29 Metals

Capricorn Copper Pty Ltd

Capricorn Copper Mine

Supporting Information Report

EA Amendment Application for Water Releases

(Conditions C2 & C3)

July 2024

Version Number	Date Issued	Author	Reviewer
Draft V1.0	17 October 2023	K. Grundy Dr G. McGuire	Dr B. Shean E. Cooney
Draft V1.1	13 January 2024	K. Grundy Dr G. McGuire	Dr B. Shean Dr G. McGuire
Draft V2.0	18 June 2024	K. Grundy Dr G. McGuire	Dr B. Shean E. Cooney
Final V3.0	19 July 2024	K. Grundy Dr G. McGuire Dr B. Shean	E. Cooney M. Warnock M. Longbottom A. Butler

Table of Contents

List of Tables

List of Figures

Appendices

Found as a separate documents:

Appendix A - Hydrobiology (2024) Receiving Environment Risk Assessment

Appendix B - Hydrobiology (2023) Annual REMP Report

Appendix C – Engeny (2023) Release Assessment

1. Executive Summary

Capricorn Copper Pty Ltd (CCPL) operates the Capricorn Copper Mine (CCM) located at Gunpowder in North Queensland, which is regulated by Environmental Authority (EA) EPML00911413 (dated 6 December 2023).

The treatment and release of Mine Affected Water (MAW) is an important mechanism for ensuring MAW does not accumulate onsite during extreme wet season events such as the event in March 2023, increasing the risk of uncontrolled release and potential environmental harm to the receiving environment. This method of managing water inventory is used by several other mining sites in the region and can have minimal impacts on the environment when completed in accordance with carefully selected parameters that ensure environmental protections.

EPML00911413 allows for a maximum volume of treated MAW to be released over a 72-hour period (70,000 cubic metres, Condition C2-4) and 12-month period (500,000 cubic metres, Condition C2-5). A recent release assessment prepared by Engeny (2023) identifies the annual and 72-hour caps on release volumes as the largest limitation to estimated release potential of treated MAW. Therefore, removal of these caps will increase the estimated annual release opportunity and assist returning the site to compliance associated with surface water inventories. More stringent contaminant release limits and higher base flows in Gunpowder Creek can be incorporated to minimise the risks from higher release volumes.

CCPL has prepared this amendment application to remove maximum volume limits, and in doing so, release a higher volume of water over a single wet season. Currently, the greatest risk to the environment on site is the potential overtopping of MAW storages in the 2024/25 wet season. Uncontrolled discharge of MAW to Gunpowder Creek could be catastrophic to the Gunpowder Creek ecosystem and further downstream, and poses risk to humans and stock that have access to the discharged water.

In addition to this, CCPL is proposing an amendment to release limits and modernising of receiving environment assessment conditions. Through the process of preparing this application and undertaking the required specialist studies, CCPL has considered the relationship between the background flows and quality of Gunpowder Creek, the quality and volume of treated MAW proposed for release, and the predicted concentration of contaminants in the receiving water. This method of assessment was not applied to the current or earlier versions of the EA, and it provides a greater level of certainty and scientific robustness to this application. Additionally, CCPL commissioned studies into the toxicity of primary toxicants of concern, copper and cobalt, and the bioavailability of these toxicants to aquatic macroinvertebrates within the Gunpowder Creek receiving environment.

The application presents an improvement to the EA in regard to environmental protection. CCPL now has a greater understanding of the receiving environment responses to different creek flows and water quality, and higher confidence that releases undertaken in accordance with the amended conditions presented in this application will not result in harm to the environmental values of Gunpowder Creek and the surrounding environment. Technical studies demonstrate that **releases undertaken in accordance with proposed amended conditions pose a lower risk of environmental harm that those undertaken in accordance with the current EA**.

Supporting reports provided with this amendment application include:

- Hydrobiology (2024) Receiving Environment Risk Assessment (including 2024 Copper and Cobalt Assessment)
- Hydrobiology (2023) Annual REMP Report
- Engeny (2023) Release Assessment.

2. Introduction

Capricorn Copper Pty Ltd (CCPL) operates the Capricorn Copper Mine (CCM) located at Gunpowder in North Queensland, which is regulated by Environmental Authority (EA) EPML00911413.

2.1 Background

2.1.1. 2023 and 2024 weather events

During March 2023, a weather system in north western and central Queensland resulted in heavy rainfall in and around the tenements of CCM, located approximately 120 km north west of Mount Isa. The extreme weather event resulted in significant inflows to the mine affected water (MAW) system and inundation of the Esperanza Underground Mine and Workshop/Warehouse areas. The 3-day total of 431.4 mm is the largest ever recorded in 133 years of rainfall records, well above the 99th percentile, and has been determined as 1 in 200 Annual Exceedance Probability (AEP). The 7-day total of 560.8 mm is also the largest on record and determined as a 1 in 200 to 1 in 500 AEP.

As a result of this weather event, MAW storage in both Mill Creek Dam (MCD) and Esperanza Pit (EPit) exceeded the maximum operating level (MOL) with an estimated additional circa 500 ML in the underground workings requiring dewatering to EPit before mining could recommence in Esperanza South.

Following on from the extreme weather event in March 2023, the Capricorn Copper site received higher than average rainfall in January, February and March 2024 as a result of the impact of successive Tropical Cyclones – Kirrily, Lincoln and Megan.

Tropical Cyclone Kirrily was a long-lived and strong tropical cyclone that affected East Australia and the Northern Territory during January and February 2024. TC Kirrily, developed from a tropical low that formed in the Coral Sea, and made landfall northwest of Townsville on 25 January 2024 as a Category 3 severe tropical cyclone. After landfall, TC Kirrily moved westwards as a tropical low resulting in heavy rainfall around the Mount Isa region including Gunpowder.

Tropical Cyclone Lincoln initially formed as a tropical low on 6 February 2024 over northern Australia between the Joseph Bonaparte Gulf and the Gulf of Carpentaria. TC Lincoln made landfall on the Gulf of Carpentaria coast between Port McArthur and the Northern Territory—Queensland border just after 06:00 UTC on 16 February 2024 as a Category 1 tropical cyclone. As the system degenerated into a tropical low it resulted in heavy rainfall around Gunpowder before turning westward and reforming off Western Australia.

Tropical Cyclone Megan initially formed as a tropical low in the Gulf of Carpentaria. TC Megan formed in the early evening of 16 March 2024. and made landfall on the south-western Gulf of Carpentaria as a Category 3 system during Monday 18 March 2024. The TC resulted in strong winds of up to 200 kilometres per hour, heavy rainfall and extensive flooding in communities across the Northern Territory. Rainfall and storm systems associated with TC Megan extended into NW Qld. Background flows in Gunpowder Creek as a result of rainfall associated with TC Megan reached up to 450 cumecs (local).

2.1.2. CCM's response to event and status on site

CCPL have introduced a number of improvements to the site water management system following the 2023 extreme wet season event including recycling of MAW for mining purposes, and installation of additional evaporators on the EPit. Despite the improvements, CCPL were unable to release enough treated water during the 2023/24 wet season to significantly reduce the volume of water stored on site due to significant weather events impacting the area (described above) and further adding to the inventory.

Continued improvement to CCPL's water management strategy includes commissioning of infrastructure for a bulk treatment and release system in the MCD (MAW neutralisation using lime dosing) and the conversion of the process plant to also treat MAW whilst operations are suspended. In parallel, CCPL has engaged Ausenco to undertake detailed design of a new and significantly larger water treatment plant. Due to the combined risk of excessive water inventory on site and the lack of tailings storage capacity on site, operations were suspended in April 2024. CCPL's intention is to focus on inventory reduction during the upcoming wet season (through evaporation and wet season releases) while additional tailings storage capacity options are investigated, approved and constructed.

2.1.3. Risk to environment

The treatment and release of MAW is an important mechanism for ensuring MAW does not accumulate onsite during extreme wet season events, increasing the risk of uncontrolled release and potential environmental harm to the receiving environment over consecutive wet seasons.

For this reason it is critical that an EA amendment is approved by 1st November 2024 to enable increased release volumes (and hence a controlled reduction of inventory).

2.2 Overview of EA Amendment Application

2.2.1. Challenges with current EA

There are a number of challenges with the existing EA that have been addressed in this amendment, including but not limited to the following:

- A 72-hour period (70,000 cubic metres) and 12-month period (500,000 cubic metres) maximum release limit. This limits CCM's ability to discharge MAW accumulated over a short period, for example, from an extreme weather event.
- The current aquatic ecosystem WQOs are often exceeded in Gunpowder Creek adjacent to the mine. The area has been impacted by historic mining disturbance and legacy infrastructure.
- High total metal release limits have been of concern to DESI for some time, and currently cannot be related to aquatic ecosystem WQOs that are applied to the dissolved metal fraction.
- Impractical timeframes for sample collection, lab analysis and reporting.

2.2.2. Overview of proposed changes to EA

The primary objective of this proposed EA Amendment is to **remove maximum release volume limits** set in conditions C2-4 and C2-5 of the current EA.

CCPL have also taken the opportunity to:

- assess and reduce contaminant release limits provided in Schedule C - Table 2,
- allow for flexibility in the release strategy with inclusion of multiple release water qualities and associated dilution ratios and maximum release rates,
- increase the minimum background flow rate,
- amend receiving water monitoring locations provided in Schedule C - Table 3 (including inclusion of a highly disturbed zone),
- include real-time monitoring of release and receiving waters, and
- modernise the receiving water protection values provided in Schedule C - Table 4.

Additional amendments that feed into those conditions are also included. Specific amendment requests are presented in Section 4.2 of this report. Details of the assessment methods and results are documented in the technical reports provided with this amendment application.

2.2.3. Overview of methods and contents of this submission

The process for developing proposed amendments to the EA, that ensured no harm to the environment, was as follows:

- Modelling of wet season releases to understand limitations to controlled release of MAW from site.
- Risk assessment to determine applicable Environmental Values (EVs) and assess potential impacts from the proposed amendment.
- Toxicity assessment to determine appropriate WQOs to ensure EV protection.
- External review of toxicity and risk assessment reports.
- Multiple pre-lodgement meetings with DESI and the OCG and revision of application material in response to pre-lodgement meeting outcomes.

3. Regulatory Requirements for the EA Amendment Application

The information presented in this supporting document has been prepared in accordance with the requirements in the Queensland *Environmental Protection Act* 1994 (EP Act) and its subordinate *Environmental Protection Regulation* 2019 (EP Reg).

Sections 226 and 226A of the EP Act (current as at 26 June 2024) specify the requirements for an EA amendment application. **Table 1** shows how the EA amendment application and the supporting information meet the requirements of Sections 226 and 226A of the EP Act.

Section 228 of the EP Act requires that *the administering authority must, after receiving an amendment application, decide whether the proposed amendment is a major or minor amendment*. The assessment criteria to determine if an application is a minor amendment (threshold) are outlined in Section 223 of the EP Act.

Table 2 provides an explanation for each of the criteria relevant to this amendment application. CCPL and its technical advisers have reviewed the minor EA amendment thresholds and consider that this application meets the criteria for a minor amendment as it will provide a reduction in the risk of environmental harm.

Table 1*: Requirements of Sections 226 and 226A of the EP Act*

Requirements for amendment application[1]	Addressed by EA amendment application and supporting information
S.226 (1) An amendment application must -	
(a) be made to the administering authority; and	The EA amendment application will be lodged with DESI via the *online portal.*
(b) be in the approved form; and	The EA amendment application has been made using the administering authority's online portal.
(c) be accompanied by the fee prescribed by regulation; and	The prescribed fee will be paid alongside the application submission.
(d) describe the proposed amendment; and	The proposed amendments are described in Section 4.2.
(e) describe the land that will be affected by the proposed amendment; and	The EA amendment applies to MLs listed on EA EPML00911413: ML5407, ML5412, ML5413, ML5418, ML5419, ML5420, ML5429, ML5430, ML5441, ML5442, ML5443, ML5444, ML5451, ML5454, ML5457, ML5459, ML5467, ML5485, ML5486, ML5489, ML5500, ML5548, ML5549, ML5550, ML5562, ML5563, ML90180, ML90181 and ML90182.
(f) include any other relevant document relating to the application prescribed by regulation.	Supporting technical documents are attached.
S.226A (1) If the amendment application is for the amendment of an environmental authority, the application must also -	
(a) describe any development permits in effect under the Planning Act for carrying out the relevant activity for the authority; and	There are no development permits for the relevant activity.
(b) state whether each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity; and	The application is to amend a site-specific EA; therefore, eligibility criteria are not relevant.
(c) if the application states that each relevant activity will, if the amendment is made, comply with the eligibility criteria for the activity – include a declaration that the statement is correct; and	Not applicable.
(d) state whether the application seeks to change a condition identified in the authority as a standard condition; and	Not applicable.
(e) if the application relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit – state whether the applicant seeks an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit; and	The application does not relate to a new tenure.
(f) include an assessment of the likely impact of the proposed amendment on the environmental values, including –	Relevant impact assessment information is provided in this report (Section 8) and attached Hydrobiology (2024) report – Appendix A. Water management systems and

Requirements for amendment application[1]	Addressed by EA amendment application and supporting information
(i) a description of the environmental values likely to be affected by the proposed amendment; and *(ii) details of emissions or releases likely to be generated by the proposed amendment; and* *(iii) a description of the risk and likely magnitude of impacts on the environmental values; and* *(iv) details of the management practices proposed to be implemented to prevent or minimise adverse impacts; and* *(v) if a PRCP schedule does not apply for each relevant activity – details of how the land the subject of the application will be rehabilitated after each relevant activity ends; and*	practices are provided in Section 7. A risk assessment has been completed in Section 9. A PRCP schedule does not apply to the activity. The proposed amendment is in relation to the volume of water released from site only and does not require any additional or change to land disturbance. Therefore, land rehabilitation is not relevant to the proposed amendment.
(g) include a description of the proposed measures for minimising and managing waste generated by amendments to the relevant activity; and	Waste management will not be affected by the amendment. CCPL's Waste Management Plan has previously been provided to DESI.
(h) include details of any site management plan or environmental protection order that relates to the land the subject of the application.	CCM is not currently operating under any Environmental Protection Order (EPO).

1 Source: Sections 226 and 226A of the EP Act, current as at 2 June 2023.

Table 2: Minor amendment (threshold) criteria

Minor amendment (threshold) criteria[1]	Explanation for amendment
Minor amendment, for an environmental authority or PRCP schedule, means an amendment that is—	
(a) for an environmental authority— *i) a condition conversion; or* *ii) a minor amendment (threshold);*	**The amendment meets the criteria for a minor amendment (threshold) as described in the following sections. No additional land disturbance or increase in mining activity is proposed, and there is no associated increase to the potential for environmental harm as detailed in the supporting technical assessments.**
Minor amendment (threshold), for an environmental authority, means an amendment that—	
(a) is not a change to a condition identified in the authority as a standard condition, other than— *i) a change that is a condition conversion; or* *ii) a change that is not a condition conversion but that replaces a standard condition of the authority with a standard condition for the environmentally relevant activity to which the authority relates; or* *iii) a change that will not result in a change to the impact of the relevant activity on an environmental value; and*	The amendment is not a change to a condition identified in the authority as a standard condition.
(b) does not significantly increase the level of environmental harm caused by the relevant activity; and	**The proposed amendment does not impose any new risks, helps reduce existing risks, and does not increase the level of environmental harm, as evidenced in the supporting technical assessments.** Key considerations include: • The 2023 Annual REMP Report (Appendix C) shows that aquatic ecosystem values have not been impacted by release waters that meet the current Contaminant Release Limits. • Proposed Contaminant Release Limits in this amendment are lower than current Contaminant Release Limits in the EA and dilution ratios are higher, meaning actual impact on the creek system (in terms of metal and metalloid concentration) will be lower under the amended EA. • The amendment will greatly reduce the existing and ongoing risk of uncontrolled releases of MAW by increasing the opportunity to remove treated MAW from site in a controlled manner.
(c) does not change any rehabilitation objectives stated in the authority in a way likely to result in significantly different impacts on environmental values than the impacts previously permitted under the authority; and	The amendment has no effect on the rehabilitation objectives of the project.

Minor amendment (threshold) criteria[1]	Explanation for amendment
(d) does not significantly increase the scale or intensity of the relevant activity; and	The amendment does not relate to the scale or intensity of the mining activity.
(e) does not relate to a new relevant resource tenure for the authority that is— *i) a new mining lease; or* *ii) a new petroleum lease; or* *iii) a new geothermal lease under the Geothermal Energy Act; or* *iv) a new GHG injection and storage lease under the GHG storage Act; and*	The proposed amendment does not relate to a new relevant resource tenure.
(f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area; and	The proposed amendment will not increase the surface area for the relevant activity by more than 10% of the existing area.
(g) for an environmental authority for a petroleum activity— *i) involves constructing a new pipeline that does not exceed 150km; or* *ii) involves extending an existing pipeline so that the extension does not exceed 10% of the existing length of the pipeline; and*	The proposed amendment is not for a petroleum activity.
(h) if the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—seeks, in the amendment application under section 224, an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.	The proposed amendment does not relate to a new relevant resource tenure.

1 Source: Section 223 of the EP Act, current as at 2 June 2023.

4. Proposed Amendment

This section serves to give a summary of all proposed changes. The methods, reasoning and substantiation for these proposed amendments are presented in Sections 5 and 6.

4.1 EA Amendment Objective

The objective of this application is to:

- reduce contaminant release limits provided in Schedule C - Table 2,
- allow for flexibility in the release strategy with inclusion of multiple release water qualities and associated dilution ratios and maximum release rates,
- remove the 72-hour and 12 -month release volume limits,
- increase the minimum background flow rate,
- amend receiving water monitoring locations provided in Schedule C - Table 3 (including inclusion of a highly disturbed zone),
- include real-time monitoring of release and receiving waters, and
- modernise the receiving water protection values provided in Schedule C - Table 4.

4.2 Proposed EA Condition Amendments

The following EA condition amendments are proposed in this application.

4.2.1. Schedule C - Table 2 (Contaminant Release Limits)

The current EA limits and proposed amendment comments are provided in **Table 3**. Proposed EA limits are presented in **Table 4** with the addition of dilution factors and maximum release rates.

Justification for each parameter and rate is provided in Section 6.1.

Table 3: Current EA Contaminant Release Limits

Parameter[1] (mg/L unless specified otherwise)	Contaminant release limit (maximum release limit unless specified otherwise)	Minimum Monitoring Frequency	Amendment comments
pH (pH units)	Must be between the range of 6.0 to ~~8.5~~	One sample must be taken at the commencement of the release event and thereafter at a minimum frequency of once every six hours for the duration of the release event.	The new automated release system will continuously monitor pH and EC. Higher pH values will assist with MAW treatment and reduce the concentration of dissolved metal concentrations, with the upper limit being increased by 0.5 to pH 9.0. EC is still to be used for indicative purposes only.
Electrical conductivity (µS/cm)	For indicative purposes only		
Dissolved oxygen (mg/L)	Must be greater than 2	One sample must be taken at the commencement of the release event; and For release events with duration of greater than twenty-four hours, samples must be taken daily for one week and once a week thereafter until the release event ceases.	To be retained.
~~Total dissolved solids (mg/L)~~	~~7,000~~		To be removed from parameter list. See Section 6.1.4 for further details.
Sulphate (mg/L)	~~3,500~~		Protection of receiving environment values can still be achieved at higher sulphate concentrations with increased dilution factors.
Suspended Solids (mg/L)	30 ~~or 10% above reference site levels during flow events~~		To be retained for 1:25 dilution ratio, increasing with dilution factor as for metals and metalloids. See Section 6.1.5 for further details.
Arsenic (mg/L)	~~0.25~~		Three sets of release limits have been selected at three different dilution ratios. Hydrobiology (2024) modelling shows that the selected limits are appropriate to meet receiving environment water quality objectives.
Cobalt (mg/L)	~~5~~		
Copper (mg/L)	~~2.5~~		
Lead (mg/L)	~~0.05~~		A lower lead level is considered achievable through the water treatment process.
Zinc (mg/L)	~~10~~		A lower zinc level is considered achievable through the water treatment process.
Oil & grease	No detectable film or odour		To be retained.

1 All metals and metalloids must be measured and reported as both total (unfiltered) and dissolved (field filtered) levels.

Table 4: Proposed EA Contaminant Release Limits and release conditions

Parameter[1]	Contaminant Release Limits and Release conditions			Monitoring frequency
	High Quality Water	Medium Quality Water	Low Quality Water	
pH (pH units)	6.0-9.0			EC and pH must be recorded at least every five (5) minutes for the duration of a release event.
Electrical conductivity (µS/cm)	For indicative purposes only			
Dissolved oxygen (mg/L)	> 2			One sample must be taken within one hour of a release event commencing and for release events with duration of greater than 24 hours, samples must be taken daily for one week and once a week thereafter until the release event ceases.
Sulphate (mg/L)	10,000			
Suspended solids (mg/L)	30	65	100	
Arsenic (mg/L)	0.1			
Cobalt (mg/L)	0.21	0.65	1.68	
Copper (mg/L)	1	2	5	
Lead (mg/L)	0.025			
Zinc (mg/L)	0.3	1	1	
Oil & grease	No detectable film or odour			
Minimum background creek flow (m^3/s)	2			Release rate and creek flowrate must be recorded at least every five (5) minutes for the duration of a release event.
Minimum Dilution Rate	1:25	1:79	1:206	
Maximum release rate (m^3/s)	3.0	2.3	1.5	

1 All metals and metalloids must be measured and reported as both total (unfiltered) and dissolved (field filtered) levels. Contaminant release limits apply to dissolved concentrations only.

4.2.2. C2-3 contaminant release limit exceedances

The current EA states:

(C2-3) Waters released from the location listed in Schedule C – Table 1 (Contaminant Release Point) must not exceed the contaminant limit listed in Schedule C – Table 2 (Release Contaminant Limits) for any specified parameter.

It is proposed that limits for metals, TSS, and sulphates are based on a 3-point moving average of consecutive release water samples to reduce the frequency of start/stops. This will not apply for release water pH, nor receiving water pH or EC, all of which will have hard limits – any breaches will result in immediate cessation of release. Refer to Section 6.1.9 for further justification of applying the 3-point average.

The proposed EA Condition amendment is as follows:

(C2-3) Waters released from the location listed in Schedule C – Table 1 (Contaminant Release Point) must not exceed the contaminant limit listed in Schedule C – Table 2 (Release Contaminant Limits) for ***pH and dissolved oxygen.***

The 3-point average of consecutive samples of *waters released from the location listed in Schedule C – Table 1 (Contaminant Release Point) must not exceed the contaminant limit listed in Schedule C – Table 2 (Contaminant Release Limits) for* ***metal/metalloids, suspended solids and sulphate.***

4.2.3. C2-4 and C2-5 release volume limits

The current EA states:

(C2-4) The maximum volume of treated waste waters released in any seventy-two (72) hour period shall not exceed 70,000 cubic metres.

(C2-5) The maximum volume of treated waste waters released in any twelve (12) month period shall not exceed 500,000 cubic metres.

It is proposed that EA Conditions C2-4 and C2-5 are **removed**.

Note that proposed maximum release rates have been included in Table 4 above.

4.2.4. C2-6 background flow rate

Justification for amendment to the background flowrate condition is presented in Section 366.1.6.

The current EA states:

*(C2-6) The holder must ensure that contaminant release to receiving waters does not occur unless background flow exceeds **1.1** metres^3/second at all times.*

The proposed EA Condition amendment is as follows:

*(C2-6) The holder must ensure that contaminant release to receiving waters does not occur unless background flow exceeds **2** metres^3/second at all times.*

4.2.5. Schedule C – Table 3 (Receiving Waters Monitoring Locations)

The current surface water monitoring locations are provided in **Table 5**. An amended list is presented in **Table 6** with the inclusion of HD and MD zone sites. A second table is proposed for inclusion in the EA (presented below as **Table 7**), titled "Schedule C – Table 4 (Real-time Creek Monitoring Stations)", to present the locations of the automated real-time monitoring stations. The monitoring frequency at the creek monitoring stations is proposed in Section 4.2.6 below. Justification for the HD and MD zones is provided in Section 5.2.

Table 5: Current EA Receiving Water Monitoring Locations

Monitoring Point	Description	Co-ordinates (GDA94, Zone 54)	
		Latitude	Longitude
Receiving Water Sites (RWS)			
GPA2	Gunpowder Creek at the Mt Oxide Road causeway (on the upstream side of the causeway)	S 19° 41' 19.6"	E 139° 21' 24.2"
GPA5	Gunpowder Creek downstream of the Mill Creek confluence	S 19° 41' 06.5"	E 139° 21' 46.1"
GPA7	Gunpowder Creek downstream of Old Mammoth Tailings Dam	S 19° 40' 42.9"	E 139° 22' 27.6"
MGA1	Magazine Creek downstream of the Mt Oxide Road causeway	S 19° 41' 23.9"	E 139° 22' 19.1"
GPD1[1]	Gunpowder Creek downstream of the Greenstone Creek confluence	S 19° 40' 00.4"	E 139° 22' 42.7"
GS2	Greenstone Creek downstream of the Magazine Creek confluence	S 19° 40' 49.1"	E 139° 22' 34.3"
Reference Sites (RS)			
GPU1[2]	Gunpowder Creek upstream of any mine impacts	S 19° 42' 27.4"	E 139° 20' 13.9"
MGU1	Magazine Creek East branch upstream of any mine impacts	S 19° 42' 11.2"	E 139° 22' 19.6"
Observation Sites			
REHAB01	At the former spillway of the Old TSF	S 19° 29' 52.9"	E 139° 22' 07.7"
REHAB02	At the spillway of Heap Leach Pad 2	S 19° 42' 05.4"	E 139° 22' 03.7"

1 When the environmental authority holder has conducted a risk assessment that has deemed that crossing Greenstone Creek puts at risk the safety and health of personnel undertaking monitoring during high flow events, monitoring locations GPA7 and GS2 may be utilised together instead of GPD1.

2 When the environmental authority holder has conducted a risk assessment that has deemed that crossing Gunpowder Creek puts at risk the safety and health of personnel undertaking monitoring, monitoring location GPA2 may be utilised instead of GPU1.

GPA6 and GPA7 monitoring will be interchangeable. GPA6 is considered more reliable as a dry season sampling site (i.e. less prone to drying out) than GPA7. Access to GPA7 has been more reliable than GPA6 in the wet season. New reference site GPU01 is proposed as an alternative reference site when required, however the site has been found to be problematic during the 2023/24 wet season due to issues with safe access (road cuts) and delayed flows (the creek at GPU01 has still been dry when flows commence at GPA2).

The monitoring of rehabilitation sites has been removed from the EA table as this will be incorporated into the rehabilitation milestone criteria of the Progressive Rehabilitation and Closure Plan Schedule.

Table 6: Proposed EA Receiving Water Monitoring Locations

Monitoring Site	Description	Location (GDA2020, Zone 54)	
		Easting	Northing
Reference Sites			
GPU0[1]	Gunpowder Creek upstream far-field site	330315	7795505
GPU1	Gunpowder Creek upstream of any mine impacts	325890	7820023
MGU1	Magazine Creek East branch upstream of any mine impacts	329379	7820555
Receiving Water Sites			
Moderately Disturbed Sites			
GPD1[2]	Gunpowder Creek downstream of the Greenstone Creek confluence	330014	7824583
GPD2	Gunpowder Creek downstream of GPD1	330327	7825276
Highly Disturbed Sites			
GPA2	Gunpowder Creek at the Mt Oxide Road causeway (on the upstream side of the causeway)	327751	7822126
GPA4	Gunpowder Creek downstream of the Mt Oxide Road causeway, close to release point W1	328025	7822279
GPA5	Gunpowder Creek downstream of the Mill Creek confluence	328385	7822535
GPA6[3]	Gunpowder Creek downstream of Old Mammoth Tailings Dam	329238	7823085
GPA7[3]	Gunpowder Creek downstream of Old Mammoth Tailings Dam	329524	7823227
MGA1	Magazine Creek downstream of the Mt Oxide Road causeway	329351	7822009
GS2	Greenstone Creek downstream of the Magazine Creek confluence	329783	7823083

1 When the environmental authority holder has conducted a risk assessment that has deemed that crossing Gunpowder Creek puts at risk the safety and health of personnel undertaking monitoring, monitoring location GPU0 may be utilised instead of GPU1.

2 When the environmental authority holder has conducted a risk assessment that has deemed that crossing Greenstone Creek puts at risk the safety and health of personnel undertaking monitoring during high flow events, monitoring locations GPA7 and GS2 may be utilised together instead of GPD1.

3 GPA6 and GPA7 monitoring will be interchangeable due to access issues and permanency of water. GPA6 will be monitored in the dry season and GPA7 will be monitored during the wet season, as safe access allows.

Table 7: Proposed EA Real-time Creek Monitoring Stations

Monitoring Site	Description	Parameters Measured	Location (GDA2020, Zone 54)	
			Easting	Northing
GPU1	Gunpowder Creek upstream of any mine impacts	pH and EC	325890	7820023
W1 Station[1]	Release water monitoring site on Mill Creek Dam	pH and EC	328472	7821996
GPD1	Receiving environment site on Gunpowder Creek downstream of the Greenstone Creek confluence	pH and EC	330014	7824583
GPD2	Receiving environment site on Gunpowder Creek downstream of GPD1	pH and EC	330327	7825276
GPA2	Gunpowder Creek at the Mt Oxide Road causeway (on the upstream side of the causeway)	Flow, pH and EC	327751	7822126
GPA4	Gunpowder Creek downstream of the Mt Oxide Road causeway, close to release point W1	pH and EC	328025	7822279

1 Monitoring is undertaken in pipe prior to release point W1.

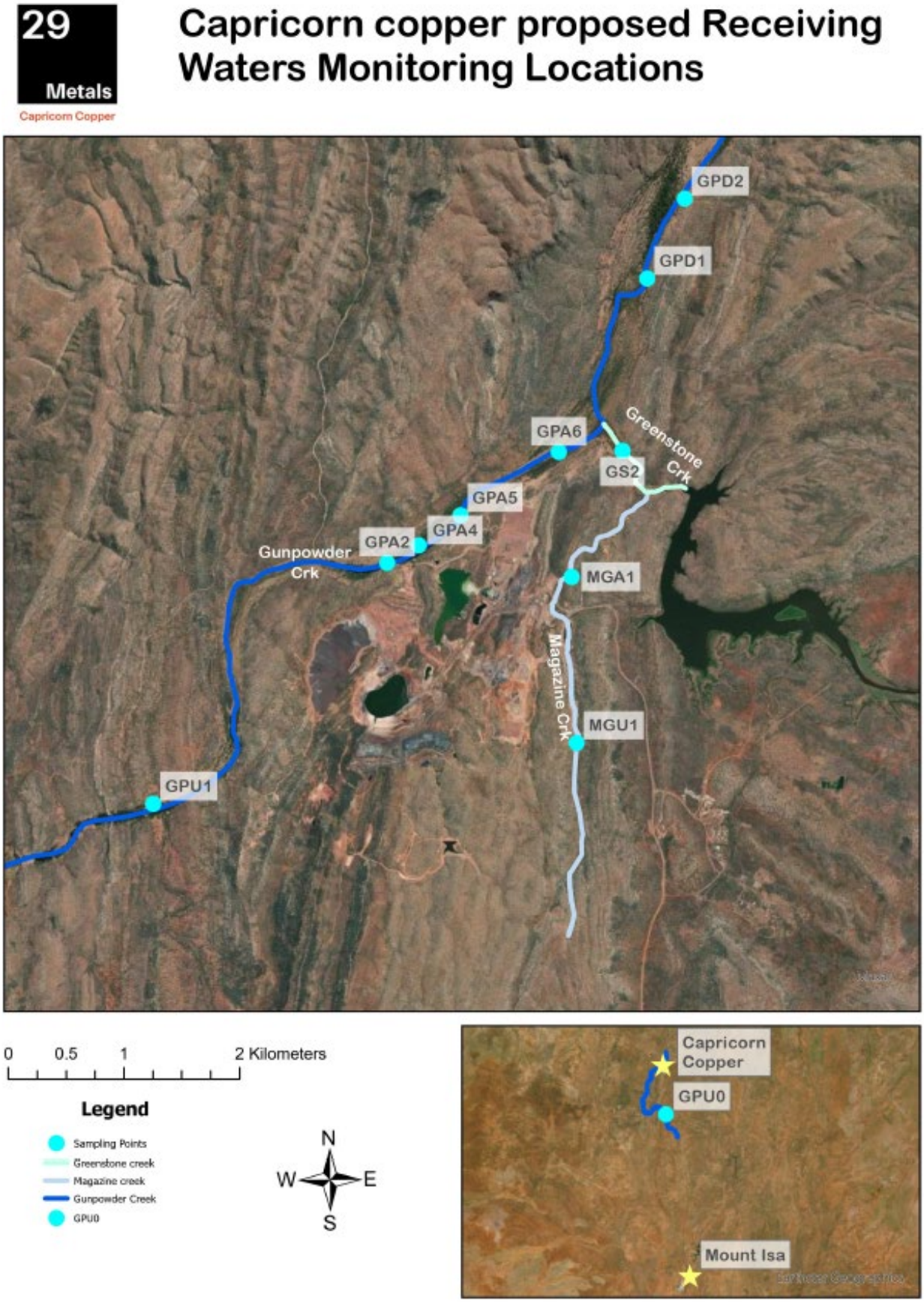


Figure 1: Proposed Surface Water Monitoring Sites

4.2.6. C3-1 receiving waters monitoring frequency

The current EA states:

(C3-1) The holder must undertake monitoring at each Monitoring Point specified in Schedule C – Table 3 (Receiving Waters Monitoring Locations) for each parameter specified in Schedule C – Table 4 (Receiving Waters Contaminant Trigger Levels and Contaminant Limits) and at the following frequency:

(a) For sediment quality at Receiving Water Sites and Reference Sites, biannually (once at the end of the wet season and once at the end of the dry season); and

(b) For water quality at Receiving Water Sites and Reference Sites, monthly when waters are not flowing; and

(c) For water quality at Receiving Water Sites and Reference Sites, weekly during flow events (where no release event occurring); or

(d) For water quality at Receiving Water Sites and Reference Sites during any release event:

*i. Once sample taken within **two** hours of the release event commencing; and*

ii. For release events with duration of greater than twenty-four hours, samples must be taken daily for one week and once a week thereafter until the release event ceases.

(e) For water quality at Observation Sites, once at the commencement of each flow event, unless the administering authority provides written advice that this is not required.

It is proposed that EA Condition C3-1 is amended to address HD and MD zone monitoring sites and reflect standard monitoring frequencies of site-specific resource EAs. Additionally, a single surface water sampling event at CCM can take in excess of 4 hours to complete. C3-1(d)i has been amended to allow six hours to access and sample all required sites. C3-1(e) has been added to capture automated monitoring at creek monitoring stations (telemetry units).

GPA2 and W1 station monitoring frequency is captured in the amendment to Schedule C - Table 2 (Contaminant Release Limits), Table 4 in this report.

GPU1 and GPA4 station monitoring will not be regulated in the EA.

The proposed EA Condition amendment is as follows:

*(C3-1) The holder must undertake monitoring at each Monitoring Site specified in Schedule C – Table 3 (Receiving Water Monitoring Locations) for each parameter specified in Schedule C – **Table 5** (Receiving Water **and Sediment Quality Objectives**); **and at each Monitoring Site and each parameter specified in Schedule C – Table 4 (Real-time Creek Monitoring Stations);** and at the following frequency:*

(a) For sediment quality at Receiving Water Sites and Reference Sites, biannually (once at the end of the wet season and once at the end of the dry season); and

(b) For water quality at Receiving Water Sites and Reference Sites, monthly when waters are not flowing; and

(c) For water quality at Receiving Water Sites and Reference Sites, weekly during flow events (where no release event is occurring and safe access allows); or

(d) For water quality at Receiving Water Sites and Reference Sites during any release event:

*i. One sample taken within **six** hours of the release event commencing; and*

ii. For release events with duration of greater than 24 hours, daily for one week and once a week thereafter until the release event ceases; and

*(e) **For EC and pH at Creek Monitoring Stations GPD1 and GPD2 (Real-time Monitoring Stations), every five (5) minutes, continuously, when water is present.***

4.2.7. Schedule C – Table 4 (Receiving Waters Contaminant Trigger Levels and Contaminant Limits)

The current surface water and sediment quality trigger levels and contaminant limits are provided in **Table 8**. An amended list is presented in **Table 9** with the removal of triggers and limits in favour of water and sediment quality objectives. The table title should be amended to "Schedule C – Table 5 (Receiving Water and Sediment Quality Objectives" to account for addition of the real-time monitoring station locations table.

The source of proposed objectives are provided in the table footnotes. HD and MD zone modelling presented in the supporting Appendix A - Receiving Environment Risk Assessment report (Hydrobiology 2024) shows that proposed release limits are suitable for the protection of EVs of the receiving environment. A summary of Hydrobiology's technical reports is provided in Section 5.

Water quality objectives have been provided for toxicants that are measured in release waters, as presented in **Table 4**. Toxicants that are not measured in release waters but are currently included as a parameter in Schedule C – Table 4 will continue to be monitored, however a WQO has not been assigned for monthly or release-based sampling. Assessment of these parameters will be undertaken as part of the annual REMP reporting.

Table 8: Current EA Receiving Water Trigger Level and Contaminant Limits

Parameter	Water Quality[6]		Sediment Quality[7]	
	Trigger Level[4] (µg/L unless otherwise specified)	Contaminant Limit[4] (mg/L unless otherwise specified)	Trigger Level[4] (mg/kg unless otherwise specified)	Contaminant Limit[4] (mg/kg unless otherwise specified)
pH (pH units)	6.0-8.5		Not applicable	
EC (µS/cm)	435	TBD*	Not applicable	
Sulphate	250 mg/L	1,000 mg/L	Not applicable	
Fluoride	80th percentile[1] of reference site concentration[2]	2 mg/L	Not applicable	
Major cations	For interpretive purposes		Not applicable	
Major anions	For interpretive purposes		Not applicable	
Aluminium	80th percentile[1] of reference site[2] concentration[3] or 55, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 5, whichever is lower	Not applicable	
Arsenic[5]	80th percentile[1] of reference site[2] concentration[3] or 13, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 0.5, whichever is lower	Reference site concentration[2] or 20, whichever is higher	70 or three times the reference site concentration[2], whichever is higher
Boron	80th percentile[1] of reference site[2] concentration[3] or 370, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 5, whichever is lower	Reference site concentration[2]	Three times the reference site concentration[2]
Cadmium	80th percentile[1] of reference site[2] concentration[3] or 0.2, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 0.01, whichever is lower	Reference site concentration[2] or 1, whichever is higher	10 or three times the reference site concentration[2], whichever is higher
Chromium[5]	80th percentile[1] of reference site[2] concentration[3] or 1.0, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 1, whichever is lower	Reference site concentration[2] or 80, whichever is higher	370 or three times the reference site concentration[2], whichever is higher
Cobalt	80th percentile[1] of reference site[2] concentration[3]	95th percentile[1] of reference site[2] concentration[3] or 1, whichever is lower	Reference site concentration[2]	Three times the reference site concentration[2]
Copper	80th percentile[1] of reference site[2] concentration[3] or 1.4, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 1, whichever is lower	Reference site concentration[2] or 65, whichever is higher	270 or three times the reference site concentration[2], whichever is higher

Parameter	Water Quality[6]		Sediment Quality[7]	
	Trigger Level[4] (µg/L unless otherwise specified)	**Contaminant Limit[4] (mg/L unless otherwise specified)**	**Trigger Level[4] (mg/kg unless otherwise specified)**	**Contaminant Limit[4] (mg/kg unless otherwise specified)**
Lead	80th percentile[1] of reference site[2] concentration[3] or 3.4, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 0.01, whichever is lower	Reference site concentration[2] or 50, whichever is higher	220 or three times the reference site concentration[2], whichever is higher
Manganese	80th percentile[1] of reference site[2] concentration[3] or 1900, whichever is higher	95th percentile[1] of reference site[2] concentration[3]	Reference site concentration[2]	Three times the reference site concentration[2]
Nickel	80th percentile[1] of reference site[2] concentration[3] or 11, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 1, whichever is lower	Reference site concentration[2] or 21, whichever is higher	52 or three times the reference site concentration[2], whichever is higher
Uranium	80th percentile[1] of reference site[2] concentration[3]	95th percentile[1] of reference site[2] concentration[3] or 0.2, whichever is lower	Reference concentration[2]	Three times the reference site concentration[2]
Zinc	80th percentile[1] of reference site[2] concentration[3] or 8.0, whichever is higher	95th percentile[1] of reference site[2] concentration[3] or 20, whichever is lower	Reference site concentration[2] or 200, whichever is higher	410 or three times the reference site concentration[2], whichever is higher
Total Hardness	For interpretive purposes only		Not applicable	
Total Organic Carbon	Not applicable		For interpretive purposes	
Particle size distribution	Not applicable		For interpretive purposes	

1. Must be determined in accordance with QWQG (2009) and ANZECC (2000) methodology.

2. Reference sites are specified in Schedule C - Table 3 (Receiving Waters Monitoring Locations).

3. Where the 80th/95th percentile of a water quality trigger level/contaminant limit is exceeded at a receiving water site and the reference site also exceeds this concentration during the release/flow event, the value of the reference site applies as the water quality trigger level/contaminant limit for the duration of the event.

4. Site specific trigger levels and contaminant limits for water quality (80th and 95th percentile of reference site concentration) must be calculated in accordance with QWQG (2009) and ANZECC (2000) methodology if sufficient monitoring data is available. The environmental authority holder must maintain a database documenting all relevant water quality monitoring data and calculation of 80th/95th percentiles adopted as water quality trigger levels and contaminant limits.

5. Routine analysis for this parameter is based on combined/total species of the element, where the exceedance of the WQO is identified, an additional sample must be taken and analysed as soon as practicable to determine and quantify speciated forms of this element. This does not apply to sediment analysis.

6. For all water quality monitoring, metals and metalloids must be measured and reported as both total (unfiltered) and dissolved (field filtered) concentrations.

7. All stream sediment sampling must be undertaken in accordance with AS 5667.12 *Guidance on Sampling of Bottom Sediments of 1998.*

TBD – The holder must determine a trigger level and contaminant limit for Electrical Conductivity in accordance with the REMP, relevant provisions of the Environmental Protection (Water) Policy 2009 and ANZECC (2000) methodology before 1 October 2013.

Table 9: Proposed Receiving Water Trigger Level and Contaminant Limits (or "Receiving Water and Sediment Quality Objectives")

Parameter[1]	Water Quality Objective[2,3] (mg/L unless otherwise specified)		Sediment Quality Objective[2,3,4] (mg/kg dry wt, unless otherwise specified)
	Highly Disturbed Zone	Moderately Disturbed Zone	
pH (pH units)	6.0-9.0		Not applicable
Electrical conductivity (µS/cm)	1201 (wet)[a] 1617 (dry)[a]		Not applicable
Sulphate	737 (wet)[a] 1117 (dry)[a]		Not applicable
Fluoride	For interpretational purposes only[b]		Not applicable
Aluminium	For interpretational purposes only[b]		Not applicable
Arsenic	0.042	0.013	20
Boron	For interpretational purposes only[b]		50[c]
Cadmium	For interpretational purposes only[b]		1.5
Chromium	For interpretational purposes only[b]		80
Cobalt	0.033[a]	0.01[a]	13.8[c]
Copper	0.05[a]	0.05[a]	65
Lead	0.022 (wet)[a] 0.043 (dry)[a]	0.014 (wet)[a] 0.026 (dry)[a]	50
Manganese	For interpretational purposes only[b]		580[c]
Nickel	For interpretational purposes only[b]		21
Uranium	For interpretational purposes only[b]		0.8[c]
Zinc	0.038 (wet)[a] 0.056 (dry)[a]	0.02 (wet)[a] 0.031 (dry)[a]	200
Major cations and anions	For interpretational purposes only		Not applicable
Total Hardness	For interpretational purposes only		Not applicable
Dissolved Organic Carbon	For interpretational purposes only		Not applicable
Total Organic Carbon	Not applicable		For interpretational purposes only
Particle size distribution	Not applicable		For interpretational purposes only

1 All metals and metalloids in receiving waters must be measured and reported as dissolved (filtered) and total (unfiltered) levels. Water quality objectives apply to the dissolved fraction only. All metals and metalloids in receiving sediments must be measured in the <2 mm fraction via HCl extraction.

2 DGVs for the protection of highly disturbed (90% species protection) and moderately disturbed (95% species protection) aquatic ecosystems from ANZG (2018), unless otherwise specified. DGVs may be hardness and DOC corrected in accordance with current ANZG guidance.

3 Water quality objectives are to be compared to receiving environment sites in accordance with ANZG (2018): being comparison of median values of physical and chemical stressors and 95th percentile values of toxicants at receiving environment sites. Where the WQO is exceeded at a receiving water site and the reference site also exceeds this concentration during a release/flow event, the value of the reference site applies as the WQO for the duration of the event. Assessment may include determination of the bioavailable fraction in accordance with ANZG (2018).

4 Sediment quality objectives are to be compared to median values at receiving environment sites, in accordance with ANZG (2018) and NRA (2021).

a Values nominated in Hydrobiology (2024).

b Not all parameters are measured in release waters. Parameters that are not measured in release waters will be monitored in receiving waters for the purposes of the REMP, and assessed in the annual REMP report.

c NRA derived site-specific guideline value, based on 80th percentile of reference site data (NRA 2021).

4.2.8. C3-2, C3-3, C3-4 and C3-5 water and sediment quality objective exceedances

The current EA states:

(C3-2) Contaminant levels in receiving waters (for water quality and sediment quality) must not exceed any of the contaminant limits specified in Schedule C - Table 4 (Receiving Waters Contaminant Trigger Levels and Contaminant Limits).

(C3-3) If a receiving waters sediment quality or water quality parameter exceeds the trigger level specified in Schedule C - Table 4 (Receiving Waters Contaminant Trigger Levels and Contaminant Limits) at a receiving water site specified in Schedule C - Table 3 (Receiving Waters Monitoring Locations), the holder must compare this result to the applicable reference site; and

(a) If the contaminant level at the receiving water site is less than the contaminant level at the reference site, no further action is required for this exceedance event; or

(b) If the contaminant level at the downstream receiving water site is greater than the contaminant level measured at the reference site:

i. Undertake sampling of potentially impacted receiving waters for all parameters listed in Schedule C - Table 4 (Receiving Waters Contaminant Trigger Levels and Contaminant Limits) and at all monitoring points defined in Schedule C - Table 3 (Receiving Waters Monitoring Locations) as soon as possible following identification of the exceedance; and

ii. Complete an investigation on the potential for environmental harm to occur in accordance with ANZECC (2000) methodology, within three (3) months of identifying this exceedance.

Note: Where a contaminant trigger level exceedance has occurred and is under investigation in accordance with condition (C4-3) (b), no further reporting is required for subsequent exceedance events of that parameter during the course of the investigation.

(C3-4) Within one (1) week of completing an investigation required for condition (C3-3) (b), the holder must provide a written report to the administering authority detailing:

(a) All pertinent aspects of the investigation including objectives, applied methodology, investigation outcomes, assumptions relied upon and justification for any assertions made; and

(b) Any actions undertaken and/or proposed (including timeframes) to prevent or minimise environmental harm.

(C3-5) For each calendar month during which a contaminant release or flow event has occurred, the holder must compile a report on all monitoring data required for conditions (C2-2), (C2-6) and (C3-1) of this authority, including a review of compliance with conditions of the authority, within fourteen days of that calendar month concluding.

It is proposed that EA Conditions C3-2 to C3-5 are amended to reflect updated water and sediment quality objectives. EA Condition C3-2 should be removed as contaminant limits will no longer apply. Condition C3-3 should remove reference to exceedance of sediment quality trigger levels, as sediment assessment should include the calculation and comparison of median values at receiving environment sites and be undertaken as part of the REMP annual reporting. C3-3 and C3-4 will be merged to provide succinct direction on investigation and reporting requirements for a WQO exceedance, and relabelled as C3-2. A larger time period (2 months) is required between collecting surface water samples and submitting a monthly report to account for sample transport, laboratory analysis and reporting, and assessment of results. The proposed amendments are provided below.

The proposed EA Condition amendments are as follows:

*(C3-**2**) If a receiving waters sediment quality or water quality parameter exceeds the quality objective specified in Schedule C - **Table 5** (**Receiving Water and Sediment Quality Objectives**) at a **Receiving Water Site** specified in Schedule C - Table 3 (Receiving Waters Monitoring Locations), the holder must compare this result to the applicable reference site; and*

*(a) If the contaminant level at the **Receiving Water Site** is less than the contaminant level at the **Reference Site**, no further action is required for this exceedance event; or*

*(b) If the contaminant level at the downstream **Receiving Water Site** is greater than the contaminant level measured at the **Reference Site**, **complete an investigation into the cause of the deterioration in water***

quality and the potential for environmental harm and submit a written report to the administering authority, within three (3) months of identifying the exceedance, outlining:

i. details of the investigation carried out

ii. findings of the investigation

iii. recommendations of the investigation; and

iv. actions taken to prevent environmental harm.

*Note: Where a contaminant exceedance has occurred and is under investigation in accordance with condition (C3-**2**)(b), no further reporting is required for subsequent exceedance events of that parameter during the course of the investigation.*

*(C3-**3**) For each calendar month during which a contaminant release has occurred, the holder must compile a report on all monitoring data required for conditions (C2-2), (C2-6) and (C3-1) of this authority, including a review of compliance with conditions of the authority, within **2 months** of that calendar month concluding.*

5. Receiving environment: Toxicology study, WQOs and disturbance zones

The purpose of this section is to provide an overview of the studies undertaken by Hydrobiology to set environmental protection objectives and ensure the proposed amendment does not pose a risk of causing environmental harm. The Appendix A - Receiving Environment Risk Assessment (and appended Copper and Cobalt Assessment) is paramount to this amendment application.

5.1 Summary

Hydrobiology were engaged by CCPL to undertake scientific assessments of the relationships between release limits, predicted and historic receiving environment water quality and the aquatic ecosystem of Gunpowder Creek.

Hydrobiology conducted a comprehensive technical assessment of the Gunpowder Creek receiving environment to ascertain relevant EVs and appropriate receiving water WQOs. A risk assessment was then undertaken to determine the risk of impacts to the receiving environment from releases of treated MAW with contaminant concentrations at the proposed release limits (e.g. maximum toxicant concentrations). The assessment involved release modelling using background water quality, proposed release water quality (three different qualities defined) and dilution rate, and other model inputs as defined in Section 2.4.1.1 of the Receiving Environment Risk Assessment (Hydrobiology 2024). The predicted receiving environment toxicant concentrations were then compared to the WQOs to identify potential impacts to EVs.

Initial modelling identified predicted concentrations of dissolved copper and cobalt as posing a residual risk to aquatic ecosystems, one of the EVs defined for the receiving environment. This did not align with findings of the receiving environment monitoring program (REMP) (Appendix B) that shows no significant differences between reference and receiving environment aquatic ecosystem communities, suggesting that existing WQOs for copper and cobalt are not suitable for assessment of water quality impacts to Gunpowder Creek. Hydrobiology then undertook a copper and cobalt assessment to investigate the bioavailability of copper and cobalt in Gunpowder Creek waters. Methods applied and results of the assessment are provided in Appendix B of the Receiving Environment Risk Assessment (Appendix A). Hydrobiology derived new copper and cobalt WQOs applicable to the protection of aquatic ecosystems of Gunpowder Creek and rerun the dilution modelling.

The results from the release modelling investigation demonstrate that proposed release limits are acceptable for all proposed dilution scenarios. Furthermore, proposed dilution scenarios and release values present a low risk to the defined EVs that pertain to the receiving environment of Gunpowder Creek (Hydrobiology 2024).

5.2 Highly and Moderately Disturbed ecosystem classification

The guideline *Deciding aquatic ecosystem indicators and local water quality guideline values* (DES 2022a) defines the HD zone as waters that are significantly degraded by human activity and of lower ecological value than other levels of protection. Specifically, HD zones are usually impacted by very specific pollutants or other specific issues. The technical guideline *Wastewater release to Queensland waters* (DES 2022b) details the objectives relevant to wastewater releases to QLD waters for HD areas as follows:

The objectives for areas where the highly disturbed level of protection is adopted are: a) the water quality should improve towards achieving the default trigger values for slightly-to-moderately disturbed systems; and b) the water quality should not measurably deteriorate as a result of the proposed discharge. An application for a discharge into these areas should be supported by local reference data. If the applicant wishes to significantly add to the load in a highly disturbed area, they will be responsible for undertaking public consultation and gaining stakeholder acceptance. Alternatively, the applicant may demonstrate that the quality of the water to be discharged complies with the default trigger values. For toxicants listed in section 3.4 of the ANZG (2018) Water Quality Guidelines, the trigger to protect 90 per cent of species should be used.

The identification of an HD zone is based on water quality data in the receiving environment. Hydrobiology (2024) have assessed CCM water quality data, specifically for mining signature parameters (sulfate and, to a lesser extent, cobalt and copper), and determined that the area adjacent the mine encompassing sites GPA2 to GPD1 and Greenstone Creek satisfy the classification of an HD zone. There is limited data to assess the receiving environment downstream of GPD1, however the limited data and classifications provided in previous studies support the assignment of MD classification.

5.3 Methods to derive Water Quality Objectives

A range of approaches were implemented during Hydrobiology's study including the assessment and update of current ANZG default guideline values and application of biotic ligand models (BLMs) to understand bioavailability of cobalt and copper in the receiving environment.

BLMs are an ideal tool for the estimation of the bioavailability of Cu and Co as a wealth of toxicological information is available on these metals, providing a comprehensive understanding of their chemistry and toxicity pathways in aquatic organisms.

The BLM outputs for both dry and wet seasons indicated that the draft ANZG default guideline values are overly conservative and that dissolved copper and cobalt in Gunpowder Creek are present in non-bioavailable forms. Bioavailability of copper was shown to be variable between wet and dry season, and so further copper assessment was based on wet season sampling data for the purpose of release-specific assessments. Cobalt concentrations were largely reported below detection limits, limiting bioavailability assessment.

The BLM tools used in Hydrobiology's assessment include the Metal Bioavailability Assessment Tool (m-BAT) and Windward Freshwater BLM. The Windward BLM requires more input parameters (water chemistry) than the m-BAT BLM. As a result, there were more historic samples from CCM that met the data requirements for m-BAT than Windward. Given the large amount of copper datapoints available for use in the m-BAT BLM and the fact that the m-BAT BLM is more conservative when setting a 95% species protection guideline than the Windward BLM, it was recommended that the m-BAT outputs (predicted no-effect concentration or PNEC) be used to set the water quality objective for the receiving environment for which copper is to conform. The proposed WQO for the receiving environment is the 80th percentile of PNECs generated from the m-BAT BLM, 0.05 mg/L.

Given the paucity of cobalt data points above the detection limit, it is recommended that the updated species sensitivity distribution (SSD) for the protection of 90% (highly disturbed systems) and 95% of species (moderately disturbed) be applied to the receiving environment, which is 0.033 and 0.01 mg/L (chronic response), respectively.

5.4 Impacts on proposed EA amendment

Default copper and cobalt guideline values for the protection of aquatic ecosystems have been shown to be overly conservative for the Gunpowder Creek system. Treatment of MAW to the level required to meet default guidelines within the receiving environment is not achievable. The derivation of appropriate site-specific or adjusted guideline values is necessary to determine maximum release limits that both:

- provide for ecosystem protection, and
- are feasible to achieve via the water treatment strategy.

This is critical to enabling the release of excess MAW currently onsite and in doing so, reducing the risk of an uncontrolled release of MAW to Gunpowder Creek.

The full list of proposed WQOs for the receiving environment is presented in **Table 9**. The process of selecting appropriate release limits in consideration of these WQOs is presented in detail in Sections 6.1.1 to 6.1.5.

6. Release of treated MAW: Quality and Conditions

6.1 Determination of proposed treated MAW release water quality and conditions

Following the determination of robust and proven WQO's, CCPL could derive compatible treated MAW release criteria and conditions with the aim of "doing no harm" to the environment. This section outlines how these new limits were proposed and what data sources they drew from.

These proposed limits were then submitted to Hydrobiology for an independent review and risk assessment (Section 6.2).

6.1.1. Expected dissolved metal content (As, Co, Cu, pb and Zn) as a function of pH

The solubility of each of the metals of interest has a direct inverse relationship to pH, with solubility decreasing with increasing pH as metals form insoluble metal hydroxide precipitates. Arsenic is a notable – but uncontroversial – exception to this, as its solubility remains low throughout the pH range of interest. Given this, the dissolved metals concentration in treated MAW is directly related to the pH reached during treatment; higher pH equates to lower dissolved metals.

It is proposed that three release water qualities be included in the EA, each of these defined by the pH that can be achieved during treatment and are proposed to be defined as:

- High quality treated MAW: pH 8.5 – 9.0
- Medium quality treated MAW: pH 7.0 – 8.5
- Low quality treated MAW: pH 6.5 – 7.0

This approach allows for flexibility, given that the performance of the two proposed water treatment systems, the temporary converted Processing Plant Water Treatment Plan (PPWTP) or the new replacement WTP (new WTP) and bulk neutralisation in the MCD, will vary at times (as evident in **Figure 2** and **Figure 3**). **Moreover, higher quality treated water (higher pH) would require less dilution, while lower quality treated water (lower pH) would require more dilution to ensure the environment receives water within WQOs.**

To determine the expected dissolved metals in solution as a function of pH, all data from 2020 – 2024 for treated and untreated MAW on site was collected and analysed. The gathered data for cobalt and copper are presented in **Figure 2** and **Figure 3**, respectively. The three proposed water qualities (defined by pH) are highlighted in these figures to demonstrate how water qualities were determined.

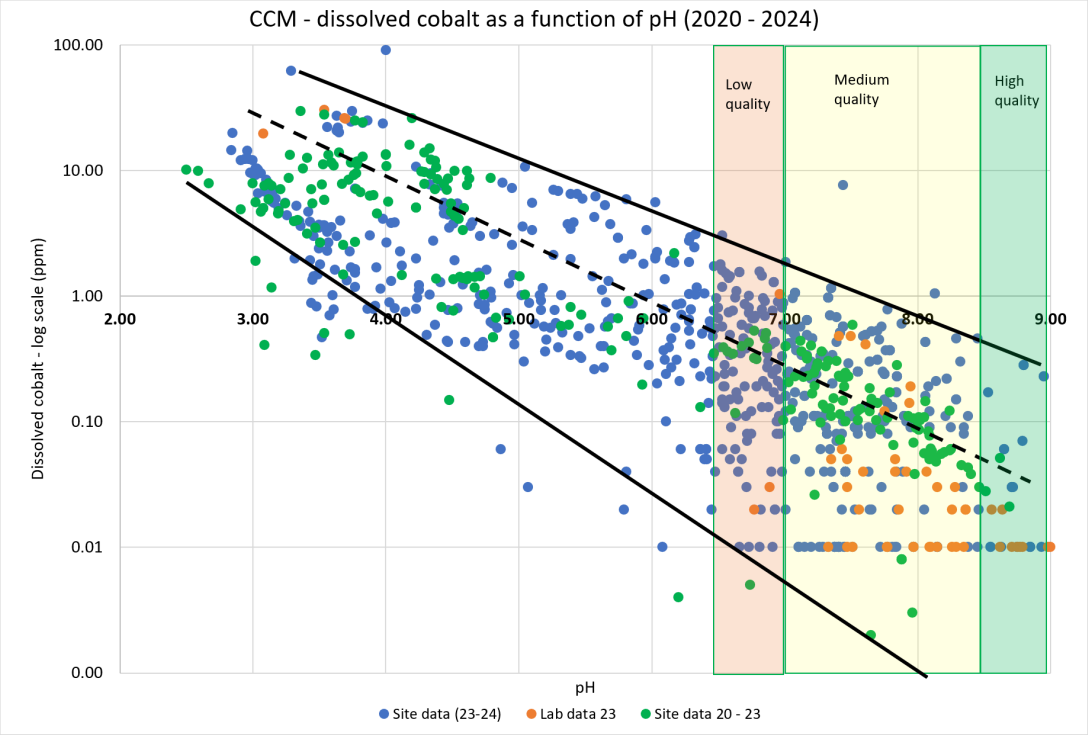


Figure 2: Dissolved cobalt content for all treated and untreated MAW samples taken on site from 2020 to 2024

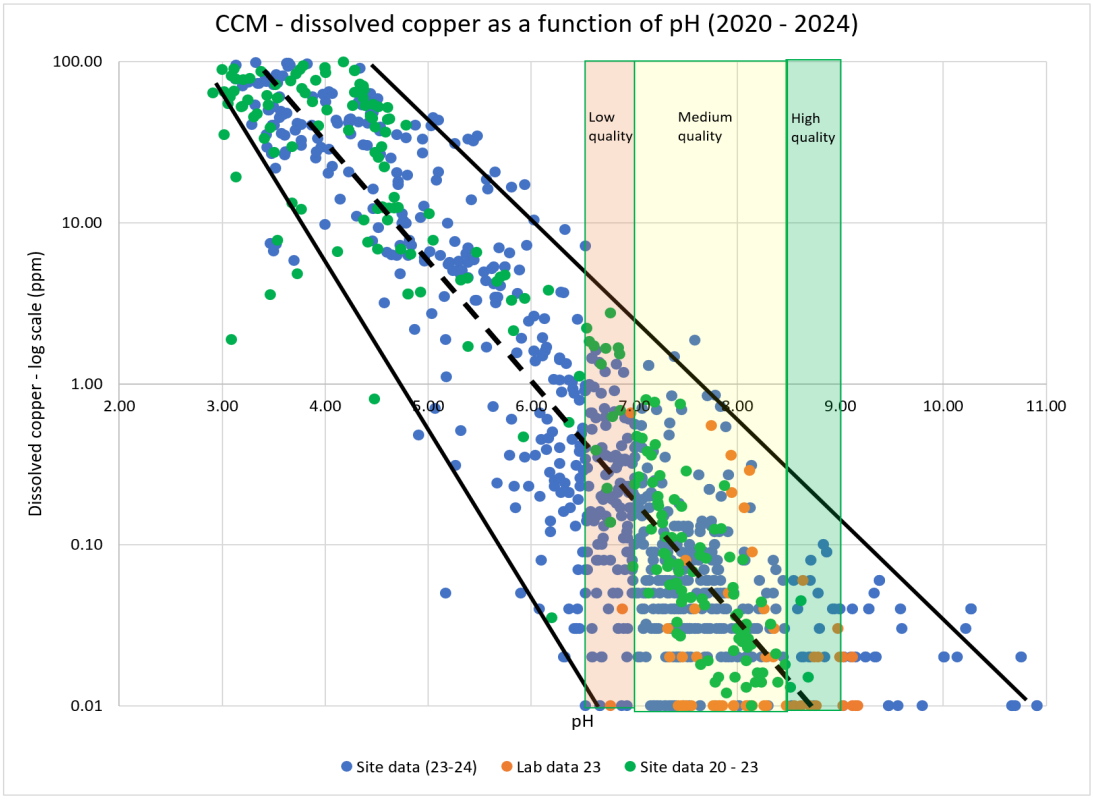


Figure 3: Dissolved copper content for all treated and untreated MAW samples taken on site from 2020 to 2024

Using this data, the average, standard deviations and confidence limits could be derived for each metal within each defined water quality range.

Cobalt has been found to have the lowest WQO limit (just 0.01 ppm, as defined in Section 4.2.1), while being prevalent in untreated MAW and having significant variation in solubility vs. pH verses the other metals of interest (compare **Figure 2** and **Figure 3** as a demonstration of this). For these reasons cobalt was found to be the "limiting contaminant" in terms of defining the required dilution ratio such that all metals in the receiving environment are beneath the proposed WQOs. As such, the 95th percentile (i.e. the average added to two standard deviations) was applied to cobalt using the data in **Figure 2** to define the proposed limit within each pH range. The 99th percentile (i.e. the average added to three standard deviations) was used for all other metals. Dilution modelling allowed further increases in limits for various metals, while ensuring expected receiving water quality was a higher quality than proposed WQOs. **This provides good confidence that proposed treated MAW quality limits will be achieved most of the time.**

Using the above approach, the following treated MAW quality targets for release (i.e. proposed Contaminant Release Limits) are presented in Table 10.

Table 10: Proposed metal limits that can be expected for high (pH 8.5 – 9.0), medium (pH 7.0 – 8.5) and low (pH 6.5 – 7.0) treated MAW qualities

Parameter	Proposed EA Limits			Current EA
	High quality	Medium quality	Low quality	
As (mg/L)	0.10			0.25
Co (mg/L)	0.21	0.65	1.68	5.00
Cu (mg/L)	1.00	2.00	5.00	2.50
Pb (mg/L)	0.025			0.05
Zn (mg/L)	0.30	1.00	1.00	10.00

Note that arsenic and lead showed little variation over full pH range of interest (6.0 – 9.0) and hence a single value was chosen.

6.1.2. Preliminary dilution modelling

As mentioned in Section 6.1.1, the proposed treated MAW release limits (for each proposed water quality) was based on a combination of statistical analysis and dilution modelling. The latter involved:

- Determining the reference data for upstream creek conditions prior to the defined highly disturbed zone. This was determined using the 80th percentile of Gunpowder Creek upstream reference site data collected between 2014 – 2024.
- Determining the "limiting contaminant" which defines the required dilution ratio for all contaminants in the receiving waters to be below their respective WQOs. This was found to be cobalt for reasons addressed in Section 6.1.1.
- Determining the minimum dilution requirement or each water quality based on the limiting contaminant (cobalt).
- Applying a 10% contingency onto the minimum dilution requirement for additional conservatism.

This process is illustrated in **Figure 4**.

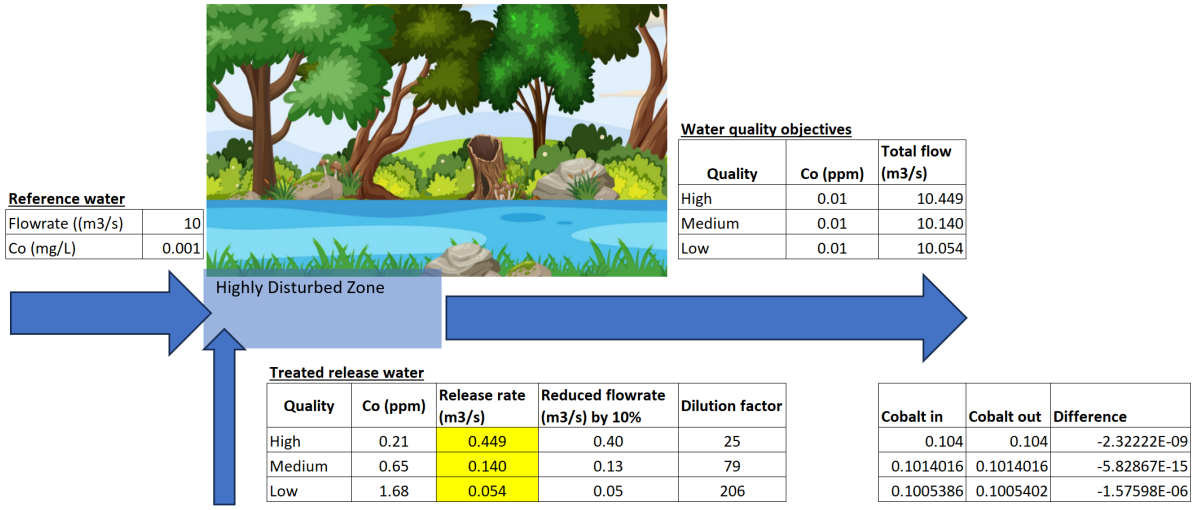


Figure 4: Dilution modelling for the limiting contaminant – cobalt – for all three proposed water qualities and the proposed WQO, to determine the minimum dilution requirements and then add 10% contingency

The outputs of the above modelling demonstrated that all proposed treated MAW release limits for As, Cu, Pb and Zn resulted in the receiving water quality being beneath the proposed WQOs for the determined dilution conditions summarised in **Table 11**.

Table 11: Proposed pH, metal limits and dilution requirements for high, medium and low treated MAW qualities

Parameter	Proposed EA Limits			Current EA
	High quality	Medium quality	Low quality	
pH	6.0 - 9.0			6.0 - 8.5
As (mg/L)	0.10			0.25
Co (mg/L)	0.21	0.65	1.68	5.00
Cu (mg/L)	1.00	2.00	5.00	2.50
Pb (mg/L)	0.025			0.05
Zn (mg/L)	0.30	1.00	1.00	10.00
Minimum Dilution ratio	1 : 25	1 : 79	1 : 206	1 : 10

The following should be noted at this stage:

- Even though high, medium and low water qualities have defined pH ranges for internal site water management, the proposed release pH limits are simplified to 6.0 – 9.0 (as per the WQO's outlined in section 4.2.7).
- All dilution ratios are significantly higher than that required in the current EA, reducing the risk of potential impacts on the environment.
- The allowable dissolved metal limits are significantly lower than the current EA limits for High and Medium water qualities (which have significantly higher dilution requirements) and comparable with Low water quality limits (which has a very high dilution requirement). This further reduces the risk of potential impact on the environment.

6.1.3. Sulphates

Previous wet seasons have seen many missed release opportunities due to treated water not achieving the current EA Contaminant Release Limit for sulphates of 3,500 ppm. This has reduced CCM's ability to reduce inventory on site.

During water treatment, the addition of calcium ions (from lime) results in the precipitation of sulphates as gypsum. The reaction is not driven by pH and, in general, sulphates are the major dissolved contaminant in MAW at CCM. Assessment of the measured sulphate levels in solution for all data from 2020 – 2024 for treated and untreated MAW on site confirmed the insensitivity to pH. It was also noted that levels never exceeded 10,000 ppm.

In sections 6.1.1 and 6.1.2 it was shown that cobalt was the "limiting contaminant", requiring high dilution ratios to ensure proposed WQOs were achieving in the receiving environment. As such, a first step of determining what receiving water quality may be produced for release water at 10,000 ppm under the proposed dilution ratios. The results for sulphates (along with cobalt and copper) are illustrated in **Figure 5**.

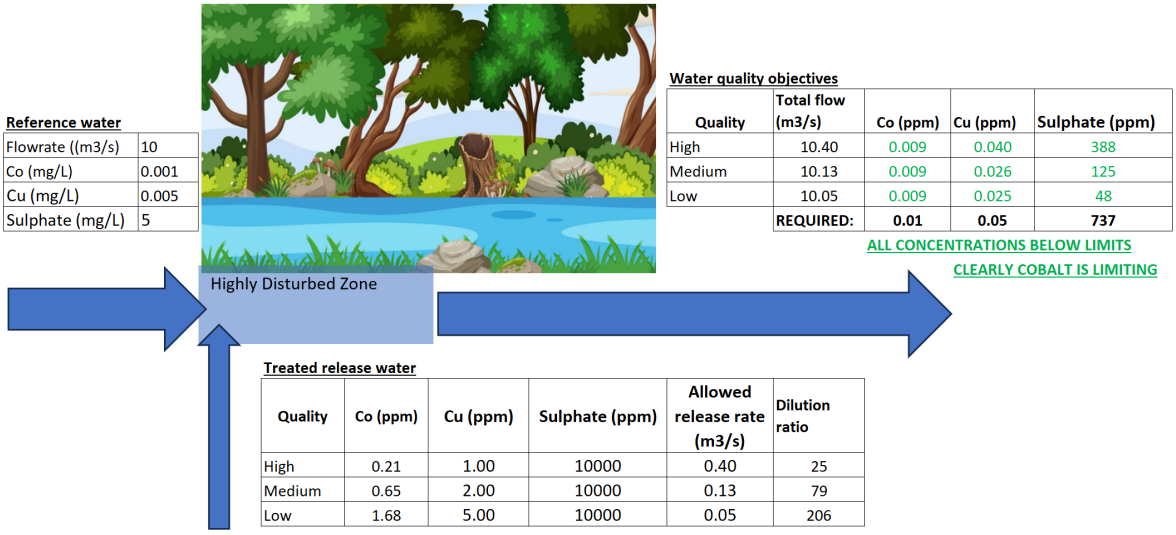


Figure 5: Dilution modelling for cobalt, copper and sulphates for all three proposed water qualities at proposed dilution ratios

Calculated receiving water quality can be compared to proposed WQO's.

The above modelling clearly demonstrates that, for 10,000 ppm in treated MAW release water the generated receiving water quality is 388 ppm, 125 ppm and 48 ppm for high quality, medium quality and low quality respectively under proposed dilution ratios. All these values are significantly beneath the proposed WQO of 737 ppm. **This is a promising outcome, as it essentially rules out sulphates as a significant risk to the environment.** Nevertheless, sulphates should be measured to ensure no extreme excursions occur, and a Contaminant Release Limit of 10,000 ppm is proposed for sulphates, for all water qualities (for simplicity). The updated proposed Contaminant Release Limits are presented in Table 12.

Table 12: Proposed pH, sulphate, metal limits and dilution requirements for high, medium and low treated MAW qualities

Parameter	Proposed EA Limits			Current EA
	High quality	Medium quality	Low quality	
pH	6.0 - 9.0			6.0 - 8.5
Sulphate (mg/L)	10000			3500
As (mg/L)	0.10			0.25
Co (mg/L)	0.21	0.65	1.68	5.00
Cu (mg/L)	1.00	2.00	5.00	2.50
Pb (mg/L)	0.025			0.05
Zn (mg/L)	0.30	1.00	1.00	10.00
Minimum Dilution ratio	1 : 25	1 : 79	1 : 206	1 : 10

The newly proposed sulphate limit may look high compared with the current EA, although it needs to be remembered that the dilution ratio for High Quality release water is 2.5 times higher.

6.1.4. Determination of EC and TDS limits in treated MAW for release

As mentioned in Section 6.1.3, the very high dilution requirements mean that the chance of sulphate exceeding the proposed WQO is very low. Moreover, sulphates represent the major constituent in treated and untreated MAW and is thus the major driver of EC and TDS measurements. **For this reason, both EC and TDS measurements are an indicative (but not always precise) measurement of sulphates in solution.** This is illustrated in **Figure**

6 and **Figure 7** which show all 2023 – 2024 treated and untreated MAW sampling data and indicate strong positive correlations.

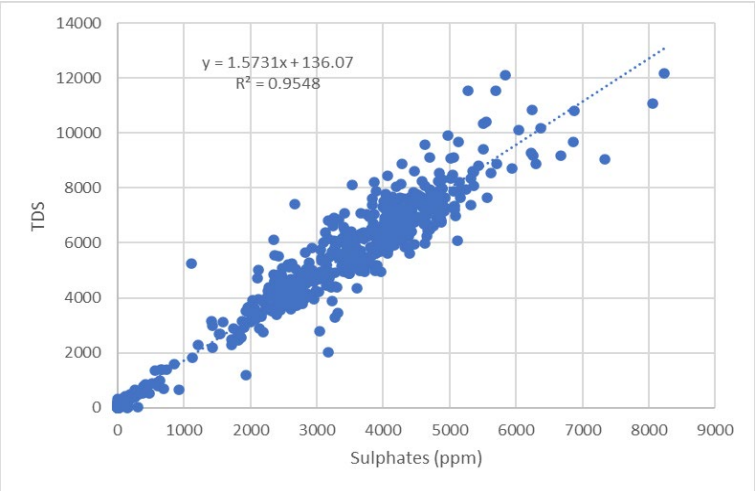


Figure 6: TDS as a function sulphate assays for all untreated and treated MAW samples taken on site from 2023 – 2024

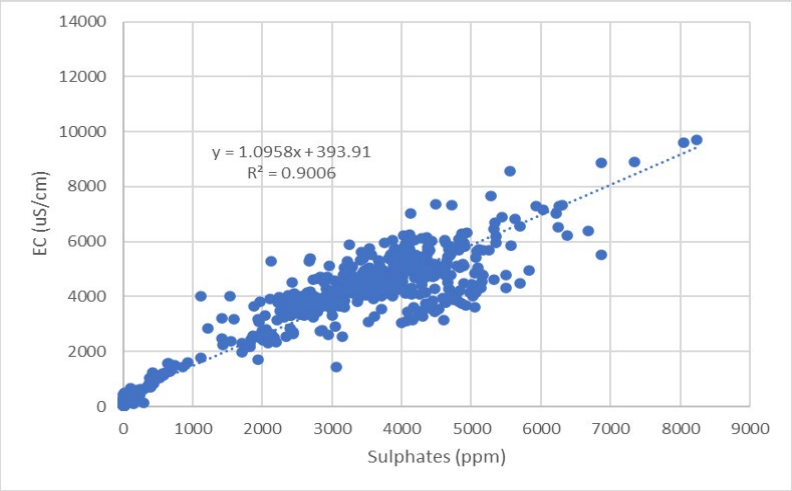


Figure 7: EC as a function sulphate assays for all untreated and treated MAW samples taken on site from 2023 – 2024

The current EA sets limits for sulphate levels and Total Dissolved Solids (TDS), with EC being used for indicative purposes only.

EC (unlike sulphate and TDS laboratory measurements) can be measured in real-time, although EC is only an **indication** of sulphate levels and is affected by other metals or salts, many of which are not of interest or included in the EA limits (as noted in the variability observed in **Figure 7**). As such, a higher than usual EC does not necessarily equate to elevated sulphate levels but does suggest something in the system has changed and further investigation is warranted, and there have been several examples on site where EC readings were elevated, but pH, sulphate levels, and all dissolved metals of interest were not elevated. **Given this, it proposed that EC continue to be used indicatively without a hard limit being enforced for the treated MAW release limits (i.e. proposed Contaminant Release Limits)**.

However, EC should still be measured in real time to indicate any changes in the system that may warrant investigation, but no firm trigger is required given there is already a limit set for sulphate levels and all metals of interest. **Moreover, an EC limit in the creek will still be enforced as part of the proposed WQOs.**

Similarly, TDS has been found to be strongly correlated with sulphate levels, even more so than EC, and given that:

i) there is already a limit for sulphates in the proposed EA limits for treated MAW

ii) the sampling of TDS is as time consuming as sulphates

iii) EC is already measured as an indication of sulphates.

It is believed that a firm limit on TDS in the updated EA is superfluous. Having said this, it is proposed that TDS continue to be measured and reported.

The updated proposed Contaminant Release Limits are shown in **Table 13**.

Table 13: Proposed pH, EC, TDS, sulphate, metal limits, and dilution requirements for high, medium and low treated MAW qualities

Parameter	Proposed EA Limits			Current EA
	High quality	Medium quality	Low quality	
pH	6.0 - 9.0			6.0 - 8.5
EC (uS/cm)	Indicative only			Indicative only
TDS (mg/L)	Indicative only			7000
Sulphate (mg/L)	10000			3500
As (mg/L)	0.10			0.25
Co (mg/L)	0.21	0.65	1.68	5.00
Cu (mg/L)	1.00	2.00	5.00	2.50
Pb (mg/L)	0.025			0.05
Zn (mg/L)	0.30	1.00	1.00	10.00
Minimum Dilution ratio	1 : 25	1 : 79	1 : 206	1 : 10

6.1.5. TSS and dissolved oxygen

As per dissolved metals and sulphates, it stands to reason that the allowable TSS release limits should increase with dilution. Moreover, the updated water management system (outlined in Section 7), which sees the implementation of a clarifier (with flocculant addition) in the temporary PPWTP (and later in the permanent WTP), followed by additional residence time spent in settling ponds 3 and 4 prior to release, will significantly improve the probability of TSS always been below target levels (noting some variation is inevitable).

No changes to dissolved oxygen requirements are proposed. The updated proposed Contaminant Release Limits are shown in **Table 14**.

Table 14: Proposed pH, DO, TSS, EC, TDS, sulphate, metal limits, and dilution requirements for high, medium and low treated MAW qualities

Parameter	Proposed EA Limits			Current EA
	High quality	Medium quality	Low quality	
pH	6.0 - 9.0			6.0 - 8.5
Dissolved oxygen	>2			>2
TSS (mg/L)	30	65	100	30, or 10% above ref
EC (uS/cm)	Indicative only			Indicative only
TDS (mg/L)	Indicative only			7000
Sulphate (mg/L)	10000			3500
As (mg/L)	0.10			0.25
Co (mg/L)	0.21	0.65	1.68	5.00
Cu (mg/L)	1.00	2.00	5.00	2.50
Pb (mg/L)	0.025			0.05
Zn (mg/L)	0.30	1.00	1.00	10.00
Minimum Dilution ratio	1 : 25	1 : 79	1 : 206	1 : 10

Note that the new TSS limits will have a lower impact on the environment, when considering the current EA requires 30 ppm at a 1:10 dilution, while the proposed EA requires 30 ppm at a 1:25 dilution.

6.1.6. Minimum creek flow requirements

The current EA states:

*(C2-6) The holder must ensure that contaminant release to receiving waters does not occur unless background flow exceeds **1.1** metres^3/second at all times.*

It is proposed that EA Condition C2-6 is amended to ensure background flows are sufficient to maintain the flush of release waters downstream before flows cease, which can result in some water remaining within stationary pools being subject to evaporation and resulting increases in contaminant concentration. Higher flows also promote improved mixing in the HD Zone.

The proposed EA Condition amendment is as follows:

*(C2-6) The holder must ensure that contaminant release to receiving waters does not occur unless background flow exceeds **2** metres^3/second at all times.*

The proposed minimum background flow rate of 2 m^3/s applies to all three proposed release water qualities presented, with dilution requirements increasing with decreasing release water quality (e.g. high-quality water can be released at a higher release rate than medium and low water quality, at the same background creek flow). The table below demonstrates allowable release rates for each water quality level at minimum background creek flow.

Water Quality[1]	Required Minimum Dilution Ratio[1]	Minimum Background Creek Flow[1]	Corresponding Minimum Release Rate
High	1:25	2 m^3/s	0.08 m^3/s; 6.9 ML/d
Medium	1:79	2 m^3/s	0.025 m^3/s; 2.2 ML/d
Low	1:206	2 m^3/s	0.01 m3/s; 0.8 ML/d

1 Water Quality, Required Minimum Dilution Ratio and Minimum Background Creek Flow will be included in the amended EA via Schedule C – Table 2 (Table 4 in this report). Minimum background flow of 2 m^3/s is also stipulated in Condition C2-6.

6.1.7. Maximum release rates

The current EA states:

(C2-4) The maximum volume of treated waste waters released in any seventy-two (72) hour period shall not exceed 70,000 cubic metres.

(C2-5) The maximum volume of treated waste waters released in any twelve (12) month period shall not exceed 500,000 cubic metres.

An independent review completed by Engeny (CCM Release Assessment – Appendix C) concluded the following:

The annual and 72-hour caps on release volumes in the current EA presents the largest limitation to estimated release potential and that removal of these caps will significantly increase estimated annual release opportunity even when a higher flow trigger is considered. In addition, [the model] also demonstrates that increased rates of treated mine affected water could be achieved whilst also limiting environmental harm through the use of higher dilution ratios.

It is noted that no legislation exists for determining safe maximum release limits. CCPL thus proposes a pragmatic approach as follows:

- Maximum release rates should be higher for higher quality release water (lower risk to environment) and decrease with decreasing water quality.
- Given the current risk to the environment, agreed maximum release rate limits should serve to allow for responsible reductions of inventory while not being excessive.
- Examples of maximum release rates in other EAs have been reviewed to determine what acceptable inclusions may look like.
- Impacts of maximum release rates should be included in the independent risk assessment report completed by Hydrobiology.

Given the above, CCPL would like to propose the following maximum release rates:

Release Conditions	Current EA	Proposed EA		
		High quality	Medium quality	Low quality
Minimum dilution	1 : 10	1 : 25	1 : 79	1 : 206
Maximum release rate (cumecs)	0.3*	3.0	2.3	1.5
Creek flowrate at which max release rate reached (cumecs)	2.70	75	178	309

*Equivalent of 70ML in 72 hours.

The following should be noted:

- The above table highlights just how conservative the existing EA is, with the maximum release rate being reached as a creak flow of just 2.7 cumecs (while the minimum creek flow requirement is 1.1 cumecs).
- The proposed maximum release rates only apply at elevated creek flowrates.
- Modelling by Engeny confirms that use of these more pragmatic maximum release rates allow for useful volumes of release water to be removed each wet season, while the dilution requirement serves to be the new biggest determination of how much water is release over a wet season.

Table 15: Proposed pH, DO, TSS, EC, TDS, sulphate, metal limits, dilution requirements, minimum creek flow rates and maximum release rates for high, medium and low treated MAW qualities

Parameter	Proposed EA Limits			Current EA
	High quality	Medium quality	Low quality	
pH	6.0 - 9.0			6.0 - 8.5
Dissolved oxygen	>2			>2
TSS (mg/L)	30	65	100	30, or 10% above ref
EC (uS/cm)	Indicative only			Indicative only
TDS (mg/L)	Indicative only			7000
Sulphate (mg/L)	10000			3500
As (mg/L)	0.10			0.25
Co (mg/L)	0.21	0.65	1.68	5.00
Cu (mg/L)	1.00	2.00	5.00	2.50
Pb (mg/L)	0.025			0.05
Zn (mg/L)	0.30	1.00	1.00	10.00
Minimum creek flow m3/s	2			1.1
Maximum release rate m3/s	2.00	1.75	1.50	0.3*
Minimum Dilution ratio	1 : 25	1 : 79	1 : 206	1 : 10

*Equivalent of 70ML in 72 hours.

6.1.8. Conservatism and contingency

Conservatism was applied throughout the process of determining updated EA conditions and limits, specifically:

- All data for metals in solution as a function of pH was drawn in addition to (more optimistic) laboratory test work results.
- Metals limits were defined at the 95th percentile for cobalt, while all other metals were determined at the 99th percentile or based on dilution modelling (whichever was higher).
- All determined dilution ratios include a 10% contingency above the dilution rate where modelling of the predicted receiving environment concentration of the limiting contaminant (cobalt) first reaches the WQO.
- The lowest dilution ratio in the new proposed EA is 2.5 times greater than the existing EA.
- Modelling has shown it is very unlikely that sulphate levels will ever exceed the proposed WQO in the receiving environment. Nevertheless, a limit has been applied that would essentially mean the WQO can't be breached.

6.1.9. Minimising missed release opportunities

Past wet seasons at CCM have repeatedly shown many missed opportunities for release due to one parameter being marginally out of specification, with a repeat sample verifying the parameter was in fact within specification and the halt of release was unnecessary. This is not completely unexpected, as storages of MAW are not homogenous, and measurement of parameters will report a level of variation. Additionally, sampling and assaying practices are imperfect and introduction of contamination and/or bias at times is inevitable.

The effects of the above are particularly disruptive because:

- Sampling, sample preparation and analysis for most metals and sulphates takes 6 – 8 hours, which is a significant amount of lost release time when the creek only flows for an average of 76 days a year (at flows greater than 2 m^3/s) on average.
- Shutting down the release (and treatment systems) is rapid, but the restart, stabilisation and re-checking for compliance of these systems is time consuming. With sampling requirements added in, it can easily take 12 - 24 hours to start releasing following the halt of a release.

Buffering or protecting from these disruptions due to sampling variation and/or potential sampling error would allow for overall increased released volumes. This is a positive environmental outcome, as the largest risk to the environment stems from a large uncontrolled release of untreated MAW and maximising the controlled release of water reduces this risk.

This can be counteracted by the implementation of a 3-point moving average – where a sporadic outlier can be investigated and addressed, prior to shutdown. Compliance is maintained when the 3-point moving average is equal to or below the contaminant release limit. Non-compliance will trigger transition to a lower water quality release (medium or low) unless the site is already releasing low quality water, in which case the release will cease.

Importantly, this 3-point average only applies to metals, TSS, and sulphates, with pH exceedances of release water and pH and EC exceedances in the receiving waters (all measured in real time) still resulting in immediate halt of release (given these parameters importance in guaranteeing dissolved metal concentrations). EC of the release water will also be measured in real time, with any significant increases being investigated (although not immediately resulting in a cessation of release). Moreover, the 3-point moving average only applies to release water quality and does not apply to receiving water quality.

6.1.10. Compliance

Several tools are being proposed and/or implemented to ensure compliance, these include:

- Online measurement of pH and EC for real time assessment of water quality
- Automation of release system.

As pH is the main indicator of water quality for dissolved metals (excluding sulphates and arsenic) a qualitative determination of water quality can be achieved in real time prior to/during releases by monitoring pH of release waters. The levels of pH and EC in the creek will be monitored in real time as a safeguard. Due to the size of the water treatment system, sudden and rapid changes in pH are not expected (a gradual increase or decrease is more likely).

6.2 Independent dilution modelling and risk assessment of proposed EA release water limits and conditions

As discussed in Section 8, EVs that have the potential to be affected by the proposed amendment are related to the receiving waters of Gunpowder Creek. Potential impacts to the receiving environment from this application include the contamination of receiving waters and sediments and the degradation of aquatic ecosystems through increased contaminant concentrations and changes to hydrological regimes. The risk assessment for the proposed amendment is provided in Appendix A - Hydrobiology (2024). The risk assessment concludes that “proposed dilution scenarios and release values present a low risk to the defined EVs that pertain to the receiving environment of Gunpowder Creek both within the HD zone and downstream MD zone”.

Considering that the proposed amendment includes the replacement of contaminant limits with more stringent WQOs and baseflow levels, CCPL are confident that the proposed release limits will meet the proposed WQOs in the HD and MD zones and in doing so protect the aquatic ecosystem EVs of the site’s receiving environment.

The final step was to define dilution ratios and assess the likelihood of achieving WQOs within the receiving environment (aquatic ecosystem protection). This was completed both by the CCPL team and independently by Hydrobiology; refer to Section 6.1.2 and Appendix A – Receiving Environment Risk Assessment. **The model results found the proposed release limits to be suitable for the achievement of EV protection.**

7. CCM Water Management System

Chapters 4, 5 and 6 have presented the proposed limits and conditions for release of water from CCM into gunpowder creek. This chapter focuses on:

- Strategy
- Site infrastructure and systems
- Compliance.

7.1 Strategy – treatment and release

In addition to recycling and evaporation, the treatment and release of MAW is a key control for ensuring MAW does not accumulate onsite across multiple wet seasons or during extreme events, increasing the risk of uncontrolled release and resultant environmental harm to the receiving environment. This method of managing water inventory is used by several other mining sites in the region and can have minimal impacts on the environment when completed in accordance with carefully selected parameters that ensure environmental protections. A number of potential release options have been assessed, including the opportunity to undertake controlled releases of treated MAW from CCM to Gunpowder Creek during various wet season scenarios. Refer to Appendix C – Engeny (2023) Release Assessment. Whilst the immediate objective is to remove the water inventory resulting from the March 2023 event and 2023/24 wet season, this EA Amendment is critical to the long-term sustainable management of MAW at CCM.

Current and proposed water management improvements at CCM include:

- Cessation of water intake from Lake Waggaboonya for mining and mineral processing, through increased recycling of MAW from EPit and MCD.
- Significant increase of mechanically enhanced evaporative throughput capacity.
- Installation of a bulk MAW treatment and release system in the MCD.
- Full refurbishment and upgrade of lime slaking plant prior to wet season 2024/2025.
- Upgrade and replacement of online creek and release monitoring system to allow for higher frequency measurement and improved reliability.
- Conversion of processing plant to a temporary WTP (PPWTP) during suspension of operations
- Installation and operation of a permanent, large-scale, WTP.

A simplified site flowsheet for the current (and long-term) water treatment and release systems is provided in **Figure 8.**

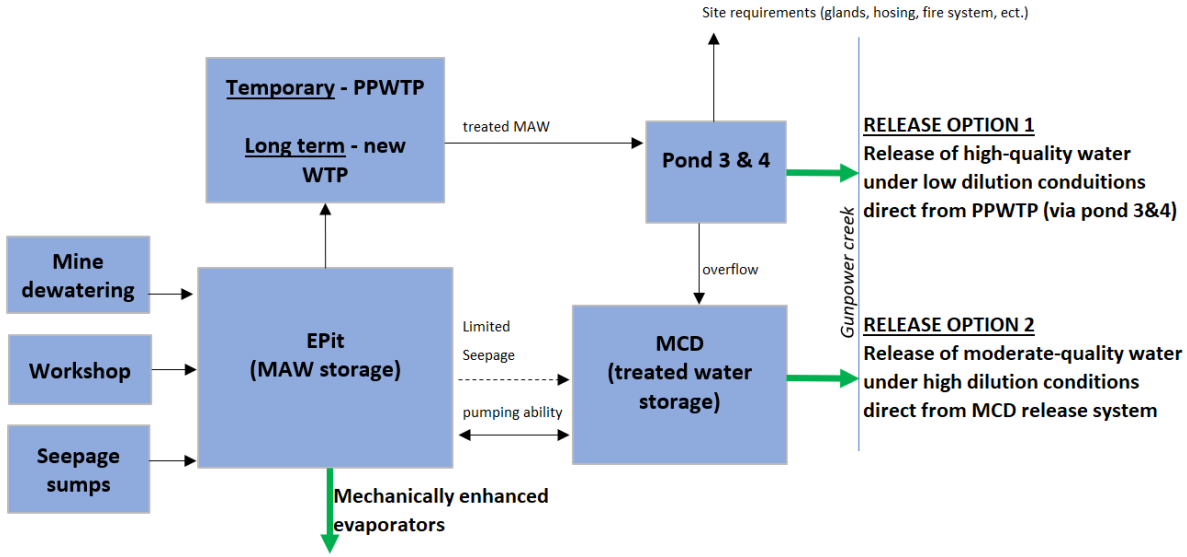


Figure 8: CCM site flowsheet for water treatment and release systems

The EPit will continue to act as the central storage for MAW on site, with all mine dewatering and seepage sumps being directed to the EPit. Temporary, and then permanent, seepage barriers will be installed to minimise or cease seepage from the EPit to the MCD. The mechanically enhanced evaporator systems located at the EPit will continue to remove MAW from site throughout the year.

MAW will be pumped to the temporary PPWTP (as of September 2024), treated, and then sent to ponds 3 and 4. The capacity of this system will be 12 ML/d. This will later be replaced by the new (permanent) WTP which will have increased capacity.

From ponds 3 and 4, freshly treated, high-quality water can be released under controlled conditions to the creek as creek flowrates allow. This release option would be the preference for lower dilution conditions in the creek (i.e. lower creek flows, but always above the 2 m^3/s lower creek flow limit).

Alternatively, if the creek is not flowing, or if the creek is flowing more quickly and release from the MCD is underway, pond 4 will overflow into the MCD and allow for top-up.

The MCD will have the ability to lime treat water in-situ and/or be topped up with PPWTP (via ponds 3 and 4). This system can be used to ensure the pH in the MCD is maintained prior to a release (e.g. if run-off into the MCD results in a slight pH drop). Alternatively, the MCD could be filled with acidic MAW and then treated in-situ (e.g. if the PPWTP is offline and the MCD is empty).

This flowsheet allows for flexibility and redundancy, with a view to maximising release opportunities during wet seasons.

7.2 Site infrastructure and systems

7.2.1. Recycling of MAW

Following the March 2023 extreme wet season event, CCM ceased all water intake from Lake Waggaboonya for mining and mineral processing requirements. As the existing WTP was inundated by the rising waters, a temporary facility was developed which enabled lime addition and mixing in Ponds 3 and 4 before pumping the treated water at a rate of 10-12ML/day to the repurposed raw water tank for supply of all mining and mineral processing requirements. This system was commissioned and operating by the re-start of operations on 1 August 2023. Subsequently, additional antiscalant dosing, automatic pH control and filtration systems were installed to mitigate impacts of water quality on equipment. The system was also successfully used to treat and release water during the 2023/2024 wet season.

7.2.2. Evaporators

CCPL have also purchased, installed and commissioned additional mechanical evaporative throughput capacity at the EPit, with the system design throughputs increasing from 97.3L/s to 284L/s.

7.2.3. Real-time water quality monitoring stations

Previously, three installed remote monitoring stations (GPU1, GPA2 and GPD1) on Gunpowder Creek used remote dataloggers to collect information from the field instruments and then transfer and store data to the online cloud storage via a satellite. To view the data from the monitoring stations, site had to login to an internet-based portal and view the data through a web page. This system has repeatedly proven to be unreliable during the wet season, as it relies on site always having internet access via a microwave radio link. This is frequently offline during bad weather or electrical storms, which is when site is likely to be considering releases to Gunpowder Creek.

The new, upgraded system includes two additional locations (GPA4 and GPD2) and allows for continuous, real time, remote monitoring of key receiving water parameters (pH, EC, and flowrate), while removing the need for a satellite uplink and internet access. This is achieved by directly linking the instrumentation data loggers to the site process control system (PCS) via a telemetry system that uses radio communication to transmit the data. A correctly designed telemetry system using radio communication is not prone to the effects of weather and/or topography and allows for the reliable transfer of data required for an automated release control system.

To ensure a reliable and continuous power supply for the remote instrumentation and data loggers (where no mains power is available), each unit has been fitted with a solar array and suitably sized battery back-up as required. This has already been found to be very reliable with the current system, and the new system (relying on radio transmittal of data) is expected to have lower power demands.

The new monitoring system allows for the creek flow, pH and EC to be measured in real time, along with treated water pH and EC. This combination enables the implementation of automated release control, whereby release is only undertaken when conditions are correct. Refer to **Figure 10** for the location of monitoring stations and **Section 7.3.2** for details of the automated release control process.

7.2.4. Full refurbishment and upgrade of lime slaking plant

A reliable and plentiful supply of milk of lime (slaked quick lime) is key to effective water treatment of MAW. Following suspension of operations at CCM in April 2024, a decision was made to strip and refurbish the existing lime slaking plant to ensure the plant's performance is returned to design specifications prior to the 20204/2025 wet season.

Additionally, the lime slaking plant has been reconfigured to use raw water (imported from Lake Waggaboonya) for slaking and gland water requirements. The lime slaking plant will be a relatively small raw water user (< 0.2 ML/d) in comparison to past mining and processing requirements and the use of high-water quality significantly reduces the formation of scale during the slaking process. This was found to be problematic during the 2023/2024 wet season, where recycled water (generated in the temporary ponds 3 and 4 lime addition system) was used for slaking.

The completion of this work assists in de-risking the wet season release strategy for the upcoming (and future) wet season(s). This work is scheduled to be completed in September 2024.

7.2.5. Temporary Water Treatment Plant

Following the suspension of operations in April 2024, design work began to temporarily convert the Processing Plant into a WTP (PPWTP). The design makes use of the rougher flotation and tailings thickener circuits. Water will be pumped from the EPit and pass through the rougher flotation circuit where pH is automatically controlled using lime addition. The roughers are also thoroughly mixed, allowing for good reaction kinetics for the precipitation of metal hydroxides and gypsum. The roughers then flow to the tailing's thickener where flocculant is added to promote settling. The overflow (the clarified treated water product) will flow to ponds 3 and 4. The precipitated metals and gypsum sludge will report to the tailing's thickener underflow, and either be recycled to the head of the roughers (to allow for seeding) or deported to the Esperanza Tailings Storage Facility (ETSF) for storage along with previously deposited tailings. This ensures sludge will not occupy volume in the MCD or EPit.

The PPWTP will have a design throughput of 12ML/d and is expected to produce "high quality" water in line with the quality targets proposed in this application. The product water will flow to pond 3, which overflows to pond 4, for further settling of any remaining suspended solids. Standby/duty pumps on pond 4 will allow for the direct release of water from pond 4 to the creek, provided creek flow and the treated water quality is in accordance with agreed targets. Alternatively, water will overflow from pond 4 into the MCD, allowing for further top-up and storage of treated MAW in the MCD ahead of a release to the creek when creek flow conditions allow.

Detailed design of the PPWTP is nearing completion, with the design making use of existing equipment only – besides requiring piping changes and installation of additional valves. No long-lead items are required. The process is expected to be online by September 2024.

7.2.6. Permanent Water Treatment Plant

In addition to design work to install the temporary PPWTP (12 ML/d throughput), design work continues for the permanent WTP for site in collaboration with Ausenco. The new WTP will have a design throughout of 15 ML/d (with allowance for greater sprint capacity) and allows for all of site's mining and processing needs (8-10ML/d) plus a surplus of 5-7 ML/d for storage in the MCD prior to the wet season for controlled release when creek flows allow. The new WTP will also be able to release water directly to the creek (via ponds 3 and 4) if required.

The design of the plant will mirror the design of the PPWTP, with the design including excess reactor residence time to allow for high quality water (with low scaling potential) to be produced. The timeline of this project is dependent on obtaining approvals for new tailings storage capacity on site.

7.2.7. MCD bulk treatment

In addition to the temporary and permanent water treatment plants, CCPL has finalised installation of the bulk neutralisation and release system in the MCD. Stage 1 commissioning has been successfully completed, and stage

2 commissioning will be completed once the refurbishment and upgrade of the lime slaking plant is completed in September 2024. See **Figure 9** illustrating the completed infrastructure in the MCD area.

Figure 9: Completed MCD bulk treatment and release system (May 2024)

The design of this system allows for pre-treated water (circa 450ML) to be stored in anticipation of ideal creek flow conditions in the creek and will have a maximum release rate of 100 ML/d with three of the four release pumps running (the other pump being on standby).

The system can also automatically lime treat water within the MCD. This can be used to ensure the contents of the MCD are held at desirable release pH levels while awaiting a release. Additionally, acidic MAW could be added from the EPit and then subsequently treated in-situ. Alternatively, the MCD will be topped up with treated water from the PPWTP (via ponds 3 and 4).

The flexibility of this design improves the likelihood of CCPL achieving significant releases during wet seasons.

7.3 Compliance and management response to exceedances

During a release event, water quality exceedances of EA values will be identified from data collected at real-time creek monitoring stations and laboratory reported data. Exceedances could occur in:

- Release waters
- HD zone waters
- MD zone waters.

Each of these waters will have different water quality limits or objectives. Further to this, the speed in which the exceedance is identified will vary considerably between the real-time stations and the laboratory analysis process.

7.3.1. Laboratory analysis reported exceedance

Release water exceedances of metals/metalloids determined via laboratory analysis will be appropriately investigated and reported on a daily basis. A 3-point moving average is suggested to help smooth-out any sporadic (and potentially erroneous) outliers in the release water data, as discussed further in Section 6.1.9.

Receiving water exceedances of parameters determined via laboratory analysis will be compared to reference site conditions and investigated in accordance with Condition C3-2, including comparison to any event-based default guideline value adjustments (e.g. DOC-adjustment).

7.3.2. Monitoring station exceedance and automated release management

Unlike the laboratory analyses for metals and metalloids, exceedances detected at telemetry monitoring stations in the creek and release water system will be automatically reported in real time. Parameters measured at the

stations will be limited to pH and EC, with the addition of flow monitoring at GPA2 immediately upstream of the release point. The parameter pH is directly indicative of metal solubility and thus the single most important parameter, making real time measurement highly beneficial in avoiding environmental harm. Actions relating to any exceedances measured by the real-time creek monitoring stations during a release, or in the event of a communications failure, are outlined below:

- State 1: Normal release operation
    - Condition: All measured process values are within CCM site defined and EA release limits/water quality objectives (WQOs).
    - Action: Creek release initiated/continued as per EA conditions.
- State 2: Water quality value alarm during release
    - Condition: One (or more) measured process values/creek monitoring station values is out of compliance with CCM defined trigger limits, but within EA limits.
    - Action:
        - Creek release continues.
        - Level alarms generated on site Process Operating System for relevant water quality values, notifying the control room that one of the critical process values is approaching the release limit/WQO.
        - Control room to initiate check of treatment system/equipment and key parameters and prepare to decrease release rate (dilution ratio) or potential shutdown.
- State 3: System trip due to non-compliance of release/creek water quality (or communications link failure)
    - Condition: One or more measured process values/creek monitoring station values is out of compliance with agreed EA limits AND/OR a communications link failure is detected.
    - Action: Automated release system trip is initiated, closing all release valves to prevent further release of water to the creek. Continue investigation of system to determine faults or errors leading to non-compliance.
- State 4: Background flow rate trip during release
    - Condition: The flow rate at monitoring station GPA2 drops below the EA minimum flow of 2 m^3/second.
    - Action: Automated Release System trip is initiated, closing all release valves to prevent further release of water to the creek. Preparation of system to continue release once creek flow increases back above minimum creek flow.

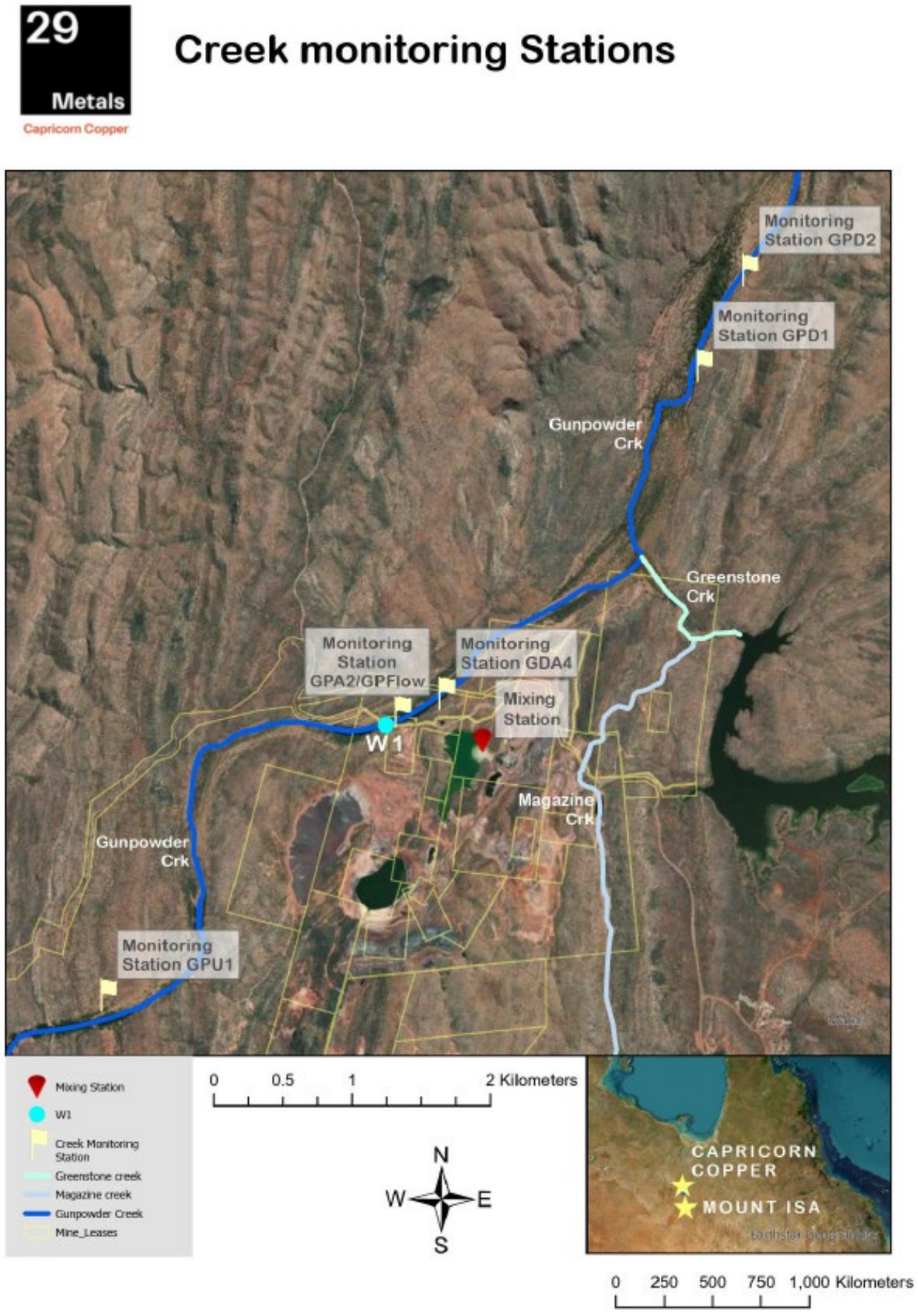


Figure 10: Real-time Creek Monitoring Stations

8. Environmental Values Assessment

Potential impacts from the proposed EA amendment (increased release volume and application of new WQOs) are limited to the receiving environment of Gunpowder Creek and have been addressed under Section 8.3 Water. The Environmental Values (EVs) of Gunpowder Creek were identified by Hydrobiology (2024) and included aquatic ecosystems, stock watering, secondary recreation, visual appreciation, industrial (mining) and cultural and spiritual values. Potential risks to EVs from the proposed amendment activity will be managed by complying with the existing and proposed EA conditions and release management risk practices as outlined in Section 7.3 of this document.

8.1 Air

Description of Environmental Value

The airshed associated with CCM is typical of a rural area impacted by agricultural activities, mining and exploration activities, and transport activities on unsealed roads.

Existing potential sources of particulate emissions from the surrounding environment primarily comprise:

- mining and exploration activities
- grazing activities
- unsealed roads
- smoke.

There are no residential areas in the vicinity of CCM; the mine camp is located approximately 1 km south-east of the closest mining lease (Magazine Creek).

Emissions or releases

Particulates are released to the environment from a range of mining activities. Sources include vehicle exhaust emissions, vehicles travelling on unsealed roads, loading and unloading ore and waste into haul trucks, transfer of stockpiled ore into crushers, crushing of ore, waste rock stockpile construction, rehabilitation earthworks and wind erosion on bare earth surfaces. Emissions (carbon monoxide, carbon dioxide, sulphur oxides and nitrous oxides) are emitted from vehicle/equipment exhaust emissions, hydrocarbon storage and use of reagents.

There will be no increase to emissions or new sources of emissions to air from the proposed amendment.

Potential impacts

There are no potential impacts to air quality specific to the amendment application.

Management practices

Not applicable.

8.2 Acoustic

Description of Environmental Value

Environmental values associated with acoustic quality are typical of a rural area impacted by agricultural activities, mining and exploration activities, and transport activities on unsealed roads.

Emissions or releases

There are no sources of noise or vibration above ambient levels except for sporadic cattle movement and the operation of the mine (including transport to the mine by road and air).

There will be no increase to noise or vibration from the proposed amendment.

Potential impacts

There are no potential impacts to acoustic quality specific to the amendment application.

Management practices

Not applicable.

8.3 Water

Description of Environmental Value

A description of the EVs of the receiving environment are provided in Appendix A – Receiving Environment Risk Assessment (Hydrobiology 2024). They include aquatic ecosystems, stock watering, secondary recreation, visual appreciation, industrial (mining) and cultural and spiritual values, pertaining to Gunpowder Creek.

Emissions or releases

Releases of contaminants via release of treated MAW are relevant to this application. Details are provided in Appendix A - Hydrobiology (2024) and Appendix C – Engeny (2023).

Potential impacts

Potential impacts to the receiving environment from this application include the contamination of receiving waters and sediments and the degradation of aquatic ecosystems through increased contaminant concentrations and changes to hydrological regimes.

Impacts to aquatic ecosystems from changes to the hydrological regime are not expected to occur as releases will be restricted to the wet season during periods of natural flow and the local ecosystems are adapted to a range of flow conditions, highly variable between years.

Whilst the current EA allows for release of contaminants in treated MAW water, the release limits set in the EA have never been linked to receiving water quality limits. CCPL are proposing to reduce release water limits in most instances and have undertaken scientific assessment of the relationships between release limits, predicted and historic receiving environment water quality and the aquatic ecosystem of Gunpowder Creek.

Hydrobiology conducted a comprehensive technical assessment pertaining to the proposed release limits, receiving water WQOs and risk assessment of the Gunpowder Creek receiving environment. The assessment involved the evaluation of various dilution ratios with set release values and the identification of risks to specific EVs of the Gunpowder Creek receiving environment. The process included a desktop assessment to define overall EVs (specifically, aquatic ecosystem values within the receiving environment downstream of the current release point on Gunpowder Creek) and prepare a dilution model to predict dilution factors for the proposed discharge scenarios into Gunpowder Creek. The model outputs and collected water quality data were assessed against relevant EV protection guidelines, site specific guidelines and recently developed guidelines based on the latest toxicity information (Hydrobiology 2024).

Initial modelling identified predicted concentrations of dissolved copper and cobalt as posing a residual risk to aquatic ecosystems defined for the receiving environment. This did not align with findings of the receiving environment monitoring program (REMP) (Appendix B) that shows no significant differences between reference and receiving environment aquatic ecosystem communities, suggesting that existing WQOs for copper and cobalt are not suitable for assessment of water quality impacts to Gunpowder Creek. Hydrobiology then undertook a copper and cobalt assessment to investigate the bioavailability of copper and cobalt in Gunpowder Creek waters. Results of the assessment are provided in Appendix B of the Receiving Environment Risk Assessment (Appendix A). Hydrobiology derived new WQOs applicable to the protection of aquatic ecosystems in Gunpowder Creek and rerun the dilution modelling.

The results from the surface water modelling investigation demonstrate that the proposed changes to release limits are acceptable for all the proposed dilution scenarios. The proposed dilution scenarios and release values present a low risk to the defined EVs that pertain to the receiving environment of Gunpowder Creek beyond the noted HD zone (Hydrobiology 2024).

Long term water quality monitoring datasets have been compared to default guideline values (DGVs) and developed guidelines for sulfate, copper and cobalt, and overall conformance was noted. GPA2 located upstream of the release point was the only site to consistently contain concentrations above guideline values for zinc and cobalt, likely due to seepage from legacy infrastructure (see ‘Pre-existing Impacts’ below). These findings further help explain why biological indicator monitoring undertaken as part of the REMP has found no significant differences in macroinvertebrate diversity index scores and community assemblages between control and test

sites. Importantly, the current EA allows for higher release values for many contaminants, yet this has not resulted in significant change in the noted biological indicator. The release values proposed as part of this EA amendment are an improvement on the current status quo (Hydrobiology 2024).

Pre-existing impacts

CCPL acknowledge that the mining legacy of the Capricorn Copper Mine site has resulted in ongoing sources of environmental contamination (seepages). CCPL have been upgrading site infrastructure to reduce known seepage from problematic sites such as North Waste Rock Dump and Old Mammoth TSF, as witnessed by DESI officials during a recent site visit.

CCPL are in the process of finalising a site-wide groundwater model after installing an additional 13 groundwater bores and will use this model to plan and undertake a comprehensive seepage and groundwater impact investigation and assessment. However, as DESI notes in pre-lodgement correspondence, this investigation is outside of the scope of the current proposal. Therefore, groundwater assessment has not been included in this application material.

Management practices

Management practices to mitigate the risk of potential impacts to aquatic ecosystems include:

- treatment and testing of MAW to ensure contaminant concentrations are reduced to levels below the relevant contaminant release limit
- real-time water quality monitoring for pH and EC
- real-time monitoring of Gunpowder Creek flow
- automated shut-off of the release with exceedances (upper and lower) in pH, EC or flow
- automated shut-off of release on communications fail with real-time monitoring stations
- annual REMP preparation.

See Sections 7.2 and 7.3 for further details.

8.4 Waste

Emissions or releases

There will be no waste generation from the proposed amendment.

Potential impacts

There are no potential impacts to waste specific to the amendment application.

Management practices

Not applicable.

8.5 Land

Description of Environmental Value

CCM is situated in the hilly and mountainous Mt Isa highlands with elevations ranging from 90 mAHD at Gunpowder Creek to 310 mAHD at the mine site. Slopes range from moderately inclined (average 25–27°) to steep (35°). Skeletal soils are extensive on the ridges and slopes and red earths occur on lower slopes and on alluvial terraces. The pre-mining land capability (at 1997) was Class VIII for almost all the areas, with the remining areas Class VII. Pastoral activities were carried out (in addition to mining and exploration) in the area and was largely limited to the waters of Gunpowder Creek.

Emissions or releases

There will not be any emissions or releases to land associated with the proposed amendment.

Potential impacts

There are no potential impacts to land specific to the amendment application.

Management practices

Not applicable.

8.6 Land Use

Schedule 8, Part 3 of the EP Regs provides guidance on the land use assessment for a proposed activity. Consideration of each of the items in this section of the regulation is provided here.

Site suitability

No amendment to the current release point has been proposed.

Location on site

As above.

Critical design requirements

Not applicable.

9. Risk Assessment

The possible risks and control measures associated with this amendment have been described and ranked in accordance with CCPL's Risk Assessment Criteria.

9.1 Consequence Rating

The consequence of an event (refer to **Table 16**) ranges from 1 (Insignificant) to 5 (Catastrophic) and covers a number of categories.

Table 16: Consequence of an event

1. CONSEQUENCE RATING

When assessing consequence, consider the most credible worst-case impact. Where a risk has multiple impacts, select the category with the highest rating.

CONSEQUENCE RATING (Rating / Category)	Group Financial	Site Financial	Health, safety & well-being	Environment	Social/Cultural Heritage	Legal & Compliance	Reputation
5. Catastrophic	>$75M	>$35M	Multiple fatalities or terminal illnesses/ Multiple total permanent disabling injuries	Irreversible impact to ecosystem/ long term harm to highly valued species/ecosystem	Irreparable damage to tangible/intangible heritage of significance	Loss of licence to operate. Imprisonment of directors/officers	Sustained local, state or national condemnation by media, public, government/non government organisations
4. Major	$15M-$75M	$7M-$35M	Fatality/ Total permanent disabling injury / multiple LTI's > 2 weeks	Long term impact to species/ecosystem	Ongoing impact to tangible/ intangible heritage of significance	Material breach of regulation. Civil litigation/prosecution	Wide spread adverse local or state attention from media, public, government/ non government organisations
3. Moderate	$5M-$15M	$2M-$7M	Lost time injury or illness	Short term impact, not affecting ecosystem function	Recoverable impact to tangible/intangible heritage	Breach of regulation with fines and penalties	Adverse attention from media or heightened concern by local community
2. Minor	$750K-$5M	$500K-$2M	Medical treatment injury or illness	Immediately recoverable environmental impact	Immediately recoverable impact to tangible/intangible heritage	Breach of low level commitment that is reportable	Limited adverse local public or media attention and complaints
1. Insignificant	<$750k	<$500K	First aid treatment injury or illness	Inconsequential environmental impact	No tangible/intangible heritage impact	Procedural non reportable breach	Public concern restricted to localised complaints

9.2 Likelihood Rating

The likelihood of an event (refer to **Table 17**) ranges from A (Rare) to E (Almost Certain).

Table 17: Likelihood of an event

2. LIKELIHOOD RATING

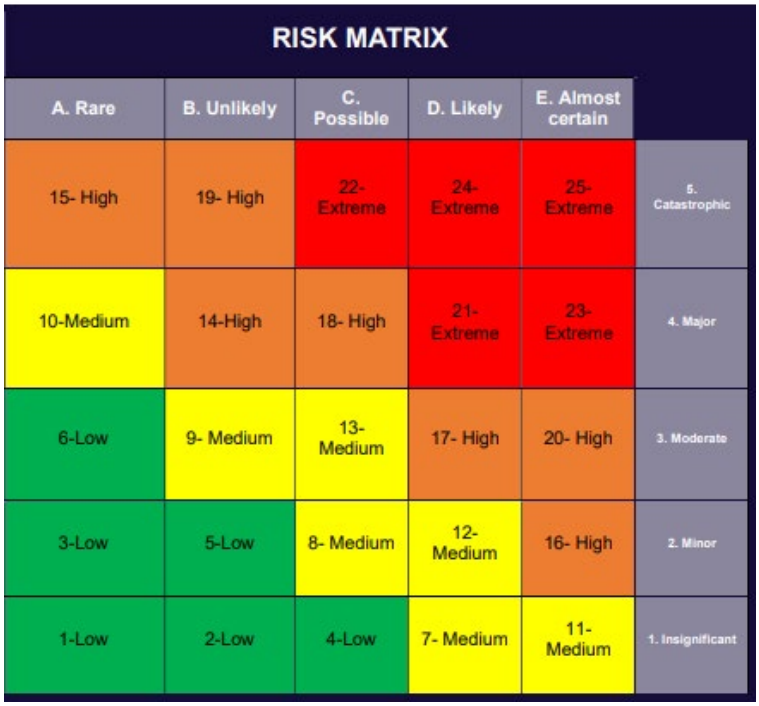
Determine the likelihood of the risk occurring and resulting in the credible worst-case impact

A. Rare	B. Unlikely	C. Possible	D. Likely	E. Almost certain	LIKELIHOOD RATING (Select the rating that best applies to the individual risk. Rows not intended to correlate.)
The event may occur in exceptional circumstances	The event could occur	The event should occur	The event will probably occur	The event is expected to occur	Description (High level business risk)
>25 years	Once every 10-25 years	Once every 5-10 years	Once every 2-5 years	More than once a year	Frequency (Operations)
<1%	1%-10%	10%-20%	20%-50%	>50%	Probability (Projects)

9.3 Risk Ranking

The risk ranking which combines the consequence and the likelihood of an event is used to determine the credible worst case impact (refer to **Table 18**).

Table 18: Risk Ranking



9.4 Risk Assessment

The risk assessment results summarised in **Table 19** has been prepared which includes the current controls and proposed mitigation measures.

Table 19: Risk Assessment of Wet Season Release EA Amendment

Risk Event	C	L	R	Justification and current controls
The site experiences a moderate to extreme weather event while a high water inventory remains onsite (target release volumes not achieved) and results in an uncontrolled release of MAW impacting on EVs of Gunpowder Creek.	4	C	18 - High	The risk ranking has been designated without this amendment approval. Approval of the amendment will allow for a higher volume of water to be released from site, reducing the current onsite water inventory and increasing storage capacity for an extreme weather event.
The water treatment process does not achieve target water quality below release limits and cannot be released, increasing risk of uncontrolled release from high water inventory.	4	B	14 - High	Several MAW treatment strategies will be implemented onsite to achieve target water quality. Additionally, evaporators are being used to reduce the site water inventory. Three water qualities have been proposed in the EA to account for variability in the water chemistry, particularly in the short-term whilst the temporary WTP is operational. Release limits have been calculated in consideration of past water treatment performance and should have a high rate of achievement. Furthermore, application of 3-point moving average will reduce missed release opportunities. See Section 6.1.9 for details of minimising missed release opportunities.

Risk Event	C	L	R	Justification and current controls
				See Section 7.2 for details of water management infrastructure and systems.
Water release equipment failure results in missed release opportunities and increases risk of uncontrolled release from high water inventory.	4	B	14 - High	Several MAW treatment strategies will be implemented onsite to achieve target water quality, which provides contingency against failure or temporary suspension of equipment associated with a single treatment and release system. All pumping equipment will have standby/duty arrangements. The MCD release system and instrumentation is run off a diesel system and is not affected by power cuts. See Section 7 for details of water management strategies, infrastructure and systems.
MAW released in accordance with the amended EA (controlled) impacts the EVs of Gunpowder Creek.	2	B	5 - Low	The release risk assessment undertaken by Hydrobiology determined that releases undertaken in accordance with the proposed condition amendments provided in this document will meet receiving environment water quality objectives and poses a low risk of impacts to the EVs of Gunpowder Creek. The risk assessment models the worst-case scenario water quality releases within compliance conditions (as if all release water concentrations are at the release limit i.e. the maximum allowed), however it is likely that most parameters will be well within the release limits most of the time (limits are set at higher levels to allow for variability within treated MAW storages).
Release water (controlled) exceeds release limits (not in compliance with amended EA) and impacts the EVs of Gunpowder Creek.	2	B	5 - Low	As the real-time monitoring station W1 detects the release water pH or EC approaching EA release limits, an alarm will trigger causing preparation for shutdown of the release. When the pH or EC at W1 reaches the EA limits, the release will automatically shut off. Receipt of daily laboratory results in exceedance of EA release limits will automatically trigger an exceedance notification and the release will be shut off. There is also contingency built into the release limits, release risk assessment and dilution ratios which will serve to buffer potential short-term exceedances experienced due to laboratory processing times. See Section 7.3 for a full description of responses to exceedances.
The background creek flow drops below 2 cumecs during a release and conditions are no longer within compliance.	1	A	1 – Low	As the real-time monitoring station at GPA2 detects the creek flow approaching 2 cumecs, an alarm will trigger causing preparation for shutdown of the release. When the flow at GPA2 reaches 2 cumecs, the release will automatically shut off. If the communications link to GPA2 fails the release will automatically shut off. See Section 7.3.2 for details of the automated release management process.

Risk Event	C	L	R	Justification and current controls
Impact to groundwater quality and quantity from release of higher volume of MAW per year.	NA	NA	NA	CCPL are in the process of finalising a site-wide groundwater model after installing an additional 13 groundwater bores and will use this model to plan and undertake a comprehensive seepage and groundwater impact investigation and assessment. Whilst CCPL acknowledge there has been seepage from legacy mining infrastructure onsite, the assessment of groundwater is not relevant to this particular amendment. See 'Pre-existing Impacts' in Section 8.3.

C = Consequence

L = Likelihood

R = Risk ranking

10. Stakeholder Engagement

CCPL have developed a Stakeholder Engagement Plan to outline the objectives and protocols regarding engagement with key stakeholders. The Engagement Plan presents an overview of the engagement undertaken by CCPL to date, the current engagement context and issues and provides guidance regarding the delivery of stakeholder engagement and its documentation and monitoring.

The site Environment & Community (E&C) team are responsible for the implementation of the Engagement Plan, as well its review and update, in collaboration with the Community Consultative Committee (CCC). The CCC is comprised of representatives of community and other interested / relevant stakeholders that are active participants in the local community and represent the community's values and issues.

Community notification and consultation is facilitated via the CCC with meetings held at least twice yearly, pre and post each wet season, and in the lead-up to significant operational changes. In the context of the Water Release EA amendment, this includes providing opportunity for feedback and input from stakeholders with a genuine interest in the impact of water releases on Gunpowder Creek.

The CCC has a number of documents and templates to capture the communication and collaboration undertaken in these meetings, including

- Stakeholder database template.
- Feedback Form
- Community Reference Group Charter & Code of Conduct.
- Meeting Minutes template.
- Nomination form for membership of the CCC.

CCPL records all interactions including engagement events, enquiries, complaints with stakeholders. In 2023 a Consultation Manager (CM) database was adopted, enabling tracking of all stakeholder interactions and actions. CM is used to ensure complaints are logged and acted upon in a timely manner. Statistical data can be easily gathered and reported on through the CM. Reports generated feed into corporate ESG reporting and enable the team to analyse current and emerging issues and tailor engagement tools accordingly.

11. References

ANZG 2018, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Governments and Australian state and territory governments, Canberra, Australia, <https://www.waterquality.gov.au/anz- guidelines/guideline-values>.

Department of Environment and Science (DES) (2022a). *Deciding aquatic ecosystem indicators and local water quality guideline values*. https://environment.des.qld.gov.au/__data/assets/pdf_file/0029/88148/deriving-local-water-quality-guidelines.pdf

Department of Environment and Science (DES) (2022b). *Technical guideline – Wastewater release to Queensland waters*. https://environment.des.qld.gov.au/__data/assets/pdf_file/0031/88636/pr-gl-wastewater-to-waters.pdf

Engeny (2023) *Gunpowder Creek Release Assessment*, memo from Tim Wallis to CCPL, dated 21 August 2023.

Hydrobiology (2023) *Capricorn Copper Mine 2023 Post-wet REMP Report*, prepared by Hydrobiology for Capricorn Copper Pty Ltd. 31 August 2023.

Hydrobiology (2024) *Receiving Environment Risk Assessment,* report prepared by Hydrobiology for Capricorn Copper Pty Ltd. 18 July 2024.

NRA (2021) *Capricorn Copper Mine Receiving Environment Monitoring Program Design Report*, R01, prepared by NRA Environmental consultants for Capricorn Copper Pty Ltd, 3 February 2021.