Middlemount Coal Pty Ltd

Operational Water Management Plan 2022

Middlemount Coal Mine

17 October 2022

M80000_038-REP-001-1

ENGENY
WATER MANAGEMENT

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Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
0	13/09/2022	Client Issue	Nutan Gothwal	Ben Kiernan	Nutan Gothwal	Ben Kiernan
1	17/10/2022	Client Issue	Nutan Gothwal	Ben Kiernan	Nutan Gothwal	Ben Kiernan
Signatures						

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1 INTRODUCTION

1.1 OVERVIEW

This Operational Water Management Plan (OWMP) has been prepared to provide Middlemount Coal Pty Ltd (MCPL) with a forecast of future water management system performance and an outline of the infrastructure and operational strategies required to minimise impacts to operations and environmental compliance.

The key objectives of the OWMP are to:

- Review the mine plan and operational strategy for MCM over the 5-year horizon (i.e., 2022 to 2027).
- Update the site water balance model to represent the mine plan over the 5-year horizon.
- Assess the ability of the water management system to minimise impacts to mining during wet and dry climate periods.
- Recommend infrastructure, and operational requirements and/or changes to water management strategies required through the 5-year timeline.
- Review and update Trigger Action Response Plans (TARP's) for the mine water management system to assist with operational water management decisions such as initiating mine water releases or implementation water conservation measures.

1.2 REGULATORY REQUIREMENTS

The OWMP and associated performance assessment of the mine water management system has considered legislative requirements outlined in the following documents:

- *Environmental Authority (EA) EPML00716913* for *MCM* (DES, 2022).
- *Environmental Protection Act 1994* (Qld).
- *Environmental Protection Regulation 2008* (Qld).
- *Water Act 2000* (Qld).

1.3 SUPPORTING DOCUMENTATION

The following documents should be read in parallel with this report:

- *Water Balance Model Development Report* (Engney, 2021).
- *Erosion and Sediment Control Plan (ESCP)* (Engeny, 2021).
- *Regulated Structures Operational Plan* (Engney, 2021).
- *Water Management Plan (WMP)* (WRM, 2019).
- *Water Balance Modelling Report* (WRM, 2019).
- *Receiving Environment Monitoring Program* (DPM Envirosciences, 2019).

2 WATER MANAGEMENT SYSTEM

2.1 SITE DESCRIPTION

(MCPL In the next 5-year horizon, ROM coal is planned to be mined in a general north-east and south-east direction within ML 70379, with overburden and interburden material emplaced in-pit behind the advancing open cut operations, and within the East Dump, located within ML 70417 and ML 700014. ROM coal is processed through a coal handling and preparation plant (CHPP) to process up to up to 5.4 million tonnes per annum (Mtpa) over the 5-year horizon and produce 4.1 Mtpa of Pulverised Coal Injection (PCI) and coking coal for the export market. Product coal is transported by rail to the Dalrymple Bay Coal Terminal and Abbot Point Coal Terminal.

Details of the surface water management system as well as a description of the existing operations and 5-year mine plan is described in the following sections.

2.1.1 Climate

The variation in historical annual rainfall depths by water year (i.e., November to October) experienced at the site is summarised in Figure 2.1. The last 5 years are highlighted on the plot in order to provide in a broader historical records. The median annual rainfall is approximately 579 mm. The preceding 5 years have been relatively 'dry' with three years (2017-18; 2019-20; 2020-21) recording below median annual rainfall depths and remaining two (2016-17; 2018-19) recording just above median annual rainfall.

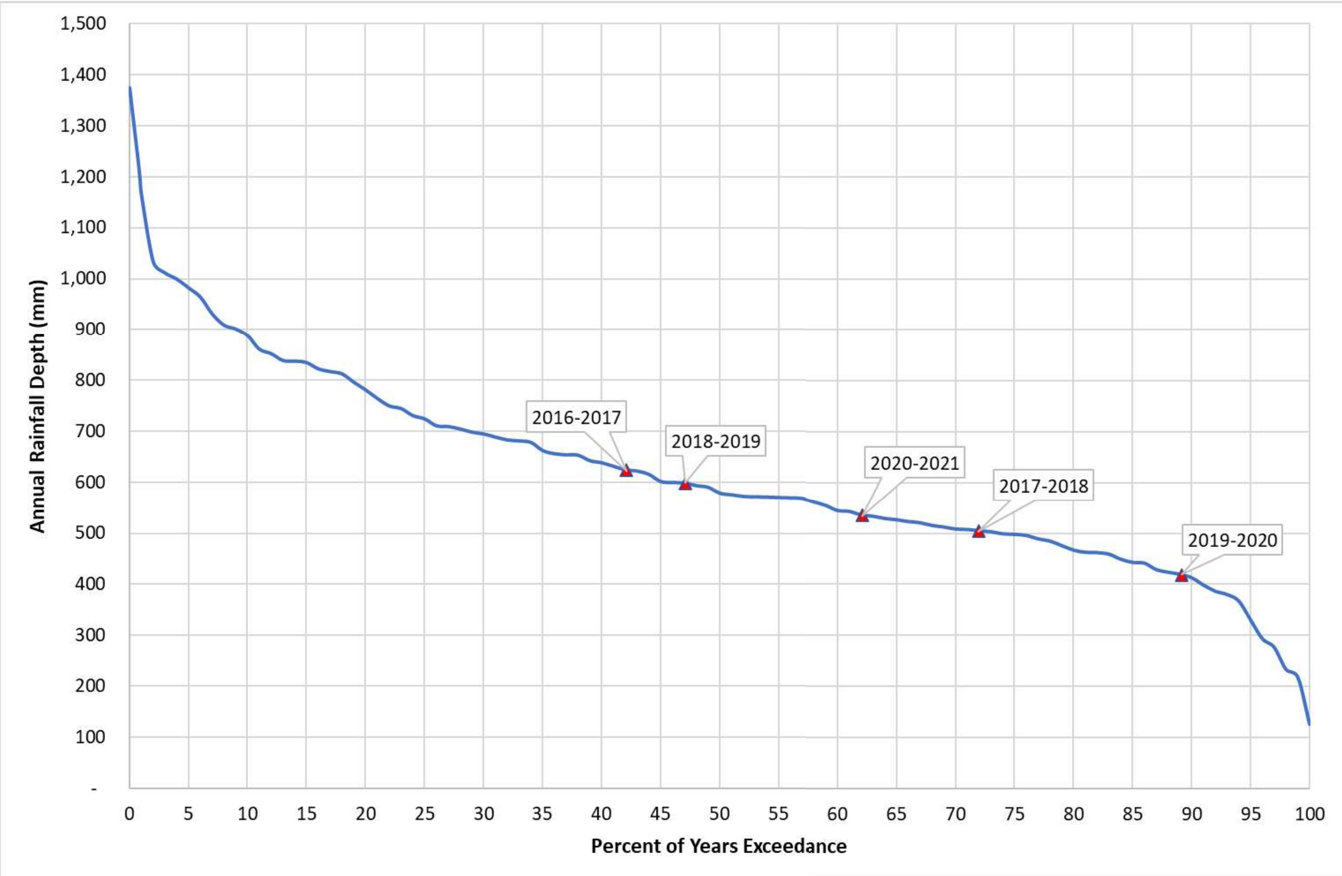


Figure 2.1: Annual Rainfall Totals (Composite Data Series)

2.2 SURFACE WATER CLASSIFICATION

The surface water generated onsite is categorised into types, based on their source and water quality:

- **'Tailings return water' –** water that has been used to wash coal in the CHPP. Tailings water potentially has a lower pH and higher concentrations TDS and metals of contaminants than 'mine affected water'.
- **'Mine affected water' –** water that is pit water, tailings dam water, processing plant water. This water may contain high TDS and metals above relevant guideline trigger values as defined by (ANZECC &ARMCANG, 2000).
- **'On-site stormwater/ sediment laden water' –** surface runoff water from areas that are disturbed by mining operations (including out-of-pit overburden dumps and haul roads). This runoff may contain high sediment loads but is generally neutral pH and does not contain high salt or metals concentrations.
- **'Catchment runoff water' –** surface runoff from catchment areas where water quality is unaffected by mining operations. Catchment runoff water includes runoff from undisturbed areas and any fully rehabilitated areas.
- **'Contaminated water' –** surface water from areas potentially containing chemicals of various types used in the mining operations (e.g., hydrocarbons). Contaminated water areas include sumps, service bays and fuel storage areas. Rainfall and resulting runoff from these areas is also potentially contaminated.
- **'External Water'** - External water is water sourced external to the mining operation.

2.3 SYSTEM OVERVIEW

The existing mine water management system (WMS) consists of a network of infrastructure (i.e., mine affected water (MAW) storages, sediment dams, pipelines, drains, diversions, and levees) to control the movement of clean, mine affected, and sediment laden water around the site. The elements of the WMS are presented geographically in Figure 2.2 and schematically in Figure 2.3. The general operational philosophy of the WMS is to:

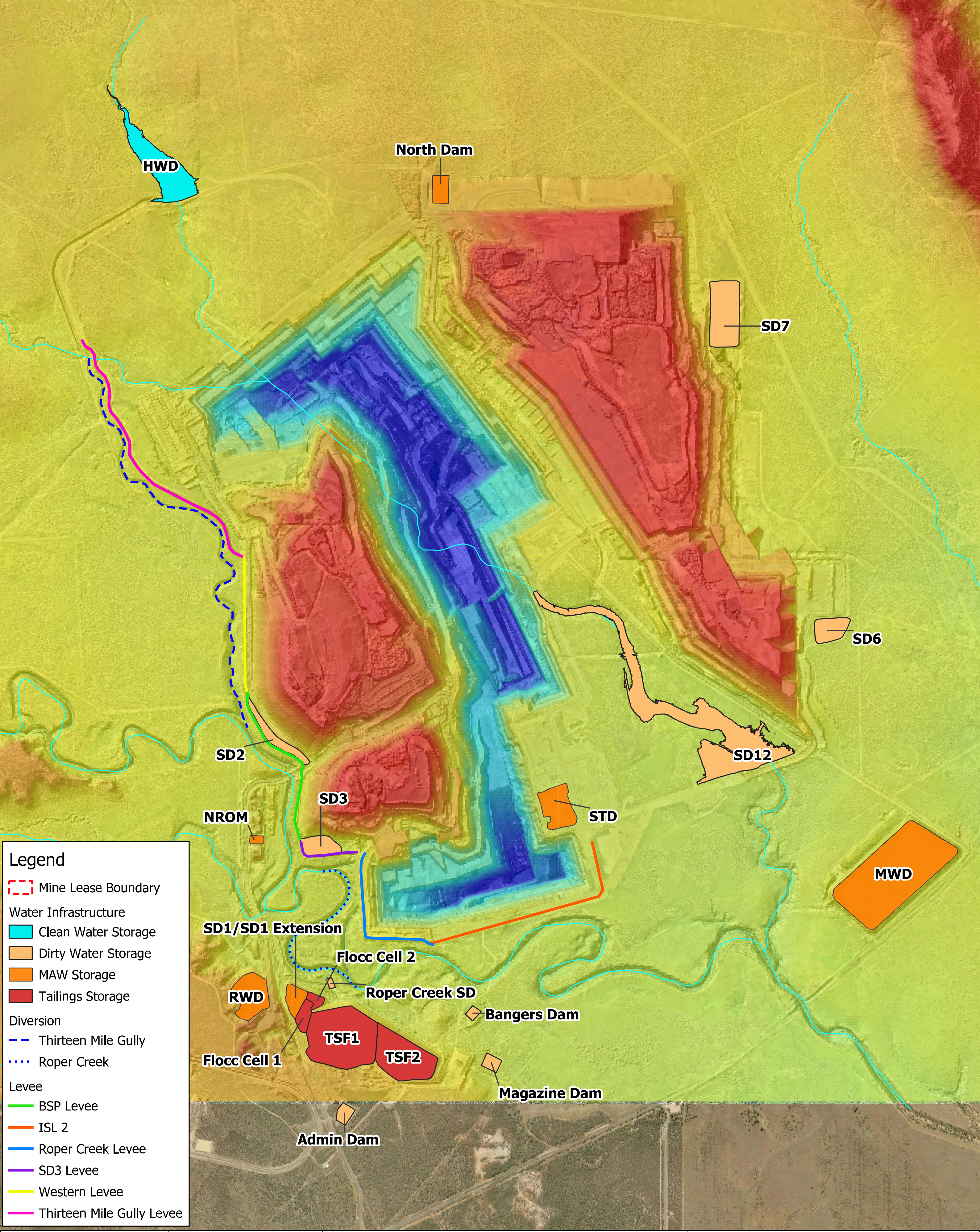
- Segregate clean and dirty/low quality water on site.
- Preferential use of mine-affected water for the site operational water demands (i.e., coal preparation and dust suppression), followed by harvested water from the overburden sediment dams and finally access external water supply.
- Use engineered water storages for mine-affected water management in preference to other storages and active mining pits.
- Retain on site, in mine, or have access to approximately 4 months' supply to meet water demands (~750 ML).
- Implement Trigger Action Response Plan (TARP) summarised in Section 3.4.

The site has two main mine-affected water storages, the Raw Water Dam (RWD) and Mine Water Dam (MWD). The main storages receive pit dewatering directly or South Transfer Dam (STD) located in the vicinity of the operational pit. The RWD and MWD act as a primary and secondary bulk storage respectively to minimise the evaporative losses. The runoff from the haul road immediately north of the CHPP and portions of the ROM and coal stockpile area drains to Sediment Dam 1 and then overflows to Sediment Dam Extension (SD1/SD ext.). A dedicated pump is located at SD1/SD1 ext. to dewatered to the RWD and minimise the risk of uncontrolled releases during the storm event. Further, runoff from the northern ROM and hardstand area is captured in the north ROM Dam (NROM) and transferred to RWD via STD. Runoff from the overburden dump area is collected in a series of Sediment Dams (constructed as part of the ESCP (Engeny, 2021) and are actively dewatered to the mine water storages for re-use or discharged as per the ESCMP. Generally, the on-site inventory is consolidated into key storages where demands are taken from to minimise the evaporation losses.

The RWD supplies the make-up CHPP demand (i.e., the difference between the gross CHPP demand and the and the volume of water returned from the active tailings storage facility (TSF2)). The tailings disposal system has been treated as a closed loop water circuit with the re-use of decant water taken into account with the provided CHPP water use data. The site dust suppression demand is currently sourced for the water cart fill points located at the Main Fill Point and North Fill Point. Dust suppression is preferentially sourced from the lowest quality water that is available on site. This has been represented in the water balance model by preferentially pumping water from the mine affected water dams before pumping water from the on-site stormwater storages (i.e., sediment dams).

At the time of development of this OWMP, the external water supply from German Creek pipeline had been ceased and MPCL is currently investigating arrangements to establish unrestrained access to 2ML/day of external water supply into RWD from BHP by January 2023 in order to supply the site operational demands.

Under the EA (DES, 2022), there are seven authorised release points, however, controlled release infrastructure is only at the MWD.



ENGENY WATER MANAGEMENT

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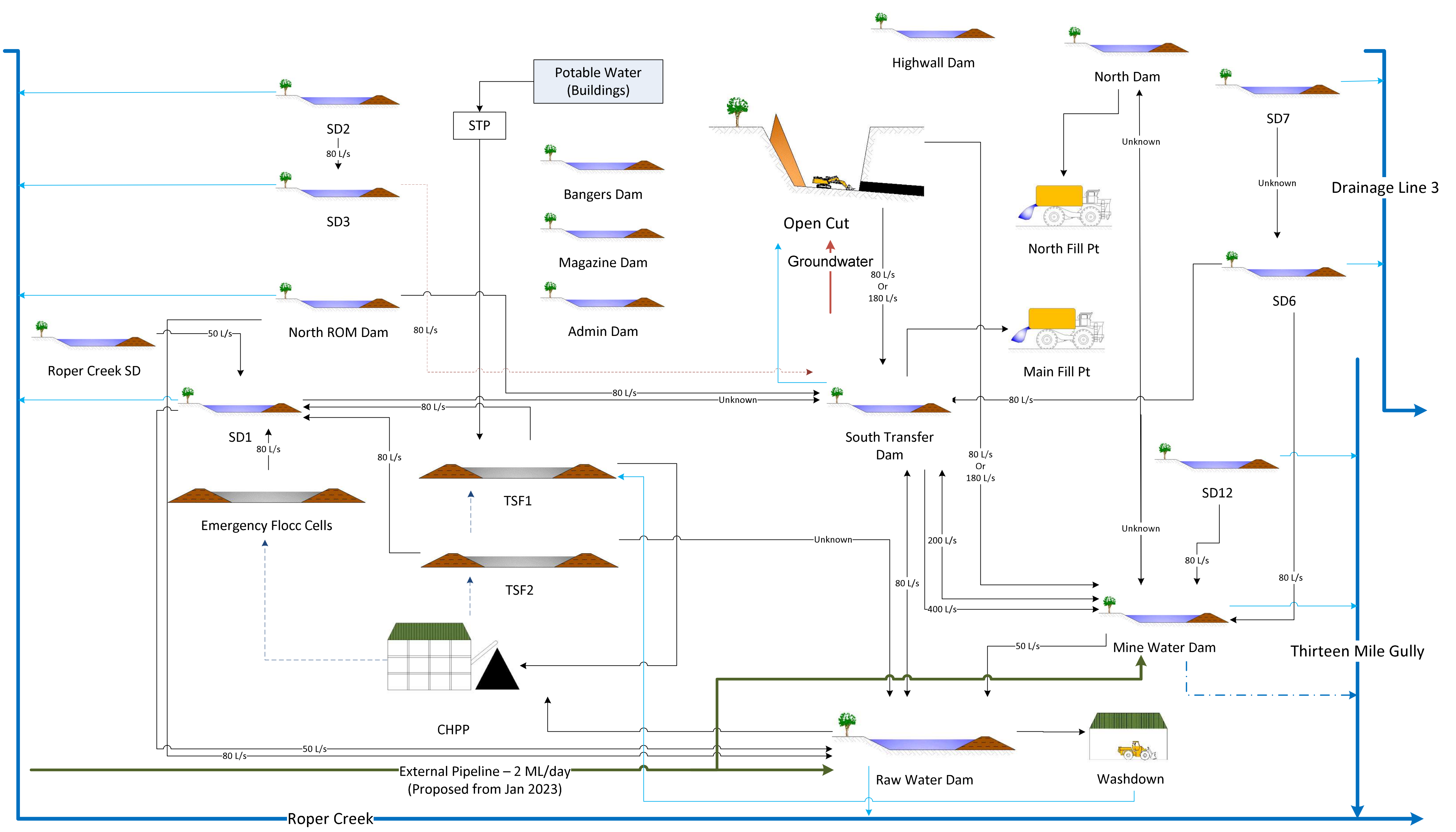
0 500 1,000 m

Scale in metres (1:22,500 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

		Middlemount Coal Pty Ltd
DATE	13/9/2022	Middlemount Coal Mine
DRAWN	AH	Existing Water Management System Infrastructure
JOB NO.	M80000_038	
		A3 Figure 2.2 A

Middlemount Coal Mine
Surface Water Management System



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Water Management System Schematic

Figure 2.3

Job Number: M80000_038
Revision: A
Date: 07/09/2022

2.4 MINE WATER INFRASTRUCTURE

Table 2.1 summarises the specification and description of the key water storages within/connected to the MCPL mine water system through pump and pipeline (Engney, 2021) (MCPL, 2021). Any clean water storages and on-site storm water storages on site not connected to the mine water system has been excluded from Table 2.1.

Table 2.1: Water Storage Characteristics and Functional Description

Storage ID	Current Catchment area (ha)	Full supply capacity (ML)	Functional Description
Open Cut Pit	942	24,500	Active mining pit, planned to be mining into north-east and south-east direction and receives groundwater inflow Operability threshold = 130 ML Continuous dewatering to STD and MWD
Raw Water Dam (RWD)	30	191	Mine affected water storage Lower threshold = 30ML; Upper threshold = 120ML Receives inflows from NROM, SD1/SD1 ext., STD, and MWD in the same order Pumps to STD if inventory exceeds 120ML Supplies water to CHPP and vehicle washdown Proposed to receive inflows (2ML/day) from Bingegang pipeline (third-party supply) from January 2023 to maintain operational volume of 120 ML.
Mine Water Dam (MWD)	31	1,927	Mine affected water storage Lower threshold = 750ML; Upper threshold = 1,705ML Receives inflows from Open Cut Pit, STD, SD6, and SD12. Pumps to RWD (bypassing STD) Can make controlled releases. Cease all controlled releases when mine water inventory is in conservation TARP mode. Refer to Section 3.4 Overflows to Thirteen Mile Gully
Sed Dam 1/ Sed Dam 1 extension (SD1/SD1 ext.)	15	60	Mine affected water storage Receives inflows from TSF1, TSF2, and FC1/ FC2 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)	24	26	Existing mine affected water storage Lower threshold = 10ML; Upper threshold = 20ML 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
North Dam[2]			North Dam is a turkey’s nest located north-west of the easter spoil dump The dam act as a staging dam between MWD and North Fill Point

Storage ID	Current Catchment area (ha)	Full supply capacity (ML)	Functional Description
North ROM Dam (NROM)	5	4	Mine affected water storage Pumps to RWD Overflows to Roper Creek
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	Emergency Flocc Cells Pumps to SD1/SD1 ext. Overflows to Roper Creek
Sed Dam 2 (SD2)	71	30	On-site sediment affected water storage Pumps to SD3 Overflows to Roper Creek
Sed Dam 3 (SD3)	42	78	On-site sediment affected water storage Pumps to STD Overflows to Roper Creek
Sed Dam 10 (SD10)	-	-	Decommissioned as of June 2021
Sed Dam 6 (SD6)	139	16	On-site sediment affected water storage (dam upgrading works are under process) Receives additional catchment area with decommissioning of SD10 Overflows to Drainage Line 3
Sed Dam 7 (SD7)	52	200	On-site sediment affected water storage Pumps to SD6 Overflows to Drainage Line 3
Sed Dam 9 (SD9)	-	-	Decommissioned as of July 2021
Sed Dam 12 (SD12)	472	131	On-site sediment affected water storage Receives additional catchment area with decommissioning of SD9 Overflows to Drainage Line 3

[1]*Excludes volume of tailings placed within the storage.*

[2]*Exculded from water balance modelling due to unavailability of staged storage curves and water transfer data from MWD. For the purpose of water balance modelling, MWD is supplying dust suppression demand as required.*

2.4.1 Storage Characteristics

Storage characteristics (level-area-volume relationship) remain consistent with the MCPL water tracking tool spreadsheet (Engeny, 2021).

2.5 WATER TRANSFER INFRASTRUCTURE

The water transfer system at MCM and from the proposed external pipeline (third-party) is represented in the site water management system schematic shown in Figure 2.3. Internal transfers have been represented in accordance with pump rates shown in the site schematic and trigger levels detailed in the Table 2.1 as previously supplied by MPCL.

2.6 MINE WATER RELEASES

The controlled releases from the MWD to Roper Creek in accordance with Conditions C8 - C10 of the Environmental Authority (EA), EPML00716913 (DES, 2022). Although there are seven authorised release points in the EA, under the current water management system, controlled release is only made from MWD. Table 2.2 summarises the modelled controlled release conditions.

Table 2.2: Mine Affected Water Release Limits (End of Pipe) (DES, 2022)

Receiving Waters/ Stream	Gauging Station Coordinates	Release Points (RP)	Receiving Water Flow Criteria for Discharge	Maximum Release Rate (m^3/s)	Electrical Conductivity[1] (µS/cm)
Roper Creek,	Easting: 667,484 Northing: 7,471,112	RP 2 (MWD)	Low Flow For a period of 28 days after natural flow event that exceeds $2m^3/s$	0.4	700
			Medium Flow $>2m^3/s$	1.12	1,500
			High Flow $>10m^3/s$	5.6	1,500
			$>10m^3/s$	>1.6	3,500
			Very High Flow $>25\ m^3/s$	2.1	<6,000

[1] End of pipe water quality is the quality of the water being released and the release potential from MWD assumes no infrastructure constraint at the release point.

3 WATER BALANCE MODEL

3.1 EXISTING GOLDSIM MODEL

The MCM site water balance model was initially developed by Engeny in 2021 using GoldSim software package. 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. Refer to Water Balance Development Report (Engney, 2021) for detailed description of the model development and Australian Water Balance Model (AWBM) parameters.

Key aspects of the model include:

- The model can be used to simulate 133 years of historical data (i.e., combination of SILO climate data and site recorded data).
- The water balance model includes a coupled salt balance to estimate 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 existing mine water infrastructure including storages, pumps and pipelines and water releases.
- Water storage characteristics are simulated using the latest storage curves representing volume-area and volume-level relationships (Engeny, 2021).
- The potential for mine water release is estimated based upon the simulated flow of receiving waterways at the nominated gauging stations in accordance with the EA conditions (DES, 2022). No constraint on the capacity of the water release infrastructure has been incorporated into this model.

The site water balance model allows the performance of the water management system to be simulated for a range of potential climate scenarios. Key performance metrics include:

- Ability of the system to contain mine affected water in accordance with the EA.
- Impact to mining operations from excess mine water accumulation.
- Ability of the system to reliably supply water for site demands.

The simulated performance of the water management system (both hindcasting and forecasting) is presented in Section 3.3 and Section 4.

3.1.1 MCPL WBM Version

The WBM is supplied to MCPL in both the full commercial (GoldSim Pro) and free Player (GoldSim Player) versions of the GoldSim software. Results can be saved within a Player file once the model has been run or copied into Excel or other software.

Model versioning has been included in the model using the in-built model versioning capabilities of the GoldSim software. Model versioning should be used to document future updates and changes to the WBM. The final model supplied to MCPL at the time of this report is M80000_038-WBM 12.1-001-V1.2-MCPL WBM dated 13 September 2022.

3.2 MODEL UPDATE

Model inputs were updated to reflect future mining operations and validated against recorded water inventories from the past wet season. The following sections describe the major updates.

3.2.1 Inflows

The following updates were made to water balance model inflows:

- Updated the historical daily rainfall data. (1889 -2022).
- Updated catchment areas and land uses for the 5-year mine planning horizon in line with the planned pit progression and rehabilitation plan (MCPL Supplied, 2022). Figure 3.1 shows the site current and forecast catchment area for Yr 2023, Yr 2025, and Yr 2027 in comparison to current catchment area.

– Planned pre-strip areas were included in the hardstand land use category.

- Initial dam volumes and water quality as summarised in Table 3.1.
- At the time of this model update, the external water supply from German Creek pipeline has been ceased and the site is planned to have unrestrained access to 2ML/day of external water supply from Bingegang Pipeline to RWD from January 2023.

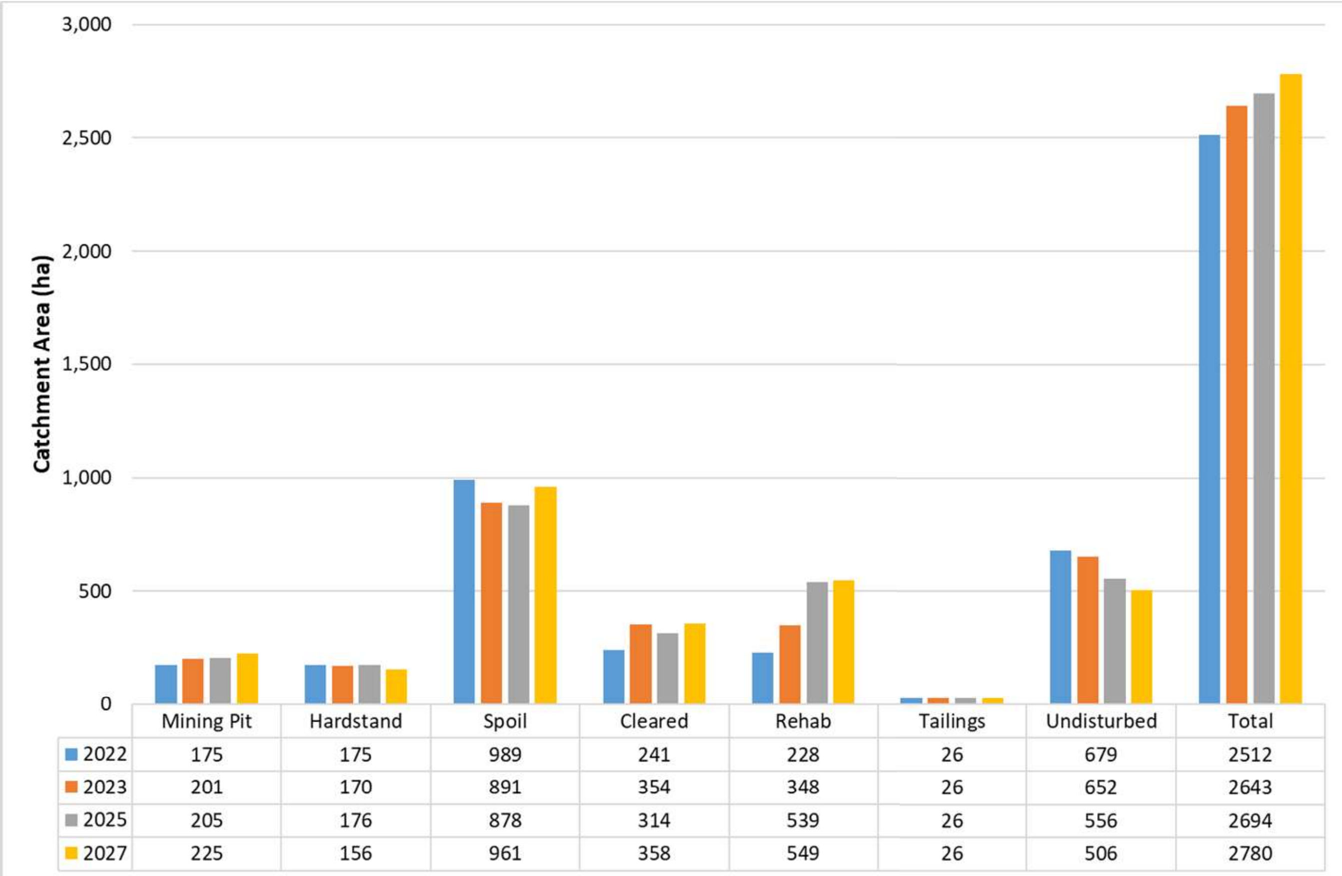

Figure 3.1: Current and Forecast Catchment Area

Table 3.1: Initial Dam Volume and Water Quality

Storage ID	Initial Volume (ML) (As of August 2022)	EC (µS/cm)
Open Cut Pit	71	11,290 [1]
Raw Water Dam (RWD)	119	11,300 [3]
Mine Water Dam (MWD)	1,646	21,300 [3]
Sed Dam 1/ Sed Dam 1 extension (SD1/SD1 ext.)	-	13,300 [3]
South Transfer Dam (STD)	10	10,144 [1]
North ROM Dam (NROM)	2	8,000 [3]
Tailings Storage Facility 1 (TSF1)	-	-

Storage ID	Initial Volume (ML) (As of August 2022)	EC (µS/cm)
Tailings Storage Facility 2 (TSF2)	-	-
Emergency Storage Cells (FC1/FC2)	-	-
Sed Dam 2 (SD2)	30	3,400 [2]
Sed Dam 3 (SD3)	45	1,360 [2]
Sed Dam 6 (SD6)	1	1,340 [3]
Sed Dam 7 (SD7)	4	568 [1]
Sed Dam 12 (SD12)	128	826 [3]

[1] Data based on previous WBM update due to unavailability of recent recorded data (Engney, 2021)
[2] Date recorded: 22/03/2021 – 24/03/2021
[3] Date recorded: 14/09/2021

3.2.2 Outflows

The following updates were made to water balance model outflows:

- Updated the historical daily evaporation data. (1889 – 2022).
- Updated the CHPP make up water demand based on the net consumption rate of 170L/ROM feed tonne (incl. return water from TSF1) and the ROM production over the next 5 years (MCPL Supplied, 2022) (refer to Figure 3.2 and Figure 3.3).
- Updated the forecast dust suppression demand based on historical recorded usage data and unmetered dust suppression demand of 3.6 ML/month (MCPL Supplied, 2022) (refer to Figure 3.3).

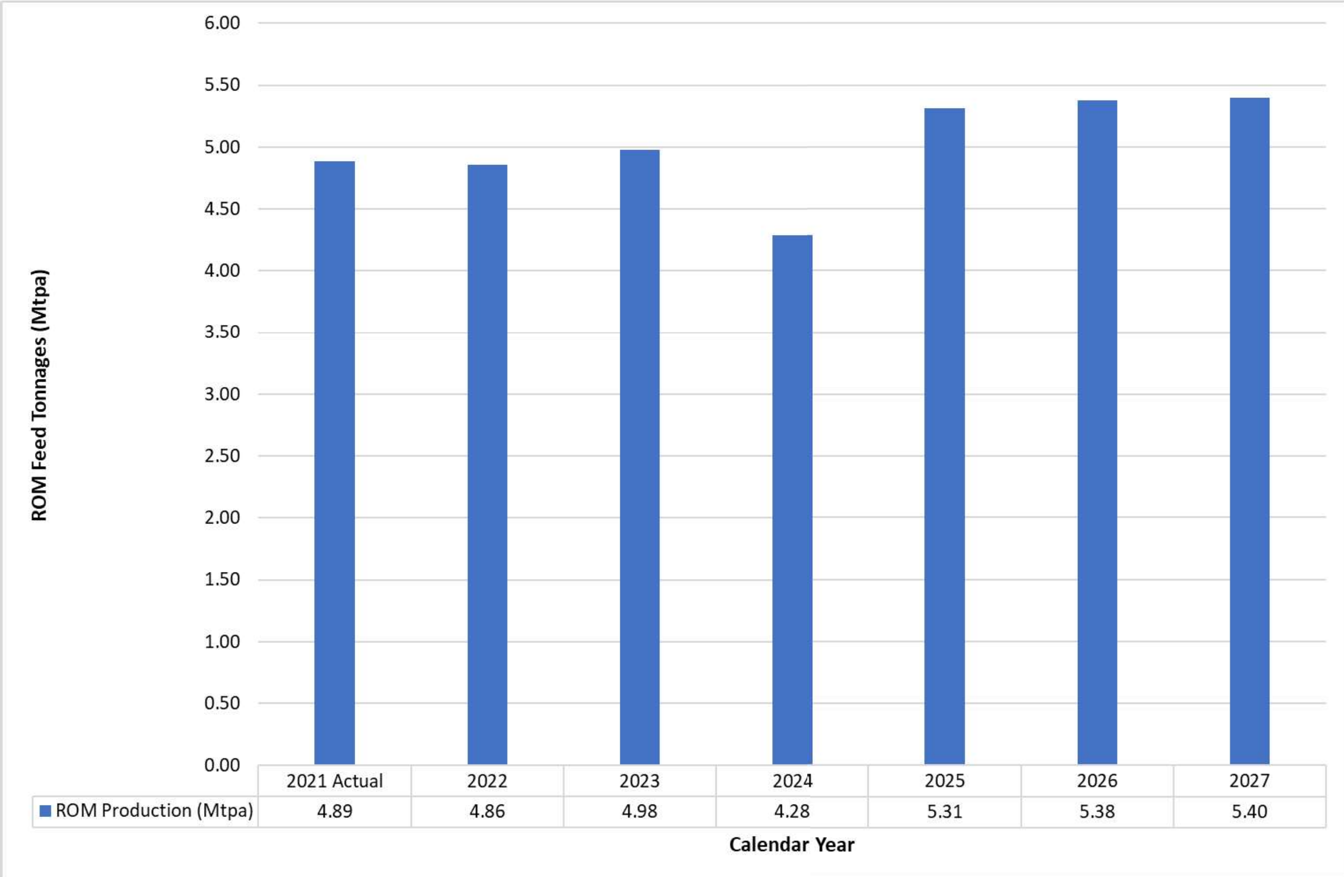

Figure 3.2: ROM Actual and Forecast Production

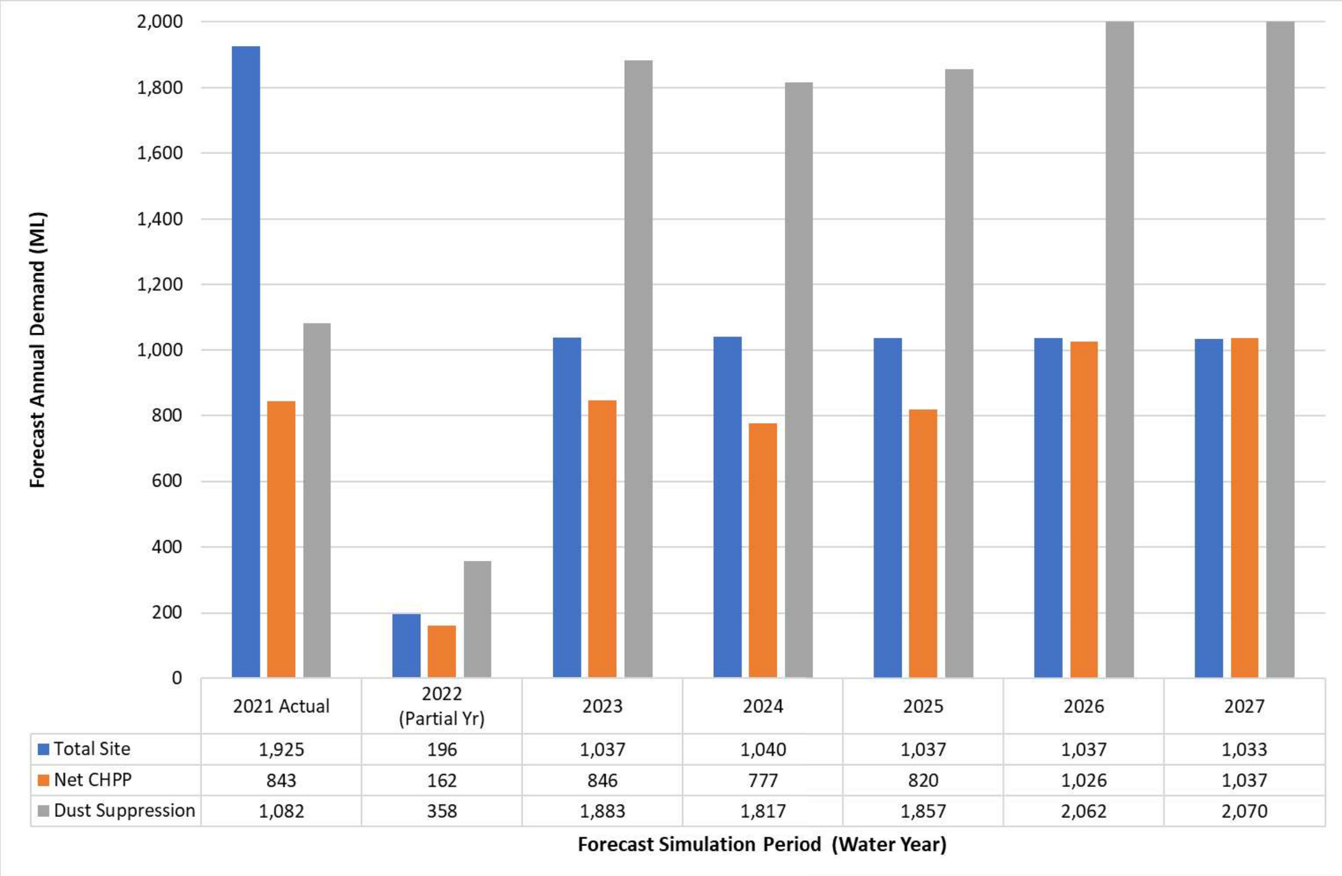

Figure 3.3: Actual and Forecast Site Water Demands

3.2.3 Update of Operational Rules

Major operational changes included in this 2022 update include:

- Decommissioning of German Creek pipeline. Bingegang pipeline is planned to be available from the start of 2023. The external pipeline is proposed to supply 2ML/day into RWD when the total mine water inventory is below 'conserve mode' of TARPs (refer to Section 3.4).
- Following decommissioning of SD9 and SD10, their respective catchments are redirected to SD12 and SD6 respectively in the water balance model.

3.3 MODEL VALIDATION

3.3.1 Approach

Water balance model calibration was undertaken using MCPL monitored storage water levels/ volumes, water usage and production data for the period July 2019 to April 2022 (~3 years). The model results were compared against recorded inventory to determine the calibration accuracy. Key data inputs and assumptions for the calibration included in Table 3.2.

Table 3.2: Validation – Key Inputs and Assumptions

Input Data	Data source	Confidence
Rainfall	Site specific weather station	High
Catchment area	Delineated based on the latest site survey taken in June 2021	High

Input Data	Data source	Confidence
Groundwater Inflows	"For the period of July 2019 to December 2021, an average daily inflow of 1.5 ML/day is adopted from historical AWT reporting (MCPL, 2020) From January 2021 onwards, the groundwater inflow is adopted based on the forecast inflow estimates undertaken by AGE (AGE, 2020)	Low
Third-party Supply	Recorded German Creek Pipeline inflows from Water Tracking Tool	High
Evaporation	Derived from SILO database	High
CHPP Net Demand	Calculated based on recorded monthly ROM CHPP feed tonnages and 170 L/tonne of net demand	Medium to High
Dust Suppression Demand	Recorded daily numbers of truck loads for dust suppression	Medium
Water Level	Recorded site storage water levels summarised in MCPL Water Tracking Tool	Very Low: Open Cut Pit, and Sed Dams Medium to High: Mine Water Dams

Storage water levels in the following key mine affected water storages:

- Open Cit Pit.
- MWD.
- RWD.
- SD1/ SD1 ext.
- STD.
- NROM Dam.
- TSF1.
- TSF2.
- FC1/ FC2.

3.3.2 Validation Results

Figure 3.4 shows the plot of the modelled total MAW inventory volume for the validation period i.e., July 2019 to April 2022, and the volume derived from the monitored water levels and available storage characteristics. The validation found:

- The model predicts similar rate of decline and mine water inventory during average and below average climate conditions suggesting model outflows are well represented.
- There was a misalignment in the modelled and recorded increase in inventory January 2020 to February 2020 rainfall event and November 2021 rainfall event. The recorded inventory does not show similar response to rainfall as modelled inventory. Review of the recorded data suggest inaccurate measurement of the inventory in pit, Figure 3.5 shows in-pit volume remains constant after the rainfall events occur.
- The water balance model reports all runoff instantaneously to a pit and mine water storage following a rainfall event. In reality volume will be residing in pit will not be accounted for in the recorded site inventory. It appears that the water collected in the pit during the rainfall events is dewatered to the mine water dams over an approximate period of 4 months as the recorded inventory matches the modelled inventory.
- Similar rainfall response is seen in the modelled inventory during the shorter rainfall events in March 2021 and July 2021 whereas no change in the in-pit inventory is recorded (refer to Figure 3.5).
- The calibration results are considered to be within reasonable bounds given the potential variability in the mine affected water movements across different storages, response to site usage, and operational logics/ constraints applied on the water balance model.

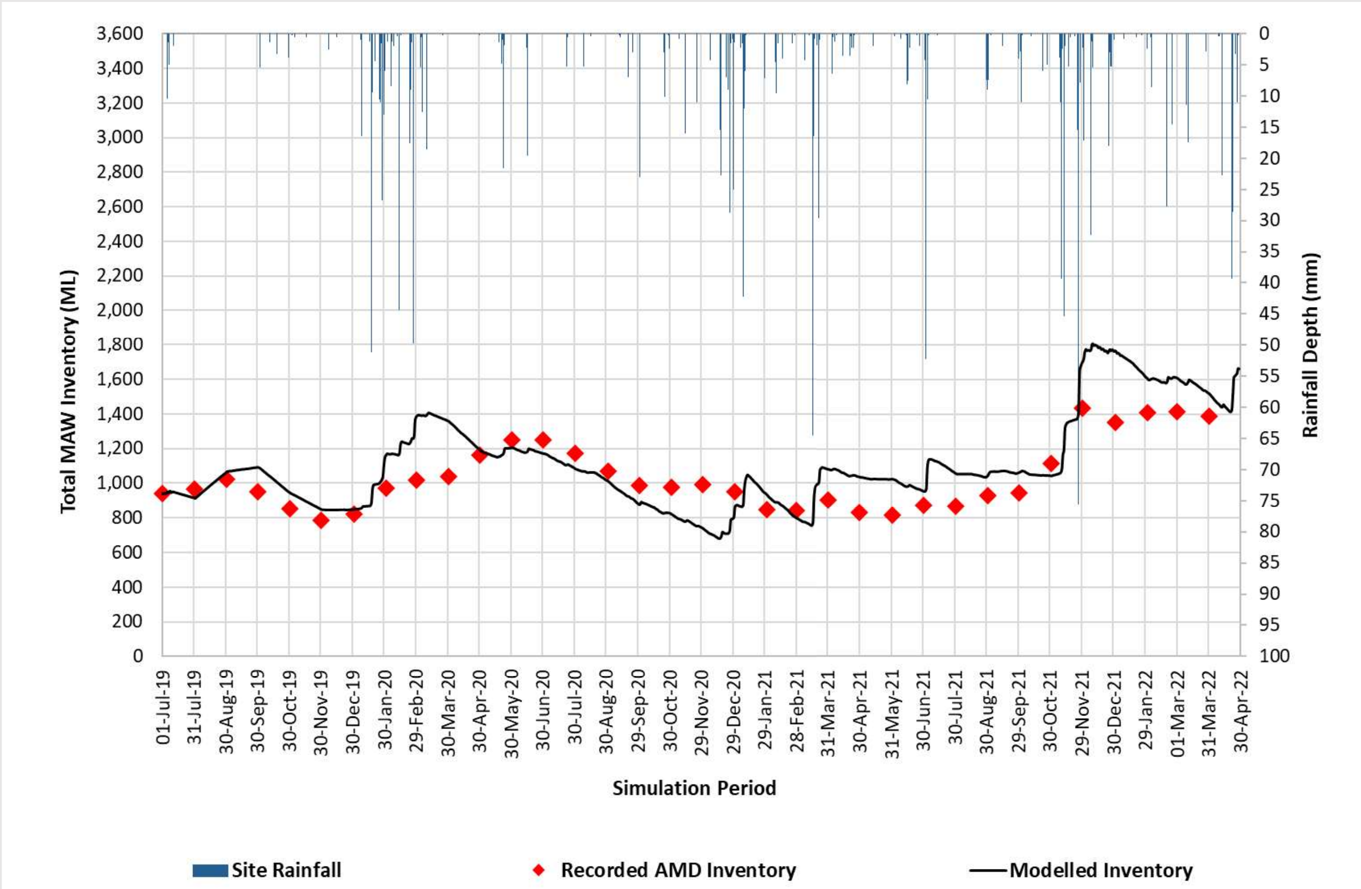

Figure 3.4: Water Balance Model Calibration – Total MAW Inventory

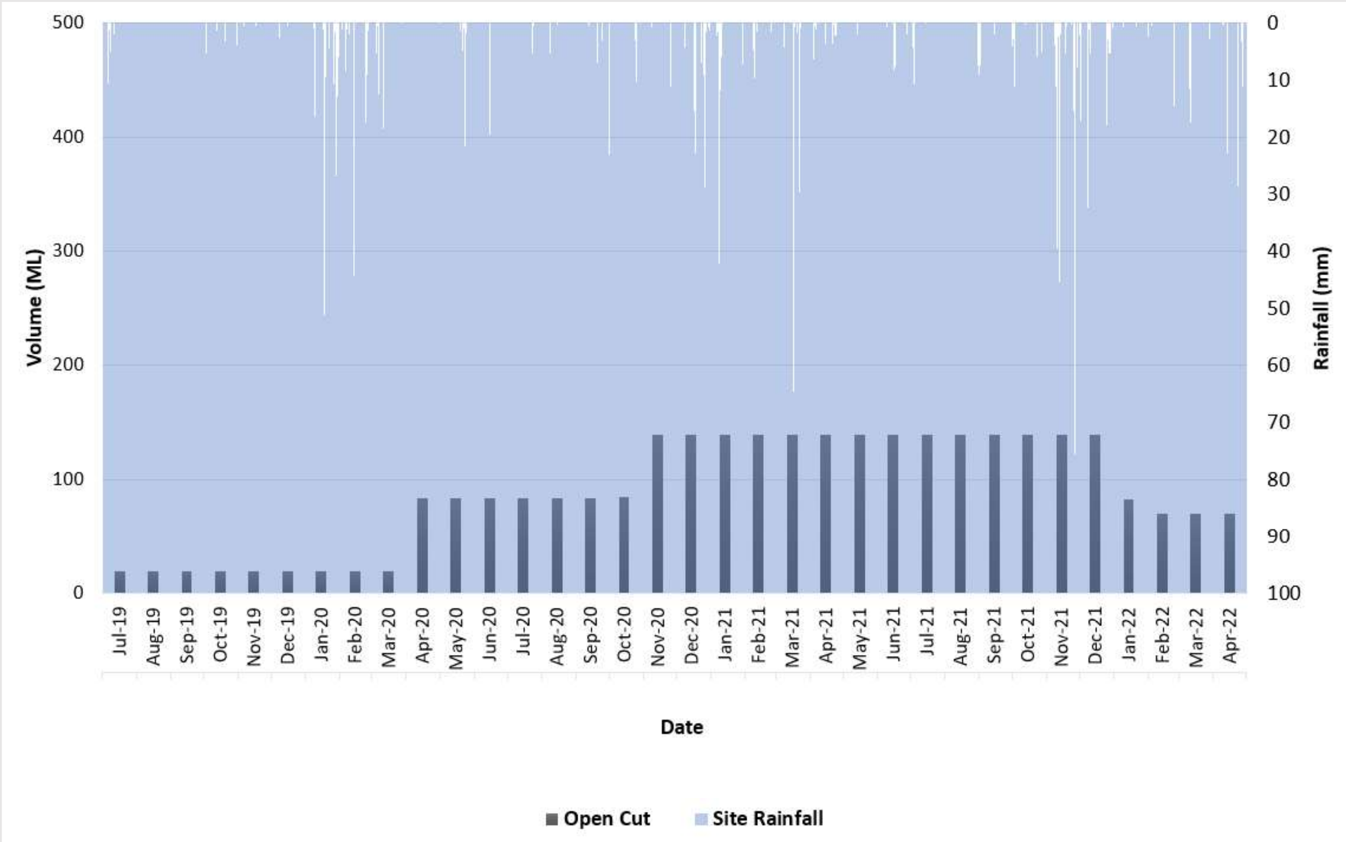

Figure 3.5: Recorded Mining Pit Inventory over Validation Period

3.3.3 Recommendations for Further Improvement

Based on the above, the following recommendations and opportunities for future improvement are provided:

- Record site water levels in all storages accurately (incl. Open Cut Pit).
- Installation of flow meters on transfer of the key water storages such as:
  - Pit dewatering to assess both rainfall runoff response and groundwater inflows.
  - Tailings decant.
  - Transfer pipelines connected to RWD and MWD.

3.4 OPERATIONAL RULES

3.4.1 Trigger Action Response Plans (TARPs)

The mine water management Trigger Action Response Plans (TARPs) were developed by Engeny (Engney, 2021). Triggers for the mine water system operating rules are shown in Table 3.3.

Table 3.3: Mine Water System Operating Rules Trigger Level

	Level 1 - Drought	Level 2 - Conserve	Level 3 - Normal	Level 4 - Contingency	Level 5 - Pre-Flood	Level 6 - Flood
Trigger - MAWInventory	<=750ML	1.0GL-750ML	1.0GL-1.8GL	1.8GL-2.0GL	2.0GL-2.2GL	>=2.2GL
Description	Below the 4-month supply to maintain operations and allowing for dead storage.	Risk of dropping below the 4-month supply to maintain operations.	Below the total DSA volume for RWD and MWD, and above conserve mode.	Above the total DSA volume for RWD and MWD. Risk of exceeding MRL.	Above the MRL volume for RWD and MWD. Risk of uncontrolled release.	Above the MRL volume for RWD and MWD. Risk of uncontrolled release.
Controlled Release	No	No	Yes	Yes	Yes	Yes
Third Party Offtake	Yes	Yes	No	No	No	No
Action - If occurs during late dry season and early wet season (Aug-Dec)	Top up the RWD & MWD with third-party offtake. Harvest water from sediment basins Review ability to reduce water cart operations	Top up the RWD & MWD with third-party offtake. Harvest water from sediment basins Review ability to reduce water cart operations	Cease Third Party Offtake. Harvest water from sediment basins	Cease Third Party Offtake. Cease harvesting water from sediment basins Consider bring on additional Water cart	Inform DES regarding incident of exceeding MRL. Consider bring on additional Water cart. Prepare to sacrifice operational pit.	Inform DES regarding incident of exceeding MRL. Sacrifice operational pit. Consider bring on additional Water cart

	Level 1 - Drought	Level 2 - Conserve	Level 3 - Normal	Level 4 - Contingency	Level 5 - Pre-Flood	Level 6 - Flood
Action - If occurs during Mid wet season (Jan-Mar)	Top up the RWD & MWD with third-party offtake. Harvest water from sediment basins Review ability to reduce water cart operations	Top up the RWD & MWD with third-party offtake. Harvest water from sediment basins Review ability to reduce water cart operations	Cease third-party offtake.	Cease Third Party Offtake. Cease harvesting water from sediment basins Consider bring on additional Water cart	Inform DES regarding incident of exceeding MRL. Consider bring on additional Water cart	Inform DES regarding incident of exceeding MRL. Sacrifice operational pit. Consider bring on additional Water cart
Action - If occurs during late wet season/Early Dry Season (April -July)	Top up the RWD & MWD with third-party offtake. Harvest water from sediment basins Review ability to reduce water cart operations	Top up the RWD & MWD with third-party offtake. Harvest water from sediment basins Review ability to reduce water cart operations	Cease third-party offtake. Harvest water from sediment basins	Cease Third Party Offtake. Cease harvesting water from sediment basins	Inform DES regarding incident of exceeding MRL. Consider bring on additional Water cart	Inform DES regarding incident of exceeding MRL. Sacrifice operational pit. Consider bring on additional Water cart

4 WATER MANAGEMENT PERFORMANCE ASSESSMENT

4.1 OVERVIEW

The performance of the MCM water management system was assessed using the current the 5-year mine plan, therefore, the WBM has been simulated to forecast from September 2022 to October 2027. The system was assessed to determine its ability to minimize impacts to mining operations during both wet and dry climate periods as well as comply with environmental license conditions. The system performance of the water management system over the forecast period of 5-years is presented in the sections below.

4.2 WATER MANAGEMENT ASSESSMENT RESULTS

The total site mine water inventory forecasts are presented in Figure 4.1 against the system TARP levels summarised in Section 3.4. These probability plots show the range of likely total stored MAW water volumes, with the solid lines showing median or "most likely" volumes, and the broken lines representing the 5th/95th percentile volumes which represent longer term lower(dry) and higher(wet) rainfall conditions respectively. The 5th percentile and 95th percentile plots are the adopted risk profile for MCPL to inform the water management system performance. It is important to note that the simulated WBM results do not represent a single climate scenario. The probability results are based on 132 realisations (i.e., the median volume inventory does not represent model forecast volume from median climate conditions).

Figure 4.2 shows the average inflows and outflows of the MCM water management system (incl. mine water dams and sediment water dams) of the 5-year forecast period.

Key outcomes for the system performance include:

- Accumulation in the 95th percentile is estimated to exceed the total storage capacity (excl. operational pit) by January 2023 and will stay within the 'flood mode' of the TARP in the next 5 years.
- The 5th percentile MAW inventory is predicted to drop into the 'drought mode' by November 2023 and is predicted to drop to dead storage in 'drought mode' within the next 5 years of operations.
- In a median climate scenario, the MAW inventory is expected to stay within the 'normal mode' of TARP.
- The average total annual inflows to the mine water system is 3.17 GL/year whereas, the total annual outflows to the system is 3.21 GL/year.
- Average annual runoff and groundwater contributes 59% and 30% respectively of the total mean annual system inflows. The system relies heavily on the predicted groundwater inflows (AGE, 2020) into the pit dry period to minimise shortfall and third-party offtake.
- Site dust suppression and CHPP net water usage makes up 32% and 28% respectively of the total mean annual system outflows, followed by evaporation, i.e., 27%.

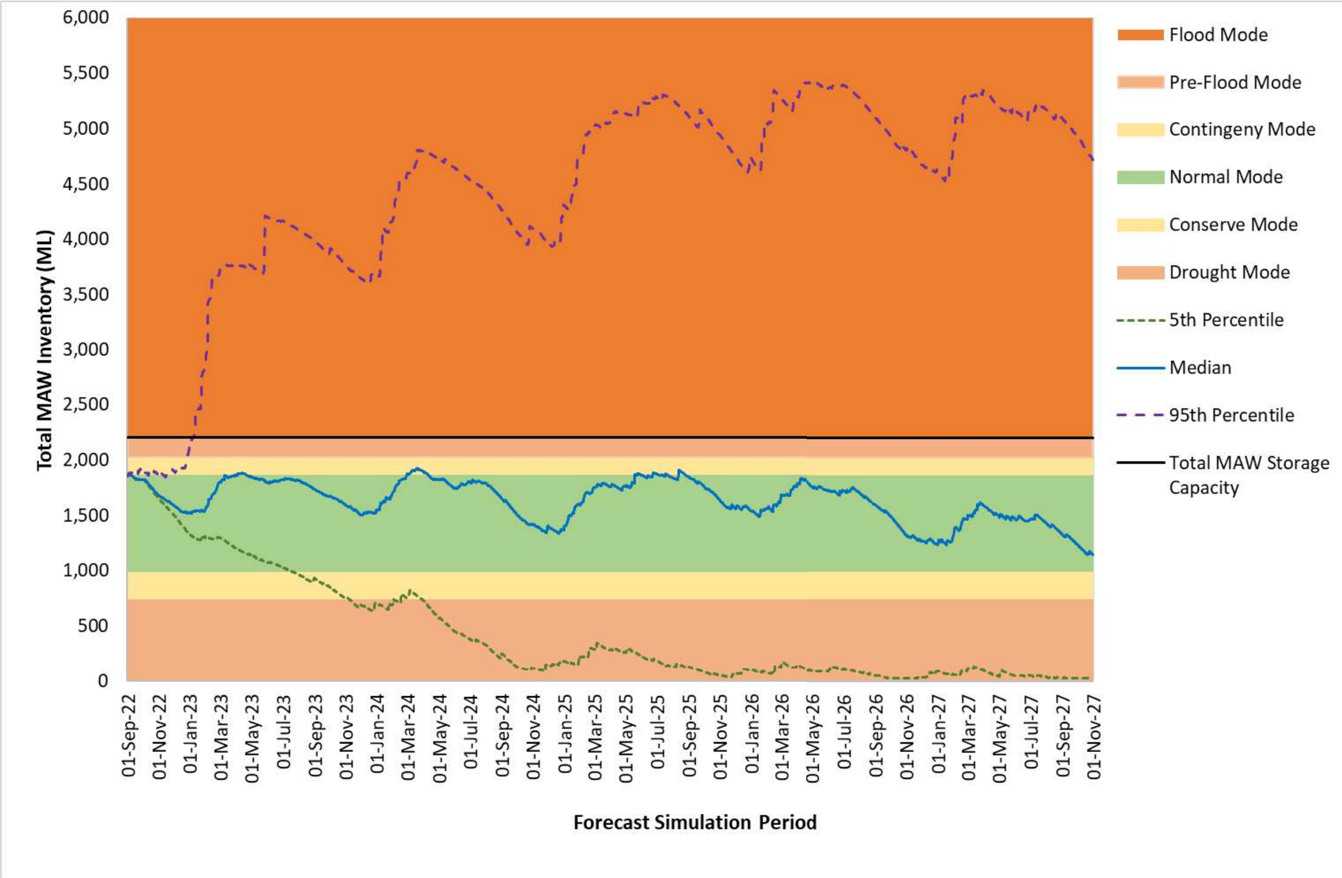

Figure 4.1: Site Mine Water Forecast Inventory

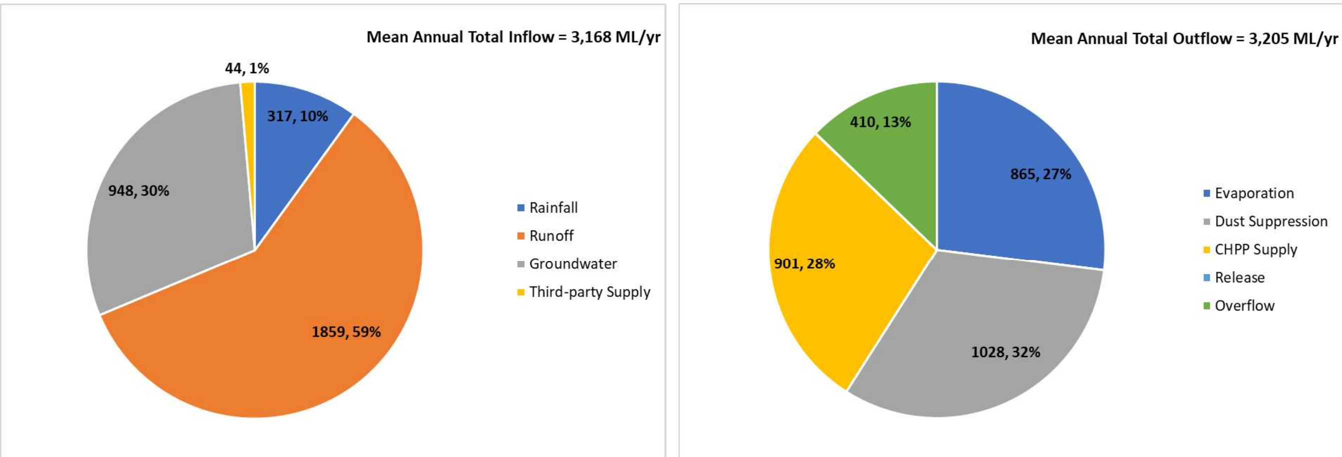

Figure 4.2: Mean Annual Inflows and Outflows over Forecast Period

4.2.1 Water Surplus

Key outcomes for the system performance under ‘wet’ climatic condition include:

- The site is expected to exceed the ‘normal operation mode’ and reach ‘flood mode’ by January 2023 under 95th percentile.
- Potential need to sacrifice part or all of the operational pit to avoid exceeding the design storage allowance (DSA) before 01 November and mandatory reporting level (MRL) of the regulated dams with Significant consequence category of ‘Failure to Contain – Overtopping’ scenario (i.e., MWD, RWD, SD1/SD1 ext.).
- Sacrificing the operational pit by accumulating water may exceed the in-pit sump capacity (i.e., operability threshold of 130 ML), leading to pit inundation impacting pit operability.

- Figure 4.3 shows the statistics of the total annual pit inundation days (i.e., pit inventory > operability threshold volume) over the simulation period. The results show significant risk to the mining operations in next 5 years:
  - 95th percentile: modelled pit inundation duration is 306 days to 365 days per year over 5 years.
  - Median: modelled pit inundation duration is 24 days to 77 days per year over 5 years.
- The forecast results indicate insufficient out of pit storage to maintain operations as usual.
- Controlled mine water release from MWD are critical to remain below 'pre-flooding mode' of TARP (see Table 3.3). However, the forecast results indicate no controlled release would occur based on the EA conditions (refer to Section 2.6). The inability of the system to release is due to high salinity (EC) in the MWD, high salinity of the groundwater, and runoff parameters:
  - It is noted that the WBM accounts for the dilution of salinity occurring during water transfers from sediment basins and high rainfall conditions.
- The MAW storages are forecast to have less than 5% risk of uncontrolled overflow in line with the requirement specified in the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures* (DES, 2016).

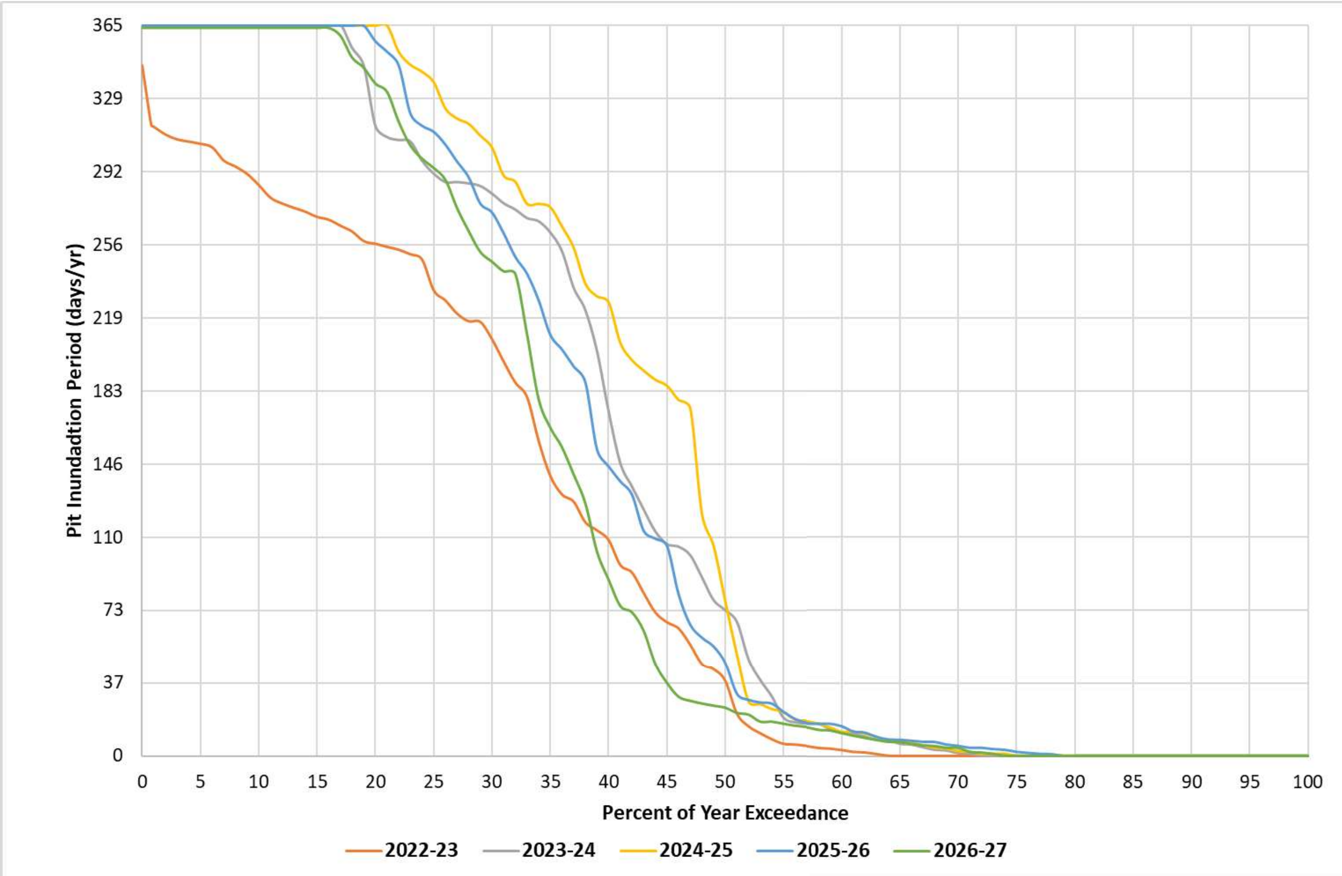

Figure 4.3: Forecast Annual Pit Inundation Period

The operational recommendations and infrastructure planning required to prevent mine water accumulation over the 5-year planning horizon are discussed in Section 5.

4.2.2 Water Deficit

Key outcomes for the system performance under 'dry' climatic condition include:

- The WBM triggers the third-party offtake from January 2023 at a maximum extraction of 2ML/day (~730 ML/yr) as the site inventory drops below the 'conserve mode' of TARP.
- Figure 4.4 delineate the water supply reliability and magnitude of shortfall volume for the next 5 years respectively. The results indicate a 25% chance of shortfall within the 5-year planning horizon with 5% chance of ~130 ML of shortfall in year 2026-27.

- The modelling suggests the third-party supply of (~730 ML/year) is insufficient to maintain 100% supply reliability over the next 5 years and the absolute volume required is heavily reliant on the groundwater inflows to the operational pit.

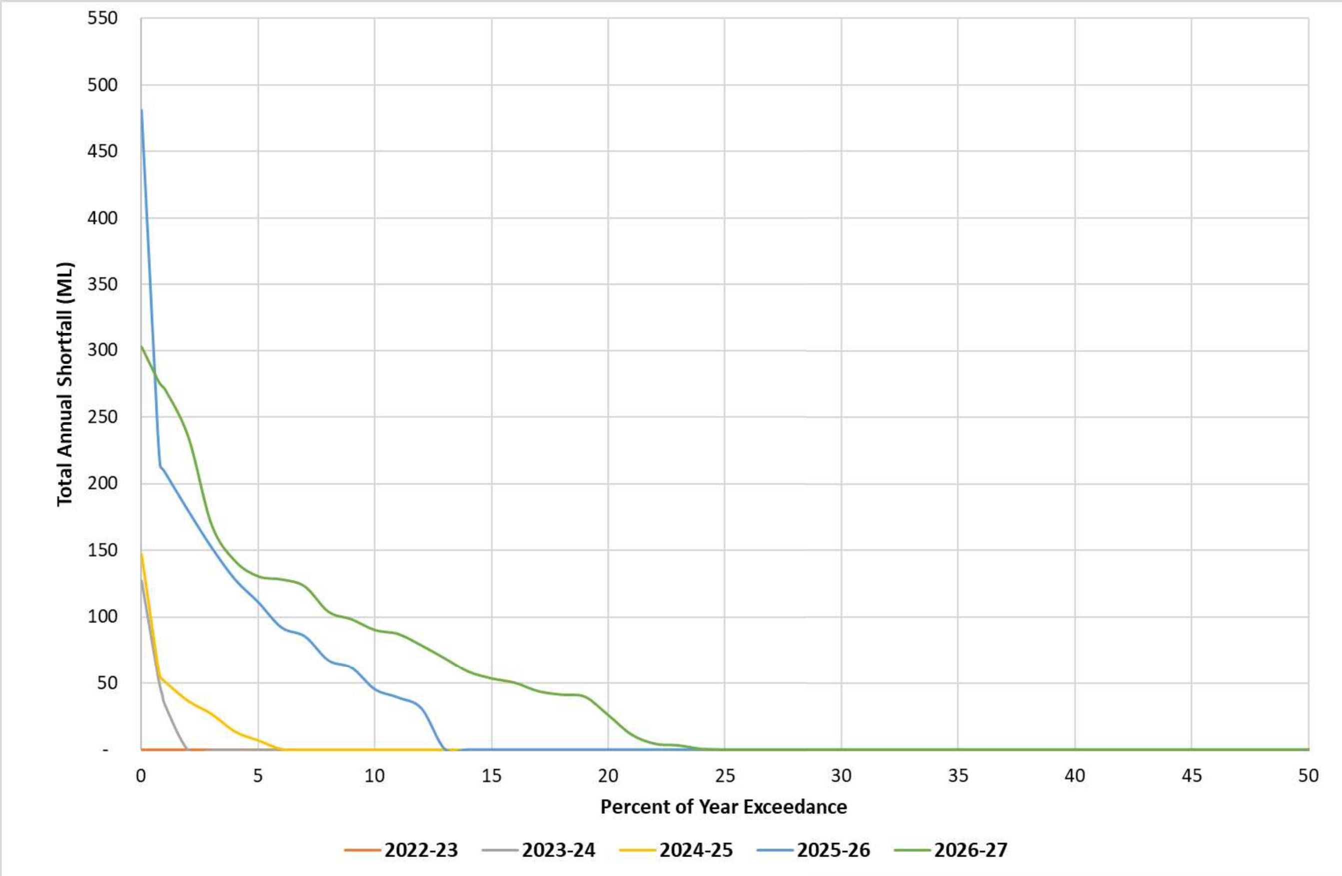

Figure 4.4: Forecast Total Annual Site Shortfall

No Third-Party Supply Sensitivity

- The modelling suggests a considerable risk of water deficit in case of no third-party supply.
- Figure 4.5 delineate the water supply reliability and magnitude of shortfall volume with no access to the third-party supply. The results indicate ~33% chance of shortfall within the 5-year planning horizon with 5% chance of ~730 ML of shortfall in year 2026-27.

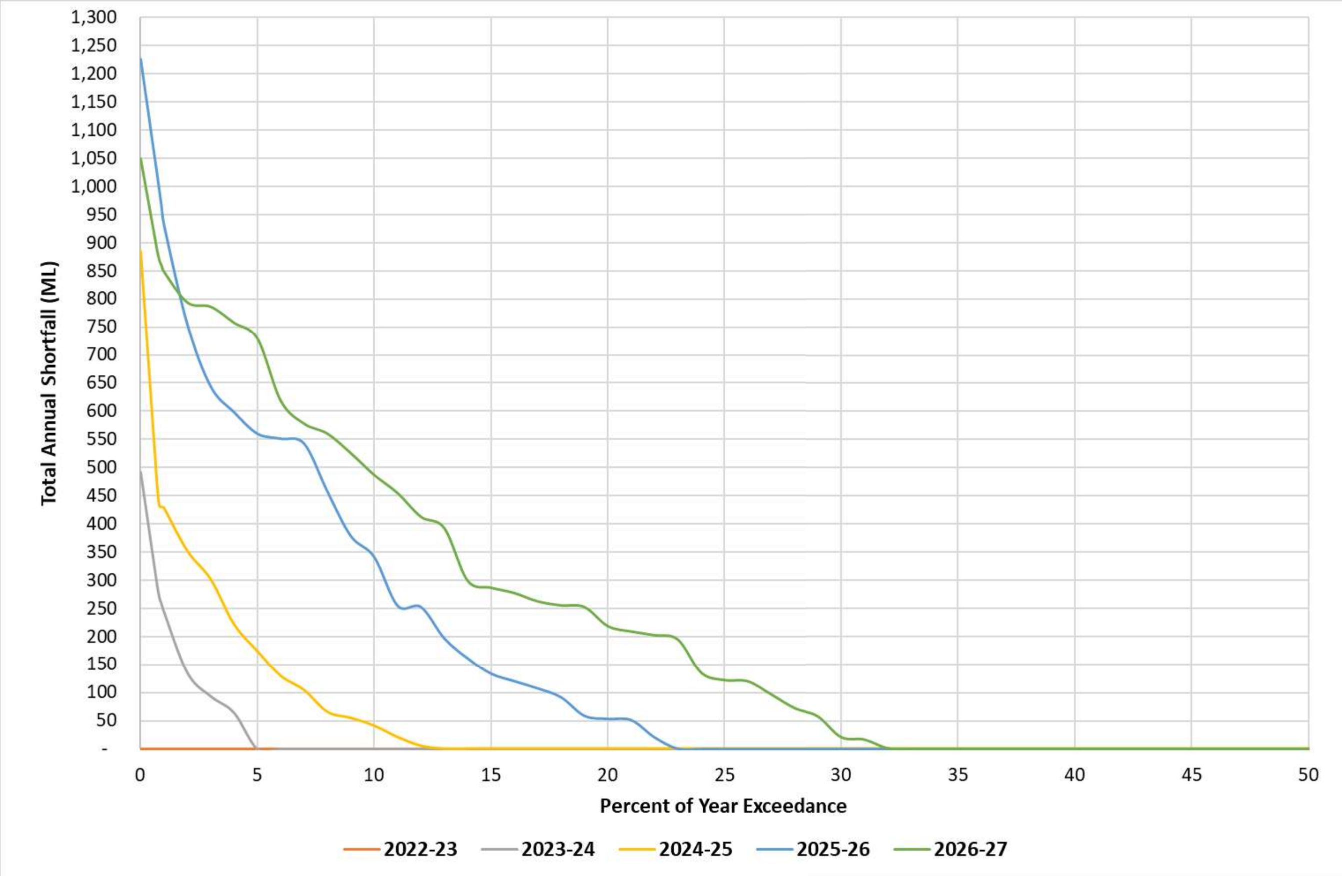

Figure 4.5: Forecast Total Annual Site Shortfall (Sensitivity – no Third-Party Supply)

The operational recommendations and infrastructure planning required to prevent mine from water security risks over the 5-year planning horizon are discussed in Section 5.

4.2.3 TARP Optimization Assessment – Third Party Offtake

A sensitivity assessment was undertaken as requested by MPCL where the third-party offtake is modelled to be available when the site inventory drops below the 'normal mode' of TARPs. The findings from this assessment are summarised below:

- The RWD operational strategy is modelled to have priority inflows from the mine water dams and triggers the inflow of third-party offtake when RWD inventory + MAW inflows drop below the dam maximum operating volume of 120 ML.
- Based on the RWD operational strategy (i.e., re-use mine affected water as priority), the modelled third-party offtake trend and volume over the forecast period is consistent as the offtake in the base modelling scenario (refer for Section 3.4.1) (i.e., third-party offtake when inventory drops below 'conserve mode' of TARPs.
- This implies that if MCPL were to operate to take third-part water when the inventory drops below 'normal mode', the operational strategy of RWD and MWD would be one of the two below scenarios:
  - Either when RWD is at its maximum operating level (120 ML), the third-party offtake will be directed to MWD
  - Or third-party offtake would be a high priority inflow to RWD and mine affected water inflow will have low priority, therefore, MWD would be used as bulk water storge for MAW.
- Based on conversation with MCPL stakeholders, the third-party offtake arrangement with BHP is likely to be 'pay per ML offtake' and not 'pay or take'.
- Following drawbacks are identified based on the TARP optimisation assessment.
  - Storing water third-party water in MWD will lead to increase in evaporation losses of the offtake
  - Operating the MWD as primary bulk water storage for MAW will impact the MAW re-use efficiency of site, (i.e., not using MAW as priority to supply operational demands).
  - It is not considered a cost-efficient TARP operational rule.
- It is recommended to only take third-party offtake when the MAW inventory drops below 'conserve mode' of TARPs

5 INFRASTRUCTURE PLANNING

The infrastructure planning for the 2022 Middlemount Coal Mine OWMP identifies future water infrastructure required for design, construction, scheduling and budgeting purposes to deliver operational resilience during wet and dry periods and maintain business as usual for the 5-year mine plan. Table 5.1 discusses the infrastructure requirement within the 5-year planning horizon and the timeframes discussed below are based on current mine plan schedule and are subject to mine sequence changes.

Table 5.1: Proposed Future Infrastructure Planning

Water Management Infrastructure	ID	Description/Purpose	Action	Required Timeframe
Roper Creek 2 Diversion and Levee	D-01	Allow mining in the southern areas and provide 1:1000 AEP flood immunity to the western and southern borders of the mining pit. Enable separation of clean water and dirty/ mine affected water.	Detailed design currently being undertaken by Engeny	January 2023
Mine Water Storage	MW-01	Additional out-of-pit storage and associated pipeline required on site to prevent and minimise the impacts to operations (i.e., pit inundation days). Prevent exceeding DSA before 01 November and MRL for regulated dams with Significant consequence category of 'Failure to Contain – Overtopping' scenario	Undertake options assessment for additional mine water storage on site (e.g., converting TSF1 to mine water storage).; or Assess options to improve mine water release capability .	January 2023
Third-party supply pipeline	PP-01	Maintain operations during the dry period and minimise the site water shortfall. It is critical to have access to third-party supply on site.	Review and action the feasibility works currently being undertaken for transferring flow from Bingegang pipeline to MCM (Engeny, 2022).	At present. With no third-party supply, the modelling results show shortfall occurring by May 2023
Sediment Water Storage; Sediment Dam 2	SW-01	Sediment Dam 2 is an existing sediment dam. The catchment area reporting to the dam increases from 60ha to 102ha within the five-year horizon. Manage on-site stormwater/ sediment storages in line with (Engeny, 2021) and maintaining environmental compliance.	Review the adequacy of the existing basin as per the site ESCP (Engeny, 2021). Potential dam upgrade required. Implement drainage control, erosion control, and sediment control as per the site ESCP (Engeny, 2021).	January 2023
Sediment Water Storage; East Dump Sediment Dam	SW-02	With decommissioning of SD10, it is proposed to capture approximately 182ha of spoil dump runoff into the East Dump Sediment Dam (new sediment storage) Manage on-site stormwater/ sediment storages in line with (Engeny, 2021) and maintaining environmental compliance.	Construct the East Dump Sediment Dam as per detailed design and issue for construction (IFC) drawings undertaken by Engeny (Proposed to be issued in September 2022). Implement drainage control, erosion control, and sediment control as per the site ESCP (Engeny, 2021).	At present
Sediment Water Storage; Sediment Dam 6	SW-03	The 5-year mine disturbance plan indicate that the existing SD6 will be dumped out by year 2023. It is recommended to relocate/ replace the SD6 to capture and contain the south-eastern part of spoil dump (~120ha).	Review the concept design works undertaken by Engeny (Engeny, 2021) and (Engeny, 2022) to manage eastern dump catchment.	January 2023

Water Management Infrastructure	ID	Description/Purpose	Action	Required Timeframe
			Implement drainage control, erosion control, and sediment control as per the site ESCP (Engeny, 2021).	
Sediment Water Storage; Sediment Dam 7	SW-04	Sediment Dam 7 is an existing sediment dam. The catchment area reporting to the dam is proposed to increase from 59ha to 173ha within the five-year horizon. Manage on-site stormwater/ sediment storages in line with (Engeny, 2021) and maintaining environmental compliance.	Review the adequacy of the existing basin as per the site ESCP (Engeny, 2021). Review the design works undertaken by Engeny (Engeny, 2022) to manage eastern dump catchment. Implement drainage control, erosion control, and sediment control as per site ESCP (Engeny, 2021).	January 2023
Sediment Water Storage; Sediment Dam 12	SW-05	With decommissioning of SD9, it is proposed to capture the spoil dump runoff into existing SD12 via dirty water drain. The catchment area reporting to SD12 is proposed to be increased from 256 ha to 448 ha within the 5-year planning horizon. Manage on-site stormwater/ sediment storages in line with (Engeny, 2021) and to minimise the spoil dump runoff into the operational pit.	Review the adequacy of the existing basin as per the site ESCP (Engeny, 2021). Potential dam upgrade required. Implement drainage control, erosion control, and sediment control as per the site ESCP (Engeny, 2021).	At present

The OWMP is proposed to be reviewed and updated annually, augmentation of the WMS is expected to be further refined and described in more detail as the mining progresses. System configuration and sizing must be designed in consideration of the mine development plans, site topography, regulatory/ compliance requirements and operational considerations including site demand.

6 CONCLUSIONS AND RECOMMENDATIONS

The simulated forecast results suggest significant risk to operations under both 'wet' and 'dry' climate conditions. The key conclusions and recommendations include:

- Under 'wet' climate conditions:
  - The forecast inventory will exceed the site storage capacity by January 2023 which will lead to accumulation of water in operational pit and sacrificing mining operations.
  - This indicates insufficient out of pit storage capacity.
  - Accumulation of water on site is a function of inability of MWD to release under EA conditions (see Section 2.6) due to high EC in the dam, groundwater inflows, and high runoff salinity. Discharges are very unlikely to occur even under very high flow conditions in Roper Creek as the MWD EC always exceeds 6,000 µS/cm.
  - It is recommended to investigate options for additional out of pit storage on site (e.g., converting of TSF1 to water storage).
  - It is recommended to increase the controlled release potential by:
    - Mixing good quality water into MWD.
    - Investigating options to release from other six release locations authorised under the EA (DES, 2022).
    - Potentially reviewing and amending the controlled release conditions to more favourable EOP EC limits and receiving water release contaminant trigger EC to increase the opportunity of release.
- Under 'dry' climate conditions:
  - Access to third-party supply is critical to site supply reliability and maintain operations.
  - Third-party supply of 2ML/day (~730ML/yr) from Bingegang pipeline is currently under feasibility study.
  - With the third-party supply, there is a 5% chance of approximately 130 ML of annual shortfall with next 5-years.
  - Third-party supply from Bingegang pipeline is insufficient and is contingent on the groundwater inflows to site.
  - It is recommended to confirm the reliability of groundwater inflows to the operational pit by undertaking monitoring.
  - It is recommended to investigate water saving opportunities on site.

7 FORWARD WORK PLAN

Upon identification and understanding the operational risks, the following forward plan has been prepared for MCPL to mitigate risks the ‘dry’ and ‘wet’ climate conditions and minimise the water security and water accumulation risk.

Actions to minimise Water Security Risk in the order of priority

- Establish the commercial arrangement for a reliable third-party supply with a minimum of 2ML/day (~730 ML/year) or higher if possible
- A reliable third part of supply of 2ML/day is estimated to results in a 5% chance of 130 ML of annual shortfall over 5 years. In order to remove uncertainty and further mitigate the water supply risk it is recommended an options assessment be completed to address the following:
  - Undertake metering TSF decant volume to firm up understanding of Gross CHPP demand and Net CHPP demand to more accurately define this sub-system mass balance
  - Identify and assess options to increase wash plant and/or TSF decant efficiency ie. secondary flocculation
  - Identify and assess options to reduce dust suppression to improve water supply reliability.
  - Assess impact to overall water balance by reducing evaporation losses by consolidating water into Raw Water Dam or creating separate cells within the Mine Water Dam
  - Review the dry weather pit dewatering metered data over the monitoring period to enhance confidence in groundwater inflow numbers..
  - MCPL to risk assess of water deficit (i.e., xx% chance of water deficit).
  - Complete a groundwater inflow sensitivity analysisto assess impacts to the water supply reliability risk

Actions to minimise Water Surplus Risk in the order of priority

- MCPL to assess the maximum potential in-pit sump capacity within the operational pit(s).
- Undertake an assessment of release potential utilising benchmark release conditions. This assessment will identify change to release potential and overall site water balance and subsequent reduction in risk profile.
- If the option if amending the EA conditions it considered feasible undertake and EA amendment to change the release conditions.

8 QUALIFICATIONS

a) In preparing this document, including all relevant calculation and modelling, Engeny Water Management (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:

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   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.

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g) This Report does not provide legal advice.

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