MEMORANDUM

BATHURST RESOURCES

INTERNAL MEMORANDUM

TO	[redacted]
FROM	[redacted]
DATE	15 May 2026
SUBJECT	Stockton Mine 80-year water quality forecast

Executive Summary

This assessment compiles available water quality data, scheduled mine expansion, expansion of acid mine drainage (**AMD**) management / treatment infrastructure, scheduled final landform rehabilitation, and supporting technical studies to provide an estimate of long-term (~80-year) water quality at Stockton Mine. Long term acidity decay at a rate of 0.62% per year is also incorporated in the forecast. This assessment was developed as part of Bathurst Resources Ltd's (**BRL**) Buller Plateaux Continuation Project (**BPCP** or **Project**) and assumes that the BPCP is approved, such that water and AMD management can continue as described in this memorandum.

The assessment is based on forecast acidity (measured to pH 7) and dissolved Aluminium (**Al**) concentrations in waterbodies draining major AMD impacted catchments. Forecasted long term trends in water quality are compared to Stockton Mine specific (derived by Instream (2026)) ecological recovery thresholds, including:

- Ecological recovery will begin at residual Al concentrations of less than 2.8 mg/L; and
- Ecology will return to unimpacted / comprehensive ecological recovery status at residual Al concentrations of less than 1 mg/L.

Modelled annual 75th percentile Al concentration values for different waterbodies are compared to these thresholds to forecast ecological recovery timeframes.

St Patrick Catchment

A continued improvement in St Patrick Catchment water quality is anticipated due to ongoing AMD treatment through the McCabes Treatment System (which incorporates diversion of Cypress mine and Fly Creek AMD to McCabes Sump, lime dosing upstream of McCabes Sump via Lime dosing plant 2 (**LDP2**)), completion of final landform rehabilitation (by 2046), and treatment of Plover Stream commencing in 2034 (coinciding with Cypress acid loads ceasing to report to McCabes Treatment System). The long-term forecast S16 acidity and Al concentration shows:

- The annual 75th percentile Al concentrations fall below the 2.8 mg/L threshold for ecological recovery commencement in 2034 (once treatment of Plover Stream commences).

The forecasted annual 75th percentile Al concentration does not fall below the 1.0 mg/L threshold at S16 for unimpacted / comprehensive ecological recovery within the 80-year timeframe quantified in this assessment. However, it is anticipated that mitigating factors discussed in Section 4.3.1, including

improvements in AMD treatment (e.g., further increasing S16 pH) and natural catchment dilution will result in the 75th percentile Al concentration falling below the 1.0 mg/L threshold in the reach of stream between S16 and the confluence with T35 Stream within the 80-year timeframe.

Mangatini Catchment

A continued improvement in Mangatini Catchment water quality is anticipated (long term) due to ongoing AMD treatment through lime dosing to Mangatini Sump (via Lime dosing plant 1 (**LDP1**)) and completion of final landform rehabilitation (by 2046). An increase in Millerton Block acidity loads pumped to the Mangatini Treatment System (between 2026 and 2046) is expected to pause further improvement in Mangatini Stream water quality in the short term, until 2046. From 2047 onwards Millerton AMD will be treated by alkaline slurry dosing directly to MW16 Sump, which will end treatment of Millerton Block AMD at the Mangatini Treatment System, reducing operational demands on existing infrastructure. The long-term forecast of S14C acidity and Al concentration shows:

- The annual 75th percentile Al concentrations fall below the 2.8 mg/L threshold for ecological recovery in 2047 (once Millerton AMD treatment by alkaline dosing in MW16 Sump commences).

The forecasted annual 75th percentile Al concentration does not fall below the 1.0 mg/L threshold at S14C for unimpacted / comprehensive ecological recovery within the 80-year timeframe quantified in this assessment. However, it is anticipated that mitigating factors discussed in Section 5.3.1, including improvements in AMD treatment (e.g., further increasing S14C pH, treatment of Duncans Sump and Ford Creek acid loads) and natural catchment dilution will result in the 75th percentile Al concentration falling below the 1.0 mg/L threshold in the reach of stream between S14C and S14B within the 80-year timeframe.

Millerton Block

The Millerton Block Water and AMD Management Report (BRL 2026) discusses proposed BPCP water and AMD management and subsequent effects on water quality. A major water quality improvement in streams draining the Millerton Block (including Granity and Miller Streams, and Mine Creek) is anticipated through the Operational Phase of the BPCP, with betterment[1] reference values met from end of mine life (**EOML** – 2033) (discussed in BRL (2026)). Further improvements are simulated as additional Crown (administered by Land Information New Zealand (**LINZ**)) AMD management infrastructure is commissioned, nominally the infrastructure associated with 'Mine Creek Sump' in 2050 and 'All AMD treatment' in 2060. It should be noted that the Crown infrastructure is not included as part of the BPCP application.

The Crown AMD infrastructure will provide additional treatment of AMD generated by remnant historic underground workings located outside of the BPCP opencast disturbance footprint. While the

[1] The concept of 'betterment' and derivation of betterment reference values specific to streams draining the Millerton Block is described in BRL (2026). The betterment reference values are not equivalent to ecological recovery thresholds. The focus of this document is forecasting long term ecological recovery and so discussion around the interim process of achieving betterment is kept to a minimum.

configuration and commissioning dates of Crown AMD infrastructure has not been defined, a GoldSim based Water and Load Balance Model (WLBM) initially developed by MWM (2024a) was modified to assess the potential effect of the additional AMD treatment (primarily AMD from remnant historic underground workings) on downstream water quality.

The long-term forecast for streams draining Millerton Block shows:

- The forecast annual 75th percentile Al concentration falls below the 1.0 mg/L threshold at the modelled NRB River site (located downstream of all St Patrick, Mangatini, and Mine Creek AMD inputs to Ngakawau River but modelled to exclude the tidal influence) in 2034 (after Millerton Project EOML).
- The forecast annual 75th percentile Al concentration for Mine Creek and Granity Stream do not quite meet the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery under current model settings, but do meet the 2.8 mg/L threshold for ecological recovery starting. It is likely that a slightly higher degree of AMD treatment (>90%) than what was assumed in AMD modelling would result in Miller Stream (S24A) and Mine Creek (S6) tributaries meeting comprehensive ecological recovery thresholds.

The additional Crown AMD management infrastructure (modelled as being commissioned in 2050 and 2060) is not included in the BPCP. Further optimisation of Crown AMD management infrastructure and alignment with progressive improvement of impacted streams with an objective to meet sustaining Mahinga kai values within 3 generations (~80 years) will be assessed as part of an independent LINZ led project.

1.0 Introduction

This memorandum compiles available water quality data, scheduled final landform rehabilitation, expansion of AMD management / treatment infrastructure, and supporting technical studies to provide an assessment of long-term (~80-year) water quality of waterbodies draining major AMD impacted catchments at Stockton Mine. The assessment utilises existing technical studies and adapts / integrates those study outputs into a simplified 80-year water quality assessment. This assessment also assumes that the BPCP is approved, such that water and AMD management can continue as described.

The basis of this assessment is described fully in Section 3.0, but in summary:

- The three major AMD impacted catchments (i.e., St Patrick, Mangatini, and Millerton Block (including Granity Stream, Miller Stream, and Mine Creek sub-catchments)) are assessed.
- Acidity (measured to pH 7) and dissolved Al concentrations are chosen to represent the effect of AMD management on water quality. Instream (2026) state that Al and pH are suitable proxies for the gross effects of AMD. These thresholds are used to guide recovery of AMD impacted waterways. Al is used as the primary measure of recovery in this assessment due to pH modelling complexity.

- Changes to annual median concentration values represent the long-term trends in water quality due to changes in AMD management / treatment, final landform rehabilitation, and concentration decay. Estimates of annual 75th percentile concentration values were calculated based on concentration variability (between annual median and annual 75th percentile concentrations) observed in existing site specific water quality monitoring datasets. The annual 75th percentile Al concentration estimates (as opposed to annual medians) were used to assess ecological recovery (Instream 2026).
- Once the comprehensive ecological recovery threshold is achieved the ecological recovery focus shifts to mahinga kai objectives, as described by Instream (2026). AMD effects relative to mahinga kai criteria have not been included in this assessment.
- The 80-year timeframe is assumed to start at the expiry of the Coal Mining Licence (1 April 2027) and therefore ends at year 2106.

This assessment will be used to support assessments of environmental effects and current and future consenting strategies by demonstrating the forecasted effect of staged future AMD management / treatment activities. These consenting strategies are not developed in this document.

2.0 Background

2.1 Stockton Overview

Stockton is the largest opencast mine in New Zealand, with an active mining area of ~787 ha. The mine is located on the West Coast, approximately 20km north-east of Westport. The majority of Stockton disturbance lies in the catchment of the Ngakawau River. The elevation of the mine ranges from 400m to 1,100m above sea level.

Stockton Mine is characterised by active coal mining areas, historic underground workings, overburden areas / Engineered landforms (**ELF**), coal stockpiles, topsoil stockpiles, highwalls, water and general infrastructure areas, rehabilitated areas and undisturbed areas. Many of these areas generate AMD, when naturally occurring sulfide minerals in waste rock react with oxygen and water. A complex array of water management infrastructure, including large sumps, coal fines storage structures, dams, extensive drainage structures and a considerable network of pumps and pipelines are used to effectively manage AMD.

AMD is the greatest environmental liability present at Stockton Mine and is likely to require the longest timeframe (80-years and longer) to treat and/or restore receiving waterways to pre-mining levels. Major AMD impacted catchments at Stockton Mine include St Patrick, Mangatini, and Millerton Block (including Granity Stream, Miller Stream, and Mine Creek). These catchments and key water quality monitoring sites are shown in Figure 1, with arrows showing general surface flow direction across each catchment. The classification of sites as compliance, performance, and reference is discussed in Instream (2026).

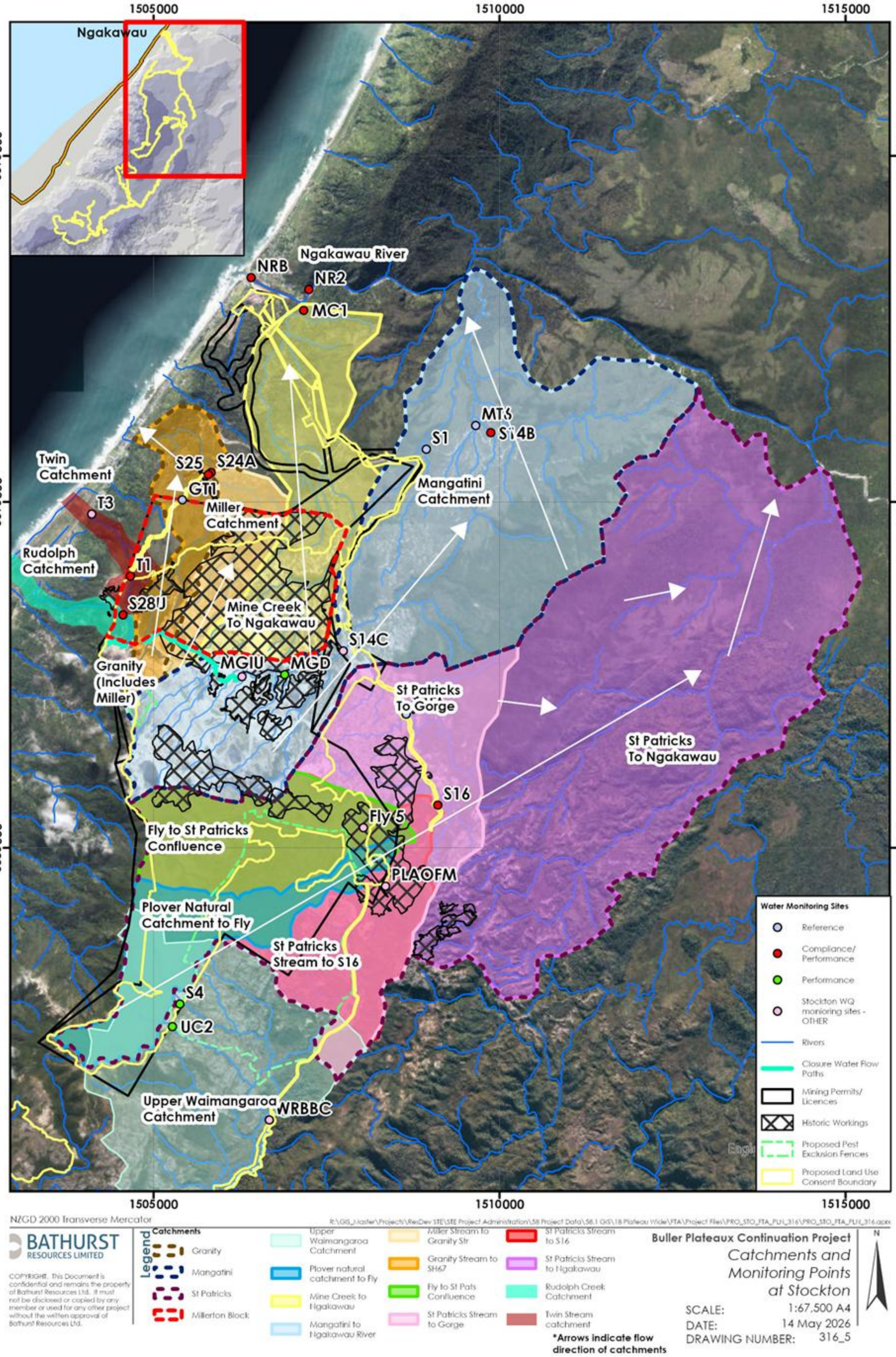


Figure 1. Stockton Mine major catchments and key water quality monitoring sites

2.2 Treasury model

To facilitate the sale of the mine when former owner/operator State Owned enterprise Solid Energy New Zealand Limited went into administration, a decision made by Cabinet in 2016 dictated the Crown take responsibility for all AMD resulting from historical mining activity at Stockton, deemed as all AMD produced by mining disturbance prior to 1st January 2017. Currently the Treasury Model shows that over 80% of the AMD draining the Stockton Mine is a Crown liability. This apportionment is calculated based on the relative volume of overburden disturbed by the two parties (BRL and the Crown/Solid Energy New Zealand Limited).

The current AMD management approach has recently been party to a 3-year review by Treasury in partnership with Te Rūnanga o Ngāti Waewae and using a team of internationally recognised experts in AMD management and aquatic ecology (Tregaskis Brown (2024)). The results indicate that the current AMD management approach to progressive improvement of the impacted streams with an objective to meet sustaining Mahinga kai values within 3 generations (~80 years) is the optimal approach, with some minor historically impacted streams uncaptured and untreated.

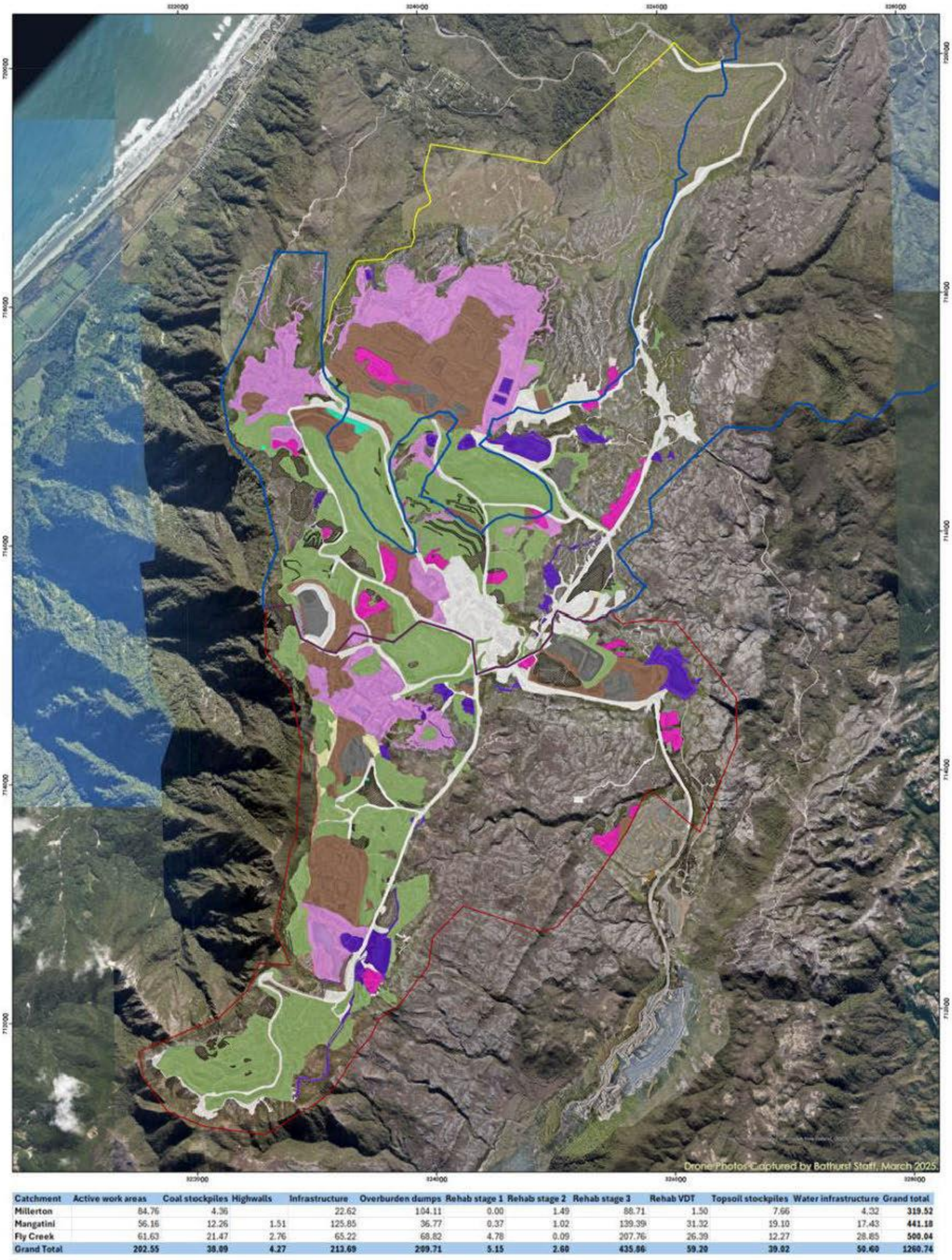
2.2.1 Acidity load decay

The key aspect of the Treasury Model relevant to this assessment is the method of calculating long term acidity (and therefore Al concentration) decrease over time after final landform rehabilitation. The applied decay rates were sourced from studies using Stockton waste rock carried out by Gandy and Younger (2007) and followed by O'Kane Consultants (2015). Further details in references.

This assessment uses the Treasury Model to quantify the effect of future rehabilitation and forecast acidity loads / concentrations in three ways:

- Future final landform rehabilitation of currently disturbed landform types deemed to contribute to AMD will cause a 50% reduction in acidity (from that proportion of the disturbed catchment) over 10 years. For modelling purposes, the acidity load reduction is assumed to occur at a constant rate of 7% per year over that 10-year period. Rehabilitation rates are assumed to be constant over the remaining life of mine (**LOM**), with all rehabilitation completed by 2046. The effect of relatively 'rapid' acidity load decay due to landform rehabilitation is modelled to end in 2056 (i.e., 10 years after final rehabilitation).
- Areas of final landform rehabilitation completed within the last 10 years will contribute to a further 25% reduction in acidity concentration (from that proportion of the rehabilitated catchment) over the next 10 years at a constant rate (assuming the other 25% reduction in acidity concentration due to rehabilitation is already observed in 2025 measured values / datasets). For these calculations rehabilitation rates over the past 10 years are assumed to be constant, i.e. (total 2025 rehab. area – total 2016 rehab. area) / 10 years = rehab. rate over past 10 years.
- A constant long term acidity decay rate of 0.62% per year is applied from 2025 for all forecasts. This is the only decay rate active beyond FY56, 10 years after final rehabilitation is completed at 2046.

The Stockton Rehabilitation Liability map (Figure 2) shows the area and Land Use types of disturbance within each catchment. NB: The Fly Creek liability catchment is a sub-catchment of the greater St Patrick catchment, which includes remaining rehabilitation to be completed at the Southern end of Stockton Mine and excludes the Cypress mine area.



Catchment	Active work areas	Coal stockpiles	Highwalls	Infrastructure	Overburden dumps	Rehab stage 1	Rehab stage 2	Rehab stage 3	Rehab VDT	Topsoil stockpiles	Water infrastructure	Grand total
Millerton	84.76	4.36		22.62	104.11	0.00	1.49	88.71	1.50	7.66	4.32	**319.52**
Mangatini	56.16	12.26	1.51	125.85	36.77	0.37	1.02	139.39	31.32	19.10	17.43	**441.18**
Fly Creek	61.63	21.47	2.76	65.22	68.82	4.78	0.09	207.76	26.39	12.27	28.85	**500.04**
Grand Total	**202.55**	**38.09**	**4.27**	**213.69**	**209.71**	**5.15**	**2.60**	**435.86**	**59.20**	**39.02**	**50.60**	**1260.74**

NZGD 1949 Buller Circuit

BATHURST RESOURCES LIMITED

Legend

- Fly Creek liability catchment
- Millerton liability catchment
- Mangatini liability catchment

Land Use Type

- Active work areas
- Coal stockpiles
- Highwalls
- Infrastructure
- Overburden dumps
- Rehab stage 1
- Rehab stage 2
- Rehab stage 3
- Rehab VDT
- Topsoil stockpiles
- Water infrastructure

Stockton Mine

Rehabilitation Liability (May 2025)

SCALE: 1:14,000

DATE:

DRAWN BY:

DRAWING NUMBER:

[redacted]

Figure 2. Stockton Rehabilitation liability (as at May 2025)

3.0 80-year WQ forecast methodology

This assessment is intended to show water quality changes at key environmental monitoring sites over the 80-year period following BPCP commencement (to year 2106). These changes are primarily due to:

- Additional AMD treatment activities as engineered water and AMD management infrastructure are constructed and commissioned.
- The effect of final landform rehabilitation over the remaining LOM reducing AMD.
- Long term AMD generation rates decreasing with time (decay).

The effect of these changes has been evaluated in various technical studies. This assessment aims to incorporate technical content from these studies into a single 80-year forecast of water quality for key waterbodies. Combining these studies requires development of a common assessment basis, as described in this section.

3.1 Assessment basis

The two key aspects of this assessment basis are that:

- Acidity (measured to pH 7) and dissolved Al are chosen to represent the effect of AMD management on water quality. The use of acidity / acidity load as the basis of the model enables long term projections to be based on documented final landform rehabilitation driven acidity decay (Gandy and Younger 2007, Okane Consultants 2015). Dissolved Al has been endorsed as a proxy for the gross effects of AMD in impacted streams by Instream (2026).
- Changes to 'annual median concentration' values represent long-term trends in water quality due to changes in AMD management / treatment, rehabilitation, and long-term concentration decay.

Dissolved Al concentrations are generally assumed to be geochemically conservative and controlled by the correlations developed for mass balance modelling calculations. However, it should be noted that these correlations are based on empirical data that will inherently include a degree of geochemical variability. The forecasting process may be improved by incorporating geochemical modelling, particularly for estimates towards the end of the 80-year period as remnant Al concentrations become lower and the solubility (in overall higher pH waters) and toxicity of remnant low Al concentrations becomes more variable.

3.1.1 Water quality parameters

Acidity and Al were selected as the key indicators of AMD impacts on water quality at Stockton. These parameters were selected for the following reasons:

- Acidity is the net product of sulfide oxidation, which is the key geochemical process driving AMD generation (with acidity including the net effect of both acidity generating and neutralising reactions). The remnant acidity concentration is also directly proportional to the amount of neutralant (e.g., Calcium Oxide (**CaO**)) that is added to AMD in the neutralisation / treatment process. Thus, acidity is a good measure of the magnitude of water degradation and the effort (i.e., product requirement and cost) required for treatment.

- Al is a major constituent of AMD / acidity, an ecotoxicant, and a proxy for the gross effects of AMD in impacted streams (Instream 2026). This is reflected in most water quality compliance sites for AMD affected streams currently having either regulatory or community Al compliance limits.
- Of the major constituents of AMD (hydrogen ion (measured as pH), Al, and Fe), Al has the higher minimum solubility pH of ~4.5 (INAP 2009). This means that Al is a better indicator (than Fe or pH) of residual acidity in moderately degraded or partially treated catchments. Thus, Al is a good indicator of effective AMD treatment / management in the Stockton mine context.
- Acidity and Al are routinely monitored at a wide range of sites across Stockton. This enables effective concentration comparisons across sites and mass balanced contaminant load models to be developed to simulate treatment and / or downstream mixing of AMD waters. The geochemistry of these processes for Acidity and Al is generally well understood and represented in models.
- Acidity and Al are common parameters used in previous AMD impact assessments / models across Stockton. This enables the key results of different technical studies to be incorporated into this document.
- Al and pH are the most commonly available measures of water quality at sites that have paired ecological data, allowing the development of ecological recovery thresholds in Instream (2026).
- Water samples for Acidity and Al testing are analysed by an external International Accreditation New Zealand (**IANZ**) accredited testing laboratory (SGS Westport and their sub-contractors) using standard methods of analysis.

3.1.2 Calculation basis

An 'annual median concentration' was selected as the basis for quantifying and forecasting water quality in this assessment, for the following reasons:

- Most water quality datasets have a sufficient sample population (due to daily to weekly sampling) for median values to be considered representative of actual median water quality without further interpretation. 'Median' values also represent a wide band of flow conditions for most sites, with significant concentration variation only occurring during relatively high or low flow conditions.
- Median water quality values are expected to be important for assessing chronic aquatic ecology toxicity changes due to long-term recovery of AMD impacted streams.
- Day to day water quality is variable at most sites, with an inverse relationship between concentration and flow rate which is primarily driven by rainfall / dilution. This is also influenced seasonally and for multi-year periods by climatic variability, with periods of high or low rainfall affecting water quality. Representing these short-term effects in long term forecast models adds complexity and is somewhat subjective (i.e., choosing how and when to simulate a future 'wet year') and can mask the long-term trends in water quality.

The ‘annual 75th percentile concentration’ estimates were calculated (for comparison against Instream (2026) Al recovery thresholds) either:

- Using the ratio of measured annual 75th percentile to median Al concentrations in existing datasets (St Patrick and Mangatini Catchments; Millerton Block pre year 2049 simulations); or
- Calculated directly from the daily timestep GoldSim model outputs (Millerton Block post 2050 simulations).

Available monitoring data suggests that long term trends associated with major AMD management activities (e.g., final landform rehabilitation, commissioning of AMD treatment infrastructure) are well represented by annual median and 75th percentile concentration values. This provides a simple basis for forecasting future treatment performance and communicating expected water quality improvement trajectories. Example comparisons of discrete Acidity and Al data versus calculated annual median and 75th percentile values for S16 and S14C are included in Appendix I for reference.

3.1.3 Acidity load versus concentration

Trends in acidity load and acidity concentration are assumed to be interchangeable at median flow values (or at a specific flow percentile value). This is not quantitatively correct as acidity load is calculated from acidity concentration multiplied by flow rate. For this assessment, a reduction in acidity load is effectively assumed to be proportional to a reduction in acidity concentration, while flow rates remain unchanged. While this assumption is not likely to be justified at the micro level (e.g., final landform rehabilitation of a disturbed area is likely to reduce seepage flow rates as well as downstream concentrations), it is assumed to be acceptable at the macro / catchment level that the water quality assessment sites are representing.

It is also useful for discussion and AMD modelling purposes to consider acidity load and concentration trends similarly, as flow data are not available at every point and therefore loads cannot always be calculated.

3.2 Water quality evaluation / monitoring sites

The forecast water quality is calculated at key water monitoring sites (shown in Figure 1), including:

- St Patrick Catchment – S16
- Mangatini Catchment – MGIU, S14C
- Millerton Block – Granity Stream (S24A, S25), Mine Creek (S6, S23, MC1), and Ngakawau River (NRB)

These sites are selected as key evaluation sites because:

- They are typically located downstream of all AMD discharge points for a given catchment; and
- There are significant water quality monitoring datasets and previous technical studies available at these sites to support the analysis.

3.3 Water quality quantification

An excel spreadsheet was used to do the 80-year water quality forecast calculations for the St Patrick and Mangatini Catchments. This spreadsheet used an annual timestep and combined:

- Measured water quality data collected between 2010 (for some sites) and 2023 / 2025.
- Calculated acidity change over time, including:
  - The effect of AMD management and treatment changes, as determined from technical studies or available water quality monitoring datasets; and
  - The effect of final landform rehabilitation and long-term concentration decay.
- Relationships between acidity and Al concentration in existing monitoring datasets to forecast future Al concentration (proportional to acidity).

For the Millerton Block, the Monte Carlo simulation software GoldSim was used. The model used a daily timestep with annual median and 75th percentile Al concentrations extracted directly from raw model results. The following aspects were considered:

- Measured and GoldSim modelled water quality and flow data within the time ranges of 2008 to 2049, for calibration against the independent AMD modelling results for Millerton Block in BRL (2026).
- Determination of pre-open cast mining underground water quality source terms using 2008 sampling data.
- Changing underground and surface catchments to simulate the effect of removing historic underground workings and fire suppression.
- Implementation of Mine Creek Sump AMD management infrastructure (commissioning assumed to be January 2050 for modelling purposes).
- Implementation of infrastructure for capture of 'all' remnant AMD (commissioning assumed to be January 2060 for modelling purposes). The methodology for capture and treatment of these flows is still to be determined, as discussed in section 6.2.1.).
- Long term acidity decay rates as outlined in section 2.2.1.

Further information on the GoldSim model development can be found in the MWM (2024a), though it should be noted that some of the source terms were modified for this assessment (described in Section 6.2). These modifications were made to incorporate additional water quality monitoring datasets collected since the original MWM (2024a) source terms were developed.

3.4 Ecological recovery

Instream (2026) discuss the ecological effects of AMD and thresholds for recovery. The focus for many AMD impacted Brunner Coal Measures (**BCM**) streams is on recovery from an impacted state. Mine planning requires thresholds that represent the beginning of the water quality recovery to guide remediation, rather than a no effects threshold that will become a consideration in the future as recovery progresses.

A key objective of long-term (80-year) AMD management / treatment is achieving ecological recovery in waterbodies draining Stockton Mine. Instream (2026) derived recovery thresholds for individual taxa and overall invertebrate communities from ecological literature and an extensive data set collected from streams on the Stockton and Denniston Plateaus. Collectively this method provided the following dissolved Al concentration ecological recovery thresholds for use in long term AMD effects modelling:

- Ecological recovery will begin at residual Al concentrations of less than 2.8 mg/L; and
- Ecology will return to unimpacted / comprehensive ecological recovery status at residual Al concentrations of less than 1 mg/L.

These Al recovery thresholds are compared to the forecast annual median and 75th percentile Al concentrations, as an indicator of long-term AMD treatment effectiveness and ecological recovery. Instream (2026) have indicated that the recovery thresholds are equivalent to annual 75th percentile water quality targets.

Instream (2026) also provided pH thresholds for ecological recovery beginning (pH > 3.8-4.0) and a return to unimpacted / comprehensive ecological recovery status (pH > 4.5). Geochemically, Al and pH are closely linked, with pH-controlled Al mineral solubility likely to limit Al concentration. Increasing pH (typically through alkaline dosing) corresponds to decreasing Al concentration with dissolved Al removed by precipitation. Aluminium was selected (over pH) as the primary ecological recovery indicator for the purposes of this 80-year water quality assessment due to the following factors:

- The Al recovery thresholds are anticipated to be more difficult to achieve than the pH thresholds, e.g., Mangatini Sump CaO dosing is typically to pH 5 (i.e., > pH 4.5) at the decant for a high degree of Al removal.
- Supporting technical studies have modelled Al more extensively than pH, allowing for better integration in this assessment.

This approach (prioritising Al concentration as the gross indicator of AMD effects) is supported by a sub-set of the pre-treatment Mangatini Sump inlet untreated (MGIU) monitoring dataset, where upstream dosing of CaO slurry resulted in partial neutralisation of MGIU AMD. The Al concentrations of MGIU samples with pH > 4 are plotted in Figure 3, and show that Al concentrations typically remain elevated (greater than the Al < 2.8 mg/L threshold where ecological recovery is expected to begin) at pH 4.5. This observation supports Al being prioritised over pH for modelling ecological recovery.

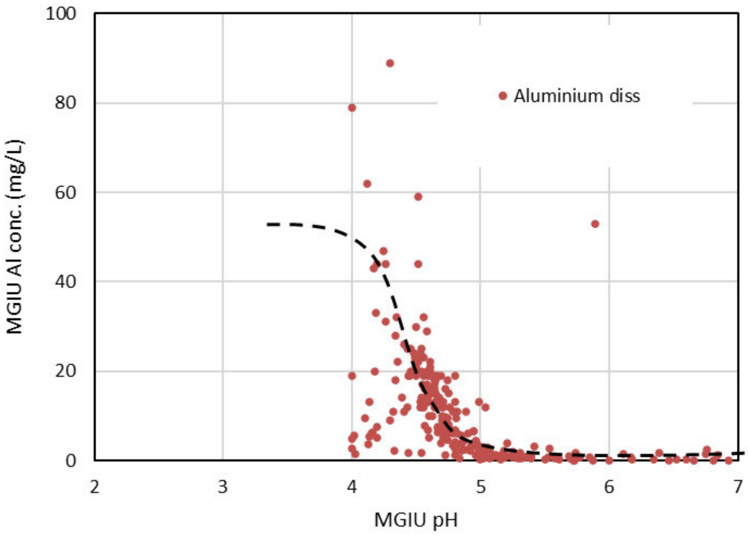


Figure 3. Partially treated (pH > 4) subset of MGIU dataset: Al concentration correlation with pH.

Once the comprehensive ecological recovery threshold is achieved the ecological recovery focus shifts to incorporate other toxicants and mahinga kai, as described by Instream (2026). AMD effects relative to other toxicants and mahinga kai criteria have not been included in this assessment.

3.5 Exclusions

Factors that have been excluded from this long-term water quality forecast that are not assessed specifically (other than their contribution to annual median and 75th percentile water quality in existing empirical datasets) are:

- Water quality fluctuations within a given year are not analysed. This may include effects from prolonged periods of low / high rainfall or AMD management / treatment infrastructure being temporarily offline.
- Potential effects of short duration high flow bypass / spills are not quantified.
- Potential effects of extreme events resulting from high rainfall, prolonged dry periods, or a specific combination of events (e.g., a prolonged dry period followed by a period of high rainfall) are not quantified. These events are assumed to be sufficiently infrequent to have a minimal effect on the annual median and 75th percentile measured Al concentration values.
- Any future changes in the ratio between annual median and 75th percentile Al concentrations (as catchments transition from partially disturbed to fully rehabilitated) have not been assessed.

While the effects of these factors have not been quantified, the variability between future discrete samples and annual medians is assumed to be similar to that shown in Appendix I.

Reactive geochemical modelling has not been incorporated into this assessment other than what is already embedded within the Millerton Block GoldSim model (MWM 2024a) and where concentrations are reduced to represent the effect of final landform rehabilitation, decay, or changes to AMD treatment processes (e.g., Plover Stream treatment commencing in 2034). The Al concentrations are generally modelled to be geochemically conservative and controlled by the correlations developed for mass balance modelling calculations. These correlations are based on empirical data that will inherently include the effects of geochemical variability within the ranges of the empirical dataset. However, geochemical modelling may improve the predicted water quality outcomes, particularly later in the assessment period (i.e., towards the end of the 80-year period) when AMD decay leads to relatively low remnant acidity and Al concentrations and relatively high pH. The contemporary empirical datasets do not necessarily represent these relatively low acidity / Al concentration correlations.

The ecological recovery thresholds developed by Instream (2026) and used in this assessment are based on dissolved Al concentrations. In future these criteria may be further refined to include the effect of toxicity modifying factors (**TMF**) such as pH, dissolved organic carbon (**DOC**), and Hardness. Geochemical modelling to include the effects of these TMFs on the toxicity of Al may result in improved forecasts of ecological recovery milestones. Future criteria may also be updated to include other potential toxicants. The proposed Instream (2026) 6-yearly ecological surveys will also provide direct assessments of ecological recovery.

Notwithstanding these exclusions, the assessment basis is considered appropriate given:

- Forecasting AMD models are based on extensive empirical water quality monitoring datasets for sites located in key receiving waterbodies;
- Dissolved Al is a good indicator of effective AMD treatment / management;
- Dissolved Al is a common parameter that has been measured at relevant sites for many years; and
- The Stockton Specific ecological recovery thresholds derived by Instream (2026) include dissolved Al as a gross indicator of AMD impacts.

4.0 St Patrick Catchment

Monitoring site S16 is the location of the 80-year water quality forecast for St Patrick Catchment (Figure 1).

4.1 Disturbance and final landform rehabilitation

Disturbance in the St Patrick Catchment includes:

- Mt Frederick end of the Stockton mine in the upper tributaries of Fly Creek and Plover Stream.
- McCabes area to the west of the McCabes Treatment System.
- The northern portion of the Cypress mine in the headwaters of St Patrick Stream.

There are significant ongoing mining activities at the Cypress mine scheduled out to EOML in 2033. An increase in acidity loads from the Cypress mine is anticipated through this period. However, effective operation of capture sumps and pump / pipelines at the Cypress mine has resulted in a significant reduction in acidity loads reporting to St Patrick Reservoir, as measured at the St Patrick Dam Underdrain (SPDU) monitoring site. Key AMD sources (e.g., Cypress Pit and the Northern ELF) have been captured in sumps and diverted directly to the McCabes Treatment System since October 2023. The Cypress mine is not expected to cause an increase in acidity at S16 over the remainder of the project as:

- The effect of residual SPDU acidity loads is already included in 'current' S16 water quality monitoring data.
- AMD pumped from Cypress to McCabes Treatment System will continue to receive a high degree of treatment, such that any potential increase to Cypress mine acidity loads is assumed to not contribute to an increase in residual acidity concentrations discharging McCabes Sump / measured at S16.

Post closure acidity concentrations from Cypress mine reporting to S16 are also expected to be negligible (relative to ecological recovery thresholds). This is due to a combination of:

- Removal of ex-pit potentially acid forming (**PAF**) landforms (e.g., Northern ELF (**NELF**)).
- Final landform design, with PAF waste rock storage in either saturated conditions or under relatively low gradient compacted surfaces and capping layers constructed using non-acid forming (**NAF**) material.
- Passive management or treatment at Cypress of any residual AMD (if required) to meet 8W compliance criteria of < 14.6 mg/L Acidity and < 1 mg/L dissolved Al (specified in Condition B8.9(a) of RC03175).

Mining in the wider St Patrick Catchment (including Fly Creek, Plover, and McCabes areas) is largely complete. Any additional mining / backfill activities in these areas are assumed to have a negligible effect (i.e., not cause an increase) on current acidity loads / concentrations.

Figure 2 shows the area of different landform types at Stockton as at May 2025. Table 1 summarises the disturbance area by landform type in the St Patrick Catchment, which includes:

- Unrehabilitated area (159.5 ha) of landform types assumed to contribute to AMD loads (Active work areas, Coal Stockpiles, Overburden areas / ELFs, Rehab Stage 1, and highwalls).
- Rehabilitated area (234.2 ha) completed to date (including Stage 2, 3, or vegetation direct transfer (**VDT**) rehabilitation types), which are also assumed to contribute to AMD.
- Other landform types (106.3 ha) are assumed to not contribute to AMD (e.g., Infrastructure, Topsoil Stockpiles, Water Infrastructure) – areas not presented in Table 1.

Table 1. St Patrick Catchment – Rehabilitated and unrehabilitated surface area for landforms assumed to contribute AMD, as at May 2025.

Landform Type	Area (ha)
Total unrehabilitated	**159.5**
Active Work Areas	61.6
Coal Stockpiles	21.5
Overburden areas / ELFs	68.8
Rehab Stage 1	4.8
Highwall	2.8
Total rehabilitated area	**234.2**
Stage 2	0.09
Stage 3	207.8
VDT	26.4
Total AMD contributing area	**393.7**
Proportion unrehabilitated	**41%**

Table 1 shows that as at May 2025 approximately 41% of landform surface area assumed to contribute acidity in the St Patrick Catchment are not yet rehabilitated. Final landform rehabilitation should contribute to an approximately 20% acidity concentration reduction across the catchment compared to 2025 values (i.e., 50% reduction in acidity concentrations from the 41% of the catchment currently unrehabilitated). Rehabilitation of these areas is scheduled to occur at varying rates through to 2046, but for modelling purposes a constant rehabilitation rate (equivalent to 7.6 ha/year) is assumed. The effect of relatively 'rapid' acidity load decay due to landform rehabilitation is modelled to end in 2056 (10 years after final rehabilitation).

In addition to future rehabilitation, site records show that 84.2 ha of final landform rehabilitation has occurred in St Patrick Catchment over the last 10 years and a further 25% reduction in acidity concentrations from these rehabilitated areas is anticipated. This equates to a further 3.2% reduction in acidity concentration (from 2025 levels) across the catchment, that is modelled to occur by 2056.

As a relatively large proportion of the catchment is already rehabilitated the long-term decay rate of 0.62 % per year is applied to all acidity concentrations throughout the modelled period (i.e., from 2026 to 2106).

4.2 Description of treatment

The LDP2 and McCabes Sump are the key elements of the McCabes Treatment System. LDP2 was commissioned in 2020 and has been used to incrementally increase AMD treatment in St Patrick catchment, including:

- Commencing 2020 – CaO slurry pumped from LDP2 to St Patrick Reservoir to neutralise Cypress mine AMD;

- Commencing October 2023 – Cypress mine AMD was pumped to McCabes Treatment System (and lime slurry dosing at St Patrick Reservoir ceased); and
- Commencing January 2024 – Diversion of Fly Creek AMD (up to 70th percentile flows at the diversion weir) to McCabes for treatment.

Fly Creek AMD is captured by a weir constructed in the stream bed. The transfer of up to 70th percentile flows from Fly Creek to McCabes for treatment was achieved by sizing the inlet and pipeline to convey a flow rate equivalent to the 70th percentile of Fly Creek. The excess flow > 70th percentile is spilled from the weir and discharges (without AMD treatment) to lower Fly Creek. These untreated spills will be diluted by increased clean water flows during these events, with overall effects included in recent empirical datasets.

The staged increases in St Patrick AMD treatment has resulted in a reduction in S16 Al concentration (Figure 4). This treatment regime is being optimised along with operation of McCabes Sump. The current treatment regime will continue until EOML for the Cypress mine in 2033. Diversion of Plover Stream (up to 70th percentile flows) to McCabes Treatment System is scheduled to commence in 2034. The scheduling of Plover Stream treatment commencement aligns with treatment capacity becoming available as Cypress mine acidity load ceases reporting to the McCabes Treatment System. Any remnant Cypress mine acidity loads will be managed independently of the McCabes Treatment System post 2034.

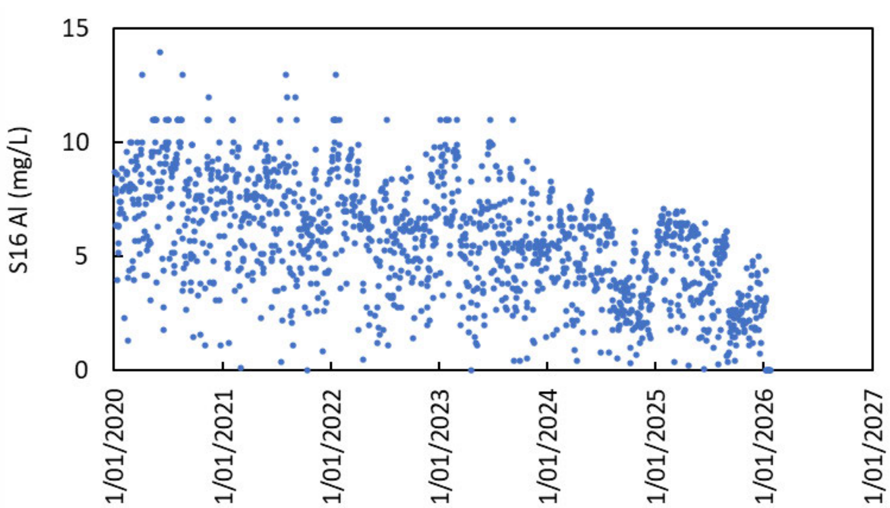


Figure 4. S16 Al concentration

The effect of treatment through 2024 and 2025 is difficult to quantify. This is due to several factors:

- A prolonged dry period in early 2025 resulted in relatively high acidity concentrations across site, including at S16.
- Slurry pipe scaling issues have been managed by direct dosing to Fly Creek from October 2024 onwards.
- Seepage from the McCabes Sump has resulted in treated AMD reporting to unknown flow paths, potentially bypassing S16, so that McCabes Sump treatment benefits may not be fairly represented in the 2024/25 S16 dataset.

- Plover Stream has overtopped the historic diversion weir and does not follow its previous flow path into Old Fly Creek workings. This has had a positive effect on S16 water quality, as the effect of this flow change (decrease in flow volumes entering historic workings) has been an estimated ~11% reduction in S16 acidity load (relative to January – October 2023 levels).

These factors (along with the potential for further McCabes Sump dosing optimisation) make forecasting future S16 acidity loads based on 2024/25 measured values complicated. To avoid these uncertainties in the measured 2024/25 dataset affecting the 80-year model forecasts, the MWM (2024b) contaminant load model has been used as the basis for forecasting treatment effects in St Patrick Catchment. MWM (2024b) derived acidity loads from different tributaries within the S16 catchment under a range of flow conditions using available data up to mid-2023. During median flow conditions the daily acidity loads were estimated as summarised in Table 2.

Table 2. MWM (2024b) estimates of S16 median daily acidity load and contribution from tributaries as at 2023.

Site	2023 Median acidity load (kg/d)
S16	**4,838**
SPDU	440
8W	5
PLOAFM	631
Fly5	1,063
McCabes	631
Unquantified*	**2,077**

*Unquantified acidity load calculated from the difference between S16 load and the sum of tributaries and is primarily attributed to Old Fly Creek workings located upstream of S16.

The 2023 S16 median daily acidity load of 4,838 kg/d coincided with a median acidity concentration of 47.7 mg/L at S16. Treatment of Cypress, Fly Creek (up to 70th percentile flows), and McCabes acidity loads at the McCabes Treatment System is assumed to reduce the median daily acidity load from each tributary by 90% (i.e., residual acidity load equivalent to 10% of influent acidity load). The calculated / forecast S16 median daily acidity load and concentration in 2025 (incorporating the effects of AMD treatment) is shown in Table 3.

Table 3. Estimated S16 median daily acidity load and concentration in 2023 (pre McCabes Sump CaO dosing) and forecast 2025 (post McCabes Sump CaO dosing)

Site	Measured 2023 Median acidity load (kg/d)	Forecast 2025 Median acidity load (kg/d)
S16	4,838	2,917
SPDU	440	44*
8W	5	5
PLOAFM	631	631
Fly5	1,063	106*
McCabes	631	63*
Unquantified	2,077	2,077
Residual S16 median acidity conc. (mg/L)	47.7	28.7**

*90% load reduction through treatment. ** 2023 – 2025 acidity concentration decrease assumed to be proportional to 2023 – 2025 acidity load decrease.

The effect of Plover Stream treatment (i.e., diversion of up to 70th percentile flows to McCabes Treatment System) commencing in 2034 on median S16 acidity concentration (as a percentage of acidity load / concentration reduction) can also be estimated from Table 3. At this time (i.e., in 2034):

- SPDU acidity load is assumed to be negligible; and
- Neutralisation of an assumed 90% of the PLOAFM load (during median flow conditions) will start.

This would be equivalent to reducing S16 median acidity load and concentration by 21% (i.e., from 2,917 kg/day to 2,306 kg/day). The forecast S16 concentration in 2033 is not calculated in Table 3 due to complexity factoring in the effect of acidity decrease due to rehabilitation in the greater St Patrick Catchment. Rather, the modelled 2033 S16 acidity concentration will be decreased by 21% to incorporate the effect of Plover Stream treatment.

4.3 80-year acidity and Al forecast

As discussed, the long term forecast of remnant Acidity concentration at S16 (including the discussed effects of final landform rehabilitation and treatment) is based on:

- Measured S16 acidity concentration in 2023.
- Modelled reduction in acidity concentration over the remaining LOM due to rehabilitation – equivalent to a 23% reduction in 2025 concentration pre-treatment.
- Modelled decay in long term acidity concentration – equivalent to 0.62% per year.
- Modelled reduction in acidity concentration due to:
  - Treatment of Cypress, McCabes, and Fly Creek tributaries from 2024 onwards; and
  - Treatment of McCabes, Fly Creek, and Plover tributaries from 2033 onwards.

The forecast S16 annual median Al concentration is scaled directly off the forecast annual median acidity concentration. This is a simplification for modelling purposes as in reality acidity is a composite chemical measure (including contributions from hydrogen ion (pH), iron (Fe), and other metals) and so a given acidity concentration value can be variable in terms of Al concentration. The theoretical contribution of the major constituents of acidity (pH, Fe, and Al) to calculated acidity is shown in Figure 5. The calculated acidity (and individual contributions from pH, Fe, and Al) is calculated using the equation below:

$$Calc. Acidity = 50 \times \left(\frac{3 \times Fe}{56} + \frac{3 \times Al}{27} + 1000 \times 10^{-pH}\right)$$

Figure 5 shows that while there are some remnant Fe and hydrogen ion (pH) contributions to acidity at S16 (data including the 2015 onwards dataset), the major contribution is from Al across the full calculated acidity concentration range. Further, as remnant acidity concentrations at S16 has decreased over time (due to increased AMD treatment and long-term decay) the Al contribution has become increasingly dominant (i.e., ~70% Al acidity when Calc Acidity < 40 mg/L). Thus, it is reasonable to assume that the correlation between Al and acidity concentration will be strong for forecasting.

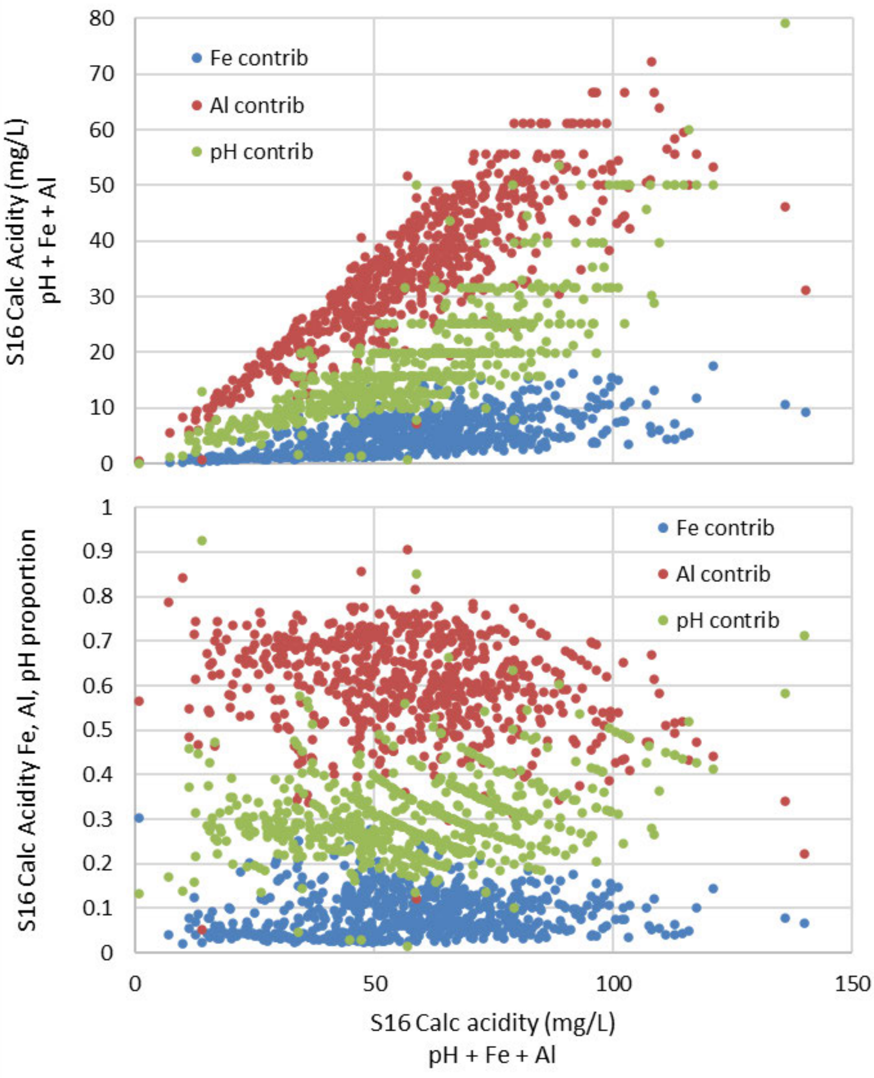


Figure 5. Dissolved Al contribution to calculated acidity (including Fe, Al, and pH contributions). (2015 onwards dataset).

For AMD modelling purposes, available S16 water quality data were used to generate a polynomial correlation between acidity and Al concentration using empirical data, shown in Figure 6. The trendline was fitted to empirical data with acidity concentrations of less than 40 mg/L, to focus on the subset of data that is most relevant for the relatively low acidity concentration conditions anticipated in the future. A y-axis intercept value of 0.2 mg/L Al was applied to the trendline to avoid anomalous values. As discussed, there is scatter in the relationship, but overall there is a positive correlation between acidity and Al concentration.

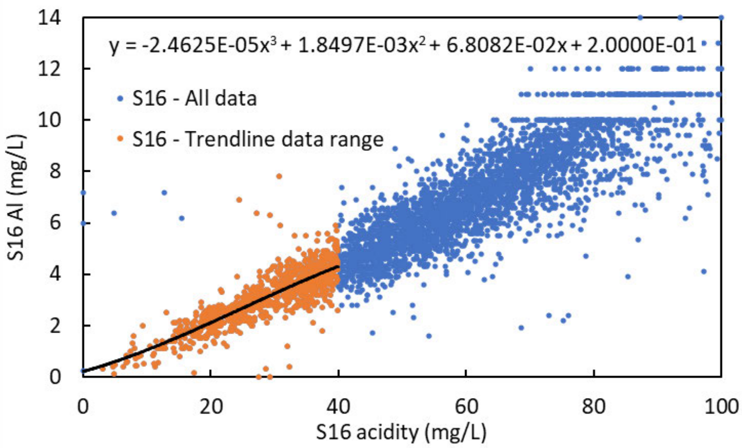


Figure 6. Median annual acidity versus Al concentration for 2010 to 2025 S16 dataset

The forecast S16 annual 75th percentile Al concentration is scaled off the forecast S16 annual median Al concentration. The scalar used is calculated from the ratio of annual median versus annual 75th percentile Al concentration for the relatively recent 2020 – 2025 dataset (Figure 7). This scaling factor of 1.21 is applied to forecast S16 annual median Al concentrations to forecast 75th percentile Al concentrations. This assumes that the current range / variability in median and 75th percentile Al concentrations at S16 is consistent over the next 80 years.

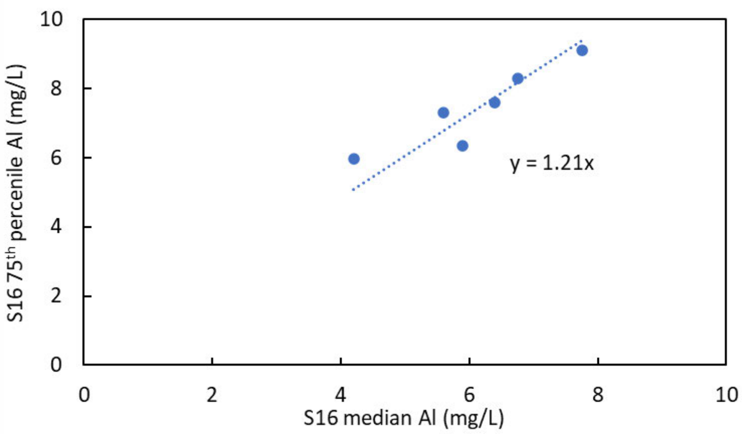


Figure 7. Scaling factor ratio of annual median to annual 75th percentile S16 Al concentration.

The resulting forecast of long term S16 acidity and Al concentration is shown in Figure 8.

A summary of forecast annual median acidity and Al concentration at other key dates is provided in Appendix II. Forecast concentration values vary linearly between these key dates.

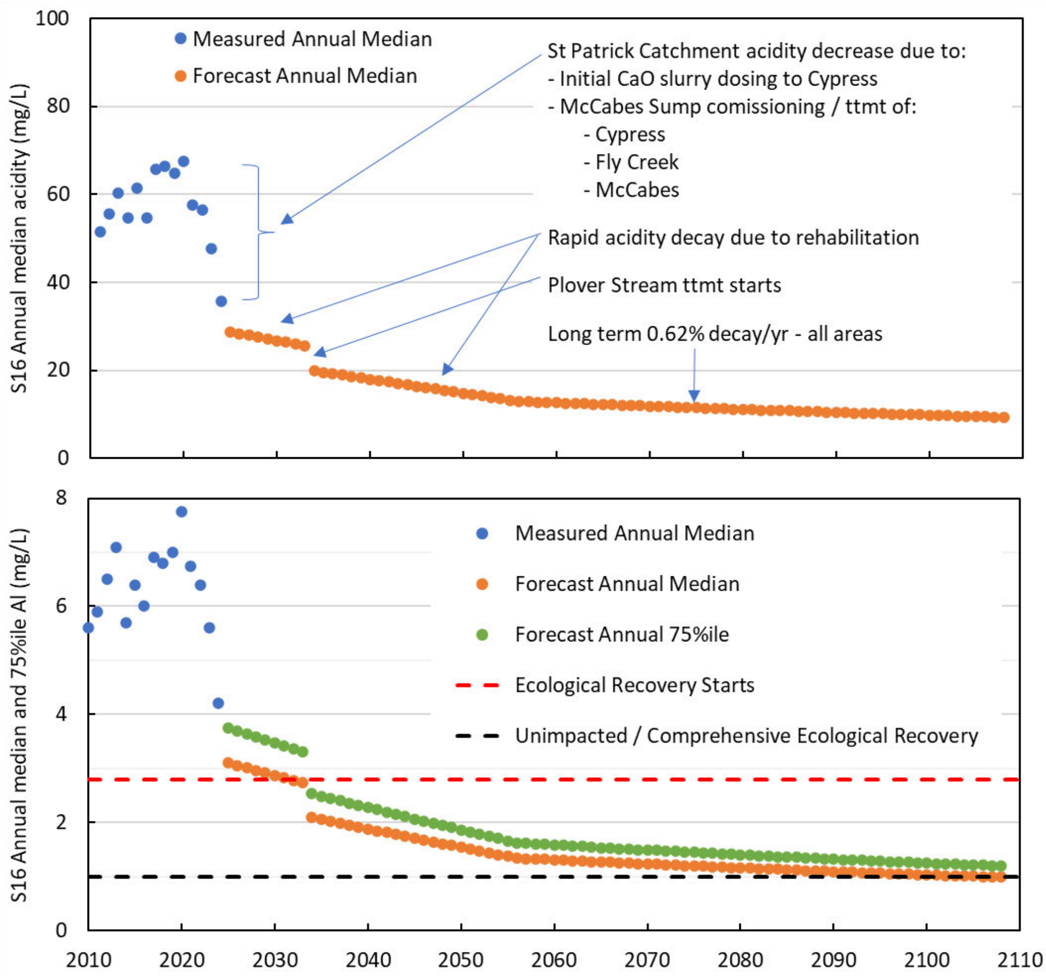


Figure 8. Forecast long term annual median and 75th percentile S16 acidity and Al concentration

The long term forecast of S16 acidity and Al concentration (Figure 8) shows:

- The annual median and 75th percentile Al concentrations fall below the 2.8 mg/L threshold for ecological recovery in 2032 and 2034 (after treatment of Plover Stream AMD commences), respectively; and
- The annual median Al concentration falls below the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery in 2105.

The forecasted annual 75th percentile Al concentration does not fall below the 1.0 mg/L threshold at S16 for unimpacted / comprehensive ecological recovery within the 80-year timeframe quantified in this assessment.

4.3.1 Mitigating Factors

Figure 8 shows forecast 75th percentile Al concentrations at S16 do not fall below 1.0 mg/L within the 80-year timeframe quantified in this assessment. While major AMD tributaries of St Patrick Stream will be captured for treatment within the 80-year timeframe (i.e., McCabes, Fly Creek, Plover Stream), there will still be an influence from the substantial historic Fly Creek Workings (identified in Table 2) which are located downstream of the LDP2 AMD capture and treatment infrastructure but upstream of S16. At this stage there are no AMD management options developed for the historic Fly Creek Workings. It is assumed that the upper portion of St Patrick Stream will continue to flow through these workings before re-joining St Patrick Stream above the S16 monitoring site.

There are several potential mitigating factors (described in the following sub-sections) that are likely to mitigate remnant acidity loads, enabling a higher degree of ecological recovery within St Patrick Stream earlier than the Figure 8 forecast suggests.

4.3.1.1 AMD treatment optimisation

Figure 9 shows that residual S16 Al concentration is influenced by pH, with lower Al concentrations occurring at higher pH. This trend is identified in the two red 'Indicative statistics' asterisks, which show:

- Median pH (pH = 3.7) plotted against median Al concentration (4.5 mg/L); and
- 25th percentile pH (pH = 4.6) plotted against 75th percentile Al concentration (6.1 mg/L).

The S16 dataset between 2024 and 2025 is presented as this period includes a higher overall degree of treatment than preceding datasets. Data suggest that if LDP2 CaO dose rates were increased such that S16 pH remained relatively high (after mixing with residual untreated AMD from historic Fly Creek Workings, etc.) there would be more removal of Al and remnant concentrations would be closer to the ecological recovery thresholds sooner. The 75th percentile Al concentration would decrease further than the Figure 8 forecast.

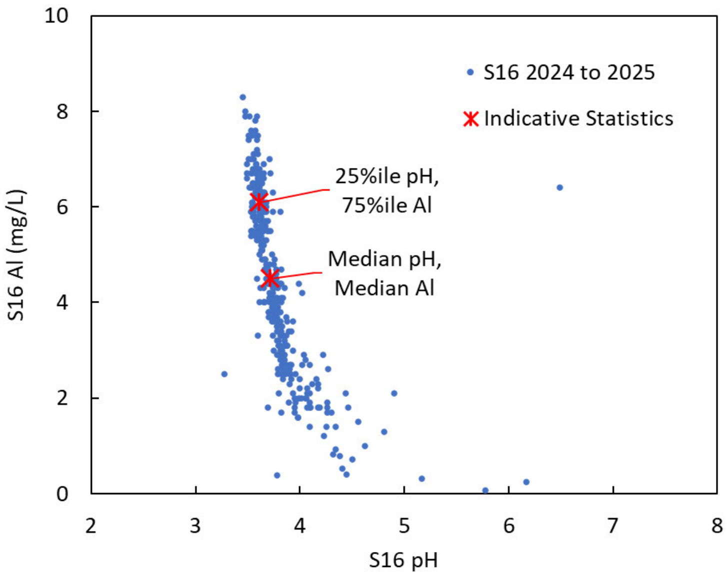


Figure 9. S16 correlation between pH and Al concentration (2024 to 2025 dataset)

4.3.1.2 Natural Catchment Dilution

The S16 site is located downstream of the McCabes Area, approximately 1,500 m below the McCabes Sump. There are significant undisturbed / natural catchments downstream of S16 that will contribute to a decrease in 75th percentile Al concentrations in St Patrick Stream (below S16) by dilution.

The effect of dilution has been assessed at the confluence of T35 Stream and St Patrick Stream, which is approximately 1,000 m downstream of S16. There are no water quality monitoring data available at the T35 – St Patrick Stream confluence site to enable a quantitative assessment of dilution. However, the catchment areas at the two sites are estimated in Figure 10, with the estimated difference between catchment sizes of:

- St Patrick Stream to Gorge / confluence with T35 – 18.65 km^2; and
- St Patrick Stream to S16 – 13.22 km^2.

Assuming that stream flow is proportional to catchment size and the Al concentration contributed from T31 and T35 catchments is negligible, the Al concentration may decrease to 71% of S16 levels by the confluence with T35 due to dilution.

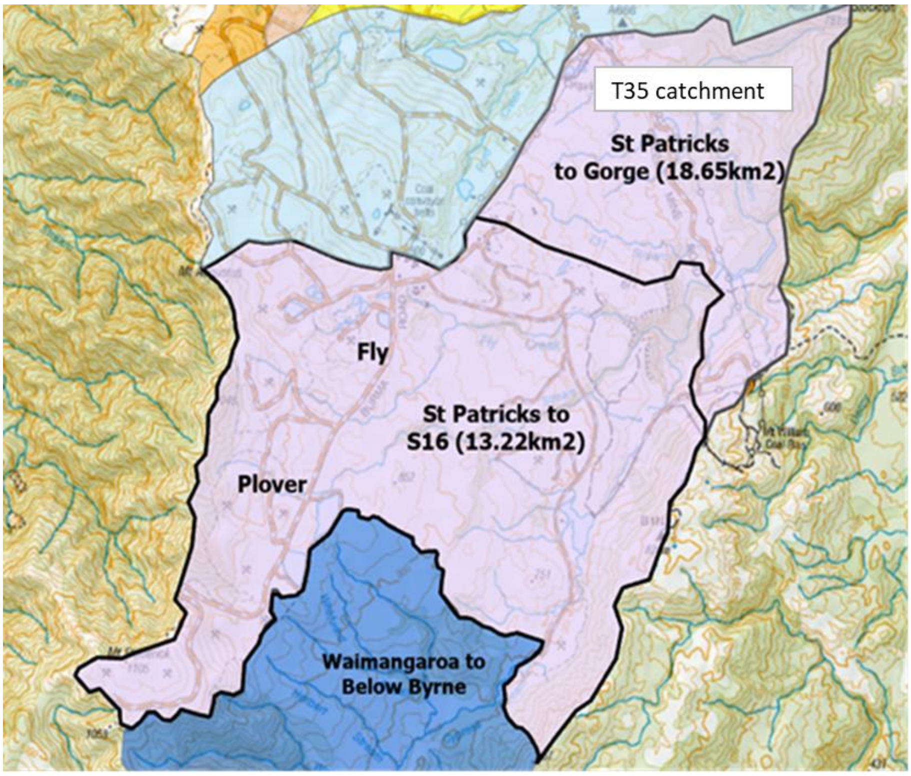


Figure 10. Estimated S16 and additional (T31 and T35) catchment area

Modelled dilution of the forecast 75th percentile Al concentration from S16 to below the T35 confluence is shown in Figure 11. Calculations suggest that natural catchment dilution may be sufficient for the St Patrick Stream below the T35 confluence annual 75th percentile Al concentration to meet the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery in ~2080.

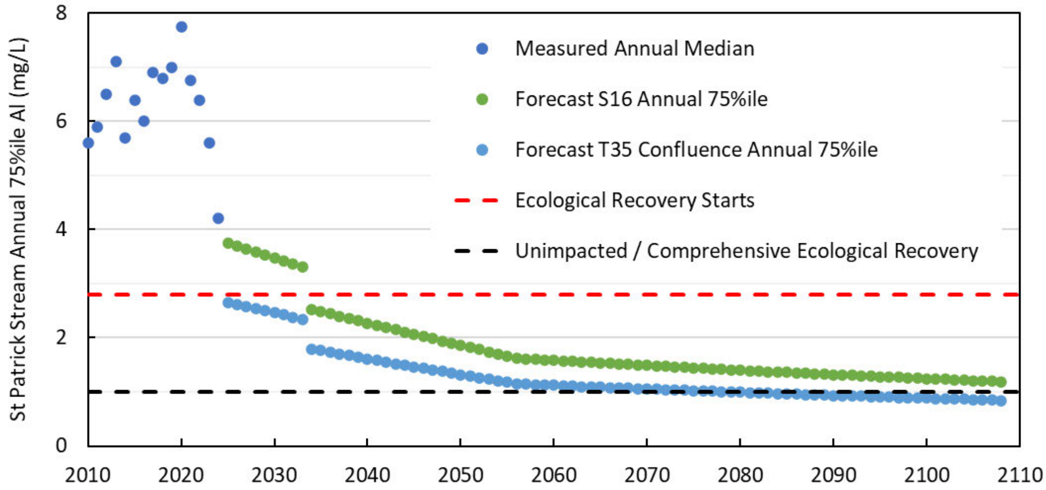


Figure 11. Dilution of annual 75th percentile Al concentration in St Patrick Stream below S16.

5.0 Mangatini Catchment

Monitoring sites MGIU and S14C are the locations of the 80-year water quality assessment for Mangatini Catchment (Figure 1).

5.1 Disturbance and final landform rehabilitation

A high proportion of the Upper Mangatini Catchment is disturbed by mining. This includes 441 ha of the total 639 ha catchment above the key monitoring site S14C. Mining in the Mangatini Catchment is largely complete. Any additional mining / backfill activities are assumed to have a negligible effect (i.e., not cause a noticeable increase) on current acidity concentrations.

Transfer of excess waste rock from the Cypress operation to Webb South ELF (**WE07**) is the main mining activity anticipated post April 2027. The conceptual closure WE07 landform has capacity to store 3.95 M loose cubic metres (lcm) of material, based on current (as at December 2025) surfaces. There is some uncertainty regarding:

- The total volume of excess material from the Cypress operation that will be disposed at WE07, which is estimated at ~3.3 Mlcm but is subject to optimisation of Cypress final landform designs; and
- The proportional volumes of NAF versus PAF material within that overall Cypress disposal volume, which will include a large component of NAF material that is either surplus to requirements or does not meet material properties requirements for final landform rehabilitation purposes (e.g., NAF colluvium).

<u>Conservatively</u> assuming a full 3.95 Mlcm is transferred to WE07 and that is made up of PAF material entirely, the Treasury Model predicts the Cypress material would increase acidity loads reporting to Mangatini Treatment System by a peak ~163 t/year during construction decreasing to ~82 t/year in the 10 years following rehabilitation completion (calculations summarised in Table 4).

Table 4. Potential acidity load contribution from Cypress mine excess material stored at WE07.

AMD potential	Volume (Mlcm)	Volume (kbcm)*	Increased acidity load (t/year)**	
			Pre-rehabilitation	10 years post rehab.
PAF	3.95	3,160	163	82
NAF	0	0	0	0

* A 1.25 factor used to convert in-situ bank cubic meter (**bcm**) volume to ex-situ lcm volume, **Increased treatable acidity load 'pre-rehabilitation' is calculated using the Treasury Model rate for St Patrick catchment material of 0.0516 t/year/kbcm (derived from Gandy and Younger (2007) and O'Kane Consultants (2015)) and '10 years post rehab.' is a 50% reduction.

There is an additional ~25 – 50 kbcm of cut material from construction of the Upper Waimangaroa Haul Road (**UWHR**) that may also be transferred to Stockton and contribute to a further minor increase in Mangatini acidity load.

In the context of acidity loads reporting to the Mangatini Treatment System from the combined Mangatini Catchment and Millerton Block pit sumps (modelled to decrease from a peak of ~8,000 t/year during the Operational Phase and to ~4,000 t/year by the end of the EOML Phase in 2046) the additional acidity loads generated by the Cypress and UWHR materials are minor, potentially contributing to an additional ~2% of acidity loads. As such, the contribution of Cypress and UWHR material has not been included specifically in Mangatini Catchment acidity load forecasts. Any spike in acidity loads mobilised from the Cypress material due to flushing of stored oxidation products during the rehandling process is also assumed to be relatively minor and manageable in the context of acidity loads reporting to Mangatini Treatment System.

Figure 2 shows the area of different landform types at Stockton as at May 2025. Table 5 summarises the disturbance area by landform type in the Mangatini Catchment, which includes:

- Unrehabilitated area (107.1 ha) of landform types assumed to contribute to AMD loads (Active work areas, Coal Stockpiles, Overburden areas / ELFs, Rehab Stage 1, and highwalls).
- Rehabilitated area (171.7 ha) completed to date (including Stage 2, 3, or VDT rehabilitation types), which are also assumed to contribute to AMD.
- Other landform types (162.4 ha) are assumed to not contribute to AMD (e.g., Infrastructure, Topsoil Stockpiles, Water Infrastructure) – areas not presented in Table 5.

Table 5. Mangatini Catchment – Rehabilitated and unrehabilitated surface area for landforms assumed to contribute AMD, as at May 2025.

Landform Type	Area (ha)
Total unrehabilitated	**107.1**
Active Work Areas	56.2
Coal Stockpiles	12.3
Overburden areas / ELFs	36.8
Rehab Stage 1	0.4
Highwall	1.5
Total rehabilitated area	**171.7**
Stage 2	1.0
Stage 3	139.4
VDT	31.3
Total AMD contributing area	**278.8**
Proportion unrehabilitated	**38%**

Table 5 shows that as at May 2025 approximately 38% of landforms assumed to contribute acidity in Mangatini Catchment are not yet rehabilitated. Final landform rehabilitation of these areas will contribute to an approximately 19.2% acidity concentration reduction across the catchment compared to 2025 values (i.e., 50% reduction in acidity concentrations from the 38% of the catchment not yet rehabilitated). Rehabilitation of these areas is scheduled to occur at varying rates through to 2046, but for modelling purposes a constant rehabilitation rate (equivalent to 7.8 ha/year) is assumed.

In addition to future rehabilitation, 70.0 ha of final landform rehabilitation has occurred in Mangatini Catchment over the last 10 years and a further 25% reduction in acidity concentrations from these rehabilitated areas is anticipated. This equates to a further 6.3% reduction in acidity concentration (from 2025 values) across the catchment.

As a relatively large proportion of the catchment is already rehabilitated the long-term decay rate of 0.62 % per year is applied to all acidity concentrations throughout the remaining LOM.

5.2 Description of AMD treatment

5.2.1 Treatment process

A high proportion of AMD generated within the Mangatini Catchment is captured and diverted to the Mangatini Treatment System. The Mangatini Treatment System has evolved over time, with key milestones including:

- Direct dosing of ultrafine limestone (**UFL**) slurry directly to Mangatini Stream (downstream of S14C water quality monitoring site) in from March 2007.

- Construction of Mangatini Sump and transition to UFL dosing above the sump (for AMD sludge capture) in June 2010.
- Construction of LDP1 and transition to CaO dosing above the Mangatini Sump in 2015.

The LDP1 and Mangatini Sump are currently the key components of the Mangatini Treatment System. The current AMD treatment regime in Mangatini Catchment is described as:

- AMD is collected from across the catchment, diverted to Mangatini Sump and discharged to Mangatini Stream after treatment.
  - All upper catchment flows are diverted to Upper Mangatini Stream and CaO dosed (to neutralise acidity);
  - During Low to moderate flow periods (<70th exceedance percentile), dosed flows are diverted into Mangatini Sump where AMD precipitates are captured. Treated water is discharged to Mangatini Stream via floating decants; and
  - During High flow periods (>70th exceedance percentile), the inlet to Mangatini Sump is closed and dosed flows are fully bypassed around the Mangatini Sump (without sedimentation).
- AMD from Ford Creek and Duncans Sump discharge to Mangatini Stream below Mangatini Sump and are not currently CaO dosed. Current compliance and community water quality targets are achieved without treatment of Ford Creek and Duncans Sump AMD. However, future treatment of these acidity loads is identified as a potential AMD treatment optimisation mitigating factor, contributing to ecological recovery in Mangatini Stream sooner (discussed in section 5.3.1.1).
- All Mangatini catchment AMD (including Ford Creek and Duncans Sump contributions) is discharged to Upper Mangatini Stream, above water quality monitoring site S14C.

Additional AMD captured in Millerton pit sumps (including MW16 Sump) will also report to the Mangatini Treatment System from ~2026 through to 2046. This process is discussed further in Section 6.0 and the Millerton Block Water and AMD Management Report (BRL 2026).

5.2.2 AMD treatment performance monitoring sites

The key water quality monitoring sites for demonstrating AMD treatment performance are MGIU and S14C.

5.2.2.1 MGIU site description

Monitoring site MGIU is located upstream of the Mangatini Sump inlet and has historically (up to 2023) represented pre-treatment water quality for the majority of the Mangatini Catchment. Lime dosing has moved upstream of MGIU since 2024, and so recent MGIU data are no longer representative of ‘untreated’ Mangatini Catchment water quality. AMD from other catchments (e.g., Millerton Block and McCabes) have also been pumped sporadically into the Mangatini Catchment (sometimes upstream of MGIU) for treatment.

5.2.2.2 S14C site description

The S14C monitoring site is located in Mangatini Stream, approximately 1 km downstream of the Mangatini Sump discharge point (decant and bypass channel) and downstream of confluences with the untreated Duncans Sump spillway and Ford Creek waters. S14C represents water quality discharging the upper Mangatini Catchment mining disturbed area and includes the effect of treating any AMD pumped from other catchments (e.g., Millerton loads from 2027 to 2046).

5.2.3 2024/25 MGIU acidity concentration

As discussed in section 5.2.2.1 the MGIU acidity concentration in 2024 and 2025 is influenced by CaO dosing upstream of the monitoring site. The median annual MGIU acidity concentration dataset was fitted with an exponential trendline (excluding 2024 and 2025 data) to provide estimates for 2024 and 2025 untreated Mangatini Catchment acidity concentrations (Figure 12). The fitted exponential trendline correlates well with the measured acidity concentration decay.

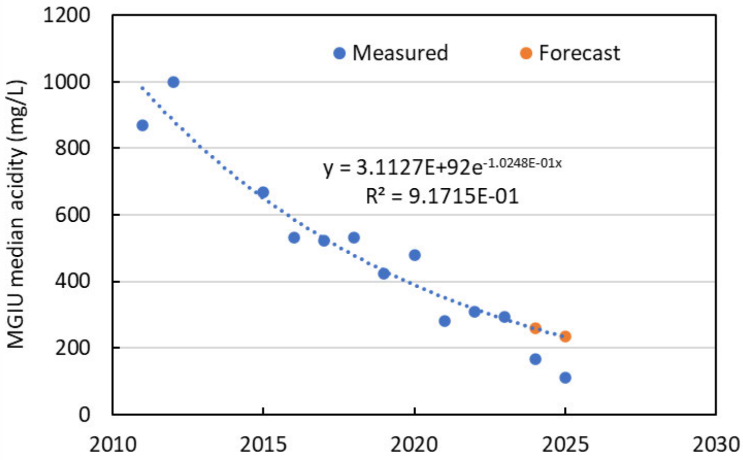


Figure 12. MGIU annual median acidity concentration decrease (exponential trendline excludes measured 2024 and 2025 data).

5.2.4 AMD treatment – Acidity concentration reduction

The Mangatini Treatment System AMD treatment efficiency is calculated from the difference between:

- Pre-treatment MGIU acidity concentration; and
- Post treatment S14C acidity concentration.

The acidity concentration reduction through the Mangatini Treatment System was quantified by comparing median annual MGIU acidity concentrations and S14C acidity concentrations, with the difference attributed to acidity neutralisation by CaO dosing. Figure 13 shows that Mangatini AMD treatment equates to an approximately 90% decrease in acidity between MGIU and S14C, which includes the effect of residual untreated acidity contributed from Duncans Sump and Ford Creek. Residual median annual S14C acidity concentrations remain in the 30 to 50 mg $CaCO_3$/L range (shown in Figure 13) despite significant variability in pre-treatment MGIU acidity concentration over time.

Current compliance and community water quality targets are achieved without treatment of Ford Creek and Duncans Sump AMD. However, Duncans Sump and Ford Creek are estimated to currently contribute

~66% of the remnant AMD effects (after Mangatini Treatment System alkaline dosing) at S14C (calculated using Al concentration trends), as discussed in Section 5.3.1.1. Future treatment of these AMD sources is identified as an option for AMD treatment optimisation.

Acidity reduction values for 2024 and 2025 were not calculated as MGIU acidity concentrations for that period were influenced by upstream CaO dosing.

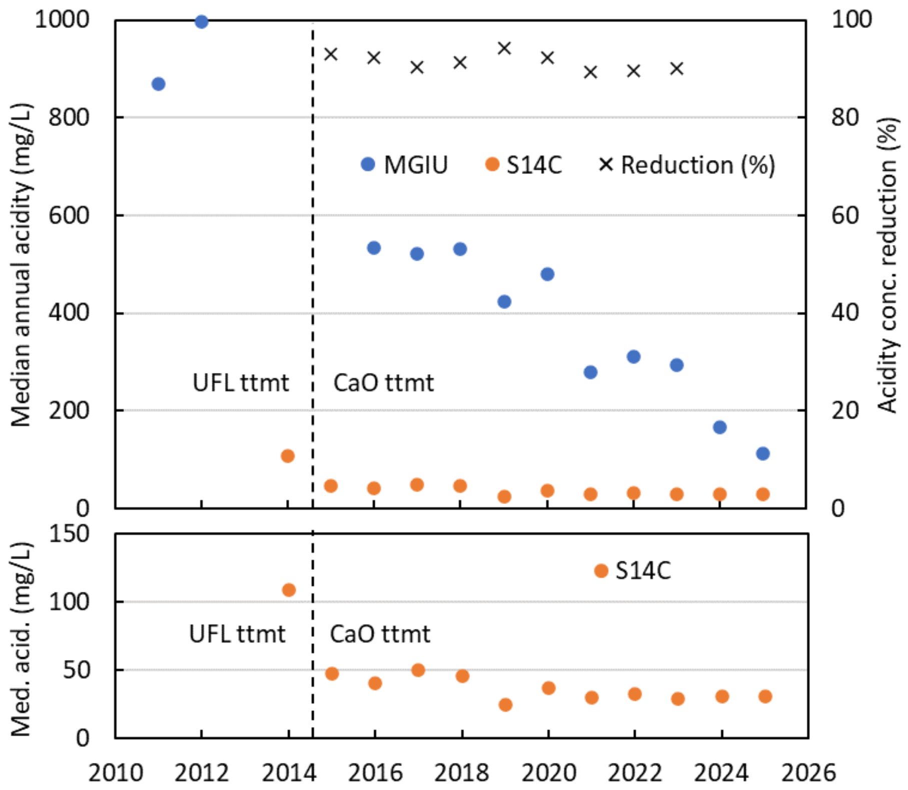


Figure 13. Mangatini Treatment System acidity reduction through treatment

5.2.5 AMD treatment – Al concentration reduction

The Al concentration reduction through the Mangatini Treatment System was quantified by comparing median annual MGIU Al concentrations and S14C Al concentrations, with the difference attributed to AMD treatment. Figure 14 shows that Mangatini AMD treatment equates to an approximately 90% decrease in Al concentration between MGIU and S14C, which includes the effect of residual untreated acidity contributed from Duncans Sump and Ford Creek. Residual median annual S14C Al concentrations remain in the 4 to 6 mg/L range despite significant variability in untreated MGIU Al concentration over time.

Current compliance and community water quality targets are achieved without treatment of Ford Creek and Duncans Sump AMD. However, Duncans Sump and Ford Creek are estimated to currently contribute ~66% of the remnant S14C Al load, as discussed in Section 5.3.1.1. Future treatment of these AMD sources is identified as an option for AMD treatment optimisation.

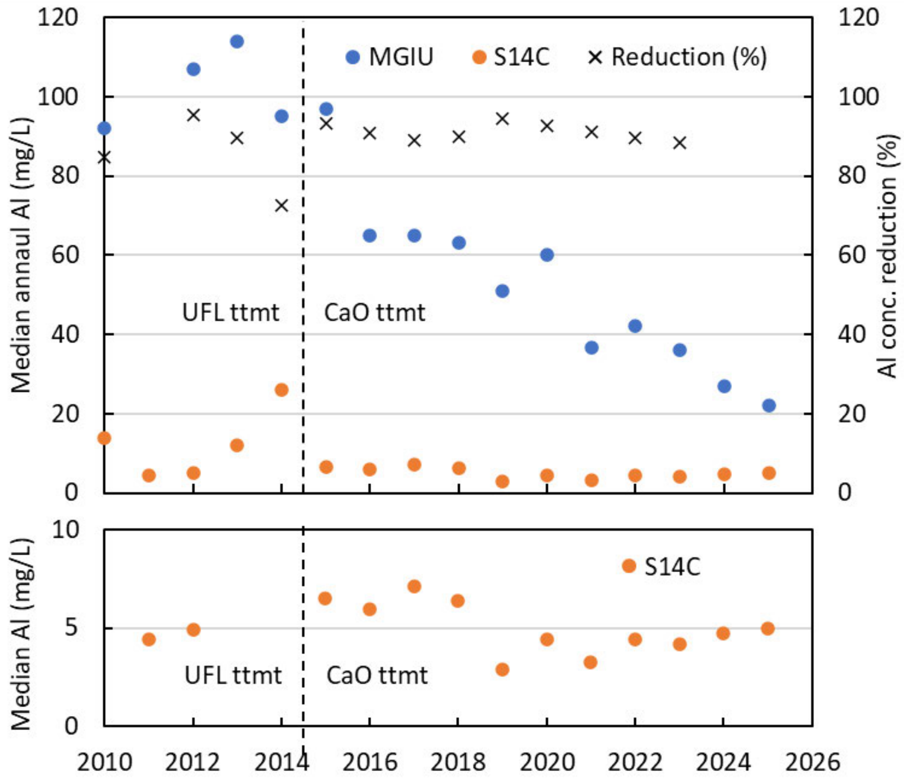


Figure 14. LDP1 / Mangatini Sump Al reduction through treatment

5.3 80-year acidity and Al forecast

As discussed already, the long term forecast of pre-treatment MGIU and post-treatment S14C acidity concentration (including the discussed effects of final landform rehabilitation and treatment) is based on:

- Estimated Mangatini Catchment acidity concentration in 2025.
- Modelled reduction in acidity concentration over the remaining LOM due to rehabilitation – equivalent to a 25% reduction in 2025 Mangatini Catchment 2025 acidity.
- Modelled decay in long term acidity concentration – equivalent to 0.62% per year.
- Modelled reduction in acidity concentration at S14C due to treatment through the Mangatini Treatment System, either:
  - Neutralising 90% of acidity; or
  - Reducing residual median annual S14C acidity concentrations to the 30 to 50 mg CaCO3/L range.

The forecast pre-treatment MGIU and post-treatment S14C Al concentration was scaled directly off the forecast acidity concentrations for each site (which is supported by Figure 15 correlations). As discussed previously, this is a simplification for modelling purposes as in reality, acidity is a composite chemical measure (including contributions from hydrogen ion (pH), Fe, and other metals).

S14C is the critical site for the long term Mangatini water quality forecasting. The theoretical contribution of the major constituents to acidity (pH, Fe, and Al) to S14C calculated acidity is shown in

Figure 15 (2015 onwards dataset). Figure 15 shows that the remnant Fe and hydrogen ion (pH) contributions to acidity at S14C are effectively negligible. This is because there is a relatively high degree of AMD treatment upstream of S14C which will preferentially reduce hydrogen ion and Fe contributions to calculated acidity. Thus, it is reasonable to assume that the correlation between Al and acidity concentration will be strong.

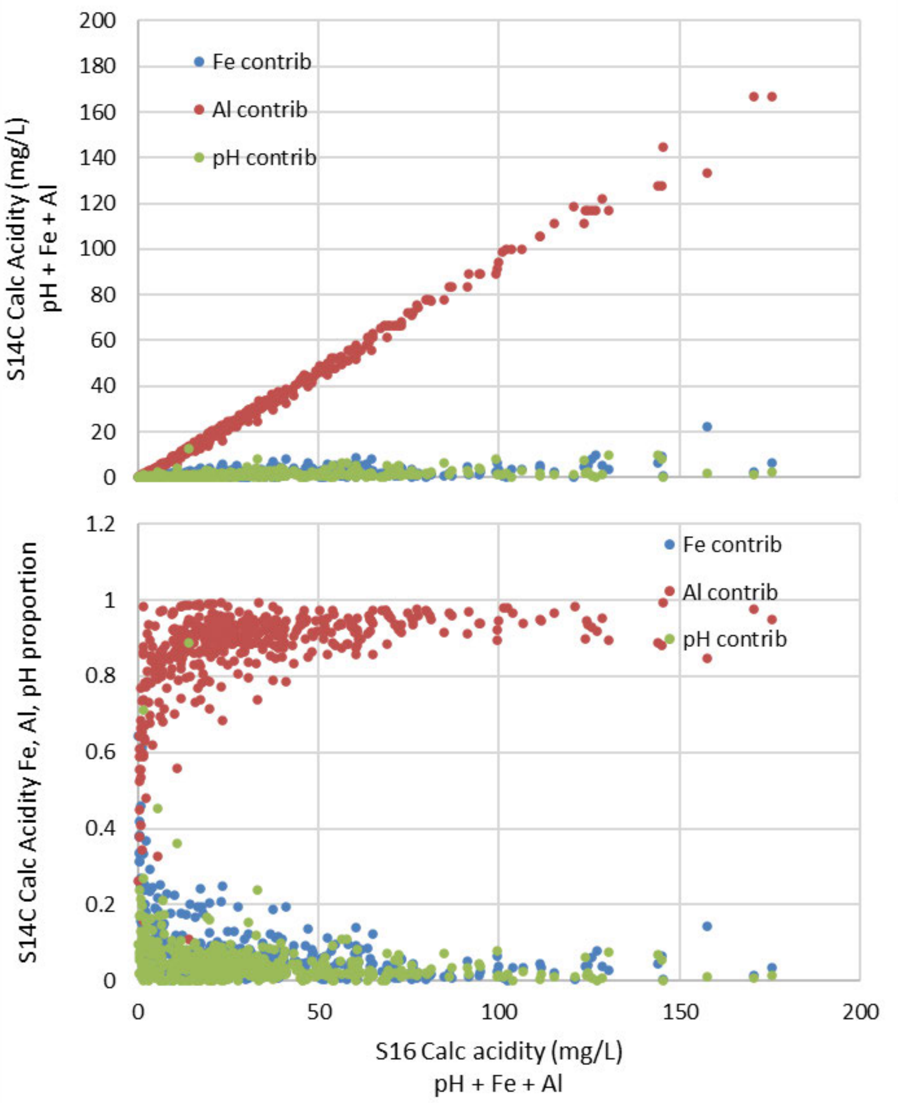


Figure 15. Dissolved Al contribution to S14C calculated acidity (including Fe, Al, and pH contributions). (2015 onwards dataset).

For AMD modelling purposes, available water quality data were used to generate site specific polynomial correlations between acidity and Al concentration, shown in Figure 16. NB: Al datapoints where acidity concentrations were reported as 0 mg/L were excluded from the trendline.

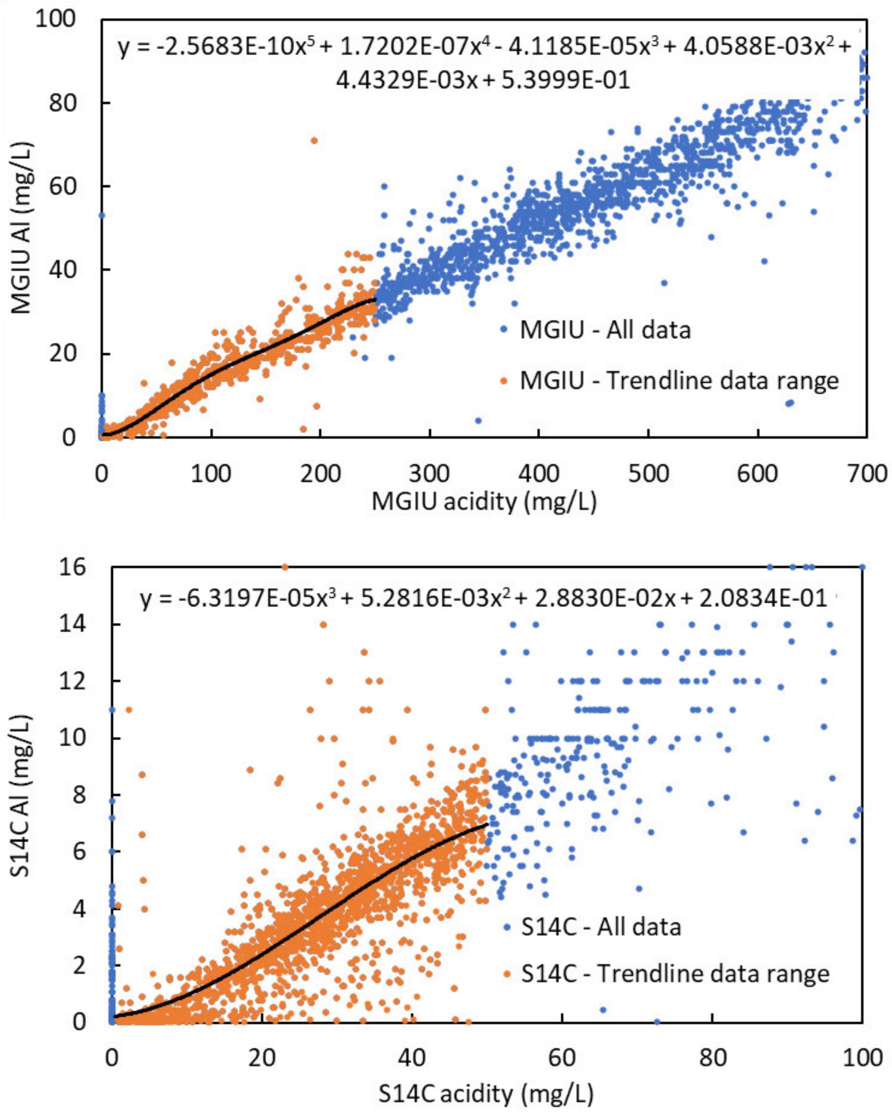


Figure 16. Median annual acidity versus Al concentration for MGIU and S14C dataset

The forecast S14C annual 75th percentile Al concentration is scaled off the forecast S14C annual median Al concentration. The scalar used is calculated from the ratio of annual median versus annual 75th percentile Al concentration for the relatively recent 2020 – 2025 dataset (Figure 17). This scaling factor of 1.56 is applied to forecast S14C annual median Al concentrations to forecast 75th percentile Al concentrations. This assumes that the current range / variability in median and 75th percentile Al concentrations at S14C is consistent over the next 80 years

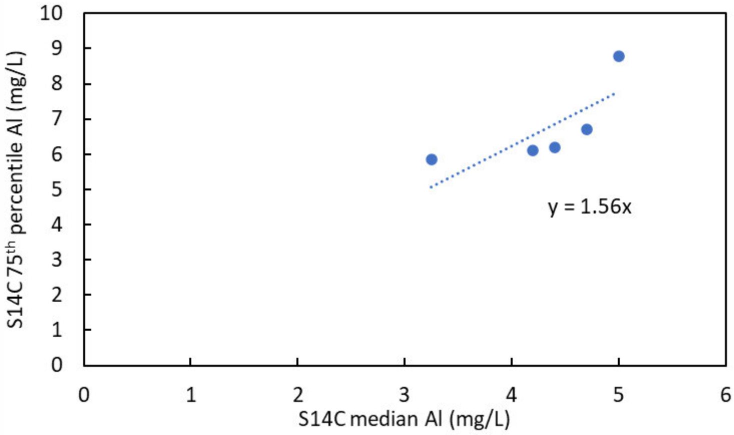


Figure 17. Scaling factor ratio of median to 75th percentile S14C Al concentration.

The resulting forecast of long-term Pre-treatment MGIU / Mangatini Catchment and S14 acidity and Al concentration is shown in Figure 18 and Figure 19, respectively. A summary of forecast Acidity and Al concentration at other key dates is provided in Appendix II. Forecast concentration values vary linearly between these key dates.

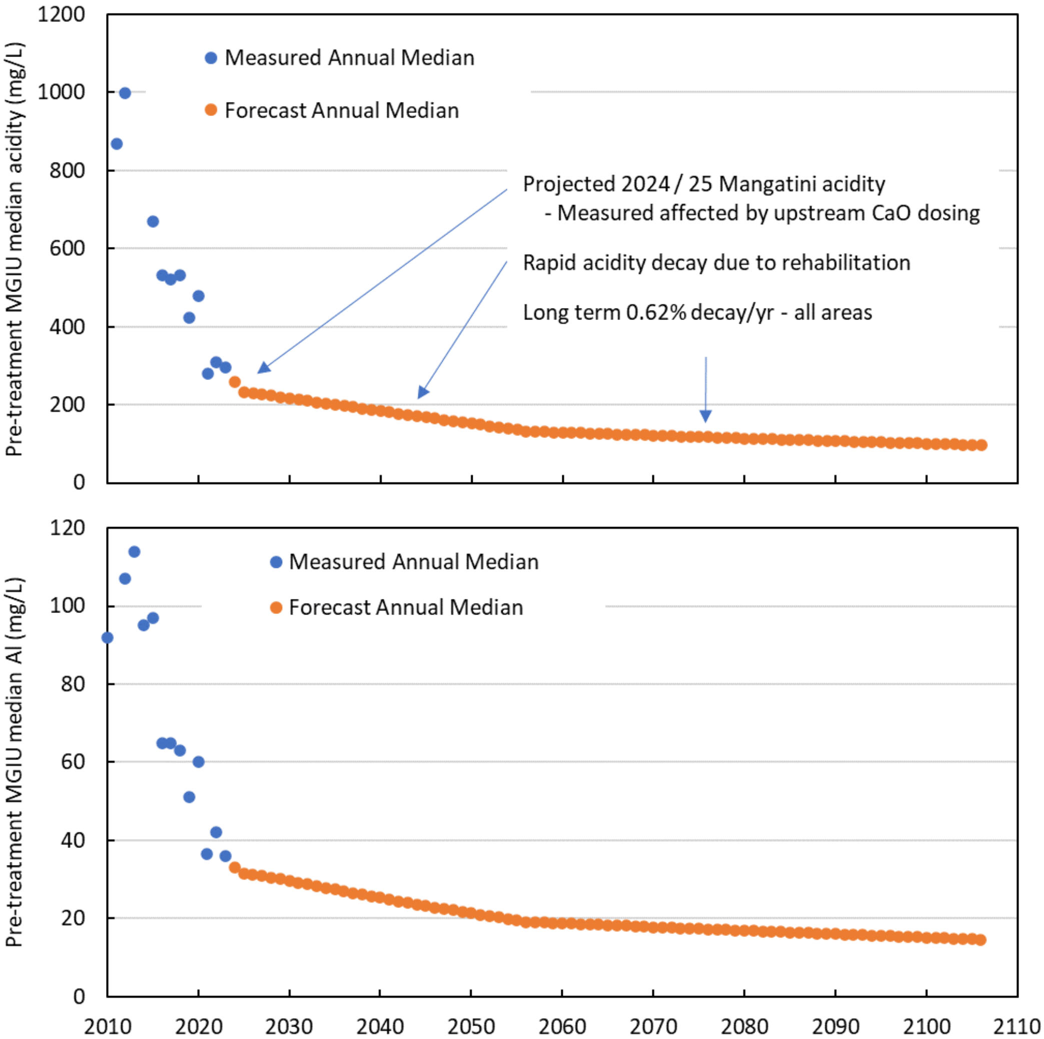


Figure 18. Forecast long term pre-treatment MGIU / Mangatini Catchment acidity and Al concentration.

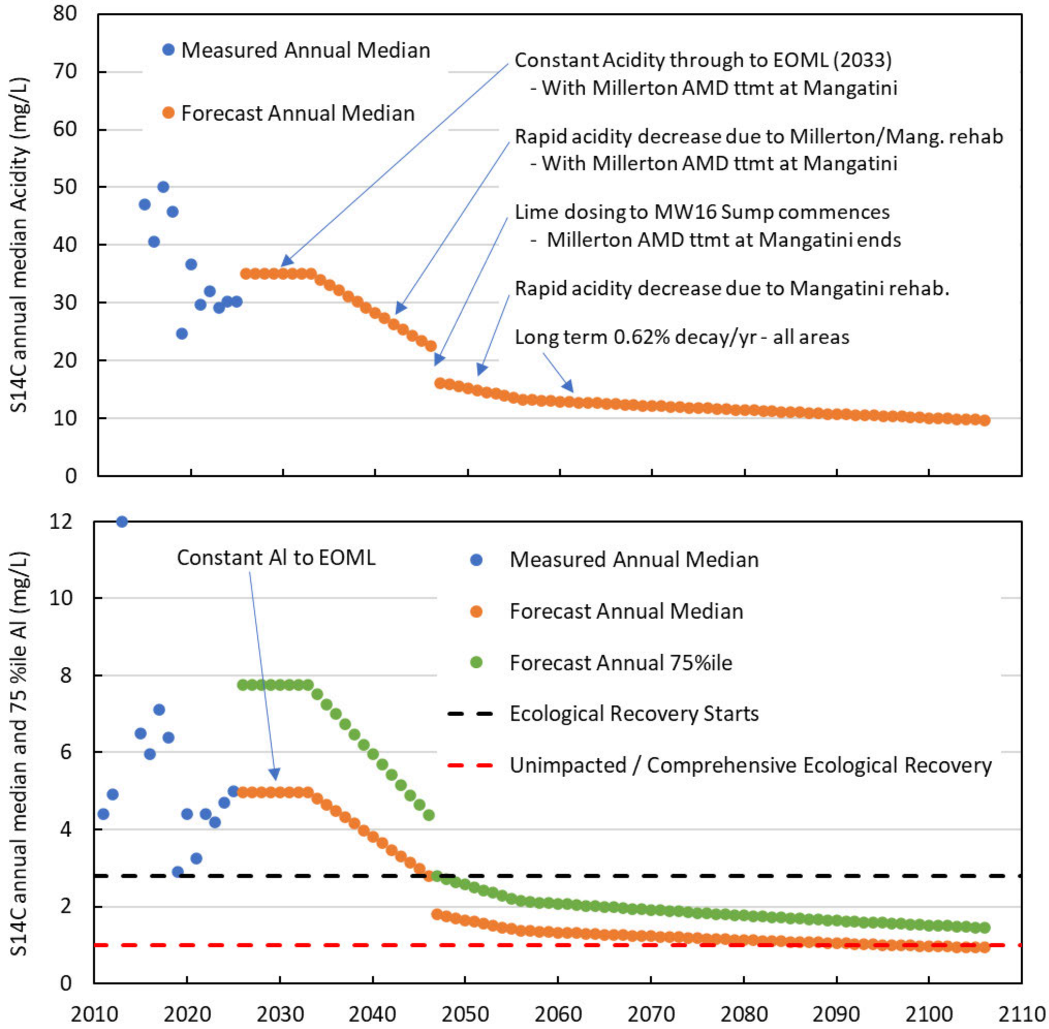


Figure 19. Forecast long term S14C annual median and 75th percentile acidity and Al concentration

The long term forecast of S14C acidity and Al concentration (Figure 19) shows:

- The annual median and 75th percentile Al concentrations fall below the 2.8 mg/L threshold for ecological recovery in 2047 (when Millerton AMD treatment in MW16 Sump commences); and
- The annual median Al concentration falls below the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery in 2098.

The forecasted annual 75th percentile Al concentration does not fall below the 1.0 mg/L threshold at S14C for unimpacted / comprehensive ecological recovery within the 80-year timeframe quantified in this assessment.

5.3.1 Mitigating Factors

Figure 19 shows forecast 75th percentile Al concentrations at S14C do not fall below the 1.0 mg/L threshold for comprehensive ecological recovery within the 80-year timeframe quantified in this assessment. There are several factors that are likely to mitigate this, enabling a higher degree of ecological recovery within Mangatini Stream earlier than the Figure 19 forecast suggests. The potential effects of these mitigating factors are discussed individually in sections 5.3.1.1 to 5.3.1.3.

5.3.1.1 AMD treatment optimisation

An increase in the degree of AMD treatment through the Mangatini Treatment System would contribute to comprehensive ecological recovery sooner. Figure 20 shows that residual S14C Al concentration is influenced pH, with lower Al concentrations occurring at higher pH. This trend is identified in the two red 'Indicative statistics' asterisks, which show:

- Median pH (pH = 4.7) plotted against median Al concentration (4.8 mg/L); and
- 25th percentile pH (pH = 4.4) plotted against 75th percentile Al concentration (8.2 mg/L).

If CaO dose rates were increased such that S14C pH increased, it is anticipated that the 75th percentile Al concentration would decrease further than the Figure 19 forecast. Instream (2026) also note that Al toxicity is reduced at circum-neutral solutions, another potential benefit of targeting a slightly higher neutralisation pH. Figure 20 suggests that dosing such that S14C pH increases to the 5.5 to 6 range could minimise remnant Al concentrations, although this would have to be carefully controlled to prevent over-dosing and potentially adversely impacting downstream aquatic ecology.

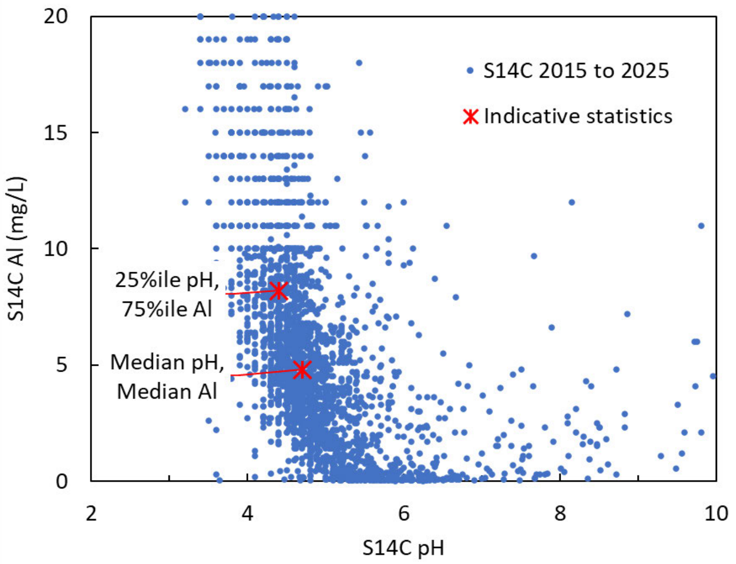


Figure 20. S14C correlation between pH and Al concentration (2015 to present dataset)

Optimisation to include treatment of Ford Creek and Duncans Sump AMD (which is not currently required to achieve compliance and community water quality targets) would also contribute to comprehensive ecological recovery sooner. Accurately quantifying the relative contribution of Ford Creek and Duncans Sump to residual S14C acidity concentration is difficult as the:

- Flow rate from Duncans Sump is not continuously flow monitored; and
- Flow rate of treated AMD discharged via the Mangatini Sump Decants (**MGD**) is controlled operationally and so MGD flow rate trends are not comparable / concurrent with the Ford Creek and Duncans Sump contribution to S14C flow trends.

However, a comparison of median Al concentration at the three key contributing sites (MGD, FC, and Duncans SW) provides an indication of Ford Creek and Duncans Sump contribution to remnant S14C Al load. Figure 21 shows the recent Al concentration data (since 2023 where concurrent values are available for all sites). Median Al concentrations are calculated for these sites and presented in Table 6.

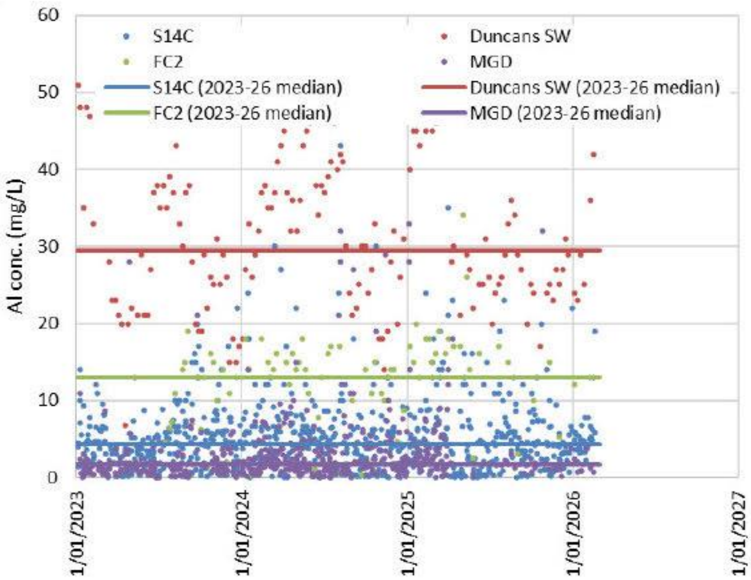


Figure 21. Al concentration of key contributors to S14C

Table 6 summarises the estimate of relative Al load contribution from Ford Creek and Duncans Sump. The calculation assumes median flow conditions coincide with the median concentration values at each site. A unitless 'load contribution' balance for each site was used to derive the proportion of flow contributed by MGD and Duncans Sump, using the corresponding median annual Al concentration. This load contribution was balanced at S14C using goal seek in Excel.

Table 6. Indicative contribution of Ford Creek and Duncans Sump to remnant S14C Al load – median flow conditions

Site	Proportion of flow (%)	Median annual Al Conc. (mg/L)	Load contribution (unitless)	Proportion of S14C Al load (%)
MGD	88**	1.7	1.5	35
Ford Creek	5*	13.0	0.7	16
Duncans Sump	7**	29.5	2.1	50
S14C	**100**	**4.3**	**4.3**	**100**

* Calculated from median flow values extracted from flow percentile distributions for S14C (476 L/s) and Ford Creek (25 L/s). ** MGD and Duncans Sump flow contribution was calculated by S14C load mass balance but equates to median flow rates of 416 L/s and 34 L/s, respectively.

This analysis suggests that ~66% of the remnant Al load at S14C (during median flow conditions) is contributed by the currently untreated Ford Creek and Duncans Sump. Flow distributions suggest Ford Creek and Duncans Sump comprise a relatively small proportion of the flow (~12%).

5.3.1.2 Natural catchment dilution

The S14C site is located relatively close to the Mangatini Catchment area of disturbance (~1,000 m downstream of the Mangatini Sump). There are significant undisturbed / natural catchments downstream of S14C that will contribute to a decrease in 75th percentile Al concentrations in Mangatini Stream (below S14C) by dilution.

The effect of dilution has been assessed at Mangatini Stream Site S14B, located approximately 5 km downstream of the Mangatini Sump decant discharge point. The dilution capacity was quantified by comparing S14B and S14C electrical conductivity (**EC**) measurements and Hardness concentrations for samples collected on the same day. EC and hardness were selected as they are the two common parameters recorded at both sites with a sufficient sample population (256 concurrent Hardness and 933 concurrent EC measurements between 2020 and 2025) to represent variability. These data suggest that Al concentration at S14B may reduce to 70% of the S14C concentration by direct dilution alone, assuming Al concentration decrease is proportional to the EC and hardness decrease (NB: potential geochemical changes discussed in the following section).

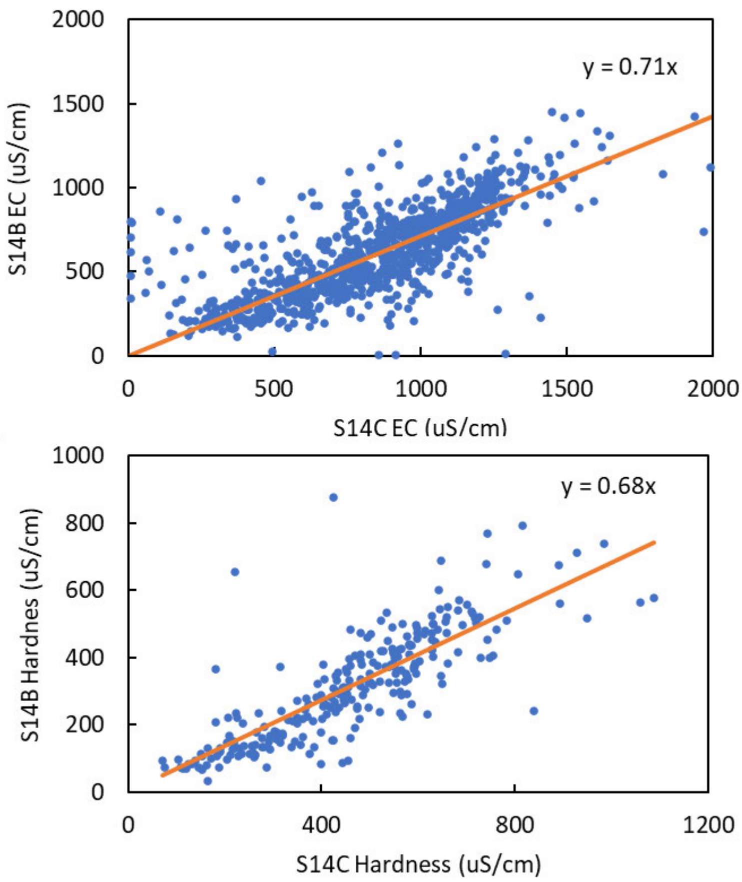


Figure 22. S14C versus S14B dilution factor, derived from concurrent hardness and EC monitoring data

Dilution of the forecast 75th percentile Al concentration from S14C (as derived in Figure 19) to S14B is shown in Figure 23. Calculations suggest that natural catchment dilution may be sufficient for the S14B Al 75th percentile to meet the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery in 2106.

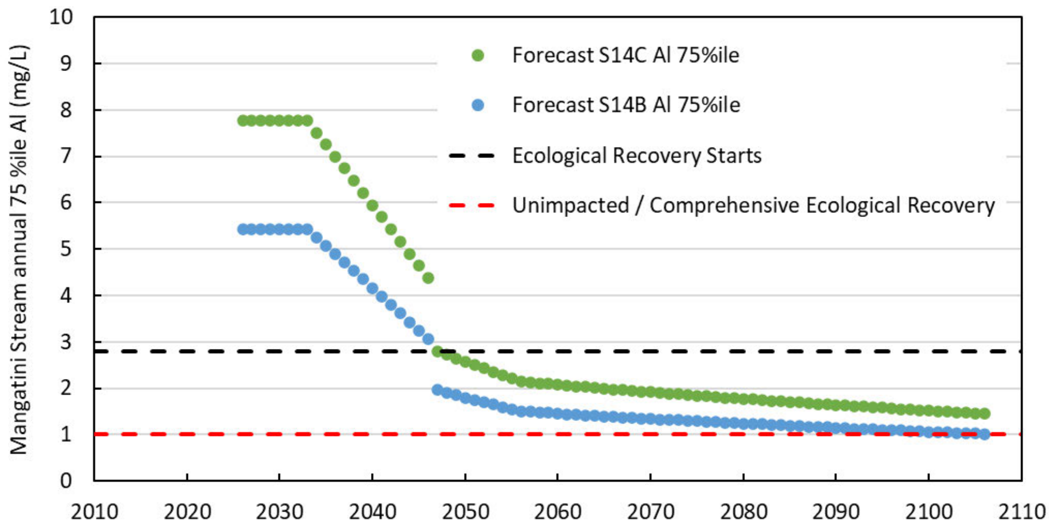


Figure 23. Dilution of Al at S14B.

5.3.1.3 Geochemical changes

Figure 20 shows a large proportion of the S14C samples fall in the pH ~4.2 to ~4.8 range. Hydrolysis of Al (where dissolved Al is converted to insoluble Al oxy-hydroxides precipitates) causes the Al buffering shown in Figure 24. In this pH range any additional neutralisation reactions are likely to predominantly reduce the dissolved Al concentration.

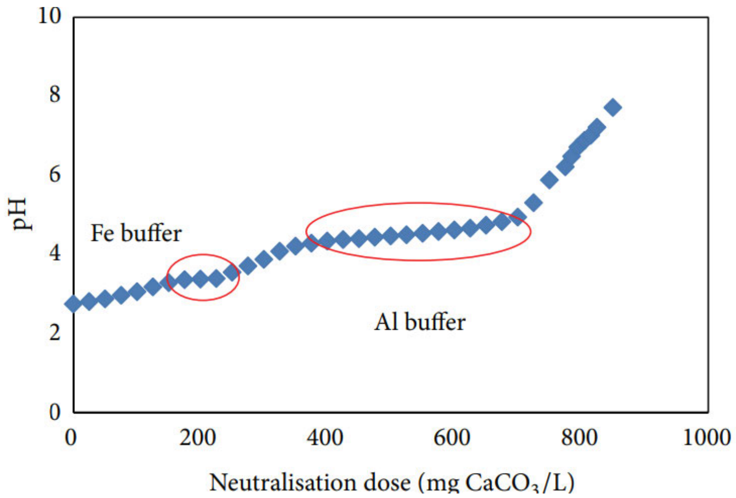


Figure 24. Neutralisation pathway of Mangatini Sump AMD (determined by 0.1 M NaOH titration) (Olds et.al. 2013)

Additional geochemical changes downstream of S14C could be caused by ongoing acidity neutralisation / Al hydrolysis as any residual alkalinity or unreacted CaO continues to decrease Al concentration (at a rate greater than dilution). Given S14C is ~1,000 m downstream of the Mangatini Sump Decants / end of bypass channel and only ~500 m downstream of the confluence with the untreated Ford Creek, it is possible that geochemical reactions have not reached equilibrium at the S14C monitoring site, particularly during high flow conditions. Golder (2002) showed a 2.5 x decrease in Al concentration between S14C and S14B. Thus, the flow dilution discussed in section 5.3.1.2 may be conservative as geochemical changes are not incorporated.

6.0 Millerton Block

The Millerton Block Water and AMD Management Report (BRL 2026) discusses proposed BPCP water and AMD management and subsequent effects on water quality. A major water quality improvement in streams draining the Millerton Block (including Granity and Miller Streams, and Mine Creek) is anticipated through the Operational Phase of the BPCP, with betterment[2] reference values met from EOML (2033) (discussed in BRL (2026)). Further improvements are simulated as additional Crown (administered by Land Information New Zealand (LINZ)) AMD management infrastructure is commissioned, nominally the infrastructure associated with 'Mine Creek Sump' in 2050 and 'All AMD treatment' in 2060. It should be noted that the Crown infrastructure is not included as part of the BPCP application. Accordingly, the future approach for Millerton Block water and AMD management is separated into two parts for this assessment.

The first part aligns with the proposed BPCP Millerton Block Water and AMD Management Report (BRL 2026), which describes opencast mining activities and treatment of AMD generated within the BPCP opencast disturbance footprint through Operational, EOML, and Closure Phases.

The second part aligns with the introduction of additional Crown AMD management infrastructure to capture and treat AMD discharging from remnant historic underground workings located outside of the BPCP opencast disturbance footprint (these AMD sources are not managed as part of the BPCP).

The monitoring sites used in the 80-year water quality assessment for Millerton Block are shown in Figure 1 and include:

- Granity Stream – S24A, S25, GB1 (at state highway bridge)
- Mine Creek – S6, S23, MC1
- Ngakawau River – NRB – at state highway bridge in the Ngakawau estuary

A wider range of sites are considered for the Millerton Block as there are multiple discharge receptors, including:

- Tributaries of Upper Granity Stream (including Miller Stream), which feed into Lower Granity Stream and discharge directly to Tasman Sea; and
- Tributaries of Upper Mine Creek, which feed into Lower Mine Creek and discharge through the Ngakawau River and Estuary to Tasman Sea.

The 80-year Millerton water quality projections are based on two studies:

- The Millerton Block Water and AMD Management Report (BRL 2026), which includes an assessment of water quality associated with the BPCP Millerton opencast mining disturbance and management

[2] The concept of 'betterment' and derivation of betterment reference values specific to streams draining the Millerton Block is described in BRL (2026). The betterment reference values are not equivalent to ecological recovery thresholds. The focus of this document is forecasting long term ecological recovery and so discussion around the interim process of achieving betterment is kept to a minimum.

of effects through a betterment strategy, with AMD management infrastructure contained within the opencast disturbance footprint; and

- A GoldSim model (MWM 2024a) simulating the effects of additional Crown AMD management infrastructure extending beyond the Millerton opencast mining disturbance footprint and including capture of historic underground workings to achieve long term ecological recovery in streams draining the Millerton Block.

This assessment uses the predicted water quality from BRL (2026) in forecasts out to year 2049. To incorporate the effects of additional Crown AMD management infrastructure (i.e., infrastructure not included in the BRL (2026) modelling) the GoldSim model has been adapted to provide simulations:

- From 2050 to 2059, for a GoldSim model simulation of 'Mine Creek Sump (MCS)' AMD management is used; and
- From 2060 onwards, for a GoldSim model simulation of 'All AMD treatment' is used.

It should be noted that these future dates for the 'Mine Creek Sump' and 'All AMD treatment' phases are nominal (and in reality, will depend upon Crown actions) but have been chosen to show the staged effects of key AMD management milestones, including:

- BPCP effects through the Operational and EOML phases including a transition to final landform AMD models in BRL (2026);
- Final rehabilitation of Millerton ELF in 2046 and transition to in-Sump alkaline dosing (at MW16 Sump) in 2047;
- Commissioning of the MCS Phase in 2050; and
- Commissioning of the All AMD treatment Phase in 2060.

The actual dates of these milestones (particularly MCS and All AMD treatment Phase commissioning) are likely to differ. The BPCP strategy for managing Millerton Block water and AMD (described in BRL 2026) does not preclude commissioning of Crown AMD management infrastructure at an earlier date.

The 80-year water quality forecasts for Millerton Block are based on Al concentration as the key indicator of gross AMD effects. Acidity concentrations have not been presented.

6.1 Millerton Block water and AMD management

The BPCP strategy for managing Millerton Block water and AMD is described in BRL (2026). Historic data and water quality forecasts out to 2049 from that assessment are reproduced in this memorandum. The BRL (2026) assessment forecasts long term annual median Al concentrations only (i.e., does not forecast annual 75th percentiles) for streams draining Millerton Block. The correlation between annual median and annual 75th percentile Al concentration in historic datasets has been used to derive the annual 75th percentile Al concentration values presented in this document (Figure 25). Forecast annual median Al concentration values have been scaled up by a factor of 1.3 to show forecast annual 75th percentile Al concentrations.

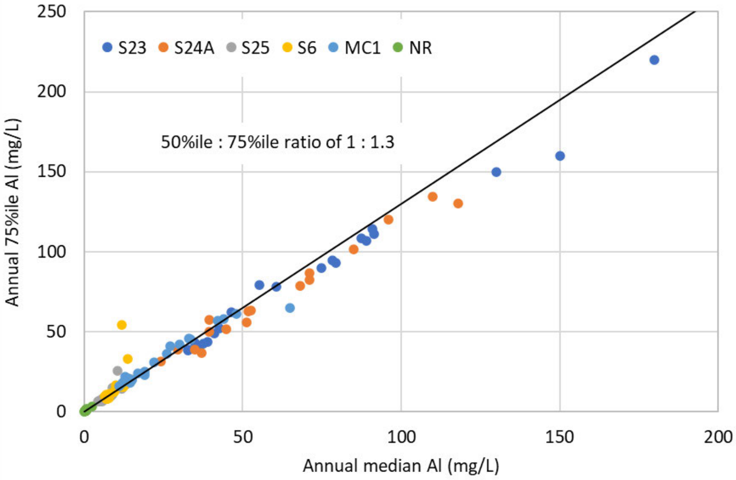


Figure 25. Correlation between annual median and 75th percentile Al concentration in Millerton Block Streams (all available data).

6.2 GoldSim Water and load balance model

6.2.1 Description of WLBM

MWM (2024a) developed a GoldSim based Water and Load Balance Model (WLBM) to support the ongoing and future management of AMD impacted waters within the Millerton Block. This model included additional Crown AMD management infrastructure. This model also included the effect of final landform rehabilitation and long-term acidity decay in simulations. As such, model outputs were only modified slightly (calculation of annual median and 75th percentile concentration values) for inclusion in this assessment.

A full description of the GoldSim modelling process is included in MWM (2024a). However, the model has been modified for use in this assessment.

The Crown (LINZ administered) concept for future AMD management on the Stockton Plateau includes the construction of significant water management infrastructure to capture and treat historic and future AMD generated in the Millerton Block in open pit and historic underground workings (but otherwise not being captured and treated by the proposed MW16 sump under the BPCP). This includes the following key scenarios:

- **Mine Creek Sump scenario:** Mine Creek Sump becomes operational and up to 90th percentile flows from Granity Stream (S25) and Miller Stream (S24A) (up to 100 L/s and 200 L/s, respectively) are captured and gravity feed to this sump. Up to 90th percentile flows from S6 (up to 400 L/s) are also directed to Mine Creek Sump. Operationally, treated water will be discharged back to the S6 catchment and remains diverted from S25 and S24A to S6 catchment. The GoldSim model does not simulate the effect of treated water discharge back to Millerton tributaries. Commissioning assumed to be 1 January 2050 for modelling purposes.
- **All AMD treatment scenario:** This scenario was not included as part of the original MWM (2024a) modelling. However, the model was adapted such that remaining uncaptured underground

workings (roughly identified by the red circle in Figure 26) within the S24A and S23 catchments (but below underground workings cut-off weirs) are captured and treated. The methodology for capture and treatment of these flows is still to be determined but possible options include treatment facilities at the Stockton mine main gate; secondary weirs and pump system constructed further down the catchments to divert residual AMD to Mine Creek Sump; sealing and flooding of the underground workings. Commissioning assumed to be 1 January 2060 for modelling purposes.

The effect of the 'All AMD treatment' scenario was modelled by reducing source term acidities to simulate a 90th percentile treatment of remaining underground workings to further reduce residual historic AMD discharges to streams draining the Millerton Block. The assessment does not simulate the effect of treated water discharge back to Millerton tributaries.

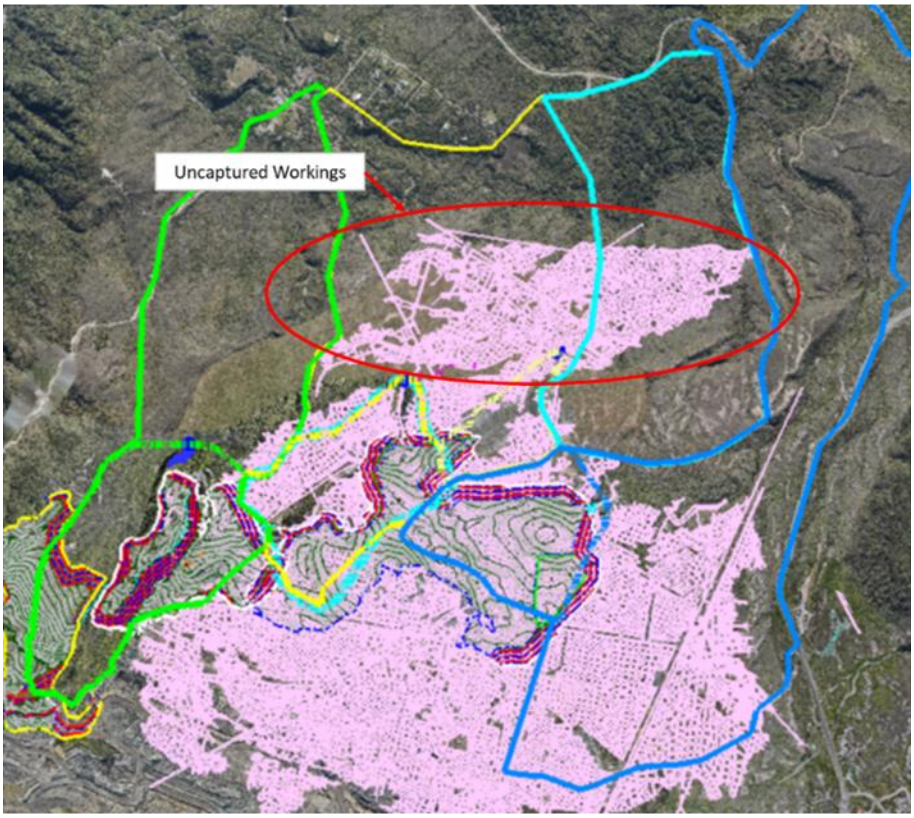


Figure 26. Remaining historic underground workings not captured under the Mine Creek Sump (MCS) scenario.

Other modifications to the GoldSim model include:

- AMD sources within the Millerton Block that were modelled were updated to include opencast final landforms (e.g., Millerton ELF, pit walls, etc.) and remnant underground workings consistent with the BRL (2026) final landforms and catchments.
- The Undisturbed Catchments source term was modified (from the original MWM (2024a)) for this 80-year water quality assessment to use data from monitoring site MT6. The MT6 dataset was not available when the GoldSim Model was originally developed.

- The 80-year forecast S14C and S16 water quality (derived in previous sections) is incorporated into model estimates for NRB.
- The MWM (2024a) model generates estimates for historic water quality back to 2008 which are compared to measured data to enable calibration. The BRL (2026) measured annual median acidity and Al concentration data (from the Stockton water quality monitoring database) are plotted in the 80-year forecast charts instead of these model estimates for the 2010 – 2025 period, where sufficient data is available.

6.3 Granity Catchment 80-year acidity and Al forecast

Key water quality monitoring sites in the Granity Stream Catchment include:

- Moderately impacted upper Granity Stream catchment – S25
- Heavily impacted Miller Stream catchment (above confluence with Granity Stream) – S24A
- Downstream Granity Stream at highway bridge, including effects at S25 and S24A – GB1

The long term forecast of Granity Stream Al concentration is based on:

- Modelled baseline water quality to 2025.
- Development of Millerton Block and incorporation of AMD management infrastructure as described in BRL (2026), including:
    - Development of Rockies, Hope Lyons, Granity, Miller, and Mine / MW16 Pits, and removal of underground workings;
    - Final landform design comprising rehabilitated highwall and coal floor, with minimal ELF seepage reporting to Granity Stream catchment;
- Pumping from pit sumps to Mangatini Treatment System as required to show water quality improvement through the Operational Phase and to achieve betterment reference values from EOML (2033);
    - Discharge from pit sumps to natural receiving water ways as water quality meets betterment reference values (all sumps naturally spilling from 2040); and
    - Continued discharge of AMD from remnant historic underground workings located outside of the Millerton Block opencast disturbance footprint, which is sufficient to prevent ecological recovery.
- Commissioning of Mine Creek Sump (nominally scheduled for January 2050) and capture / diversion of flows representative of the 90th percentile from the upper Granity and Miller Catchments to Mine Creek for treatment.
- Commissioning of All AMD treatment (nominally scheduled for January 2060), involving capture and treatment of all remaining underground workings AMD from Granity and Miller Streams. Treated water would be returned back to natural catchments (the effects of treated water discharge on downstream water quality has not been simulated in the GoldSim model).

- Modelled decrease in long term acidity concentration due to final landform rehabilitation and decay.

Forecast water quality plots in Granity Catchment are shown in Figure 27 and Figure 28. The forecast annual 75th percentile Granity Stream Al concentration:

- Falls below the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery at S25 after MCS commissioning (nominally scheduled for 2050);
- Falls below the 2.8 mg/L threshold for ecological recovery beginning S24A after All AMD treatment commissioning (nominally scheduled for 2060); and
- Does not fall below the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery at S24A under modelled scenarios.

The cause of S24A not meeting the 1 mg/L annual 75th percentile Al concentration threshold is expected to be that the assumed treatment efficiency of 90% is insufficient for full Al removal from S24A waters. This may be addressed by a higher degree of treatment. Further optimisation of Crown AMD management infrastructure and alignment with the Crown's progressive improvement of impacted streams with an objective to meet sustaining Mahinga kai values within 3 generations (~80 years) will be assessed as part of an independent LINZ led project.

The anomalously high S24A Al concentrations predicted through the MCS phase (2050 – 2059) from the GoldSim model is not expected and was not resolved, but may require further modification of source terms to reflect final landform surface types.

The forecast annual median Acidity and Al concentration for both sites is provided in Appendix II.

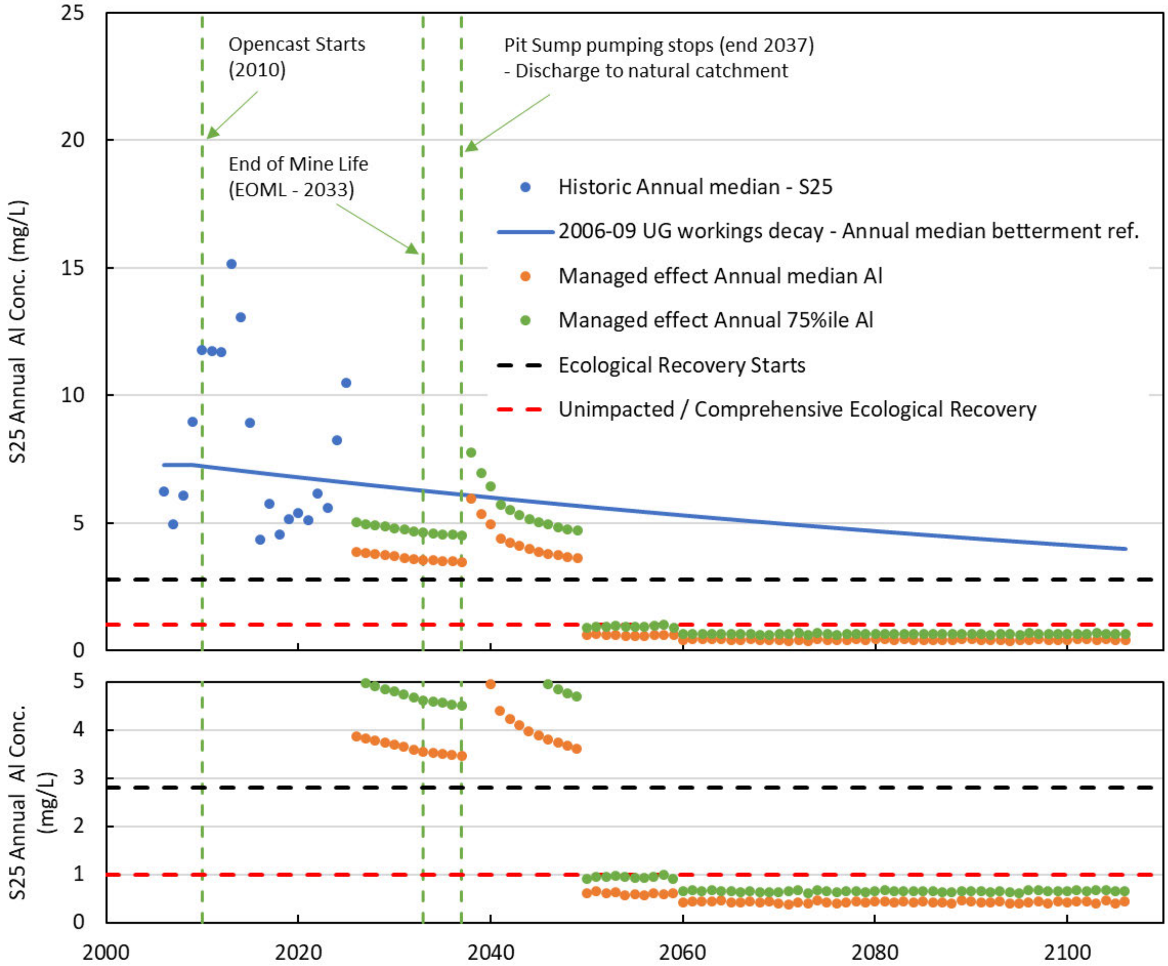


Figure 27. Forecast long term S25 Al concentration including annual median and 75th percentile values. NB: Forecast S25 Al concentration plotted in bottom figure with compressed y axis to show long term forecast concentrations relative to ecological recovery thresholds.

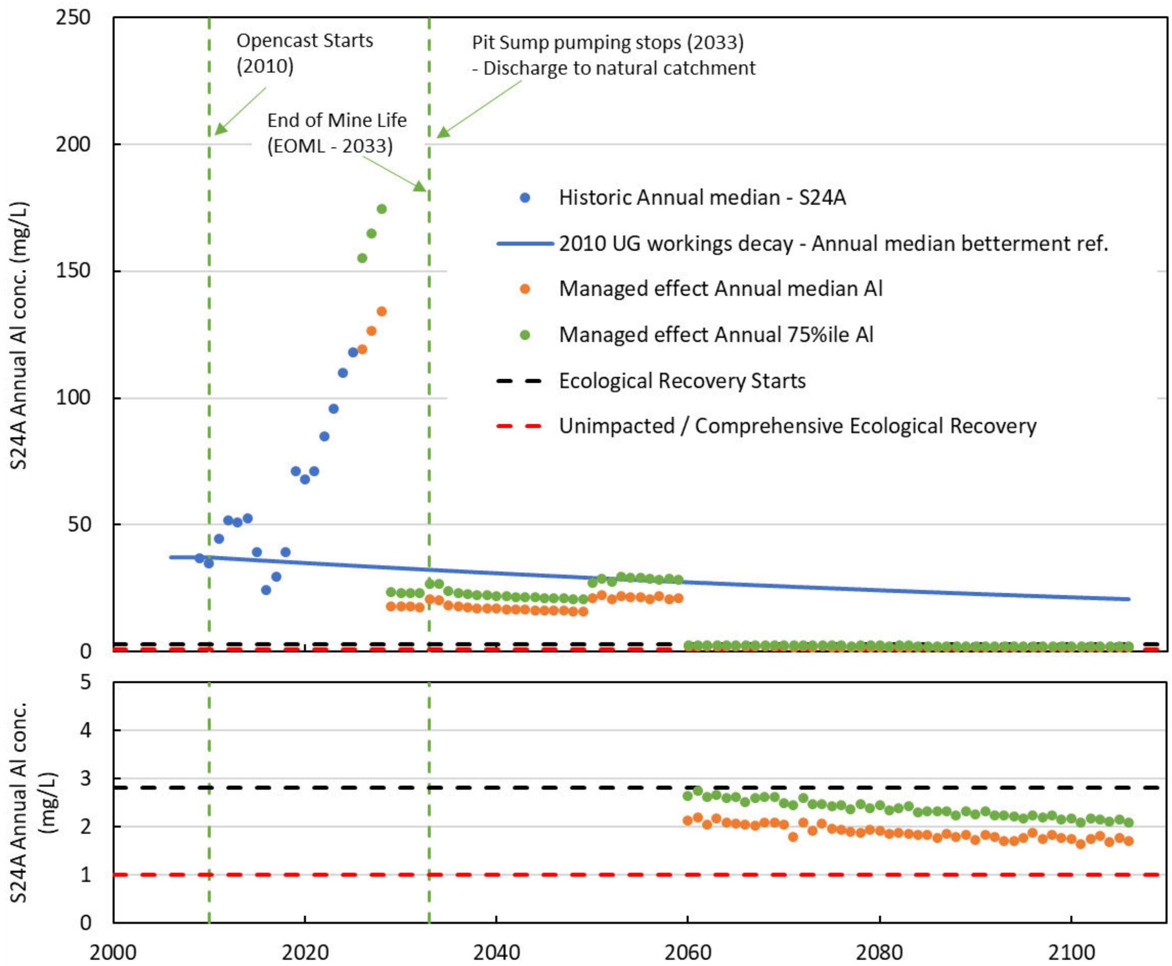


Figure 28. Forecast long term S24A Al concentration including annual median and 75th percentile values. NB: Forecast S24A Al concentration plotted in bottom figure with compressed y axis to show long term forecast concentrations relative to ecological recovery thresholds.

6.4 Mine Creek / Ngakawau Catchment 80-year acidity and Al forecast

Key water quality monitoring sites in the Mine Creek / Ngakawau Catchment include:

- Moderately impacted upper Mine Creek tributary catchment – S6
- Heavily impacted upper Mine Creek tributary catchment – S23
- Lower Mine Creek above confluence with Ngakawau River – MC1
- Ngakawau River at highway bridge, which includes the effect of Mine Creek, Mangatini Stream, and St Patrick Stream - NRB. BRL (2026) model the lower Ngakawau River as the modelled 'NRB River' site, which excludes the effect of tidal influence on water quality.

The long term forecast of Mine Creek / Ngakawau Catchment water quality is based on:

- Modelled baseline water quality to 2025.
- Development of Millerton Block and incorporation of AMD management infrastructure as described in BRL (2026), including:
    - Development of Mine / MW16 Pit and removal of historic underground workings;

- Final landform design comprising rehabilitated highwall and coal floor, Millerton ELF, and contouring such that the majority of AMD is diverted to MW16 Sump for management / treatment;
- Pumping from Pit Sumps / MW16 Sump to the Mangatini Treatment System through the Operational Phase to show water quality improvement;
- Pumping from MW16 Sump to the Mangatini Treatment System until 2046 as required to meet betterment reference values; and
- Transition to alkaline dosing (using Magnesium Oxide (**MgO**)) in MW16 Sump and discharge to Mine Creek (S6 tributary) from 2047 onwards such that MC1 water quality continues to meet betterment reference values.

- Continued discharge of AMD from remnant historic underground workings located outside of the Millerton Block opencast disturbance footprint, which is sufficient to prevent ecological recovery.
- Commissioning of Mine Creek Sump (nominally scheduled for 2050) which provides capture and treatment of AMD affected flows up to the 90th percentile within the upper S6 catchment. Treated water will be returned to Mine Creek (effects of treated water discharge not simulated in the GoldSim model).
- Commissioning of All AMD treatment (nominally scheduled for 2060), involving capture and treatment of all remaining underground workings AMD from Mine Creek. Treated water would be returned back to natural catchments (effects of treated water discharge not simulated in the GoldSim model).
- Modelled decrease in long term acidity concentration due to final landform rehabilitation and decay.

Forecast water quality plots in Mine Creek / Ngakawau Catchment are shown in Figure 29 and Figure 30. The forecast annual 75th percentile Mine Creek / Ngakawau River Al concentration:

- Reaches the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery at MC1 after commissioning of the ‘All AMD treatment’ infrastructure (nominally scheduled for 2060), though occasional exceedances are also forecast by the GoldSim model; and
- Falls below the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery at the hypothetical NRB River site in 2034, as Millerton Block mining transitions from an operational phase to final landform construction phase, and material disturbance decreases.

Water quality predictions for Mine Creek tributaries are included in Appendix III. These predictions show:

- S23 reaches the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery after commissioning of the ‘All AMD treatment’ infrastructure (nominally scheduled for 2060); and
- S6 falls below the 2.8 mg/L threshold for commencement of ecological recovery starting after commissioning of the ‘All AMD treatment’ infrastructure (nominally scheduled for 2060).

Full ecological recovery of Mine Creek (at site MC1) is not quite achieved in this simulation, but may be possible with a higher degree of treatment of historic underground workings AMD and MW16 Sump AMD in the S6 tributary. Further optimisation of Crown AMD management infrastructure and alignment with the Crown's progressive improvement of impacted streams with an objective to meet sustaining Mahinga kai values within 3 generations (~80 years) will be assessed as part of an independent LINZ led project.

The hypothetical NRB River annual 75th percentile Al concentration increases to a constant 0.8 mg/L from 2050 onwards. This is higher than the BRL (2026) prediction for 2049 (0.5 mg/L), but an increase in NRB Al concentration at this time is not expected. This anomaly was not investigated further given both models predict NRB River meets the comprehensive ecological recovery threshold.

The forecast annual median Acidity and Al concentration is provided in Appendix II.

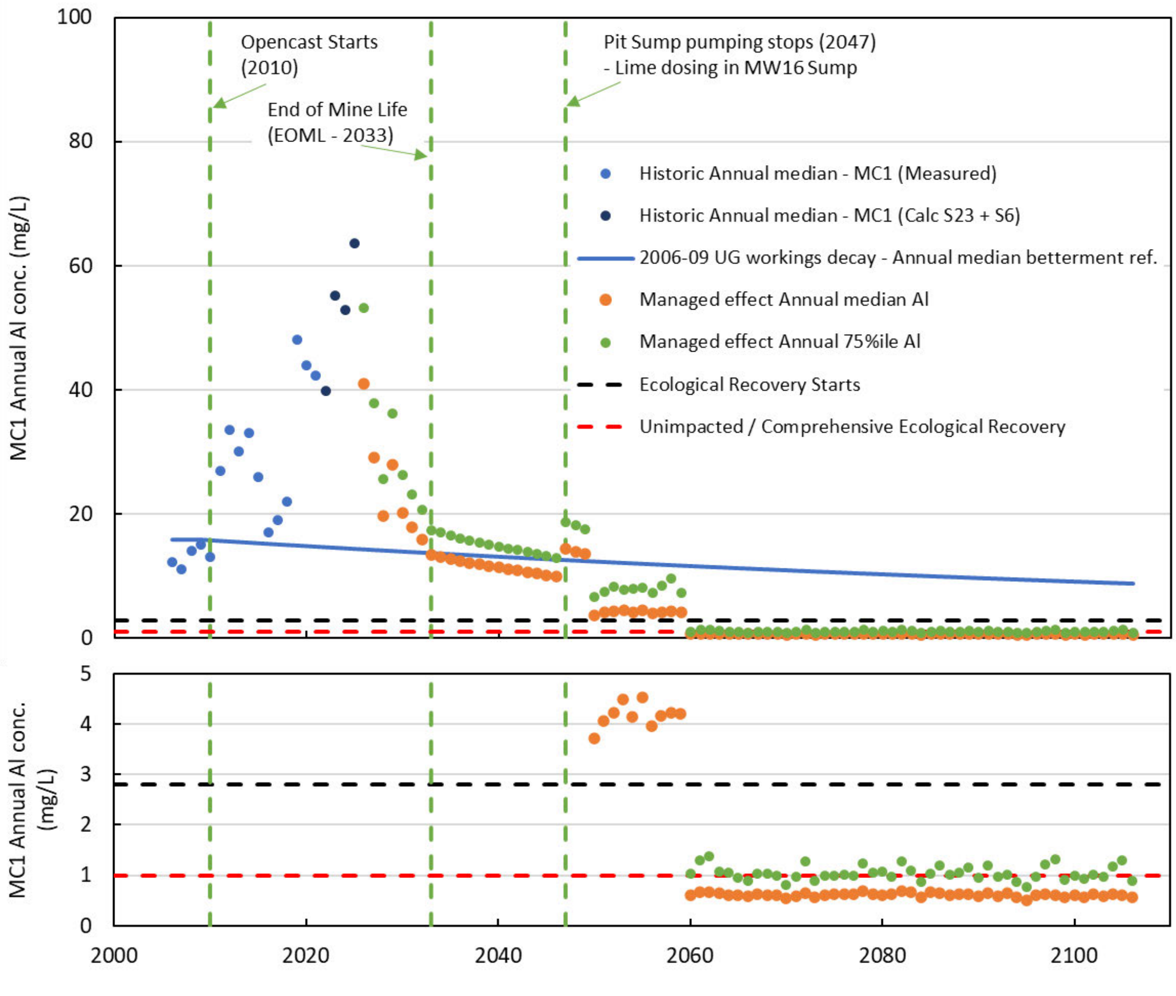


Figure 29. Forecast long term MC1 Al concentration including annual median and 75th percentile values. NB: Forecast MC1 Al concentration plotted in bottom figure with compressed y axis to show long term forecast concentrations relative to ecological recovery thresholds.

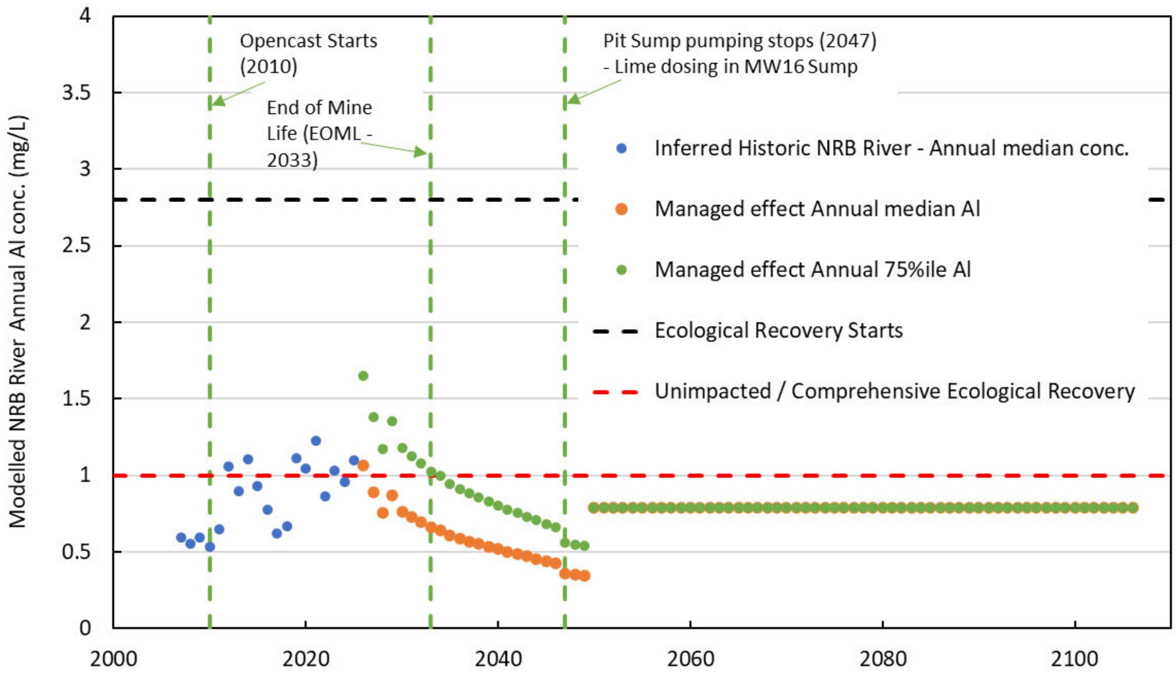


Figure 30. Forecast long term Hypothetical NRB River site Al concentration including annual median and 75th percentile values.

The MWM (2024a) GoldSim model uses background NR alkalinity to neutralise residual acidity reporting to Ngakawau River (according to a series of geochemical modelling assumptions). The residual NRB acidity concentration was found to be very sensitive to the background NR alkalinity value used, with the default alkalinity value of 5 mg $CaCO_3$/L resulting in negligible residual NRB acidity concentrations during Stage 1 (NB: Stage 1 GoldSim model outputs not discussed in this memorandum, but they were important for model calibration). The NR alkalinity source term was revised to use an alkalinity of 2 mg $CaCO_3$/L to prevent the model from predicting very low (essentially 0 mg/L) acidity concentration forecasts at NRB. Some low level of remnant acidity concentration is expected at NRB River as a function of solution buffering to pH 7.

7.0 Stockton Plateau Recovery Summary

7.1 Forecast 80-year ecological recovery status

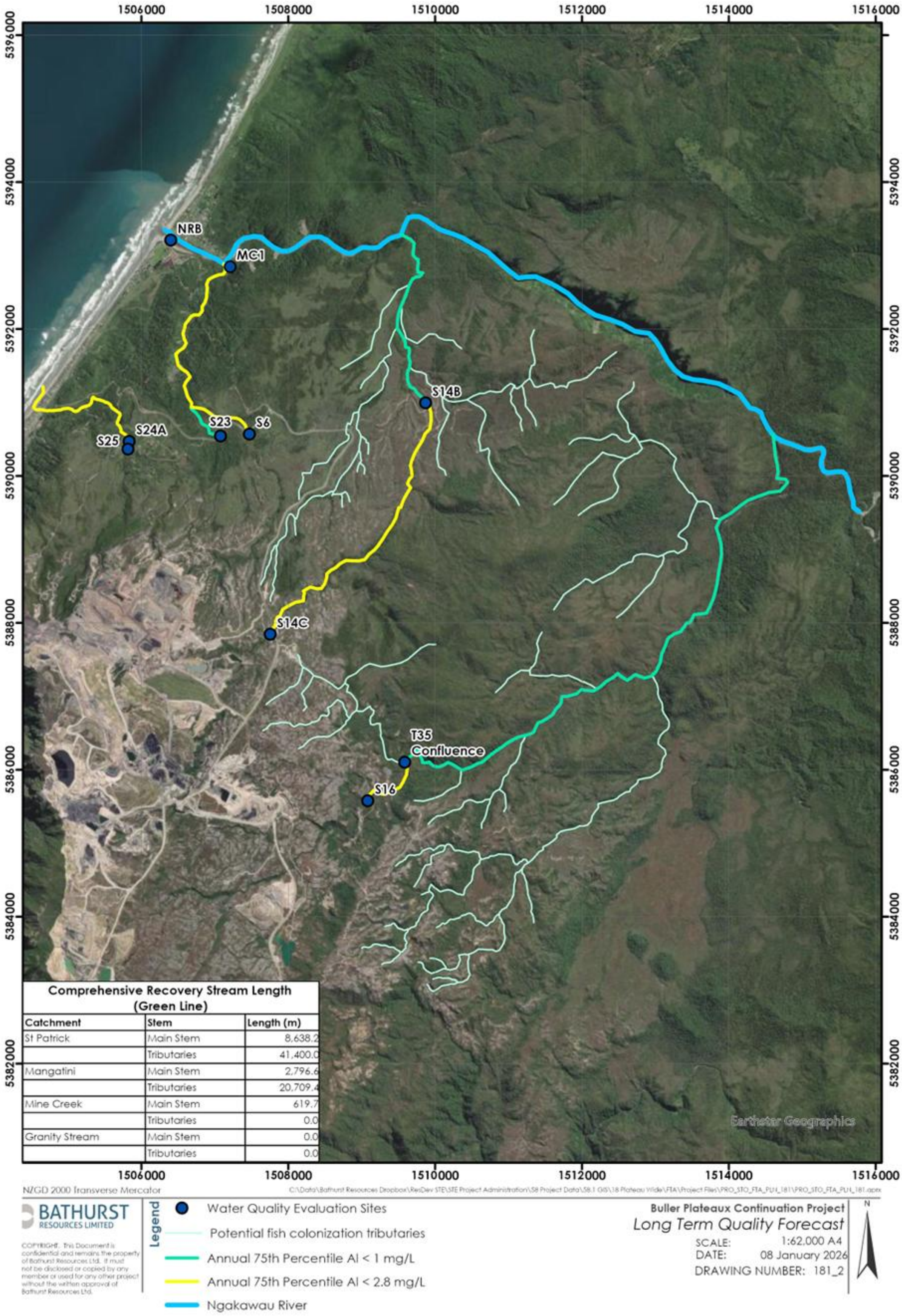
The recovery status of waterbodies draining the Stockton Plateau at year 2106 is summarised in Figure 31. The map identifies reaches of streams:

- With forecast annual 75th percentile Al concentrations below the 1.0 mg/L threshold for unimpacted / comprehensive ecological recovery (Green lines); and
- With forecast annual 75th percentile Al concentrations that fall below the 2.8 mg/L threshold for recovering ecology (Yellow lines).

Through this timeframe an estimated ~12 km of 'Main Stem' waterbodies are expected to achieve comprehensive ecological recovery, with recovery by catchment shown in Figure 31. This is expected to improve connectivity with an additional ~62 km of 'potential fish colonisation tributaries' (which were identified as non-AMD affected tributaries of the 'Main Stem' that meet the comprehensive ecological recovery threshold). Neither Mine Creek nor Granity Stream quite achieve comprehensive ecological recovery in the modelled simulations, except for the upper branch of Mine Creek between the S23 site and S6 branch confluence. However, a slightly higher degree of AMD treatment than modelled is expected to result in the comprehensive ecological recovery threshold being met and is subject to further optimisation as part of an independent LINZ led project.

A similar assessment in Instream (2026) shows all the Main Stem reaches in Figure 31 are currently (2025) in an impacted state, with the annual 75th percentile Al concentration exceeding 2.8 mg/L. This provides context to the expected positive outcomes of improved AMD management through:

- Removing ~50% of the historic underground workings area (relative to the 2010 extent) and ceasing operational fire suppression in Millerton Block by Millerton EOML (2033) (discussed in BRL 2026);
- Completing final landform rehabilitation across the Stockton mine;
- Constructing and commissioning water and AMD management infrastructure proposed in the BPCP through the Millerton Block over the remaining life of mine; and
- Continuing and expanding operational AMD capture and treatment across the Stockton Plateau.



Comprehensive Recovery Stream Length (Green Line)

Catchment	Stem	Length (m)
St Patrick	Main Stem	8,638.2
	Tributaries	41,400.0
Mangatini	Main Stem	2,796.6
	Tributaries	20,709.4
Mine Creek	Main Stem	619.7
	Tributaries	0.0
Granity Stream	Main Stem	0.0
	Tributaries	0.0

Figure 31. Stockton Plateau long term water quality forecast and stream recovery

7.2 Summary of six-yearly water quality recovery trajectory

A summary of forecasted St Patrick and Mangatini Al concentration values at six-yearly intervals (from consent commencement in 2027) are shown in Table 7. These values have been extracted from the AMD forecasting models for comparison against future performance monitoring data as part of the proposed six-yearly water quality thresholds review, described in Instream (2026). Figure 32 identifies the six-yearly values extracted into Table 7. This is intended as a guide to quantify modelled expectations following the commissioning of water quality improvement measures and measure performance against targets.

The forecasted Millerton Block Al concentration betterment reference values for comparison against actual performance monitoring data as part of the proposed six-yearly water quality thresholds review (described in Instream (2026)) are presented in the Millerton Water and AMD Management Report (BRL (2026)) and exclude the modelled effects of incorporating additional Crown AMD management infrastructure discussed in Section 6.0.

Table 7. Forecasted six-yearly Mangatini and St Patrick Al concentration recovery trajectory.

		Six-yearly interval Al recovery trajectory (mg/L)			
Project Year	Calendar year	S16 Annual Median	S16 Annual 75th %ile	S14B Annual Median	S14B Annual 75th %ile
Commencement	2027	3.0	3.6	3.5	5.4
6	2032	2.8	3.4	3.5	5.4
12	2038	1.9	2.4	2.9	4.5
18	2044	1.7	2.1	2.2	3.4
24	2050	1.5	1.9	1.2	1.8
30	2056	1.3	1.6	1.0	1.5
36	2062	1.3	1.6	0.9	1.4
42	2068	1.2	1.5	0.9	1.4
48	2074	1.2	1.5	0.8	1.3
54	2080	1.2	1.4	0.8	1.2
60	2086	1.1	1.4	0.8	1.2
66	2092	1.1	1.3	0.7	1.1
72	2098	1.0	1.3	0.7	1.1
78	2104	1.0	1.2	0.7	1.0

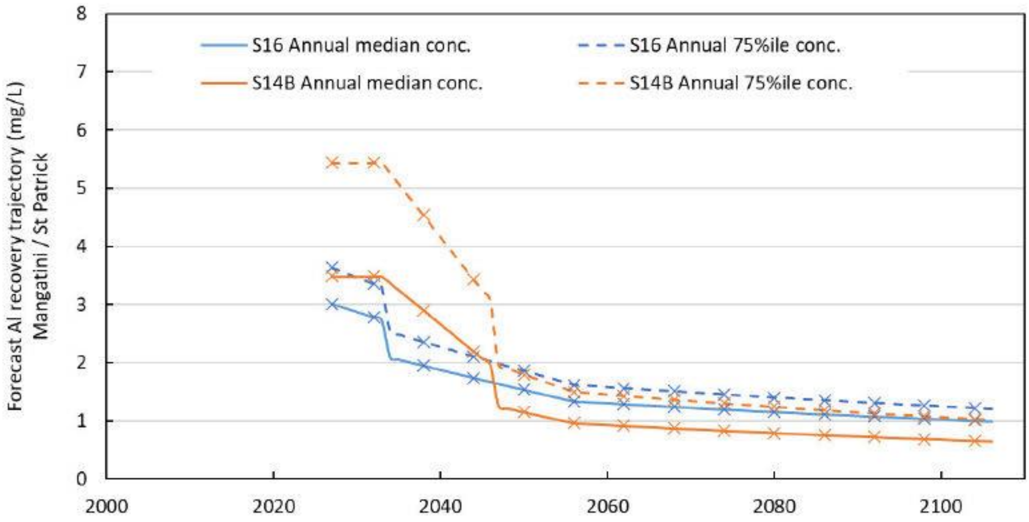


Figure 32. Modelled annual median and 75th percentile Al concentration recovery trajectory. The 'X' points identify the six-yearly values extracted in Table 7.

8.0 Acronyms

Acronym	Definition
Acidity	Acidity to pH 7
Al	Aluminium
AMD	Acid Mine Drainage
bcm	Bank cubic metres
BCM	Brunner Coal Measures
BPCP	Buller Plateau Continuation Project
BRL	Bathurst Resources Limited
CaO	Calcium Oxide – acidity neutralising agent
DOC	Dissolved Organic Carbon
EC	Electrical Conductivity
ELF	Engineered Landform
EOML	End of Mine Life
Fe	Iron
IANZ	International Accreditation New Zealand
LDP1	Lime Dosing Plant 1 – Mangatini Catchment
LDP2	Lime Dosing Plant 2 – St Patrick Catchment
LINZ	Land Information New Zealand
LOM	Life of Mine
MCS	Mine Creek Sump
MGD	Mangatini Sump Decants
MgO	Magnesium Oxide – acidity neutralising agent

NAF	Non-acid Forming
NELF	Northern Engineered Landform
PAF	Potentially Acid Forming
TMF	Trigger Modifying Factor
UG	Underground
UFL	Ultrafine Limestone – acidity neutralising agent
UWHR	Upper Waimangaroa Haul Road
VDT	Vegetation Direct Transfer
WE07	Webb South Engineered Landform

9.0 References

BRL 2026. Millerton Block Water and AMD Management Report. Stockton Mine. 2026.

Gandy and Younger 2007. Predictive Modelling of Waste Rock Leaching at Stockton Mine. Hydrogeochemical Engineering Research and Outreach Institute for Research on Environment and Sustainability Newcastle University, UK issued July 2007.

INAP 2009. The International Network for Acid Prevention (INAP), 2009. Global Acid Rock Drainage Guide (GARD Guide). http://www.gardguide.com/

Instream 2026. Stockton Plateau Aquatic Ecology: history, thresholds and long-term management. Instream Consulting Client Report for BRL. 2026.

MWM 2024a. Millerton WLBM Report. Model Build and Option 4 Scenario. GoldSim dashboard and Technical Report No J-NZ0354-002-R-Rev0 issued 25 June 2024.

MWM 2024b. St Patrick Catchment contaminant load model. 2023 Model update. Technical Report No J-NZ0341-001-R-Rev0 issued 7 August 2024.

Olds, W.E., Tsang, D.C.W., Weber, P.A., Weisener, C.G. 2013. Nickel and Zinc removal from acid mine drainage: roles of sludge surface area and neutralising agents. *Journal of Mining* (2013) Article ID 698031. https://doi.org/10.1155/2013/698031.

O'Kane Consultants 2015. Acid Mine Drainage Liabilities. Stockton and Cypress Operations. Report No. 949/01-01 issued July 2015.

Tregaskis Brown and Tonkin + Taylor 2024. Stockton Mine AMD Management Project. Prepared for Te Tai Ōhanga – The Treasury, Version 2.2, dated 6 Marcy 2024. https://treasury.govt.nz/publications/information-release/stockton-acid-mine-drainage

Appendix I: S16 and S14C comparison of discrete sample and annual median data

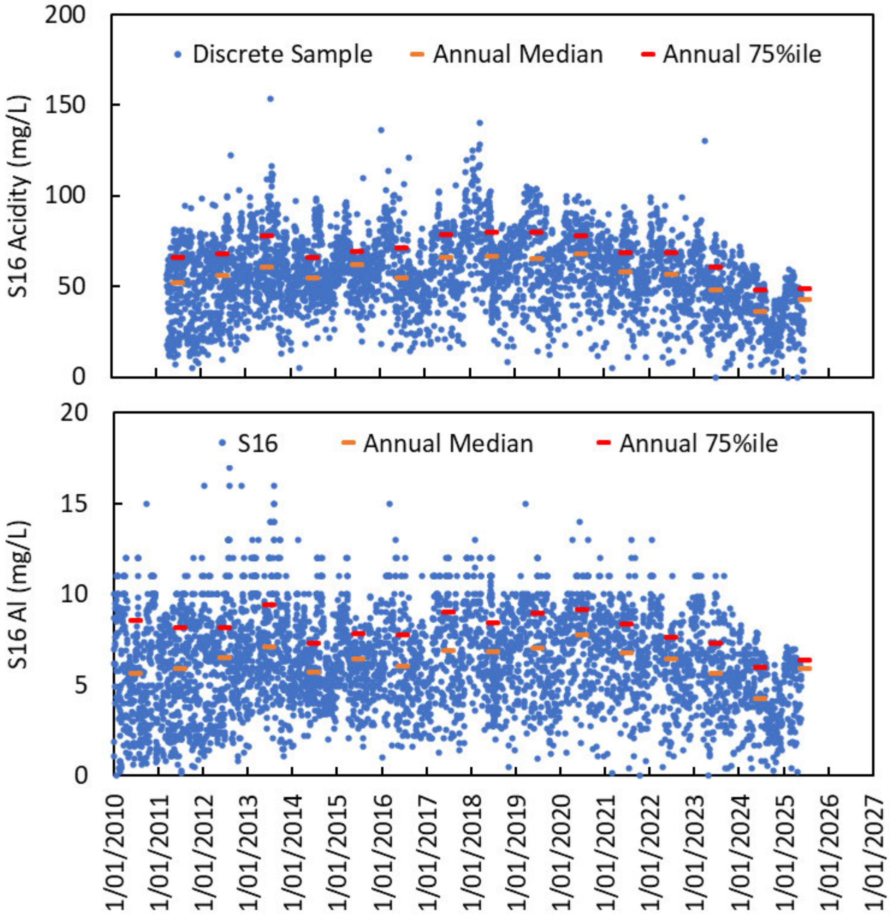


Figure 33. S16 comparison of discrete sample and annual median

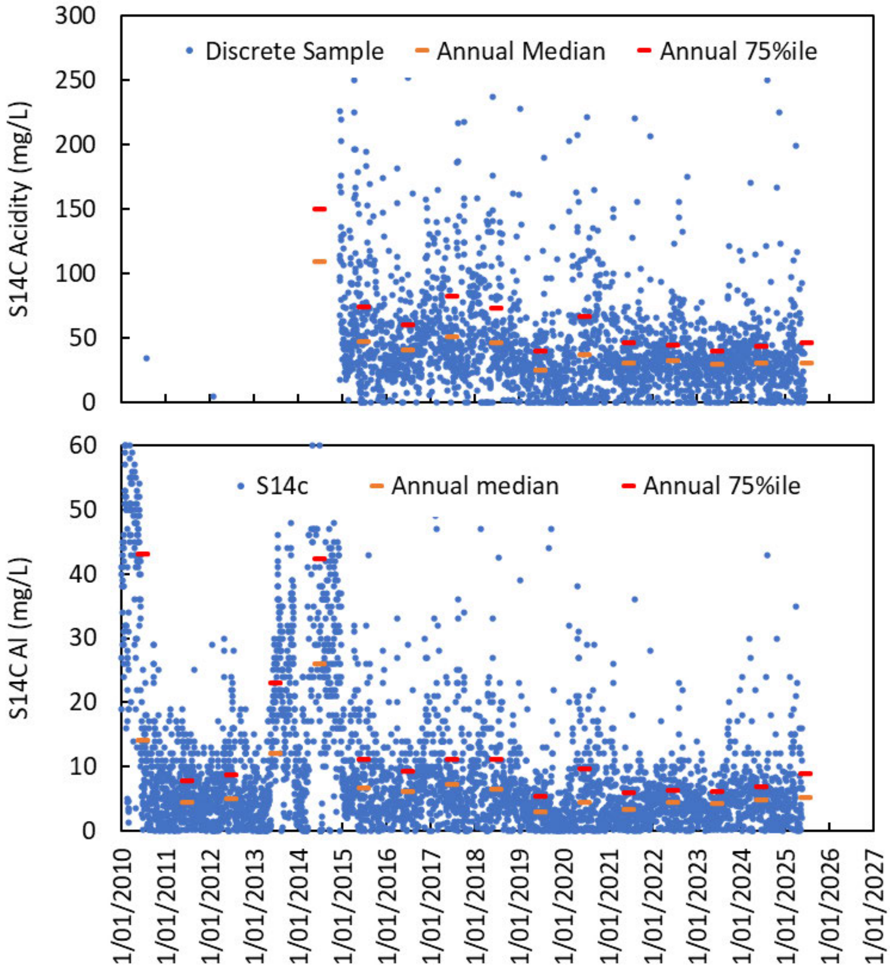


Figure 34. S14C comparison of discrete sample and annual median and 75th percentile

Appendix II: Summary of forecast Acidity and Al concentration at key dates

These lists summarise forecast Acidity and Al concentration (mg/L) at key dates for each site.

The forecast concentrations for S16, MGIU, S14C, and S14B vary linearly between dates.

The Millerton Block estimates are compiled from the two separate models, with BRL (2026) values used up to 2049 and GoldSim predictions used from 2050 onwards.

Site	Year	Acidity (med)	Al (med)	Al (75th %ile)	Description
S16	2023	47.7	5.6	7.3	Measured median (ref. year for LDP2 treatment effects)
	2025	28.7	3.1	3.8	Forecast S16 with treatment fully operational
	2033	25.5	2.7	3.3	Last year LDP2 treatment of Cypress
	2034	19.9	2.1	2.5	Cypress treatment ceases, Plover treatment starts
	2046	16.1	1.7	2.0	All rehab completed
	2056	12.9	1.3	1.6	'Rapid' rehab decay effect ends
	2106	9.5	0.99	1.2	80-yr forecast
MGIU	2023	295	36.0	-	Measured median (ref. year for MGIU 2025 forecast)
	2024	258	33.2	-	Forecast median
	2025	233	31.6	-	Forecast median
	2046	165	22.9	-	All rehab completed
	2056	133	19.1	-	'Rapid' rehab decay effect ends
	2106	97	14.6	-	80-yr forecast
S14C	2025	35	5.0	8.8	Measured median (year to date)
	2026-33	35	5.0	8.8	Forecast concentrations (Millerton EOML)
	2046	22.5	2.8	4.4	Last year of Millerton treatment at Mangatini
	2047	16.2	1.8	2.8	Millerton AMD treatment at MW16 Sump
	2056	13.3	1.4	2.1	'Rapid' rehab decay effect ends
	2106	9.8	0.9	1.5	80-yr forecast
S14B	2025	-	3.5	6.1	Measured median (year to date)
	2026-33	-	3.5	5.4	Forecast concentrations (Millerton EOML)
	2046	-	2.0	3.1	Last year of Millerton treatment at Mangatini
	2047	-	1.3	2.0	Millerton AMD treatment at MW16 Sump
	2056	-	1.0	1.5	'Rapid' rehab decay effect ends
	2106	-	0.7	1.0	80-yr forecast

Year	S25		S24A		GB1		S23		S6		MC1		NRB	
	Med	75%	Med	75%	Med	75%	Med	75%	Med	75%	Med	75%	Med	75%
2025	11	14	118	153			180	234	7.1	9.2	64	83	1.1	1.7
2026	4	5.0	119	155			101	131	4.7	6.2	41	53	1.1	1.7
2027	4	5.0	127	165			70	91	4.7	6.2	29	38	0.9	1.4
2028	4	4.9	134	175			46	60	4.7	6.2	20	26	0.8	1.2
2029	4	4.9	18	23			6	8.4	62	80	28	36	0.9	1.4
2030	4	4.8	18	23			6	8.4	43	56	20	26	0.8	1.2
2031	4	4.7	18	23			6	8.4	37	48	18	23	0.7	1.1
2032	4	4.7	18	23			6	8.4	32	42	16	21	0.7	1.1
2033	3.6	4.6	21	27			6.5	8.4	26	34	13	17	0.7	1.0
2034	3.5	4.6	20	27			6.4	8.4	26	33	13	17	0.6	1.0
2035	3.5	4.6	18	24			6.4	8.3	25	32	13	16	0.6	0.9
2036	3.5	4.5	18	23			6.4	8.3	24	31	12	16	0.6	0.9
2037	3.5	4.5	17	23			6.3	8.2	23	31	12	16	0.6	0.9
2038	6.0	7.8	17	22			6.3	8.2	23	30	12	15	0.6	0.9
2039	5.4	7.0	17	22			6.2	8.1	22	29	12	15	0.5	0.8
2040	4.9	6.4	17	22			6.2	8.1	22	28	11	15	0.5	0.8
2041	4.4	5.7	17	22			6.2	8.0	21	28	11	14	0.5	0.8
2042	4.2	5.5	17	22			6.1	8.0	21	27	11	14	0.5	0.8
2043	4.1	5.3	17	22			6.1	7.9	20	26	11	14	0.5	0.7
2044	4.0	5.2	16	21			6.1	7.9	19	25	10	13	0.5	0.7
2045	3.9	5.0	16	21			6.0	7.8	19	25	10	13	0.4	0.7
2046	3.8	4.9	16	21			6.0	7.8	18	24	10	13	0.4	0.7
2047	3.7	4.8	16	21			5.9	7.7	27	36	14	19	0.4	0.6
2048	3.7	4.8	16	21			5.9	7.7	26	34	14	18	0.4	0.5
2049	3.6	4.7	16	21			5.9	7.6	25	33	14	18	0.3	0.5
2050	0.6	0.9	21	27	7.8	13	8.8	13.6	2.5	6.5	3.7	6.5	0.8	0.8
2051	0.7	1.0	22	29	8.8	15	9.7	15.3	1.5	4.9	4.1	7.5	0.8	0.8
2052	0.6	0.9	21	28	7.7	14	8.6	14.1	3.6	7.9	4.2	8.2	0.8	0.8
2053	0.6	1.0	22	30	8.8	17	9.0	15.8	2.9	7.1	4.5	7.8	0.8	0.8
2054	0.6	0.9	21	29	8.3	16	9.0	15.8	2.3	5.9	4.1	7.9	0.8	0.8
2055	0.6	0.9	22	29	9.1	16	9.5	15.7	1.5	6.5	4.5	8.1	0.8	0.8
2056	0.6	0.9	21	29	8.1	16	9.0	14.9	1.8	5.6	4.0	7.2	0.8	0.8
2057	0.6	1.0	22	28	8.6	16	8.8	15.1	3.0	7.0	4.2	8.4	0.8	0.8
2058	0.6	1.0	21	29	8.5	16	8.6	14.7	3.3	9.1	4.2	9.6	0.8	0.8
2059	0.6	0.9	21	29	8.7	16	9.0	15.6	1.6	4.7	4.2	7.3	0.8	0.8
2060	0.4	0.6	2.1	2.6	1.1	1.8	0.6	0.7	0.6	1.2	0.6	1.0	0.8	0.8
2061	0.4	0.7	2.2	2.7	1.2	1.9	0.6	0.7	0.7	1.9	0.7	1.3	0.8	0.8
2062	0.4	0.6	2.0	2.6	1.1	1.8	0.6	0.7	0.6	2.3	0.7	1.4	0.8	0.8
2063	0.4	0.7	2.2	2.7	1.2	1.9	0.6	0.7	0.6	1.6	0.6	1.1	0.8	0.8
2064	0.5	0.6	2.1	2.6	1.1	1.8	0.6	0.7	0.6	1.2	0.6	1.1	0.8	0.8
2065	0.4	0.7	2.1	2.6	1.1	1.8	0.6	0.7	0.5	1.1	0.6	0.9	0.8	0.8

Year	S25		S24A		GB1		S23		S6		MC1		NRB	
	Med	75%	Med	75%	Med	75%	Med	75%	Med	75%	Med	75%	Med	75%
2066	0.4	0.6	2.0	2.5	1.1	1.7	0.6	0.7	0.6	0.9	0.6	0.9	0.8	0.8
2067	0.4	0.6	2.0	2.6	1.1	1.9	0.6	0.7	0.6	1.2	0.6	1.0	0.8	0.8
2068	0.4	0.6	2.1	2.6	1.2	1.8	0.6	0.7	0.6	1.3	0.6	1.0	0.8	0.8
2069	0.4	0.6	2.1	2.6	1.2	1.8	0.6	0.7	0.5	1.2	0.6	1.0	0.8	0.8
2070	0.4	0.6	2.0	2.5	1.1	1.7	0.6	0.7	0.5	0.8	0.5	0.8	0.8	0.8
2071	0.4	0.7	1.8	2.5	0.9	1.7	0.5	0.7	0.6	1.0	0.6	1.0	0.8	0.8
2072	0.4	0.7	2.1	2.6	1.2	1.9	0.6	0.7	0.6	1.7	0.6	1.3	0.8	0.8
2073	0.4	0.6	1.9	2.5	1.1	1.7	0.6	0.7	0.5	1.0	0.6	0.9	0.8	0.8
2074	0.5	0.7	2.1	2.5	1.2	1.8	0.6	0.7	0.6	0.9	0.6	1.0	0.8	0.8
2075	0.4	0.7	1.9	2.4	1.1	1.7	0.6	0.7	0.6	1.4	0.6	1.0	0.8	0.8
2076	0.4	0.6	1.9	2.4	1.0	1.7	0.6	0.7	0.6	1.4	0.6	1.0	0.8	0.8
2077	0.4	0.7	1.9	2.4	1.0	1.6	0.5	0.7	0.6	1.5	0.6	1.0	0.8	0.8
2078	0.4	0.7	1.9	2.5	1.0	1.7	0.6	0.7	0.6	2.0	0.7	1.2	0.8	0.8
2079	0.4	0.6	1.9	2.4	1.1	1.7	0.6	0.7	0.6	1.5	0.6	1.1	0.8	0.8
2080	0.4	0.7	1.9	2.4	1.1	1.8	0.6	0.7	0.6	1.3	0.6	1.1	0.8	0.8
2081	0.4	0.7	1.8	2.3	1.0	1.7	0.6	0.7	0.6	1.2	0.6	1.0	0.8	0.8
2082	0.4	0.7	1.9	2.4	1.0	1.8	0.5	0.7	0.7	2.1	0.7	1.3	0.8	0.8
2083	0.4	0.7	1.9	2.4	1.0	1.8	0.6	0.7	0.6	1.6	0.7	1.1	0.8	0.8
2084	0.4	0.6	1.8	2.3	1.0	1.6	0.5	0.6	0.5	0.8	0.6	0.9	0.8	0.8
2085	0.4	0.7	1.8	2.3	1.1	1.7	0.6	0.7	0.7	1.7	0.7	1.0	0.8	0.8
2086	0.4	0.6	1.8	2.3	0.9	1.7	0.5	0.6	0.6	2.0	0.6	1.2	0.8	0.8
2087	0.4	0.6	1.9	2.3	1.0	1.6	0.6	0.6	0.6	1.7	0.6	1.0	0.8	0.8
2088	0.4	0.6	1.8	2.2	1.0	1.5	0.5	0.6	0.6	1.3	0.6	1.0	0.8	0.8
2089	0.5	0.7	1.8	2.3	1.1	1.7	0.6	0.6	0.6	1.8	0.6	1.1	0.8	0.8
2090	0.4	0.6	1.7	2.3	1.0	1.6	0.5	0.6	0.6	1.0	0.6	0.9	0.8	0.8
2091	0.4	0.6	1.8	2.3	1.0	1.7	0.5	0.6	0.6	1.9	0.6	1.2	0.8	0.8
2092	0.4	0.6	1.8	2.2	1.0	1.6	0.6	0.6	0.6	1.2	0.6	1.0	0.8	0.8
2093	0.4	0.7	1.7	2.2	0.9	1.6	0.5	0.6	0.6	1.6	0.6	1.0	0.8	0.8
2094	0.4	0.6	1.7	2.2	1.0	1.5	0.5	0.6	0.5	0.9	0.6	0.9	0.8	0.8
2095	0.4	0.6	1.8	2.2	1.0	1.5	0.5	0.6	0.5	0.8	0.5	0.8	0.8	0.8
2096	0.4	0.7	1.9	2.2	1.1	1.6	0.5	0.6	0.6	1.3	0.6	1.0	0.8	0.8
2097	0.4	0.7	1.7	2.2	1.0	1.6	0.5	0.6	0.6	1.8	0.6	1.2	0.8	0.8
2098	0.4	0.6	1.8	2.2	1.1	1.6	0.5	0.6	0.6	2.2	0.6	1.3	0.8	0.8
2099	0.4	0.7	1.8	2.2	1.0	1.6	0.5	0.6	0.5	0.9	0.6	0.9	0.8	0.8
2100	0.4	0.6	1.7	2.2	1.0	1.6	0.5	0.6	0.6	1.4	0.6	1.0	0.8	0.8
2101	0.4	0.7	1.6	2.1	0.9	1.5	0.5	0.6	0.6	1.0	0.6	0.9	0.8	0.8
2102	0.4	0.7	1.7	2.2	1.0	1.6	0.5	0.6	0.6	1.6	0.6	1.0	0.8	0.8
2103	0.4	0.7	1.8	2.2	1.1	1.6	0.5	0.6	0.6	1.3	0.6	1.0	0.8	0.8
2104	0.5	0.7	1.7	2.1	1.0	1.6	0.5	0.6	0.6	1.8	0.6	1.2	0.8	0.8
2105	0.4	0.6	1.8	2.2	1.1	1.6	0.5	0.6	0.6	2.1	0.6	1.3	0.8	0.8
2106	0.4	0.7	1.7	2.1	1.0	1.5	0.5	0.6	0.5	0.9	0.6	0.9	0.8	0.8

Appendix III: S23 and S6 water quality forecast

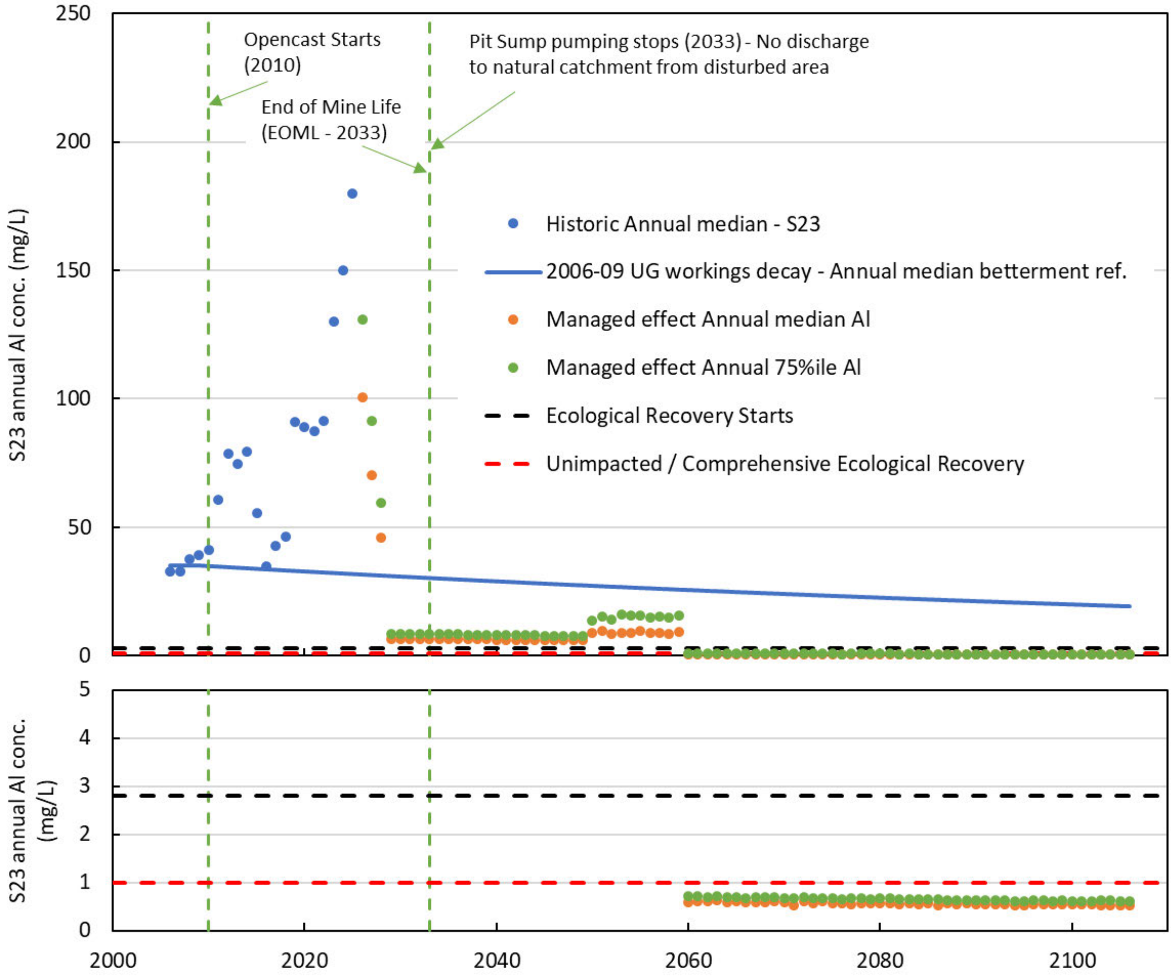


Figure 35. Forecast long term S23 Al concentration including annual median and 75th percentile values. NB: Forecast S23 Al concentration plotted in bottom figure with compressed y axis to show long term forecast concentrations relative to ecological recovery thresholds.

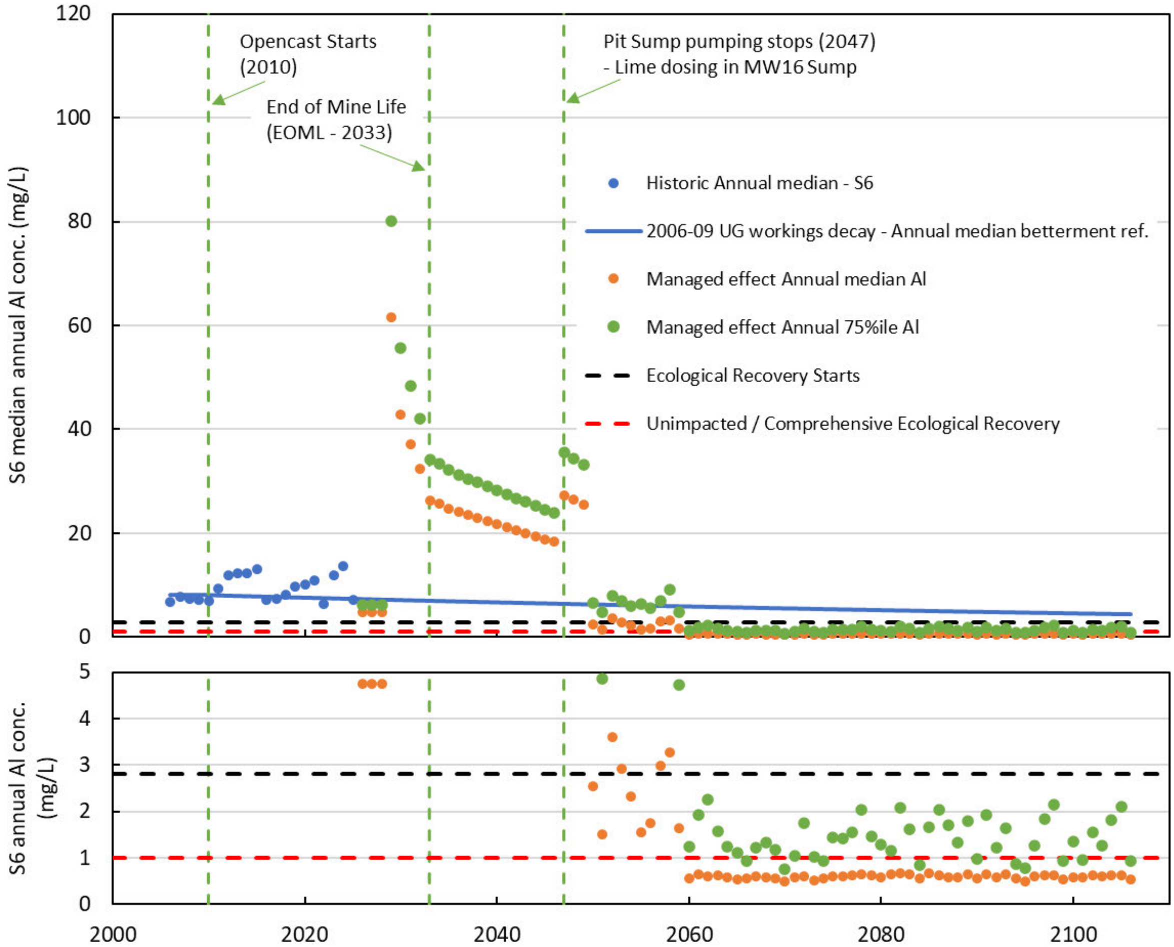


Figure 36. Forecast long term S6 Al concentration including annual median and 75th percentile values. NB: Forecast S6 Al concentration plotted in bottom figure with compressed y axis to show long term forecast concentrations relative to ecological recovery thresholds.