MIDDLEMOUNT COAL PTY LTD

Technical Assessment

Environmental Authority Amendment

QC1006_004-REP-002-1

5 APRIL 2024

DISCLAIMER

This Report has been prepared on behalf of and for the exclusive use of Middlemount Coal PTY LTD and is subject to and issued in accordance with Middlemount Coal PTY LTD instruction to Engeny Australia Pty Ltd (Engeny). The content of this Report was based on previous information and studies supplied by Middlemount Coal PTY LTD.

Engeny accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this Report by any third party. Copying this Report without the permission of Middlemount Coal PTY LTD or Engeny is not permitted.

Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
0	29/01/2024	Client Issue	Nutan Gothwal	Ben Kiernan	Nutan Gothwal	Ben Kiernan
1	5/04/2024	Client Issue	Nutan Gothwal	Ben Kiernan	Nutan Gothwal	Ben Kiernan
Signatures:						

CONTENTS

Tables

Figures

1. INTRODUCTION

Middlemount Coal Pty Ltd (MCPL) is the operator of the Middlemount Coal Mine (MCM), an established open-cut coal mining operation situated approximately 7 kilometres southwest of the Middlemount township within the Isaac Regional Local Government Area, Queensland. The mining activity encompasses a singular open-cut pit, two out-of-pit dumps, and the requisite infrastructure, per the approved Environmental Authority (EA) granted under EPML00716913 (DESI, 2024).

The recent Operational Water Management Plan (OWMP) (Engeny, 2022) concluded that the site faces intricate challenges in managing Mine-affected Water (MAW) inventory under varying climate conditions. In scenarios of elevated rainfall, the study estimated the projected MAW volume could exceed designated storage capacity. The inability to release MAW under the current EA conditions, is the main driver of risk under 'wet' climate conditions. Conversely, extended dry seasons heightened the need for a secure third-party water supply to sustain mining activities.

MCPL has undertaken a series of technical assessments to reduce the risk to operations and non-compliant release of MAW. One of the recommendations out of the assessment has been to amend the current mine water release conditions to mitigate the risk of accumulating volume and evapo-concentration of salt posing a mine closure risk. Under the EA amendment application, MCPL is requesting to amend the existing release conditions for MCM site to be consistent with the surrounding coal mine operations in the Roper Creek catchment. Along with the minor amendment supporting information, the following technical study describes the impact of the proposed amended release conditions on the MCM site operations, downstream environment, and downstream operations.

Figure 1.1 shows the regional overview and water management infrastructure for the MCM.

1.1 Purpose and Scope

This technical documentation is intended to address the implication of the proposed amendments to the release conditions outlined in Section 3 of the Supporting Information Document and Table 1.1. The key findings from the technical study will be referenced where applicable to provide context for the impact assessment. This document will outline the following:

- Calibration of natural rainfall runoff parameters
- Water balance model validation against recoded water inventory and water quality in MWD (bulk water storage)
- Correlation of EC and sulphate concentrations
- Water balance modelling forecast
- Impact assessment of proposed enhanced release conditions, including:
  - Impact on the operational performance.
  - Impact on the downstream environment.
  - Impact on downstream operations.

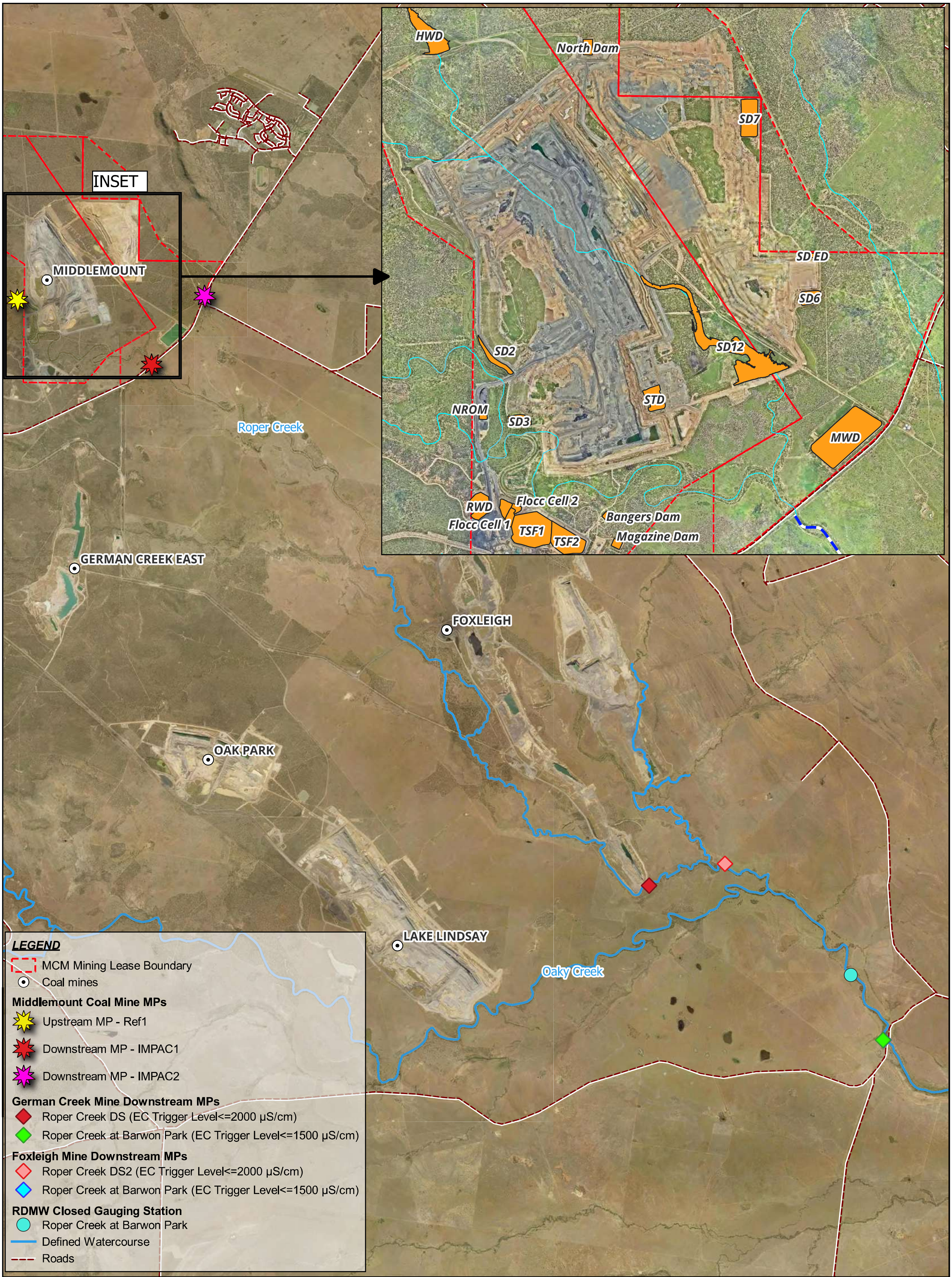
1.2 Relevant Legislations and Guidelines

- QWMN Good Modelling Practice Principles (DES (now DESI), 2018)
- Technical Guideline. Wastewater Release to Queensland Waters (DES (now DESI), 2022)
- Guideline. Receiving environment monitoring program (DES (now DESI), 2022)
- Fitzroy Basin regional receiving environment monitoring program guideline (DES (now DESI), 2023)
- Guideline. Reef discharge standards for industrial activities (DES (now DESI), 2023).

1.3 Technical Framework

The technical study, detailed in this report, uses the latest site-specific GoldSim water balance model (Engeny, 2022) to conduct a water balance assessment. The study delineates the potential releases that may arise from the proposed amendments, detailed in the Section 3 of the Supporting Information document and Table 1.1 summarises the proposed release conditions.

In this technical assessment, potential releases are evaluated in terms of both water quality and quantity. The controlled release dam, i.e., Mine Water Dam (MWD) is modelled at a constant electrical conductivity (EC) of 10,000 µS/cm, representing the maximum proposed End-of-Pipe (EOP) EC (refer to Table 1.1). By adopting this modelling approach and utilizing a constant EC, the assessment mitigates the limitations or uncertainties associated with the water quality modelling. The proposed release conditions are designed to augment the existing approved activities at MCM with no requirement for any modifications to the mine plan, or the approved extent of disturbance. Therefore, the intention behind these proposed conditions is not to change the existing mine plan but to optimise the operational strategy in a manner that aligns with industry standards and enhances operational resilience.



R	DETAILS	DATE
1	Final Issue	25-01-2024

DRAWN	NG	CHECKED	BK
APPROVED	BK	DATE	25-01-2024

NOTES:

N

0 1,000 2,000

SCALE @ A3 - 1:100,000

GDA94 / MGA zone 55

DISCLAIMER

Engeny has endeavoured to sure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map.

DATA SOURCE

QLD Government Open Data Source

ENGENY

middlemount coal PTY LTD

Figure 1.1

Middlemount Coal Pty Ltd
EA Amendment Supporting Information
Middlemount Coal Mine - Regional and Site Overview

Drg Ref.
QC1004_006-SKE-001

Q:\Projects\QC1006 Middlemount Coal\QC1006_004 MCPL Release Potential\05 Design\QGIS\Workspaces\QC1006_004-WOR-001-B-Figures-NG.qgz

TABLE 1.1: PROPOSED CONTROLLED RELEASE CONDITIONS

Receiving Waters	Receiving Water Flow Criteria	Receiving Water Flow Rate	EOP Release Rate *	EOP Release Limits **	Receiving Waters Contaminant Trigger Levels **
Roper Creek	Low Flow	For a period of 28 days after natural flow events that exceed 2 m^3/s	0.4 m^3/s	Electrical Conductivity = 700 µS/cm Sulphate, SO_4 = 250 mg/L	Electrical Conductivity = 700 µS/cm Sulphate, SO_4 = 250 mg/L
	High Flow	> 2 m^3/s	2.0 m^3/s	Electrical Conductivity = 10,000 µS/cm Sulphate, SO_4 = 1,000 mg/L	Electrical Conductivity = 2,000 µS/cm Sulphate, SO_4 = 250 mg/L

** EOP is abbreviation for end of pipe.*

*** No changes are proposed to EOP release limits and receiving waters trigger levels for other contaminants summarised in Table C2 and Table C5 of the EA (DESI, 2024).*

2. ENVIRONMENTAL CONTEXT

2.1 Climatic Conditions

The MCM regional area has a semi-arid to sub-tropical climate, typical for Central Queensland. The site experiences typical wet-dry climate pattern. The wet season, usually from November to March which brings the majority of the annual rainfall. Whereas the site enters dry season from April to October. Rainfall significantly decreases during this time and evaporation rates increase due to the reduced cloud cover and higher temperatures.

2.1.1 Rainfall Pattern

Figure 2.1 shows average monthly rainfall graph which illustrates the typical rainfall patterns observed at MCM.

Further, an analysis has been conducted on the historical rainfall data for the MCM. This data comprises a combination of on-site recorded rainfall available from April 2016 onwards and drill data rainfall from January 1889 to the present. By combining the datasets, a long-term rainfall exceedance plot was created as shown in Figure 2.2. This plot specifically also includes the annual rainfall trends from the water year 2016 to 2023 (i.e., June to July).

The plot indicates that the year 2016-17 had slightly above-average annual rainfall (623 mm/year), while the subsequent four years (2017-18 to 2020-21) were consistently dry, with annual rainfall below average and median conditions. In contrast, the last two years, 2021-22 and 2022-23, stood out as high-rainfall years, recording 826 mm/year and 873 mm/year respectively.

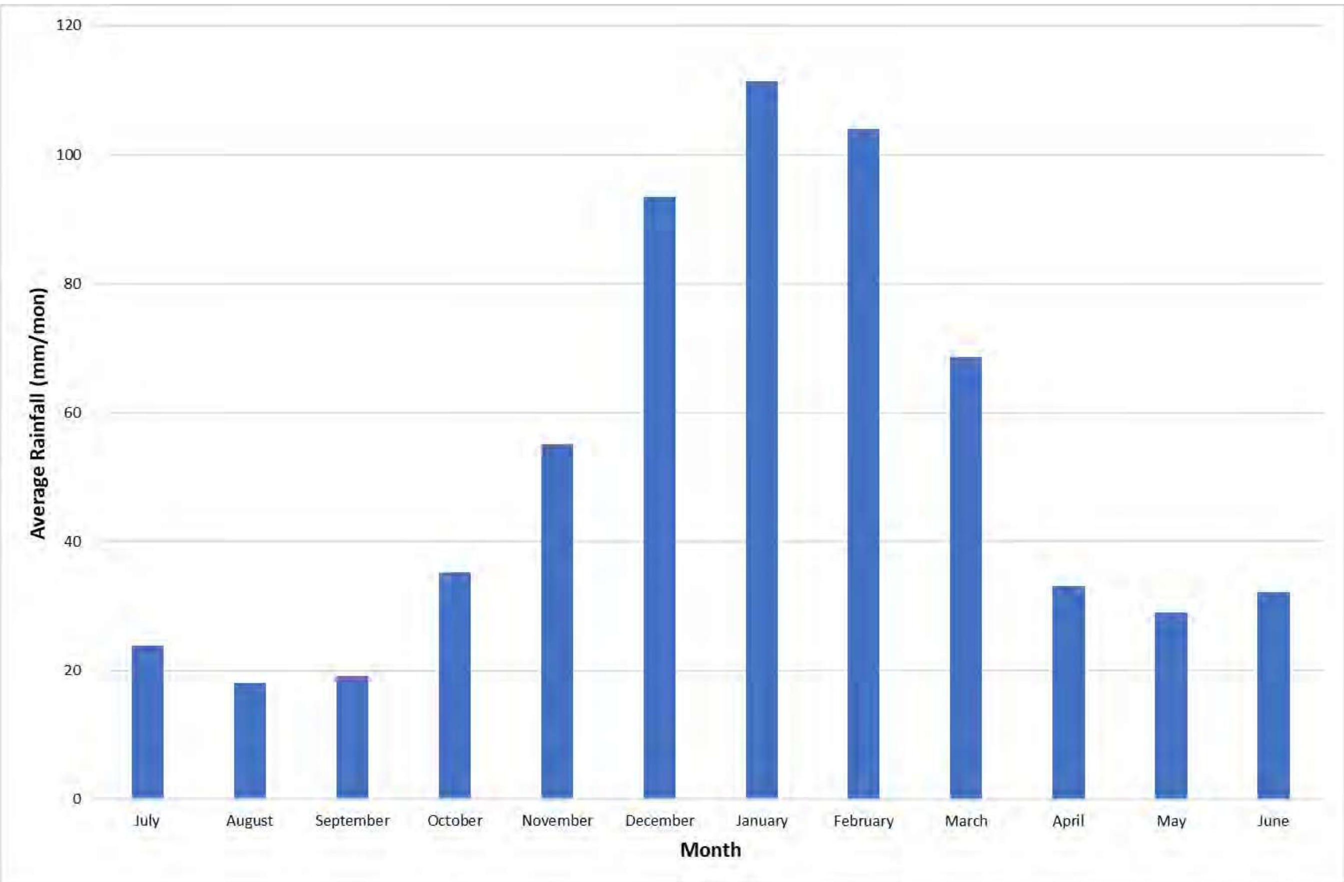


Figure 2.1: Average Monthly Rainfall

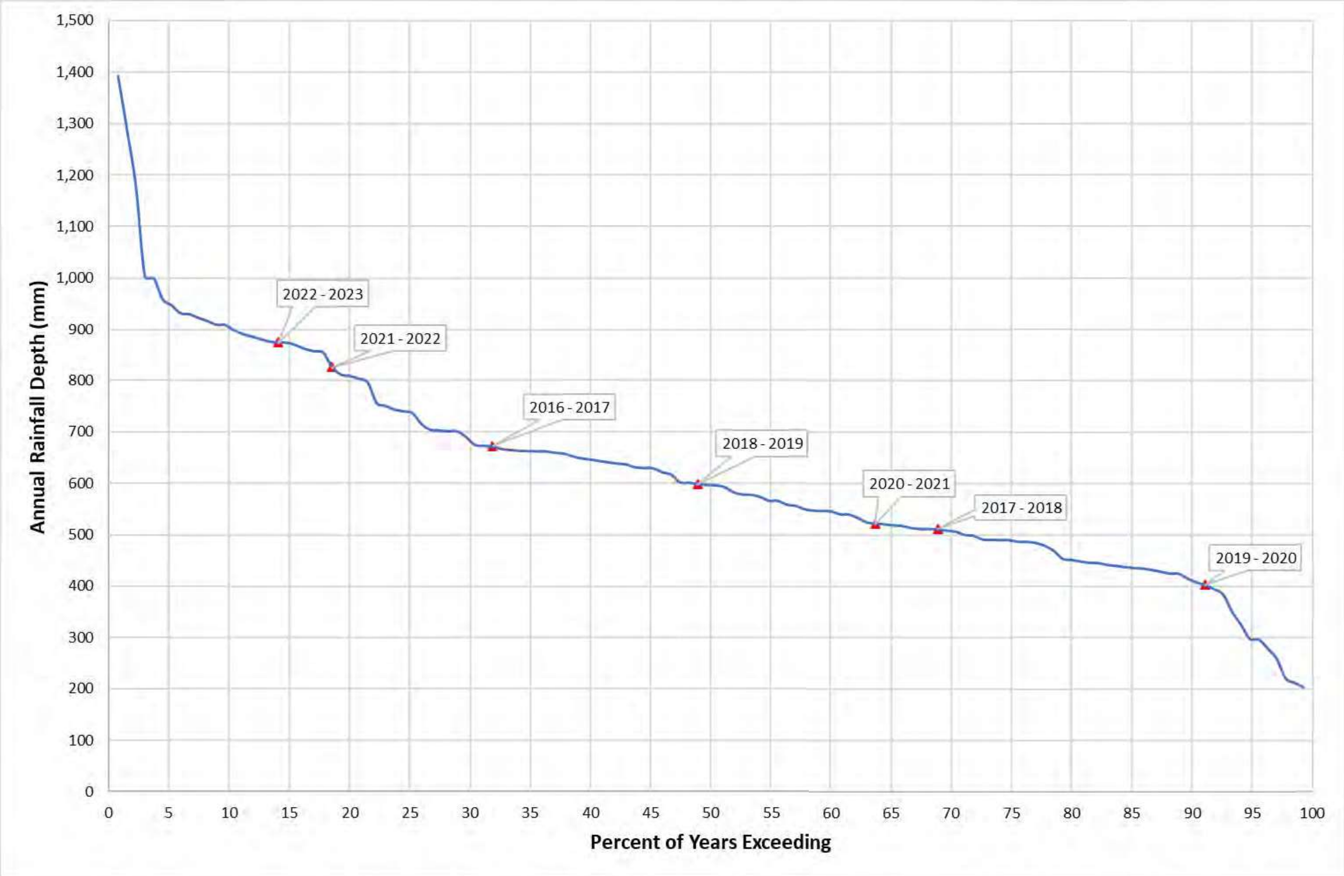


Figure 2.2: Annual Rainfall Totals (Composite Data Series)

2.1.2 Evaporation

Morton's Lake evaporation data extracted from SILO data drill was used to estimate the loss of water due to evaporation from the ponded surface in the WBM. Figure 2.3 provides an illustration of the annual distribution of average monthly evaporation. Throughout the year, the average monthly evaporation surpasses the average monthly rainfall. This is further reflected in the annual average evaporation rate, which amounts to 1,796 mm/year, significantly exceeding the corresponding annual average rainfall.

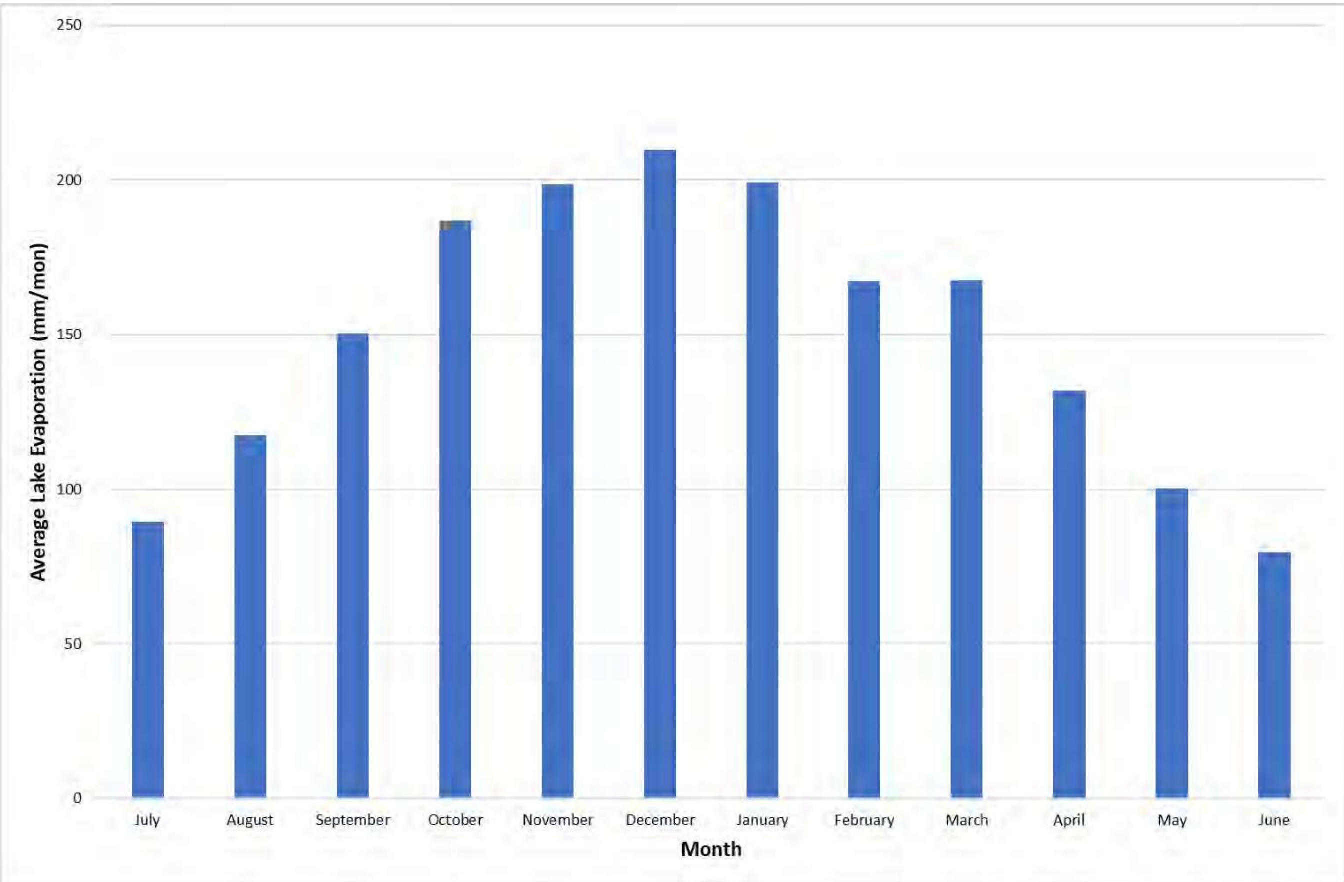


Figure 2.3: Average Monthly Evaporation

2.2 Receiving Environment: Roper Creek Catchment

MCM is situated within the Roper Creek Catchment. This catchment is characterized by a network of natural waterways, including Roper Creek, Thirteen Mile Gully, and an unnamed tributary of Roper Creek. Refer to Figure 1.1.

The controlled releases of mine-affected water are designated to take place within Roper Creek from authorised release point (RP2), spanning the distance between the specified upstream and downstream monitoring locations outlined in the EA (DESI, 2024).

Roper Creek is an ephemeral waterway that flows in response to rainfall (i.e., no base flow). This characteristic often results in brief but intense flow periods following rainfall events. The catchment area of Roper Creek up to the downstream boundary of the MCM mine lease, inclusive of the Thirteen Mile Gully catchment, is approximately 389 km². This area accounts for approximately 23% of the area of Roper Creek at Barwon Park Gauging Station and approximately 1.3% of the total area with the Mackenzie River.

2.2.1 Land Use

The land downstream of the MCM is typically used for grazing and mining, with rural homesteads located on properties. Several other mining and petroleum tenements are located within the Roper Creek catchment, surrounding the MCM site, including the German Creek Coal Mine, Foxleigh Coal Mine and Oaky Creek Coal Mine which adjoins the MCM site to the west and south. These downstream sites are also authorised to release mine-affected water under their respective release conditions. Refer to Figure 2.4 for land use mapping.

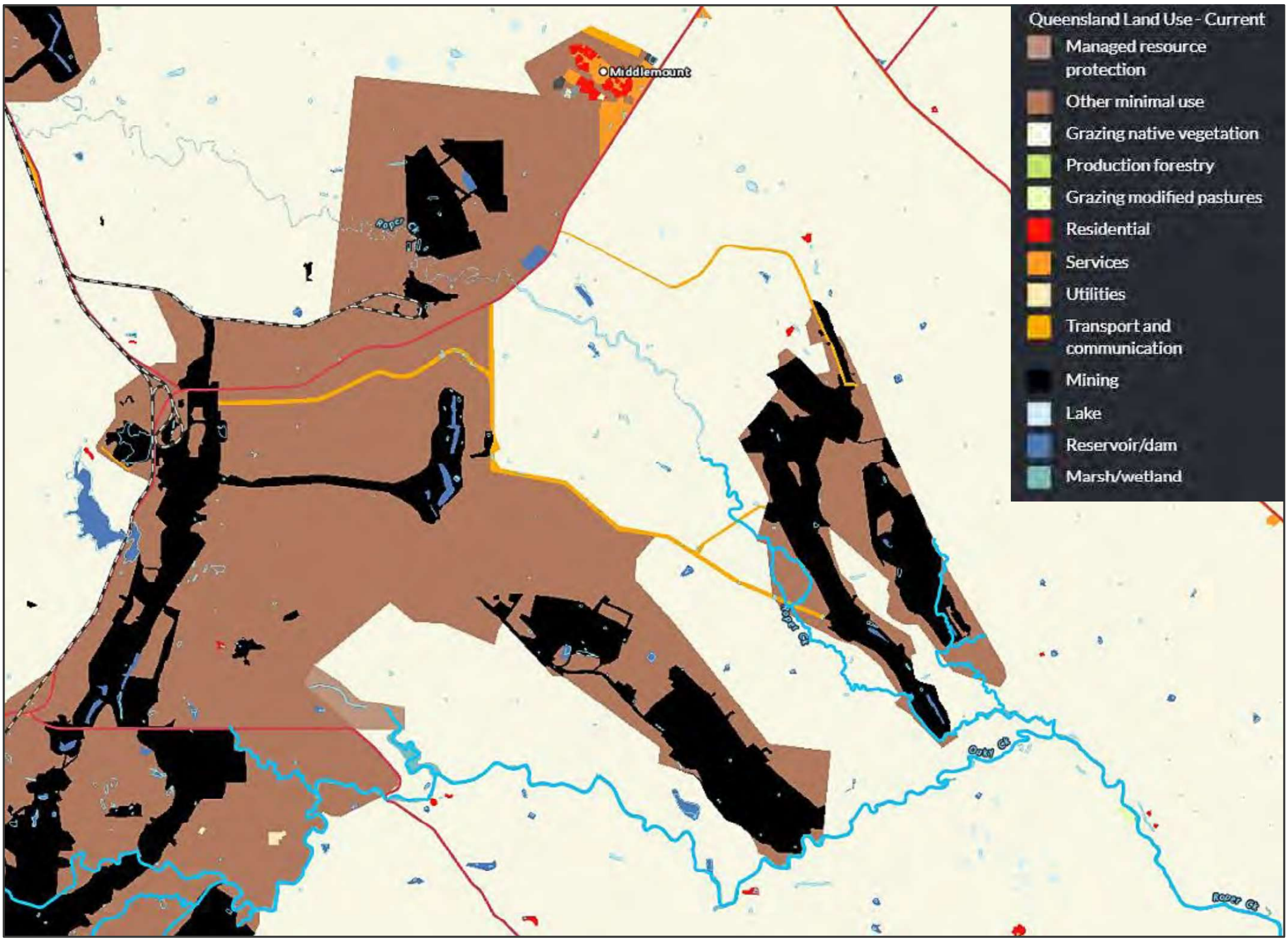


Figure 2.4: Land Use in The Vicinity Of MCM Site

2.2.2 Environmental Values

The environmental values (EVs) relevant to the EA amendment application are discussed in the Section 4 of the Supporting Information Document.

3. STREAMFLOW ASSESSMENT

3.1 Streamflow Gauging Station

The Queensland Government operated a streamflow gauge on Roper Creek at Barwon Park (Station No. 130107A), located approximately 28 km downstream of MCM, refer to Figure 1.1. The gauging station was operating from October 1971 to September 1988 (18 years) and the catchment area reporting to the station is 2,126 km2.

3.2 Natural Rainfall Runoff Calibration

A rainfall-runoff model (Australian Water Balance Model (AWBM)) was developed for the Roper Creek streamflow gauge at Barwon Park to calibrate the natural runoff AWBM parameters to estimate a streamflow series at the Roper Creek upstream and downstream monitoring locations outlined within the Table C6 of the EA (DESI, 2024). The rainfall-runoff model was simulated on a daily timestep for the period 01/10/1971 to 30/09/1988 (18 years) and compared against the recorded streamflow data. A schematic representation of the AWBM is provided in Figure 3.1. The AWBM can be summarised as:

- Three surface stores simulate partial areas of runoff, with the water balance of each surface store calculated independently of the others.
- At each time step, rainfall (mm) is added to each of the three surface stores and evapotranspiration (mm) is subtracted from each store.
- If the depth of water in any store exceeds the capacity of that store, a defined fraction of the excess moves to the surface runoff store, and the remainder moves to the baseflow store.
- The excess is released from the surface runoff store and the baseflow store according to a regression constant.
- The total runoff is the sum of the baseflow and surface runoff components.

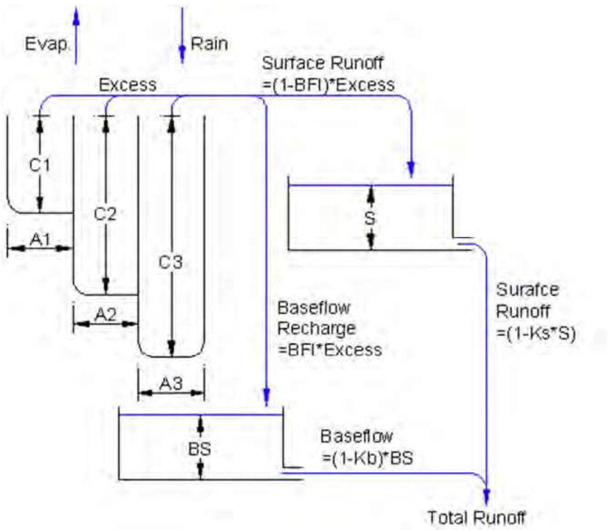


Figure 3.1: AWBM Schematic

3.2.1 Climate Data

Data drill daily climate sequence data were extracted from the SILO (Scientific Information for Land Owners) database maintained by the Queensland Government's Department for Environment, Science and Innovation (DESI) from October 1971 to September 1988. Average daily rainfall and evaporation data for the rainfall-runoff model was developed using the 4 data drill points (DD1: -22.85 148.45; DD2: -22.85 148.65; DD3: -23.05 148.45; DD4: -23.05 148.65) within Roper Creek at Barwon Park catchment. Daily evapotranspiration was calculated based on average morton actual evapotranspiration.

3.2.2 Calibration Performance

The AWBM model parameters were calibrated so the modelled streamflow volumes produced the best possible fit to the recorded streamflow. The calibration process involved the following:

- Matching modelled and recorded annual and monthly streamflow volumes
- Matching the daily streamflow duration curve
- Reproducing daily runoff volumes and timing of the largest recorded individual runoff events
- Matching the number of days per year such that modelled and recorded streamflow is above the proposed flow threshold of 2 m^3/s (172.8 ML/day).

The three initial store depths and partial areas were adjusted to match runoff volumes for the small, medium and large runoff events, and the baseflow index and rescission constants were adjusted to match streamflow duration characteristics. The calibrated AWBM parameters are shown in Table 3.1 and the calibration results are summarised in Table 3.2. Detailed calibration results are provided in Figure 3.2, Figure 3.3, and Figure 3.4.

TABLE 3.1: ROPER CREEK AT BARWON PARK CALIBRATED AWBM PARAMTERS

AWBM Parameters	Calibrated Value
Soil Store Depths (mm)	C1 = 50
	C2 = 250
	C3 = 300
Partial Areas	A1 = 0.09
	A2 = 0.44
	A3 = 1-(A1+A2)
Baseflow Index (BFI)	0.1
Surface Recession Constant (Ks)	0.96
Baseflow Recession Constant (Kb)	0.54

TABLE 3.2: AWBM CALIBRATION RESULTS SUMMARY

Parameter	Recorded	AWBM
Runoff Coefficient (%)	4.43	4.43
Average Annual Flow (GL)	60.9	60.9
Average Monthly Flow (GL)	5.3	5.3

3.2.3 Calibration Summary

The AWBM calibration to the Roper Creek at Barwon Park can be summarised as:

- Calibration was first undertaken using existing natural AWBM parameters developed in previous studies, however, due to poor calibration using existing parameters, AWBM parameters for natural catchment were then refined by matching observed and AWBM flow duration curves and hydrographs.

- The calibrated set of AWBM parameters are summarised in Table 3.1. The calibrated AWBM parameters produced a reasonable calibration to the Roper Creek at Barwon Park streamflow gauging station for both runoff volumes and flow duration characteristics above the proposed flow threshold.
- The annual runoff for the recorded flow for calibration period averages 28.7 mm/year, while AWBM predicted flow is 28.6 mm/year.
- The model calibration is considered to be good for the purpose of this assessment as the linear regression correlation coefficient (R^2) for release opportunity per year is 0.9, refer to Figure 3.4:.
- The AWBM calibrated parameter produce similar average annual and average monthly runoff volumes compared to recorded data, refer to Table 3.2.
- Key limitations of calibration:
  - The SILO data drill daily climate data is interpolated from the BoM gauging stations and therefore the lack of gauged climate data available is a limitation of the calibration accuracy.
  - The AWBM calibration is undertaken such that the parameters produce similar flows above the proposed flow threshold of 2 m^3/s. Therefore, the parameters may not accurately estimate runoff volumes during streamflow events smaller than 2 m^3/s.

In the water balance model, the AWBM parameters given in Table 3.1 are used to simulate runoff from 'natural/ roper creek' sub-catchment areas and are used simulate the flows at the Roper Creek upstream monitoring station, Ref1 (refer to Figure 1.1) and Roper Creek downstream monitoring point (IMPAC1).

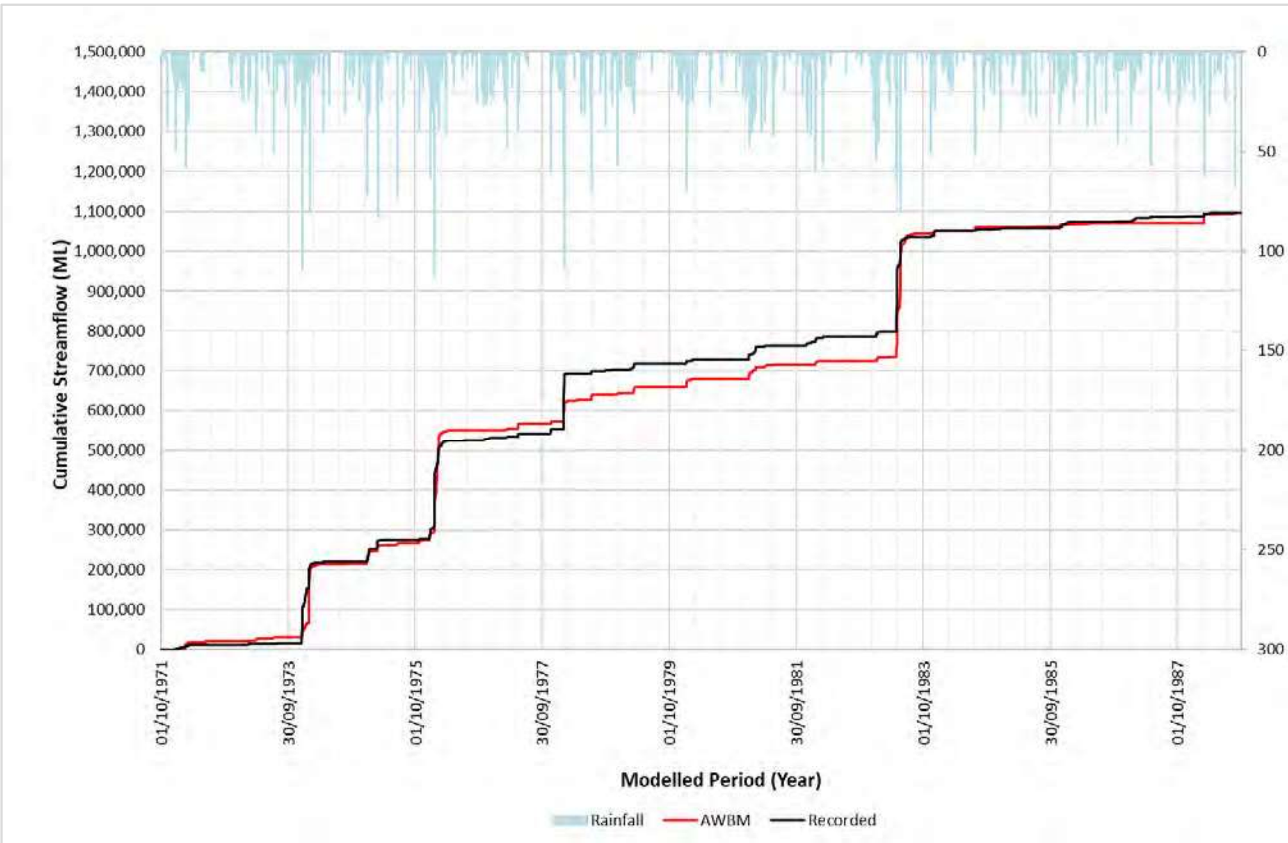


Figure 3.2: Cumulative Streamflow Volume

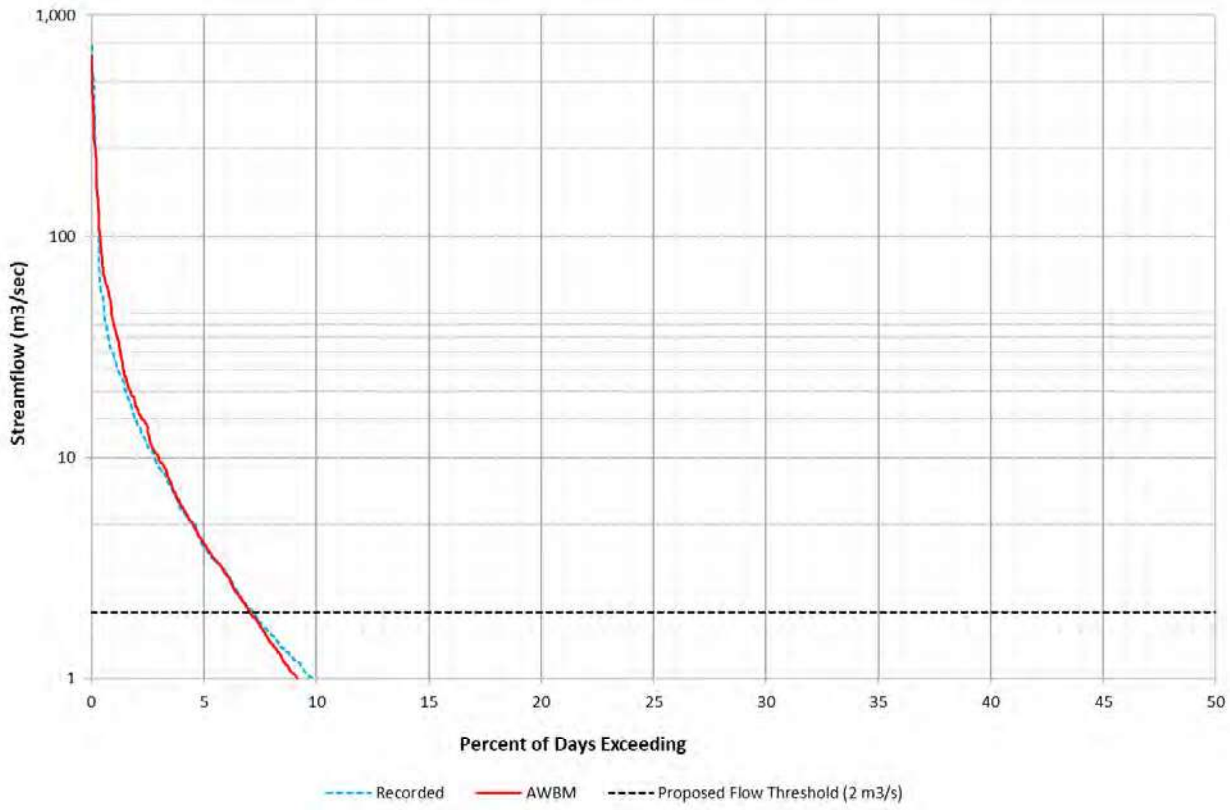


Figure 3.3: Daily Flow Duration Curve

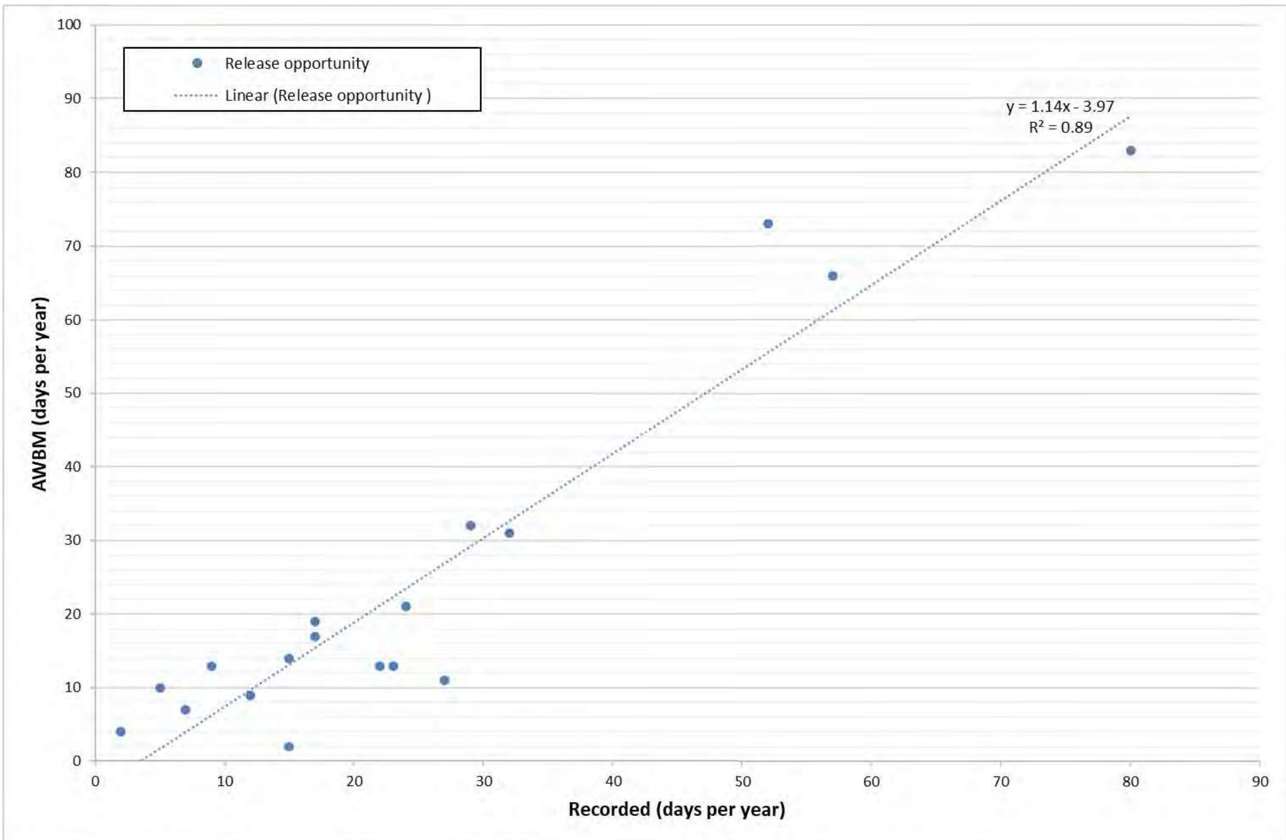


Figure 3.4: Release Opportunity Comparison (I.E., Streamflow > Proposed Flow Threshold)

4. WATER BALANCE MODELLING

4.1 Model Objective

The key objectives of the MCM water balance model (WBM) for this technical documentation are:

- Undertake model validation to enhance confidence in forecast modelling outcomes.
- Represent the mine Water Management System (WMS) including the maximum disturbance footprint (no rehabilitation) and storages based on the Life of Mine (LoM) plan.
- Represent the strategies developed for key operational activities to assist in management of changing climate conditions.
- Demonstrate the outcomes of the proposed release conditions (see Table 1.1) as to how it will improve the risk to operations and its associated impacts on the downstream environment and downstream operations.

4.2 Model Description

The MCM site WBM was initially developed by in 2021 using the GoldSim software package (Engeny, 2021). and was further updated 2022 (Engeny, 2022).

The latest version of the model was adopted for this technical assessment. The model operates on a daily time step and simulates the quantity and quality of water within water storages and operational pits, as well as waterways that have the potential to receive discharges of mine-impacted surface water during large rainfall events.

The MCM WBM simulates changes in stored volumes of water in all modelled storages in response to inflows and outflows. For each storage, the model simulates:

Change in Storage = Inflow – Outflow

The inflows and outflows of the MCM WBM are demonstrated in Table 4.2.

Key aspects of the model include:

- The model can be used to simulate 135 years of historical data (combination of SILO climate data and site recorded data).
- The water balance model includes a coupled salt balance to estimate the Total Dissolved Solids (TDS) within each storage and receiving waterway.
- TDS is converted to EC within the model based on an assumed conversion factor of 1 mg/L TDS = 1.49 µS/cm EC in accordance with the Australian Drinking Water Guidelines (NHMRC, 2022).
- The model simulates the LoM mine water infrastructure, including storage, pumps, pipelines, and water releases.
- Water storage characteristics are simulated using the latest storage curves representing volume-area and volume-level relationships.
- The potential for mine water release is estimated based upon the simulated flow of receiving waterways using the calibrated AWBM parameters as well as the salt assimilative capacity at the Roper Creek upstream monitoring point, Ref1 (refer to Figure 1.1) in accordance with the EA conditions (DESI, 2024).
- The water balance model forecast is performed using deterministic simulation over 135 years to demonstrate the mine affected water system performance using 135 years of historical climate sequence.
  - Inflows: The model assumes maximum inflows to the site water management system.
    - The model has adopted the maximum catchment areas based on the maximum disturbance footprint. This operational scenario is conservative as it assumes no progressive rehabilitation whereas, the MCPL strategy is to progressively rehabilitate the spoil dump to minimise the mine affected water runoff.
    - The maximum estimated groundwater inflows are adopted.
  - Outflows: The model assumes current site water demands as the minimum outflows from the site water management system.
    - Current CHPP throughput and dust suppression demand is adopted as the constant demand over the simulation period.

4.2.1 Modelled Storage and Operational Rules

Table 4.1 provides a summary of the key modelled water storages within or connected to the MCM WMS via pumps and pipelines shown in Figure 4.1.. The storages and their functional descriptions outlined below reflect an adopted operational strategy designed to accommodate potential future changes in the MCM WMS.

TABLE 4.1: MODELLED STORAGES AND FUNCTIONAL DESCRIPTION

Storage ID	Maximum Modelled Catchment Area (ha)	Full Supply Capacity (ML)	Functional Description
Raw Water Dam (RWD)	30	191	Mine affected water storage Min. Operating Volume = 30 ML Max. Operating Volume = 120 ML Receives inflows from NROM, SD1/SD1 ext., STD, MWD2, and MWD. Receives inflows from Bingegang third-party supply at 2ML/day if the total mine water inventory < 750 ML. Pumps to STD if inventory exceeds 120 ML. Supplies water to CHPP and vehicle washdown.
Mine Water Dam (MWD)	31	1,927	Mine affected water storage. The MWD is proposed to act as the secondary bulk water storage after commencement of the MWD2 and consequently be the secondary supply for the operational demands. Min. Operating Volume = 750 ML Max. Operating Volume = 1,705 ML Receives inflows from Open Cut Pit, MWD2, STD, SD6, and SD12. Pumps to RWD (bypassing STD) Can make controlled releases. Cease all controlled releases when the total mine water inventory <1,750ML. Overflows to Thirteen Mile Gully
North Mine Water Dam (MWD2)	12	1,187	Mine affected water storage currently undergoing construction. The dam is proposed to act as the primary bulk water storage for the site and supplying the demands and needed. Min. Operating Volume = 750 ML Max. Operating Volume = 1,050 ML Proposed to receive inflows from the Open Cut Pit. Proposed to pump to RWD and MWD. Proposed to supply dust suppression demand.
Sed Dam 1/ Sed Dam 1 extension (SD1/SD1 ext.)	15	60	Mine affected water storage Receives inflows from TSF1, TSF2, and FC1/ FC2

Storage ID	Maximum Modelled Catchment Area (ha)	Full Supply Capacity (ML)	Functional Description
			Pump dry to RWD when storage capacity available and to unconstraint pumping to STD to minimise the risk of uncontrolled overflow. Overflows to Roper Creek
South Transfer Dam (STD)	22	26	Existing mine affected water storage Min. Operating Volume = 10 ML Max. Operating Volume = 20 ML Receives inflows from Open Cut Pit, RWD, NROM, SD1/SD1 ext., SD3, and SD6 Pumps to RWD and MWD Supplied water to dust suppression demand. Overflows to mining pit
Open Cut Pit	1,660	-	Active mining pit is planned to be mining into north, south, and south-east direction during its life of mine (LoM). The pit receives groundwater inflow. Operability threshold = 130 ML Continuous dewatering to STD and MWD
Tailings Storage Facility 1 (TSF1)	16	187[1]	Inactive tailings storage facility Pumps direct rainfall and runoff volume to SD1/SD1 ext. Overflows to Roper Creek
Tailings Storage Facility 2 (TSF2)	11	535[1]	Active tailings storage facility Supplies water to CHPP and RWD (via SD1/SD1 ext.) Overflows to Roper Creek
Emergency Storage Cells (FC1/FC2)	5	52[1]	Emergency Flocc Cells Pumps to SD1/SD1 ext. Overflows to Roper Creek
North ROM Dam (NROM)	5	4	On-site sediment affected water storage Pumps to RWD Overflows to Roper Creek
Sed Dam 2 (SD2)	41	30	On-site sediment affected water storage Pumps to SD3 Overflows to Roper Creek
Sed Dam 3 (SD3)	25	78	On-site sediment affected water storage Pumps to STD if the total MAW inventory < 1,000 ML Overflows to Roper Creek

Storage ID	Maximum Modelled Catchment Area (ha)	Full Supply Capacity (ML)	Functional Description
East Dump Sed Dam (SD_ED)	147	59	On-site sediment affected water storage Overflows to SD6
Sed Dam 6 (SD6)	175	54	On-site sediment affected water storage Pumps to MWD if the total mine water inventory < 1,000 ML Overflows to Roper Creek
Sed Dam 7 (SD7)	210	200	On-site sediment affected water storage Overflows to SD_ED
Sed Dam 12 (SD12)	552	326	On-site sediment affected water storage Pumps to MWD if the total mine water inventory < 1,000 ML Overflows to Roper Creek

[1]*This is remaining tailings storage capacity and is excluded from the total MAW storage capacity.*

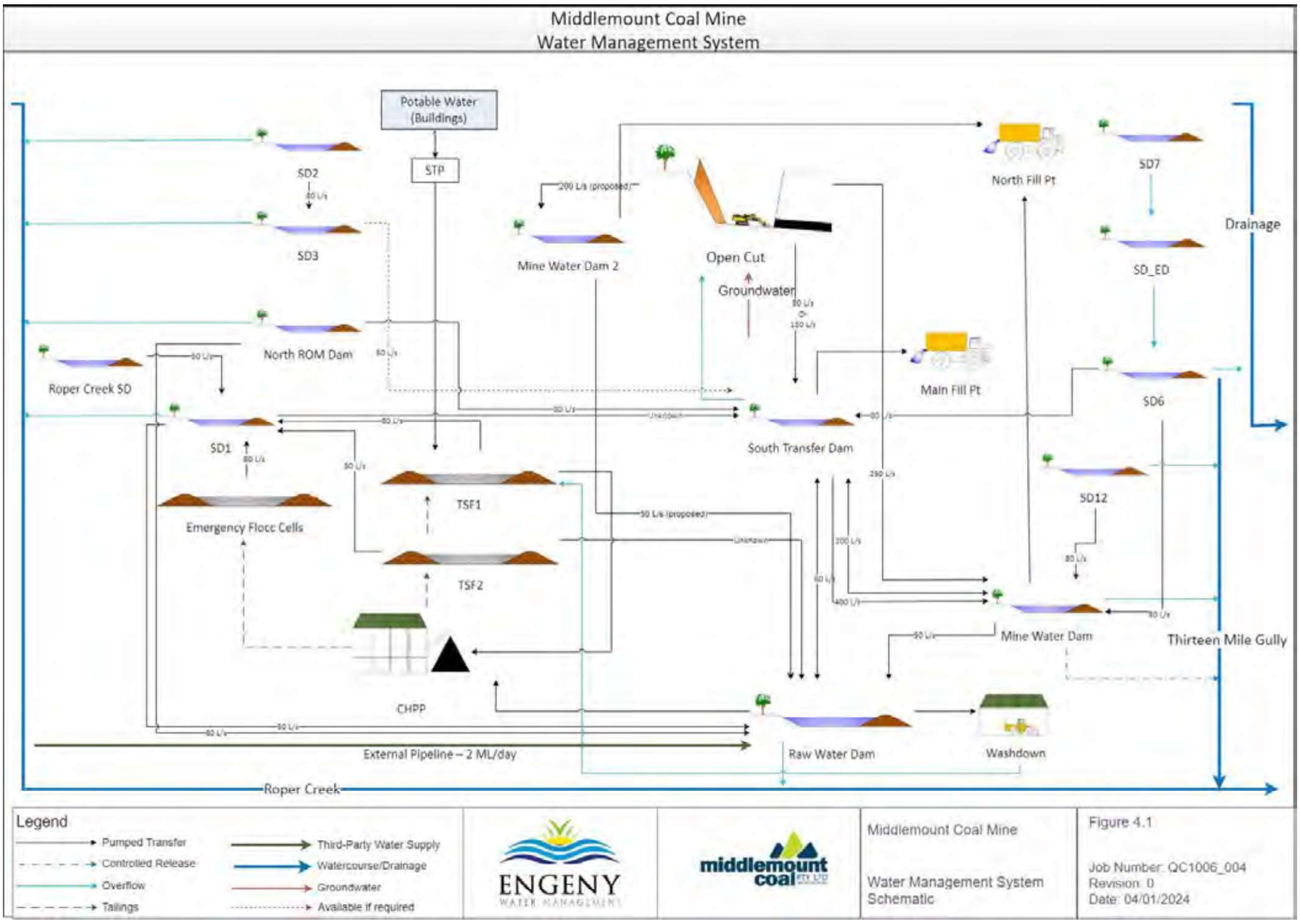


Figure 4.1: Modelled Water Management System

4.2.2 Model Input Data and Assumptions

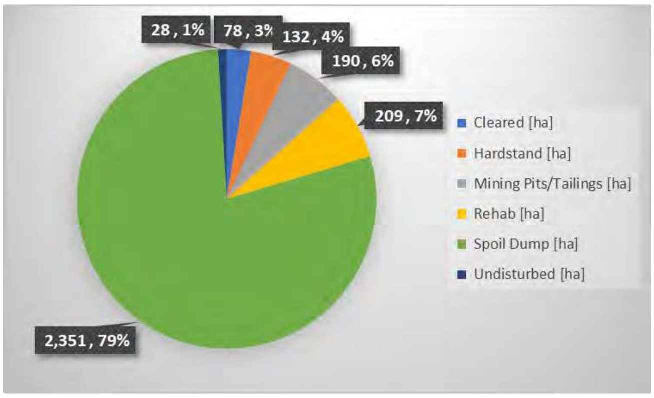
TABLE 4.2: INPUTS AND ASSUMPTIONS

Input	Description
Water Balance Model Simulation Settings	
Run Control	The water balance model is simulated over continuous 135 years using historical climate data with single realisation to capture the a snapshot in time to estimate maximum potential mine affected water releases under the proposed release conditions. A continuous simulation allows for a thorough analysis of the water balance, accounting for various hydrological processes, seasonal variations, and interannual variability. This provides a holistic understanding of the system's response to different climatic conditions and long-term water management system performance. The simulation is based on water year (1 July to 30 June)
Inflows	
Rainfall	Rainfall is recorded on a daily basis at Middlemount Coal Mine rainfall gauging station and is available from April 2016 onwards. Due to short-term period of the site recorded data, regional data has been obtained to develop a long-term data set. The climate series is developed using combination of the following and the combined data set covers the period of January 1889 to April 2023 (135 years): • Historical SILO Data Drill climate series taken at Latitude - 22.85; Longitude 148.65 (Source: https://www.longpaddock.qld.gov.au/silo/point-data/). • Site recorded rainfall data from April 2016 onwards. (Source: https://www.weathermation.net.au/WMLogin.aspx). The long-term annual average rainfall at Middlemount Coal Mine is 623 mm. Refer to Section 2.1.1 for variation in historical annual rainfall depths by water year experienced at the site.
Catchment Runoff	Catchment runoff has been simulated using the AWBM. The model represents the catchment using three surface stores to simulate partial areas of runoff. The water balance of each surface store is calculated independently of the others. The model calculates the water balance of each partial area at daily time steps. At each time step, rainfall is added to each of the three surface stores and evapotranspiration is subtracted from each store. If the value of water in the store exceeds the capacity of the store, the excess water becomes runoff. Part of this runoff becomes recharge of the baseflow store if there is a baseflow component to the stream flow. The adopted AWBM parameters for the site are shown below.

Parameters	*Undisturbed*	*Hardstand*	*Mining Pit/Tailings*	*Soil Dump*	*Rehab*	*Cleared*
C1 (mm)	24	4	3	40	24	20
C2 (mm)	118	20	15	200	118	100
C3 (mm)	268	40	30	400	268	200
A1	0.062	0.33	0.33	0.1	0.062	0.1
A2	0.439	0.33	0.33	0.4	0.439	0.4
BFI	0	0	0	0.9	0	0
Kb	0	0	0	0.8	0	0
Ks	0	0	0	0	0	0

Input	Description					
Evapotranspiration	Morton actual evapotranspiration					
Runoff EC (µS/cm)	380	1,000	5,800	500	500	1,000

The contributing catchment to the open-cut pit and each water storage dam has been determined using the maximum disturbance based on the LoM disturbance extent supplied by MCPL in February 2023. The catchment areas and land use distribution are shown below, and a constant catchment area is adopted over the simulation period.



Input	Description
Ground Water Inflows	Estimates of the groundwater inflow rates to the mining pits were predicted as part of the Southern Extension Project - Groundwater Impact Assessment (AGE, 2020). A constant groundwater inflow is adopted over the simulation period based on the year 2023 (maximum groundwater inflow). It is assumed that only 50% of the estimated groundwater inflows contribute to the mine water system due to evaporative losses from the coal seam face. This assumption is validated as part of the water balance model validation (refer to Section 4.3). Constant groundwater inflow = 50% of the Year 2023 inflows (AGE, 2020) = 1.74 ML/day The groundwater inflow water quality is adopted as 21,000 µS/cm based on annual groundwater data (AGE, 2022).
Bingegang third-party supply	At the time of this assessment, the external water supply from German Creek pipeline had ceased and the site is planned to have unrestrained access to 2ML/day of external water supply from Bingegang Pipeline to Raw Water Dam (RWD) when the total mine water inventory < 750 ML.
Outflows	
Evaporation	Long-term daily evaporation data has been obtained from SILO Data Drill climate series taken at Latitude - 22.85; Longitude 148.65 (Source: https://www.longpaddock.qld.gov.au/silo/point-data/). Morton's lake evaporation has been applied as the evaporative loss from water bodies (i.e., from the ponded water surface). The average annual lake evaporation at Middlemount Coal Mine is 1,796 mm.
Coal Handling and Preparation Plant (CHPP) Demand	The constant CHPP throughput of 4.98 Mtpa is adopted based on the Year 2023 (calendar year). The makeup water, supplied from the RWD, is the difference between the CHPP water use and the volume of water returned to the CHPP from TSF1/TSF2. The tailings disposal system has been treated as a closed loop water circuit with the reuse of decant water considered with the provided CHPP water use data. The adopted CHPP demand has been based on a net consumption rate of 128 L/tonne (including return water from the TSF1), i.e., 1.74 ML/day.
Dust Suppression Demand	The forecast average monthly dust suppression demand is estimated using historical recorded usage data and unmetered dust suppression demand of 3.6 ML/month. The monthly dust suppression demand varies from 2.2 ML/day to 3.2 ML/day due to seasonal variability.

Input	Description
Controlled Water Releases	Although there are currently seven (7) approved release points within the EA, refer to Table C1 and Condition C2 within the EA (DESI, 2024), under the current mine affected water management system, the controlled releases discharge pipes within the sediment allowance are only located at MWD. The water balance model simulates controlled releases from MWD only to Roper Creek. Per the EA amendment application, the forecast releases from MWD are estimated based on proposed controlled release conditions summarised in Table 1.1. The water balance modelling undertaken only estimates the salinity of the system. The EA also refers to the monitoring of other water quality parameters pH, turbidity, total suspended solids, and sulphate. Whilst salinity is considered the dominant contaminant for modelling and there is a strong correlation between the electrical conductivity (EC) concentration and sulphate concentration as demonstrated in Section 4.3.2, it has been assumed that MCM mine will monitor all contaminants in accordance with the table above and EA before commencing releases. The water balance model estimates the flow at the Roper Creek upstream monitoring point, Ref1 (refer to Figure 1.1) in accordance with the EA conditions (DES, 2022). In a conservative modelling scenario, the study assumes no mixing zone and estimates the salt assimilative capacity at the upstream monitoring point, Ref1, for Roper Creek (refer to Figure 1.1). The model calculates releases in a way that the EC at the MWD release point, RP2, remains below 2,000 µS/cm during any release event. As a result, the modelled releases are also controlled to ensure that the EC at the downstream monitoring point of Roper Creek never exceeds 2,000 µS/cm. The dilution release utilisation is limited to 80% of the available assimilative capacity in the receiving environment. This decision is taken to account for the presence of other downstream operations. Therefore, for the purpose of modelling a receiving waterway target EC of 1,600 µS/cm is adopted as a conservative target by MCPL. The operational efficiency of the controlled releases is assumed at 80%. It is to be noted that in the unlikely instance where more than one authorised release points are actively releasing, MCM will not exceed the approved combined End of Pipe (EOP) release rate of 2m3/s and all releases will be undertaken in compliance with the approved release conditions.

4.3 Model Validation

Validation of the MCM water balance model has been undertaken against recorded site data (including water storage volumes) over the period from June 2022 to April 2023. The model was configured to reflect the site operations during this period, with appropriate transfer rates, system configuration and water inflows and outflows.

Validation of the water balance model was undertaken against the recorded inventory and water quality for the MWD. MWD is the main out of pit bulk water storage and makes up for 87% of the total mine affected water storage capacity and is the only release dam under the current water management system, refer to Table 4.3.

TABLE 4.3: MODEL VALIDATION – KEY INPUTS

Input Data	Source	Confidence
Rainfall	Site specific weather station (https://www.longpaddock.qld.gov.au/silo/point-data/)	High
Catchment area	Delineated based on the latest site survey undertaken in 2022	High
Groundwater inflows	It is assumed that only 50% of the estimated groundwater inflows (AGE, 2020) contribute to the mine affected water system.	Medium
Third party inflows	No third-party inflows are recorded during validation period in the MCPL water tracking tool	High

Input Data	Source	Confidence
Evaporation	Derived from SILO database	High
CHPP Net Demand	Calculated based on recorded monthly ROM CHPP feed tonnages and 128 L/tonne of net demand	High
Dust Suppression Demand	Recorded daily numbers of truck loads for dust suppression	High
Water Level	Recorded site storage water levels summarised in MCPL water tracking tool	Low: Open Cut Pit and Sediment Dams Medium to High: Mine Water Dams (incl. main storages MWD and RWD)

4.3.1 Model Validation Results

Figure 4.2 and Figure 4.3 shows the plot of the modelled MWD inventory and water quality for the validation period against the recorded data for MWD. The validation found that the model is found to provide a close fit to the recorded data over the validation period. A similar response to rainfall is observed in the modelled inventory and recorded inventory, therefore the model closely represents the pit dewatering flows.

The modelled EC generally matches well with the recorded EC within the MWD. The recorded EC shows higher dilution compared to the modelled EC in response to the rainfall events in January 2023 and April 2023. The water balance model produces slightly higher EC and is considered conservative for the purpose of this modelling assessment.

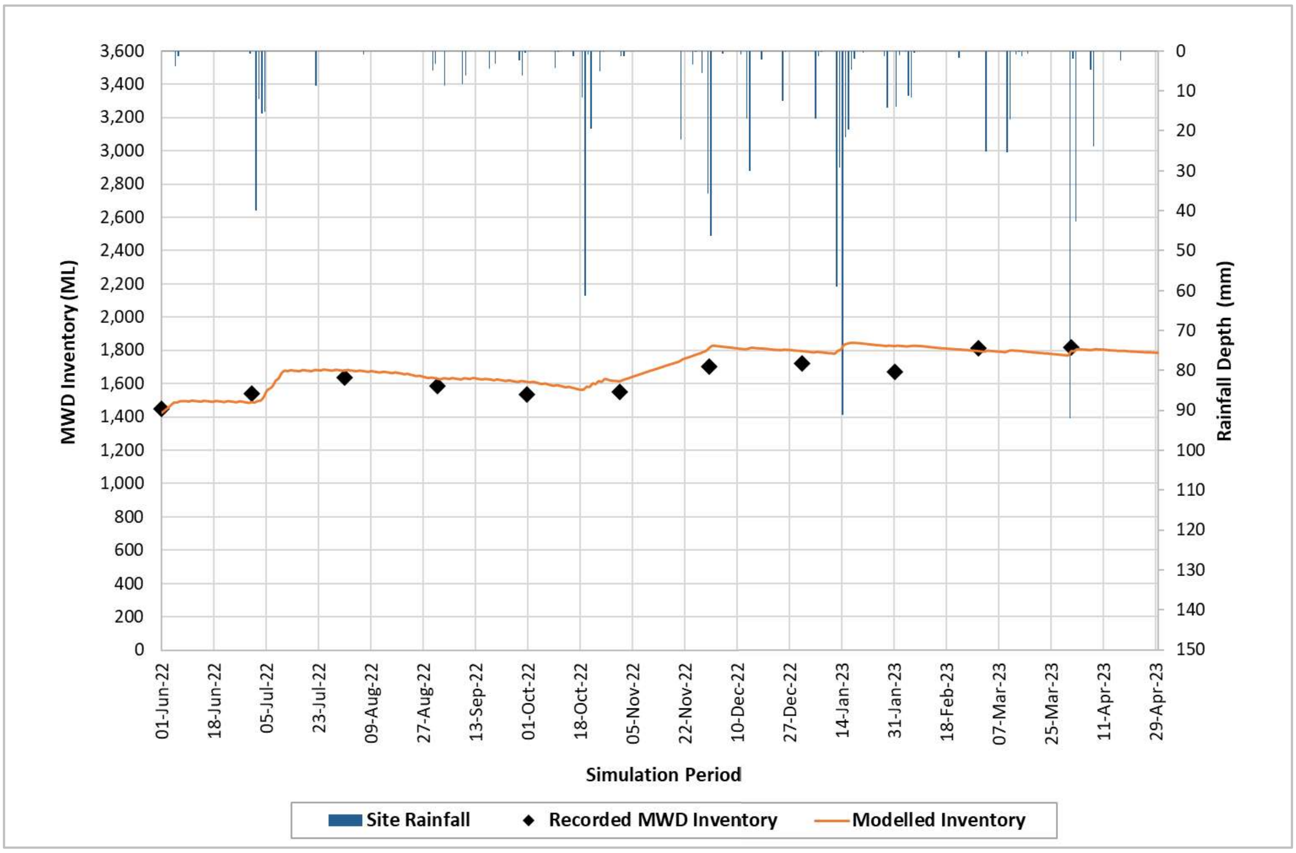


Figure 4.2: Water Balance Model Validation – MWD Inventory

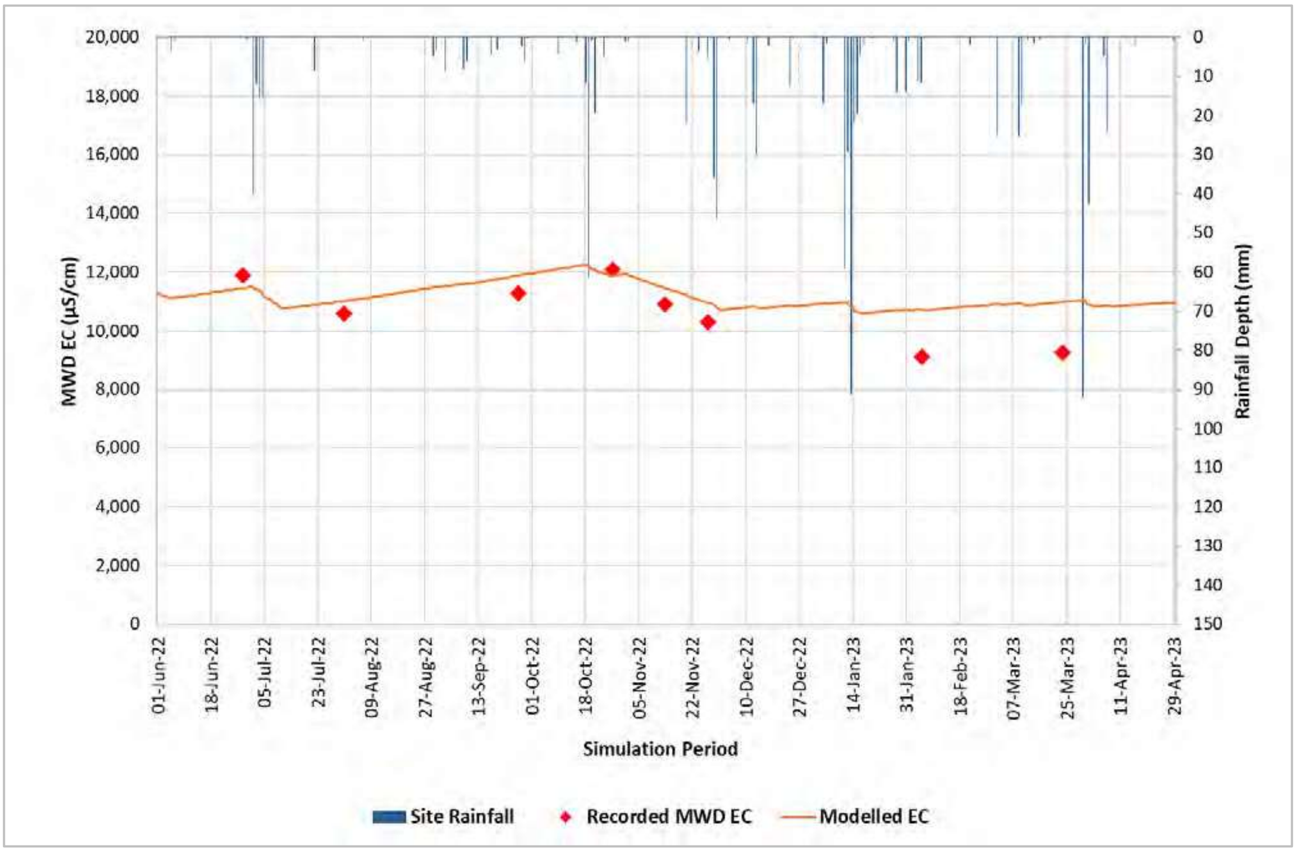


Figure 4.3: Water Balance Model Validation – MWD Water Quality

4.3.2 Correlation – Electrical Conductivity and Sulphate

The WBM is limited to the water quality modelling of EC and TDS). However, a technical study undertaken by the Queensland Government demonstrated a strong linear relationship between EC and sulphate [SO_4^{2-}] in the mine affected water within Fitzroy River Basin. The study concludes the linear regression correlation coefficient (R^2) between EC and sulphate of 0.97 based on grab samples from a mine water dam between 2007 and 2011 (Dunlop et al., 2011).

A review of water quality data for MWD from March 2019 to June 2023 (4 years) was conducted to examine the relationship between EC and sulphate concentrations. The correlation results show in Figure 4.4 mark a strong linear correlation between the two contaminants, with a linear regression correlation coefficient (R^2) of 0.9, indicating that 90% of the variance in the data is explained by the linear regression. Consequently, EC can serve as a reliable proxy for sulphate concentration within the MWD, and the sulphate concentration can be determined using the linear regression equation.

Water quality monitoring data from majority of coal mines in the Fitzroy Basin is reported to the Water Tracking and Electronic Reporting System (WaTERS). The Department of Environmental Science (DES) prepared a project report for the Fitzroy Partnership for River Health (FPRH) that utilized FPRH's comprehensive review of water quality data from coal mines across the catchment. The review identified EC as the primary contaminant of concern for coal mines in the Fitzroy Basin, although its levels vary significantly between sites. Other water quality issues include sulphate and suspended solids/turbidity. Sulphate levels generally correlate with EC, while suspended solids in mine-affected water are typically lower than those in receiving water during events (DES (now DESI), 2018).

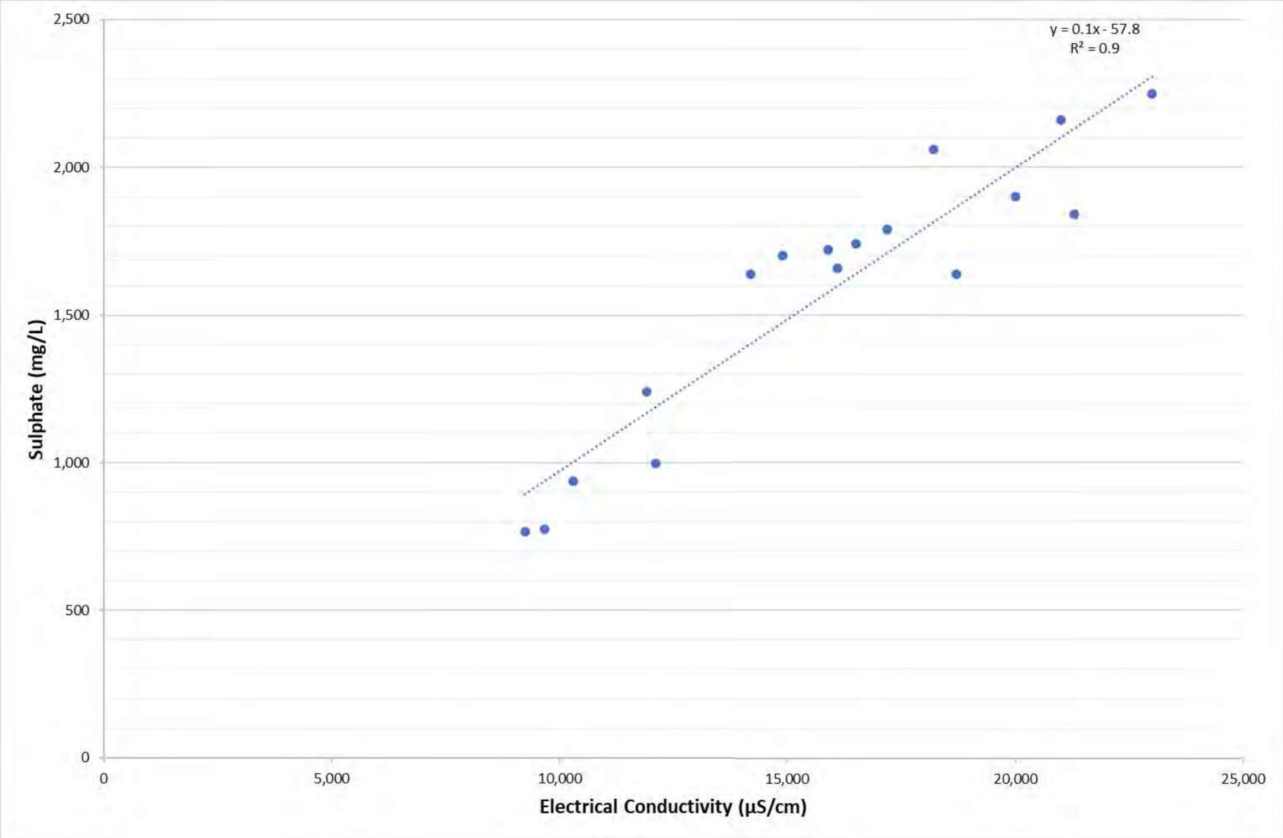


Figure 4.4: Relationship Between EC and Sulphate Concentrations

4.4 Model Results

4.4.1 Mine Water Inventory

The predicted total MAW inventory is shown in Figure 4.5, comparing the site's storage capacity with and without the new MWD2. The storages represented in the capacity line are:

- RWD
- MWD
- SD1/ SD1ext.
- STD
- MWD2 (currently being constructed).

The key outcomes are:

- The annual probability of exceeding the available MAW storage capacity is estimated to reduce to 2% as compared to 36% with no controlled releases from the site. This highlights the importance of the proposed release conditions required for the MCM site.
- The combination of the additional containment volume and enhanced releases from MWD minimises the risk of storing water in the operational pit, and hence, improving the operational resilience.

Section 4.4.2 and Section 4.4.4 summarise the pit operability and controlled releases from MWD respectively.

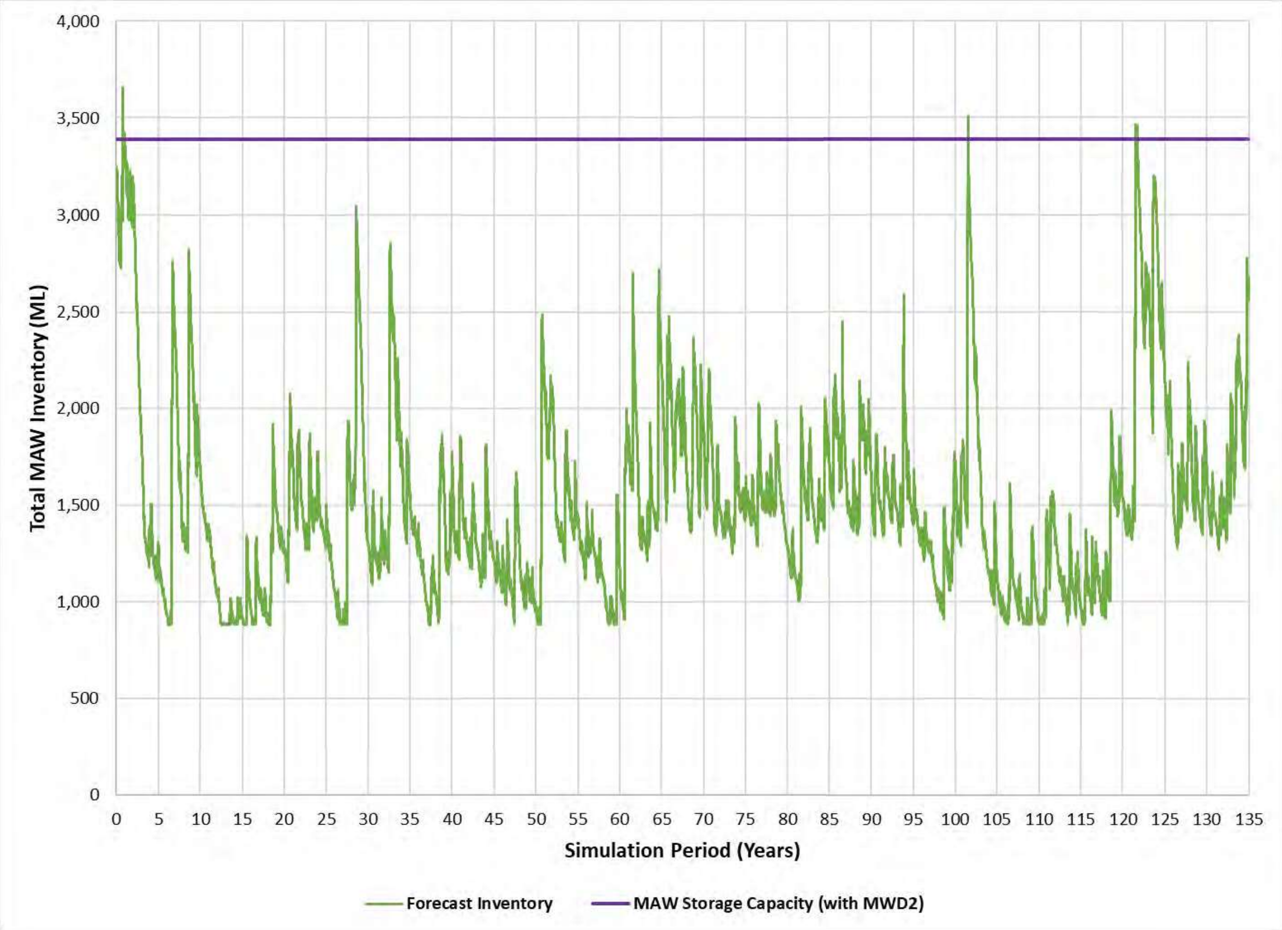


Figure 4.5: Forecast Mine Affected Water Inventory

4.4.2 Controlled Releases

The controlled releases from the MWD are modelled based on the proposed conditions outlined in Table 1.1. The potential annual release opportunity and annual release volume from the MWD is shown in Figure 4.6 and Figure 4.7 respectively. The keys outcomes are:

- The potential release area is estimated to occur in approximately 40% of the years, with an annual average of 4 days/year of release opportunity.
- The annual average release volume is approximately 308 ML/year under the proposed EA conditions.

Further assessment of the limiting factor for the controlled releases from the MWD highlighted the following outcomes:

- The flow threshold in the Roper Creek (i.e., streamflow at upstream monitoring point >= 2m^3) is the primary limiting factor as the modelling shows that the condition is only true for approximately 2% of the total simulated days.
- The secondary limiting factor for the controlled release is the site operational strategy of holding at least 1,750 ML on site prior to releasing.
- The limiting factor assessment confirms that the constant EC of 10,000 µS/cm is not forecasted to be the limiting factor for the predicted controlled release events.

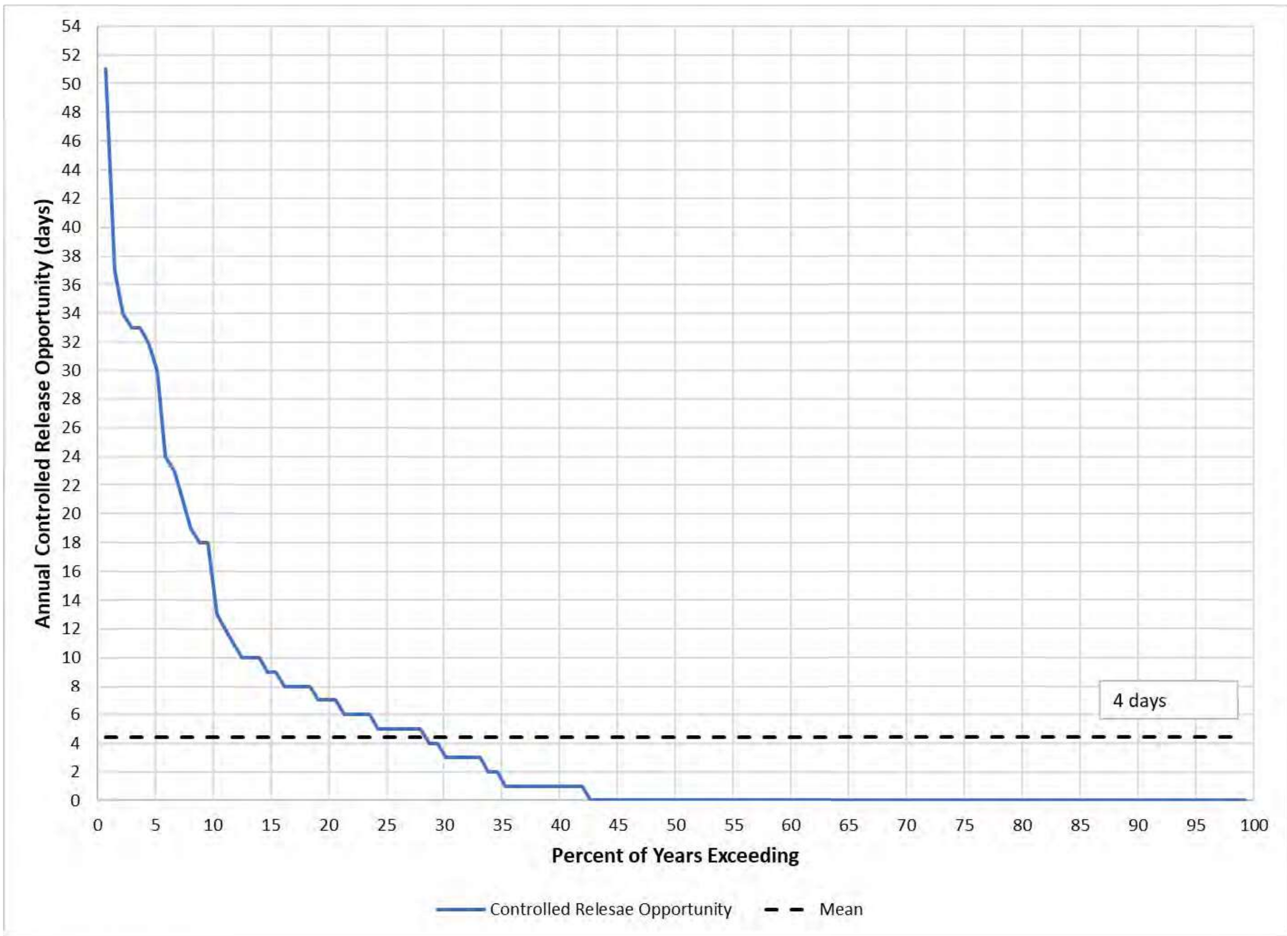


Figure 4.6: Forecast Annual Release Opportunity

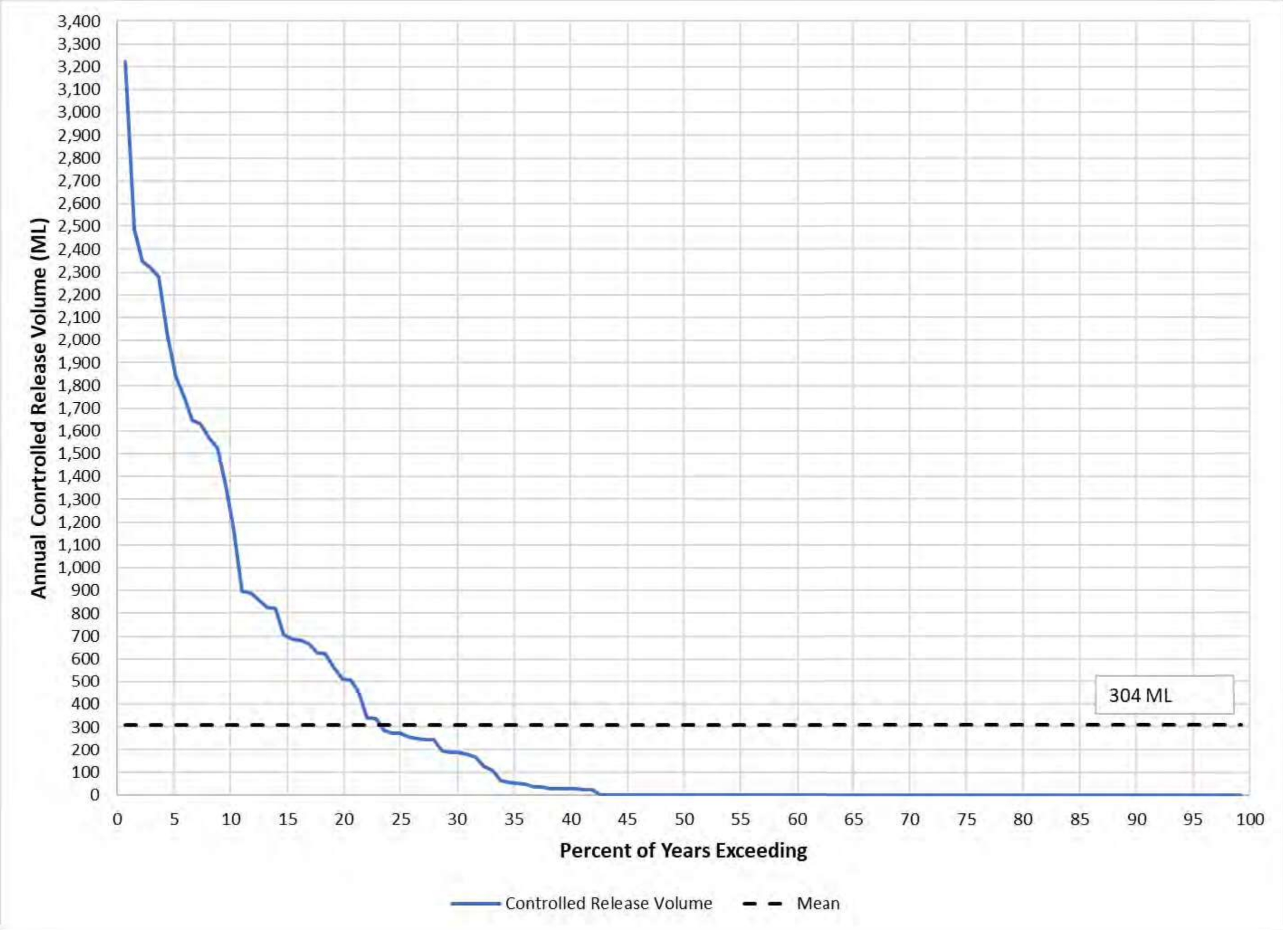


Figure 4.7: Forecast Annual Release Volume

4.4.2.1 Controlled Release and Instream Water Quality

The MWD is modelled at a constant end-of-pipe electrical conductivity (EC) of 10,000 µS/cm, representing the maximum proposed end-of-pipe EC to mitigate any limitations or uncertainties in the water quality modelling. The modelled results in Figure 4.8 shows the instream water quality downstream monitoring points (DS MP) (i.e., MCPL DS MP, German Creek DS MP, Barwon Park Gauging Station) against the proposed instream EC Trigger value of 2,000 µS/cm during the release events. The key outcomes are:

- Modelled results indicate that controlled releases occur for approximately 1% of simulated days.
- Under the proposed EA conditions and MCPL's operational strategy, the MCPL DS MP is not likely to exceed the proposed instream EC trigger value and the instream EC further gets diluted downstream to 880 µS/cm and 594 µS/cm at German Creek DS MP and Barwon Park Gauging Station respectively during the release events.

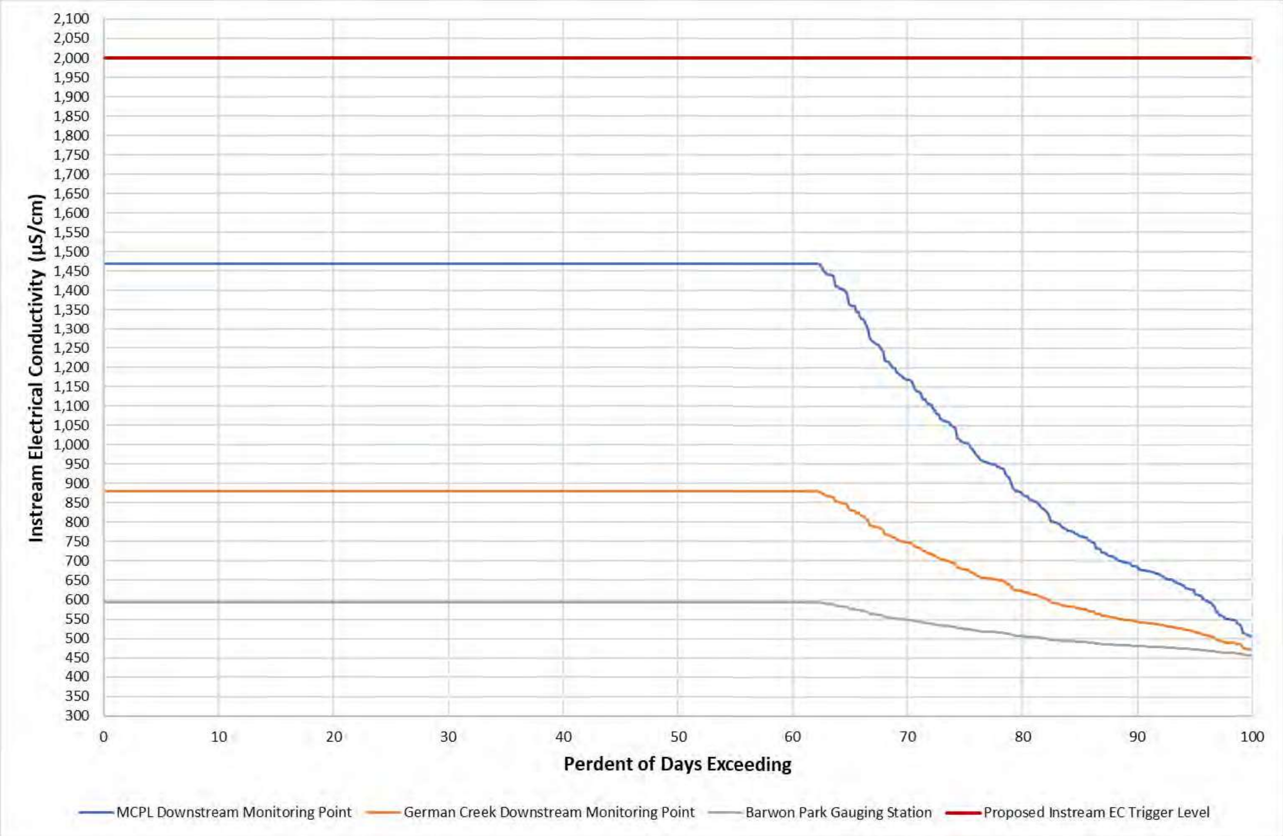


Figure 4.8: Forecast Instream Water Quality During Release Events

4.4.3 Impacts to Pit Operability

The water balance model is used to assess the potential risk of excess mine water accumulation impacting the pit operability. A sump capacity of 130 ML has been adopted for the pit and per the operational strategy, the pit dewaters into STD, MWD2, and MWD. The number of days per year that the accumulated water exceeds the pit sump capacity is estimated based on the modelled results. Figure 4.9 shows the forecast probability of exceeding the pit sump capacity. The key outcomes are:

- The modelled results indicate 72 days/year and 46 days/year of pit inundation under the 95th Percentile and 90th Percentile respectively. This is a significant improvement compared to the 95th Percentile pit inundation results from the 2022 Operational WMP, where the modelled pit inundation duration was between 306 days to 365 days per year over 5 year forecast period (Engeny, 2022).
- The forecasted annual average days of pit inundation is 16 days per year.

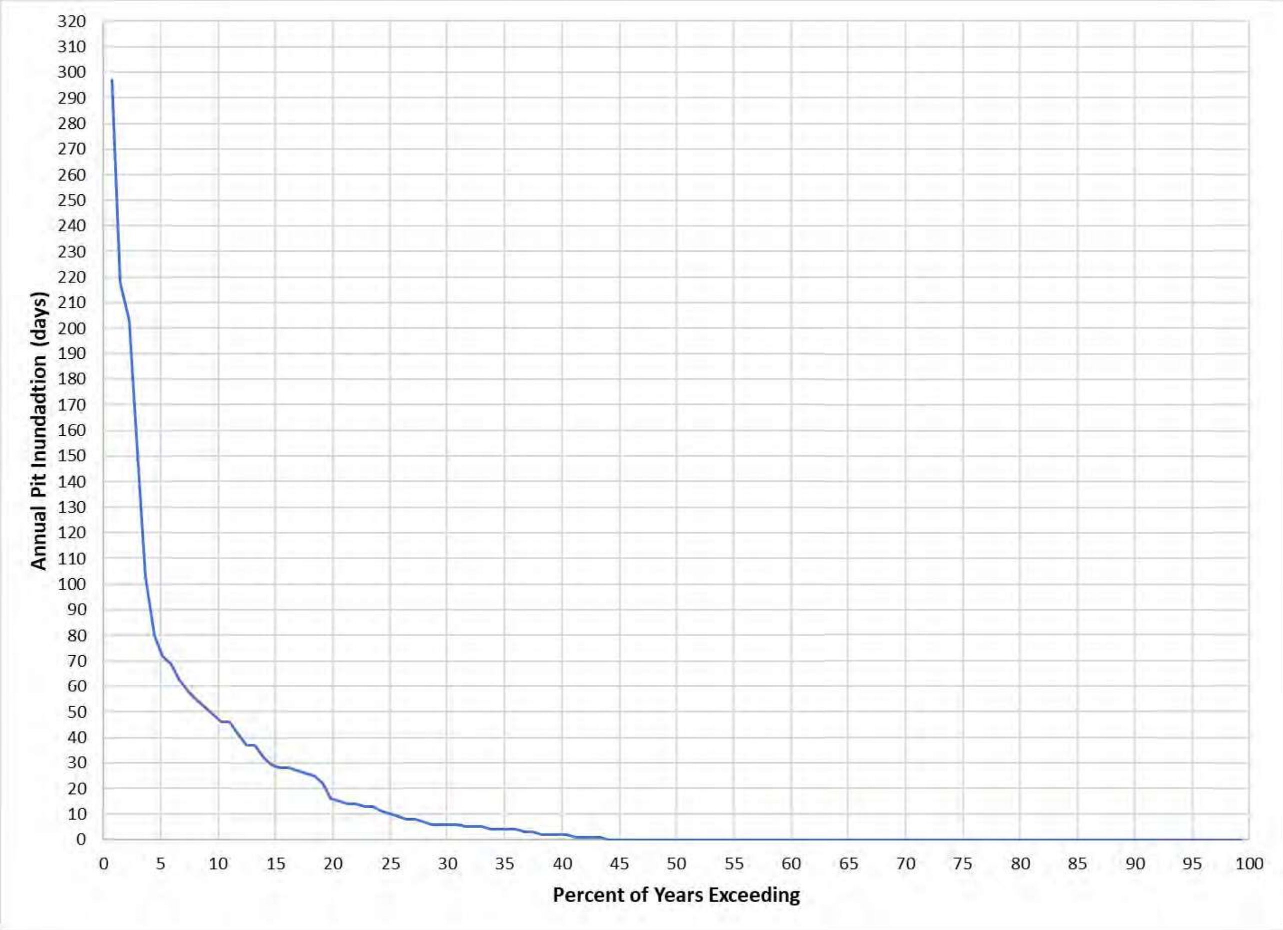


Figure 4.9: Forecast Probablity of Exceeding Pit Operability Threshold

4.4.4 Third-party Offtake and Shortfall

Under the modelled scenario, the results show no shortfall and does not necessitate the incorporation of an additional third-party supply.

5. IMPACT ASSESSMENT

This section presents an impact assessment that is based on the technical study conducted to substantiate the rationale behind the proposed modified release conditions. The potential impacts of the proposed release conditions include:

- Impact on the site operations
- Impact on the downstream environment
- Impact on the downstream operations, i.e., German Creek Mine
- Cumulative Impacts on aquatic ecosystem
- Impact on Great Barrier Reef.

5.1 MCM Site Operation

The key indicators of the site's operational performance are pit operability, and ability to supply site water demands, and MAW containment performance.

The modelled results in Figure 4.5 show that with additional MAW containment storage (MWD2) and proposed release conditions (Table 1.1) predicts significant improvement in the pit operability results with an annual average pit inundation of 16 days/ year. The modelled results highlight that by enabling controlled releases from the site, the proposed modified conditions directly contribute to the management of site MAW inventory. The annual probability of exceeding the available MAW storage capacity reduced down to 2% as compared to 36% with no controlled releases from the site.

The implementation of these release conditions proactively addresses the potential impacts of inventory buildup and evapo-concentration effects, which can lead to the accumulation of salts and other contaminants. By controlling the release of water, the site's inventory is managed more effectively, minimizing the potential for detrimental effects on the environment and operational stability.

In the modelled scenario, the results indicate self-sufficiency with no shortfalls or need for third-party offtake. This demonstrates the system's resilience, efficiently meeting on-site water demands as well as preventing water accumulation risks under the proposed release conditions.

5.2 Downstream Environment

The assumed EOP EC of the MWD is 10,000 µS/cm to demonstrate the maximum potential impacts and mitigates any limitations or uncertainties in the water quality modelling. The downstream water quality objective proposed at the MCPL DS MP is 2,000 µS/cm which is considered as the industry standard based on the literature review of the EA release conditions of the nearby coal mine operations within the Roper Creek catchment. The modelling assumes no mixing zone and limits the dilution release utilisation to 80% of the available assimilative capacity in the Roper Creek to acknowledge the downstream operations.

Figure 4.8: shows the instream EC at MCPL DS MP, German Creek DS MP, and Barwon Park Gauging station during the release events (i.e., only 1% of the simulated days). The modelled results show that instream EC at the MCPL DS MP does not exceed the proposed trigger value of 2,000 µS/cm during release events with the maximum modelled EC of 1,468 µS/cm. The modelling also shows that the EC gets further diluted downstream with the maximum modelled EC of 880 µS/cm and 594 µS/cm at the German Creek DS MP and Barwon Park gauging station during the release events.

Middlemount Stage 2 EIS assessment report (DERM, 2011) suggest no vulnerable or endangered aquatic flora or fauna species have been recorded in the MCM site area's waterways. Creeks in the study area and catchment generally maintain a moderate condition, with relatively low biodiversity comprising fish and macroinvertebrate species tolerant of varying and harsh conditions. The report also states that the biological values of aquatic ecosystems in the MCM study area align with the wider catchment. Therefore, it is likely that the riparian vegetation and aquatic ecosystem within the isolated reach of the Roper Creek is of similar nature to downstream reaches of Roper Creek (i.e., downstream of the German Creek DS MP), refer to Figure 1.1.

Given the EA of the nearby coal mines approve an instream EC of up to 2,000 µS/cm during release events suggesting that the aquatic flora and fauna in the Roper Creek is tolerant of elevated EC. Therefore, it is likely that the aquatic ecosystem within the isolated reach of Roper Creek is tolerant of occasional elevated EC. As the proposed operational strategy of MCM site is release only up to 80% of the total assimilative capacity in Roper Creek and therefore maintain the maximum EC of 1,600 µS/cm or less during release events.

Further, the proposed release conditions serve as a preventive measure to mitigate the legacy risks associated with accumulated inventory on-site. By strategically managing and releasing water, the potential for evapo-concentration effects will be diminished and will therefore enhance the long-term environmental sustainability. Consequently, the proposed release conditions are not anticipated to have adverse impacts on the downstream environment.

5.3 Downstream Operations

MCM is situated upstream of German Creek Mine and Foxleigh Mine within the Roper Creek catchment, and all three operations are authorized to release mine-affected water into Roper Creek as per their respective EAs. This section focuses on evaluating the potential impacts of MCM's proposed release conditions on downstream operations, particularly German Creek Mine as it is the immediate downstream operation and relies on controlled releases into Roper Creek. The assessment elaborates on how MCM's enhanced releases might affect German Creek Mine's controlled releases.

The water balance model estimates the release potential for German Creek Mine under its approved EA conditions, assuming the maximum approved EOP EC of 10,000 µS/cm and a maximum combined EOP release rate of 2m³/s. It's important to note that this assessment doesn't consider the operational strategy or infrastructure limitations specific to German Creek Mine.

The modelling results indicate that without releases from MCM, German Creek Mine has an annual average release potential of 1,400 ML/year. However, under the proposed release conditions for MCM, this volume is slightly reduced by 4%, resulting in an estimated 1,350 ML/year, still approximately 4 times the annual average release volume of MCM.

Furthermore, the modelling indicates no net change in the annual average release opportunity for German Creek Mine, with both scenarios (MCM releasing and not releasing) showing an average of 12 days/year when releases can occur, which is 3 times the potential release opportunity for MCM. This assessment provides valuable insights into the potential impacts of MCM's proposed release conditions on downstream operations, particularly German Creek Mine's release potential.

The consistent annual average number of days for release opportunity at German Creek Mine, despite MCM's modelled releases, indicates that German Creek Mine retains the potential to release on the days when MCM is also modelled to release. This alignment stems from MCM's operational strategy, limiting releases to 80% of the total assimilative capacity in Roper Creek. Additionally, the influx of runoff from the natural catchment further contributes to diluting the water quality downstream in Roper Creek. As a result, the release opportunity for German Creek Mine is maintained. In summary, the proposed release conditions by MCM are not expected to adversely impact downstream operations, specifically the release opportunities for German Creek Mine.

5.4 Cumulative Impacts

A study of cumulative impacts on water quality of mining activities in the Fitzroy River Basin was undertaken by the Department of Environment and Resource Management (DERM) (DERM, 2009) to examine the implications of water discharges from mines on water quality in the Fitzroy River Basin. The study focused on discharges from coal mining operations as the Fitzroy River Basin's large-scale mining activities are dominated by coal mining and planned coal mine expansions. The study focussed on salinity impacts as these were of major concern to the communities in the areas affected by the large quantity mine discharges in 2008 and the available data relates more to salinity than any other contaminant.

The study completed a risk assessment for 40 coal mine EAs based on the available discharge information. Cumulative impact risk assessment matrix was developed to help assess the potential for cumulative risk from the mines based on the level of EC sampled immediately downstream from the discharge and the volume or frequency of the discharge. In terms of risk assessment categories for EC, the likely environmental values and water quality objectives for the freshwater reach of the Fitzroy River were considered. Environmental values of particular interest and most sensitivity to salinity are protection of aquatic ecosystem, crop irrigation and potential use for drinking water. The cumulative risk matrix is presented in Table 5.1. The study determined that MCM has a 'low' cumulative risk (see Table 6 of (DERM, 2009)).

The modelling results discussed in Section 4.4.4 suggest that MCM is forecasted to release an annual average volume of 308 ML with an annual average release potential of 4 days/ year which corresponds to infrequent releases. With the proposed EA amendment to release conditions, the modelling depicts a transition to a 'medium' cumulative risk of mine water discharges. It is important to emphasize that the modelling results are a function of maximum mine affected catchment and an assumed constant EOP EC of 10,000 µS/cm. In reality, ongoing rehabilitation will likely reduce the mine affected catchment and consequently the volume of controlled releases from MWD. Also, the EC is MAW will not always be 10,000 µS/cm, especially given the cessation of high EC German Creek Mine water supply and the anticipated dilution of operational pit water following substantial rainfall events.

TABLE 5.1: CUMULATIVE RISK ASSESSMENT MATRIX USED TO ASSESS THE MINE DISCHARGES IN THE FITZROY CATCHMENT (DERM, 2009)

Frequency/ Volume (ML/year)			v. low EC < 720 µS/cm	low EC < 1,250 µS/cm	medium EC < 2,500 µS/cm	high EC > 2,500 µS/cm
v. low	zero/small	< 100 ML	v. low	low	low	medium
low	few releases, infrequent	< 1,000 ML	low	low	medium	medium
medium	frequent	< 10,000 ML	low	medium	medium	high
high	continuous, some dry weather	< 10,000 ML	medium	medium	high	v. high
v. high	continuous, months	> 100,000 ML	medium	high	v. high	v. high

5.5 Reef Impacts

The MCM site is located within the Fitzroy Basin and is therefore required to address the Reef discharge standards for industrial activities, herein after referred to as 'Reef Discharge Guideline' (DES (now DESI), 2023) as per section 41AA of the Environmental Protection Regulation 2019. Guideline states that the intent of section 41AA of the EP Regulation is to apply to activities that are directly releasing dissolved inorganic nitrogen (DIN) and fine sediments or total suspended solids (TSS) into the GBR catchment waters, otherwise known as point source releases. Section 41AA of the EP Regulation is only intended to apply to controlled releases of the wastewater, in this case of MCM, mine-affected water with an aim to achieve no residual impact.

5.5.1 Total Suspended Solids

For an amendment to an existing activity, the total load will be the load associated with the amendment to the extent the amendment application proposes any additional point source releases. The total load associated with the amendment application will not include any existing loads already authorised on the EA to be released from point sources (DES (now DESI), 2023). The existing release conditions outlined in Table C2 of the EA (DESI, 2024) require EOP monitoring of suspended solids concentrations as part of the water quality monitoring of for controlled mine affected water releases. The MCM EA states the EOP TSS is to be no more than 1062 mg/L when flow in Roper Creek exceeds 2m^3/s.

Water quality samples were collected from the upstream monitoring site (Ref 1) (refer to Figure 1.1) after the recent rainfall event occurred between 13 February 2024 and 16 February 2024 receiving a cumulative rainfall of 88 mm over 72 hours. The site streamflow gauge at Ref 1 recorded a peak stream flow of 20 m^3/s (refer to Figure 5.1). The water quality sampling of Roper Creek conducted during a flow event on 16 February 2024 shows the background TSS concentration of 1,800 mg/L, which exceeds the allowable mine-affected release concentration outlined in Table C2 of the EA (DESI, 2024). The predominant land use within the Roper Creek catchment upstream of the background monitoring point, Ref 1, is grazing, considered one of the main contributors to increased load within the creek systems as a result of historical clearing activities.

As part of the MCM operations, which include the implementation of grazing exclusion as a land management practice on-site, cattle grazing land use is not present within the MCM mining leases (MLs). The mine-affected water is contained within the mine water management system. The main water management objective for MCM is to collect, re-use, and recycle the mine affected water predominantly to meet site water demands. The predicted average annual release opportunity (4 days/ year) and predicted annual average release volumes (300 ML/year) (refer to Section 4) are relatively small window of opportunity and volumes that Is predicted to only occurs during very wet climate conditions.

The predicted TSS release from MWD during a release event is expected to be significantly lower than the TSS loads generated from surrounding grazing land use and the pre-mining loads generated from MCM operational area.

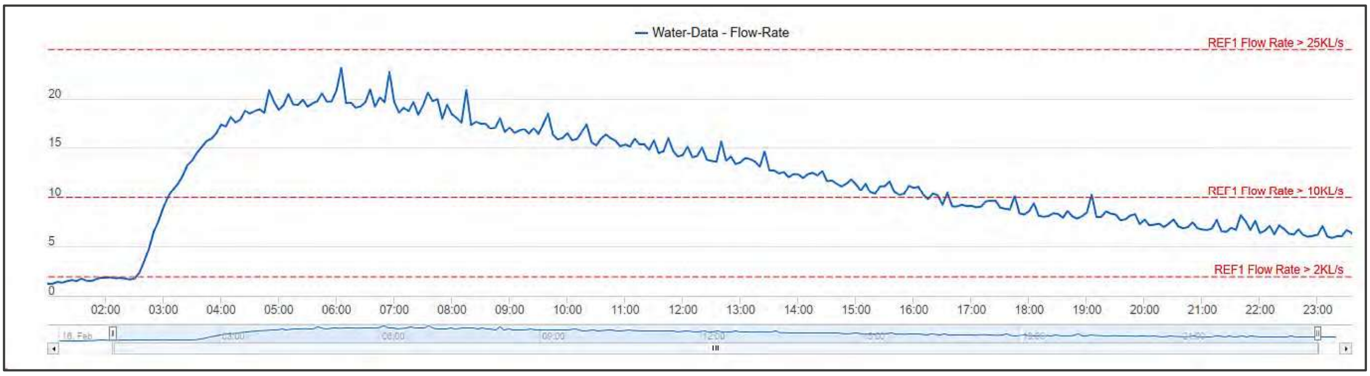


Figure 5.1: Streamflow Record At Ref 1 On 16 February 2024

5.5.2 Dissolved Inorganic Nitrogen

Dissolved Inorganic Nitrogen (DIN) releases are typically a concern for activities such as sewage treatment, aquaculture, abattoirs/meat processing, or intensive fertilizer use (DES (now DESI), 2023). DIN is not considered as a relevant constituent for the purpose of release monitoring in the context of the current release limits outlined in Table C2 and Table C4 of the EA (DESI, 2024). Since it is not possible to quantify the existing approved DIN loads for the quantify the existing approved DIN loads for MCM, therefore, this assessment defaults to a comparison with background/ pre-mining conditions. Historically, the predominant land use at the site was grazing. With the commencement of MCM operations, the land use in the area transitioned from cattle grazing to mining activities. The proposed amendments are to the EA Schedule for surface water only do not impact conditions associated with sewage treatment within the EA (DESI, 2024).

Therefore, considering the shift from cattle grazing to mining activities and the implementation of grazing exclusion as a land management practice on-site, MCM controlled releases are likely to generate significantly fewer loads compared to pre-mining conditions and surrounding land use activities.

6. REFERENCES

AGE. (2020, November 12). Middlemount Coal Mine - Southern Extension Project Groundwater Impact Assessment.

AGE. (2022, March 28). Middlemount Coal Mine 2021. Annual Review. MID5000.001_Middlemount Annual Groundwater Review 2021_v02.01.docx .

DERM. (2009, April). A study of cumulative impacts on water quality of mining activities in the Fitzroy River Basin .

DERM. (2011, October). Environmental Impact Statement (EIS) Assessment Report under the Environmental Protection Act 1994. Middlemount Coal Project, Stage 2 Proposed by Middlemount Coal Pty Ltd.

DES (now DESI). (2018, November). Fitzroy Coal Mine Receiving Water Monitoring for Regulation – Efficiency Review and Gap Analysis. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.publications.qld.gov.au/ckan-publications-attachments-prod/resources/2b0039e8-08e7-4964-a599-fa04fd092122/fitzroy-remp-review.pdf?ETag=6a1d5761597bfbc8537a99d457a6d659

DES (now DESI). (2018, April). Queensland Water Modelling Network Good Modelling Practice Principles. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://science.des.qld.gov.au/__data/assets/pdf_file/0011/81110/qwmn-good-modelling-practice-principles.pdf

DES (now DESI). (2022, July 19). Receiving environment monitoring program guideline. ESR/2016/2399 • Version 3.00. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://environment.des.qld.gov.au/__data/assets/pdf_file/0014/90131/era-gl-receiving-environment-monitoring-program.pdf

DES (now DESI). (2022, April 04). Technical guideline. Wastewater release to Queensland waters. ESR/2015/1654 Version 2.04. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://environment.des.qld.gov.au/__data/assets/pdf_file/0031/88636/pr-gl-wastewater-to-waters.pdf

DES (now DESI). (2023, Decemeber 01). Environmental authority EPML00732613.

DES (now DESI). (2023, June 22). Fitzroy Basin regional receiving environment monitoring program guideline. ESR/2023/6463 • Version 1.00. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://environment.des.qld.gov.au/__data/assets/pdf_file/0019/315361/era-gl-fitzroy-basin-remp.pdf

DES (now DESI). (2023, May 24). Guideline. Environmental Protection Act 1994. Reef discharge standards for industrial activities. Reef discharge standards for industrial activities. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://environment.des.qld.gov.au/__data/assets/pdf_file/0019/238132/era-gl-reef-discharge-standards-industrial-activities.pdf

DESI. (2024, January 19). Environmental authority EPML00716913.

Dunlop et al. (2011, November). Development of Ecosystem Protection Trigger Values for Sodium Sulfate in Seasonally Flowing Streams of the Fitzroy River Basin. Retrieved from https://www.researchgate.net/publication/263810275_Development_of_Ecosystem_Protection_Trigger_Values_for_Sodium_Sulfate_in_Seasonally_Flowing_Streams_of_the_Fitzroy_River_Basin

Engeny. (2021, November 01). Water Balance Model Development. Middlemount Coal Mine. M80000_029-REP-001-0.

Engeny. (2022, October 17). Operational Water Management Plan 2022. Midddlemount Coal Mine. M80000_038-REP-001-1.

NHMRC. (2022, January). National Water Quality Management Strategy - Australian Drinking Water Guidelines 6. 2011. Version 3.7.

Resource Strategies. (2020, November). MIDDLEMOUNT COAL MINE. SOUTHERN EXTENSION PROJECT. ENVIRONMENTAL VALUES ASSESSMENT.

WRM. (2019, June 12). Middlemount Coal Mine - Water Balance Modelling Report.

WRM. (2020, August 20). Middlemount Coal Mine. Southern Extension Project Surface Water Impact Assessment.

7. QUALIFICATIONS

(a) In preparing this document, including all relevant calculation and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

(b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

(c) Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

  (i) Additional sources of information not presently available (for whatever reason) are provided or become known to Engeny; or

  (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

(d) Engeny does not give any warranty nor accept any liability in relation to the completeness or accuracy of the works, which may be inherently reliant upon the completeness and accuracy of the input data and the agreed scope of works. All limitations of liability shall apply for the benefit of the employees, agents and representatives of Engeny to the same extent that they apply for the benefit of Engeny.

(e) This document is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this Report.

(f) If any claim or demand is made by any person against Engeny on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the Report or information therein, Engeny will rely upon this provision as a defence to any such claim or demand.

(g) This Report does not provide legal advice.