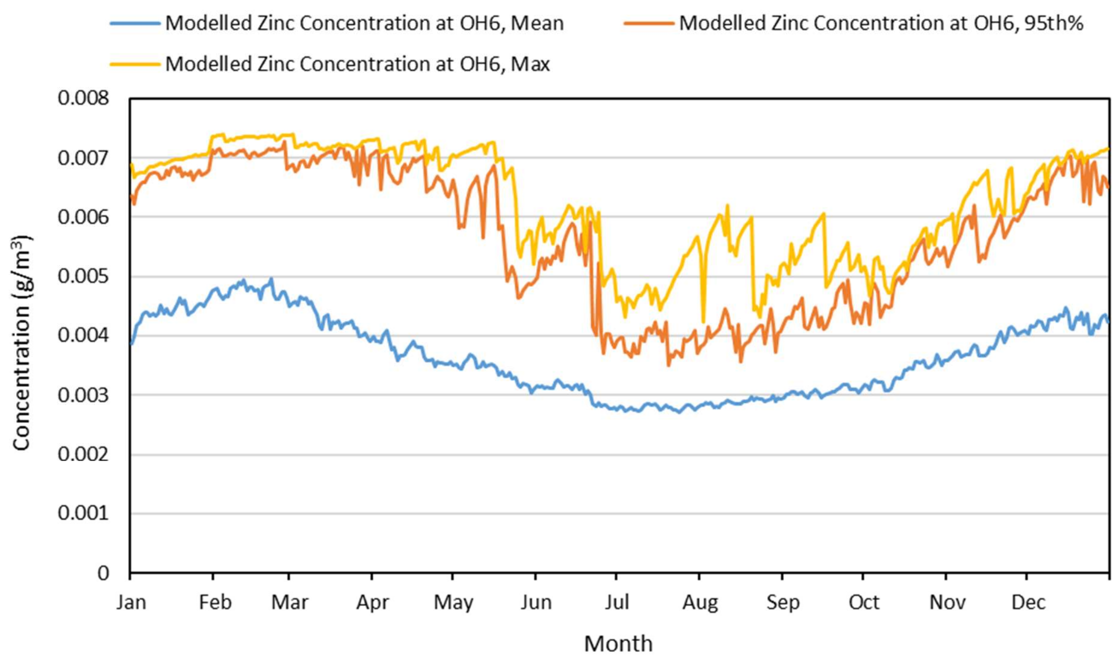


Figure 42 **Predicted zinc concentrations at OH6 over year 8**

6.3.8 LOM Ohinemuri River Water Quality

The receiving surface water quality is expected to vary throughout the LOM and be closely related to the development of Waihi North. The LOM predictions for sulphate and cyanide are illustrated in Figure 43 and Figure 44 respectively. The increasing iron concentrations are closely tied to the development of WUG whereas the predicted WAD cyanide concentrations are more closely tied to the ore processing volumes and tailings development.

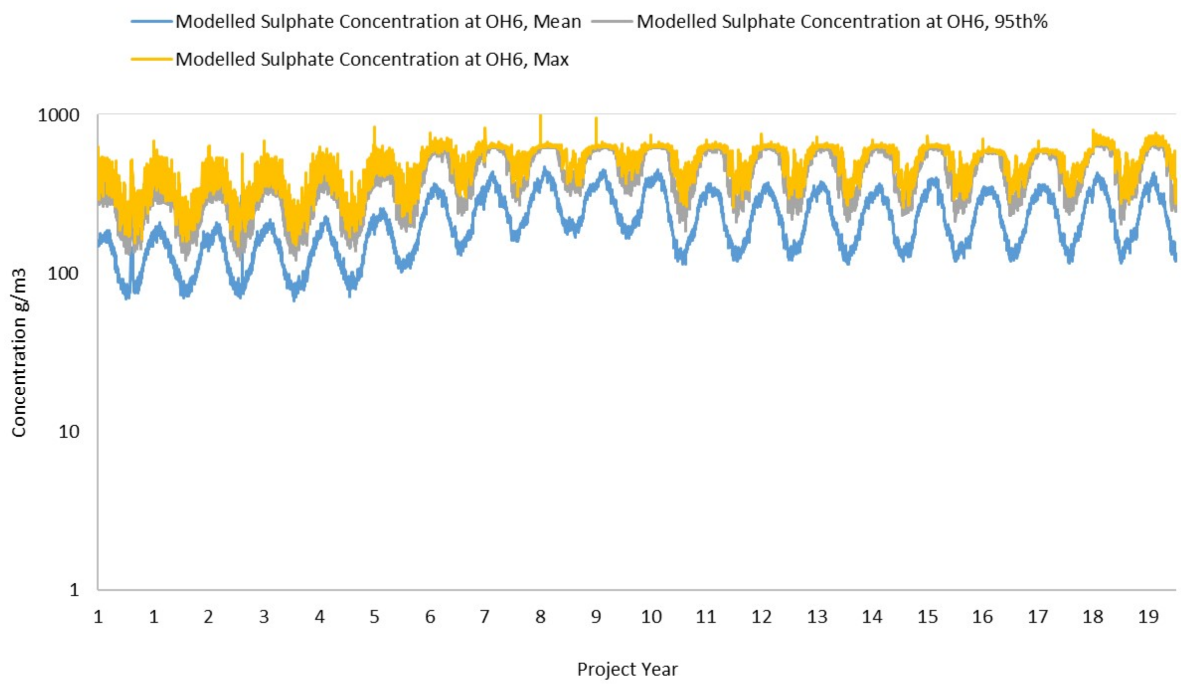


Figure 43 Predicted LOM sulphate concentrations at OH6

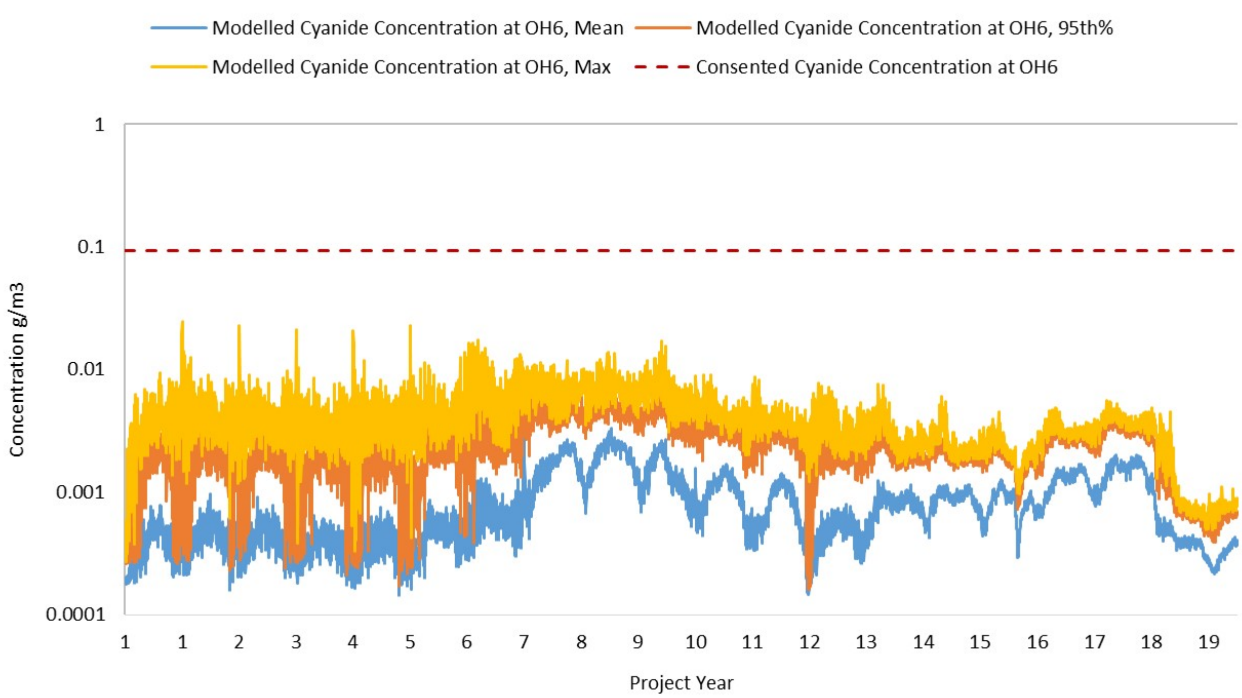


Figure 44 Predicted LOM WAD cyanide concentrations at OH6

7 CONCLUSIONS

Based on the water balance analysis and the assumptions outlined, the Waihi North Project can be implemented using the existing and upgraded WTP functionality and within the currently consented discharge and receiving environment conditions subject to renewal of those consents for an appropriate term. The capacity of the current WTP facilities will require upgrading to cope with the expected volume of water requiring treatment and to process up to the maximum volumes provided for in the existing consent.

Based on the principles of the Waikato Regional Council Erosion and Sediment Control Guidelines being adopted for the design, construction, maintenance and decommissioning as outlined in Southern Skies (2025) and BECA (2025) and the collection and treatment of mine impacted water being directed to the WTP, the project is not expected to cause significant adverse flooding or erosion effects, have significant adverse effects on water quality and/or flow regimes at locations adjacent project infrastructure, at points of discharge to the receiving environment and/or downstream of the project areas.

The estimated volume of water from the WUG Mine has a significant impact on the total volume of water requiring treatment at Waihi. Given the peak flows would not occur until year 8, assumptions relating to the main additional component (the groundwater inflow rates), will be validated well in advance and, importantly, OGNZL will have time to adapt their water management approach in advance of the critical period. In addition, the assumed water chemistry for WUG water sources is considered conservative. As more information on the WUG inflow volumes and ochemistry becomes available, this will be incorporated into the assessment.

There is a modelled risk of surplus of Priority One water sources during summer dry periods once WUG is fully developed. These flows can be managed operationally by one or more of the following measures:

- Excess flows sent to the operational TSF
- Dewatering of MUG/WUG temporarily suspended
- Mine scheduling amendments / changes
- Potential future alternative discharge options

The storage available within the TSFs is shown to be adequate to contain predicted water gains without overflow.

There is a modelled risk to the inundation of deeper stopes in MUG during LOM as WUG water treatment requirements increase. The majority of the stopes (apart from the very deepest ones) show a low risk of inundation. Dewatering in advance (before the critical period) could reduce the risk of this inundation.

Water quality predictions for the LOM as outlined are compliant with existing discharge and receiving environment consent conditions except for some minor modelled exceedances. These modelled exceedances are considered an element of the conservative nature of some of the inputs and assumptions. The current WTP operating regimes suit the expected changes in operation for the Waihi North Project. In the event that water quality parameters are encountered that reflect the conservative outlying data and/or are worse than those anticipated in this report, there is opportunity to utilise the RO plant to mitigate the impact and ensure compliance is maintained. Furthermore, most in-river concentrations are modelled as being one or more orders of magnitude less than the corresponding receiving water compliance criteria ensuring that higher than predicted discharge concentrations are unlikely to lead to non-compliance.

Key differences to current operations that will need to be managed by OGNZL include:

- To meet dewatering targets, the WTP operation will need to focus on maximising the treatment and discharge of minewater to the Ohinemuri River flow. If dewatering targets are not met the impact will be on mine development.
- To decrease the risk of surplus Priority One waters during peak mine development and low summer flow periods, the WTP operation will need to maximise the treatment and discharge of non-Priority One waters when the WTP capacity and river flows allow (to ensure the tailings ponds have capacity if required to receive Priority One water during periods of restricted discharge).
- There will be a number of years where two TSF decant ponds require treatment and the rate of MUG dewatering drops as target depths have been met. However, the large volume of water sourced from the WUG mine means that the proportion of cyanide water remains low and the discharge will be able to be operated at Regime E most of the time.
- The RO plant provides contingency that has not been included in the analysis presented in this report. The RO plant can be used to change Regimes (and increase the allowable discharge) and remove additional contaminant flux if required.

8 RECOMMENDATIONS

This section outlines recommended surface water quality and flow monitoring requirements for the Waihi North Project. Recommendations are centered on the two main receiving surface water bodies : Ohinemuri River (the WTP discharge and downstream of the site discharge) and Mataura Stream; and also Wharekirauponga Stream (located above the WUG Mine).

Ohinemuri River.

OCGNZL currently hold Waikato Regional Council (WRC) resource consent (RC) no. 971318.01.13 to allow the discharge of treated water from the Water Treatment Plant into the Ohinemuri River. WTP discharge monitoring within this consent currently requires water quality monitoring based on the schedule as outlined in Table 15.

Table 15 WTP Discharge and Ohinemuri River Monitoring (currently consented)

Frequency	Site	Parameters
Continuously	WTP Discharge	Flow (at both discharge sites), turbidity, conductivity, pH, temperature
	Frendrups Torrens (Ruddocks)	Flow, temperature
Daily	WTP Discharge	Cyanide (WAD), copper, iron, manganese, suspended solids, ammoniacal N, silver
Weekly	WTP Discharge Ohinemuri River (at location OH5 for discharges at point E1, and location OH6 for discharge at point E2)	Selenium, Antimony
Monthly	WTP Discharge	Parameters listed in condition 14, Table1. (TSS, nickel, zinc, arsenic, mercury, cadmium, chromium (VI), lead, hardness)
Annual	WTP Discharge	Cobalt

It is recommended that the conditions as outlined in Table 15 are updated for the Waihi North Project to reflect the increased volume of treated water discharging to the Ohinemuri River as outlined in Table 16 (highlighted cells indicate recommended changes).

Table 16 WTP Discharge and Ohinemuri River Monitoring (recommended)

Frequency	Site	Parameters
Continuously	WTP Discharge	Flow (at both discharge sites), turbidity, conductivity, pH, temperature
	Frendrups Torrens (Ruddocks)	Flow, temperature
Daily	WTP Discharge	Cyanide (WAD), copper, iron, manganese, suspended solids, ammoniacal N, silver
Weekly	Ohinemuri River (at location OH5 for discharges at point E1, and location OH6 for discharge at point E2)	Selenium, Antimony
Monthly	WTP Discharge	TSS, nickel, zinc, arsenic, mercury, cadmium, chromium (VI), lead, hardness, sulphate, selenium, antimony
	Ohinemuri River (at locations OH5 and OH6)	Cyanide (WAD), copper, iron, manganese, suspended solids, ammoniacal N, silver, TSS, nickel, zinc, arsenic, mercury, cadmium, chromium (VI), lead, hardness, sulphate
Annual	WTP Discharge	Cobalt

In addition, OCGNZL currently holds WRC RC no. 971323 to discharge water from the TSF1a ponds following rehabilitation into an unnamed tributary of the Ohinemuri River. It is recommended that conditions of this consent be applied to discharge water from TSF3 and GOP TSF following rehabilitation.

Mataura Stream

It is recommended flow and water quality monitoring be undertaken at location M10 and flow and water quality monitoring at location M12 for the Waihi North Project as outlined in Table 17.

Table 17 Mataura Stream Monitoring (recommended)

Frequency	Site	Parameters
Continuously	M12	Water level, turbidity, conductivity, pH, temperature
Monthly	M12 / M10	Copper, iron, manganese, suspended solids, ammoniacal N, silver, nickel, zinc, arsenic, mercury, cadmium, chromium (VI), lead, total suspended solids, sulphate

Wharekirauponga Stream

Recommendations for flow monitoring within the Wharekirauponga catchment are summarised in Table 18. In addition, two control sites within the Lignite Stream (to the North) and the Waiharakeke Stream (to the south) are included. There is no proposed surface water discharge from the Waihi North Project into the Wharekirauponga catchment. It is however recommended that surface water sampling be undertaken to coincide with manual flow gauging events on a quarterly basis throughout the project as outlined in Table 18.

Table 18 Wharekirauponga Stream Monitoring (recommended)

Frequency	Site	Parameters
Continuously	WKP01 / WKP03 / T-Stream West / Edmonds Stream, Thompsons Stream, Adams Stream, LS1, LS6, WS2, WHK2.	Water Level
Quarterly	WKP01 / WKP03 / T-Stream West / Edmonds Stream, Thompsons Stream, Adams Stream, LS1, LS6, WS2, WHK2.	Conductivity, pH, turbidity, temperature, copper, iron, manganese, suspended solids, ammoniacal N, silver, nickel, zinc, arsenic, mercury, cadmium, chromium (VI), lead, total suspended solids, sulphate

9 REFERENCES

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WBM

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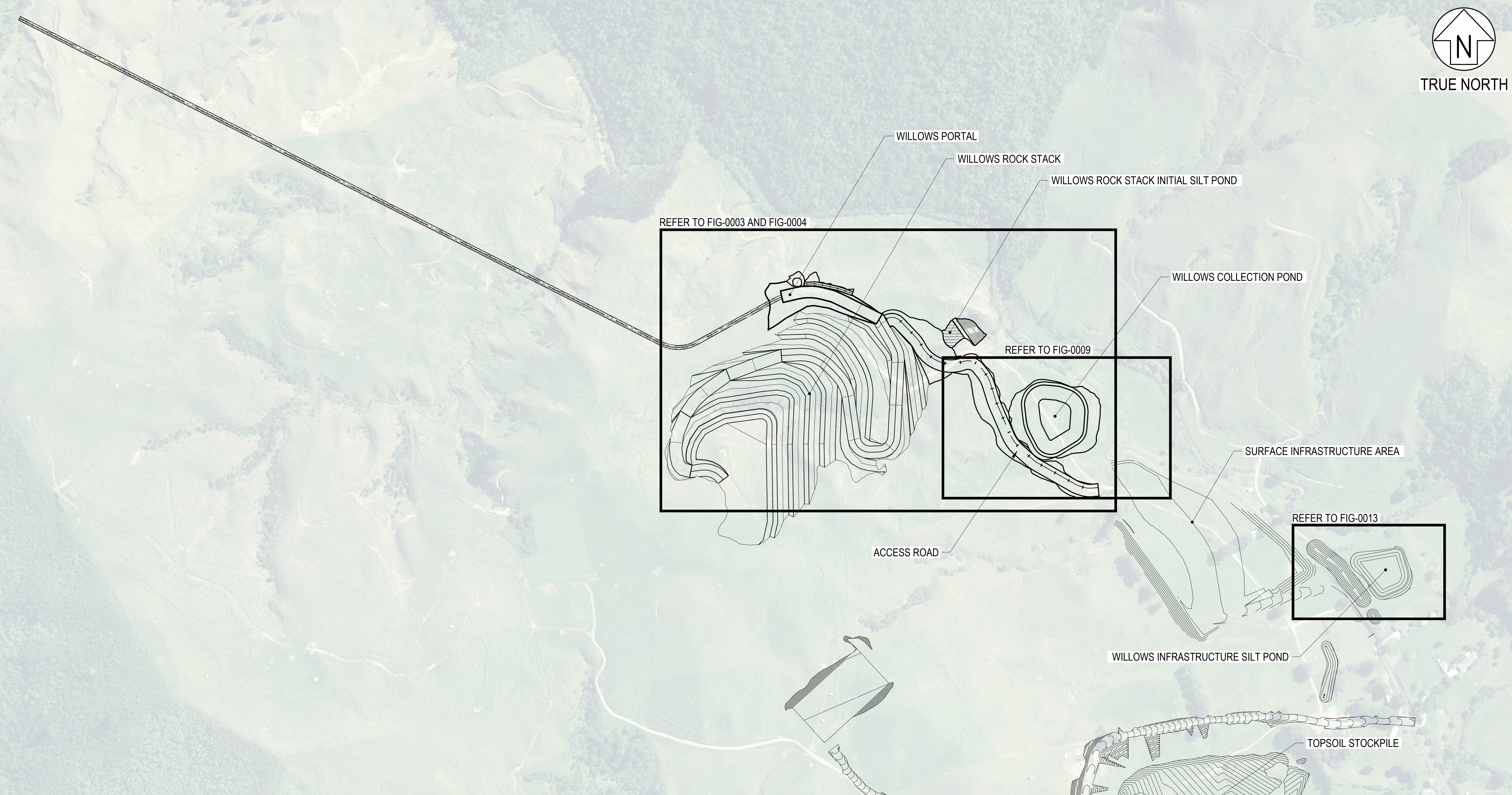
WWLA, 2024b. Martha Underground (MUG) and Wharekirauponga Underground (WUG) Dewatering Rate Predictions. 18 September 2024.

WWLA, 2025. Assessment of Groundwater Effects – Tunnel Elements. Waihi North Project.

Appendices

Appendix A

Willows Infrastructure Layout



NOTES:

1. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
2. AERIAL PHOTO IS DOWNLOADED FROM LINZ DATA SERVICE *https://data.linz.govt.nz/layer/119199-waikato-03m-rural-aerial-photos-2023-2024/* ON 17/07/2024.

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WAI-985-000-DWG-EA-0002

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OCEANAGOLD
WAIHI OPERATION

WAIHI NORTH PROJECT
WILLOWS FARM
GENERAL
SITE PLAN

DRAWN	S.K.	DATE	JOB No	SCALE (A3)	REV.
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Appendix B

Background Water Quality Data

Table 1 Ohinemuri Water Quality – OH3

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as CaCO3	72	6.4	26.0	13.9	12.9
Antimony-Dissolved	g/m^3	78	0.0002	0.0004	0.0002	0.0002
Arsenic-Dissolved	g/m^3	77	0.001	0.002	0.001	0.001
Bicarbonate	g/m^3 at 25°C	72	7.8	29.0	16.9	15.7
Cadmium-Dissolved	g/m^3	77	0.00005	0.00010	0.00005	0.00005
Calcium-Dissolved	g/m^3	77	1.5	9.3	3.1	3.0
Chloride	g/m^3	72	7	14	11	11
Chromium-Hexavalent	g/m^3	77	0.001	0.010	0.009	0.010
Cobalt-Dissolved	g/m^3	74	0.0002	0.0005	0.0002	0.0002
Copper-Dissolved	g/m^3	77	0.0005	0.0012	0.0005	0.0005
Cyanide-Total	g/m^3	72	0.002	0.020	0.002	0.002
Electrical Conductivity	mS/m	77	5.4	13.7	8.5	8.4
Hardness-Total	g/m^3 as CaCO3	77	7.3	38.0	15.7	15.1
Iron-Dissolved	g/m^3	77	0.05	0.33	0.12	0.10
Lead-Dissolved	g/m^3	77	0.0001	0.0002	0.0001	0.0001
Magnesium-Dissolved	g/m^3	77	0.85	3.60	1.90	1.87
Manganese-Dissolved	g/m^3	77	0.0009	0.0690	0.0126	0.0105
Mercury-Dissolved	g/m^3	77	0.00008	0.00008	0.00008	0.00008
Nickel-Dissolved	g/m^3	77	0.0005	0.0010	0.0005	0.0005
Nitrate-N	g/m^3	72	0.10	2.30	0.55	0.53
Nitrate-N + Nitrite-N	g/m^3	72	0.10	2.30	0.55	0.54
Nitrite-N	g/m^3	72	0.1	0.1	0.1	0.1
Total Ammoniacal N	g/m^3	77	0.01	0.23	0.02	0.01
pH	pH units	78	6.3	8.7	7.1	7.1
Potassium-Dissolved	g/m^3	72	1.5	4.9	2.2	2
Selenium-Dissolved	g/m^3	78	0.0002	0.0010	0.0003	0.0002
Sodium-Dissolved	g/m^3	72	4.6	10.8	8.8	8.8
Sulphate	g/m^3	74	3	28	6	5
Zinc-Dissolved	g/m^3	77	0.001	0.007	0.002	0.002

*Data inclusive of sampling undertaken 2020-2024

Table 2 Ohinemuri Water Quality – OH5

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as CaCO3	78	7.3	26.0	16.3	15.3
Antimony-Dissolved	g/m^3	317	0.0002	0.0049	0.0008	0.0005
Arsenic-Dissolved	g/m^3	84	0.001	0.002	0.001	0.001
Bicarbonate	g/m^3 at 25°C	78	8.9	31.0	19.7	18.7
Cadmium-Dissolved	g/m^3	84	0.00005	0.00010	0.00005	0.00005
Calcium-Dissolved	g/m^3	85	2.8	188.0	58.7	44.0
Chloride	g/m^3	78	7	25	14	14
Chromium-Hexavalent	g/m^3	84	0.001	0.010	0.009	0.010
Cobalt-Dissolved	g/m^3	80	0.0002	0.0052	0.0009	0.0006
Copper-Dissolved	g/m^3	85	0.0005	0.0119	0.0011	0.0006
Cyanide-Total	g/m^3	78	0.002	0.020	0.002	0.002
Electrical Conductivity	mS/m	84	7.0	109.7	42.9	36.7
Hardness-Total	g/m^3 as CaCO3	85	13	600	178	139
Iron-Dissolved	g/m^3	84	0.04	0.43	0.10	0.09
Lead-Dissolved	g/m^3	84	0.0001	0.0023	0.0001	0.0001
Magnesium-Dissolved	g/m^3	85	1.2	31.0	7.7	6.0
Manganese-Dissolved	g/m^3	84	0.0046	0.0830	0.0155	0.0126
Mercury-Dissolved	g/m^3	84	0.00008	0.00008	0.00008	0.00008
Nickel-Dissolved	g/m^3	84	0.0005	0.0010	0.0005	0.0005
Nitrate-N	g/m^3	80	0.1	2.8	1.1	1.1
Nitrate-N + Nitrite-N	g/m^3	81	0.1	2.8	1.1	1.2
Nitrite-N	g/m^3	80	0.04	0.34	0.12	0.10
Total Ammoniacal N	g/m^3	87	0.01	1.04	0.20	0.16
pH	pH units	317	6.0	8.8	7.2	7.1
Potassium-Dissolved	g/m^3	78	1.9	6.6	3.6	3.2
Selenium-Dissolved	g/m^3	317	0.0002	0.0053	0.0011	0.0010
Sodium-Dissolved	g/m^3	78	4.8	36.0	15.9	14.7
Sulphate	g/m^3	80	7	580	179	133
Zinc-Dissolved	g/m^3	84	0.001	0.048	0.002	0.002

*Data inclusive of sampling undertaken 2020-2024

Table 3 Ohinemuri Water Quality – OH6

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as $CaCO3$	75	7.4	26.0	16.1	15.6
Antimony-Dissolved	g/m^3	311	0.0002	0.0042	0.0008	0.0005
Arsenic-Dissolved	g/m^3	79	0.001	0.002	0.001	0.001
Bicarbonate	g/m^3 at 25°C	75	9	32	20	19
Cadmium-Dissolved	g/m^3	79	0.00005	0.00010	0.00005	0.00005
Calcium-Dissolved	g/m^3	80	3.3	169.0	62.0	48.0
Chloride	g/m^3	75	10	27	15	14
Chromium-Hexavalent	g/m^3	79	0.001	0.010	0.010	0.010
Cobalt-Dissolved	g/m^3	75	0.0002	0.0048	0.0011	0.0008
Copper-Dissolved	g/m^3	80	0.0005	0.0102	0.0010	0.0006
Cyanide-Total	g/m^3	75	0.002	0.002	0.002	0.002
Electrical Conductivity	mS/m	79	6.9	107.6	45.0	37.7
Hardness-Total	g/m^3 as $CaCO3$	80	13.4	530.0	187.6	148.0
Iron-Dissolved	g/m^3	79	0.05	0.22	0.09	0.09
Lead-Dissolved	g/m^3	79	0.0001	0.0003	0.0001	0.0001
Magnesium-Dissolved	g/m^3	80	1.2	28.0	8.0	6.8
Manganese-Dissolved	g/m^3	79	0.005	0.083	0.023	0.022
Mercury-Dissolved	g/m^3	79	0.00008	0.00008	0.00008	0.00008
Nickel-Dissolved	g/m^3	79	0.0005	0.0010	0.0005	0.0005
Nitrate-N	g/m^3	76	0.12	2.90	1.10	1.12
Nitrate-N + Nitrite-N	g/m^3	77	0.12	2.90	1.18	1.13
Nitrite-N	g/m^3	76	0.05	0.33	0.12	0.10
Total Ammoniacal N	g/m^3	81	0.01	0.71	0.17	0.10
pH	pH units	311	6.3	8.5	7.0	7.1
Potassium-Dissolved	g/m^3	75	2.3	9.4	3.9	3.7
Selenium-Dissolved	g/m^3	311	0.0002	0.0048	0.0011	0.0010
Sodium-Dissolved	g/m^3	75	8.2	50.0	17.0	16.0
Sulphate	g/m^3	75	19	520	189	151
Zinc-Dissolved	g/m^3	79	0.001	0.032	0.003	0.002

*Data inclusive of sampling undertaken 2020-2024

Table 4 Ruahorehore Water Quality – RU1

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as CaCO3	71	7.6	28.0	14.7	13.4
Antimony-Dissolved	g/m^3	76	0.0002	0.0004	0.0002	0.0002
Arsenic-Dissolved	g/m^3	75	0.001	0.002	0.001	0.001
Bicarbonate	g/m^3 at 25°C	71	9.3	34.0	17.8	16.3
Cadmium-Dissolved	g/m^3	75	0.00005	0.00011	0.00005	0.00005
Calcium-Dissolved	g/m^3	75	3.5	52.0	7.2	5.2
Chloride	g/m^3	71	11	17	14	15
Chromium-Hexavalent	g/m^3	75	0.001	0.010	0.010	0.010
Cobalt-Dissolved	g/m^3	73	0.0002	0.0065	0.0014	0.0008
Copper-Dissolved	g/m^3	75	0.0005	0.0010	0.0005	0.0005
Cyanide-Total	g/m^3	71	0.002	0.002	0.002	0.002
Electrical Conductivity	mS/m	75	7.5	41.0	14.5	14.0
Hardness-Total	g/m^3 as CaCO3	75	14.7	164.0	29.5	24.0
Iron-Dissolved	g/m^3	75	0.06	0.36	0.17	0.16
Lead-Dissolved	g/m^3	75	0.0001	0.0002	0.0001	0.0001
Magnesium-Dissolved	g/m^3	75	1.4	8.0	2.8	2.6
Manganese-Dissolved	g/m^3	75	0.0088	0.2400	0.0374	0.0290
Mercury-Dissolved	g/m^3	75	0.00008	0.00008	0.00008	0.00008
Nickel-Dissolved	g/m^3	75	0.0005	0.0031	0.0006	0.0005
Nitrate-N	g/m^3	71	0.10	3.20	0.70	0.64
Nitrate-N + Nitrite-N	g/m^3	71	0.10	3.20	0.70	0.64
Nitrite-N	g/m^3	71	0.1	0.1	0.1	0.1
Total Ammoniacal N	g/m^3	75	0.01	0.18	0.02	0.01
pH	pH units	76	6.3	7.4	7.0	7.0
Potassium-Dissolved	g/m^3	71	2.9	6.6	4.0	3.8
Selenium-Dissolved	g/m^3	76	0.0002	0.0020	0.0003	0.0003
Sodium-Dissolved	g/m^3	71	7.8	26.0	13.6	11.7
Sulphate	g/m^3	73	9	143	25	23
Zinc-Dissolved	g/m^3	75	0.001	0.020	0.004	0.003

*Data inclusive of sampling undertaken 2020-2024

Table 5 Mataura Stream Water Quality - M12

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as $CaCO_3$	16	6.6	15.2	9.3	8.8
Aluminium-Dissolved	g/m^3	12	0.018	0.132	0.039	0.030
Antimony-Dissolved	g/m^3	12	0.0002	0.0002	0.0002	0.0002
Arsenic-Dissolved	g/m^3	16	0.001	0.001	0.001	0.001
Bicarbonate	g/m^3 at 25°C	16	8.0	18.5	11.3	10.7
Boron-Dissolved	g/m^3	12	0.01	0.01	0.01	0.01
Cadmium-Dissolved	g/m^3	12	0.00005	0.00005	0.00005	0.00005
Calcium-Dissolved	g/m^3	16	1.8	3.0	2.3	2.3
Chloride	g/m^3	16	6	10	9	9
Chromium-Dissolved	g/m^3	12	0.0005	0.0005	0.0005	0.0005
Cobalt-Dissolved	g/m^3	12	0.0002	0.0002	0.0002	0.0002
Copper-Dissolved	g/m^3	12	0.0005	0.0005	0.0005	0.0005
Electrical Conductivity	mS/m	16	5.2	6.9	6.2	6.2
Hardness-Total	g/m^3 as $CaCO_3$	16	8.7	13.6	11.2	11.2
Iron-Dissolved	g/m^3	16	0.02	0.07	0.03	0.03
Lead-Dissolved	g/m^3	12	0.0001	0.0001	0.0001	0.0001
Magnesium-Dissolved	g/m^3	16	1.02	1.58	1.33	1.31
Manganese-Dissolved	g/m^3	16	0.001	0.004	0.002	0.002
Mercury-Dissolved	g/m^3	12	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	12	0.0002	0.0002	0.0002	0.0002
Nickel-Dissolved	g/m^3	12	0.0005	0.0005	0.0005	0.0005
Nitrate-N	g/m^3	16	0.04	0.24	0.11	0.012
Nitrate-N + Nitrite-N	g/m^3	16	0.04	0.24	0.11	0.012
Nitrite-N	g/m^3	16	0.002	0.002	0.002	0.002
pH	pH units	16	6.3	7.2	6.9	6.9
Potassium-Dissolved	g/m^3	16	0.91	1.22	1.02	1.01
Sodium-Dissolved	g/m^3	16	6.1	7.4	6.9	6.9
Sulphate	g/m^3	16	5	10	8	9
Zinc-Dissolved	g/m^3	12	0.001	0.015	0.002	0.001

*Data inclusive of sampling undertaken 2020-2024

Table 6 Mataura Stream Water Quality - R12

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as $CaCO_3$	3	7.5	11	9	8.4
Aluminium-Dissolved	g/m^3	2	0.029	0.047	0.038	0.038
Antimony-Dissolved	g/m^3	2	0.0002	0.0002	0.0002	0.0002
Arsenic-Dissolved	g/m^3	3	0.001	0.001	0.001	0.001
Bicarbonate	g/m^3 at 25°C	3	9.1	13.4	10.9	10.2
Boron-Dissolved	g/m^3	2	0.01	0.01	0.01	0.01
Cadmium-Dissolved	g/m^3	2	0.00005	0.00005	0.00005	0.00005
Calcium-Dissolved	g/m^3	3	1.37	1.81	1.59	1.59
Chloride	g/m^3	3	7	9	8	9
Chromium-Dissolved	g/m^3	2	0.0006	0.0007	0.0007	0.0007
Cobalt-Dissolved	g/m^3	2	0.0002	0.0002	0.0002	0.0002
Copper-Dissolved	g/m^3	2	0.0005	0.0005	0.0005	0.0005
Electrical Conductivity	mS/m	3	5.3	6.4	5.9	6.1
Hardness-Total	g/m^3 as $CaCO_3$	3	7.1	9.1	8.3	8.6
Iron-Dissolved	g/m^3	3	0.04	0.06	0.05	0.04
Lead-Dissolved	g/m^3	2	0.0001	0.0001	0.0001	0.0001
Magnesium-Dissolved	g/m^3	3	0.9	1.1	1.0	1.1
Manganese-Dissolved	g/m^3	3	0.002	0.025	0.010	0.003
Mercury-Dissolved	g/m^3	2	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	2	0.0002	0.0002	0.0002	0.0002
Nickel-Dissolved	g/m^3	2	0.0005	0.0005	0.0005	0.0005
Nitrate-N	g/m^3	3	0.37	0.73	0.58	0.65
Nitrate-N + Nitrite-N	g/m^3	3	0.37	0.73	0.58	0.65
Nitrite-N	g/m^3	3	0.002	0.002	0.002	0.002
pH	pH units	3	6.4	6.7	6.6	6.6
Potassium-Dissolved	g/m^3	3	1.15	1.25	1.18	1.15
Sodium-Dissolved	g/m^3	3	6.2	7.6	7.1	7.4
Sulphate	g/m^3	3	6	7	6	6
Zinc-Dissolved	g/m^3	2	0.001	0.003	0.002	0.002

*Data inclusive of sampling undertaken 2020-2024

Table 7 Mataura Stream Water Quality - M10

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as $CaCO_3$	3	6.6	9.9	8.5	8.9
Aluminium-Dissolved	g/m^3	2	0.52	0.054	0.053	0.053
Antimony-Dissolved	g/m^3	2	0.0002	0.0002	0.0002	0.0002
Arsenic-Dissolved	g/m^3	3	0.001	0.001	0.001	0.001
Bicarbonate	g/m^3 at 25°C	3	8.0	12.0	10.3	10.8
Boron-Dissolved	g/m^3	2	0.01	0.01	0.01	0.01
Cadmium-Dissolved	g/m^3	2	0.00005	0.00005	0.00005	0.00005
Calcium-Dissolved	g/m^3	3	1.8	2.6	2.2	2.1
Chloride	g/m^3	3	8	10	9	9
Chromium-Dissolved	g/m^3	2	0.0005	0.0005	0.0005	0.0005
Cobalt-Dissolved	g/m^3	2	0.0002	0.0002	0.0002	0.0002
Copper-Dissolved	g/m^3	2	0.0005	0.0005	0.0005	0.0005
Electrical Conductivity	mS/m	3	5.2	6.5	5.9	6.1
Hardness-Total	g/m^3 as $CaCO_3$	3	8.7	11.7	10.2	10.2
Iron-Dissolved	g/m^3	3	0.02	0.03	0.03	0.03
Lead-Dissolved	g/m^3	2	0.0001	0.0001	0.0001	0.0001
Magnesium-Dissolved	g/m^3	3	1.02	1.29	1.18	1.22
Manganese-Dissolved	g/m^3	3	0.002	0.004	0.003	0.003
Mercury-Dissolved	g/m^3	2	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	2	0.0002	0.0002	0.0002	0.0002
Nickel-Dissolved	g/m^3	2	0.0005	0.0005	0.0005	0.0005
Nitrate-N	g/m^3	3	0.03	0.21	0.13	0.16
Nitrate-N + Nitrite-N	g/m^3	3	0.03	0.21	0.13	0.16
Nitrite-N	g/m^3	3	0.002	0.002	0.002	0.002
pH	pH units	3	6.5	7.2	6.8	6.8
Potassium-Dissolved	g/m^3	3	0.89	1.01	0.95	0.94
Sodium-Dissolved	g/m^3	3	6.2	7.1	6.7	6.7
Sulphate	g/m^3	3	6	9	8	9
Zinc-Dissolved	g/m^3	2	0.001	0.002	0.002	0.002

*Data inclusive of sampling undertaken 2020-2024

Table 8 Mataura Stream Water Quality - R11

Analytes	Units	Count	Minimum	Maximum
Alkalinity - Total	g/m^3as $CaCO_3$	2	6.9	9.2
Aluminium-Dissolved	g/m^3	1	0.029	0.029
Antimony-Dissolved	g/m^3	1	0.0002	0.0002
Arsenic-Dissolved	g/m^3	2	0.001	0.001
Bicarbonate	g/m^3at 25°C	2	8.4	11.2
Boron-Dissolved	g/m^3	1	0.01	0.01
Cadmium-Dissolved	g/m^3	1	0.00005	0.00005
Calcium-Dissolved	g/m^3	2	1.09	1.22
Chloride	g/m^3	2	7	8
Chromium-Dissolved	g/m^3	1	0.0005	0.0005
Cobalt-Dissolved	g/m^3	1	0.0002	0.0002
Copper-Dissolved	g/m^3	1	0.0005	0.0005
Electrical Conductivity	mS/m	2	5.0	5.6
Hardness-Total	g/m^3as $CaCO_3$	2	5.8	6.4
Iron-Dissolved	g/m^3	2	0.14	0.64
Lead-Dissolved	g/m^3	11	0.0001	0.0001
Magnesium-Dissolved	g/m^3	2	0.74	0.82
Manganese-Dissolved	g/m^3	2	0.0148	0.032
Mercury-Dissolved	g/m^3	1	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	1	0.0002	0.0002
Nickel-Dissolved	g/m^3	1	0.0005	0.0005
Nitrate-N	g/m^3	2	0.05	0.25
Nitrate-N + Nitrite-N	g/m^3	2	0.05	0.25
Nitrite-N	g/m^3	2	0.002	0.004
pH	pH units	2	6.3	6.8
Potassium-Dissolved	g/m^3	2	0.92	1.31
Sodium-Dissolved	g/m^3	2	6.5	7.8
Sulphate	g/m^3	2	7	8
Zinc-Dissolved	g/m^3	1	0.0018	0.0018

*Data inclusive of sampling undertaken 2020-2024

Table 8 T Stream West Water Quality

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m3as CaCO3	24	12.8	26.0	17.2	17.4
Aluminium-Dissolved	g/m3	16	0.007	0.030	0.016	0.016
Antimony-Dissolved	g/m3	16	0.0002	0.0020	0.0003	0.0002
Arsenic-Dissolved	g/m3	24	0.001	0.010	0.001	0.001
Bicarbonate	g/m3at 25°C	24	15.6	31.0	20.8	21.0
Boron-Dissolved	g/m3	16	0.007	0.050	0.011	0.009
Cadmium-Dissolved	g/m3	16	0.00005	0.00050	0.00008	0.00005
Calcium-Dissolved	g/m3	24	2.4	4.4	3.2	3.3
Chloride	g/m3	24	5	10	8	8
Chromium-Dissolved	g/m3	16	0.0005	0.0050	0.0008	0.0005
Cobalt-Dissolved	g/m3	16	0.0002	0.0020	0.0003	0.0002
Copper-Dissolved	g/m3	16	0.0005	0.0050	0.0008	0.0005
Electrical Conductivity	mS/m	24	5.8	7.9	6.7	6.5
Hardness-Total	g/m3as CaCO3	23	10.7	19.2	14.3	14.5
Iron-Dissolved	g/m3	24	0.02	0.020	0.03	0.02
Lead-Dissolved	g/m3	16	0.0001	0.0010	0.0002	0.0001
Magnesium-Dissolved	g/m3	24	1.2	2.0	1.5	1.5
Manganese-Dissolved	g/m3	24	0.0005	0.0050	0.0007	0.0005
Mercury-Dissolved	g/m3	16	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m3	16	0.0002	0.0020	0.0003	0.0002
Nickel-Dissolved	g/m3	16	0.0005	0.0050	0.0008	0.0005
Nitrate-N	g/m3	23	0.01	0.05	0.03	0.03
Nitrate-N + Nitrite-N	g/m3	24	0.01	0.05	0.03	0.03
Nitrite-N	g/m3	23	0.002	0.002	0.002	0.002
pH	pH units	24	6.3	7.6	7.2	7.2
Potassium-Dissolved	g/m3	24	0.86	1.12	0.97	0.96
Sodium-Dissolved	g/m3	24	6.4	8.0	7.3	7.5
Sulphate	g/m3	24	5	20	6	5
Zinc-Dissolved	g/m3	16	0.001	0.010	0.002	0.001

*Data inclusive of sampling undertaken 2020-2024

Table 9 T Stream East Water Quality

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m3as CaCO3	23	12.6	22.0	16.8	17.1
Aluminium-Dissolved	g/m3	15	0.01	0.03	0.02	0.02
Antimony-Dissolved	g/m3	15	0.0002	0.0020	0.0003	0.0002
Arsenic-Dissolved	g/m3	23	0.001	0.010	0.001	0.001
Bicarbonate	g/m3at 25°C	23	15.3	26.0	20.4	21.0
Boron-Dissolved	g/m3	15	0.01	0.05	0.01	0.01
Cadmium-Dissolved	g/m3	15	0.00005	0.00050	0.00008	0.00005
Calcium-Dissolved	g/m3	23	2.4	4.4	3.2	3.2
Chloride	g/m3	23	5	10	8	8
Chromium-Dissolved	g/m3	15	0.0005	0.0050	0.0008	0.0005
Cobalt-Dissolved	g/m3	15	0.0002	0.0020	0.0003	0.0002
Copper-Dissolved	g/m3	15	0.0005	0.0050	0.0009	0.0005
Electrical Conductivity	mS/m	23	5.9	7.8	6.6	6.5
Hardness-Total	g/m3as CaCO3	22	10.9	19.2	14.2	14.0
Iron-Dissolved	g/m3	23	0.02	0.20	0.03	0.02
Lead-Dissolved	g/m3	15	0.0001	0.0010	0.0002	0.0001
Magnesium-Dissolved	g/m3	23	1.2	2.0	1.5	1.5
Manganese-Dissolved	g/m3	23	0.0005	0.0050	0.0007	0.0005
Mercury-Dissolved	g/m3	15	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m3	15	0.0002	0.0020	0.0003	0.0002
Nickel-Dissolved	g/m3	15	0.0005	0.0050	0.0008	0.0005
Nitrate-N	g/m3	22	0.01	0.05	0.03	0.03
Nitrate-N + Nitrite-N	g/m3	23	0.01	0.05	0.03	0.03
Nitrite-N	g/m3	22	0.002	0.002	0.002	0.002
pH	pH units	23	6.3	7.5	7.2	7.3
Potassium-Dissolved	g/m3	23	0.86	1.14	0.98	0.96
Sodium-Dissolved	g/m3	23	6.7	8.1	7.4	7.4
Sulphate	g/m3	23	5	7	5	5
Zinc-Dissolved	g/m3	15	0.001	0.010	0.002	0.001

*Data inclusive of sampling undertaken 2020-2024

Table 10 WKP01 Water Quality

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as $CaCO_3$	20	10.8	22.0	16.5	17.3
Aluminium-Dissolved	g/m^3	12	0.006	0.114	0.033	0.0165
Antimony-Dissolved	g/m^3	12	0.0002	0.0002	0.0002	0.0002
Arsenic-Dissolved	g/m^3	20	0.001	0.001	0.001	0.001
Bicarbonate	g/m^3 at 25°C	20	13.2	26.0	19.9	20.5
Boron-Dissolved	g/m^3	12	0.009	0.0012	0.010	0.010
Cadmium-Dissolved	g/m^3	12	0.00005	0.00005	0.00005	0.00005
Calcium-Dissolved	g/m^3	20	2.0	4.3	3.0	3.1
Chloride	g/m^3	20	6	11	9.2	9.5
Chromium-Dissolved	g/m^3	12	0.0005	0.0009	0.0006	0.0005
Cobalt-Dissolved	g/m^3	12	0.0002	0.0002	0.0002	0.0002
Copper-Dissolved	g/m^3	12	0.0005	0.0005	0.0005	0.0005
Electrical Conductivity	mS/m	20	5.6	8.5	7.0	6.9
Hardness-Total	g/m^3 as $CaCO_3$	19	9.9	19.5	13.7	13.3
Iron-Dissolved	g/m^3	20	0.02	0.05	0.03	0.02
Lead-Dissolved	g/m^3	12	0.0001	0.0003	0.0001	0.0001
Magnesium-Dissolved	g/m^3	20	1.16	2.10	1.56	1.56
Manganese-Dissolved	g/m^3	20	0.0005	0.0028	0.0012	0.0011
Mercury-Dissolved	g/m^3	12	0.00008	0.00008	0.000008	0.00008
Molybdenum-Dissolved	g/m^3	12	0.0002	0.0002	0.0002	0.0002
Nickel-Dissolved	g/m^3	12	0.0005	0.0005	0.0005	0.0005
Nitrate-N	g/m^3	19	0.002	0.026	0.006	0.002
Nitrate-N + Nitrite-N	g/m^3	20	0.002	0.027	0.006	0.003
Nitrite-N	g/m^3	19	0.002	0.002	0.002	0.002
pH	pH units	20	6.3	7.6	7.2	7.3
Potassium-Dissolved	g/m^3	20	1.01	1.65	1.25	1.23
Sodium-Dissolved	g/m^3	20	6.9	9.3	8.0	7.9
Sulphate	g/m^3	20	2	8	5	5
Zinc-Dissolved	g/m^3	12	0.001	0.001	0.001	0.001

*Data inclusive of sampling undertaken 2020-2024

Table 11 WKP02 Water Quality

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as $CaCO_3$	24	11.6	24.0	16.9	17.3
Aluminium-Dissolved	g/m^3	16	0.008	0.060	0.024	0.017
Antimony-Dissolved	g/m^3	16	0.002	0.0002	0.0002	0.0002
Arsenic-Dissolved	g/m^3	24	0.001	0.001	0.001	0.001
Bicarbonate	g/m^3 at 25°C	24	14.1	29.0	20.5	21.0
Boron-Dissolved	g/m^3	16	0.008	0.012	0.009	0.009
Cadmium-Dissolved	g/m^3	16	0.00005	0.00005	0.00005	0.00005
Calcium-Dissolved	g/m^3	24	2.3	4.7	3.2	3.2
Chloride	g/m^3	24	5	12	9	9
Chromium-Dissolved	g/m^3	16	0.0005	0.0006	0.0005	0.0005
Cobalt-Dissolved	g/m^3	16	0.0002	0.0002	0.0002	0.0002
Copper-Dissolved	g/m^3	16	0.0005	0.0005	0.0005	0.0005
Electrical Conductivity	mS/m	24	5.8	8.7	7.0	6.8
Hardness-Total	g/m^3 as $CaCO_3$	23	10.6	20.0	14.1	13.7
Iron-Dissolved	g/m^3	24	0.02	0.04	0.03	0.02
Lead-Dissolved	g/m^3	16	0.0001	0.0001	0.0001	0.0001
Magnesium-Dissolved	g/m^3	24	1.18	2.00	1.51	1.52
Manganese-Dissolved	g/m^3	24	0.0005	0.0038	0.0023	0.0024
Mercury-Dissolved	g/m^3	16	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	16	0.0002	0.0002	0.0002	0.0002
Nickel-Dissolved	g/m^3	16	0.0005	0.0005	0.0005	0.0005
Nitrate-N	g/m^3	23	0.004	0.039	0.016	0.05
Nitrate-N + Nitrite-N	g/m^3	24	0.004	0.039	0.017	0.016
Nitrite-N	g/m^3	23	0.002	0.002	0.002	0.002
pH	pH units	24	6.9	7.9	7.3	7.2
Potassium-Dissolved	g/m^3	24	0.99	1.59	1.20	1.19
Sodium-Dissolved	g/m^3	24	6.5	8.7	7.6	7.6
Sulphate	g/m^3	24	3	8	5	5
Zinc-Dissolved	g/m^3	16	0.001	0.001	0.001	0.001

*Data inclusive of sampling undertaken 2020-2024

Table 12 WKP03 Water Quality

Analytes	Units	Count	Minimum	Maximum	Mean	Median
Alkalinity - Total	g/m^3 as $CaCO_3$	24	11.7	22.0	17.2	17.7
Aluminium-Dissolved	g/m^3	16	0.006	0.059	0.021	0.017
Antimony-Dissolved	g/m^3	16	0.0002	0.0002	0.0002	0.0002
Arsenic-Dissolved	g/m^3	24	0.001	0.002	0.001	0.001
Bicarbonate	g/m^3 at 25°C	24	14.2	27.0	21.0	22.0
Boron-Dissolved	g/m^3	16	0.008	0.012	0.009	0.009
Cadmium-Dissolved	g/m^3	16	0.00005	0.00005	0.00005	0.00005
Calcium-Dissolved	g/m^3	24	2.3	4.9	3.4	3.5
Chloride	g/m^3	24	5	11	9	9
Chromium-Dissolved	g/m^3	16	0.0005	0.0005	0.0005	0.0005
Cobalt-Dissolved	g/m^3	16	0.0002	0.0002	0.0002	0.0002
Copper-Dissolved	g/m^3	16	0.0005	0.0014	0.0006	0.0005
Electrical Conductivity	mS/m	24	5.6	8.5	7.0	6.9
Hardness-Total	g/m^3 as $CaCO_3$	23	10.5	21.0	14.7	15.1
Iron-Dissolved	g/m^3	24	0.02	0.05	0.03	0.03
Lead-Dissolved	g/m^3	16	0.0001	0.0001	0.0001	0.0001
Magnesium-Dissolved	g/m^3	24	1.18	2.00	1.52	1.53
Manganese-Dissolved	g/m^3	24	0.0032	0.0087	0.0055	0.0050
Mercury-Dissolved	g/m^3	16	0.00008	0.00008	0.00008	0.00008
Molybdenum-Dissolved	g/m^3	16	0.0002	0.0002	0.0002	0.0002
Nickel-Dissolved	g/m^3	16	0.0005	0.0005	0.0005	0.0005
Nitrate-N	g/m^3	23	0.004	0.079	0.020	0.017
Nitrate-N + Nitrite-N	g/m^3	24	0.004	0.079	0.020	0.018
Nitrite-N	g/m^3	23	0.002	0.002	0.002	0.002
pH	pH units	24	6.3	7.5	7.1	7.2
Potassium-Dissolved	g/m^3	24	0.99	1.66	1.24	1.25
Sodium-Dissolved	g/m^3	24	6.7	8.6	7.7	7.7
Sulphate	g/m^3	24	5	7	6	5
Zinc-Dissolved	g/m^3	16	0.001	0.004	0.001	0.001

*Data inclusive of sampling undertaken 2020-2024

Appendix C

Site Water Balance Model

C-1 Model Description

A water balance model was used to assess how water gains change over the life of the mine and to check that proposed infrastructure for conveyance, storage and treatment will be adequate. The GoldSim water balance model described in this section was first developed in 2012 as an initiative of the site environmental team. The objective in building the model was to have a tool to forecast storage requirements in the TSF's in the future (i.e. to check embankment construction was aligned) and as an ongoing check that the site water management infrastructure as a whole had capacity for ongoing mine development. The model was also used to predict water treatment requirements post closure as a component of annual bond calculations.

Given the model has been calibrated against the site water balance and in use for some time there is confidence that it does represent well the quantities of water generated from the different water sources that require treatment.

The model has been recalibrated against 2015 to 2017 site operation data and modified to represent the changes to the mine plan development timeframe and additional water quantities requiring treatment under the Waihi North Project.

C-2 Introduction to GoldSim

GoldSim (refer www.goldsim.com) is a software package designed to run Monte Carlo simulations for probabilistic analysis of dynamic systems. The software package essentially provides a visual interface for an excel spreadsheet type programming environment. Within the visual interface, elements are created to represent processes and events using equations and logic based decisions.

GoldSim allows user interfaces (dashboards) to be created which are used to specify model inputs and variable data before or during simulations. Models developed in GoldSim with appropriate dashboards can be exported as an executable program that can be run with the freely available GoldSim player software.

GoldSim includes features which make it a suitable tool for water balance modelling. These include; user specified time stepping, dimensional awareness and a range of programmed elements that can be implemented. Model updates can be scheduled to occur at user specified time steps for the duration of a simulation and these can be specified to complement input data resolution such as rainfall or river flow. To improve modelling accuracy unscheduled model updates are also included to capture dynamic processes such as the time at which a reservoir begins to overflow or a discrete event is triggered.

Dimensions are specified for all input data and an internal database is applied to unit conversions to ensure consistency throughout the model. Within the GoldSim interface programmed elements are implemented to simulate a variety of dynamic and discrete events.

The range of elements that are useful for water balance modelling include;

- Containers – allow a model to be subdivided into sub-systems, for example, individual catchments or processes.
- Inputs – this category of elements allow initial conditions to be specified and lookup tables to be defined containing information such as daily rainfall.
- Stocks – these elements capture how the state of a system changes with time and can represent reservoirs, ponds or other stores.
- Functions – these elements define processes or decisions at each model update, for example, calculating catchment runoff or the current discharge quality. Scripts can also be written to simulate complex behaviour or iterative processes.
- Events – events can be set to occur at a given point in time or can be triggered where specified conditions are met. This allows conditions within the simulation to be changed, such as specifying a date from which a pond can safely overflow.
- Delays – delay elements account for the time that it takes information or material to pass from one point to another, for example, water to be treated then discharged.
- Results – results can be recorded to display final model conditions or the dynamic behaviour of a system over the simulation period. GoldSim enables model results to be viewed as deterministic for individual realisations or probabilistic where multiple model realisations have been run.

Using these features detailed water balance models can be produced which simulate short term system responses and long-term behaviour under a range of conditions.

C-3 Waihi North Water Balance

C-3-1 Model Categories

The aim of the Waihi North Water Balance Model (WBM) is to capture all significant water movements across the site affected by mine operations. This is achieved through accounting for water sources, sinks and processes within the WBM that are summarised in the following categories:

- Rainfall on catchment areas
- Ohinemuri River flow
- Mine dewatering
- Seepage flow
- Sinks
- Evaporation
- Retained moisture
- Processes
- Pump rates
- Overflow rates
- Ore processing
- Water treatment rates

The WBM is run as a probabilistic simulation for the duration of the Waihi North Project where the sources and model time step are defined at daily intervals. For each year modelled an annual rainfall time series is randomly selected from the database of daily rainfall records between 1916 and 2016. The model is run for 1000 realisations of the full project duration and statistical results are generated considering all realisations.

Figure 1 shows a schematic of the WBM where each of the elements represents a container enclosing a model to represent the localised system. Linking each of the containers are arrows, which indicate the flow of water through the model.

The colour coding of the arrows indicates the water type, where water requiring cyanide removal is red, minewater is grey, tailings slurry is brown and clean river water is blue. The following sub-sections contain a description of each of these containers and their functions.

The WBM also includes functions to model water quality within the water management system. Contaminant concentrations are modelled from each source and a mass balance determines the discharge quality of water processed through the WTP.

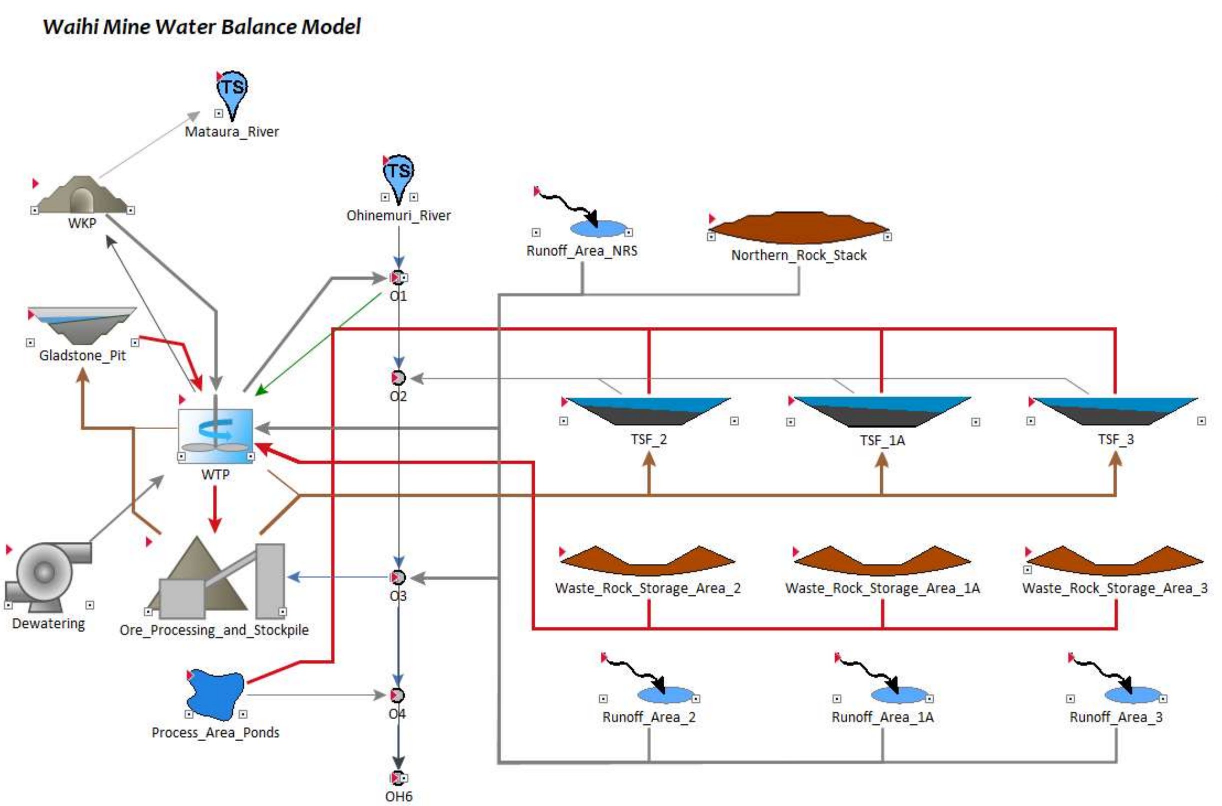

Figure 1 Waihi WBM Outline

C-3-2 Sources

Rainfall

Measured rainfall data is used to calculate runoff for each catchment area included in the Waihi North Project. Daily rainfall data was sourced from local rain gauges for the 100 simulation years between 1917 and 2016. Measurements are taken from; Cliflow agent 1550 (station B75381) for the period of 1/1/1917 to 1/1/1990, Newmont data for 1990 to 2010 infilled with Cliflow VCS (station P198205) data, and the Waihi met station for 2011 to 2016 in-filled with B75495 and Mill gauge data. These data have been utilised as representative of the operations at Waihi.

In addition rainfall data from the Golden Cross rainfall gauge (NZTM 1846987, 5865767) and a rainfall gauge within the Wharekirauponga catchment has been utilised to calculate runoff for the catchments associated with the Wharekirauponga component of the project (Ohinemuri and Wharekirauponga catchments respectively). The Golden Cross rainfall gauge includes records from 1991 to present and the Wharekirauponga rainfall gauge including records from 2019 to present. Records have been extended by extrapolation from the overlapping period with the extended Waihi data set.

Runoff Areas

Daily rainfall on each catchment area determines the flow into associated ponds.

All collection ponds identified in the model are pumped to the WTP as Priority One (inclusive of process area runoff, seepage, collection ponds and WUG groundwater) and the aim is to keep the level of these ponds low to maintain capacity for high rainfall events. Table1 provides a summary of the maximum catchment areas considered in the WBM for each area and the corresponding runoff coefficients. Each of these catchment areas drain to a collection pond or sump with a defined volume and pumping rate. In the model there is some variation applied to account for catchment development over time.

Table 1 Catchment Areas

Name	Description	Area (ha)	Runoff Factor	Volume (m3)	Modelled Pumping Withdrawal Rate (m^3/d)	Water Treated For
WRS Collection Pond	Runoff and seepage from WRS	5.5	0.5	10,383	4,320	Trace elements
TSF1A	Tailings storage facility 1A	38.8	1.0	See stage-volume relationships	12,000	Cyanide and trace elements
TSF2	Tailings storage facility 2	41.5	1.0	See stage-volume relationships	12,000	Cyanide and trace elements
TSF3	Tailings storage facility 3	33.7	1.0	See stage volume relationships	12,000	Cyanide and trace elements
GOP TSF	Tailings storage facility in GOP	18	1.0	See stage volume relationships	12,000	Cyanide
West Silt Pond	Runoff from TSF2 embankments	28.72	0.7	12,472	23	Trace elements
S3	Runoff from TSF1A embankments	27.46	0.7	44,688	1,651	Trace elements
S4 (modified with the construction of TSF3)	Runoff from TSF1A embankment	17.61	0.7	45,100	597	Trace elements
S5 (decommissioned with construction of TSF3)	Runoff from TSF1A embankment	20.5	0.7	34,465	1,283	Trace elements
S6 (replaces S5)	Runoff from TSF1A embankment	15	0.7	34,758	1,283	Trace elements
S7	Runoff from TSF3 embankment	37	0.7	80,826	2,000	Trace elements

NRS Silt Pond	Runoff from the NRS	41.5	0.7	80,000	2,000	Trace elements
Gladstone Pit	Runoff within the Gladstone Pit	18	0.7	-	3,000	Trace elements
Mill Pond	Process area ponds	8.6	1.0	21,132, combined	526, combined	Cyanide
Favona Stockpile Area		9.81	0.6			Cyanide
TCP1A		0.46	0.7			Cyanide
TCP2		1.03	0.7			Cyanide
WTP		1.79	0.8			Cyanide
	Notes: Martha pit is accounted for in the dewatering calculations, silt ponds are not included in this summary					

Runoff from the TSF1A, TSF2 and TSF3 embankments is captured within the collection ponds as defined in Table 1 and is treated as minewater in the WTP. Where the river flow is above the 80th percentile or when the ponds are re-designated as silt ponds via consent they can overflow to the river if full.

The process area ponds collect runoff from the catchments around the WTP and processing plant area and are treated as cyanide water in the model (note this is a conservative assumption since in actuality treatment through the minewater stream generally applies). Overflow of these ponds is not permitted before the date specified in the model. There is provision on site for water to be pumped between these ponds and with consideration to this the process area ponds' volume and catchment areas are amalgamated in the model. During high rainfall events water from the process area ponds can also be pumped into the active TSF as an emergency storage facility, then later treated as decant water.

River Flow

River flow data is derived using the Australian Water Balance Model (AWBM) (Boughton 2004[4]) based on the measured daily rainfall data. The model is calibrated to Ohinemuri River and Ruahorehore Stream flow data measured at the Frendrups and Ruddock gauges between 28/3/1985 and 19/4/2017. Calibration of the model places emphasis on periods where flow rates affect the consented discharge regimes. In addition, river flow data is also derived for the Mataura Stream using the AWBM. The calibration of the Mataura Stream with the GoldSim generated flow is based on the monitoring data during 2020 and 2021 (refer Section 3.2.1).

Four separate discharge locations (O1 to O4 in **Figure** 2) are modelled to maintain clarity of the discharge from each source, though these are not necessarily representative of site layout. The WTP discharges into O1. Overflow from the TSF's, collection ponds and process area ponds discharges into O2, O3 and O4 respectively and the resultant river flow is defined at O5.

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[4] Boughton, W. 2004. The Australian water balance model, *Environmental Modelling & Software*. 19(10), 943-956.

WUG Groundwater

Inflow volumes of groundwater into the WUG Access Tunnel, WUG tunnel to the processing plant area and WUG Mine are detailed in WWLA, 2025. The WBM assumes this water is directed directly to the WTP where it is treated as Priority One water.

MUG Dewatering and Dust Suppression

The WBM allows dewatering to be represented by two methods. The first method specifies a mean annual dewatering rate and the WTP aims to treat the flow where capacity allows. Where the WTP does not have the required capacity the excess is identified as a deficit on the extraction target. A cumulative deficit is indicative that the chosen pump rate is too low to meet dewatering targets.

The second method calculates dewatering based on a model of the Martha underground water system and a target dewatering level. A maximum dewatering pump capacity is specified and the model aims to meet the dewatering targets within the constraints of the dewatering pump capacity and the WTP discharge capacity. Drawdown of the water table is determined by the actual volume of water extracted, such that the pumps and WTP will work at full capacity until the target level is reached.

Dust suppression for the site is deducted from the dewatering flows prior to treatment in the WTP and this is specified by a fixed average rate for the life of the mine.

Seepage (rock stacks and embankments)

Seepage flows as described in Section 2.6.3 are each defined by a daily average value for the duration of the model. These flows gravitate to the WTP without the ability for intermediate storage. As there is no storage modelled; these flows are treated as Priority One and are treated immediately.

C-3-3 Sinks

Evaporation

The WBM assumes that water will evaporate from the TSF ponds where decant water is available. Evaporation is calculated daily based on average monthly Penman open-water evaporation rates. These are taken from Cliflow Station B75381 records from 26/4/1971 to 30/7/2001.

Retained Moisture

When the tailings are placed in the TSF impoundment a small component of tailings liquor is retained as porewater (~24% depending upon slurry makeup) and the remainder is released to decant water or seepage.

C-3-4 Processes

Water Treatment Plant

The central component of the WBM is the WTP which aims to treat all minewater and cyanide impacted water generated or captured across the site. The consented discharge of the WTP is governed by the operating regimes and the daily flow rate of the Ohinemuri River. The operating regime is determined by the ratio of minewater to cyanide water to be treated. The maximum discharge of the WTP is set to 90% of the daily permitted discharge. This reduction factor is applied to recognise that the WTP cannot consistently operate at an efficiency to achieve the maximum consented discharge each day.

To make up the consented discharge, water is requested from each of the sources based on a set of priorities. These priorities reflect the ability to control or importance of controlling each water source:

- Priority 1 - Process area runoff, WUG minewater, seepage and collection ponds
- Priority 2 - Decant water from the TSF's
- Priority 3 - Mine dewatering

Priority One flows are those with little or no storage capacity and the model reports an error if these sources cannot be treated and/or contained. Priority Two flows are allocated to the active TSF ponds. The remaining capacity is allocated to Priority Three flows, which attempt to satisfy mine dewatering rates.

Ore Processing and Stockpile

Daily ore volumes are calculated from the mine plan production schedule.

The volume of water required to process ore on a daily basis is calculated based on the average fraction of tails in the slurry mix. The required volume of processing water is requested from available sources based on the following order of preference.

- Elution flow - extracted at a fixed daily rate from the Ohinemuri River where flow conditions allow.
- Decant water - from the active tailings pond.
- Seepage flow.
- Mine dewatering flow - to satisfy the remaining demand.

Tailings are distributed to the active TSF and split into two components; tails solids with retained moisture, and decant water.

Tailings Storage Facility

The WBM accounts for the two existing TSF's plus TSF3 and Gladstone TSF and makes provision for changes in their active status. Through the model run, tailings are deposited into the TSF defined as the "active" pond.

Once the calculated tailings capacity of for each facility is reached, the active pond definition is updated to inactive. Based on previous experience with TSF2, a period of 2.5 years is applied to each TSF from when it was last active to when it can be considered "clean" and direct discharge is allowed. CN treatment is ceased after 1.5 years.

The daily decant water gain is calculated as the sum of rainfall and decant water added less evaporation.

Decant water is withdrawn from the TSF's to satisfy a demand from the WTP based on the available treatment capacity. The WTP allocates a demand to each TSF that aims to remove the previous day's rainfall, up to the smallest of the Priority Two flow capacity and defined decant pump capacity. A minimum of 20% of the Priority Two flow capacity is allocated to the active pond in order to remove any accumulated volume. The remaining flow capacity is allocated to the non-active TSF (if treatment is required) based on proportional catchment area. This distribution of demands prioritises withdrawal from the non-active TSF ponds for treatment.

Further withdrawals from the active TSF pond are requested to satisfy slurry makeup requirements in the ore processing area. The demands from the WTP and ore processing area for each TSF are only fulfilled if there is a suitable volume of water available to satisfy the flow.

The accumulation of tailings and decant water within each TSF is monitored against a stage-volume relationship for each TSF. This allows the remaining capacity and freeboard of each pond to be determined throughout each of the modelled scenarios.

C-4 Model Calibration

A calibration of the WBM was completed with measured river flow data and recorded operation data from the WTP and mine site.

For the given calibration period the WBM is shown to provide a reasonable representation of the water balance and treatment requirements across the mine site. A degree of conservativeness is represented as the model has over predicted the minewater and cyanide water treatment requirements. Further to this, the collection pond overflow predicted is higher than measured.

Overall, the model is considered to provide a good representation of site conditions and based on the calibration is conservative.

C-5 Representation of Waihi North Project in the WBM

The WBM was modified to represent the Waihi North Project as summarised below.

TSF Operation and Capacity

It is assumed for the purpose of this assessment that TSF1A will be constructed to a proposed height of 182.00 mRL resulting in an additional 2.80 Mm^3 of tails storage; TSF2 will be constructed to a proposed height of 159.5 mRL resulting in an additional 1.76 Mm^3 of tails storage; TSF3 will be constructed to a proposed height of 155.00 mRL resulting in an additional 5.69 Mm3 of tails storage; and Gladstone Pit will provide an additional 1.89 Mm3 of tails storage to a height of 1103 m (mine datum). Table 2 shows the total available capacity for the TSFs.

Table 2 TSF Capacity

Facility	From mRL	To mRL	Capacity (m^3)
TSF 1A		173.60	100,000
TSF 1A	174.80	176.30	550,000
TSF 1A	176.30	179.30	1,195,000
TSF 1A	179.30	182.00	954,422
TSF 2	156	159.5.00	1,755,000
TSF 3	Ground	135.00	720,000
TSF 3	135.00	145.00	2,020,000
TSF 3	145.00	155.00	2,950,000
TSF GOP	060.00	080.00	319,011
TSF GOP	080.00	103.00	1,680,047

Tailings volumes calculated in the WBM are allocated according to the tailings deposition schedule beginning with TSF1A, followed byTSF2 and then TSF3. Dual deposition of GOP TSF and TSF3 occurs when mining in GOP is finished. Filling of the TSF's is modelled based on pre-determined stage volume relationships (Appendix D).

The surface level of the tailings is determined from this stage volume relationship and water level is calculated by adding the volume of free water within the TSF on top of the tailings. The water level is monitored to identify freeboard encroachment or overflow potential. There is no provision to increase abstraction rates through manual intervention when large volumes of water accumulate through a model run as would be done in practice. Therefore, overflow potential predicted by the model provides a conservative indication of risk. Once a TSF pond has been classified as clean it can fill and overflow from the freeboard level.

Catchment Areas and Runoff

Table 1 provides a summary of the maximum catchment areas considered in the WBM for each area. Each of these catchment areas drain to a collection pond or sump with a defined volume and pumping rate. In the model there is some variation applied to account for catchment development over time.

The catchment areas given for the TSFs include the pond surface area and the surrounding embankments that drain into the pond. It is assumed that all of the runoff ends up in the pond so the runoff factor is taken as 1. Rainfall runoff to collection ponds from the process areas use an area weighted runoff factor of 0.78 to account for all potentially cyanide affected water and recognising that the surface of the process area is well compacted or sealed and has low permeability.

Runoff from the remaining areas is accounted for by a runoff factor of 0.5 to 0.7.

Seepage Rates

Seepage rates from TSF1A and TSF2 are modelled as 364 m^3/d combined and these are determined from mine operation data for 2015 and 2016. For TSF3, NRS and the WRS, the modelled captured seepage applied to the modelling is 360 m^3/d, 1,353 m^3/d and 270.9 m^3/d respectively. These flows contain some groundwater volumes that are captured in the underdrainage assessment. Captured GOP TSF seepage is estimated to be 1,252 m^3/d; this volume is only realised post LOM and after groundwater recharge.

WUG Groundwater Inflow

Inflow volumes of groundwater into the Willows access tunnel and Plant access tunnel are detailed in WWLA, 2025 and are calculated at up to 11,825 m^3/d.

MUG Dewatering Rates

To achieve the target water table drawdown rates annual average extraction rates of up to 15,500 m^3/d are expected.

To represent the practicalities of achieving this rate under variable WTP discharge conditions and fluctuating flows from other sources, a variable pump rate is applied.

Operational Water

Dust suppression is taken at a constant daily rate that is assumed to be 500 m^3/d.

Production Rates

Production rates and ore sources for the LOM were provided by OGNZL and are reproduced in Appendix D for reference.

C-6 Ohinemuri Cumulative Assessment

Existing Uncaptured Seepage

The existing uncaptured seepage is defined as seepage from existing facilities (predominantly TSF1A and TSF2) that is currently not intercepted by drains but seepage that leaks through the facility liners, mixes with groundwater and ultimately ends up in the Ohinemuri River. The existing uncaptured seepage also potentially includes non-mine related sources.

This existing seepage has been calculated as a mass contaminant load utilising water quality and flow data from 2019. Utilising days in which monitoring data aligned, it has been possible to calculate background mass loads at the following locations:

- OH3. Representative of water quality upstream of the mine.
- E1 & E2. Representative of water quality discharged from the WTP to the Ohinemuri River
- RU1. Representative of water quality from Ruahorehore before discharge into Ohinemuri River
- OH6. Representative of downstream mixing / consent compliance location

These locations are presented on **Figure** 2.

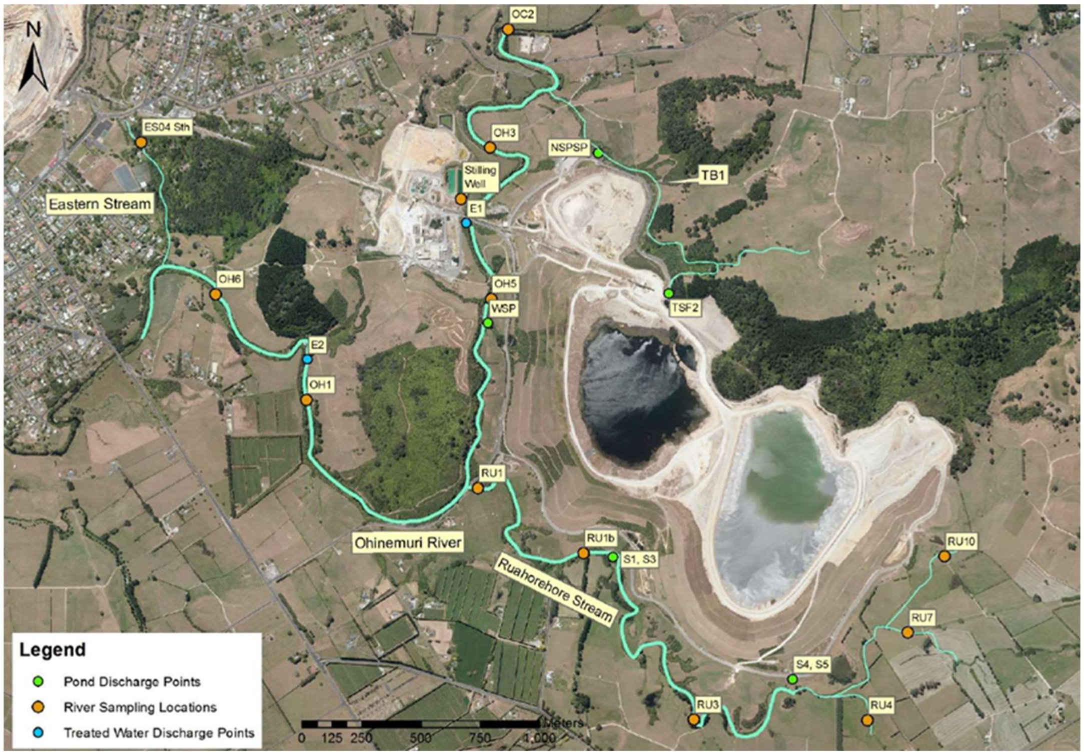

Figure 2 Ohinemuri water discharge and Sampling locations

Based on the calculated contaminant mass load at OH6, the proportion of load attributable to the WTP discharge and natural background has been calculated. Where the WTP discharge and natural background load do not account for the full contaminant load observed at OH6, the additional load is assumed to be from a combination of uncaptured seepage / runoff from current site operations and other potential non-mining sources.

These loads have been calculated where flow data and water quality align at the various monitoring locations throughout the 2019 period with data points covering a range of different flow conditions. Figure 3 shows plots of the calculated additional mass loads versus flow at OH6. For most trace elements (ie. Sb, Ni, Zn and Se) the calculated difference (between known load inputs and load at OH6) is negligible (< 0.2 kg/day) and the difference observed are more likely a result of inconsistent sampling between sampling locations (ie. sampling carried out throughout the day and not simultaneously) and use of recorded concentrations at the method detection limit. However for manganese and sulphate there is a distinct pattern of additional calculated loadings at most flow levels suggesting that another source apart from the known sources is possible. Measurements of other trace elements of concern were recorded as being largely below the method detection limit at OH6 and therefore no additional loading was assumed or could be calculated.

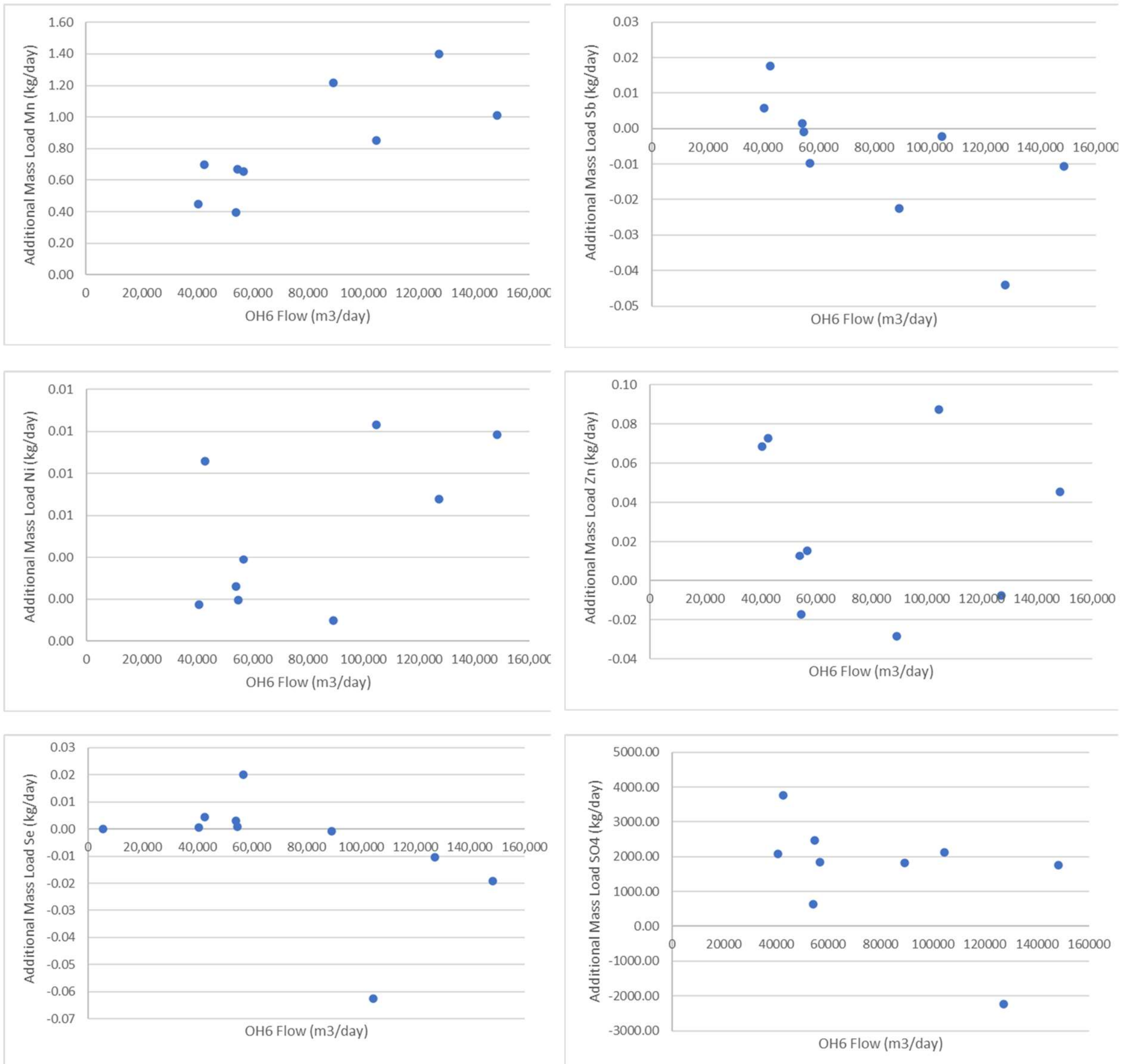

Figure 3 Calculated background uncaptured contaminant mass loads

The additional load for manganese shows a weak correlation to flow however is has been assumed a constant uncaptured load of 0.8 kg/day is applicable. For sulphate, the additional load is reasonably consistent and an additional uncaptured load of 2,000 kg/day is assumed.

The lack of additional load for the majority of the trace elements and observed additional loading for manganese and sulphate is likely explained via differing attenuation and/or precipitation controls. Sulphate is largely controlled by the ratio of calcium to sulphate and the formation of gypsum whereas manganese will stay in solution unless under elevated pH conditions (in excess of pH 8). The other trace elements are more likely to precipitate at a lower pH and hence any leaching of these trace elements from existing facilities is likely to be attenuated and unlikely to add to the additional mass loads within the Ohinemuri River.

Water Balance Modelling

The water balance model has elements provided to calculate a cumulative mass loading at sample location OH6 in the Ohinemuri River. The following elements have been added as direct inputs representing uncaptured contaminant mass loads:

- WRS uncaptured seepage
- NRS uncaptured seepage
- TSF3 uncaptured seepage
- Gladstone uncaptured seepage
- Baseline uncaptured seepage

Contaminant mass load coming from the WTP discharge was calculated using daily discharge concentration and flow. Baseline Ohinemuri River and Ruahorehore Stream mass loads were calculated using an assumed median concentration and daily AWBM flow rates.

Relative calibration of the cumulative component of the model has been achieved by comparing a realisation within the model that had a similar annual rainfall to that recorded in 2019 – in which the uncaptured background contaminant loads have been calculated. Annual average key contaminant concentrations were generally modelled in line with or above the average 2019 monitoring data. Differences observed were attributable to samples being recorded below the method detection limit and the simplification of the water quality data to median values. However for the purposes of the cumulative assessment and assessment of additional loading through the Waihi North Project, the calibration is deemed adequate.

Appendix D

Water Balance Model Input Tables

Table 1 Key Model Inputs

Variable	Value	Description
Tails Production	Monthly averages determined from daily site data	Monthly time series
Dewatering sources	Daily rates applied from site data	Daily time series
Rainfall	WBM input data applied as described in Section C-3-2	Daily time series
River Flow	WBM derived data as described in Section C-3-2	Daily time series
Evaporation	Monthly averages determined from meteorological stations as described in Section C-3-2	Monthly average value
Seepage Flow	Average flow rate determined from daily site data	362 m^3/d, combined TSF1A and TSF2
Elution Flow	Average flow rate determined from daily site data	159 m^3/d
Dust Suppression Flows	Assumed value	500 m^3/d
Specific Gravity of Rock	Assumed value	2.74
Slurry (% Solids by Volume)	Average proportion determined from daily site data	16%
Moisture Retained by Tails	A calculated value, based on fully saturated and consolidated tails	24.4%
Tails Dry Density	Assumed value	1.2 tonne/m^3
Collection Ponds Runoff Factor	Assumed value	0.5 - 0.7
Process Area Runoff Factor	Assumed value	0.78

Table 2 Processed Tonnes

Area	Gladstone Hill	Martha Phase 4 Pit	Martha Underground	WUG	Combined
Units	Mt	Mt	Mt	Mt	
Yr1	0.00	0.00	0.42	0.00	0.42
Yr2	0.00	0.00	0.42	0.00	0.42
Yr3	0.00	0.00	0.44	0.00	0.44
Yr4	0.00	0.00	0.51	0.00	0.51
Yr5	0.00	0.00	0.50	0.00	0.50
Yr6	0.00	0.00	0.54	0.00	0.54
Yr7	0.00	0.00	0.54	0.00	0.54
Yr8	0.20	0.00	0.54	0.00	0.74
Yr9	0.32	0.00	0.45	0.16	0.92

Area	Gladstone Hill	Martha Phase 4 Pit	Martha Underground	WUG	Combined
Yr10	0.35	0.00	0.00	0.59	0.95
Yr11	0.57	0.00	0.00	0.80	1.37
Yr12	0.85	0.00	0.00	0.85	1.70
Yr13	0.30	0.00	0.00	0.82	1.13
Yr14	0.00	0.00	0.00	0.81	0.81
Yr15	0.00	0.00	0.00	0.81	0.81
Yr16	0.00	0.00	0.00	0.80	0.80
Yr17	0.00	0.00	0.00	0.49	0.49
Y18	0.00	0.00	0.00	0.10	0.10
Y19	0.00	0.00	0.00	0.00	0.00
Y20	0.00	0.00	0.00	0.00	0.00
TOTAL	2.59	0.00	4.36	6.25	13.20

Table 3 TSF1A Height Storage Table

TSF1A			
Column 1		Column 2	
Elevation (mRL)	Volume (m^3)	Elevation (mRL)	Volume (m^3)
107	-	161	9,701,000
108	200	162	10,024,000
109	2,200	163	10,353,000
110	8,100	164	10,685,000
111	18,400	165	11,021,000
112	32,300	166	11,361,000
113	50,100	167	11,705,000
114	73,400	168	12,052,000
115	102,000	169	12,403,000
116	138,000	170	12,758,000
117	182,000	171	13,116,000
118	239,000	172	13,479,000
119	308,000	172.5	13,658,748
120	389,000	173	13,839,336
121	484,000	173.5	14,020,706
122	595,000	174	14,202,826
123	717,000	174.5	14,385,671

TSF1A			
124	849,000	175	14,569,240
125	988,000	175.5	14,753,534
126	1,134,000	176	14,938,554
127	1,287,000	176.5	15,124,302
128	1,447,000	177	15,310,779
129	1,616,000	177.25	15,404,383
130	1,793,000	177.5	15,497,987
131	1,978,000	178	15,685,927
132	2,168,000	178.5	15,874,601
133	2,365,000	179	16,064,010
134	2,568,000	179.5	16,254,155
135	2,776,000	180	16,445,038
136	2,989,000	180.5	16,636,660
137	3,208,000	181	16,829,023
138	3,431,000	181.5	17,022,128
139	3,658,000	182	17,215,977
140	3,891,000	182.5	17,410,571
141	4,128,000	183	17,605,911
142	4,370,000	183.5	17,801,999
143	4,616,000	184	17,998,836
144	4,866,000	184.5	18,196,424
145	5,120,000	185	18,394,764
146	5,379,000	185.5	18,593,858
147	5,641,000	186	18,793,707
148	5,908,000	186.5	18,994,312
149	6,178,000	187	19,195,675
150	6,451,000	187.5	19,397,798
151	6,728,000	188	19,600,681
152	7,008,000	188.5	19,804,326
153	7,291,000	189	20,008,735
154	7,579,000	189.5	20,213,909
155	7,869,000	190	20,419,849
156	8,163,000	190.5	20,626,556
157	8,462,000	191	20,834,028
158	8,764,000	191.5	21,042,251
159	9,070,000	192	21,251,187
160	9,382,000		

Table 4 TSF2 Height Storage Table

TSF2			
Column 1		Column 2	
Elevation (mRL)	Volume (m^3)	Elevation (mRL)	Volume (m^3)
148	-		
148.5	170,419		
149	341,956		
149.5	514,589		
150	688,424		
150.5	863,566		
151	1,039,995		
151.5	1,218,008		
152	1,397,443		
152.5	1,578,230		
153	1,760,407		
153.5	1,943,859		
154	2,128,585		
154.5	2,314,277		
155	2,500,610		
155.5	2,687,460		
156	2,874,788		
156.5	3,062,440		
157	3,244,274		
157.5	3,427,047		
158	3,611,030		
158.5	3,796,296		
159	3,982,944		
159.5	4,170,968		
160	4,360,214		
160.5	4,550,661		
160.7	4,742,352		

Table 5 TSF3 Height Storage Table

TSF3			
Column 1		Column 2	
Elevation (mRL)	Volume (m^3)	Elevation (mRL)	Volume (m^3)
117	10,848	153	7,401,324
118	31,684	154	7,747,624
119	64,521	155	8,099,809
120	109,210		
121	167,830		
122	238,228		
123	320,116		
124	413,300		
125	518,031		
126	655,087		
127	802,688		
128	959,481		
129	1,124,717		
130	1,297,676		
131	1,478,859		
132	1,667,833		
133	1,864,196		
134	2,067,847		
135	2,278,859		
136	2,504,791		
137	2,737,780		
138	2,977,579		
139	3,224,125		
140	3,477,414		
141	3,739,067		
142	4,007,385		
143	4,282,353		
144	4,563,957		
145	4,852,241		
146	5,150,535		
147	5,454,317		
148	5,763,513		
149	6,078,031		
150	6,397,876		

Table 6 GOP TSF Height Storage Table

GOP TSF			
Column 1		Column 2	
Elevation (m)	Volume (m^3)	Elevation (mRL)	Volume (m^3)
60	0	84	525,853
61	5,914	85	573,415
62	12,621	86	622,466
63	19,976	87	673,026
64	27,999	88	725,094
65	36,691	89	778,718
66	46,076	90	834,251
67	56,167	91	901,902
68	66,977	92	971,687
69	78,529	93	1,043,208
70	91,038	94	1,116,451
71	111,596	95	1,191,448
72	133,521	96	1,268,209
73	156,565	97	1,346,756
74	180,732	98	1,427,111
75	206,039	99	1,509,277
76	232,507	100	1,593,740
77	260,143	101	1,691,599
78	288,971	102	1,791,999
79	319,011	103	1,894,479
80	350,560	104	1,999,058
81	391,971	105	2,105,735
82	435,142	106	2,214,617
83	479,764	106.95	2,325,988

Table 9 Waihi North Tailings Deposition Schedule

Cumulative Tails (m^3)	Active Pit
2,798,895	TSF1A
4,554,323	TSF2
10,244,323	TSF3
12,236,341	GOP

Appendix E

Ohinemuri Flood Model

E-1 Introduction

E-1-1 Purpose

This report describes the hydraulic model GHD has built for OGNZL to define flood inundation potential of the Ohinemuri River in the vicinity of proposed mine development, including the NRS. New mining infrastructure needs to be located or protected to avoid river inundation and potential infrastructure damage.

The model of the river was also built to check that proposed mine developments do not result in increased flood potential to the downstream Waihi township.

The Ohinemuri River is located in the Hauraki District of the Waikato Region. Although its upper catchment is near the eastern coast, the river flows west past the township of Waihi and through the narrow Karangahake Gorge before joining the Thames/Waihou River near Paeroa.

This report provides an overview of the model build process and the model results.

E-2 Input information

E-2-1 Existing information

Previous flood modelling

Modelling of the 100 year floodplain in the vicinity of Baxter Road was undertaken by Woodward-Clyde in 1996. Figure 1 below shows the flood extent around the tailings storage facilities predicted previously. There is no known Hauraki District Council modelling for the Ohinemuri River.

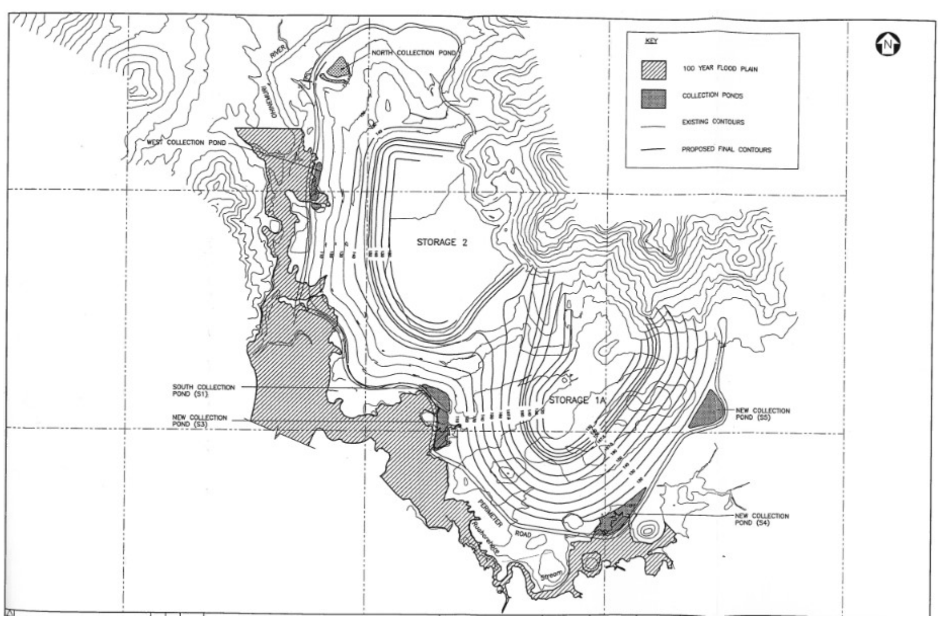

Figure 1 Previous Modelling of 100 year floodplain

Anecdotal evidence suggests no known flooding of the Ohinemuri River above the level of Baxter Road Bridge. However minor flooding of a low point on the left bank immediately upstream of the bridge has been reported in large events by site staff. Flooding of the

Ruahorehore Stream, a tributary of the Ohinemuri River south of the Tailings Storage Facilities (TSF's), has also been noted in large rainfall events. Recent large rainfall events include:

- 13 April 2017
- 8 March 2017

E-2-2 Ohinemuri Catchment

General description

The Ohinemuri River has a total catchment area of 290 km^2. The upper catchment to the east consists of the predominantly flat farmland of the Waihi Plains. Numerous tributaries join the river as it flows west, with upper catchments becoming steep and forested further inland. The Ohinemuri River flows through the narrow Karangahake Gorge prior to joining the Thames/Waihou River in the west.

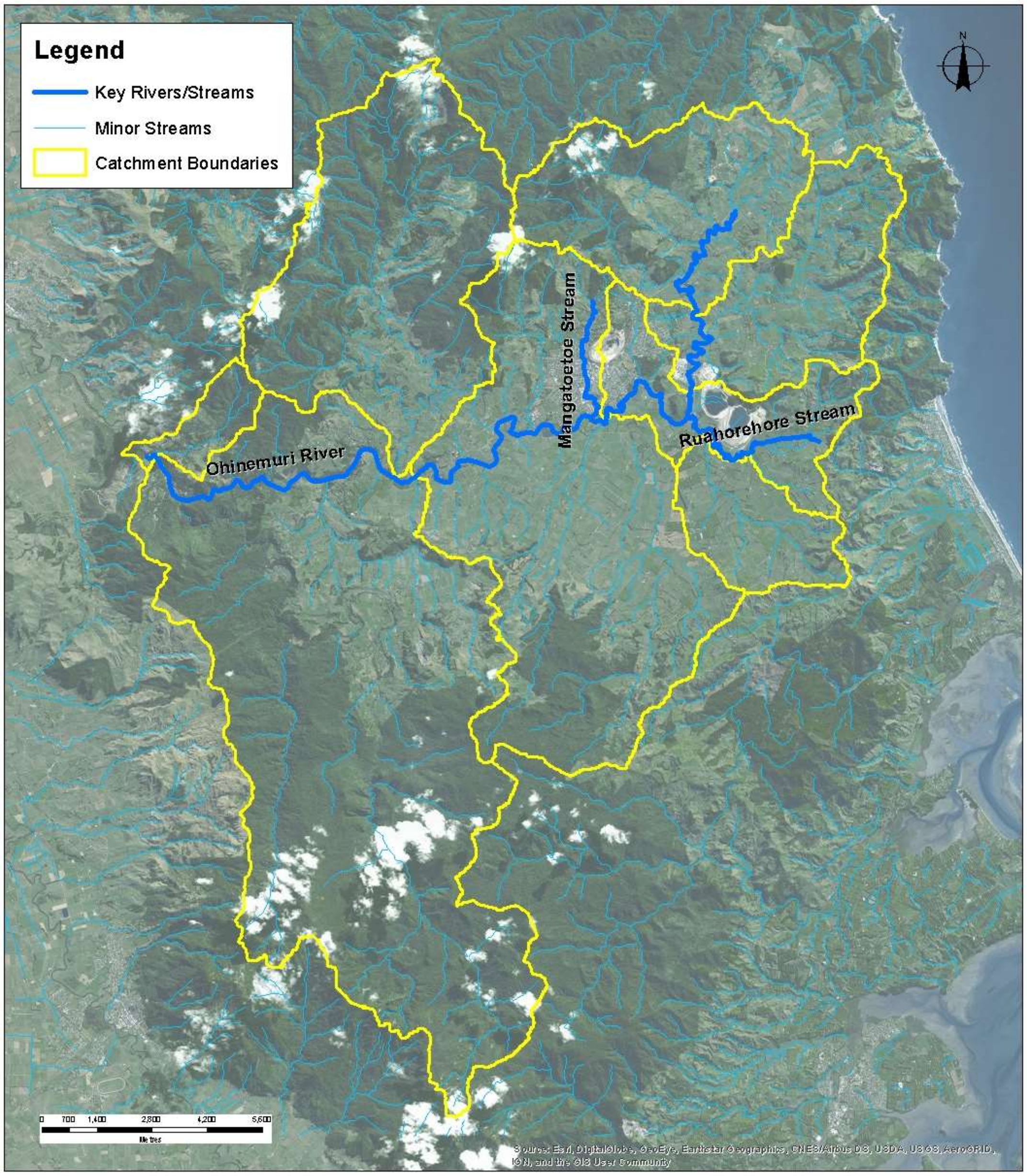

Figure 2 Ohinemuri River and Sub-catchments

Area of interest

The specific catchment area of interest for this study is the proposed project area east of the township of Waihi in the upper river catchment. This is the location of existing mining infrastructure, with TSF's to the east of the Ohinemuri River and plant areas to the west of the river.

The Project will introduce the NRS to the north of the site access bridge.

A focus of the model is to define the floodplain extent in the reach where there is existing mine infrastructure and future development is proposed. Also of interest is any impact of site development on the Waihi township. An overview of the model area of interest is provided in Figure 3.

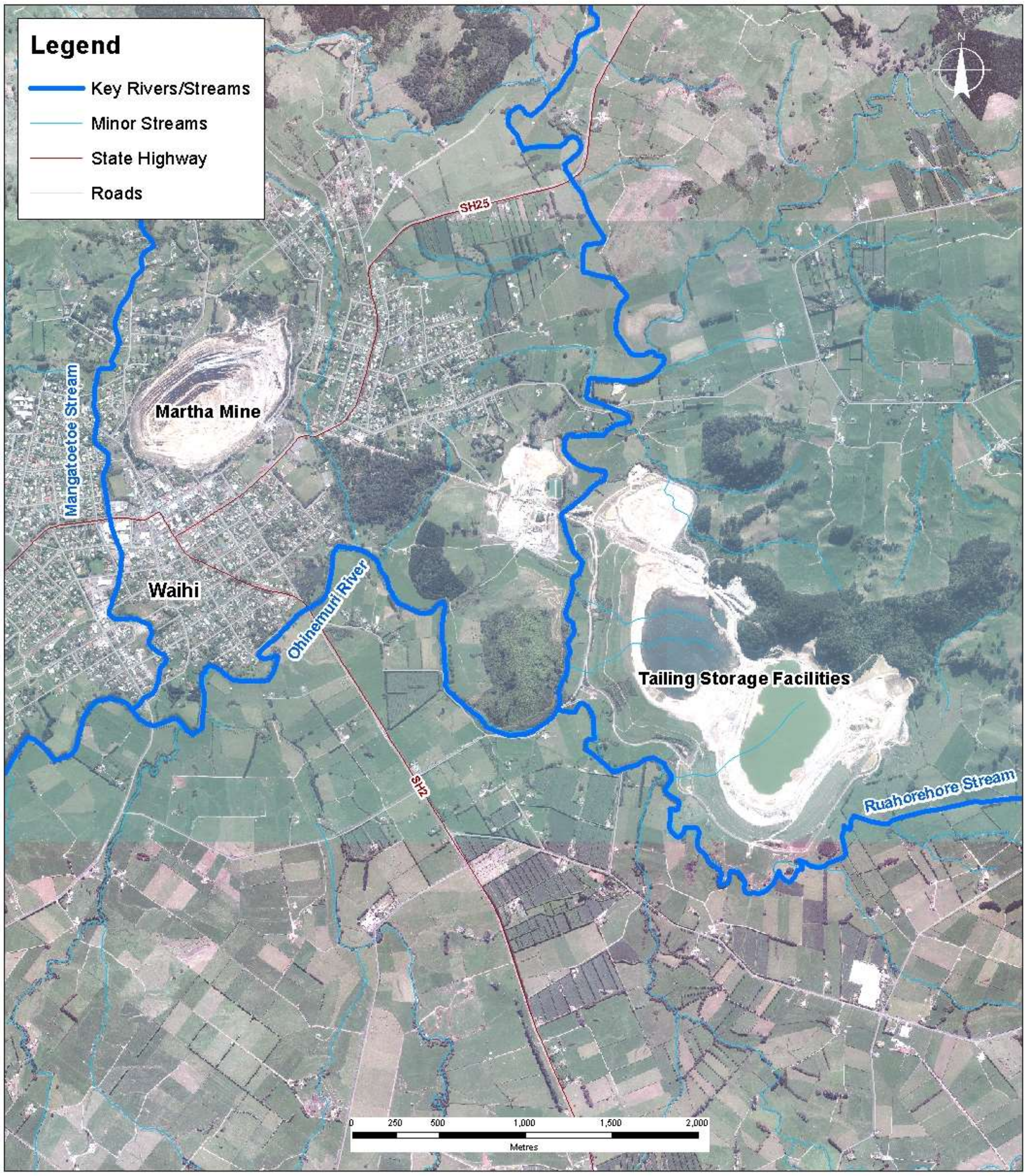

Figure 3 Ohinemuri River model area of interest

Topographic data

Topographic data from various sources was examined as part of the model build process. Available information includes:

1. 20 m interval contours from LINZ for the entire catchment
2. 2010 LiDAR from Waikato Regional Council along the main river channel
3. Surveyed river cross section data from Engineering Geology Limited for the downstream sections of the Ohinemuri River.

Figure 4 illustrates the extent of LiDAR and survey information, as well as the catchment boundaries as identified from LINZ contour information.

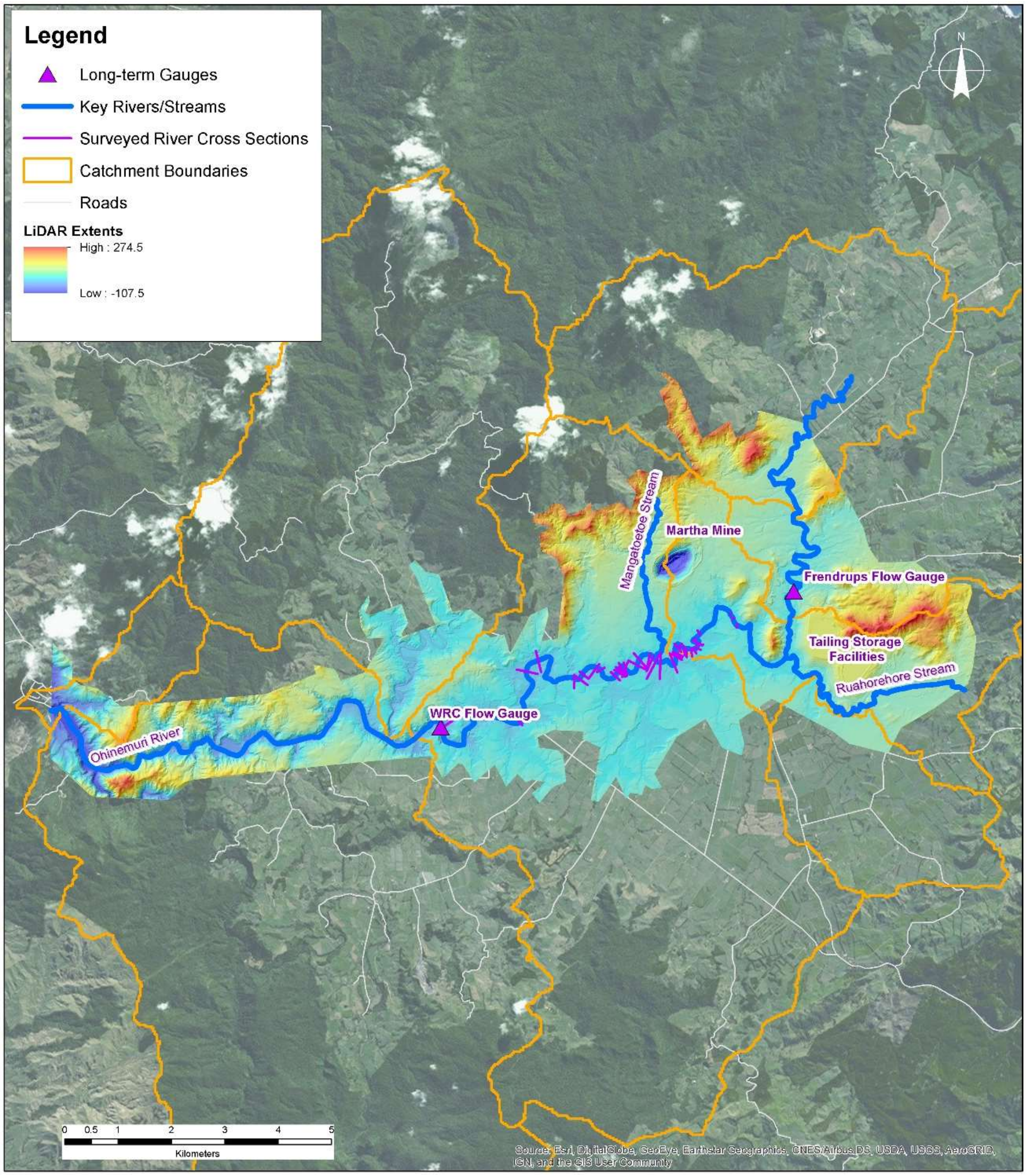

Figure 4 Extent of LiDAR and Survey Information

Surveyed cross sections were found to be inconsistent with other data such as LiDAR and aerial imagery and the accuracy was not able to be verified and therefore not used in the project.

E-2-3 Hydrometric data

Hydrometric data includes flow and water level information obtained from long-term gauges located as shown in Figure 5 and used for the hydrological and hydraulic model validation.

Flow and frequency

Two data sources were available for the study: the Waikato Regional Council gauge at Queen's Head downstream of the project area, and the OGNZL Frendrups gauge near the Ruahorehore Stream in the vicinity of the mining infrastructure. This information is summarised below.

In the model a 10% flow escalation factor is included in the estimates to account for future climate change with an additional 20% to allow for uncertainties in the flood frequency analyses and to account for flow attenuation along the river channels. This is a conservative approach.

Queen's Head flow gauge

Queen's Head flow gauge is located downstream of the project area, as indicated in Figure 4. The latest Return Period Flow information for Ohinemuri at Queens Head was provided by Waikato Regional Council and is included in Table 1 along with the stage which currently corresponds to those flows.

This analysis is based on a WISKI (Water Information System KISTERS) calculation for the period 1984 to 2017 and includes the recent large March 2017 event.

The 100 year Annual Recurrence Interval (ARI) peak flow derived from this analysis is 485 m^3/s.

Table 1 Queen's Head gauge data

Return Period	Flow (m^3/s)	Corresponding Level (m)
5 Year	267	5.85
10 Year	320	6.44
20 Year	370	6.89
30 Year	399	7.12
50 Year	436	7.40
100 Year	485	7.71

Frendrups flow gauge

The OGNZL flow gauge has a catchment area of approximately 50 km^2 and has collected 15 min interval data since 1985. Flow frequency analysis of this gauge undertaken by Hydro Logic NZ Ltd is reproduced in Figure 5 following and summarised in Table 2.

Table 2 Frendrups Gauge Data Analysis

Return Period		Flow (m^3/s)
5 Year		80
20 Year		108
100 Year		147

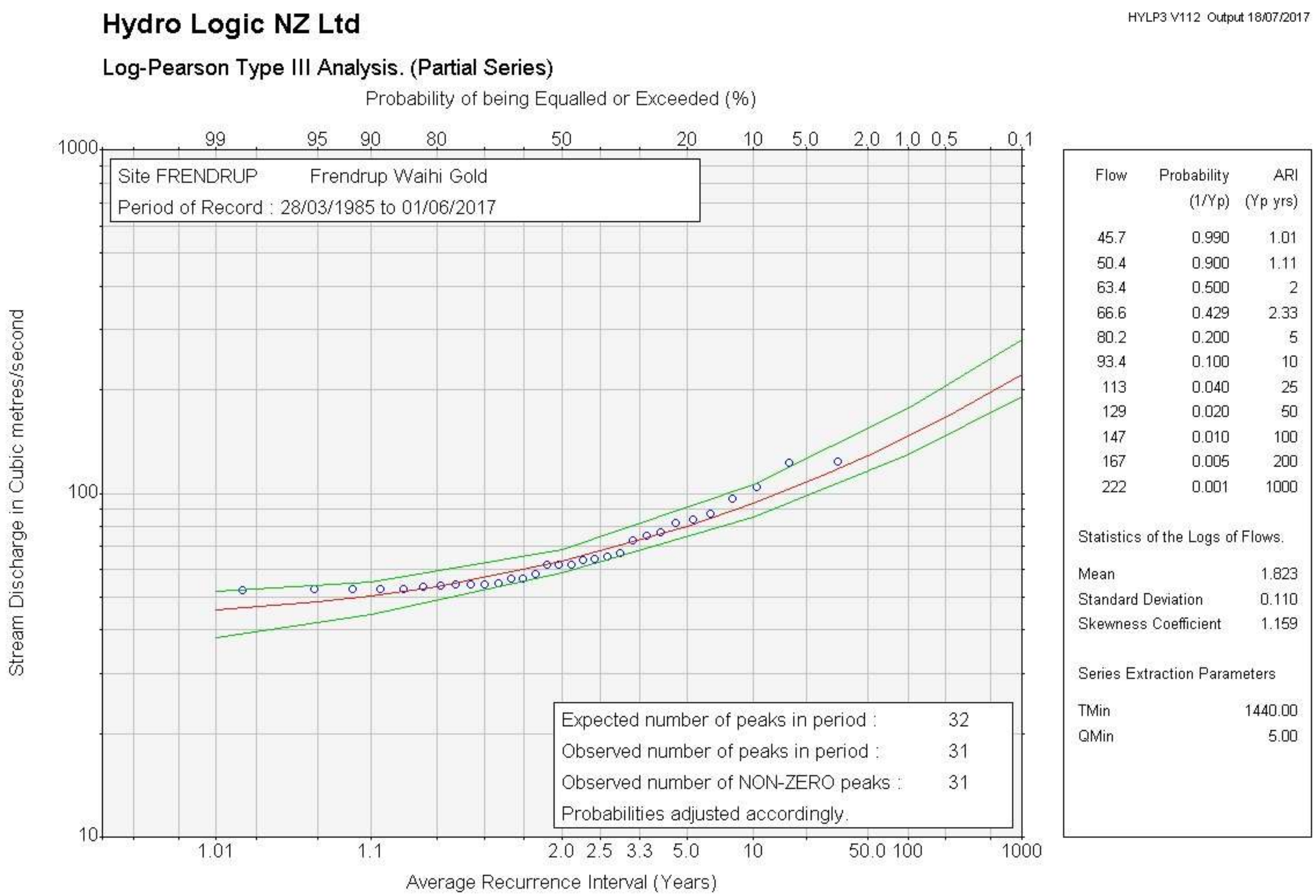

Figure 5 Frendrups Gauge Flow Frequency Analysis

E-3 MIKE 21 model

E-3-1 Schematisation overview

MIKE 21 software by DHI was used to model the Ohinemuri River study area shown in Figure 6. Catchment hydrology is defined in the model by flow hydrographs representing sub-catchment flows. These flow hydrographs connect to the MIKE 21 2D grid as “Source Points” for the area of interest in order to model the floodplain effects. The Ohinemuri River channel itself is modelled as part of a 2D grid, i.e. there is no 1D model component for the river. The model covers only the upstream catchment in order to allow greater focus on the area of interest.

The future scenario model was schematised by addition of the proposed future mining infrastructure to the existing scenario MIKE 21 2D grid. The design contours for the proposed future infrastructure were received from Engineering Geology Limited. The proposed Gladstone Pit, NRS and NRS collection pond were included in the future scenario model.

E-3-2 Hydrological model

Ohinemuri catchment hydrology is defined using a series of sub-catchments. The catchment boundary and sub-catchments were delineated from GIS analysis of 20 m LINZ contours for the entire catchment area. Based on Flow-Frequency data from Frendrups and Queens Head gauges, the contributing flows are proportionally assigned to each sub catchment based on sub-catchment area.

The shape of the flow hydrograph used in the model was developed from analysis of the gauged flow data for several rainfall events from Queen’s Head and Frendrups gauges.

The modelled peak flow hydrograph from each sub-catchment is approximated as a triangular distribution with a total duration of 20 hours with 8 hours to the peak as shown in Figure 6. All sub-catchments were assumed to peak at the same 8 hour duration even though the sub-catchments are expected to peak at different times during the storm. These hydrographs connect to the MIKE 21 grid at sub-catchment discharge points along the rivers

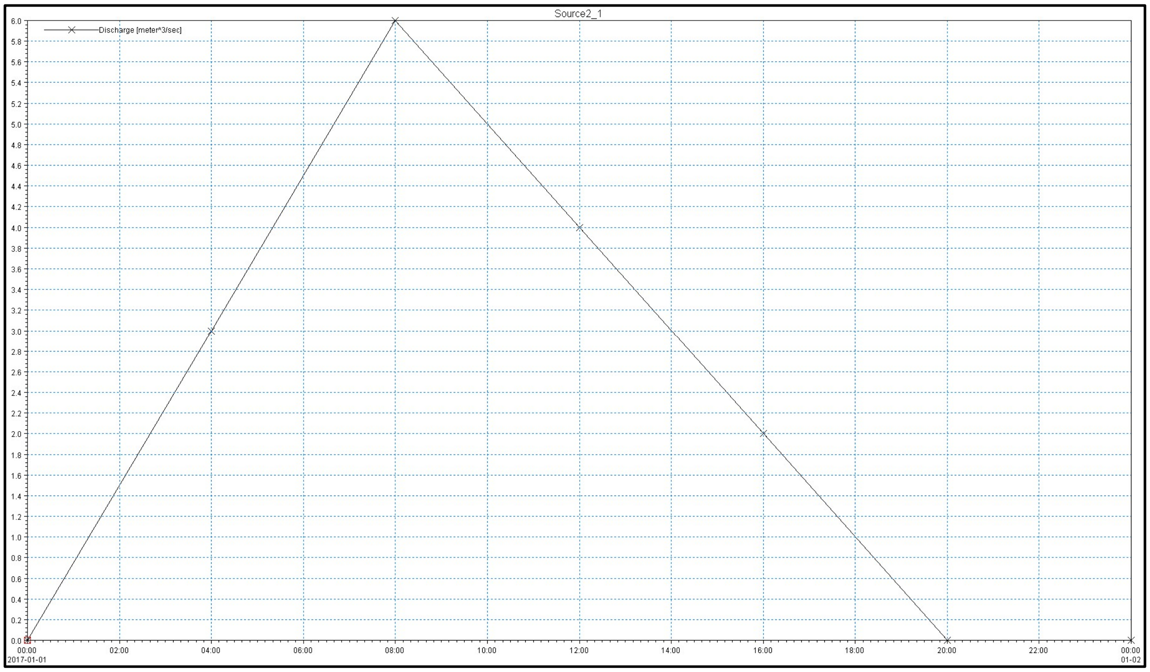

Figure 6 Modelled Peak Flow Hydrograph

E-3-3 Hydrodynamic Model

Routing of flood flows is modelled in MIKE 21.

LiDAR around the Ohinemuri River was used to create a 4 m x 4 m grid to represent the floodplain and river channel ground surface. The modelled bathymetry extents are illustrated in Figure 7.

The Ohinemuri River channel bathymetry is modelled based on the LiDAR surface levels. LiDAR represents the top water level rather than the bottom of the river channel, therefore the model is conservative as there is some loss of river cross sectional area.

Where the river is crossed by roads, the river channel was manually cut into the 2D surface to provide continuation of the river channel. Bridges are not explicitly represented in the model at this stage as there is no evidence of historical overtopping of the bridges and therefore no interaction between the bridge deck and floodwaters.

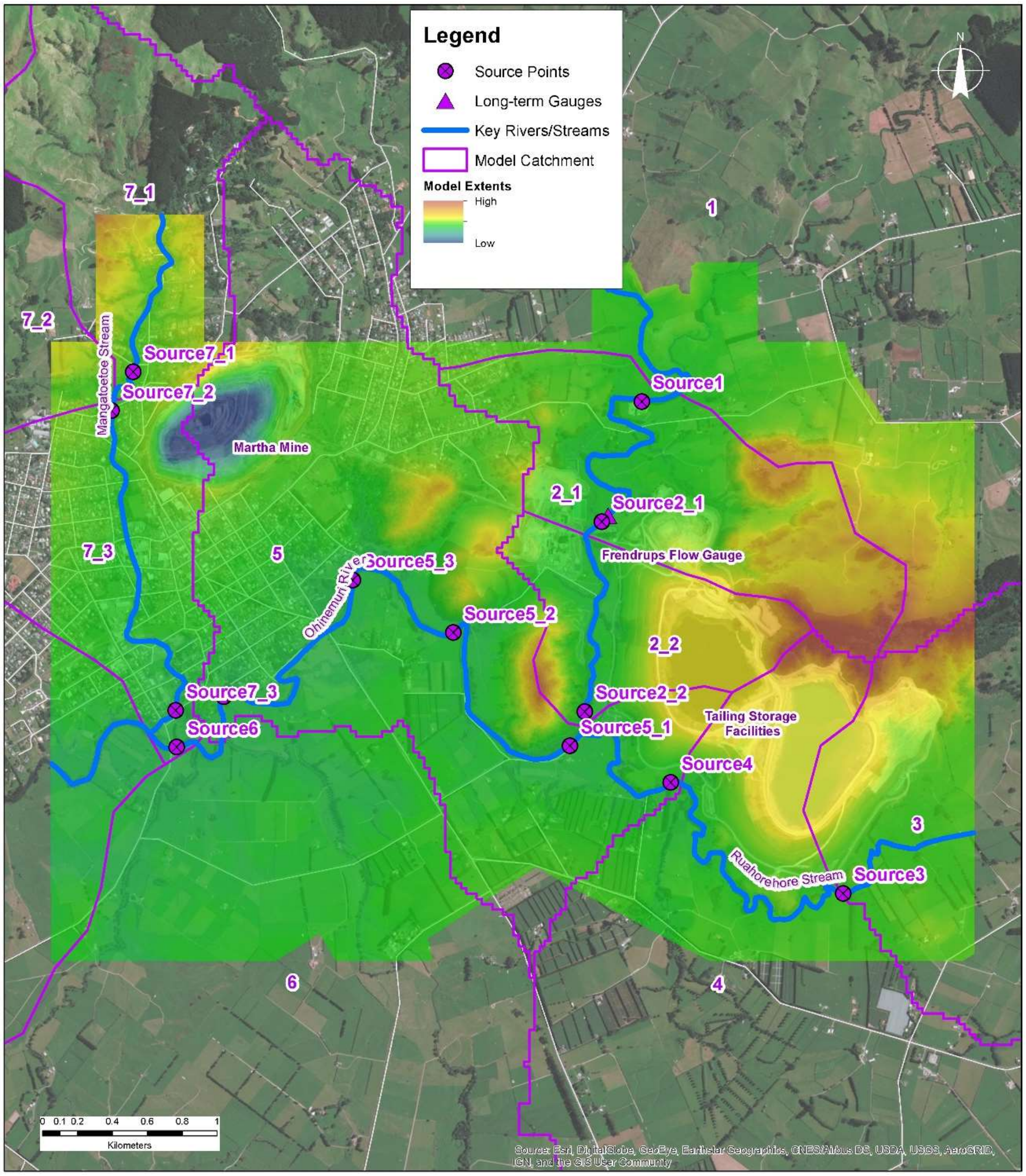

Figure 7 Hydrodynamic Model Extents – Existing Scenario

Key model parameters for the 2D surface model are summarised in Table 3.

Table 3 2D model parameters

Parameter	Values
Floodplain resistance, Mannings M	20
Flooding depth	0.02 m
Drying depth	0.01 m
Eddy viscosity	0.4 m^2/s

E-3-4 Model Boundaries

The Ohinemuri River downstream water level at the open boundary is set at a constant water level of 79 m in the model. This is equivalent to the base flow water level at this location.

The flow hydrographs derived from analysis of the gauged flow data from Queen's Head and Frendrups gauges are connected to the MIKE 21 2D grid as "Source Points". The locations of these flow boundaries (Source Points) are shown in Figure 7.

E-3-5 Model Limitations

The limitations of the model are discussed below. The model uses a conservative approach for the purpose of assessing the flood plain effects on current and future mining infrastructure works.

- The sub-catchment peak flows are assumed to peak at the same time in the model although the peak flow timings can vary significantly in practise depending on the sub-catchment size, topography, etc.
- The peak flows used in the model are derived from limited long term gauging. These flows have been conservatively increased by 20% to provide some allowance for the uncertainty associated with the limited gauge record. This could be improved if more gauging was available.
- The Ohinemuri River channel bathymetry is modelled based on the LiDAR surface levels. LiDAR represents the top water level rather than the bottom of the river channel, therefore the model is conservative as there is some loss of river cross sectional area. Some surveyed cross section data was provided for the Ohinemuri River in the downstream end the project area. However these were found to be inconsistent with the LiDAR and aerial imagery, and the accuracy was not able to be verified.
- Where the river is crossed by roads, the river channel was manually cut into the 2D surface to provide continuation of the river channel. Bridges are not explicitly represented in the model at this stage as there is no evidence of historical overtopping of the bridges, therefore no interaction between the bridge deck and floodwaters.

E-3-6 Model verification

The model peak flows and volumes at several points along the rivers as shown in Figure 8 were compared with the expected peak flows and volumes to verify the model outputs. The 100 year ARI results are summarised in Table 4. The model peak flows and volumes in the river channels are validated to within +1% (towards downstream end of river channel) to +20% (upstream end). The model results are somewhat conservative at the upstream river channels.

A good validation of model peak water level at the Frendrups gauge location was achieved when compared with the river water level data from the Frendrups gauge.

Table 4 100 Year Model Verification

Location	Model Vs Derived Peak Flow	Model Vs Derived Volume	Model Vs Measured Water Level
1 (Ruahorehore Stream)	+ 16%	+20%	-
2 (Frendrups Gauge, Ohinemuri River)	+14%	+18%	< +/- 0.5 m
3 (Mangatoetoe Stream)	+14%	+17%	-
4 (Ohinemuri River)	+1%	+12%	-

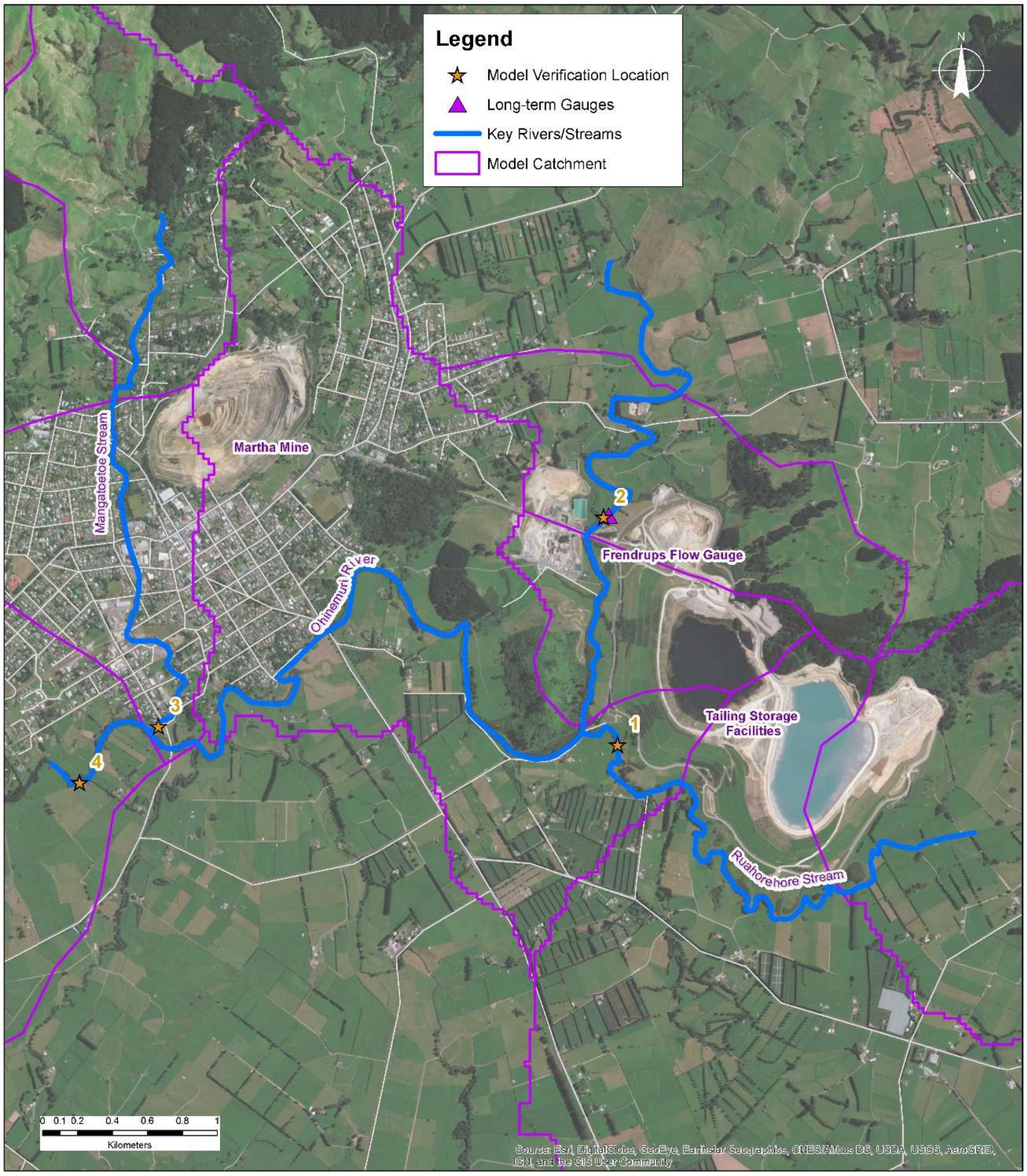

Figure 8 Model Verification Locations

E-4 Existing development results

Flood analysis for the area of interest show flooding of the Ruahorehore Stream and Ohinemuri River to be broadly consistent with reported flooding in recent high rainfall events. The Ohinemuri River flow is largely contained within its banks with minimal flooding in the vicinity of existing mine infrastructure up to a 100 year ARI event.

E-5 Future development results

Figure 9 shows the floodplain maps for the area of interest and show flooding of the Ruahorehore Stream and Ohinemuri River with the NRS, NRS collection pond and Gladstone Pit in place.

The Ohinemuri River flow is largely contained within its banks with minimal flooding in the vicinity of existing and proposed future mining infrastructure. The proposed NRS collection pond design will need to account for flood inundation potential.

There is no predicted impact on upstream or downstream flood potential from the proposed mine development.

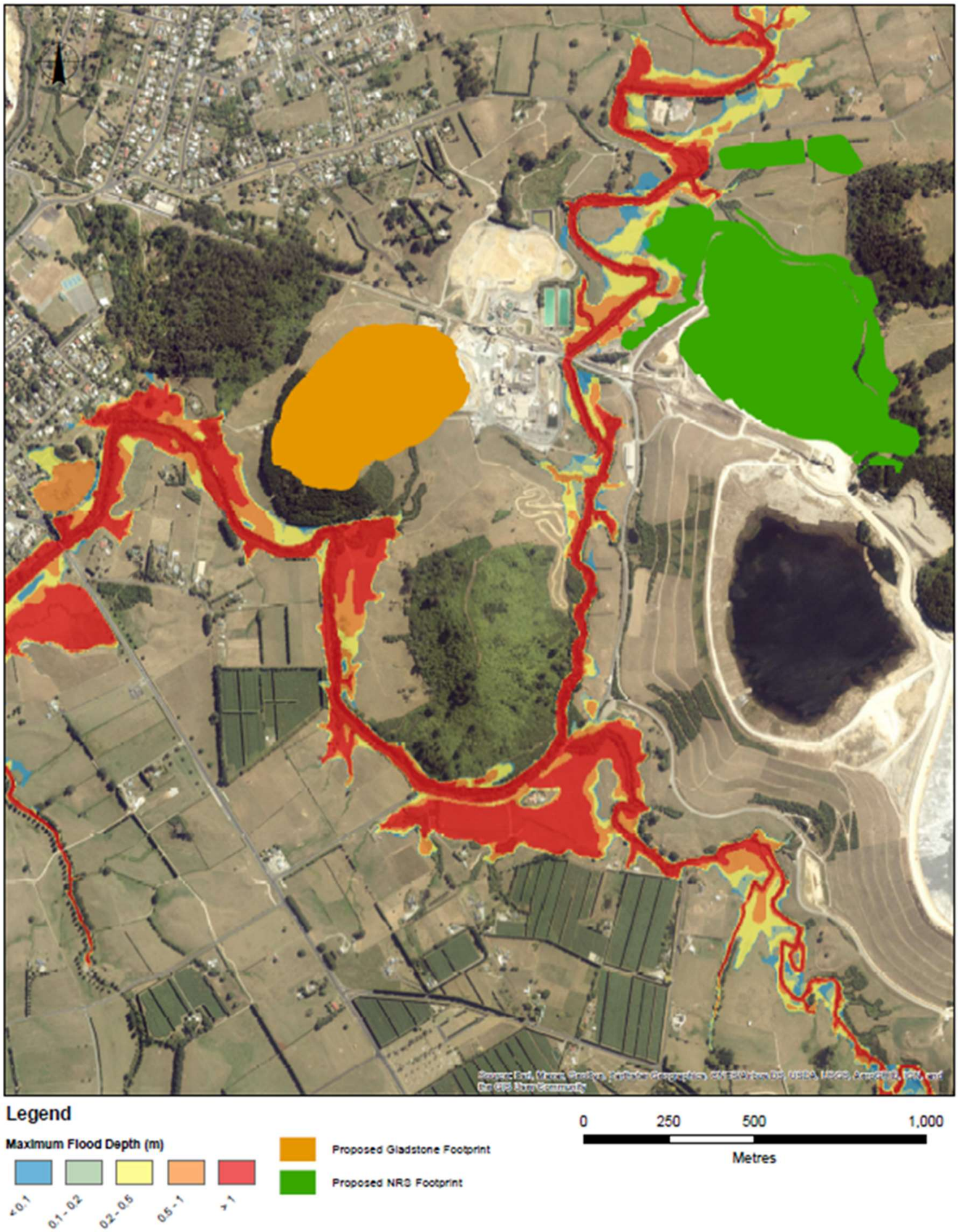

Figure 9 Ohinemuri and Ruahorehore 100 year flood plain

E-6 Summary and Conclusions

- A hydraulic model of study area was build using MIKE 21 software to assess the flood plain effects from the Ruahorehore Stream and the Ohinemuri River on the existing and future mining infrastructure

- The results from the hydraulic model have been successfully verified for peak flows, peak water levels and volumes, and considered acceptable to be used for the purpose of this study.
- Existing development scenarios show that the Ohinemuri River is largely contained within its banks with minimal flooding in the vicinity of existing mine infrastructure up to a 100 year ARI event.
- Future scenarios indicate that proposed infrastructure is not affected by the river water levels other than the area of the proposed NRS collection pond and design of this feature will need to account for flood water levels.
- No impact on upstream / downstream water levels is shown from the modelling.

Appendix F

Water Balance Modelling – Water Treatment Plant Throughput

Figure 1 Modelled estimated daily mean contaminant loads reporting to water treatment plant by source and year

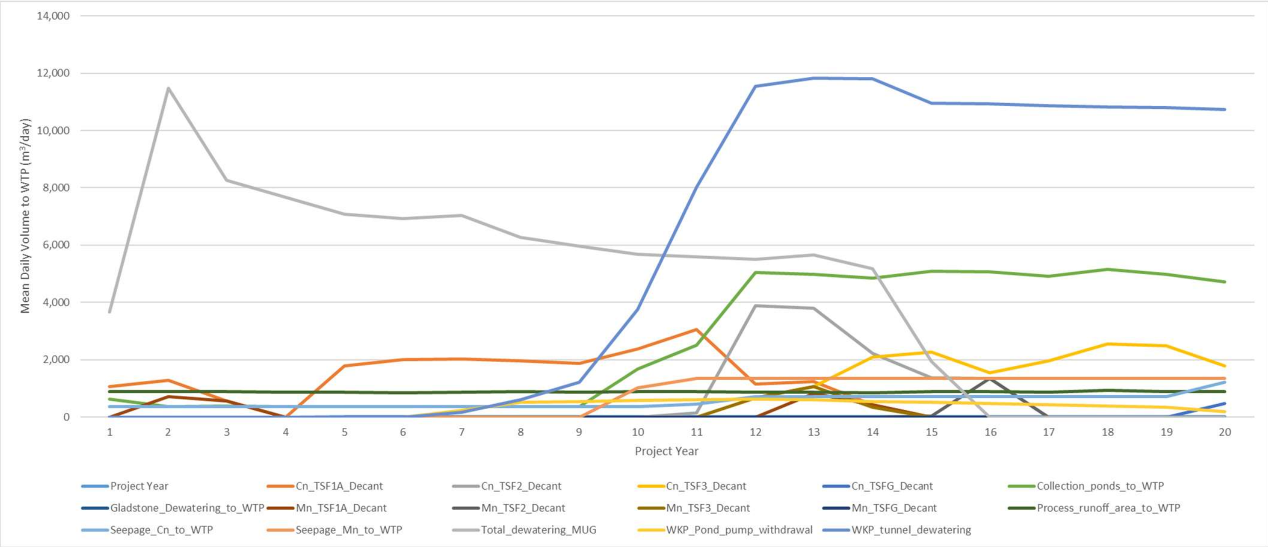

Figure 1 Modelled estimated daily mean volumes reporting to water treatment plant by source and year

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