Active Water Treatment Plant Basis of Design

Buller Plateaux Continuation Project

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EXECUTIVE SUMMARY

Bathurst Resources Limited (BRL) is seeking to obtain authorisation through the Fast Track Approvals Act (FTAA) to progress development and mining of the coal resources across the wider Buller Plateaux. This project is referred to as the Buller Plateaux Continuation Project (BPCP). Process Flow Limited (PFL) has developed this report on active water treatment for both the Mount Frederick South (MFS) and Escarpment Extension (ESE) sub-areas associated with the BPCP.

The purpose of the BPCP is to reconsent the existing infrastructure and mining operations associated with the existing Stockton Mine and provide access to additional coal mining areas across the Buller Plateaux and, as the coal resources in the current Stockton mine are close to depletion, develop further coal resources for on-going blending with the Stockton coal.

There are five key project sub-areas being:

- Stockton mining area (Stockton)
- Mt Frederick South (MFS)
- Escarpment Extended (ESE)
- Upper Waimangaroa Haul Road (UWHR) Transport Corridor
- Cypress (which is an existing mining area)

This report evaluates the requirements and options associated with the construction of two new active water treatment plants (WTPs) one each for MFS and ESE.

Specifically, the scope of work for Process Flow Limited in 2025 included.

- MIW (Mine Influenced Water) Jar and Settlement testing to inform process selection, chemical selection and process sizing. See *"Summary of Water Quality Testing – PFL-2408-PRO-RPT-000001_0 (Process Flow Limited) and associated appendices".*
- Develop a Basis of Design for two active water treatment plants (this report)

Compliance criteria for the discharge of treated water from the Water Treatment Plant is required to be within the guideline compliance limits summarised in RMA Science compliance criteria V3 – 121125 – guidelines summary (RMA Science, 2025)

The various water testing programs undertaken support treatment using common treatment processes at MFS and ESE, but with different capacities and layouts to reflect the scale of mining and the constraints of the sites as well as plant feed rates and qualities. Lamella clarifier plants fed by pumping from a surge pond and discharging into a treated water polishing pond prior to being discharged into the receiving catchment.

Both plants will include a surge pond ahead of the WTP to buffer the WTP feed water. (For MFS only a stockpile area pond for blending stockpile area water is included). The Plant feed pumps will be mounted on pontoons for access and maintenance. The plants will consist of lime dosing (CaO) for neutralisation, metal chelating and flocculant dosing to aid metals removal and settling. Metals and suspended solids will be removed using Lamella Clarifiers sized for maximum plant feed flows. Treated water will be pH adjusted to ensure receiving water pH consent criteria are met. Treated water will be mixed/diluted with receiving waters prior to compliance monitoring points.

The **Escarpment Extension (ESE) Water Treatment Plant (WTP)** will be constructed to treat Mine Influenced Water (MIW) ahead of the mining operations phase set to commence in 2028. It will also remain operational into the Active Closure phase (post mining operations but before passive water treatment can be fully commissioned) until Post Closure passive treatment takes over (WTP is decommissioned and only passive treatment remains) in 2057.

The flow rates for the preliminary design of the ESE Water Treatment Plant are based on water load balance modelling undertaken by Mine Waste Management (MWM) with the reference information listed in section 2.1. These flow rates are summarised as follows.

DESCRIPTION	FLOW RATE (L/SEC)
Maximum Flow Rate into Treatment Plant	750 l/sec*
Maximum Flow Rate into WTP Feed Sump	630 L/sec**
Average Flow Rate into Treatment Plant	386 l/sec***
Minimum Flow Rate into Treatment Plant	75 l/sec****

(* 750 L/sec based on max WTP capacity from Feed Sump to WTP – 5 Lamellas)
(** 634 l/sec based on max WTP feed sump inflow 2038 from MWM J-NZ0433-003-R-Rev0)
(*** 386 l/sec based on MWM Escarpment Extended Mine Project - Water and Load Balance Model. Mine Waste management report: MWM J-NZ0433-003-R-Rev0 average annual flow rate)
(**** 75 l/sec based on 1 Lamella Clarifier operating at 50% capacity)

The **Mount Frederick South (MFS) Water Treatment Plant (WTP)** will be constructed to treat Mine Influenced Water (MIW) ahead of the mining operations phase set to commence in 2029. Mining operations will begin within the West Pit, and the adjoining West Pit Sump will be constructed ahead of mining to manage West Pit MIW. This sump will go on to receive pumped water from the East Pit once mining begins in this area. All MIW from the West Pit Sump will be pumped to the WTP until the West Pit operates under passive treatment in the Post Closure phase, at which point, MIW from the East Pit will be pumped to the WTP until it, too, shifts to passive treatment.

The flow rates for the preliminary design of the water treatment plant are based on the reference information listed in section 2.1. These flow rates are summarised as follows.

DESCRIPTION	FLOW RATE (L/SEC)
Maximum Flow Rate into Treatment Plant	300 L/sec*
Maximum Flow Rate into WTP Feed Sump	235 L/sec**
Average Flow Rate into Treatment Plant	126 L/sec***
Minimum Flow Rate into Treatment Plant	75 L/sec****

(* 300 L/sec based on max WTP capacity from Feed Sump to WTP – 2 Lamellas)
(** Maximum WTP feed sump Inflow is 235 L/sec – MWM, 2026. Mt Frederick South - Water and Load Balance Model. Mine Waste management report: J-NZ0377-003-R-Rev0)
(*** 126 L/sec based on MWM, 2025. Mt Frederick South - Water and Load Balance Model. Mine Waste management report: J-NZ0377-003-R-Rev0)
(**** 75 L/sec based on 1 Lamella Clarifier operating at 50% capacity)
All proposed active water treatment processes utilise standard water treatment industry equipment and treatment chemicals which are available in New Zealand.

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1 INTRODUCTION

Bathurst Resources Limited (BRL) is seeking to obtain authorisation through the Fast Track Approvals Act (FTAA) to progress development and mining of the coal resources across the wider Buller Plateaux. This project is referred to as the Buller Plateaux Continuation Project (BPCP). Process Flow Limited (PFL) has developed this report on active water treatment for both the Mount Frederick South (MFS) and Escarpment Extension (ESE) sub-areas associated with the BPCP.

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There are five key project areas:

- Stockton mining area (Stockton)
- Mt Frederick South (MFS)
- Escarpment Extended (ESE)
- Upper Waimangaroa Haul Road (UWHR) Transport Corridor
- Cypress (which is an existing mining area)

This report evaluates the requirements and options associated with the construction of two new active water treatment plants (WTPs) being one each for MFS and ESE.

2 GLOSSARY OF TERMS

The following is a glossary of terms used in this report.

- AMD – Acid and Metalliferous drainage
- BASF – Supplier of chemical dosing equipment
- BPCP – Buller Plateaux Continuation Project
- CaO – Calcium Oxide (used as water treatment neutralising agent)
- CHAZOP – Control Hazard and Operability Study
- DGV – Default Guideline Value
- DOC – Dissolved Organic Carbon
- ESE – Escarpment Extension mine site
- Filtrate – referring to subnatant from a sludge filter press
- FTAA – Fast Track Approvals Act 2024
- GV – Guideline Value
- HAZOP – Hazard and Operability Study
- HSNO Act – Hazardous Substances and New Organisms Act 1996
- HDS – High Density Sludge
- IBC – Intermediate Bulk Container (1000L)
- IXOM – Supplier of chemicals and reagents
- LOP – Level of Protection

- Manchester St- Raw Sample water from Stockton “Manchester Street” location
- MWM – Mine Waste Management Limited
- MetalsorbFZA proprietary name for a coagulant/metal chelating agent
- MFS – Mount Fred South mine site
- MIW – Mine Influenced Water
- PFL - Process Flow Limited
- Rheomax 1030 proprietary name for a flocculant
- Subnatant – Treated water or sludge discharge (underflow) from WTP
- Supernatant – Treated water discharge (overflow) from WTP clarifier
- TMF – Toxicity Modifying Factor
- WTP – Water Treatment Plant
- WLBM – Water Load Balance Model

3 PROCESS OBJECTIVES AND ASSUMPTIONS

3.1 Reference Information

- MWM (Mine Waste Management). 2026. Water Treatment Report: MFS and ESE - Buller Plateaux Continuation Project. Mine Waste Management Report J-NZ0480-004-R-Rev0
- MWM (Mine Waste Management). 2026. Escarpment Extended, Water Load Balance Model. Mine Waste Management Report J-NZ0433-003-R-Rev0
- MWM (Mine Waste Management). 2026. Mount Frederick South, Water Load Balance Model. Mine Waste Management Report J-NZ0377-003-R-Rev1
- MWM (Mine Waste Management). 2026. AMD Sludge Management - Buller Plateaux Continuation Project. Mine Waste Management Report: J-NZ0349-015-R-Rev0.
- RMA Science, 2026. Water quality compliance criteria – Guidelines_summary_table_V4_190326
- RMA Science, 2025. Water quality compliance criteria – Guidelines summary equations V5 190326
- PFL, 2025. Summary of Water Quality Testing – *PFL-2408-PRO-RPT-000001_3* and associated appendices.

3.2 Process Objectives

This scope of this report is to provide a preliminary design for active Water Treatment Plants (WTPs) for the MFS and ESE sub-areas.

Specifically, the scope of work for Process Flow Limited in 2025 included.

- MIW (Mine Influenced Water) Jar and Settlement testing to inform process selection, chemical selection and process sizing. *Summary of Water Quality Testing – PFL-2408-PRO-RPT-000001_0 (Process Flow Limited) and associated appendices.* This testing was undertaken on expected best average and worst-case quality AMD waters likely to present to the WTP’s to provide a wide plant concentration design envelope.
- Basis of Design Summary for two active water treatment plants (this report)
- Estimation of WTP capital and operating costs, which are contained in a separate report

Where applicable the WTP design has incorporated WTP elements already in use for water treatment at the existing Stockton and Escarpment Mines which has been operated for the last 10-15 years and draws on experience and results obtained treating Stockton mine impacted water (MIW).

Water management for ESE and MFS has been developed by MWM, and integrates mining operations schedules with waste rock characterisation, ELF construction and cover systems, evaluation of rainfall data (the Buller Plateaux has annual average rainfall of ~6,000mm/year), sizing and pumping requirements for surface and Mine impacted water.

Various optimisations have been undertaken to develop the currently proposed MFS and ESE Water and Load Balance Models (WLBMs) (MWM, 2026) which are treated as live documents and will be updated to reflect operational changes and monitoring results obtained during and post operations. The model covers the Operations, Active Closure and Post Closure phases.

Key outputs from the WLBM that affect the ESE and MFS WTP Process Design are:

- Maximum and average flow rates requiring treatment to meet pumping and sump level requirements
- Influent water quality especially TSS, metals and acidity

3.3 Project Description

The BPCP will enable the recovery of ~20Mt of predominantly coking coal from existing opencast operations at Stockton and Cypress, and new operations at the ESE and MFS sub-areas. The mines are in areas partly affected by historic underground and opencast operations, which generate legacy Acid and metalliferous drainage (AMD) discharges. Some legacy discharges along with suspended solids, pH and metals in new mine impacted water will require treatment to meet proposed receiving water quality guidelines.

Active water treatment of mine impacted water by modular or relocatable pH adjustment and flocculation to promote settlement of suspended solids will be used temporarily during construction activities (the Construction Phase), during which time the WTP's for ESE and MFS will be built, and commissioned. These temporary modular treatment systems are not in the scope of this report and will be developed and located on site by BRL as required.

The ESE and MFS WTP's will accommodate the higher flows predicted during the Operational Phase (mining) and Active Closure Phase (post mining and rehabilitation prior to passive treatment systems being fully commissioned). As ELFs are progressively rehabilitated during the Operational and Active Closure Phases, and where loads allow, the treatment of AMD impacted seepage will transition into passive treatment. WLBM results indicate that the WTP can be replaced by passive treatment systems (PTS) within 1-2 decades of mining cessation, which then defines the commencement of the Post Closure Phase.

Active water treatment in the WTP's will be undertaken on a 24/7 basis for 365days/year (taking into account maintenance and downtime considerations discussed in sections 4 and 5) and will operate as part of the overall water management regimes for the two mining areas to meet overall water management requirements which are a function of flow rate and water quality. (Ref, MWM, 2026. Reports).

Maximum flows predicted for the ESE and MFS WTP surge ponds are 630l/sec and 235l/sec respectively. The capacity of the WTP's relates to the disturbed area and volumes of rock, and the

characteristics of the rock. The WTP's will utilise conventional acid neutralisation, flocculation and settling, and chemical addition for metals removal processes, and equipment common to the water treatment industry to achieve the required WTP discharge water qualities.

3.4 Discharge Water Requirements

Discharge from the Water Treatment Plant is required to be within the guideline compliance limits summarised in "RMA Science compliance criteria V4 – 190326 – guidelines summary" (Hickey, 2026).

For this guidance we have been informed that the following levels of protection (LOP) apply for each site:

- ESE WTP Discharge
  - Whareatea River, KEL compliance monitoring site – 95% LOP
  - V8 Creek (Cascade catchment), M-M1 compliance monitoring site – 80% LOP
- MFS WTP Discharge
  - Waimangaroa River, 2W "Smokestack" compliance monitoring site – 90% LOP
  - Waimangaroa River, 17W compliance monitoring site – 90% LOP

Table 3.1 Compliance Criteria – Reproduced from RMA Science (Hickey, 2026)

Application (Note 1)	Guideline Value (µg/L) (Note 2)	TMF range (Note 3).	Derivation notes
Dissolved Aluminium Guideline Values (µg/L)			
	Chronic Al GV		
95% LoP. pH ≤ 6.5	500	pH: ≤ 6.5 (Note 4)	See "Note 4" for basis of change of pH threshold. This reduces set change at this pH transition. Eqn at pH 6.5, H=10, DOC=5 → 160 ug/L
95% LoP. pH > 6.5	exp(0.645×ln(DOC) + 2.255×ln(Hardness) + 1.995×pH + (-0.284×ln(Hardness)×pH) -9.898) *Note if algorithm is ≤ pH 6.5 use 500.	pH: 6.5 – 8.7 Hardness: 10 – 430 mg/L DOC: 0.08 – 12.3 mg/L	
90% LoP	95% LoP / 0.79		The adjustment factor is calculated from the Canadian chronic SSD.
80% LoP	95% LoP / 0.58		As above
Dissolved Copper Guideline Values (µg/L)			
	Chronic Cu GV		
95% LoP	$DGV_{0.5}$ x (DOC/0.5)^0.70 where $DGV_{0.5}$ = 0.73	pH: 6 – 8.5 Hardness: 2 – 400 mg/L DOC: 0.1 – 20 mg/L	
90% LoP	$DGV_{0.5}$ x (DOC/0.5)^ 0.70 where $DGV_{0.5}$ = 0.89		
80% LoP	$DGV_{0.5}$ x (DOC/0.5)^ 0.70 where $DGV_{0.5}$ = 1.4		
	Acute Cu GV		
95% LoP	exp (-6.6 + 0.78xpH + 0.58×ln(Hardness) + 0.70×ln(DOC)	pH: 5 – 8.8 Hardness: 3.9 – 898 mg/L DOC: 0.1 – 30 mg/L	
90% LoP	exp (-6.3 + 0.78xpH + 0.58×ln(Hardness) + 0.70×ln(DOC)		
80% LoP	exp (-5.8 + 0.78xpH + 0.58×ln(Hardness) + 0.70×ln(DOC)		
Dissolved Iron Guideline Values (µg/L)			
All LoP	1000	All conditions	
Dissolved Zinc Guideline values (µg/L)			
	Chronic Zn GV		

Application (Note 1)	Guideline Value (µg/L) (Note 2)	TMF range (Note 3).	Derivation notes
95% LoP	exp(0.947xln(Hardness) - 0.815xpH + 0.398xln(DOC) + 4.63)	pH: 5.7 – 8.1 Hardness: 15 – 399 mg/L DOC: 0.3 – 22.9 mg/L	
90% LoP	95% LoP / 0.67		
80% LoP	95% LoP / 0.39		
	Acute Zn GV		
95% LoP	exp (2.5 - 0.12×pH + 0.6×ln(Hardness) + 0.13×ln (DOC)	pH: 5.4 – 8.5 Hardness: 14 – 826 mg/L DOC: 0.1 – 22 mg/L	
90% LoP	exp (2.9 - 0.12×pH + 0.6×ln(Hardness) + 0.13×ln (DOC)		
80% LoP	exp (3.4 - 0.12×pH + 0.6×ln(Hardness) + 0.13×ln (DOC)		
	Dissolved Cobalt Guideline values (µg/L)		
	Chronic Co GV		
95% LoP	Exp((0.414xLn(hardness)-1.285)	Hardness range: 52-396 mg/L	CCME (2017). Equations for 90% and 80% protection calculated from CCME chronic data. Note: This has hardness modifier which was not in the ANZECC (2000) guidelines.
90% LoP	Exp((0.414xLn(hardness)-0.427)		
80% LoP	Exp((0.414xLn(hardness)+0.557)		
	Acute Co GV		
95% LoP	95%Chronic CoGV/0.16	Hardness range: 52-396 mg/L	Acute peak estimated based on zinc no effect acute and chronic ratio for index water quality conditions.
90% LoP	95%Chronic CoGV/0.11		
80% LoP	95%Chronic CoGV/0.062		
	Dissolved Nickel Guideline values (µg/L)		
	Chronic Ni GV		
95% LoP	11x(Hardness/30)^0.85	Hardness range: 30-400 mg/L. No guidance for pH application range. Normally taken as physiological pH range as used for testing (pH 6.5-8.5)	ANZG (2018) guideline.
90% LoP	13x(Hardness/30)^0.85		
80% LoP	17x(Hardness/30)^0.85		
	Acute Ni GV		
95% LoP	95%Chronic NiGV/0.16	Hardness range: 30-400 mg/L	Acute peak estimated based on zinc no effect acute and chronic ratio for index water quality conditions.
90% LoP	95%Chronic NiGV/0.11		
80% LoP	95%Chronic NiGV/0.062		
	Dissolved Manganese Guideline values (µg/L)		
	Chronic Mn GV		
95% LoP	Exp((0.411xLn(hardness)+4.46)	Hardness range: 25-670 mg/L Simplified equation for hardness only calculated at pH 7.5. Look-up tables provided for pH 5.8 to 8.4.	CCME (2019). Equations for 90% and 80% protection calculated from CCME chronic data and used to adjust from 95% protection. Note: This has hardness modifier which was not in the ANZECC (2000) guidelines.
90% LoP	Exp((0.411xLn(hardness)+4.89)		
80% LoP	Exp((0.411xLn(hardness)+5.38)		
	Acute Mn GV		
95% LoP	(Exp((0.878xLn(hardness)+4.84))/2.13	Hardness range: 25-250 mg/L	CCME (2019). Equations for 90% and 80%
90% LoP	(Exp((0.878xLn(hardness)+6.90)/2.13		

Application (Note 1)	Guideline Value (µg/L) (Note 2)	TMF range (Note 3).	Derivation notes
80% LoP	(Exp((0.878xLn(hardness)+7.20)/2.13		protection calculated from CCME chronic data and used to adjust from 95% protection. Adjustment factor of 2.13 converts the acute EC50 to acute no effect based on the zinc ratio (from Gadd et al 2024).
	Dissolved Cadmium Guideline values (GVs, µg/L)		
	Chronic Cd GV		CCME (2014)
95% LoP	10^(0.83*LOG10(Hardness)-2.46)	Hardness range: 17-280 mg/L	CCME (2014). Equations for 90% and 80% protection calculated from CCME chronic data and used to adjust from 95% protection.
90% LoP	(10^(0.83*LOG10(Hardness)-2.46))*1.84		
80% LoP	(10^(0.83*LOG10(Hardness)-2.46))*4.15		
	Acute Cd GV		
95% LoP	(10^(1.016*LOG10(Hardness)-1.71))/2.13	Hardness range: 5.3-360 mg/L	CCME (2014) acute dataset. Equations for 90% and 80% protection calculated from CCME chronic data and used to adjust from 95% protection. Adjustment factor of 2.13 converts the acute EC50 to acute no effect based on the zinc ratio (from Gadd et al 2024).
90% LoP	(10^(1.016*LOG10(Hardness)-1.71))/2.77		
80% LoP	(10^(1.016*LOG10(Hardness)-1.71))/9.58		
	Nitrate-N (ANZG – hardness (H)-dependent; guideline)		
	Chronic Nitrate-N GV		
95% LoP	1100 (H<30); 2600 (H30-150); 29,000 (H >150)	Hardness dependent	ANZG (2025a)
90% LoP	1500 (H<30); 4200 (H30-150); 38,000 (H >150)		
80% LoP	2300 (H<30); 7100 (H30-150); 56,000 (H >150)		
	Acute Nitrate-NGV		
	Not available		
	Nitrate-N (NPS-FM; standard)		
	Chronic Nitrate-N Standard (median standard)		MfE (2020)
95% LoP	2400		
90% LoP	Below “bottom line”		
80% LoP	Below “bottom line”		
	Acute Nitrate-N Standard (95th percentile standard)		
95% LoP	3500		
90% LoP	Below “bottom line”		
80% LoP	Below “bottom line”		
	Chronic ammoniacal-N (ANZG guideline)		
95% LoP	1200	pH and temperature dependent. Values at pH 7 and 15°C.	ANZG (2026)
90% LoP	2000		
80% LoP	3600		
	Acute ammoniacal-N (ANZG guideline)		
	Not available		
	Chronic ammoniacal-N (NPS-FM median standard)		

Application (Note 1)	Guideline Value (µg/L) (Note 2)	TMF range (Note 3).	Derivation notes
95% LoP	580	pH dependent. Values at pH 7.	
90% LoP	Below "bottom line"		
80% LoP	Below "bottom line"		
	Acute ammoniacal-N (NPS-FM 95th percentile standard)		
95% LoP	968	pH dependent. Values at pH 8.	
90% LoP	Below "bottom line"		
80% LoP	Below "bottom line"		
	pH		
	Maintain in range 4.5 – 7.0 for WTP discharge		pH: Upper pH to be confirmed from bryophyte analysis for sites with differing levels of protection.

Note 1: The level of protection (LoP) values are species protection levels based on narrative descriptors from ANZG (2018).

Note 2: The compliance range for pH at Smokestack is 4.5 to 7.0. The equations vary in their calibrated TMF ranges. For monitored water quality values less than the lowest calibrated TMF value the calculated guideline value (GV) will apply to that monitoring occasion.

Note 3: Toxicity modifying factors (TMFs) are pH, hardness (calcium and magnesium concentrations) and dissolved organic carbon (DOC, measured as dissolved purgeable organic carbon (DPOC) in natural waters).
For pH, hardness and DOC values exceeding the TMF range use the lowest or highest calculated LoP value (except for dissolved aluminum where a 500 µg/L LoP applies to waters below pH 6.5 for all hardness and DOC concentrations).

Note 4: pH minimum for aluminum is based on the pH transition for Al3+ and Al-DOM (dissolved organic matter) binding which have elevated concentrations at lower pH levels. This pH threshold also corresponds to that used in the ANZG (2018) and ANZECC (2000) guidelines for Australia and New Zealand.

The ESE and MFS WTP process design has been selected following water quality testing detailed in section 3.5; which informs the best suited WTP process that will meet the proposed water quality discharge guidelines.

3.5 Jar and Settlement Test Results

Process Flow Ltd was engaged by Bathurst Resources to carry out treated water quality optimisation testing as part of the consenting process for the proposed Escarpment mine site.

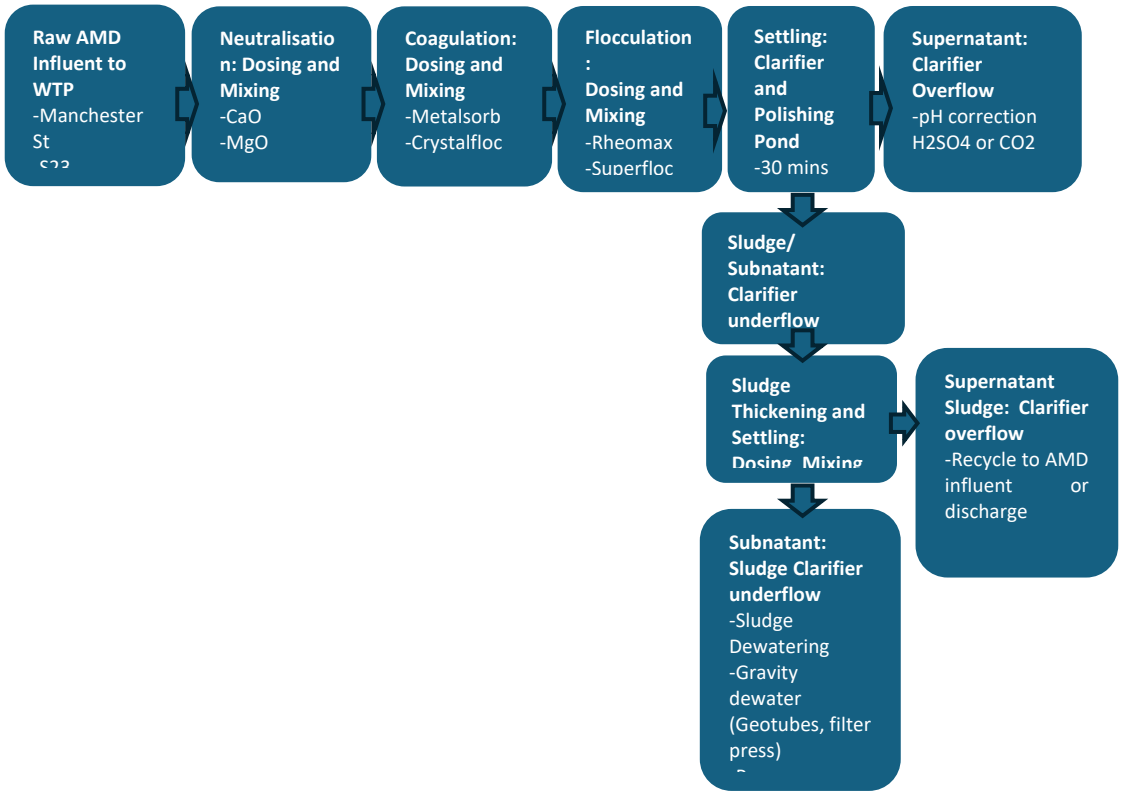
Testing undertaken and results are summarised in report PFL-2408-PRO-RPT-000001 – WQ Summary of Testing (PFL, 2025), and further details are provided in appendices to that report

Figure 3.1 outlines the active treatment processes that have been simulated by the bench and column scale testing performed by Process Flow, for determining the treatment requirements of the Active Water Treatment Plant.

Testing at several scales (bench jar scale 1 litre, column 56 litres and bulk barrel 175 litre scale) has shown overall that repeatable guideline (RMA Science,2025) compliant supernatant (treated water for discharge) results were able to be achieved using active water treatment processes.

Water treatability trials (PFL, 2025) determined that neutralisation with calcium oxide (CaO), coagulation with Metalzorb FZ, and flocculation with Rheomax 1030 effectively reduces TSS and dissolved metals in the supernatant, producing water quality consistent with meeting ESE and MFS receiving water guideline values.

Figure 3.1 Active WTP processes simulated in testing



Results from the testing has provided data to allow for the design and sizing of an active treatment plant which can treat the influent AMD in preparation for discharge offsite and effectively deal with sludge contaminant byproducts onsite (see sections 4.13 and 5.14 for sludge management design)

3.6 General WTP Design Elements

Active treatment is expected for a total of approximately 18 years at MFS and 30 years at ESE (noting this excludes the Construction Phase, prior to the WTP being commissioned (~1 year)).

The WTPs include the following treatment processes:

- WTP Surge Ponds (and a "Stockpile Surge Pond' at MFS and the Ex-Pit Seal Pit at ESE) – receiving water from the run-off, seepage areas, and from pumping from the mine sumps.
- Powdered CaO silos and mixing tanks to generate a neutralising slurry for MIW water from the surge ponds.
- Pontoon mounted pumps to transfer water from the surge ponds to the acidity neutralisation tank.

- pH controlled CaO slurry dosing of AMD in the acidity neutralisation tank.
- Flocculant and metal-chelating agent dosing to CaO neutralised water (including mixing and retention time) prior to transfer to the Lamella Clarifiers.
- Separation of suspended and precipitated solids in the Lamella Clarifier with potential for partial sludge return to the Lamella Clarifier in-flow (i.e., High Density Sludge (HDS) loop).
- Remaining sludge is thickened with flocculant and pumped to a pressure filter for dewatering. Dewatered filter cake is discharged to a bunker for loadout and trucking to disposal areas.
- Sulfuric acid trimming of the lamella clarifier overflow (treated supernatant) to remove additional metals and meet pH compliance limits where required.
- Treated supernatant will report to a polishing pond where it will undergo further settling after pH correction with sulfuric acid prior to discharge to the receiving environment.
- Under high rainfall conditions, mine pit or surge sump capacities are expected to exceed design flows, leading to untreated discharge. This is not part of the WTP scope and is discussed in MWM (2026).
- Sludge management will comprise thickening and dewatering of sludge for final disposal.

The WTP's will also include the following general design elements

- The WTP's will be powered by generators, with the possibility at ESE of upgrading to mains power during the operations phase. Preliminary maximum demand for the WTP's is approx. 750kVa for ESE, and 450kVa for MFS.
- Trials have proven that makeup water for WTP reagents can come from the polishing ponds, however initial (startup) water will need to be sourced from the Waimangaroa River, Pit 3 or Lake Brazil until commissioning is complete and the treated water ponds are full, or as contingency supply
- The WTP's will be designed to Operate 24/7 365 days per year, with maintenance and shutdown windows managed by sump levels. (considering maintenance and downtime considerations discussed in sections 4 and 5)
- The WTP's will be Partially supervised/operated, with PLC control, and SCADA systems with automatic and manual operating modes including remote access and control function, automated alarm messaging systems, and trend functions on main drives and instruments. Silo and tank levels will also be monitored.
- Powdered lime delivery (CaO) is based on delivery of Calcium Oxide powder in 28 tonne (53m3 capacity) tankers. Assumed bulk density of the Calcium Oxide powder is 1092 kg/ m^3. Preliminary Silo volumes are 120m^3 for ESE and 90m^3 for MFS.
- MetalZorb FZ will be delivered in 1000L IBC's its likely these will be ordered in container lots (approx. 18 IBCs per delivery) and stored onsite until need for dilution into purpose-built HSNO compliant storage tanks at the WTP's

- Rheomax Flocculant will be delivered in powdered format will include purpose-built HSNO Act compliant flocculant makeup systems at the WTP's.
- Sulphuric Acid will be delivered by 10,000L road tanker at 98% concentration and stored onsite for use in purpose built HSNO compliant chemical storage tanks. (Depending on final design this may be diluted for onsite storage).
- HAZOPs Hazard and Operability Study and CHAZOPs(Control Hazard and Operability Study) will be conducted during detailed design phase.
- Structures built to meet design life, seismic, and wind load criteria applicable for the sites.
- Resource consents will be applied for under the FTAA. Building consents and HSNO stationary container certificates will be applied for during the detailed design phase and prior to the construction phase in accordance with local body rules, HSNO regulations and site management plans.
- Sludge Management – for purposes of this report mechanical dewatering has been selected as a means of WTP sludge management. Other options that will be evaluated during the detailed design phase include, aqueous disposal in ex-pit seal (which will involve pumping) and Geotube dewatering. These options may also be used as a contingency in case of mechanical breakdown, and at different phases of mine closure.

4 ESCARPMENT ACTIVE WATER TREATMENT PLANT

The ESE WTP will be constructed to treat MIW ahead of the mining operations phase set to commence in 2028. It will also remain operational into the active closure phase until post closure passive treatment takes over in 2057.

The WTP process parameters have been informed by extensive water quality testing and settlement trials which have been carried out during 2025. These tests are summarised in the following report. (PFL, 2025). *"Summary of Water Quality Testing – PFL-2408-PRO-RPT-000001_0 and associated appendices".*

Sizing of the WTP and unit equipment has been confirmed and aligns with the flow, acidity, sulphate, metals and suspended solids loading calculations presented in report MWM, 2025. Escarpment Extended Mine Project - Water and Load Balance Model. Mine Waste management report: J-NZ0433-003-R-Rev0. This is summarised (for the normal rainfall scenario) in Table 4.1.

Table 4.1 Annual Flow, Acidity, TSS, Al and Fe Loads into WTP Surge Sump

Year	Surge sump flow (L/yr)	Ave Flow (L/sec)	Acidity (T/yr)	TSS (T/yr)	Al (T/yr)	Fe (T/yr)
Year 2028	7,061,544,705	224	404	1,226	44	20
Year 2029	8,698,174,539	276	724	1,499	76	33
Year 2030	8,488,351,375	269	702	1,662	75	32
Year 2031	11,575,929,988	367	1,426	2,041	149	65
Year 2032	12,874,943,047	408	1,866	1,825	200	89
Year 2033	14,265,157,879	452	2,373	2,042	255	114
Year 2034	14,925,303,025	473	3,017	2,197	317	142
Year 2035	15,185,556,687	481	3,774	2,351	386	173
Year 2036	16,280,375,651	516	4,515	2,419	455	205
Year 2037	16,189,112,937	513	4,502	1,778	452	206
Year 2038	17,761,731,395	563	4,081	1,949	410	185
Year 2039	13,901,952,469	441	3,200	1,845	325	146
Year 2040	14,876,265,090	471	4,133	1,878	414	187
Year 2041	15,843,922,684	502	4,457	1,975	444	201
Year 2042	16,067,906,542	509	4,028	1,688	402	183
Year 2043	16,267,493,728	515	3,384	1,703	339	154
Year 2044	12,467,786,005	395	2,325	1,176	235	109
Year 2045	12,431,494,538	394	1,637	1,152	167	77
Year 2046	10,682,917,979	339	1,211	99	119	56
Year 2047	10,691,343,676	339	1,008	99	99	47
Year 2048	10,677,720,575	338	898	99	89	42
Year 2049	10,712,174,627	339	807	99	80	38
Year 2050	10,726,735,167	340	729	99	73	34
Year 2051	10,739,304,386	340	673	99	67	31
Year 2052	10,726,234,740	340	637	100	64	30
Year 2053	10,760,882,480	341	604	100	61	28
Year 2054	10,775,437,013	341	574	100	58	27
Year 2055	10,787,959,061	342	547	100	55	26
Year 2056	10,774,762,622	341	522	100	53	25
Year 2057	10,809,416,847	343	508	100	51	24

Equipment selections, including chemical dosing and mechanical dewatering equipment, have been informed by key industry suppliers within New Zealand, with experience in the treatment and processing of mine influenced water.

4.1 Definition of Plant Flow Rates

The design flow rates for the ESE water treatment plant are based on the reference information listed in section 3.1. and are summarised as follows.

Table 4.2 ESE WTP Flow Rates

DESCRIPTION	FLOW RATE (L/SEC)
Maximum Flow Rate into Treatment Plant	750 l/sec*
Maximum Daily Average Flow Rate into WTP Feed Sump	634 L/sec**
Average Flow Rate into Treatment Plant	386 l/sec***
Minimum Flow Rate into Treatment Plant	75 l/sec****

(* 750 L/sec based on max WTP capacity from Feed Sump to WTP – 5 Lamellas)
(** 634 l/sec based on max WTP feed sump inflow 2038 from MWM J-NZ0433-003-R-Rev0)
(*** 386 l/sec based on MWM Escarpment Extended Mine Project - Water and Load Balance Model. Mine Waste management report: J-NZ0433-003-R-Rev0 average annual flow rate)
(**** 75 l/sec based on 1 Lamella Clarifier operating at 50% capacity)

4.2 Plant Location and Footprint

The proposed location for the Escarpment WTP is located near the area labelled “Water Treatment Plant” in Figure 4.1 (general location map showing Central Infrastructure area). This was selected by BRL in consultation with Process Flow as:

- The location of the ESE WTP is in the Central Infrastructure area and adjoins other infrastructure, minimising the overall mine footprint
- It will be able to use generator power initially, but has good potential to upgrade to Mains supply
- It utilises the Ex-Pit Seal as the WTP surge sump
- It has a good location for the polishing pond to the southwest of the WTP
- It has good access for consumables supply and service vehicles.

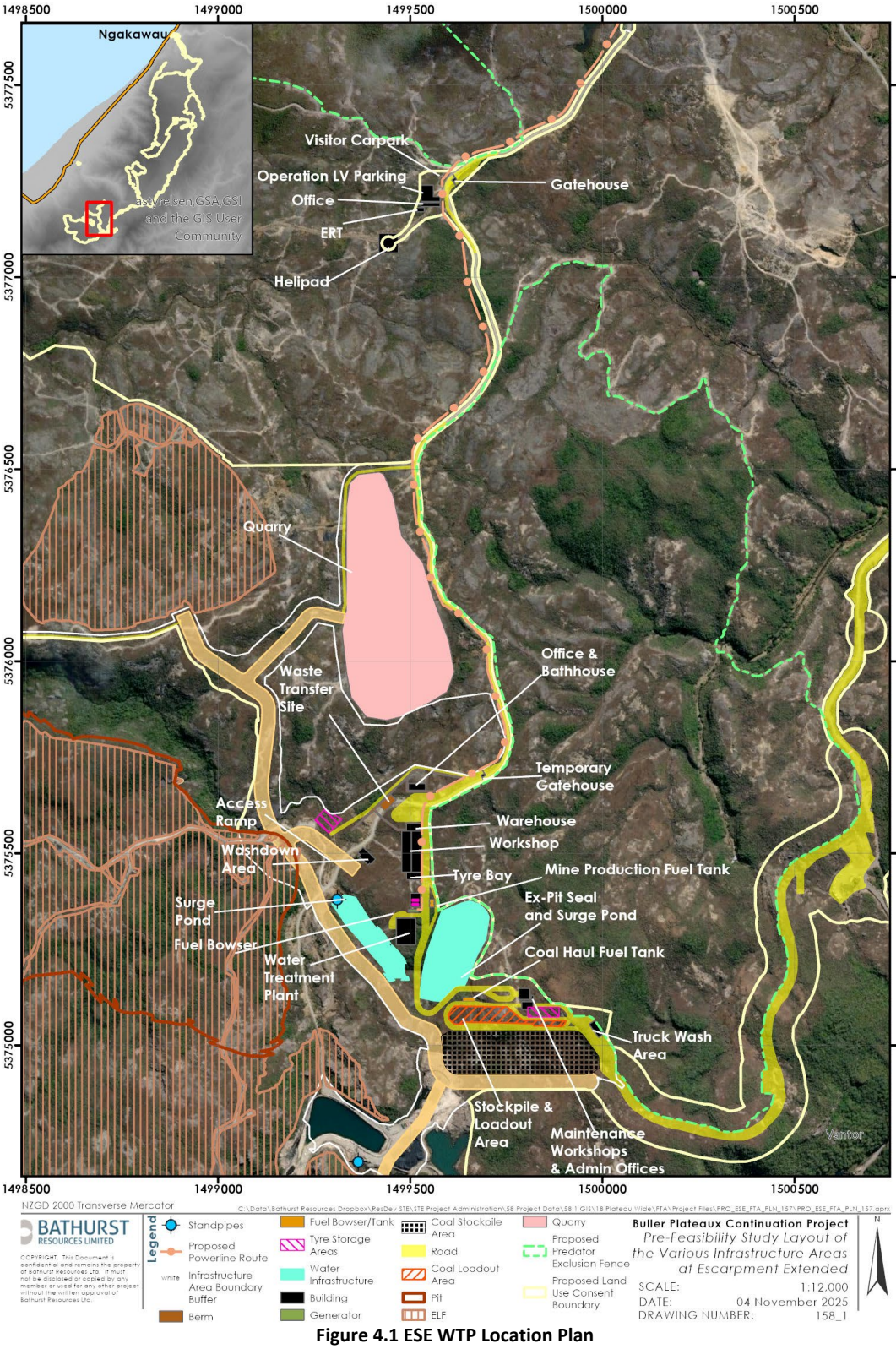


Figure 4.1 ESE WTP Location Plan

The size and footprint requirements for the WTP is as follows (refer Figure 4.2).

- WTP Footprint – An area approximately 110m x 110m located near the surge and treated water ponds (This may need to be split level to aid with Lamella flow)

- MIWWTP Surge Pond – 207,446 m^3 (see section 4.4for detail and sizing philosophy)
- MIWWTP Polishing Pond – 54,432 m^3 (see section 4.8 for detail and sizing philosophy)

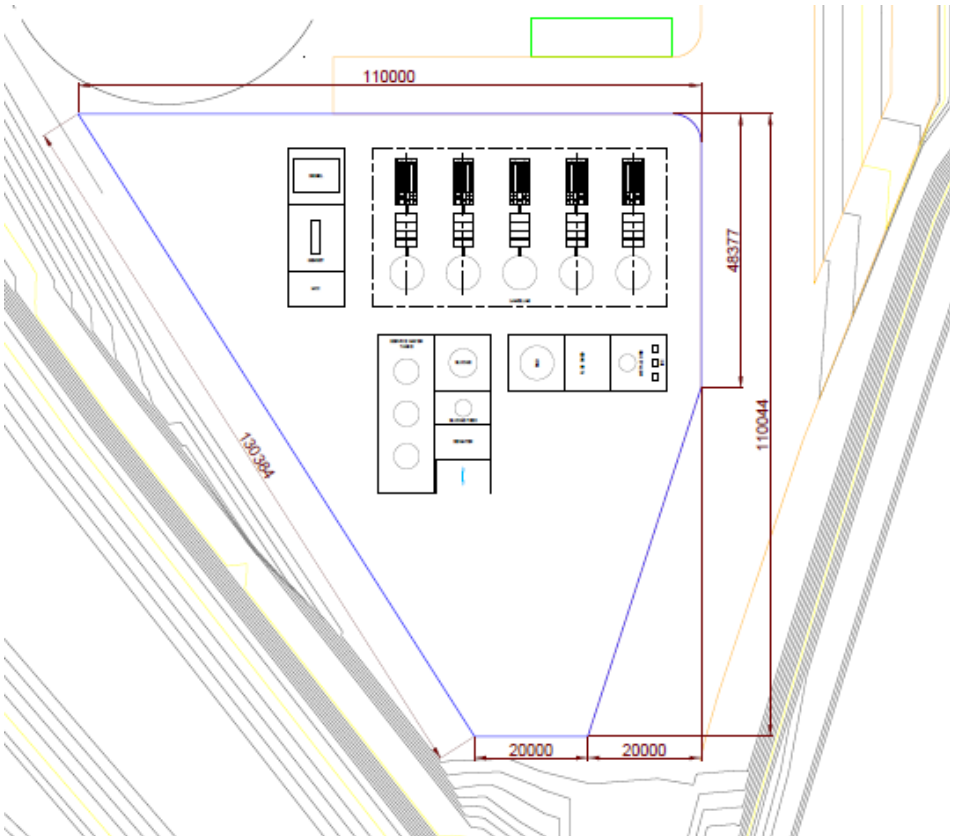


Figure 4.2 ESE WTP Plan View

4.3 Preliminary Process Design

The following is a description of the preliminary process design developed for the purpose of informing the next stage of design which will be a FEED Study and Detailed Design for the WTP.

The selected process and sizing of equipment is based on the outcome of the Jar and Settlement testing discussed in section 3.5. The testing supports a lamella clarifier plant process fed by a surge pond and discharging into a polishing pond prior to being discharged into the receiving catchment.

The process selected involves the following unit processes, and the process flow is shown schematically in Figure 4.3

- WTP surge pond
- Pontoon mounted pumps for plant feed (surge pond)
- Lime dosing (CaO for purposes of this report)
- Neutralising tank (fast mix)
- Flocculant dosing
- Metal chelating agent dosing
- Flocculant tank (slow mix)
- Lamella clarifiers
- pH dosing/trimming and settling in polishing pond
- Polishing Pond

- Sludge dewatering

Water will be pumped from the in-pit Surge Sumps directly to the Water Treatment Plant Surge Pond. Under normal conditions water from the Pit pipeline will be buffered by the WTP surge Pond prior to pumping into the WTP for treatment.

The mine influenced water will be neutralised in the range pH 7.0 to pH 8.5 (or higher) depending on treatment requirements in the fast mix neutralisation tank. A lime dosing system (using a slurry of calcium oxide) will be installed for neutralisation.

Once neutralised the water will be flash mixed with flocculant and metal chelating agent before entering a slow mix tank where flocculant and a metal chelating agent react to aid settling and metals removal.

Once dosed and mixed the water will enter a Lamella gravity settler where solids/metals will settle out as sludge, and supernatant (Lamella overflow) will report to the treated water sump for retention/polishing before being discharged into the receiving catchment. If Polishing Pond water quality monitoring determines that an acceptable level for discharge to the polishing pond is not achieved treated water can be diverted back to the WTP surge sump and reprocessed.

The treated water will require pH adjustment to lower the pH (to approx. pH 6.5) on the Lamella overflow; this is required to meet compliance and to lower the dissolved Aluminium which will settle out in the polishing pond.

The lamella underflow sludge will contain around 3% solids and will be mechanically dewatered via plate and frame filter to >12% solids allow handling, transport and disposal.

The plant will be designed to operate at the maximum flow rate 24/7, 365 days per year. Planned maintenance will be managed during times of lower flow, and the WTP will have the following contingencies for unplanned maintenance and breakdowns.

- The water treatment plant consists of 5-unit processes each capable of taking 1/5th of the overall flow. One unit can be taken offline at a time for maintenance.
- Reagent storage equipment (silos and tanks and associated plant items) will be consistent across both ESE and MFS sites, and a full set of spares will be held on site ready in case of breakdowns.
- Dewatering equipment will be consistent (filters, sludge pumps and associated plant items) will be consistent across both ESE and MFS sites, and a full set of spares will be held on site ready in case of breakdowns. Geotubes could be held in a location near each plant for sludge diversion in case of breakdowns.

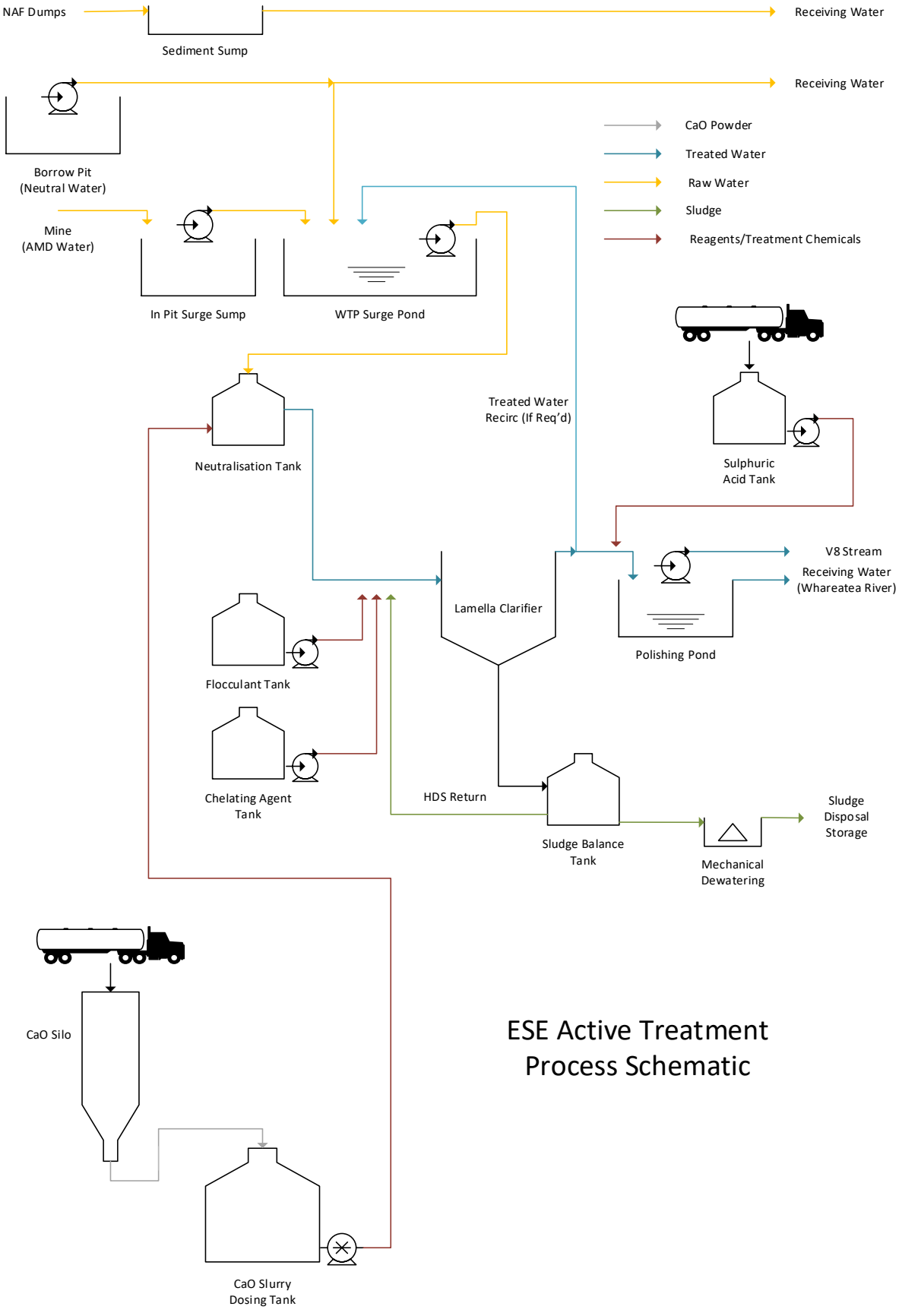


Figure 4.3 ESE WTP Process Schematic

4.4 WTP Surge Pond

A surge pond located adjacent to the water treatment plant has been included in the design. Primarily this is to allow a pumped (fixed speed) feed to the treatment plant. Recommended pond sizing is based on having greater than seven days storage at average flow.

Table 4.3 WTP Surge Pond Sizing

PLANT FEED RATE	DURATION/RETENTION	RECOMMENDED SUMP VOLUME
Average Flow Rate (386 l/sec)	7.2 Days	240,000 m^3
Max Flow Rate (630 l/sec)	4.41 Days	240,000 m^3

4.5 Pontoon Mounted Pumps

A pontoon mounted pump system with multiple pumps is recommended to reclaim MIW from the WTP surge pond for plant feed. As described in section 4.6, five Lamella clarifiers (each capable of processing 1/5 of the maximum flow) will be required to cater for maximum flow conditions and settling requirements. Therefore, five centrifugal pumps are recommended (each capable of feeding one clarifier at full flow. The required pump specification is as follows.

Table 4.4 Pontoon Pump Sizing

PUMP DETAILS	TECHNICAL DATA
Actual Calculated Flow	150 l/sec each (5 off delivering 750 l/sec)
Resulting Head of Pump	4.5 bar
Rated Power	110kW each

4.6 Lime Dosing/Neutralisation

Calcium Oxide delivery and storage design is based on delivery of Calcium Oxide powder in 28 tonne (53m3 capacity) tankers. Assumed bulk density of the Calcium Oxide powder is 1092 kg/ m^3.

Preliminary Calcium Oxide storage design is for one 120m^3 Silo. Required time between deliveries at maximum Calcium Oxide dose rate will be 4.09 days (6.67 days at average dose rate). Delivery to the silos will be via air pneumatic delivery, taking approximately 50 minutes per delivery.

The Silo design will incorporate a bin activator powder fluidising mechanism and dry air circulated will be evacuated from the silo via a pulse jet filter. Overpressure protection will be provided

The CaO powder will be metered from the silo and be batch slaked into a slurry for dosing and held in an agitated slurry tank at 20% solution ready for dosing. The nominal dose rate resulting from preliminary testing is 0.26kg CaO/$m^3$of water treated
This results in the following powder dose rates.

Table 4.5 CaO Powder Dose Rates

DESCRIPTION	RATE
CaO Powder Dose Rate at Max Flow	702.00 kg/hr
CaO Powder Dose Rate at Average Flow	361.30 kg/hr
CaO Powder Dose Rate at Minimum Flow	70.20 kg/hr

The slurry will dose into the WTP feed water prior to being held in a rapid mix (neutralisation) tank while neutralisation happens. Nominal mixing time and speed have been determined from preliminary testing and result in the following mix tank requirements.

Table 4.6 Neutralisation Tank Sizing

DESCRIPTION	RATE/DATA
Slurry Mix (Detention) Time	20 Mins
Mixing speed (RPM and associated g Value)	350 rpm, G Value $450s^{-1}$
Tank Size (per Lamella)	$150m^3$

4.7 Metal Chelating Agent Dosing

The metal chelating agent which achieved the best results in preliminary testing was the IXOM supplied, Metalzorb FZ. Dosing equipment has been preliminarily sized on the dose rates for this chemical.

Metalzorb FZ is delivered as a liquid product in shipments of 18 IBC's (18,000L). The nominal dose rates for Metal Zorb determined during preliminary testing 0.002ml/l.

Table 4.7 Chelating Agent Dose Rate

DESCRIPTION	RATE
Concentrated Dose Rate at Max Flow	5.40 l/hr
Concentrated Dose Rate at Average Flow	2.78 l/hr
Concentrated Dose Rate at Minimum Flow	0.54 l/hr

The concentrated product will require dilution for dosing, which during preliminary testing was diluted at 1ml/l (or 0.1%) but will likely be diluted at 1.0% in practice. The storage/batch tank for dosing has been sized at $30m^3$ for the preliminary design.

The metal chelating agent is dosed into the Lamella feed water following the neutralisation step. Nominal mixing time and speed have been determined from preliminary testing and result in the following mix tank requirements.

Table 4.8 Chelating Agent Mixing

DESCRIPTION	RATE/DATA
Flash Mix (Detention) Time	1 Mins
Mixing speed (RPM and associated g Value)	30 rpm, G Value $450s^{-1}$
Tank Size (per Lamella)	$1.1m^3$ (Could be dosed into an agitated flume)

4.8 Flocculant Dosing

The Flocculant which achieved the best results in preliminary testing was the Chemiplas supplied, Rheomax 1030. Dosing equipment has been preliminarily sized on the dose rates for this chemical.

Rheomax 1030 is delivered as a powdered product in shipments of 1000 kg Bulk Bags. The nominal dose rates for Rheomax 1030 determined during preliminary testing 1mg/l.

Table 4.9 Flocculant Dose Rates

DESCRIPTION	RATE
Powder Dose Rate at Max Flow	2.70 kg/hr
Powder Dose Rate at Average Flow	1.39 kg/hr
Powder Dose Rate at Minimum Flow	0.27 kg/hr

The flocculant dosing system used in this preliminary design is based on a previously quoted dosing system from Chemiplas and includes the following components.

- 7m^3 Powder Hopper
- BASF 600T Auto Jet Wet Unit
- 15m^3 Flocculant Storage Tank
- 0.25-5m^3/hr Dosing Pump Skid
- BASF Alcotech TC Ultra Floc dose control system

The Flocculant is dosed into the Lamella feed water following the metal chelating step. Nominal mixing time and speed have been determined from preliminary testing and result in the following mix tank requirements.

Table 4.10 Flocculant Mixing

DESCRIPTION	RATE/DATA
Flash Mix (Detention) Time	1 Mins
Mixing speed (RPM and associated g Value)	350 rpm, G Value 450s^{-1}
Tank Size (per Lamella)	1.1m^3 (Could be dosed into an agitated flume)

4.9 Slow Mix Tank

The preliminary testing included a slow mix step/tank which mixes at a much slower rate and allows for Floc formation prior to entering the Lamella Clarifiers.

Nominal mixing time and speed have been determined from preliminary testing and result in the following mix tank requirements.

Table 4.11 Slow Mix Tank Sizing

DESCRIPTION	RATE/DATA
Slow Mix (Detention) Time	10 Mins
Mixing speed (RPM and associated g Value)	30 rpm, G Value 15s^{-1}
Tank Size (per Lamella)	75m^3

4.10 Lamella Clarifiers

The preliminary Jar and Settlement testing discussed in section 2.0 has determined a surface overflow rate of 2.0 m/hr. This was determined following settling column tests on Manchester Street water (Raw Sample water from Stockton “Manchester Street” location) both with and without sediment addition.

Settling laboratory tanks assume an ideal settling basin and this design method does not account for concentration or density gradients, wind movement, flow variation, differences in tank shape, inlet/outlets structures and temperature variations. Scaleup factors to account for this are suggested, as follows. Surface Overflow Rate = Laboratory value/Scaleup factor, using a Scaleup factor of 1.25 to 1.75

For this preliminary design we have used a scaleup factor of 1.5, which results in a sizing factor for Lamella Clarifier selection of 1.333' $m^3/hr/m^2$. (m/hr)

At maximum flow of 2,268 m^3/hr (630 l/sec) the required Lamella surface area equates to 1701 m^2.

Our preliminary equipment selection is based on a New Zealand fabricated "Parkson" Lamella designed to the following specification.

Table 4.12 Lamella Clarifier Requirements

DESCRIPTION	DATA
Parkson LGS3900	362m^2
Materials of Construction	316L Stainless wetted, 304L Exoskeleton

Therefore, based on the minimum settling area required of 1701 m^2, five Lamella units (with 362m^2 each) will be required given a total surface area of 1,810 m^2. A typical lamella plant is shown in figure 4.4 for visual reference. (Note this is typical only and final design will differ from this image)

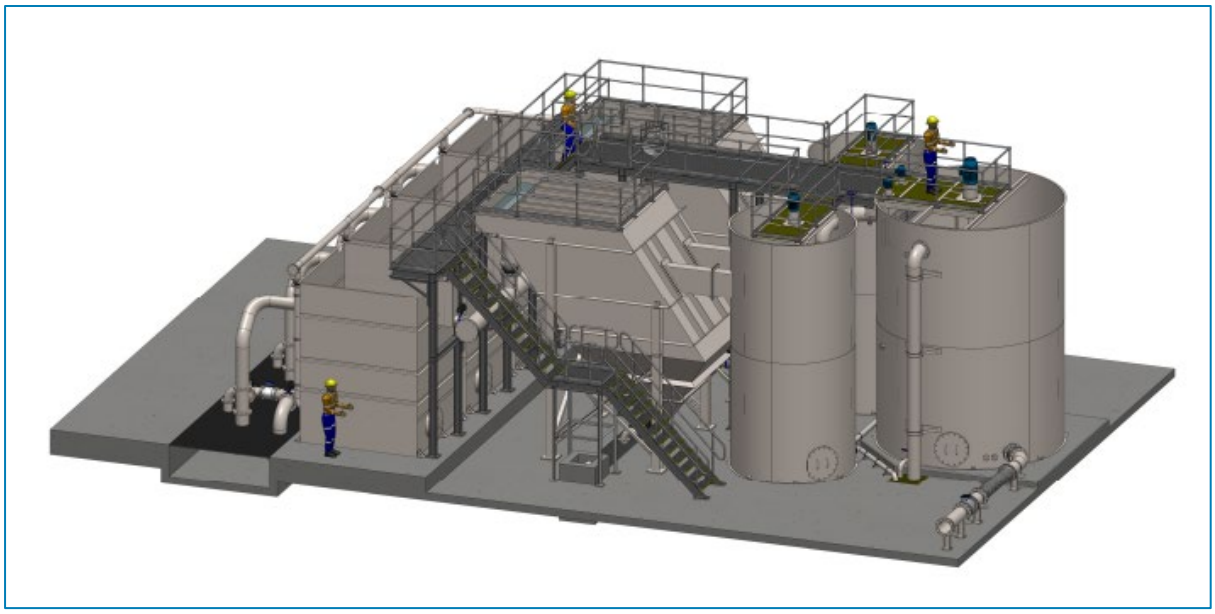


Figure 4.4 Typical Lamella Clarifier Plant

4.11 Sulphuric Acid Dosing

As described in section 3.3 sulphuric acid dosing will be required to lower the pH of the treated water (Lamella overflow) Nominal Dose rates to achieve a final pH of 6.5 are as follows.

Table 4.13 Sulphuric Acid Dose Rates

DESCRIPTION	RATE
Sulphuric Dose Rate at Max Flow	13.70 L/hr*

DESCRIPTION	RATE
Sulphuric Dose Rate at Average Flow	7.05 L/hr*
Sulphuric Dose Rate at Minimum Flow	1.37 L/hr*

Based on concentrated (98.5%) dose rate of 0.005076 mL/L)

Delivery quantities equate to approx. 16000L max for 98% in a truck/trailer arrangement.
Ixom suggest that for supply security and load planning, a site storage tank in the range of 25,000/30,000L storage capacity will be appropriate.

One truck/trailer delivery at ESE would last approx. 95 days at average flow, so the delivery could be shared between the two WTPs (ESE and MFS) and storage volume at each site could be reduced.

4.12 Polishing Pond

A treated water polishing pond located adjacent to plant has been included in the design. Primarily this is to allow retention time on treated water prior to discharge. Additional residence time post Lamella is recommended to allow for any Floc carry over from the clarification process to settle before discharge. Recommended sump/pond sizing is based on 24 hours storage at maximum flow.

Table 4.14 Polishing Pond Sizing

PLANT FEED RATE	DURATION/RETENTION	RECOMMENDED SUMP VOLUME
Average Flow Rate (386 l/sec)	39 Hours	54,432 m^3
Max Flow Rate (630 l/sec)	24 Hours	54,432 m^3

4.13 Sludge Management

The following sludge volumes have been determined from MWM AMD Sludge Management – Buller Plateaux Continuation Project. Mine Waste management report: J-NZ0349-015-R-Rev0. Maximum sludge volumes are seen in YR2036. (It is expected that sludge from the Lamella clarifier will be at approx. 3% solids, this will be mechanically dewatered to > 12% for handling and disposal).

Table 4.15 Annual Sludge Quantities - ESE

YEAR	TOTAL SLUDGE WET 3% SOLIDS (M^3)	TOTAL SLUDGE WET 12% SOLIDS (M^3)	TOTAL SLUDGE DRY (M^3)
Year 2027	*	*	*
Year 2028	47,114	11,779	1,413
Year 2029	60,619	15,155	1,819
Year 2030	65,838	16,459	1,975
Year 2031	88,960	22,240	2,669
Year 2032	88,898	22,225	2,667
Year 2033	103,857	25,964	3,116
Year 2034	117,838	29,459	3,535
Year 2035	132,928	33,232	3,988
Year 2036	145,091	36,273	4,353
Year 2037	123,436	30,859	3,703
Year 2038	123,090	30,773	3,693
Year 2039	107,442	26,861	3,223
Year 2040	121,239	30,310	3,637

YEAR	TOTAL SLUDGE WET 3% SOLIDS (M^3)	TOTAL SLUDGE WET 12% SOLIDS (M^3)	TOTAL SLUDGE DRY (M^3)
Year 2041	128,821	32,205	3,865
Year 2042	113,369	28,342	3,401
Year 2043	104,894	26,224	3,147
Year 2044	72,627	18,157	2,179
Year 2045	62,137	15,534	1,864
Year 2046	20,455	5,114	614
Year 2047	17,617	4,404	529
Year 2048	16,083	4,021	482
Year 2049	14,824	3,706	445
Year 2050	13,743	3,436	412
Year 2051	12,972	3,243	389
Year 2052	12,485	3,121	375
Year 2053	12,023	3,006	361
Year 2054	11,619	2,905	349
Year 2055	11,248	2,812	337
Year 2056	10,918	2,730	328
Year 2057	10,721	2,680	322
Total	1,972,905	493,226	59,187

** - Construction Phase – Minor AMD treatment with AMD sludge being disposed to Pit 3 Pit at ESE (200,000 m^3 capacity) and within a purpose construction facility at MFS near the MFS coal pad. For management purposes, and for context it is assumed that ~20% of the first years AMD sludge is produced each year (10,000 m^3 for ESE and 2,000 m^3 for MFS)*

A Matec filter press or similar (Typical example shown in figure 4.5) would be suitable for dewatering the AMD sludge. Sludge will be pumped from the Lamella underflow(s) to a sludge conditioning tank provided as part of the dewatering plant package. From there sludge is pumped into the filter press and dewatered into a cake for trucking and disposal. *(MWM, 2026. AMD Sludge Management – Buller Plateaux Continuation Project. Mine Waste management report: J-NZ0349-015-R-Rev0).*

Mechanically dewatered sludge will be loaded by wheel loader from a bunker for trucking to a purpose-built disposal location elsewhere on site.

Table 4.16 Filter Press Details

DESCRIPTION	PRODUCT DATA
Filter press model	Ignis 1000x1000/60 Fast TT2
Size of plates	1000 x 1000
Number of plates	60 (with TT2 Fast Opening)
Chamber Thickness	30mm
Total cycle time assumed	35 mins (assumed)
Total chamber volume	1.605 m^3
Total filtration area	571.2 m^2

Figure 4.5 Example of Plate and Frame Filter

5 MOUNT FRED SOUTH ACTIVE WATER TREATMENT PLANT

The Mount Frederick South (MFS) Water Treatment Plant (WTP) will be constructed to treat Mine Influenced Water (MIW) ahead of the mining operations phase set to commence in 2029. Operations will begin within the West Pit, where the West Pit Sump will be constructed ahead of mining to manage MIW. This sump will go on to receive pumped water from the East Pit once mining begins in this area. The collection of MIW will be pumped from the West Pit Sump to the WTP until the West Pit operates under passive treatment; at this point, MIW from the East Pit will be pumped to the WTP until it, too, shifts to passive treatment in year 2047.

The WTP process parameters have been informed by extensive water quality testing and settlement trials which have been carried out during 2025. These tests are summarised in the following report. (PFL,2025 *"Summary of Water Quality Testing – PFL-2408-PRO-RPT-000001_3 and associated appendices").*

Sizing of the WTP and unit equipment has been confirmed and aligns with the flow, acidity, sulphate, metals and suspended solids loading calculations presented in report MWM, 2025. Mt Fred South - Water and Load Balance Model. Mine Waste management report: J-NZ0377-003-R-Rev0. This is summarised (for the normal rainfall scenario) in Table 5.1.

Table 5.1 Annual Flow, Acidity, TSS, Al and Fe Loads

Year	Surge sump flow (L/yr)	Ave Flow (L/sec)	Acidity (kg/yr)	TSS (kg/yr)	Al (kg/yr)	Fe (kg/yr)
Year 2029	2,697,635,809	86	89,441	276,063	8,542	3,350
Year 2030	2,659,152,071	84	91,872	333,063	8,812	3,277
Year 2031	2,605,361,315	83	100,498	345,451	9,664	3,615
Year 2032	2,814,036,692	89	120,751	404,894	11,650	4,338
Year 2033	2,929,046,707	93	144,366	465,688	13,960	5,209
Year 2034	2,988,708,296	95	167,503	524,356	16,224	6,060
Year 2035	4,629,575,211	147	239,233	719,160	23,101	9,110
Year 2036	4,788,160,645	152	296,963	727,371	28,656	11,684
Year 2037	5,877,546,156	186	308,960	832,554	29,741	12,136
Year 2038	5,997,004,874	190	306,743	865,945	29,528	11,977
Year 2039	5,199,908,855	165	320,816	773,182	31,003	12,623
Year 2040	5,035,283,910	160	324,103	743,210	31,319	12,823
Year 2041	5,186,445,342	164	314,553	869,073	30,410	12,296
Year 2042	5,391,315,582	171	264,741	821,233	25,554	10,222
Year 2043	4,348,911,036	138	192,935	391,251	19,525	8,185
Year 2044	4,146,837,085	131	141,028	29,207	14,343	7,016
Year 2045	2,083,180,274	66	46,124	13,689	5,066	2,570
Year 2046	2,084,533,056	66	46,776	13,701	4,983	2,483

Equipment selections including chemical dosing and mechanical dewatering equipment have been informed by key industry suppliers within New Zealand, with experience in the treatment and processing of mine influenced water.

5.1 Definition of WTP Flow Rates

The flow rates for the preliminary design of the water treatment plant are based on the reference information listed in section 2.1. These flow rates are summarised as follows.

Table 5.2 MFS WTP Flow Rates

DESCRIPTION	FLOW RATE (L/SEC)
Maximum Flow Rate into Treatment Plant	300 L/sec*
Maximum Daily Average Flow Rate into WTP Feed Sump	235 L/sec**
Average Flow Rate into Treatment Plant	126 L/sec***
Minimum Flow Rate into Treatment Plant	75 L/sec****

(* 300 L/sec based on max WTP capacity from Feed Sump to WTP – 2 Lamellas)
(** Maximum WTP feed sump Inflow is 235 L/sec – MWM, 2026. Mt Fred South - Water and Load Balance Model. Mine Waste management report: J-NZ0377-003-R-Rev0)
(*** 126 L/sec based on MWM, 2026. Mt Fred South - Water and Load Balance Model. Mine Waste management report: J-NZ0377-003-R-Rev0)
(**** 75 L/sec based on 1 Lamella Clarifier operating at 50% capacity)

5.2 Plant Location and Footprint

The proposed location for the MFS WTP is located at the southern end of the MFS site as shown in Figure 5.1. Numerous options were evaluated by BRL, in consultation with PFL, and this site was chosen because:

- It provides good access for delivery of services and consumables via the Upper Waimangaroa Haul Road
- Can readily treat mine impacted water from the coal stockpile area
- Geotechnical conditions are expected to be favourable
- Discharge of treated water to the Waimangaroa River is preferable to discharge to Deep Creek and its tributaries due to overall lower environmental impacts
- It facilitates the discharge of untreated water as an active bypass to the WTP during high flows (>90th percentile) to the Waimangaroa River, as proposed in the water management regime developed by MWM and modelled in the *(MWM, 2025. Mt Frederick South - Water and Load Balance Model. Mine Waste management report: J-NZ0377-003-R-Rev0).*

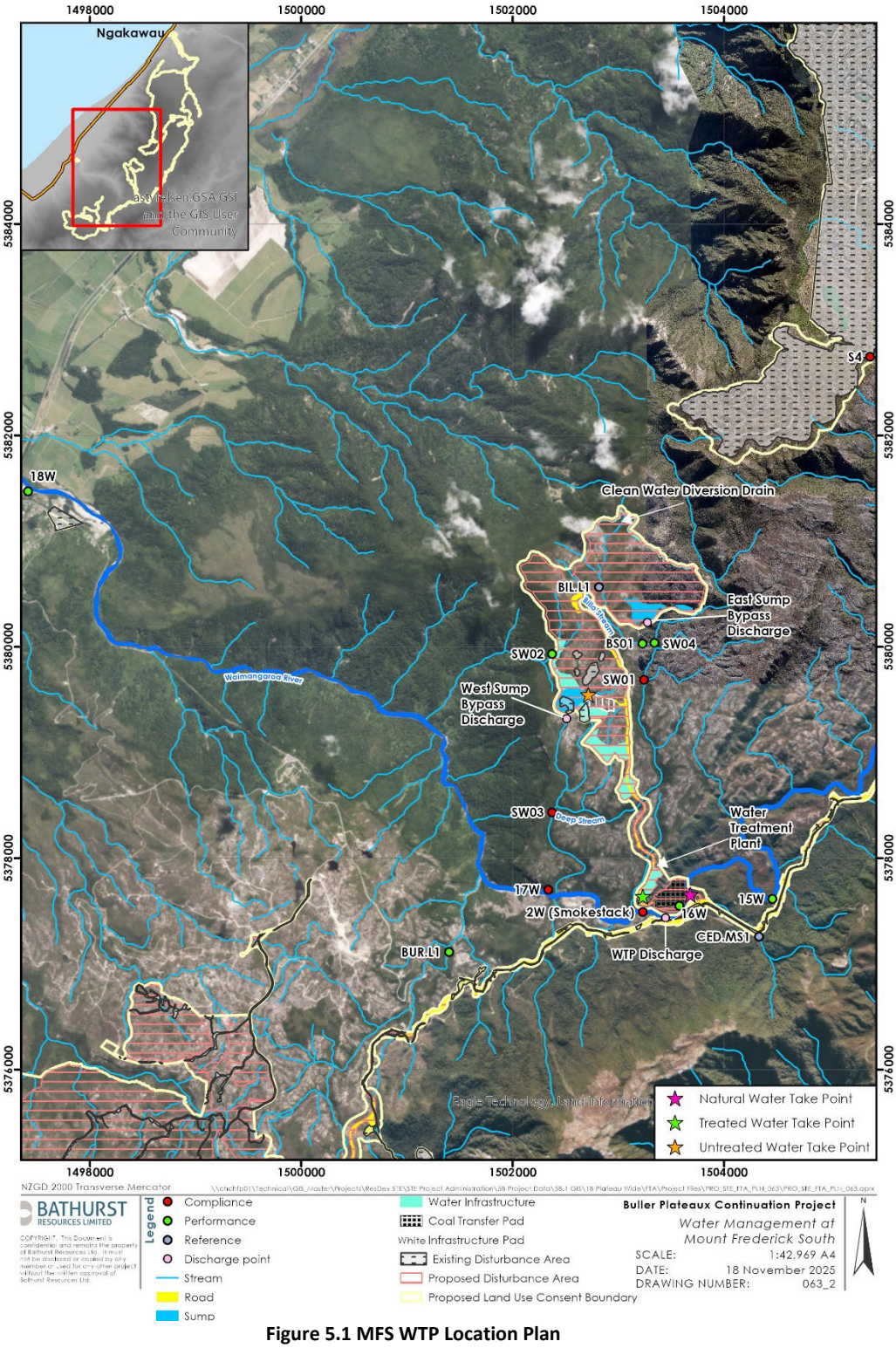


Figure 5.1 MFS WTP Location Plan

The size and footprint requirements for the WTP and Surge and Treated water ponds is as follows.

- WTP Footprint – An area approximately 80m x 80m located near the surge and treated water ponds will be required to accommodate the Water Treatment Plant equipment
- See PFL-2408-GEN-GAD-000002 – MFS Preliminary Site Layout
- WTP Surge Pond – 3000 m^3 (see section 5.1 for detail and sizing philosophy)

- WTP Stockpile Surge Pond – 22,000 m^3 (see section 5.1 for detail and sizing philosophy)
- WTP Polishing Pond – 25,000 m^3 (see section 5.8 for detail and sizing philosophy)

The preliminary layout of the MFS WTP is shown in Figure 5.2 and has been designed to minimise the area disturbed.

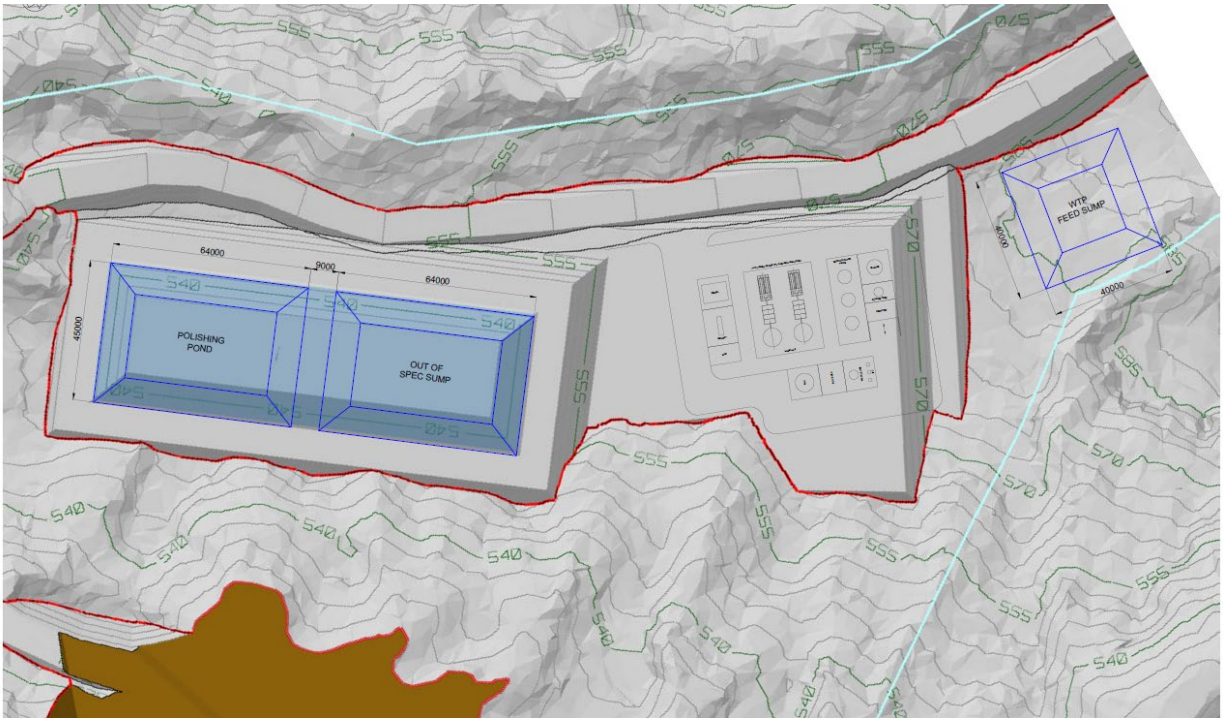


Figure 5.2 MFS WTP Preliminary Layout

5.3 Preliminary Process Design

The following is a description of the preliminary level process design which has been developed for the purpose of selecting plant options.

The selected process and sizing of equipment is based on the outcome of the Jar and Settlement testing discussed in section 3.7. The testing supports a lamella clarifier plant process fed by a surge pond and discharging into a treated water pond prior to being discharged into the receiving catchment.

The process selected involves the following unit processes.

- WTP Surge pond
- Stockpile Surge Pond
- Pontoon mounted pumps for plant feed (Surge Pond)
- Pontoon mounted pumps (out of spec pond)
- Lime dosing (CaO for purposes of this report)
- Neutralising tank (fast mix)
- Flocculant dosing
- Metal chelating agent dosing
- Flocculant tank (slow mix)
- Lamella clarifiers
- pH dosing/trimming

- Polishing Pond
- Sludge dewatering

Water will be pumped from the West Pit or East Pit Surge Sumps directly to the Water Treatment Plant site. Under normal conditions water from the West Pit or East Pit pipeline will be buffered by the WTP Surge Pond and then pumped directly into the WTP for treatment.

The mine influenced water will be neutralised in the range pH 7.0 to pH 8.5 depending on treatment requirements in the fast mix neutralisation tank. A lime dosing system (using a slurry of calcium oxide) will be installed for neutralisation.

Once neutralised the water will be flash mixed with flocculant and metal chelating agent before entering a slow mix tank where flocculant and a metal chelating agent react to aid settling and metals removal.

Once dosed and mixed the water will enter a Lamella gravity settler where solids/metals will settle out as sludge and supernatant (Lamella overflow) will report to the treated water sump for retention/polishing before being discharged into the receiving catchment. If Polishing Pond water quality monitoring determines that an acceptable level for discharge to the polishing pond is not being achieved by the treatment process, treated water can be diverted back to the WTP surge sump and reprocessed.

The treated water will require pH adjustment to lower the pH (to approx. pH 6.5) on the Lamella overflow; this is required to meet compliance and to lower the dissolved Aluminium which will settle out in the polishing pond.

The lamella underflow sludge will contain around 3% solids and will be mechanically dewatered via plate and frame filter to >12% solids allow handling, transport and disposal.

Water from the coal stockpile area will be collected and pumped to the Out of Spec sump. From here it can be blended with WTP feed sump water for treatment through the WTP.
The plant will be designed to operate at the maximum flow rate 24/7, 365 days per year. Planned maintenance will be managed during times of lower flow, and the WTP will have the following contingencies for unplanned maintenance and breakdowns.

- The water treatment plant consists of 2-unit processes each capable of taking 1/2 of the overall flow. One unit can be taken offline at a time for maintenance.
- Reagent storage equipment (silos and tanks and associated plant items) will be consistent across both ESE and MFS sites, and a full set of spares will be held on site ready in case of breakdowns.
- Dewatering equipment will be consistent (filters, sludge pumps and associated plant items) will be consistent across both ESE and MFS sites, and a full set of spares will be held on site ready in case of breakdowns. Geotubes could be held in a location near each plant for sludge diversion in case of breakdowns.

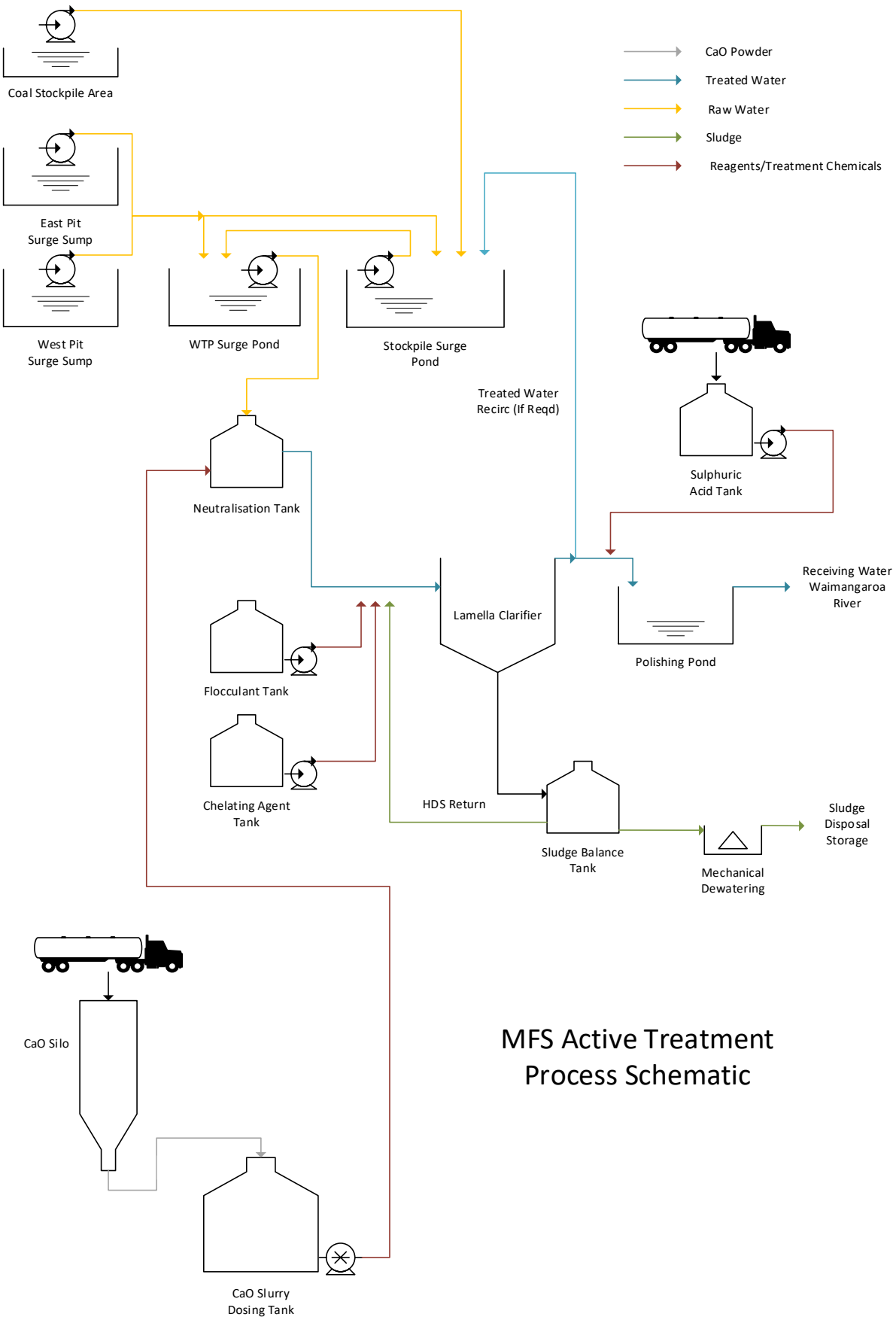


Figure 5.3 MFS WTP Process Schematic

5.4 WTP Surge Pond

A surge pond (WTP Surge Pond) located adjacent to plant has been included in the design. Primarily this is to allow a pumped (fixed speed) feed to the plant. Recommended sump/pond sizing is based on three hours storage at maximum flow. 300m^3 of storage should always be held in reserve to capture the volume of the West and East Pit Pipelines to empty the pipelines on shutdown as well as remove the risk of high-pressure water being supplied directly for the pit.

Table 5.3 MFS Surge Pond Sizing

PLANT FEED RATE	DURATION/RETENTION	RECOMMENDED SUMP VOLUME
Average Flow Rate (126 l/sec)	6.6 Hours	3000 m^3
Max Flow Rate (235 l/sec)	3.5 Hours	3000 m^3

5.5 WTP Stockpile Surge Pond

A stockpile surge pond located adjacent to the WTP has been included in the design. Primarily this is to allow water from the stockpile area to be stored and recycled through the WTP, this is done by blending water at a controlled rate with the plant feed. This pond will also capture any water pumped as returned form the Lamella overflow, allowing this water to also be blended with the plant feed at a controlled rate. Recommended sump/pond sizing is based on a minimum of twenty-four hours storage at maximum flow. Pump rates from the out of spec pond will be variable but typically will be blended with plant feed water at 25% of the plant feed flow. The WTP stockpile surge pond will also be used as a contingency to capture Pit pipeline water in the event the WTP surge pond is full, and Pit pumping has not ceased.

Table 5.4 MFS WTP Stockpile Surge Pond Sizing

PLANT FEED RATE	DURATION/RETENTION	RECOMMENDED SUMP VOLUME
Average Flow Rate (126 l/sec)	48.5 Hours	22,000 m^3
Max Flow Rate (235 l/sec)	26 Hours	22,000 m^3

5.6 Pontoon Mounted Pumps

A pontoon mounted pump system with multiple pumps is recommended to reclaim MIW from the WTP surge pond for plant feed. As described in section 5.6, two Lamella clarifiers (each capable of processing 1/2 of the maximum flow) will be required to cater for maximum flow conditions and settling requirements. Therefore, two centrifugal pumps are recommended (each capable of feeding one clarifier at full flow). One pump will also be required to reclaim water from the stockpile surge pond (pumping back to the WTP Surge Pond).
The required pump specification is as follows.

Table 5.5 Pontoon Pumps Sizing

PUMP DETAILS	TECHNICAL DATA
Actual Calculated Flow	150 l/sec each (2 off delivering 300 l/sec)
Resulting Head of Pump	4.5 bar
Rated Power	110kW each

5.7 Lime Dosing/Neutralisation

Calcium Oxide delivery and storage design is based on delivery of Calcium Oxide powder in 28 tonne (53m3 capacity) tankers. Assumed bulk density of the Calcium Oxide powder is 1092 kg/ m^3.

Preliminary Calcium Oxide storage design is for one 90m^3 Silo, not allowing for redundancy. Time between deliveries at maximum Calcium Oxide Dosing will be 11 days (20.5 Days at average flow) Delivery to the silos will be via air pneumatic delivery, taking approximately 50 minutes per delivery.

The Silo design will incorporate a bin activator powder fluidising mechanism and dry air circulated will be evacuated from the silo via a pulse jet filter.

The CaO powder will be batch slaked into a slurry for dosing and held in an agitated slurry tank at 20% solution ready for dosing. The nominal dose rate resulting from testing is 0.26kg CaO/m^3 water treated.
This results in the following powder dose rates.

Table 5.6 CaO Dose Rates

DESCRIPTION	RATE
CaO Powder Dose Rate at Max Flow	280.80 kg/hr
CaO Powder Dose Rate at Average Flow	117.94 kg/hr
Cao Powder Dose Rate at Minimum Flow	70.20 kg/hr

The slurry will be dosed into the WTP feed water prior to being held in a rapid mix (neutralisation) tank while neutralisation happens. Nominal mixing time and speed have been determined from testing and result in the following mix tank requirements.

Table 5.7 Neutralisation Tank Sizing

DESCRIPTION	RATE/DATA
Slurry Mix (Detention) Time	20 Mins
Mixing speed (RPM and associated g Value)	350 rpm, G Value 450s^{-1}
Tank Size (per Lamella)	150m^3

5.8 Metal Chelating Agent Dosing

The metal chelating agent which achieved the best results in testing was the IXOM supplied, Metalzorb FZ. Dosing equipment has been preliminarily sized on the dose rates for this chemical.

Metalzorb FZ is delivered as a liquid product in shipments of 18 IBC's (18,000L). The nominal dose rates for Metal Zorb determined during testing 0.002ml/l.

Table 5.8 Chelating Agent Dose Rates

DESCRIPTION	RATE
Concentrated Dose Rate at Max Flow	2.16 l/hr
Concentrated Dose Rate at Average Flow	0.91 l/hr
Concentrated Dose Rate at Minimum Flow	0.54 l/hr

The concentrated product will require dilution for dosing, which during testing was diluted at 1ml/l (or 0.1%) but will likely be diluted at 1.0% in practice. The storage/batch tank for dosing has been sized at 30m^3 for the preliminary design.

The metal chelating agent is dosed into the Lamella feed water following the neutralisation step. Nominal mixing time and speed have been determined from testing and result in the following mix tank requirements.

Table 5.9 Chelating Agent Dose Rates

DESCRIPTION	RATE/DATA
Flash Mix (Detention) Time	1 Mins
Mixing speed (RPM and associated g Value)	350 rpm, G Value $450s^{-1}$
Tank Size (per Lamella)	$1.1m^3$ (Could be dosed into an agitated flume)

5.9 Flocculant Dosing

The Flocculant which achieved the best results in preliminary testing was the Chemfeed supplied, Rheomax 1030. Dosing equipment has been preliminarily sized on the dose rates for this chemical.

Rheomax 1030 is delivered as a powdered product in shipments of 1000 kg Bulk Bags. The nominal dose rates for Rheomax 1030 determined during testing 1mg/l.

Table 5.10 Chelating Agent Dose Rates

DESCRIPTION	RATE
Powder Dose Rate at Max Flow	1.08 kg/hr
Powder Dose Rate at Average Flow	0.45 kg/hr
Powder Dose Rate at Minimum Flow	0.27 kg/hr

The flocculant dosing system used in this preliminary design is based on a previously quoted dosing system from Chemfeed solutions and includes the following components.

- $7m^3$ Powder Hopper
- BASF 600T Auto Jet Wet Unit
- $15m^3$ Flocculant Storage Tank
- 0.25-$2m^3$/hr Dosing Pump Skid
- BASF Alcotech TC Ultra Floc dose control system

The Flocculant is dosed into the Lamella feed water following the metal chelating step. Nominal mixing time and speed have been determined from preliminary testing and result in the following mix tank requirements.

Table 5.11 Flocculant Mix Tank Sizing

DESCRIPTION	RATE/DATA
Flash Mix (Detention) Time	1 Mins
Mixing speed (RPM and associated g Value)	350 rpm, G Value $450s^{-1}$
Tank Size (per Lamella)	$1.1m^3$ (Could be dosed into an agitated flume)

5.10 Slow Mix Tank

The preliminary testing included a slow mix step/tank which mixes at a much slower rate and allows for Floc formation prior to entering the Lamellas.

Nominal mixing time and speed have been determined from preliminary testing and result in the following mix tank requirements.

Table 5.12 Slow Mix Tank Sizing

DESCRIPTION	RATE/DATA
Slow Mix (Detention) Time	10 Mins
Mixing speed (RPM and associated g Value)	30 rpm, G Value $15s^{-1}$
Tank Size (per Lamella)	$75m^3$

5.11 Lamella Clarifiers

The Jar and Settlement testing discussed in section 4.0 has determined a surface overflow rate of 2.0 m/hr. This was determined following settling column tests on Manchester Street water both with and without sediment addition.

Settling laboratory tanks assume an ideal settling basin and this design method does not account for concentration or density gradients, wind movement, flow variation, differences in tank shape, inlet/outlets structures and temperature variations. Scaleup factors to account for this are suggested, as follows. Surface Overflow Rate = Laboratory value/Scaleup factor, with a scaleup factor between 1.25 to 1.75.

For this preliminary design we have used a scaleup factor of 1.5, which results in a sizing factor for Lamella Clarifier selection of 1.333' $m^3/hr/m^2$. (m/hr)

At maximum flow of $846m^3/hr$ (235 l/sec) the required Lamella surface area equates to $634.5m^2$.

Our preliminary equipment selection is based on a New Zealand fabricated "Parkson" Lamella designed to the following specification.

Table 5.13 Lamella Clarifier Sizing

DESCRIPTION	DATA
Parkson LGS3900	$362m^2$
Materials of Construction	316L Stainless wetted, 304L Exoskeleton

Therefore, based on the minimum settling area required of $634.5m^2$, two Lamella units will be required giving a total area of $724m^2$.
A typical lamella plant is shown in figure 5.4 for visual reference. (Note this is typical only and final design will differ from this image)

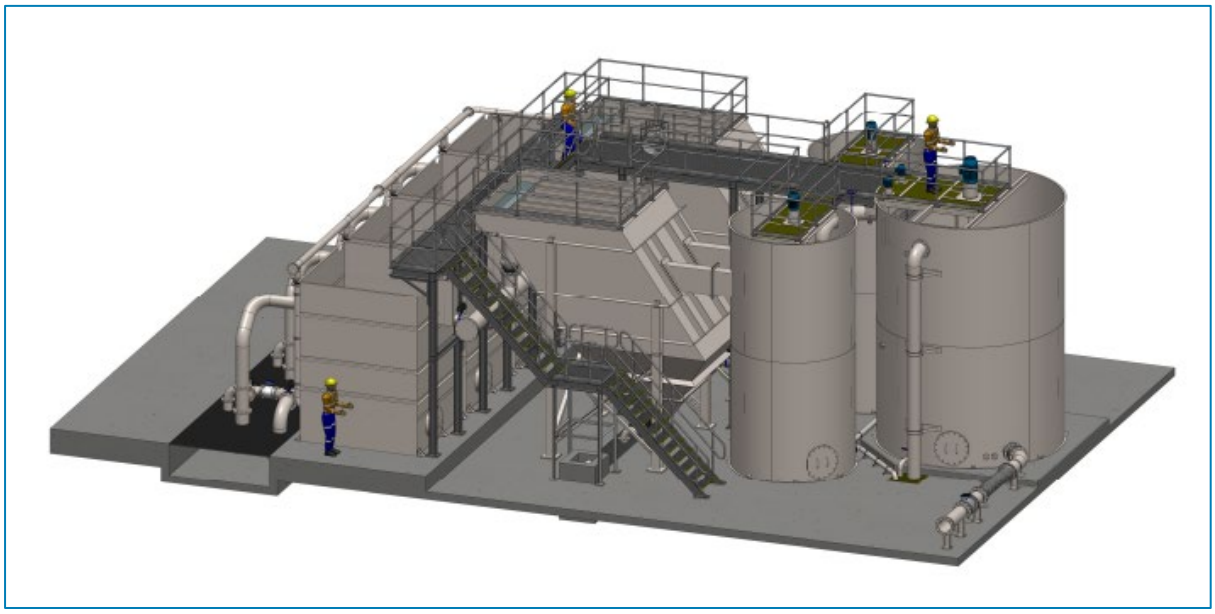


Figure 5.4 Typical Lamella Clarifier Plant

5.12 Sulphuric Acid Dosing

As described in section 3.3 sulphuric acid dosing will be required to lower the pH of the treated water (Lamella overflow) Nominal Dose rates to achieve a final pH of 6.5 are as follows.

Table 5.14 Sulphuric Acid Dose Rates

DESCRIPTION	RATE
Sulphuric Dose Rate at Max Flow	5.48 L/hr*
Sulphuric Dose Rate at Average Flow	2.30 L/hr*
Sulphuric Dose Rate at Minimum Flow	1.37 L/hr*

Based on concentrated (98.5%) dose rate of 0.005076 mL/L)

Delivery quantities equate to approx. 16000L max for 98.5% in a truck/trailer arrangement.
Ixom suggest that for supply security and load planning, a site storage tank in the range of 25/30KL storage capacity will be appropriate.

One truck/Trailer delivery at MFS would last approx. 290 days at average flow, so the delivery could be shared between the two WTPs and storage volume at each site could be reduced.

5.13 Polishing Pond

A polishing pond located adjacent to plant has been included in the design. Primarily this is to allow retention time on treated water prior to discharge. Additional residence time post Lamella is recommended to allow for any Floc carry over from the clarification process to settle before discharge. Recommended sump/pond sizing is based on 24 hours storage at maximum flow.

Table 5.15 Polishing Pond Sizing

PLANT FEED RATE	DURATION/RETENTION	RECOMMENDED SUMP VOLUME
Average Flow Rate (126 l/sec)	55 Hours	25,000 m^3
Max Flow Rate (235 l/sec)	29 Hours	25,000 m^3

5.14 Sludge Management

The following sludge volumes have been determined from MWM WLBM spreadsheet – (MWM, 2026). Mt Frederick South - Water and Load Balance Model. Mine Waste management report: J-NZ0377-003-R-Rev0. Maximum sludge volumes are seen in YR2041. (It is expected that sludge from the Lamella clarifier will be at approx. 3% solids, this will be mechanically dewatered to > 12% for handling and disposal).

Table 5.16 MFS Annual Sludge Quantities

YEAR	TOTAL SLUDGE WET 3% SOLIDS (M^3)	TOTAL SLUDGE WET 12% SOLIDS (M^3)	TOTAL SLUDGE DRY (M^3)
Year 2027	*	*	*
Year 2028	*	*	*
Year 2029	10,388	2,597	312
Year 2030	12,313	3,078	369
Year 2031	12,844	3,211	385
Year 2032	15,097	3,774	453
Year 2033	17,441	4,360	523
Year 2034	19,707	4,927	591
Year 2035	27,177	6,794	815
Year 2036	28,247	7,062	847
Year 2037	31,906	7,977	957
Year 2038	32,985	8,246	990
Year 2039	30,099	7,525	903
Year 2040	29,149	7,287	874
Year 2041	33,207	8,302	996
Year 2042	30,930	7,732	928
Year 2043	15,766	3,942	473
Year 2044	3,038	759	91
Year 2045	1,185	296	36
Year 2046	1,173	293	35
Total	352,653	88,163	10580

** - Construction Phase*

A mechanical dewatering solution has been proposed for the Mount Frederick South site; this is predominantly driven by the lack of available real estate near the Water Treatment Plant site for alternative options such as Geotube dewatering or drying cells/ponds

A Matec, or similar specification (example shown in figure 5.5) filter press has been selected as suitable for the dewatering the AMD sludge. Sludge will be pumped from the Lamella underflow(s) to a sludge conditioning tank provided as part of the dewatering plant package. From there sludge is pumped into the filter press and dewatered into a cake for trucking and disposal.

Table 5.17 Filter Press Details

DESCRIPTION	PRODUCT DATA
Filter press model	Ignis 1000x1000/30 Fast TT2
Size of plates	1000 x 1000
Number of plates	30 (with TT2 Fast Opening)
Chamber Thickness	30mm

DESCRIPTION	PRODUCT DATA
Total cycle time assumed	35 mins (assumed)
Total chamber volume	0.803 m^3
Total filtration area	285.6 m^2

Figure 5.5 Example of Filter Press

6 DISCLAIMER

This report is preliminary in nature and has been prepared to provide the client with water treatment information suitable for an "Order of Magnitude" assessment for the overall project. The information provided is not suitable for detailed design or construction purposes and the information should not be used as a specification for tendering or any other construction related purpose.

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