

**APPENDIX D**  
**SURFACE WATER IMPACT**  
**ASSESSMENT**



# **James Bailey and Associates Pty Ltd**

## **Boggabri Coal Mine Modification 8 Amendment**

### **Updated Surface Water Assessment**

17 November 2022

N4002\_003-REP-004-5

Job no. and Project Name: N1216\_003Boggabri coal Mine Modification 8 – Surface Water Impact Assessment  
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| Rev        | Date       | Description                            | Author                                                                              | Reviewer                                                                            | Project Mgr.                                                                          | Approver                                                                              |
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| A          | 14/12/2020 | Draft Review                           | AW                                                                                  | SES                                                                                 | AW                                                                                    | SES                                                                                   |
| 0          | 2/02/2021  | Client Issue                           | AW                                                                                  | SES                                                                                 | AW                                                                                    | SES                                                                                   |
| 1          | 13/03/2021 | Final Issue                            | MB                                                                                  | AW                                                                                  | AW                                                                                    | AV                                                                                    |
| 2          | 28/04/2021 | Final Issue                            | MB                                                                                  | AW                                                                                  | AW                                                                                    | AV                                                                                    |
| 3          | 2/07/2021  | Final Issue                            | MB                                                                                  | AW                                                                                  | AW                                                                                    | AV                                                                                    |
| 4          | 5/10/2022  | Revised and updated for MOD8 Amendment | MB                                                                                  | AW                                                                                  | AW                                                                                    | SES                                                                                   |
| 5          | 17/11/2022 | Revised and updated for MOD8 Amendment | MB                                                                                  | AW                                                                                  | AW                                                                                    | SES                                                                                   |
| Signatures |            |                                        |                                                                                     |                                                                                     |                                                                                       |                                                                                       |
|            |            |                                        |  |  |  |  |

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# 1 INTRODUCTION

Boggabri Coal Operations Pty Ltd (BCOPL), a subsidiary of Idemitsu Australia (IA), is seeking approval for a modification to operations at the Boggabri Coal Mine (BCM). Specifically, BCOPL is seeking a modification to the existing State Significant Development Approval (SSD) 09\_0182 to increase the depth of approved mining operations within the currently approved Mine Disturbance Boundary and to facilitate the construction of a fauna movement crossing of the existing haul road at the BCM (MOD 8). Approval is sought via an application made in July 2021 under Section 4.55 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The potential surface water impacts of the BCM incorporating changes sought by MOD 8 were originally assessed by Engeny Water Management (Engeny) (2021) and included in the Modification Report that was placed on public exhibition by the Department of Planning and Environment (DPE) from 12 August 2021 to 9 September 2021. A total of 60 submissions were received by DPE and DPE requested BCOPL prepare a response. The mine plan for MOD 8 has since been revised and BCOPL is seeking to amend the modification application at the same time as responding to stakeholder submissions.

Engeny has been engaged by James Bailey and Associates Pty Ltd (JBA) to undertake this surface water impact assessment (SWIA) for the revised mine plan for MOD 8 (MOD 8 Amendment). This SWIA has also addressed relevant stakeholder submissions in relation to surface water matters as relevant to the MOD 8 Amendment where possible. Appendix A provides a summary of relevant stakeholder submissions and where each has been addressed relevant to the MOD 8 Amendment within this report.

## 1.1 MODIFICATION DESCRIPTION

The BCM is an open-cut coal mine located approximately 15 kilometres (km) northeast of the township of Boggabri in north western NSW. The mine has been operating since 2006. Truck and excavator operations are used to mine coal which is crushed and screened or washed in the Coal Handling Preparation Plant (CHPP) to produce thermal, semi-soft coking and Pulverised Coal Injected (PCI) products. Product coal is loaded onto trains via an on-site train loading facility and transported by rail to the Port of Newcastle for sale to the export market. BCOPL manages the BCM operations on behalf of IA and its joint venture partners.

BCM operates pursuant to SSD 09\_0182 (as modified) which allows for the extraction of up to 8.6 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until the end of December 2033 (Approved Operations).

In summary, the original MOD 8 included:

- Recovering an additional 61.6 Million tonnes (Mt) of ROM coal within the currently approved Mine Disturbance Boundary.
- Extending the mine life by six (6) years.
- Constructing a specifically designed fauna movement crossing over the existing haul road between the overburden emplacement area and the western side of the regional biodiversity corridor.

BCOPL has since made refinements to the mine plans for MOD 8 and is seeking an amendment to the MOD 8 mine plan (MOD 8 Amendment).

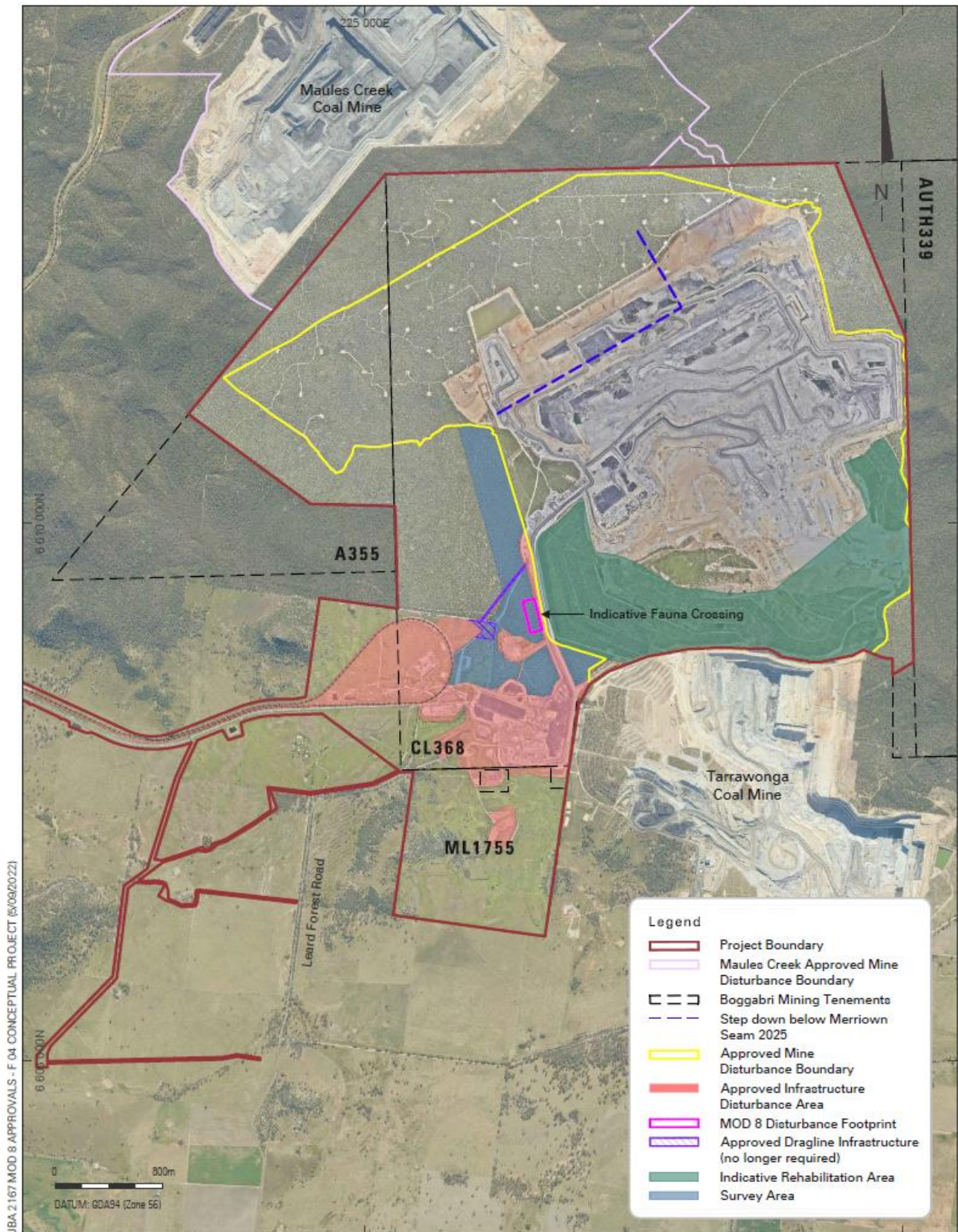
The MOD 8 Amendment project will:

- Recover an additional 28.1 (Mt) of ROM coal within the currently approved Mine Disturbance Boundary.
- Extend the mine life by three (3) years.
- Retain the same currently approved annual rate of 8.6 Mtpa of ROM coal.
- Enable construction of a specifically designed fauna movement crossing over the existing haul road between the overburden emplacement area and the western side of the regional biodiversity corridor

There will be no proposed changes to the MOD 8 Disturbance Footprint, infrastructure requirements, water management or mining methods from those previously assessed for MOD 8. Figure 1-1 shows the location of the BCM, surrounding features

and nearest properties. It also illustrates the key features related to the MOD 8 Amendment, including the approved Mine Disturbance Boundary and Project Boundary.

MOD 8 Amendment does not seek to make changes to various aspects of the BCM including (but not limited to): the approved Mine Disturbance Boundary, operational hours, mining methods, mining related infrastructure, coal handling, processing and transport methods and rates and access to the site.



BOGGABRI COAL MINE

MOD 8 Conceptual Project Layout



Figure 1-1: Conceptual Modification Layout

## 1.2 MEASURES TO MINIMISE OR AVOID POTENTIAL SURFACE WATER IMPACTS

The revisions to the mine plans for MOD 8 as per the MOD 8 Amendment have been identified from additional mine planning studies which have been undertaken since the submission of the 2021 Modification Report. This approach in line with a range of other key factors has minimised the potential for the MOD 8 amendment to impact on surface water resources. The other key factors include:

- Proposed modifications are located within the approved disturbance boundary.
- Refinement of the approved conceptual final landform to include macro-relief to manage runoff generated by waste rock emplacement area.
- Refinement of the rehabilitation schedule to reduce the volume of water managed within the site water management system and return flows to the downstream environment.
- Management of water take and discharges within regimes established by NSW water and pollution control legislation. NSW legislation provides for sustainable water take from water sources and management of water quality by licensing of discharges.
- Minor changes to the existing approved water management system (WMS).
- Design of WMS components to meet legislative requirements and relevant guidelines (e.g. guidelines for treatment of runoff from disturbed areas).
- Continued maximised water recycling within the WMS to minimise the total volume of water extracted from external supplies and discharge of excess water.

## 1.3 POTENTIAL SURFACE WATER IMPACTS

Notwithstanding the measures to minimise impacts, the aspects of MOD 8 amendment, outlined in Table 1-1, have the potential to impact on surface water resources.

**Table 1-1: Potential Water Resources Impacts**

| Aspect                                                                                                                                                                                    | Expected Impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Landform changes, as a result of the open cut mining operations, including: <ul style="list-style-type: none"> <li>• Open Cut Mining.</li> <li>• Overburden emplacement areas.</li> </ul> | MOD 8 amendment proposes to maintain mining operations within the approved Mine Disturbance Boundary (albeit deeper) and overburden emplacement areas.<br><br>As a result, impacts to downstream flow regimes, including flooding, are expected to be consistent with approved impacts.                                                                                                                                                                                                                   |
| Landform changes, as a result of the proposed fauna movement crossing of the existing haul road and associated changes to surface water drainage within these areas.                      | Localised drainage paths adjacent the existing haul road will require realignment to cater for the landform changes brought by the construction of the fauna movement crossing. Minimal downstream impacts are anticipated.                                                                                                                                                                                                                                                                               |
| Changes to the water balance for the BCM, including the import and export of water to and from the site.                                                                                  | As MOD 8 does not propose to increase the maximum product coal production rate for BCM, material changes to the existing water demands and discharges are not expected.<br><br>The deeper mining activities and the augmentation of the existing OEA will likely result in additional groundwater inflows and surface runoff to manage within the WMS.<br><br>The existing water demands and discharges will be extended by a further three-years as a result of the proposed extension to the mine life. |

The following surface water aspects were reviewed as part of the SWIA:

- Flow regimes (associated with potential impacts on baseflows).
- Catchment area changes.
- Water quality.
- Geomorphological and hydrological values.
- Riparian and ecological values.

- Water users.

A detailed assessment of these potential impacts has been undertaken for MOD 8 Amendment with consideration of downstream impacts.

## 1.4 STRUCTURE OF THIS REPORT

The SWIA Report includes the following sections:

- Surface water context, including regulatory framework, catchments and watercourses, flow regimes, water quality and water users (Section 2).
- Water Management System (Section 3).
- Water Balance assessment (Section 4).
- Potential impacts, including consideration of cumulative impacts and proposed mitigation measures (refer to Section 5).
- Management, Monitoring, Licensing and Reporting (refer to Section 6).

## 2 SURFACE WATER CONTEXT

The BCM is in the catchment areas of Nagero Creek and Bollol Creek (Figure 2-1). Both Nagero Creek and Bollol Creek are tributaries of the Namoi River, which is a part of the Barwon-Darling River system. The BCM site lies North of Tarrawonga Coal Pty Ltd (TCPL), which is approved to operate until 2030, and South of Maules Creek Coal Project (MCCM), which is approved to operate until 2034.

The changes to mining operations and other aspects associated with MOD 8 Amendment are located within the BCOPPL WMS (Figure 2-1).

### 2.1 REGULATORY FRAMEWORK

#### 2.1.1 Relevant NSW Legislation

The Approved Operations (i.e. the activities currently authorised by SSD 09\_0182) and proposed changes associated with MOD 8 Amendment exist within a well-regulated system that has been designed to provide for the sustainable management of the State's water resources. This includes:

- licensing of allowable water-take with consideration of environmental flow requirements of watercourses and the needs of other water users;
- control of water pollution, including management of sustainable salt loads associated with all water sources, including mine water discharges; and
- guidelines that govern the appropriate design of water management systems for mines to provide for appropriate water quality in accordance with Environment Protection Licence (EPL) requirements.

Further details of the NSW surface water regulatory framework and how it will continue to be applied to the changes sought by MOD 8 Amendment is provided below.

#### 2.1.2 NSW Regulatory Requirements - Water Use/Take

There are two key acts that provide the regulatory framework for water management in NSW:

- Water Management Act 2000 (WM Act); and
- Water Act 1912.

The WM Act applies to areas of NSW that have a water sharing plan (WSP). The objectives of the WM Act includes the sustainable and integrated management of water in NSW and is based on the concept of ecologically sustainable development. The WM Act, through water sharing plans, defines water access and water sharing strategies within NSW. The WM Act supersedes the provisions of the Water Act 1912 regarding water take works adjacent to or within watercourses.

As part of the WM Act, WSPs have been developed across NSW to protect the health of rivers, whilst at the same time securing sustainable access to water for all users. The WSPs specify maximum water extractions and allocations. By complying with the requirements of the WSPs, water take will be within the sustainable yield for the water system as determined by the NSW government. This in turn provides for sustainable environmental flows within the water systems.

The Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016 (Namoi Regulated WSP) applies to the regulated watercourses, whilst the Water Sharing Plan for the Namoi and Peel Unregulated Rivers Water Sources 2012 (Namoi Unregulated WSP) applies to the unregulated watercourses in the vicinity of the BCM. The BCM is largely located within the catchment forming part of the Bluevale Water Source of the Namoi Unregulated WSP and extracts surface water from the Namoi River to the west of BCM, which forms part of the Lower Namoi Regulated Water Source of the Namoi Regulated WSP.

#### 2.1.3 Commonwealth Legislation

The aspects of MOD 8 Amendment which have the potential to result in impacts on Matters of National Environmental Significance (MNES) which are regulated under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

were referred to the Commonwealth Department of Agriculture Water and the Environment (DAWE) on 17 February 2021 to determine whether the aspects are considered to be a controlled action. On 21 May 2021, DAWE determined that Mod 8 (before the project was amended) was a controlled action requiring approval under the EPBC Act. A summary of the potential surface water impacts of MOD 8 Amendment in accordance with the requirements of the Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (DoE 2013) has been prepared and is included in Section 6.

#### **2.1.4 Licensing**

All water extraction in NSW, apart from some exemptions for government authorities and basic landholder rights extractions, must be authorised by a water licence. Harvestable rights, which are a basic landholder right under the WM Act, allow a landholder to capture, and use for any purpose, up to 10 per cent of the average annual regional rainfall runoff from their landholding. Landholders can build harvestable rights dams on non-permanent minor streams, hillsides or gullies (but not on or within 40 metres of a third-order or higher order stream). Basic landholder rights are exempt from licensing requirements. Further to this, dams constructed for the capture, containment, and recirculation of water to prevent the contamination of a water source and located on a minor stream are also exempt from licensing requirements.

Each water licence, referred to under the WSP system as a Water Access Licence (WAL), specifies a share component. This can include a zero share component that allows the holder to buy or transfer an allocation from another WAL holder. The share components of specific purpose licences such as local water utility, major utility and domestic and stock are expressed as a number in megalitres per year. The share components of regulated river (high security), regulated river (general security) and supplementary WALs are expressed as a number of unit shares for the water source. The value of each permanent share component WALs is subject to Available Water Determinations (AWD's) as specified by DPE – Water (formerly known as DPI Water).

Details of the licences currently held by BCOPL are included in Section 3.2 and licences required for MOD 8 Amendment are discussed in Section 7.2.

#### **2.1.5 Environment Protection Licences**

The Protection of the Environment Operations Act 1997 (POEO Act) is the key piece of environmental protection legislation administered by the NSW Environment Protection Authority (EPA). Where discharge of waters is permitted, it is controlled by licence conditions such that discharges do not result in significant impacts on water resources.

Under Section 120 of the POEO Act, it is an offence to pollute waters or cause harm unless licensed to do so. Pollution in NSW is regulated by the POEO Act with discharges from mine water management systems requiring licensing by an EPL if the discharge would otherwise constitute a pollution of waters (Section 120 of the POEO Act). Discharges from the BCOPL at the three EPL Discharge Points listed are licensed under EPL 12407 and shown on Figure 2.1.

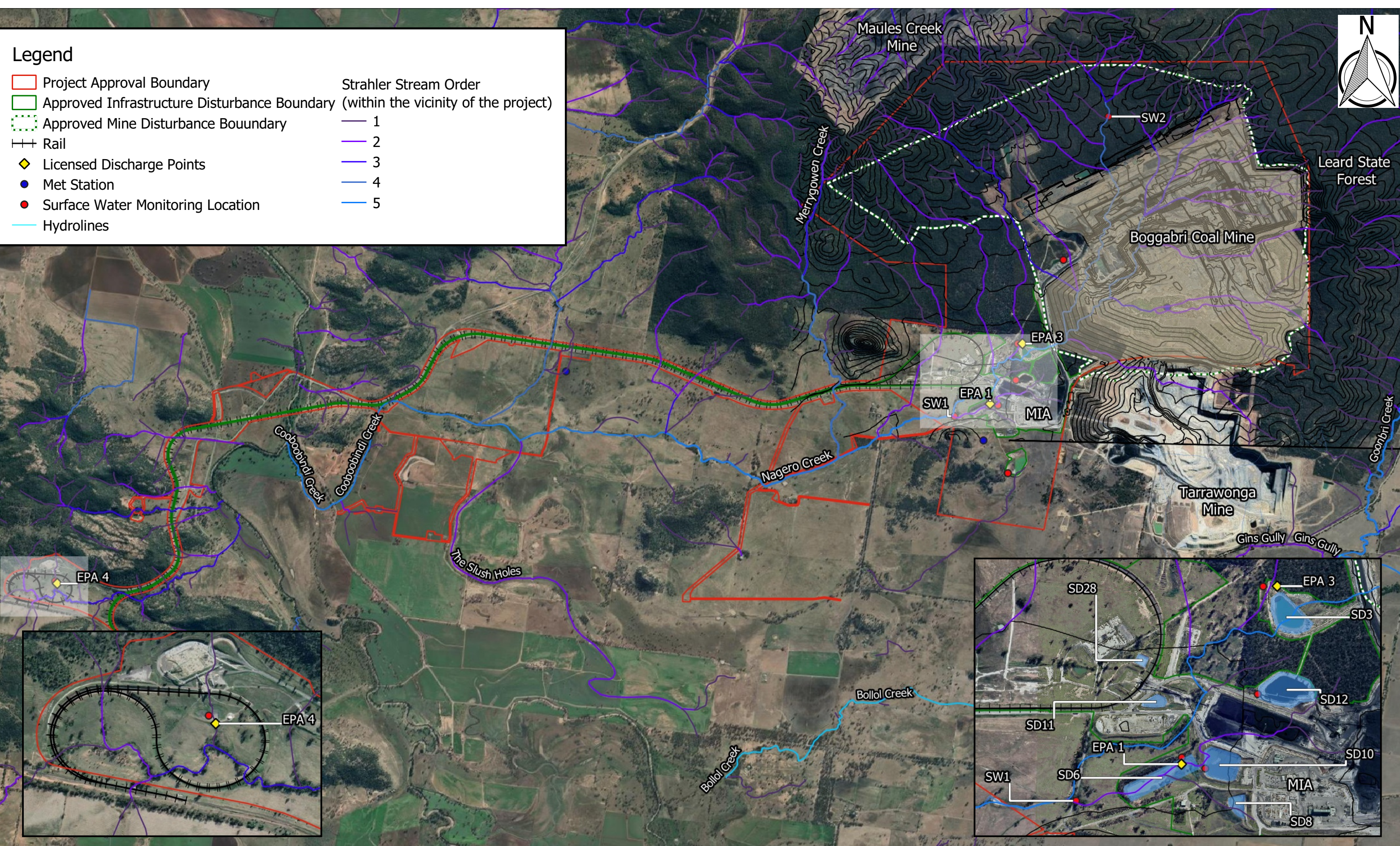
A summary of water discharge requirements for the BCOPL, including the Approved Operations and for MOD 8 Amendment, is included in Section 7.2.

### Legend

- Project Approval Boundary
- Approved Infrastructure Disturbance Boundary (within the vicinity of the project)
- Approved Mine Disturbance Boundary
- Rail
- Licensed Discharge Points
- Met Station
- Surface Water Monitoring Location
- Hydrolines

### Strahler Stream Order

- 1
- 2
- 3
- 4
- 5



## 2.2 CATCHMENT AREAS AND WATERCOURSES

BCM is located within the catchment areas of Nagero Creek and Bollol Creek (Figure 2-1). Nagero Creek and Bollol Creek are ephemeral tributaries within the Namoi River catchment.

Land uses within and immediately surrounding the BCM primarily include other mining operations, agricultural land, and rural residential land holdings. Downstream water users are discussed further in Section 2.4.

Previous mining operations have modified local catchments through the capture of runoff from mining areas within the WMS and diversion of upslope runoff around the mining operations.

### 2.2.1 Nagero Creek

Nagero Creek flows westwards from its headwaters in the Leard State Forest and BCM operations, through agricultural lands, to its confluence with the Namoi River (via Cooboobindi Creek) about 13 km downstream (west) of the BCM. Nagero Creek is ephemeral, with flows only occurring after significant or prolonged rainfall events. There were no observed flows in Nagero Creek between 2015 and 2020, however flows were recorded at SW1 on at least thirteen occasions to November 2022. Downstream of BCM (west), Nagero Creek passes through mostly agricultural lands, and includes several in-line farms dams.

### 2.2.2 Bollol Creek

Bollol Creek flows from its headwaters east of the BCM, flowing westwards to the Namoi River via Barbers Ponds, south of both BCM and Tarrawonga mine. Bollol Creek flows through mostly agricultural lands, and generally consists of a shallow, U-shaped channel lined dense grasses and reeds, with several small in-line farm dams. Like Nagero Creek, Bollol Creek is ephemeral, with flows only occurring after significant or prolonged rainfall events.

The Bollol Creek catchment includes the BCM infrastructure area (i.e. no BCM mining areas).

## 2.3 WATER QUALITY

### 2.3.1 Monitoring Program

BCOPL undertake surface water monitoring in accordance with the surface water monitoring program outlined in the Surface Water Management Plan (2017). This plan includes monitoring of the following elements of the site water management system and surrounding catchment areas:

- Surface water quality and flows in upstream and downstream watercourses.
- Geomorphology condition of Nagero Creek, upstream and downstream of the site.
- Stream and riparian health conditions in Nagero Creek and the Namoi River.
- On-site water management, including water quality within dirty and mine water dams.

The surface water monitoring program covers all three water category areas within the BCM: clean; dirty; and mine water systems (Section 3). The surface water monitoring program requires quarterly monitoring at each water storage, and event-based monitoring of two external monitoring locations on Nagero Creek (upstream and downstream) for the following parameters:

- pH.
- Electrical conductivity (EC).
- Total suspended solids (TSS).

### 2.3.2 Historical Surface Water Quality Monitoring Results

Water quality monitoring data for pH, EC and TSS and temperature are reported in the BCOPL Annual Reviews. Water quality is monitored within sediment and mine water dams on a quarterly basis, and event-based monitoring at two external (clean water) monitoring points on Nagero Creek, one downstream (SW1) and one upstream (SW2) of BCOPL. Historical monitoring results from January 2015 to November 2022 indicate that there were no flow events in Nagero Creek, until January 2020 (SW1 only) and February 2020 (SW1 and SW2), with several flow events occurring in 2021 and 2022. Based on the limited monitoring results, ambient water quality within Nagero Creek is generally good, with relatively low salinity (as EC) and suspended solids

(as TSS) (Table 2-1). A spike in TSS at SW2 on the 24 November 2021 is noted, however as this sample is between two very low samples (taken on 22 and 27 November), it is likely that this result is in error.

**Table 2-1: Ambient Water Quality Laboratory Results**

| Date                         | SW1 (downstream) |            |            | SW2 (upstream) |            |                  |
|------------------------------|------------------|------------|------------|----------------|------------|------------------|
|                              | pH               | EC (µS/cm) | TSS (mg/L) | pH             | EC (µS/cm) | TSS (mg/L)       |
| 16 January 2020              | 7.14             | 114        | 262        | -              | -          | -                |
| 8 February 2020              | 7.87             | 334        | 506        | 7.08           | 206        | 11               |
| 25 February 2021             | 6.65             | 35         | 587        | 6.68           | 73         | 232              |
| 23 March 2021                | 7.22             | 217        | 134        | 7.11           | 199        | 177              |
| 11 October 2021              | 8.28             | 139        | 118        | 6.50           | 109        | 12               |
| 22 November 2021             | 7.67             | 181        | 42         | 7.87           | 73         | 19               |
| 24 November 2021             | 8.69             | 243        | 60         | 7.03           | 215        | 386 <sup>A</sup> |
| 27 November 2021             | 8.39             | 200        | 44         | 7.66           | 116        | 22               |
| 7 July 2022                  | 7.53             | 230        | 45         | 6.54           | 98         | 23               |
| 21 September 2022            | 7.26             | 166        | 127        | 6.91           | 124        | 30               |
| 28 September 2022            | 7.71             | 288        | 31         | 6.86           | 145        | 6                |
| 18 October 2022              | 7.59             | 316        | 30         | 7.03           | 165        | 6                |
| 19 October 2022              | 7.7              | 320        | 21         | 7.13           | 173        | 8                |
| 1 November 2022 <sup>B</sup> | 7.74             | 329        | -          | 7.76           | 162        | -                |
| 2 November 2022 <sup>B</sup> | 7.41             | 256        | -          | 7.14           | 154        | -                |

<sup>A</sup> Outlier TSS suggesting potential poor sampling method or “initial flush” of sediments.

<sup>B</sup> Laboratory results were not available for 1 and 2 November. Field results for pH and EC reported.

### 2.3.3 Trigger Values

EPL 12407 sets water quality limits for discharges from three wet weather discharge points (at SD6, SD3 and SD4). These are provided in Table 2-2.

**Table 2-2: EPL 12407 Water Quality Limits**

| Analyte | Units | Trigger   |
|---------|-------|-----------|
| pH      | -     | 6.5 – 8.0 |
| TSS     | mg/L  | 50        |

## 2.4 WATER USERS

BCM is located within Namoi River catchment. Water usage within the Namoi River is managed by the Upper Namoi and Lower Namoi Regulated River Water Sources 2016, which covers two regulated water sources:

- Upper Namoi Regulated River Water Source – regulated river sections between Split Rock Dam and Keepit Dam.

- Lower Namoi Regulated River Water Source – regulated river sections downstream of Keepit Dam to the Barwon River.

A summary of water users within the Upper Namoi and Lower Namoi Regulated River Water Sources is included in Table 2-3. The largest water user in the Namoi River catchment is agriculture, primarily cotton irrigation.

**Table 2-3: Water users in the Namoi Valley (WaterNSW 2019)**

| Statistic                                    | Water Source                |                             |
|----------------------------------------------|-----------------------------|-----------------------------|
|                                              | Upper Namoi Regulated River | Lower Namoi Regulated River |
| Basic landholder rights – domestic and stock | 160 ML/year                 | 1,776 ML/year               |
| Domestic and stock use                       | 90 ML/year                  | 1,998 ML/year               |
| Local water utilities                        | 515 ML/year                 | 2,271 ML/year               |
| High security                                | 80 unit shares              | 3,904 unit shares           |
| General security                             | 11,454 unit shares          | 245,074 unit shares         |

A summary of WALs held by BCOPL to access surface water from the Lower Namoi Regulated River Water Source is included in Section 3.2.

## 3 WATER MANAGEMENT

The approved Water Management Plan (2017) (WMP) includes the Water Management System (WMS).

The objectives of water management at BCM, as described in the WMP, are to:

- Minimise the contamination of clean water runoff from catchment areas upslope of the operations.
- Minimise potential effects of erosion and its associated impacts due to mining operations.
- Securely contain mine water and other site water that comes into contact with areas disturbed by mining activities – including overburden emplacement areas, coal stockpiles and the Coal Handling Preparation Plant (CHPP) area.
- Maximise the re-use of mine water for onsite water use such as coal washing and dust suppression. Reusing mine water is preferred rather than using water from the Namoi River and/or groundwater borefield.
- Management of water during periods of shortfall (drought) and excess (flood).

### 3.1 WATER MANAGEMENT SYSTEM

The approved WMS has the following key objectives and functions:

- Where reasonable and feasible, diversion of clean water around mining operations to minimise capture of upslope runoff and separate clean water runoff from mining activities.
- Segregating mine impacted water and runoff from undisturbed and revegetated areas with better water quality to minimise the volume of mine impacted water that requires reuse.
- Reuse of mine impacted water within the WMS to reduce reliance on raw/clean water.
- Minimising adverse effects on downstream waterways (i.e. hydraulic and water quality impacts).
- Reducing the discharge of contaminants from the mine to the environment.

Water management at the BCM considers three categories of water, each with different potential to cause environmental harm. The target design criteria for each of the three categories of water are summarised in Table 3-1.

**Table 3-1: WMS – Design Criteria**

| Water Category | Water Description                                                                                                           | Target Design Criteria                                                                                                                                                                    |
|----------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clean          | Runoff from undisturbed or rehabilitated areas.                                                                             | Release, where practicable, to downstream environment.                                                                                                                                    |
| Dirty          | Runoff from disturbed areas (does not include water captured in mining pit areas or runoff from mine infrastructure areas). | Managed in line with the Blue Book (Managing Urban Stormwater: Soils and Construction Volumes 1 and 2E).<br><br>Designed to manage runoff from the 5 day, 95th percentile rainfall event. |
| Mine           | Runoff from areas exposed to coal or water used in coal processing or from coal stockpile areas.                            | Contained for events up to and including the 1% annual exceedance probability (AEP) 72 hour storm event.                                                                                  |

One of the key objectives of the WMS is to convey clean water around the mining operations (where reasonable and feasible) or, when runoff water from rehabilitated areas becomes clean, enable the runoff from these rehabilitated areas to flow directly to the downstream environment instead of being managed as part of the WMS.

Dirty water (i.e., runoff from disturbed areas outside the mining pit and infrastructure areas, such as overburden emplacement areas (both active and under rehabilitation) captured in the sediment dams) is pumped to storages within the WMS (or released during wet weather discharges under the EPL).

Mine water (i.e., runoff from areas exposed to coal or water used in coal processing or from coal stockpile areas) is managed as part of the mine WMS. Mine affected water is generally transferred to and stored within two dams (MW5 and MW3) for reuse on site.

## 3.2 WATER IMPORTS

The current surface and groundwater WALs held by BCOPL are summarised in Table 3-2. The groundwater WALs cover groundwater intercepted by the open cut pit, as well as groundwater extracted from the nearby alluvial borefield.

**Table 3-2: BCOPL Water Access Licences**

| Source                                                                                 | Category                                    | Water Access Licence number | Share component (units) | Account Watert (ML) |
|----------------------------------------------------------------------------------------|---------------------------------------------|-----------------------------|-------------------------|---------------------|
| <u>Upper and Lower Namoi Regulated River Water Source</u>                              |                                             |                             |                         |                     |
| Lower Namoi River                                                                      | General Security (Irrigation)               | WAL 2571                    | 51                      |                     |
|                                                                                        | General Security (Irrigation, Mining)       | WAL 2595                    | 243                     |                     |
|                                                                                        | Supplementary Water (Irrigation, Mining)    | WAL 2596                    | 26.6                    |                     |
|                                                                                        | Supplementary Water (Irrigation)            | WAL 2572                    | 5.6                     |                     |
| Upper Namoi River                                                                      | General Security                            | WAL 37067                   | 128                     |                     |
| Blue Vale                                                                              | Unregulated                                 | WAL 44134                   | 0                       | 846                 |
| <u>Groundwater Sources</u>                                                             |                                             |                             |                         |                     |
| <u>WSP for the NSW Murray Darling Basin Porous Rock Groundwater Sources Order 2020</u> |                                             |                             |                         |                     |
| Gunned-h - Oxley Basin<br>MDB Groundwater<br>Source                                    | Aquifer (Extraction Works)                  | WAL 29473                   | 142                     |                     |
|                                                                                        | Aquifer (Irrigation)                        | WAL 29562                   | 700                     |                     |
| <u>WSP for the Namoi Unregulated and Alluvial Water Sources 2016</u>                   |                                             |                             |                         |                     |
| Upper Namoi Zone 4<br>Groundwater Source                                               | Aquifer<br>(Industrial, Mining, Irrigation) | WAL 15037                   | 172                     |                     |
|                                                                                        |                                             | WAL 24103                   | 275                     |                     |
|                                                                                        |                                             | WAL 12691                   | 457                     |                     |
|                                                                                        |                                             | WAL 37519                   | 84                      |                     |
|                                                                                        | Aquifer<br>(Irrigation)                     | WAL 12767                   | 3                       |                     |
|                                                                                        |                                             | WAL 36547                   | 37                      |                     |
| Maules Creek Zone 11<br>Groundwater Source                                             | Aquifer                                     | WAL 42234                   | 20                      |                     |

## 3.3 LICENSED DISCHARGES

The EPL (No 12407: last review 16 August 2019) allows releases of surplus water via three licensed discharge points (LDPs) into the Nagero Creek system (refer to Figure 2-1). Discharges may only occur in accordance with the conditions of the EPL and the approved Water Management Plan.

Dirty water sediment dams have been sized based on the criteria recommended in the guidelines *Managing Urban Stormwater - Soils and Construction - Volume 1* (Landcom 2004) (the Blue Book). The Blue Book guidelines recommend that the 'settling zone' be sized to capture the 90<sup>th</sup> percentile 5 day duration rainfall depth (39 mm), and the 'sediment zone' be sized at 50% of the 'settling zone' volume. This sizing is based on site disturbance duration of more than three years, and results in a long term

average sediment dam overflow frequency of approximately two to four overflows per year (noting recent wet weather has resulted in above average discharges). A wet weather event is defined as an event which exceeds the design capacity of the dam (i.e. greater than 38.4 mm of rainfall over a 5 day period).

Mine water dams have been designed to store runoff from a 1% AEP 24 hour storm event, with a 20% allowance for sediment storage. BCM maintain sufficient freeboard in contaminated water dams to satisfy the design criteria.

**Table 3-3: Licensed Discharge Points**

| EPL Point | Type                  | Location | Overflow Destination                 |
|-----------|-----------------------|----------|--------------------------------------|
| 1         | Wet weather discharge | SD6      | Nagero Creek                         |
| 3         | Wet weather discharge | SD3      | Unnamed Tributary of Nagero Creek    |
| 4         | Wet weather discharge | SD4      | Unnamed Tributary of the Namoi River |

Note: refer to Figures 3.1 to 3.4 for sediment dam and licenced discharge point locations

Overflows from dirty water sediment dams are expected to occur from SD3, SD4 and SD6 when the design capacity is exceeded (39 mm of rainfall over 5 days) via the dam spillway (as per DECC (2008)).

### 3.4 CHANGES WITH THE MODIFICATION

It is proposed to continue to utilise the existing WMS for MOD 8 Amendment. That is, there are no appreciable changes to the approved WMS, except those associated with the extended mine life (to 2036).

The proposed WMS components for 2023, 2027, 2035 and the conceptual final landform are presented in Figure 3-1 to Figure 3-4.

It is important to note that the plans presented in Figure 3-1 to Figure 3-4 are concept designs. While the concept designs establish the design objectives and performance standards, the detailed designs will be determined by construction and mining schedules. The WMS will be constructed and modified, as and when required, to support the infrastructure and mine development. Further, the plans indicate only the components of the WMS which are required for a stage of the mine and does not preclude the construction of some components earlier.

Similarly, the conceptual storage capacities recommended for the various water management dams have been sized for the purposes of meeting environmental compliance requirements. The actual dam configuration and geometry for both the dirty water dams and dryland attenuation basins (detention basins) will be determined during future detailed engineering design stages. An initial review of existing sediment dams indicates sufficient capacity to manage the modified catchments, however this will be reviewed and confirmed as part of future water management plan updates.

The existing WMS will continue to be used to manage runoff with all pit water and mine surface runoff directed to the WMS. There are no new diversions proposed or required as part of MOD 8 Amendment. Runoff from the clean catchment upslope of the pit will continue to be intercepted by mining operations. BCM are currently reviewing licensing requirements for this intercepted runoff, and have obtained a zero share WAL (44134) and 846ML of accountable surface water take from the Blue Vale water source. It is noted that the upslope catchment area will continued to reduce as mining progresses.

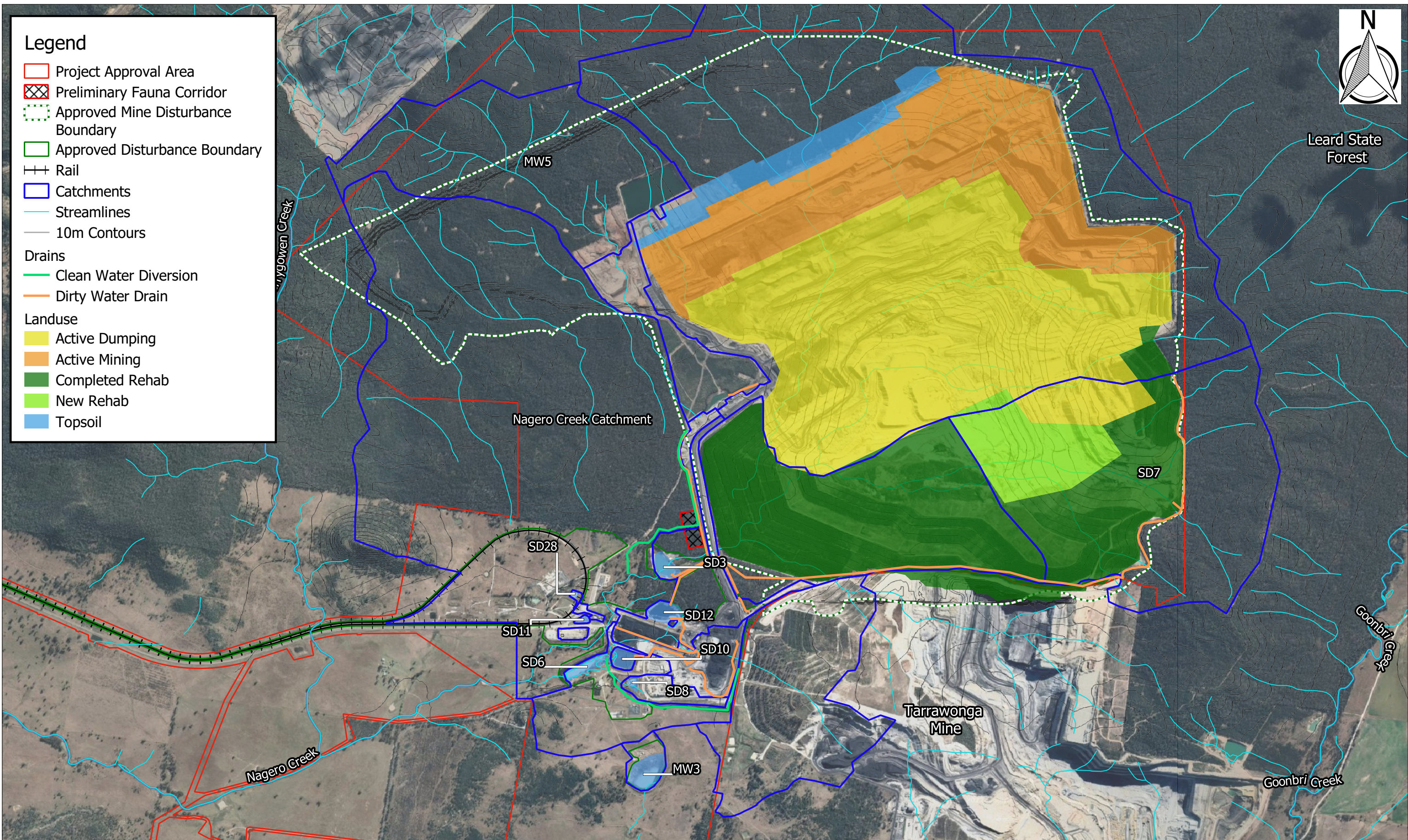
The conceptual final landform (Figure 3-4) will be generally free-draining, with the exception of a shallow graded final void area, comparable in size to the approved conceptual final landform. The final void will have a floor level of about 285 mAHD and a floor area of about 240 ha. A drain which forms part of the final landform will be constructed to manage runoff from the south-eastern rehabbed area. This drain will divert runoff from the catchment to the immediate east of BCM along with catchments from the south eastern rehabilitation area around the developed overburden emplacement area and to the Nagero Creek catchment to the west of BCM. The drain will be connected to the Nagero Creek catchment upon the establishment of the rehabilitated final landform (refer to Figure 3-4). A bund and other drainage lines will be established on the final landform to direct rainfall runoff on the rehabilitated landform around the partially infilled final void and into the Nagero Creek catchment.

## Legend

- Project Approval Area
- Preliminary Fauna Corridor
- Approved Mine Disturbance Boundary
- Approved Disturbance Boundary
- Rail
- Catchments
- Streamlines
- 10m Contours
- Drains
- Clean Water Diversion
- Dirty Water Drain
- Landuse
- Active Dumping
- Active Mining
- Completed Rehab
- New Rehab
- Topsoil



Leard State Forest



Level 5, 45 Watt St Newcastle NSW 2300

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600 0 600 m

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

## Boggabri Coal MOD8 SWIA

### Figure 3-1: Proposed Conceptual WMS - 2023

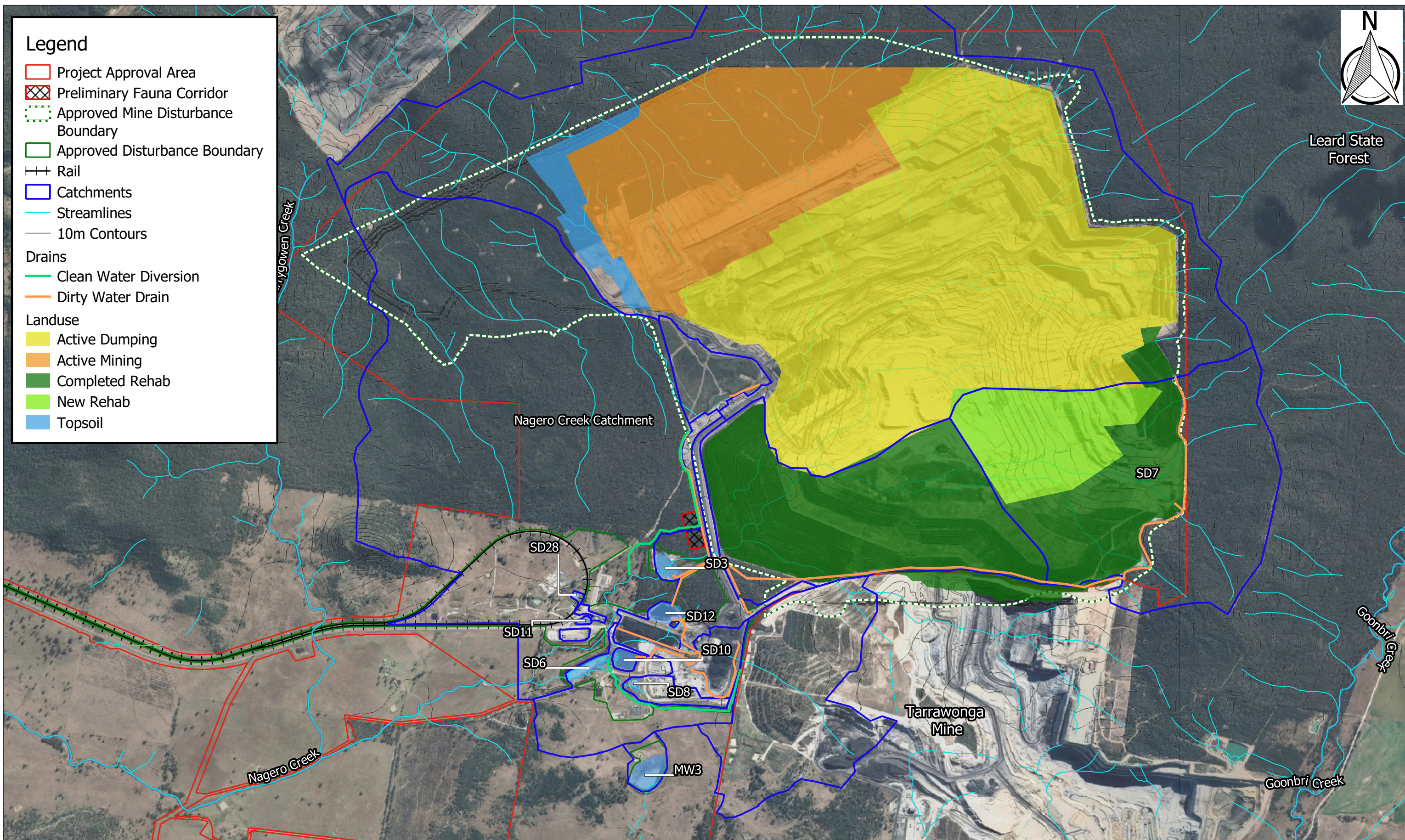
Job Number: N4002\_003

Revision: 0

Drawn: SGG

Checked: AW

Date: 30/9/2022



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Vertical Datum: Australia Height Datum  
Grid: Map Grid of Australia, Zone 56

## Boggabri Coal MOD8 SWIA

### Figure 3-2: Proposed Conceptual WMS - 2027

Job Number: N4002\_003

Revision: 0

Drawn: SGG

Checked: AW

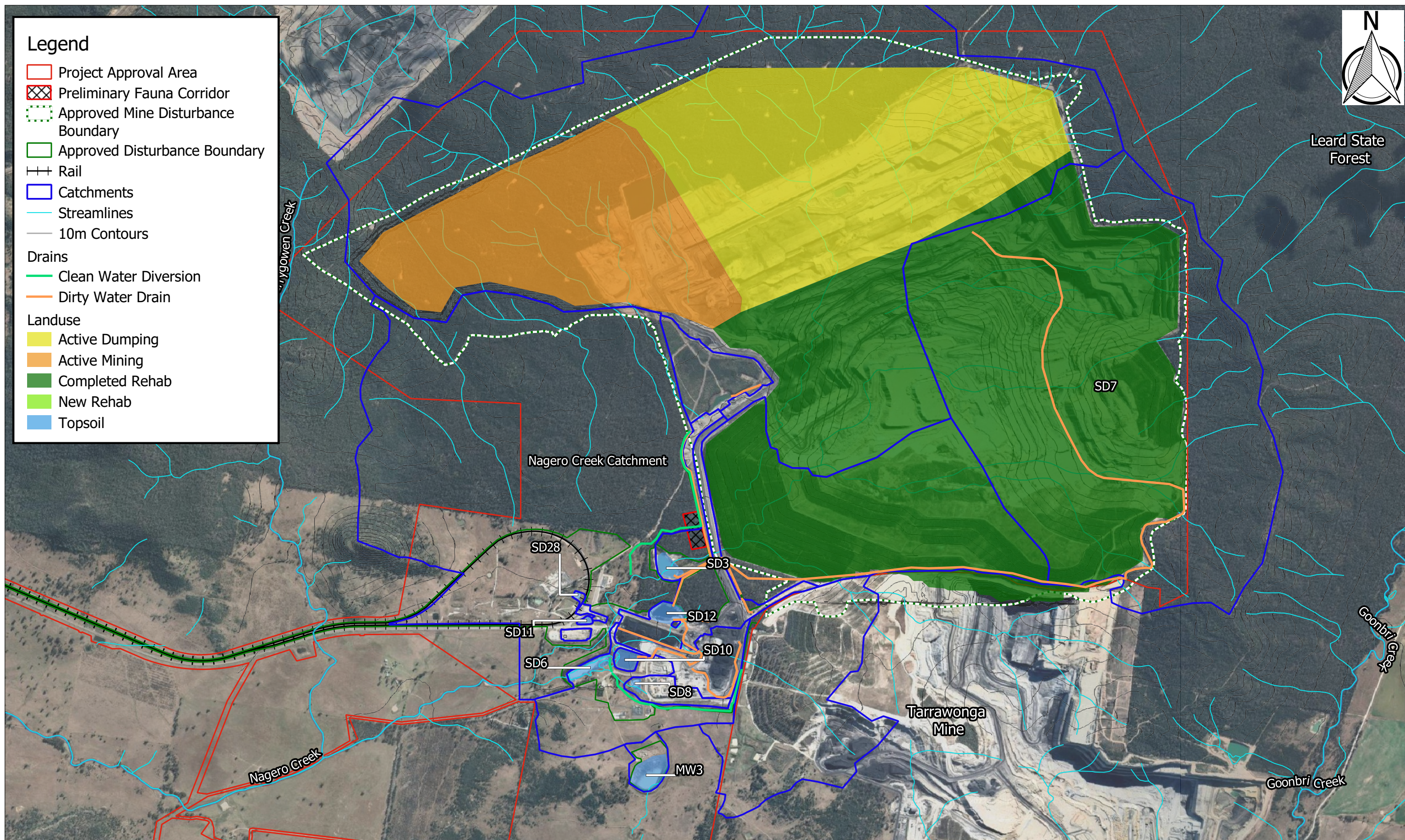
Date: 30/9/2022

## Legend

- Project Approval Area
- Preliminary Fauna Corridor
- Approved Mine Disturbance Boundary
- Approved Disturbance Boundary
- Rail
- Catchments
- Streamlines
- 10m Contours
- Drains
  - Clean Water Diversion
  - Dirty Water Drain
- Landuse
  - Active Dumping
  - Active Mining
  - Completed Rehab
  - New Rehab
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Map Projection: Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Vertical Datum: Australia Height Datum  
Grid: Map Grid of Australia, Zone 56

## Boggabri Coal MOD8 SWIA

### Figure 3-3: Proposed Conceptual WMS - 2035

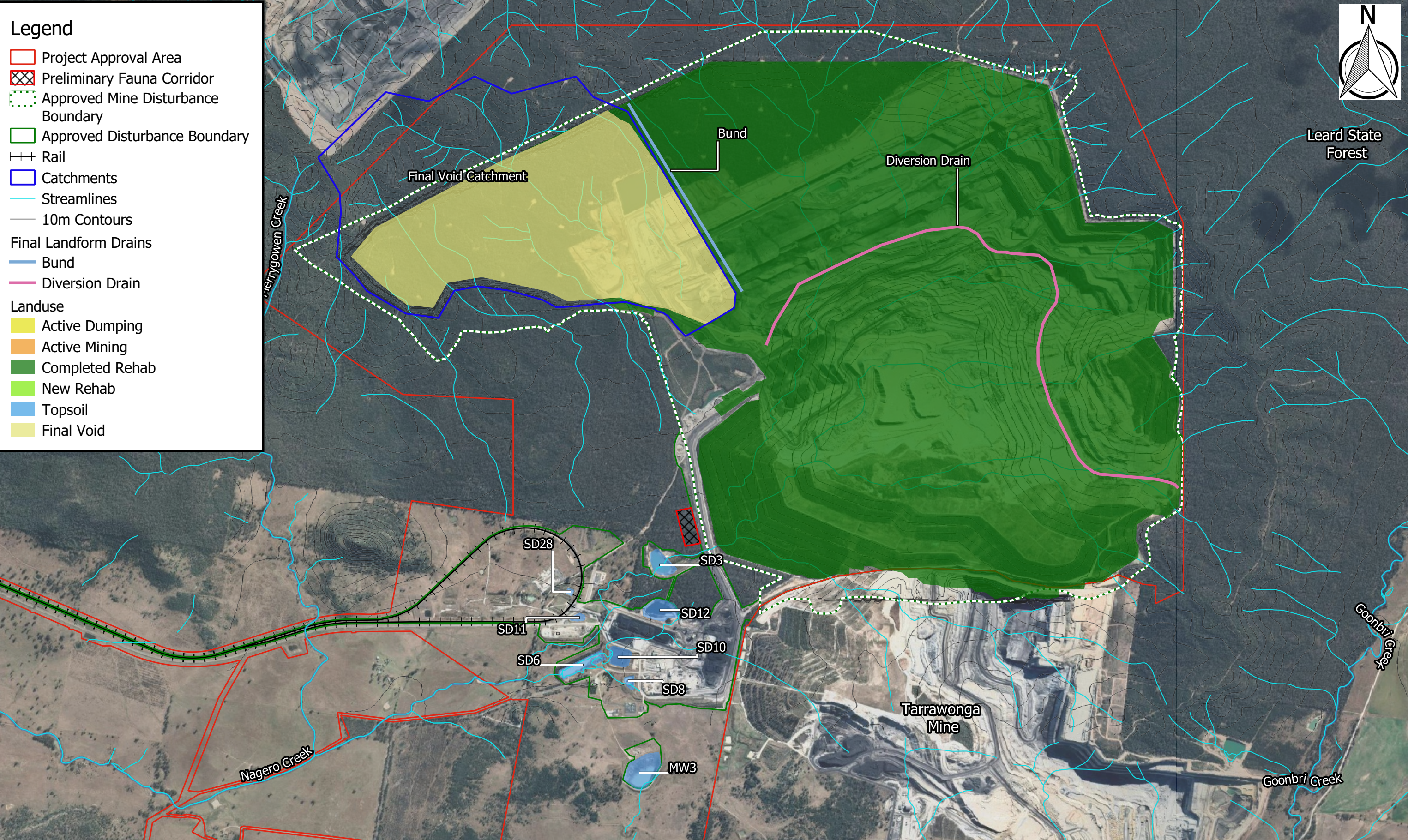
Job Number: N4002\_003

Revision: 0

Drawn: SGG

Checked: AW

Date: 30/9/2022



### **3.4.1 Clean Water Capture and Harvestable Rights**

The existing approved operations capture runoff from undisturbed catchments areas (i.e. clean) either in pit or within clean water (highwall) dams. Whilst approved, these dams are not proposed to be constructed until 2033 (as per the existing approved water management plan), and clean water runoff is currently captured directly in the pit.

As the pit and dams within the Project Boundary are not used for stock watering purposes, and the intercepted watercourses are not first or second order watercourses (Figure 2-1), water captured will either need to be licensed, or covered by harvestable rights provisions, or other licence exemption. Clean water captured from minor watercourses (in excess of BCOPL's harvestable right) and non-minor watercourses within the Bluevale Water source will require licencing.

## 4 WATER BALANCE

### 4.1 OVERVIEW

The GoldSim site water balance model for the BCM was initially developed as part of the surface water impact assessment (PB 2010) undertaken to support the BCM Continuation of Mining Operations Project Environmental Assessment (Boggabri EA) (Hansen Bailey 2010). As part of the consent conditions, the water balance model has been reviewed annually as part of a continuous improvement process. The last revision was undertaken by Engeny on behalf of BCOPL (2022). The 2021 Site Water Balance Report (Engeny, 2022) included a major revision of the model structure, methodology, logic, and implementation to include more modern and realistic representations of site water management processes. This model update resulted in a significant improvement in the results of the validation of the model and is the reason that the results of this assessment differ from those presented in the previous MOD8 assessment (Engeny, 2021). A copy of the report detailing the updated modelling methodology is included in Appendix B. Section 4.2 details the changes and assumptions made to this model as part of this assessment.

The water balance model was updated to simulate the mining and coal handling characteristics because of MOD 8 Amendment. The model considers existing and future operations and is used to estimate the likely water surplus/deficits and requirements into the future. The model allows detailed analysis, and considers:

- Direct rainfall onto dam/water storage surfaces.
- Water loss due to evaporation from water storages and pits.
- Runoff from natural, rehabilitated and disturbed catchment areas.
- Groundwater inflow to open cut pits.
- Water lost to product coal through the CHPP and ROM coal through the crusher (based on projected production rates).
- Water used for on-site dust suppression (haul roads and stockpiles).
- External water supplies.
- Site discharges.

The assessment of the potential impacts of MOD 8 Amendment on the predicted water balance is based on the outcomes of a GoldSim model. The model uses the SILO climate data for 126 years. The potential impacts of MOD 8 Amendment were assessed using 126 possible climatic sequences and as such assesses the water balance for many rainfall possibilities.

### 4.2 INPUT DATA

The existing water balance model (Engeny 2022) was updated to model the predicted impacts of MOD8 Amendment with data supplied by site. This process included updating values for annual ROM coal processing water demands, groundwater ingress (AGE 2022) and dust suppression demands associated with changes in haul road length. These changes are detailed in Figure 4-1, Figure 4-2 and Figure 4-3.

MW5, the main storage on site, is due to be mined through before 2027. After 2027 a replacement dam of similar capacity will be required to allow for continued mining operations for both base case and the MOD8 Amendment. BCM are currently investigating options for the location and capacity of this dam.

BCOPL are approved to process a maximum of 4.2 Mt in any calendar year through the CHPP. Production in excess of this bypasses the CHPP and is assumed to not contribute to any demand for coal washing. In later years for the proposed modification, where the total ROM is below 4.2 Mt, it was assumed that this was all processed through the CHPP. The historic water usage and processing tonnage were used to define a rate of water usage per Mt in the CHPP in the existing site model (refer to Appendix B). This relationship was updated for this assessment to use additional data for the 2021 calendar year.

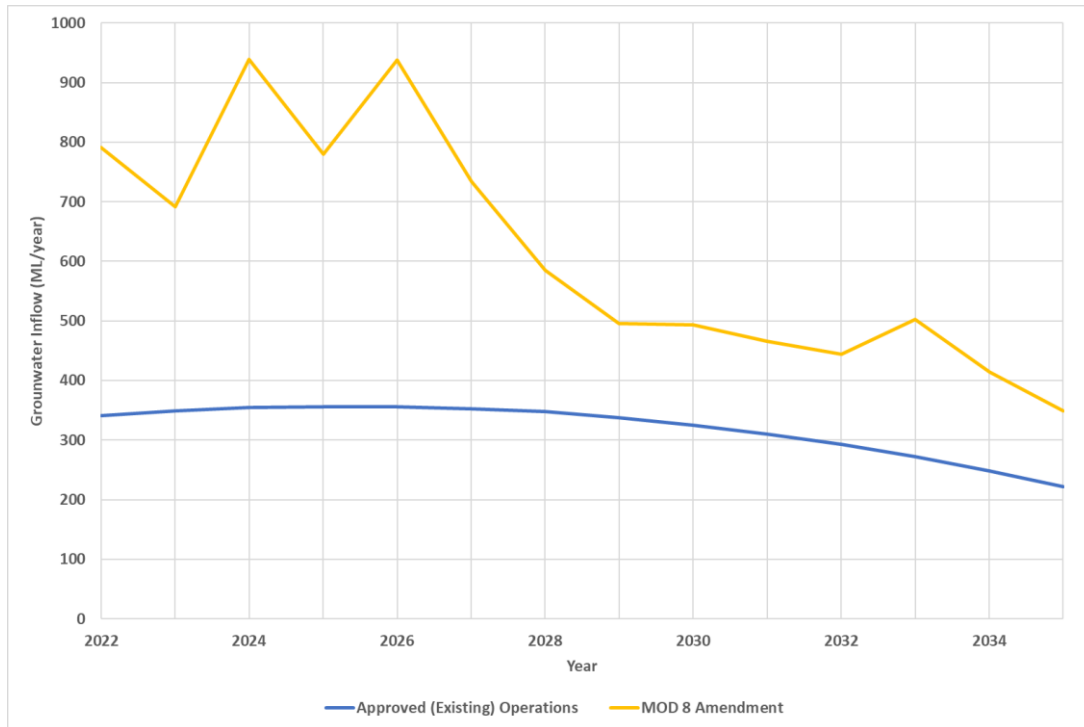


Figure 4-1: Existing and Mod 8 Amendment Groundwater Inflows

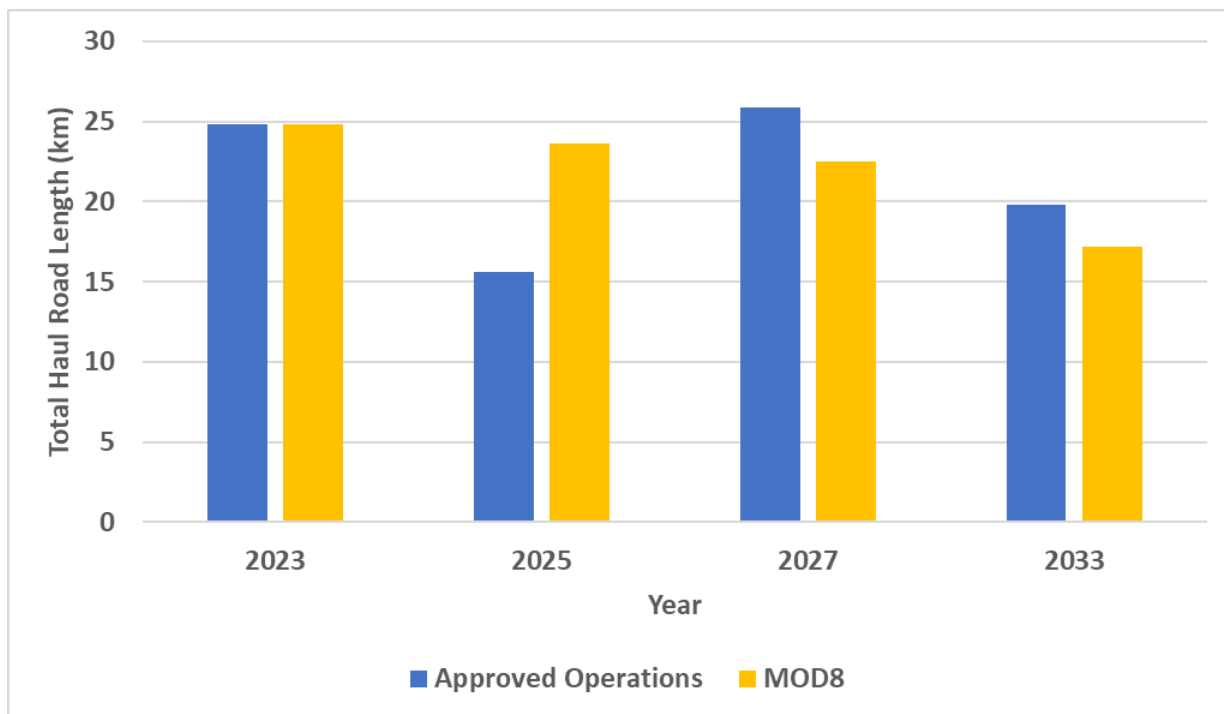


Figure 4-2: Existing and Mod 8 Amendment Haul Road Lengths <sup>1</sup>

<sup>1</sup> Approved (existing) conditions for 2023 were based on previous mine plans, however there is no proposed changes to the mine plan for 2023. The estimated changes for the haul road length in 2023 are the result of more detail included in the 2023 MOD8 Amendment.

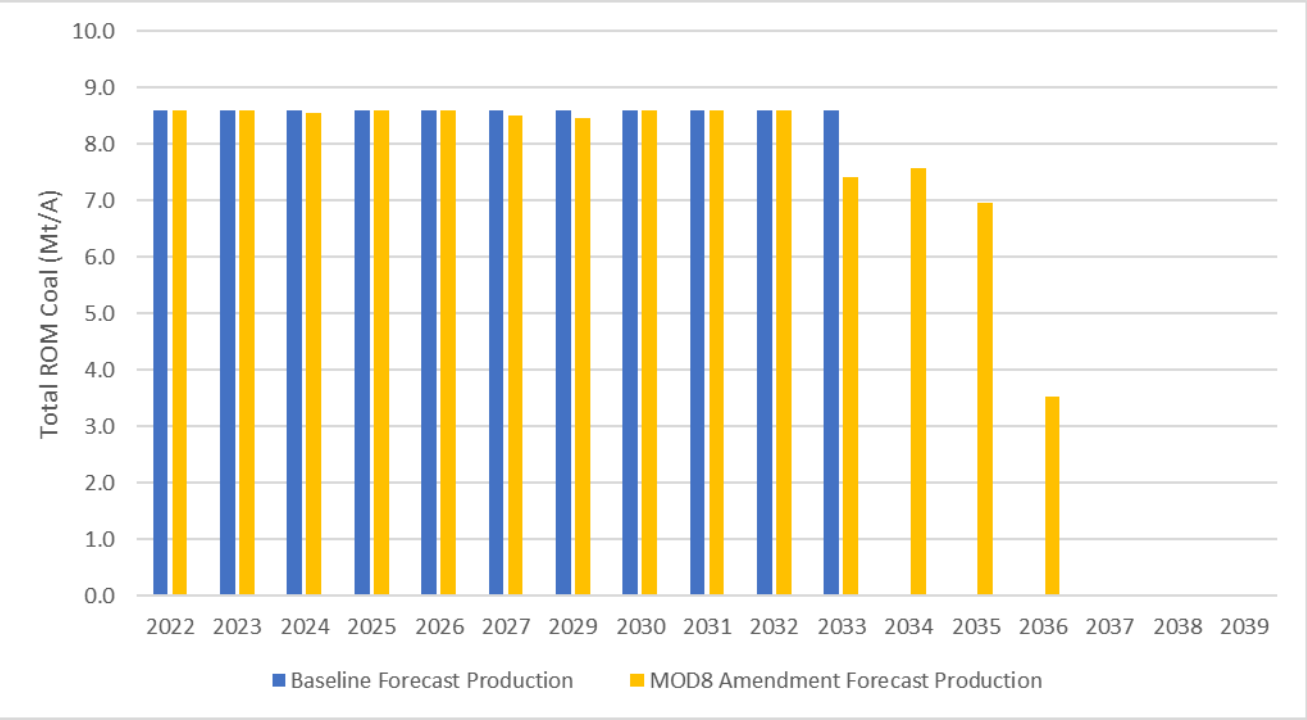


Figure 4-3: Mod 8 Amendment ROM Coal Production

## 4.3 APPROVED OPERATIONS

The predicted water balance for the Approved (existing) Operations is presented in Table 4-1.

**Table 4-1: Summary of Average Predicted Water Balance – Approved Operations**

| Water Management Element                | 2022                | 2023                | 2027                | 2033                |
|-----------------------------------------|---------------------|---------------------|---------------------|---------------------|
| <b>Inflows (ML)</b>                     |                     |                     |                     |                     |
| Direct rainfall and runoff:             |                     |                     |                     |                     |
| • Clean water (highwall) dams           | -                   | -                   | -                   | -                   |
| • Dirty water (sediment) dams           | 136                 | 125                 | 110                 | 105                 |
| • Contaminated water dams, MWDs and Pit | 526                 | 542                 | 599                 | 637                 |
| Groundwater make <sup>1</sup>           | 637                 | 726                 | 624                 | 587                 |
| Licensed imported water from borefield  | 1,028               | 1,028               | 1,028               | 905                 |
| Imported water from additional sources  | 207                 | 144                 | 37                  | -                   |
| <b>Total inflows (ML)</b>               | <b><u>2,535</u></b> | <b><u>2,564</u></b> | <b><u>2,399</u></b> | <b><u>2,234</u></b> |
| <b>Outflows (ML)</b>                    |                     |                     |                     |                     |
| Demands:                                |                     |                     |                     |                     |
| • Dust suppression                      | 1,549               | 1,616               | 1,458               | 1,110               |
| • CHPP                                  | 326                 | 326                 | 326                 | 326                 |
| • MIA and potable water                 | 183                 | 183                 | 183                 | 183                 |
| Evaporation:                            |                     |                     |                     |                     |
| • Clean water (highwall) dams           | -                   | -                   | -                   | -                   |
| • Dirty water (sediment) dams           | 62                  | 70                  | 75                  | 76                  |
| • Contaminated water dams, MWDs and Pit | 203                 | 210                 | 213                 | 221                 |
| Uncontrolled Discharges                 |                     |                     |                     |                     |
| • Clean water (highwall) dam discharges | -                   | -                   | -                   | -                   |
| • Dirty water (sediment) dam discharges | -                   | -                   | -                   | -                   |
| • Mine water dams and pit               | -                   | -                   | -                   | -                   |
| Controlled Discharge of Clean Water     | -                   | -                   | -                   | -                   |
| <b>Total Outflows (ML)</b>              | <b><u>2,322</u></b> | <b><u>2,404</u></b> | <b><u>2,254</u></b> | <b><u>1,915</u></b> |
| Change in storage (ML)                  | 213                 | 161                 | 145                 | 319                 |

1. Includes predicted groundwater inflow and modelled inflow from the spoil seepage model.

## 4.4 POTENTIAL IMPACTS WITH MOD 8

Table 4-2 presents a summary of the water balance results for MOD 8. The predicted water inventory is also shown on Figure 4-5.

**Table 4-2: Summary of Average Proposed Water Balance – with MOD 8 Amendment**

| Water Management Element                | 2022         | 2023         | 2027         | 2033         | 2036         |
|-----------------------------------------|--------------|--------------|--------------|--------------|--------------|
| <b>Inflows (ML)</b>                     |              |              |              |              |              |
| Direct rainfall and runoff:             |              |              |              |              |              |
| • Clean water (highwall) dams           | -            | -            | -            | 6            | 6            |
| • Dirty water (sediment) dams           | 188          | 201          | 216          | 193          | 195          |
| • Contaminated water dams, MWDs and Pit | 552          | 565          | 571          | 661          | 675          |
| Groundwater make <sup>1</sup>           | 579          | 612          | 621          | 736          | 693          |
| Licensed imported water from borefield  | 1,028        | 1,028        | 1,028        | 636          | 629          |
| Imported water from additional sources  | 134          | 113          | 97           | -            | -            |
| <b>Total inflows (ML)</b>               | <b>2,481</b> | <b>2,518</b> | <b>2,532</b> | <b>2,232</b> | <b>2,198</b> |
| <b>Outflows (ML)</b>                    |              |              |              |              |              |
| Demands:                                |              |              |              |              |              |
| • Dust suppression                      | 1,549        | 1,616        | 1,608        | 1,417        | 1,295        |
| • CHPP                                  | 326          | 326          | 326          | -            | -            |
| • MIA and potable water                 | 183          | 183          | 183          | 183          | 183          |
| Evaporation:                            |              |              |              |              |              |
| • Clean water (highwall) dams           | -            | -            | -            | 0            | 0            |
| • Dirty water (sediment) dams           | 66           | 86           | 91           | 140          | 144          |
| • Contaminated water dams, MWDs and Pit | 193          | 194          | 198          | 203          | 202          |
| Uncontrolled Discharges                 |              |              |              |              |              |
| • Clean water (highwall) dam discharges | -            | -            | -            | -            | -            |
| • Dirty water (sediment) dam discharges | -            | -            | -            | 10           | -            |
| • Mine water dams and pit               | -            | -            | -            | -            | -            |
| Controlled Discharge of Clean Water     | -            | -            | -            | 6            | 6            |
| <b>Total Outflows (ML)</b>              | <b>2,316</b> | <b>2,404</b> | <b>2,405</b> | <b>1,958</b> | <b>1,829</b> |
| <b>Change in storage (ML)</b>           | <b>164</b>   | <b>114</b>   | <b>127</b>   | <b>274</b>   | <b>369</b>   |

<sup>1</sup>. Includes predicted groundwater inflow and modelled inflow from the spoil seepage model.

The water balance modelling indicates total water inventory (Figure 4-5) on site is primarily driven by groundwater inflows into the pit, and licensed imported water. However, the uncertainty in the modelled total water inventory (Figure 4-5) is largely a result of the range of climatic conditions (i.e. flood and drought) that would alter the volume of surface water captured by the WMS.

The modelling indicates a period of decline in total site water inventory prior to 2027 (Figure 4-5), due to reduced groundwater extraction between 2022 and 2024 (Figure 4-7). However, recent heavy rainfalls have resulted in excess water on site, offsetting the previously identified risk of water shortage should prolonged or severe drought occur. Under these conditions, site water inventories have the potential to drop below about 1,000 ML (Figure 4-5), requiring licensed groundwater extractions to be maximised (Figure 4-9), and additional external water supplies may be required (Figure 4-9), in the form of available water allocation from the market, consistent with current practices on site.

Predicted total site inventory for approved conditions (Figure 4-4) and MOD8 Amendment (Figure 4-5) are similar. During all weather conditions, the water balance modelling indicates that the total inventory will remain below the target high operating volume for the site (Figure 4-5). Total site inventories exhibit seasonal fluctuations due to cyclic changes in evaporation and rainfall. It should be noted that the total site inventory never drops below 500 ML due to model logic that imports additional water if MW5 (and its future replacement dam) storage reaches a volume below 600 ML. In practice, total inventory values may be able to drop below this level as opposed to sourcing extra licences for water import.

The water balance modelling indicates that, for average conditions, MOD 8 Amendment will result in a small increase in the water imported from the borefield after 2022 (Figure 4-9). This increase, however, is not expected to result in the need to purchase any additional WALs, as the modelled imported water from the Lower Namoi River Regulated Water Source is reduced. The water balance modelling suggests that there is likely to be sufficient WALs to allow for increased coal production.

The volume of uncontrolled discharges (overflows) of water from sediment dams is expected to be negligible (Table 4-2, Figure 4-6 and Figure 4-7), largely as a result of the rehabilitation of the overburden emplacement areas and subsequent release of runoff to the downstream environment. The rehabilitation of the catchment areas reduces the overall volume of water intercepted by and managed within the dirty water management system (sediment dams). This reduction is considered a more realistic reflection of current site operations and rehabilitation strategies. It is noted that should runoff generated within the rehabilitated catchment area continue to be managed within the dirty water system, external water supplies would be reduced. Modelled overflows under approved operations (Figure 4-6) and with Mod 8 Amendment are only expected in the 95<sup>th</sup> percentile and above climatic conditions. There is expected to be a reduction in these overflows with the Mod 8 Amendment (Figure 4-7).

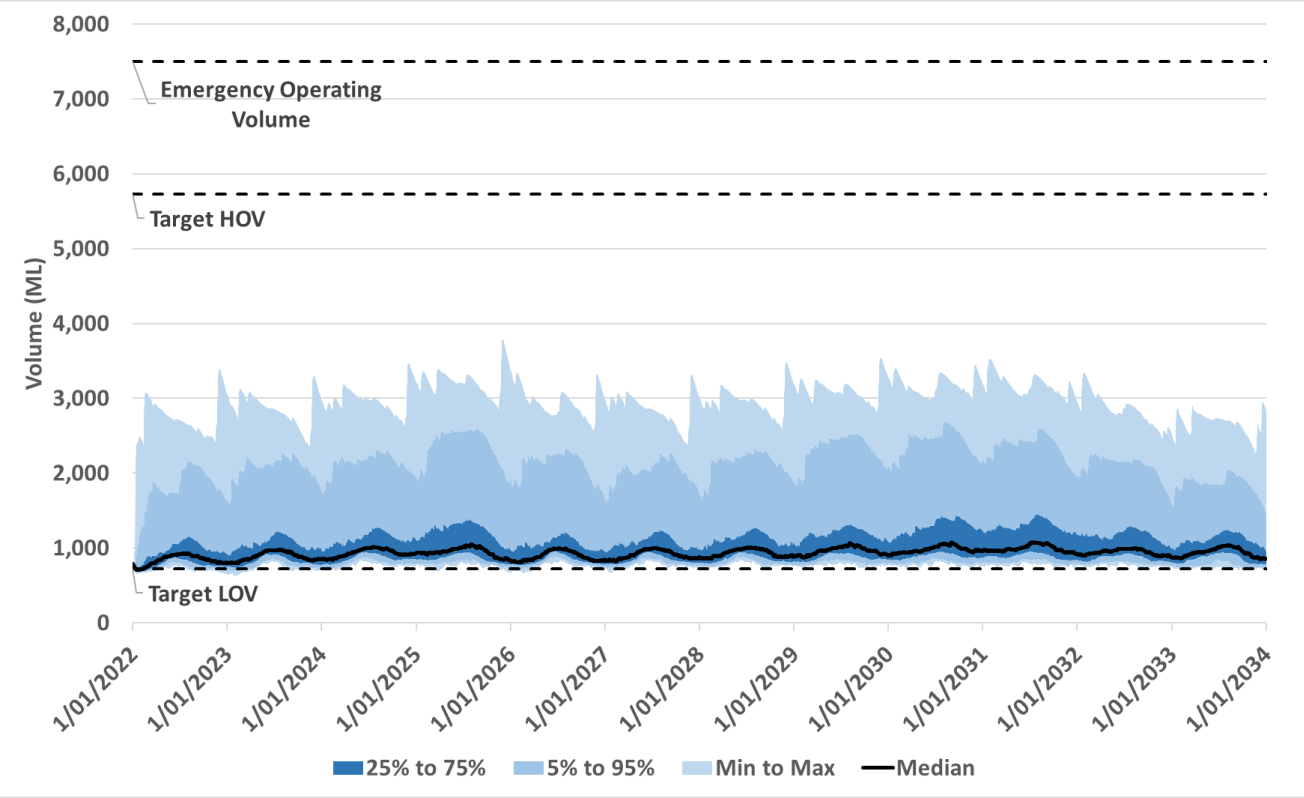


Figure 4-4: Predicted Water Storage Inventory – Approved Operations

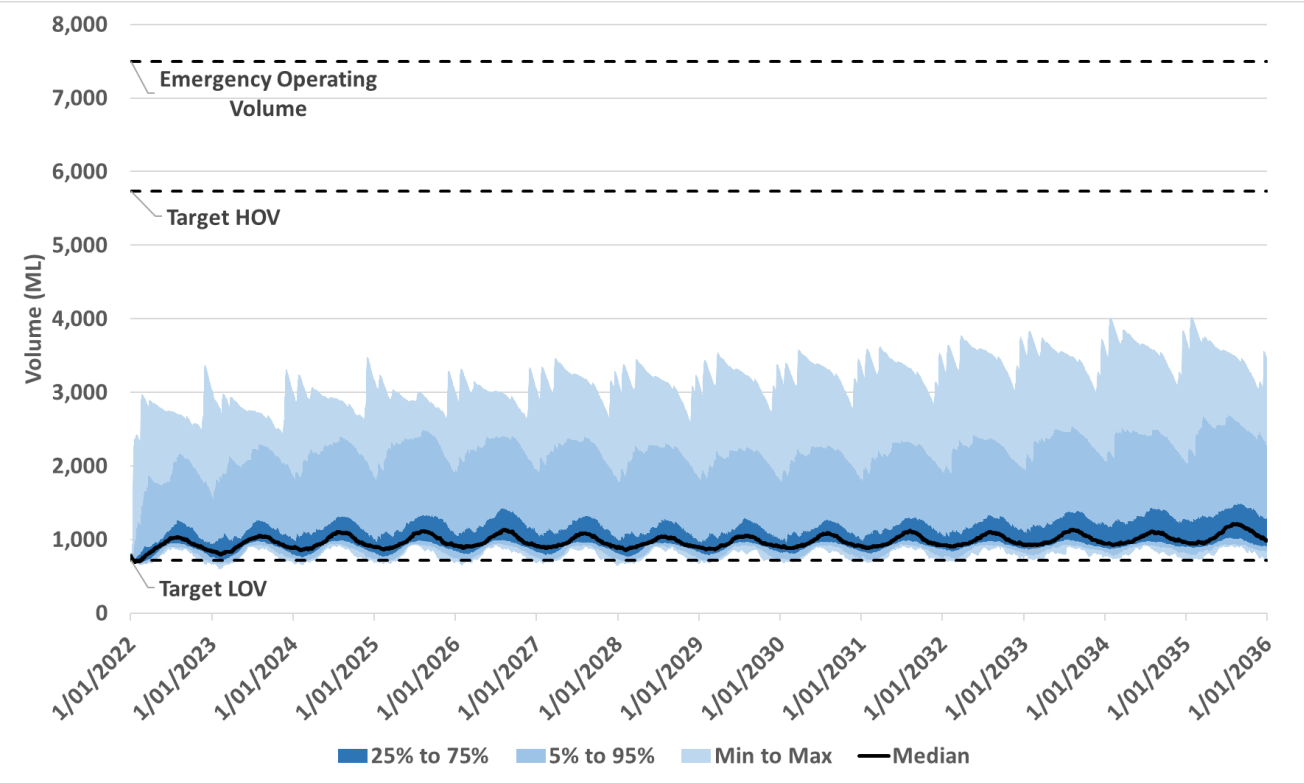


Figure 4-5: Predicted Water Storage Inventory – MOD 8 Amendment

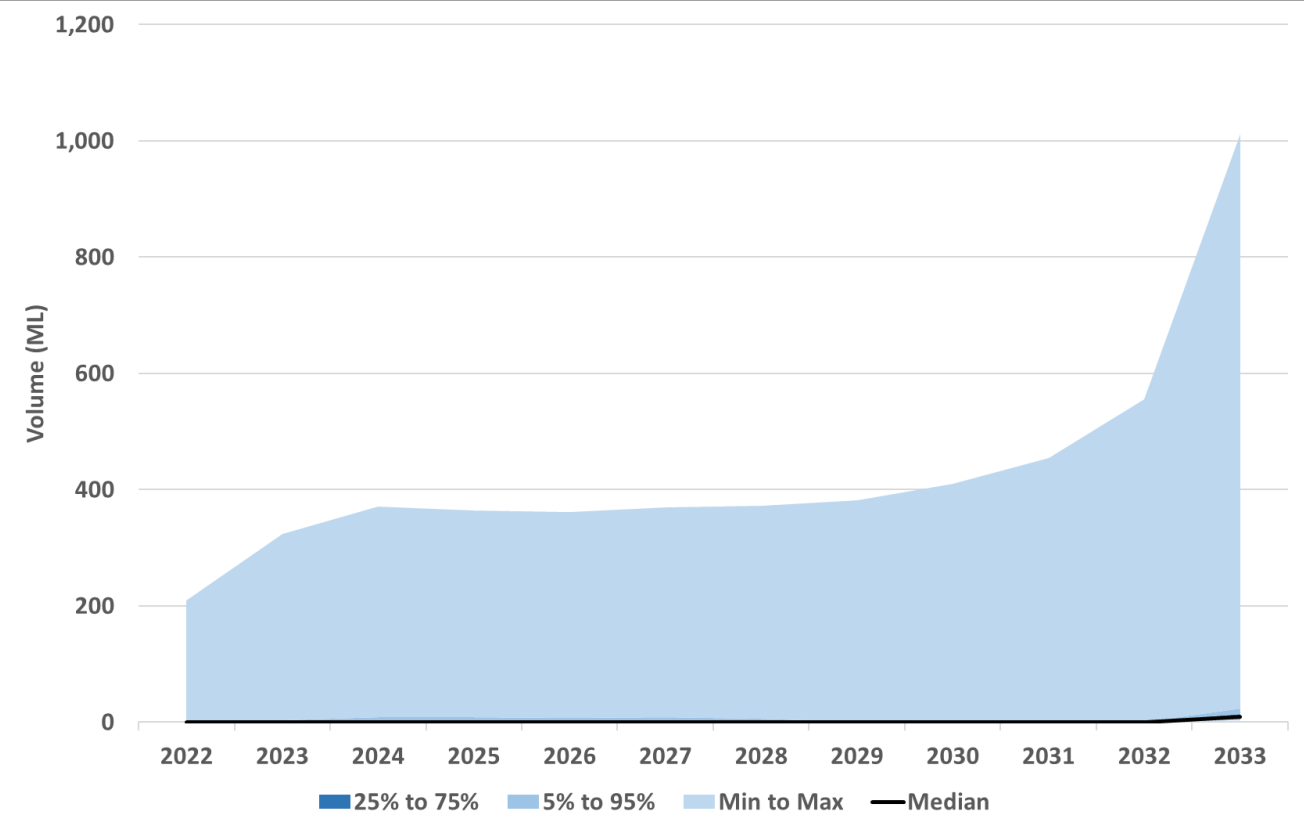


Figure 4-6: Modelled Sediment Dam Overflows – Existing Operations

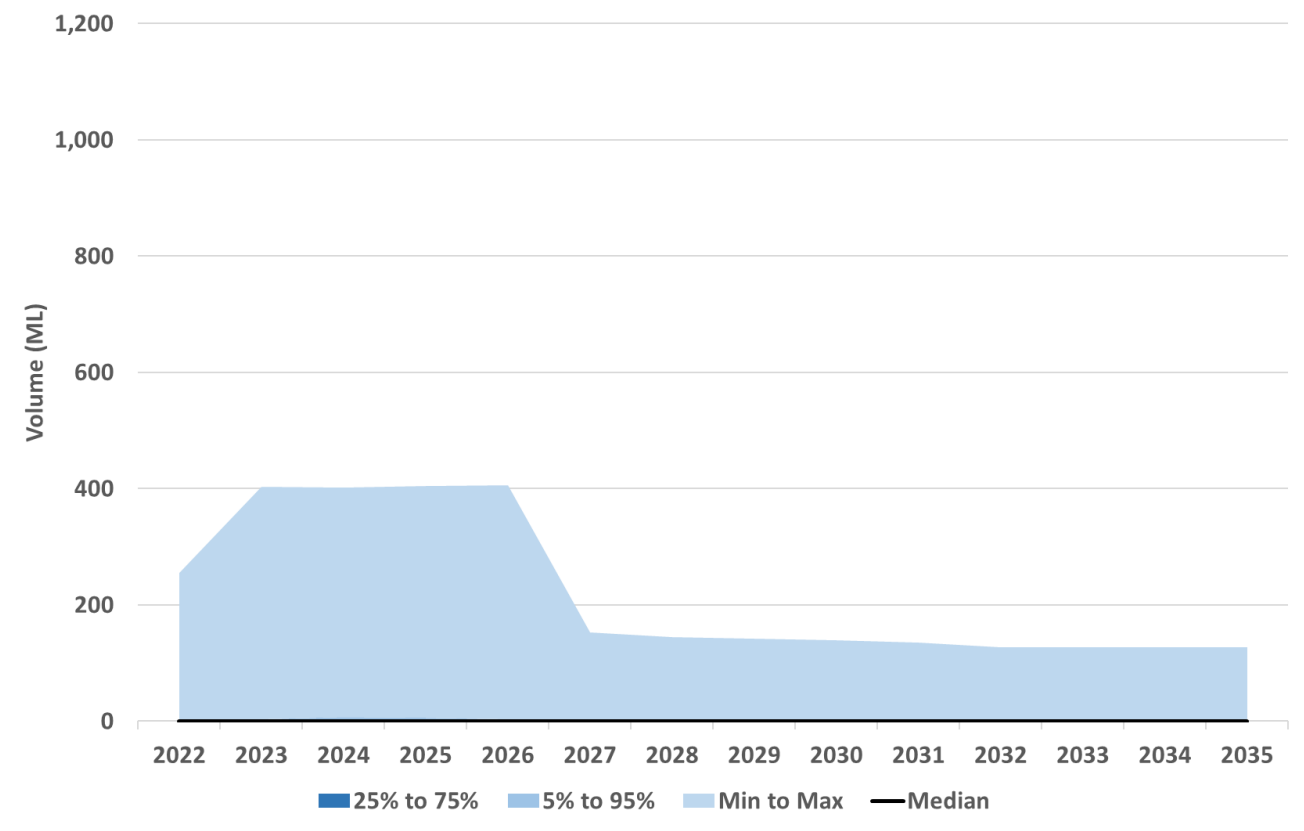


Figure 4-7: Modelled Sediment Dam Overflows – MOD 8 Amendment

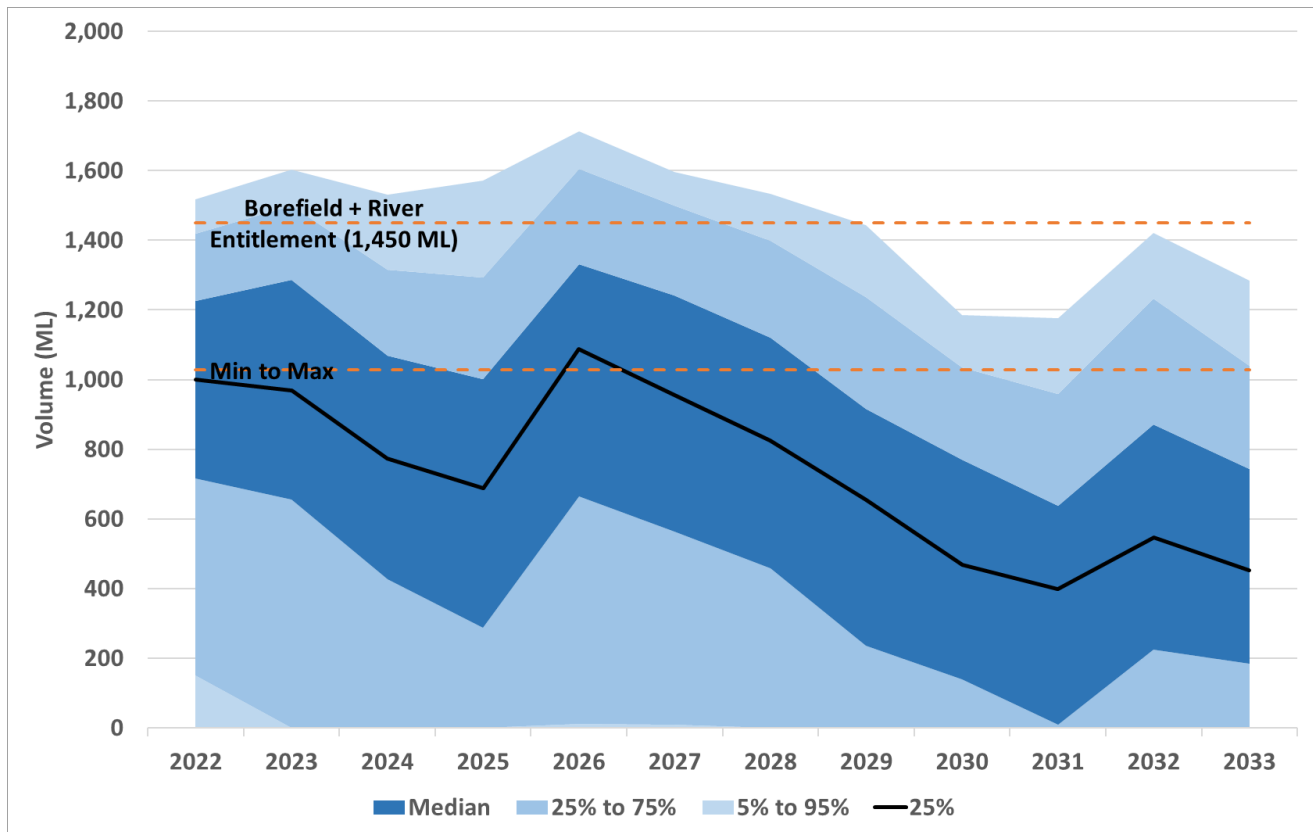


Figure 4-8: Total Modelled External Water Requirements– Approved Operations

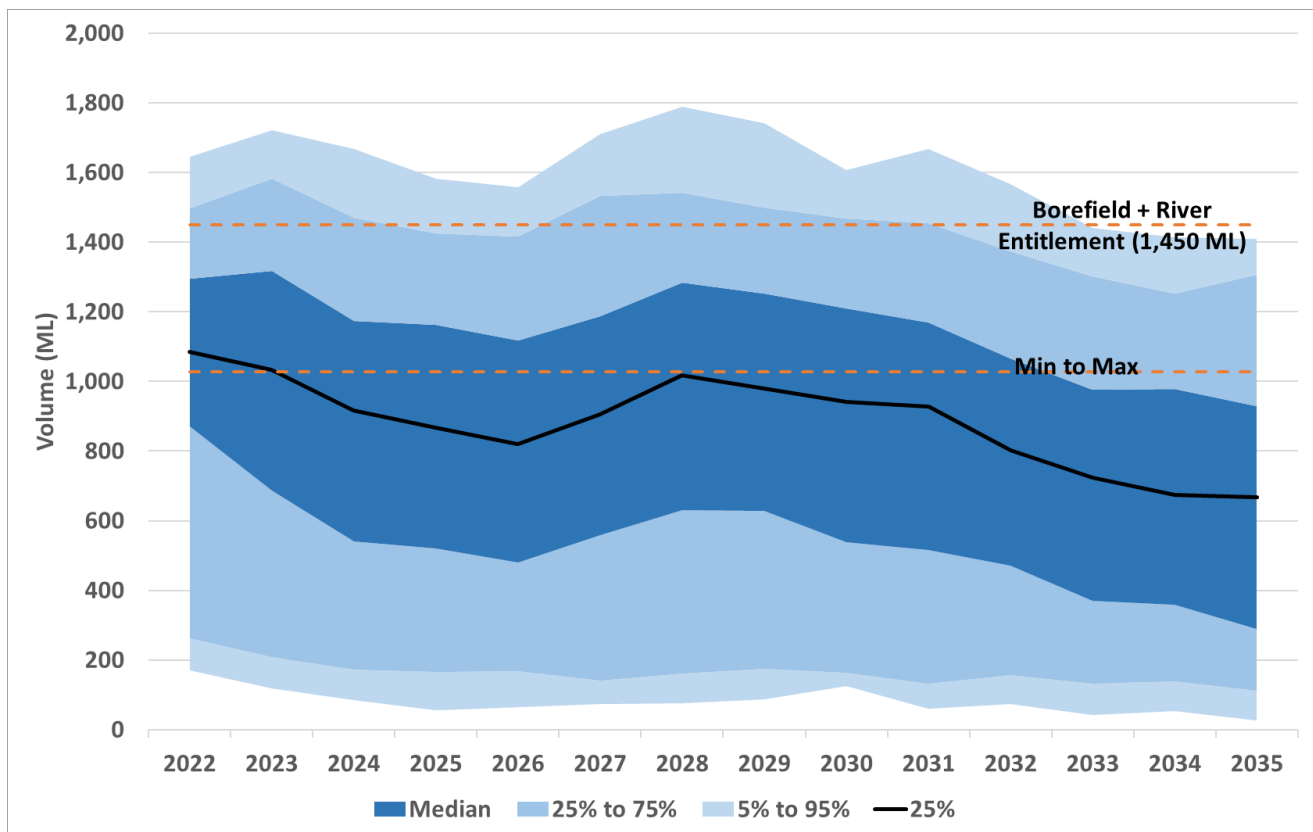


Figure 4-9: Total Modelled External Water Requirements– MOD 8 Amendment

## 5 SURFACE WATER IMPACTS AND MITIGATION MEASURES

### 5.1 CATCHMENT AREAS

As the MOD 8 Amendment does not include changes to the total surface footprint of mining, no appreciable change to surrounding catchment areas (including cumulative impacts) is expected to occur because of the proposed changes to mining, or final landform (compared to the approved conceptual final landform).

Some minor changes to local catchments are expected, due to the amended final landform design, , establishment of the Fauna Movement Crossing, and increased rehabilitation of waste rock dump areas allowing for earlier release of these areas into the downstream environment. These changes are contained within the mining footprint and have been considered in the water balance modelling undertaken (Section 4).

The proposed conceptual final landform is considered to be generally consistent with the approved conceptual final landform, with the additional infilling of the mining area to reduce the surface area of the partially infilled final void and subsequently increase the surface area from the landform that will be free-draining compared with approved conceptual final landform (as required by SSD 09\_0182).

### 5.2 FLOW REGIMES

The Groundwater Impact Assessment (AGE 2022) indicates that MOD 8 Amendment results in some increases to groundwater interception, largely as a result of the increase in mining depth and the extended mine life. However negligible impacts are anticipated to the surrounding watercourses as a result of this additional groundwater interception and therefore, the potential for impacts to streamflow regimes (including cumulative impacts) are considered to be negligible, consistent with the approved operations.

### 5.3 FLOODING AND WATERCOURSE STABILITY

As the MOD 8 Amendment does not include changes to the total extent of mining or significant changes to the approved water management system, the potential for changes in downstream flooding regimes and watercourse stability (including cumulative impacts) is considered negligible, consistent with the approved operations.

### 5.4 WATER QUALITY

As the MOD 8 Amendment does not include changes to the approved water management system, the potential for changes to downstream water quality (including cumulative impacts) is considered minor, compared to the to the approved operations.

The WMS is designed to enable BCOPL to meet licence conditions within the requirements of the POEO Act, taking account of both historical and current water qualities in the surrounding watercourses, and current and future downstream water users. The risk of overflows during events that exceed the approved design criteria and potential impacts associated with overflows is currently managed by the WMP. No changes to the design criteria for water management infrastructure are proposed.

The WMP allows for the ongoing assessment of risk as mining operations progress, and the implementation of improvements and changes where required. The design strategy for the WMS (refer to Section 3) includes:

- Management (capture and storage) of mine water exposed to coal and/or coal processing for events up to and including the 1% AEP 72 hour storm event. Additionally, 1000 ML of total freeboard is required to be maintained across all mine water storages at BCM.
- Management of runoff from disturbed areas, including overburden emplacement areas, based on the Blue Book requirements (Landcom, 2004 and DECC, 2008).
- Ongoing evaluation of the WMS adequacy based on the design criteria validated through water quality sampling.

The site Water Management Plan (BCOP 2017) includes a description of erosion and sediment controls that are required to manage runoff from disturbed areas.

Currently BCOPL monitors for pH, EC and TSS at SW1 and SW2. It is recommended that this monitoring is expanded to include metals/metalloids, nutrients, oils, and grease on a quarterly basis (when there is suitable flow in the creek) and during major flow events at a suitable time to allow for first flush spate events to have passed the monitoring location. A comparison of water quality results to ANZG (2018) guidelines for 95% species protection for aquatic ecosystems should be undertaken.

## 5.5 WATER USERS

As the MOD 8 Amendment does not include changes to the total extent of mining or significant changes to the approved water management system, including changes to clean water runoff harvesting, the potential for changes in downstream flow regimes (including cumulative impacts), and therefore downstream water users, is limited to the additional three years of mining operations. Therefore, the potential impacts are considered minor compared to the approved operations. Water balance modelling indicates that the current WALs remain sufficient to supply BCM, with the periodic purchase of additional water to continue as per current practice on site.

## 5.6 FINAL VOID

Groundwater modelling (AGE 2022) indicates that the long-term groundwater level within the vicinity of the final void will be below the partially filled level of the final void floor. Therefore, groundwater inflows into the final void will be minimal, and the void will likely provide additional groundwater recharge through the capture and infiltration of surface water. Modelling of the final void indicates that surface water will accumulate within the void following periods of high rainfall intensity or extended wet weather. This intercepted water will be retained and lost to evaporation and infiltration. Therefore, no final pit lake is expected (in accordance with the requirements of Schedule 3, condition 69, Table 16 of the SSD 09\_0182).

## 5.7 SUMMARY OF PROPOSED MITIGATION MEASURES

Erosion and sediment control will continue to be undertaken in accordance with the approved WMP, which will be reviewed and updated to ensure it is consistent with the operation of the mine associated with the MOD 8 Amendment. This includes the additional monitoring recommended in Section 5.4. The approved WMP provides a framework for the management of erosion and sedimentation at BCM.

The operational phase will involve the ongoing management of the WMS.

The objective of the approved WMP is to ensure that appropriate structures and programs of work are in place to:

- Identify activities that could cause erosion and generate sediment.
- Describe the location, function and capacity of erosion and sediment control structures required to minimise soil erosion and the potential for transport of sediment downstream.
- Ensure erosion and sediment control structures are appropriately maintained.
- Fulfil the statutory conditions of the project approval.
- Meet industry standards and best practice, specifically:
  - Landcom 2004. Managing Urban Stormwater – Soils and Construction, Volume 1·4th Edition.
  - DECC 2008. Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries.

## 6 COMMONWEALTH SIGNIFICANT IMPACT GUIDELINES

A summary of the potential surface water impacts against the Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments – impacts on water resources (DoE 2013) is included in Table 6-1.

**Table 6-1: Assessment Against Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources**

| Aspect                                                                                                | Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flow Regimes                                                                                          | <p>The assessment indicates that the MOD 8 Amendment will have minor to negligible impacts on flow regimes (Section 5.2) including flooding (Section 5.3), when compared to the existing Approved Operations.</p> <p>The assessment of potential impacts of flow regimes on riparian and ecological values is included in Section 5.5.</p>                                                                                                                                                                                                      |
| Recharge Rates; Aquifer pressure or pressure relationships between aquifers; Groundwater table levels | Refer to Groundwater Impact Assessment Mod 8 Amendment (AGE 2022).                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Groundwater/surface water interactions                                                                | <p>Groundwater interactions are discussed and assessed in the Groundwater Impact Assessment for the Mod 8 Amendment (AGE 2022).</p> <p>The groundwater assessment indicates that the proposed conceptual final void includes an invert level above the estimated long term recovery level of the regional groundwater. Therefore, interactions between surface and groundwater are expected to be limited to localized infiltration and groundwater recharge, with no pit lake expected within the conceptual final landform (Section 5.6).</p> |
| River/floodplain connectivity                                                                         | The MOD 8 Amendment is not expected to have an impact on river / floodplain connectivity as no changes are sought to the approved infrastructure located on floodplain areas.                                                                                                                                                                                                                                                                                                                                                                   |
| Inter-aquifer connectivity                                                                            | Refer to Groundwater Impact Assessment (AGE 2022).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Coastal Processes                                                                                     | The site is located more than 270 km from coastal areas and will therefore have no impacts on coastal processes.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Impact on water users                                                                                 | <p>The magnitude of impacts on water users are expected to be comparable to those for the approved operations, however, would continue for an additional three years (Section 5.5).</p> <p>All water take associated with the MOD 8 Amendment will be licensed in accordance with the WM Act.</p>                                                                                                                                                                                                                                               |
| State Water Resource Plans                                                                            | <p>The surface water sources within and adjacent to the BCM are managed under the Namoi Unregulated WSP. In addition, water extraction from the Namoi River is managed under the Namoi Regulated WSP. Both WSPs are State Water Resource Plans and are governed under the WM Act.</p> <p>Water take for the BCM will continue to comply with the above listed WSPs and WM Act which are designed to provide for the sustainable use of NSW's water resources.</p>                                                                               |

## 7 MANAGEMENT, MONITORING, LICENSING AND REPORTING

### 7.1 WATER MANAGEMENT PLAN AND MONITORING

The existing WMP includes details of erosion and sediment controls, surface water and groundwater monitoring programs, as well as a surface and groundwater response plan. The WMP includes specific monitoring for:

- Erosion and sediment control measures.
- Surface water quality monitoring.
- Stream health and channel stability monitoring.

The WMP will be reviewed and updated to include the WMS and water balance associated with the MOD 8 Amendment.

As the MOD 8 Amendment is constrained to the approved mine disturbance footprint, and results in impacts to the surrounding surface water environment that are considered consistent with the approved impacts, no proposed changes to the monitoring locations and metrics are considered necessary in response to the MOD 8 Amendment. It is noted, however, that the monitoring will be continued for the life of the project (i.e. to at least 2036) until the site is rehabilitated, including the additional monitoring identified in Section 5.4

### 7.2 LICENSING REQUIREMENTS

#### 7.2.1 Protection of the Environment Operations Act 1997

Licensing requirements for the operations under the POEO Act remain generally unchanged with the MOD 8 Amendment.

#### 7.2.2 Water Sharing Plan - During Operations

The MOD 8 Amendment will not result in an increase in the capture/diversion of runoff take from clean catchment areas. Runoff from dirty and mine water catchments will be contained within the WMS to meet the requirements of EPL 12407. There are also no additional harvesting dams proposed as part of the MOD 8 Amendment. As such, the licensing regime for the Approved Operations during the operational stages in regard to surface water is not predicted to change as a result of the MOD 8 Amendment, but will be required for an additional three years to cover the additional operational period.

#### 7.2.3 Water Sharing Plan - Final Landform

The proposed MOD 8 Amendment final landform is based on the objectives of the approved final landform, and includes improvements to the final voids (partial infilling to increase the area that is free-draining) and macro relief to manage surface water runoff generated on the overburden emplacement areas.

Consistent with the approved final landform, the proposed MOD 8 Amendment conceptual final landform includes a shallow final void that will capture some surface water runoff. The captured surface water will be temporarily retained before being lost to the environment via infiltration, groundwater recharge, and evapotranspiration. No permanent water storage is expected within the final void. As a result, there are no significant changes to the WALs required to manage the surface water harvest associated with the MOD 8 Amendment conceptual final landform, compared to the approved final landform. The changes to the partial filling of the final void and diversion drain will reduce the clean water catchment area reporting to the final void, reducing the WALs that will be required (to be determined as part of the final landform development process).

### 7.3 REPORTING

A summary of surface water monitoring results will continue to be provided in the Annual Review (including the review of the water balance model), which will, at a minimum, include:

- A summary of monitoring results;
- An analysis of monitoring results against impact assessment criteria, historical monitoring results;
- Annual site water balance and comparison against predictions in the Modification Report;
- An identification of any trends in the monitoring results;

- Any non-compliances reported during the year;
- Actions taken to address any non-compliances; and
- Any changes to WAL requirements to cover forecasted water take

In addition, the Annual Review is to include reporting on significant issues regarding the implementation of the WMP, including:

- The effectiveness of the erosion and sediment controls.
- Changes to the site water balance; and
- Any identified issues or exceedances of trigger values.

The Annual Review will also document reviews and feedback relating to the maintenance and performance of the WMS.

## 7.4 CONCLUSION

This assessment identified that the MOD 8 Amendment is likely to result in minor impacts to imported water requirements during mining operations. However, the modified final landform reduces the clean catchment area reporting to the final void, thereby reducing the volume of clean runoff that would have been intercepted by the final void and instead returning it to the downstream environment.

## 8 REFERENCES

AGE, 2022, Groundwater Impact Assessment for the Mod 8 Amendment

ANZECC/ARMCANZ, 2000. National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality.

BCOPL, 2021, Site Water Balance

BCOPL, 2017, Water Management Plan, Revision No. 6

Department of Environment and Climate Change (DECC), 2008. Managing Urban Stormwater – Soils and Construction, Volume 2A Installation of services.

Department of Environment and Climate Change (DECC), 2008. Managing Urban Stormwater – Soils and Construction, Volume 2C Unsealed Roads.

Department of Environment and Climate Change (DECC), 2008. Managing Urban Stormwater – Soils and Construction, Volume 2D Main Road Construction.

Department of Environment and Climate Change (DECC), 2008. Managing Urban Stormwater – Soils and Construction, Volume 2E – Mines and Quarries.

Engeny, 2021, Boggabri Coal Mine Modification 8 Amendment Surface Water Assessment, prepared on behalf of James Bailey and Associate

Landcom, 2004. Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition.

NSW Government, 2005. NSW Floodplain Development Manual

NSW Office of Water (NOW), undated. Water Reporting Requirements for Mines.

PB, 2010, Continuation of Boggabri Coal Mine Project – Surface Water Assessment, prepared on behalf of Hansen Bailey.

WaterNSW, 2019, *Annual Operations Plan Namoi Valley 2019-20*

## 9 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:
  - 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.

# Appendix A:

## Response to Comments

## Appendix Table A. 1: Response to OWS Comments (to Engeny 2021)

| Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Response                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| 7. The proponent has provided an updated water balance model, however, the data used to inform the model is lacking. The proponent should provide further information on the construction, parameters, assumptions and limitations, as well as the data used to inform the model.                                                                                                                                                                                           |                                                                 |
| a. The proponent has stated that the uncertainty in the modelled total water inventory is largely a result of the range of climatic conditions used in the model (Engeny 2021). However, details of the climatic conditions used in the model were not presented.                                                                                                                                                                                                           | Appendix B                                                      |
| b. OWS notes that during extended dry periods, the site will use water from the Namoi River utilizing Water Access Licenses (WALS). Further justification on how this was calculated within the model should be provided.                                                                                                                                                                                                                                                   | Appendix B                                                      |
| c. The proponent has not provided the estimated modelled discharge quantities expected over the climate scenarios.                                                                                                                                                                                                                                                                                                                                                          | Appendix B                                                      |
| d. It is unclear if the proponent has captured the surface water streamflow data of Nagero and Bollol creeks in the hydrodynamic model (OWS 2021-013).                                                                                                                                                                                                                                                                                                                      | Appendix B                                                      |
| e. The water balance model was not verified. A sensitivity or uncertainty analysis were also not provided.                                                                                                                                                                                                                                                                                                                                                                  | Appendix B                                                      |
| 8. As stated in the previous advice (OWS 2021-013), the proponent predicts it is unlikely that there will be any adverse cumulative impacts associated with water quality in Nagero Creek, Bollol Creek or the Namoi River from mining activities. However, these claims are not justified and, as recommended in the previous advice (OWS 2021-013), to determine if there is any adverse cumulative impacts associated with the project the following should be provided: |                                                                 |
| a. A sediment and erosion management plan which outlines mitigation strategies to minimise the risk of sediment run-off from on-site reject material stockpiles (Paragraph 10 a (ii)).                                                                                                                                                                                                                                                                                      | Refer to Section 5.4                                            |
| b. Monthly or quarterly physico-chemical monitoring data, including a suite of metals and metalloids for future monitoring of Nagero Creek and on-site sediment dams, to ensure that the proposed action does not contribute to a material increase in cumulative water quality degradation of surrounding watercourses (Paragraph 14 b (i)).                                                                                                                               | Expanded monitoring programme recommended, refer to Section 5.4 |
| 14. The proponent has not provided adequate information as highlighted by the previous advice (OWS 2021-013) which considered BCOPL (2017b).                                                                                                                                                                                                                                                                                                                                |                                                                 |
| a. The proponent has only provided details of the surface water monitoring program which includes quarterly monitoring at each water storage site, event based monitoring of two external monitoring locations on Nagero Creek (upstream and downstream) for pH, EC and TSS only (Engeny 2021, p. 13). Furthermore, the proponent has not presented an analysis of the monitoring data, only three measured data points are provided.                                       | Section 2.3.2                                                   |
| b. OWS notes that EPL-12407 requires six monthly groundwater monitoring of all analytes (EPA 2021, Section M2.3, p. 16). This however, is not required for surface water monitoring or the EPL discharge locations; the requirement is to monitor for pH, EC and TSS only.                                                                                                                                                                                                  | Expanded monitoring programme recommended, refer to Section 5.4 |
| i. OWS considers that the proponent should monitor surface water for all analytes, such as a broad suite of metals and other contaminants, in addition to pH, EC, TSS and turbidity. A comparison of results should be undertaken with ANZG (2018) guidelines for 95% species protection for aquatic ecosystems.                                                                                                                                                            | Expanded monitoring programme recommended, refer to Section 5.4 |
| ii. OWS noted in previous advice (OWS-2013) that baseline surface water quality data has been provided in BCOPL (2017b). The baseline physico-chemical data (of Nagero Creek and the Namoi River) should also be                                                                                                                                                                                                                                                            | Expanded monitoring programme recommended, refer to Section 5.4 |

| Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Response                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>considered by the proponent in their assessment to quantify the incremental impact of the proposed project on the water quality of these watercourses.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                            |
| <p>c. The project site has three licensed discharge points, EPL 1, 3 and 4. The map providing the locations of the discharge points is unclear (Engeny 2021, Figure 2.1). Furthermore, there is an EPL 40 located on Figure 2.1, this is not listed in the EPL-12407. The proponent should provide a map which provides a closer view of the discharge locations, description of the discharge locations and where the discharge will be released. The proponent should also provide the quantity of current and historical discharges, including details on the water quality and frequency of discharge occurrences. Furthermore predicted quantities for discharges should be estimated.</p> | <p>Figure 2.1 updated.</p> <ul style="list-style-type: none"> <li>- Overview windows provided for more clarity at each LDP.</li> <li>- LDP 40 removed.</li> </ul> <p>Historical discharges addressed in Section 2.3.2.</p> <p>Predicted discharges addressed in Section 4.2 (Table 4.2 and Figure 4.2)</p> |
| <p>i. Information on the term 'wet weather discharge' should be clarified by the proponent as this is not defined in the EPL.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Section 3.3</p>                                                                                                                                                                                                                                                                                         |
| <p>ii. The proponent should also provide monitoring data from event based discharges which consider all analytes, as presented in Paragraph 14 b (i).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>Expanded monitoring programme recommended, refer to Section 5.4</p>                                                                                                                                                                                                                                     |
| <p>iii. This should also consider the first flush spate events, which can potentially produce a high concentration of metals and contaminants into the receiving environment.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Expanded monitoring programme recommended, refer to Section 5.4</p>                                                                                                                                                                                                                                     |
| <p>d. The proponent has stated that the proposed project will utilise the existing water management system and OWS notes what is presented for the proposed project is a conceptual plan, the actual plans will be provided as the site is developed.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                            |
| <p>i. The Figures 3.1-3.5 (Engeny 2021) show the clean runoff water is captured following drainage along a roadside through the coal rail line. Further information and details on how the clean water which passes this area is not contaminated by coal dust and other contaminants from runoff during wet weather events should be provided. Monitoring of the water quality may be required to provide assurances the water is not contaminated.</p>                                                                                                                                                                                                                                        | <p>Alternate flow path defined to match existing watercourse. Refer to Figures 3.1 to 3.4</p>                                                                                                                                                                                                              |
| <p>iii. The clean water diversion point south of the rail line appears to drain into a paddock. The proponent should provide information on this site in a sediment and erosion management plan, which provides assurances there is no runoff or erosion occurring during rainfall events.</p>                                                                                                                                                                                                                                                                                                                                                                                                  | <p>Alternate flow path defined to match existing watercourse. Does not discharge into paddock. Refer to Figures 3.1 to 3.4.</p>                                                                                                                                                                            |

## Appendix Table A. 2: Response to DPIE Comments (to Engeny 2021)

| Comment                                                                                                                                                                                                                                                                                                                                                                                                                    | Response                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| That the proponent:                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>quantify the changes to surface water take including water take that is both exempt and water take that needs to be accounted for. Where it needs to be accounted for the proponent needs to demonstrate the ability to obtain sufficient entitlement.</li> </ul>                                                                                                                   | <p>Section 4</p> <p>Little change to current licencing requirement (Section 3.4)</p>                                                                   |
| <ul style="list-style-type: none"> <li>provide further information on the potential to obtain sufficient water from the regulated Namoi River via trading and supply to meet the additional demands during a drought period. An analysis of trading history and the operation of the regulated Namoi River in the most recent drought would assist.</li> </ul>                                                             | <p>Water supplies to be managed as per current practices on site (Section 5.5)</p> <p>Little change to current licencing requirement (Section 3.4)</p> |
| <ul style="list-style-type: none"> <li>provide further information on the capture of clean runoff from upstream of the pit and the limited proposal for clean water diversions and how this differs from what is currently approved. We recommend that clean water diversions be implemented wherever possible. If not possible an impact assessment on the downstream environment and water users is required.</li> </ul> | <p>Section 3.1</p>                                                                                                                                     |

# Appendix B:

## Site Water Balance Update 2022



Boggabri Coal Operations Pty Ltd  
**Site Water Balance**  
3 May 2022

## Revision Control Chart

| Revision                   | Date       | Prepared by                 | Reviewed by             | Approved by |
|----------------------------|------------|-----------------------------|-------------------------|-------------|
| 0                          | 27/04/2012 | L Doeleman                  | L Gleeson,<br>T Swanson | J Rennick   |
| 1                          | 14/09/2012 | L Doeleman                  | B Bird                  | J Green     |
| 2                          | 19/07/2013 | N Harcombe,<br>A Hedjripour | S Trott,<br>V O'Keefe   | C Dingle    |
| 3                          | 9/10/2013  | N Harcombe,<br>A Hedjripour | S Trott,<br>V O'Keefe   | C Dingle    |
| 4                          | 18/11/2013 | N Harcombe                  | S Trott                 | J Green     |
| 5                          | 12/02/2014 | K Agllias                   | S Trott                 | J Green     |
| 6                          | 4/06/2015  | L Doeleman                  | N Geale                 | J Green     |
| 7                          | 10/09/2015 | L Doeleman                  | N Geale                 | J Green     |
| 8                          | 18/05/2017 | T Tinkler,<br>A Wyatt       | H Russell               | P Forbes    |
| 9<br>(Calendar year 2019)  | 23/04/2021 | M Best,<br>A Wyatt          | K Halliday              | H Russell   |
| 10<br>(Calendar Year 2020) | 30/08/2021 | M Best,<br>A Wyatt          | K Halliday              | H Russell   |
| 11<br>(Calendar Year 2020) | 20/04/2021 | M Best,<br>A Wyatt          | K Halliday              | H Russell   |

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## Abbreviations

| Abbreviation | Term                                                                            |
|--------------|---------------------------------------------------------------------------------|
| AR           | Annual Review                                                                   |
| ARI          | Average Recurrence Interval                                                     |
| AWBM         | Australian Water Balance Model                                                  |
| AWD          | Available Water Determinations                                                  |
| BCM          | Boggabri Coal Mine                                                              |
| BCOP         | Boggabri Coal Operations Pty Limited                                            |
| BOM          | Bureau of Meteorology                                                           |
| BTM Complex  | Boggabri-Tarrawonga-Maules Creek Complex                                        |
| CCC          | Community Consultative Committee                                                |
| CD           | Clean Water Highwall Dam                                                        |
| CHPP         | Coal Handling and Preparation Plant                                             |
| DPI&E        | NSW Department of Planning, Industry and Environment                            |
| EA           | Environmental Assessment                                                        |
| EC           | Electrical Conductivity                                                         |
| EPA          | Environment Protection Authority                                                |
| EP&A Act     | <i>Environmental Planning and Assessment Act, 1979</i>                          |
| EPL          | Environment Protection Licence                                                  |
| GWMP         | Groundwater Management Plan                                                     |
| HD           | Highwall Dam                                                                    |
| IFD          | Intensity-Frequency-Duration                                                    |
| MCCM         | Maules Creek Coal Mine                                                          |
| MIA          | Mine Infrastructure Area                                                        |
| ML           | Megalitres                                                                      |
| Mtpa         | Million Tonnes Per Annum                                                        |
| MWD          | Mine water dam                                                                  |
| NLLS         | North West Local Lands Services (formerly Namoi Catchment Management Authority) |
| PAC          | NSW Planning Assessment Commission                                              |
| ROM          | Run of Mine                                                                     |
| SD           | Sediment dam                                                                    |
| SWB          | Site Water Balance                                                              |
| SWMP         | Surface Water Management Plan                                                   |
| TCM          | Tarrawonga Coal Mine                                                            |
| TCPL         | Tarrawonga Coal Pty Ltd                                                         |
| WAL          | Water Access Licence                                                            |
| WMP          | Water Management Plan                                                           |
| WSP          | Water Sharing Plan                                                              |

# 1. Introduction

## 1.1 Overview

This Site Water Balance (SWB) has been developed for Boggabri Coal Mine (BCM) which is managed by Boggabri Coal Operations Pty Ltd (BCOP). BCOP is owned by Idemitsu Australia Resources Pty Limited (80%), Chugoku Electric Power Australia Resources Pty Ltd (10%) and NS Boggabri Pty Limited (10%). BCM is located 15 km north-east of the township of Boggabri in north-western New South Wales.

BCM is an open cut coal mine that has been operating since 2006. Truck and excavator operations are used to mine a run-of-mine (ROM) coal which is crushed and screened to produce a thermal coal product or washed in the Coal Handling Preparation Plant (CHPP) to produce Coking or Pulverised Coal Injected product. Product coal is loaded onto trains via a train loading facility at the mine site and transported by rail to the Port of Newcastle for export.

The mine currently operates under State Significant Development Consent (SSD 09\_0182), which allows BCOP to produce 8.6 million tonnes per annum (Mtpa) of run of mine (ROM) coal from BCM until the end of 2033. Approval was granted by the NSW Planning Assessment Commission (PAC) under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act) on 18 July 2011 and has been subject to a number of modifications.

In 2015, BCOP lodged an application under Section 75W of the EP&A Act 1997 to modify PA09\_0182 (MOD 5). The modification was supported by an Environmental Assessment (Parsons Brinckerhoff, 2015) for the conversion of existing test bores to operational production bores for the supply water to BCM and the installation of ancillary infrastructure on adjoining properties. The application was determined by the NSW Department of Planning and Infrastructure, Executive Director under delegation by the Minister for Planning and was approved on 30 August 2016.

Schedule 3, Condition 38 (a) of the state Project Approval requires the preparation of a SWB. This SWB has been prepared in fulfilment of these requirements. The specific requirements of the SWB are listed in Table 1-1.

Conditions of approval under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) were granted by the then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (now Department of Agriculture, Water and the Environment (DAWE)) on 11 February 2013 (EPBC Approval). The EPBC Approval conditions do not relate specifically to the SWB, but rather to the Surface Water Management Plan (SWMP). The SWB forms part of the SWMP.

The SWB considers the current Life-of-Mine planning and information available to define components of the SWB. To ensure clarity throughout the SWB, reference is made to two distinct mine plans for which demand, usage and storage characteristics are based, specifically the:

1. Mining Operations Plan 2020-2024 Amendment A (MOP): The MOP spans a period between 2020 and 2024. Mine plan snapshots and water management systems relevant to mine years existing and 2021, are aligned with the MOP.
2. Environmental Assessment (EA) Mine Plan: lodged in 2009 and conditionally approved by the NSW Minister for Planning and Infrastructure in July 2012. The EA mine plan spans a 21 year period between 2013 and 2034. Mine plan snapshots and water management system for years 2024 and 2033 in this SWMP are based on the EA mine plan.

The Project Approval (PA 09\_0182) conditions outlining the requirements for the SWB are provided the WMP and summarised in Table 1-1.

**Table 1-1 Project Approval Conditions – Planning Assessment Commission of NSW**

| Applicable Condition        | Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SWB Reference                                                                                                                       |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Schedule 3, Condition 38(a) | The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must be prepared in consultation with OEH, DPIW, North Water Local Land Service and the CCC, by suitably qualified and experienced person/s whose appointment has been approved by the Secretary, and be submitted to the Secretary for approval within 6 months of the date of this approval [which shall include]:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | This SWB forms part of the WMP. Suitably qualified and approved persons have prepared the plan in accordance with this requirement. |
|                             | <ul style="list-style-type: none"> <li>a Site Water Balance, that: <ul style="list-style-type: none"> <li>includes details of: <ul style="list-style-type: none"> <li>sources and security of water supply, including contingency for future reporting periods;</li> <li>prioritisation strategy for water sources;</li> <li>water use on site;</li> <li>water management on site;</li> <li>any off-site water discharges;</li> <li>reporting procedures, including the preparation of a site water balance for each calendar year;</li> <li>a program to validate the surface water model, including monitoring discharge volumes from the site and comparison of monitoring results with modelled predictions;</li> <li>methodologies used in the preparation of the site water balance, including provision of data sources, measurement type (direct sample / mass balance / engineer calculations / factors) and formulas used for all inflows, processes and outflows; and</li> </ul> </li> </ul> </li> </ul> | Refer to Section 3 and 4                                                                                                            |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 3.1.3 and 4.3.3                                                                                                    |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 3.1.3.1                                                                                                            |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 3.1                                                                                                                |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 3.1                                                                                                                |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 4.3.4                                                                                                              |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 6.3                                                                                                                |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 4 and 6.2                                                                                                          |
|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Section 4 and Appendix A                                                                                                   |
|                             | <ul style="list-style-type: none"> <li>is supported by an annual improvement program to identify and address deficiencies and improvements within monitoring, measurement and calculation methods; and</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Refer to Section 6.1                                                                                                                |
|                             | <ul style="list-style-type: none"> <li>includes an action plan and schedule to implement annual water efficiency initiatives and the recommendations in the Advisian peer review report titled "Peer Review of Site Water Balance Use Aspects of Boggabri Coal MOD 5 Project, 22 July 2016" as set out in Appendix 6A; and</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Refer to Section 5                                                                                                                  |
|                             | <ul style="list-style-type: none"> <li>describes the measures that would be implemented to minimise clean water use on site</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Refer to Section 3.1.3 and Section 5                                                                                                |

## 1.2 Related Water Management Documents

This SWB report has been prepared as an integral part of, and should be read in conjunction with, the documents listed in Table 1-2. The water management plan (WMP) document hierarchy is shown in Figure 1-1.

**Table 1-2 Related Water Management Documents**

| Document                                                                 | Description                                                                                                                                              |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Boggabri Tarrawonga Maules Creek (BTM) Complex Water Management Strategy | Regional strategy prepared in consultation with Tarrawonga Coal Mine (TCM) and Maules Creek Coal Project (MCCM)                                          |
| Water Management Plan                                                    | Overarching document setting out water management framework, statutory requirements and procedural requirements                                          |
| Surface Water Management Plan                                            | Surface water baseline data, performance criteria, monitoring program, response plan, water management system description, erosion and sediment controls |
| Groundwater Management Plan                                              | Groundwater baseline data, performance criteria, monitoring program, response plan and groundwater model validation program                              |
| <b>Site Water Balance report</b>                                         | <b>Mine water balance modelling methodology, assumptions, and results, mine water management system operating philosophy</b>                             |

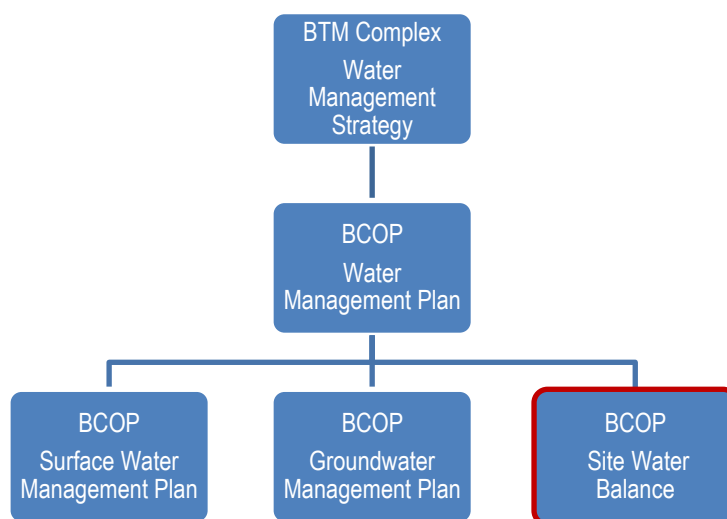


**Figure 1-1 Document Hierarchy**

## 1.3 Consultation

Previous versions of this SWB have been prepared in consultation with representatives from the NSW Environment Protection Agency (EPA), NSW Department of Primary Industry – Water (DPI Water) (now DPIE), North West Local Land Services (NLLS) (formerly Namoi Catchment Management Authority and the Community Consultative Committee (CCC).

The SWB has been prepared by suitably qualified persons approved by DP&E to undertake this work.

## 1.4 Environment Protection Licence

The conditions described in this SWB reflect the conditions set out in the current EPL (12407, as at the date of the SWB). Condition L1.1 requires compliance with Section 120 of the Protection of the Environment Operations Act 1997. As mining progresses, EPL discharge points will be reviewed and updated in consultation with the EPA. Surface water discharge criteria are specified in the EPL and outlined in the Surface Water Management Plan (SWMP).

## **2. Existing Environment**

### **2.1 Catchment Description**

The BCM is in the catchment area of an unnamed ephemeral drainage line locally referred to as Nagero Creek and partly within the catchment of Bollol Creek. Both are ephemeral tributaries of the Namoi River, which is a part of the Barwon-Darling River system. The BCM site lies north of Tarrawonga Coal Mine (TCPM) which is approved to operate until 2030, and south of Maules Creek Coal Mine (MCCM) which is approved to operate until 2034.

The Nagero Creek catchment is described in the Surface Water Management Plan (SWMP).

### **2.2 Climate**

BCOP maintains a weather station on site with rainfall data available from 2013 to present. There are two operating Bureau of Meteorology (BoM) rainfall gauges in the vicinity of BCM. Appendix A provides a summary of the available rainfall and evaporation data including historic data from several discontinued gauges.

## 3. Surface Water Management System

The key objectives of the existing water management system (WMS) are to:

- separate clean runoff, dirty runoff and contaminated water generated from rainfall events and mining operations where reasonable and feasible;
- minimise the volume of contaminated mine water (surface runoff draining to pit) generated by the Project;
- provide enough on-site storage to store contaminated water that could affect the quality of downstream watercourses;
- where reasonable and feasible treat dirty runoff from un-rehabilitated overburden areas to settle coarse suspended solids; and
- where reasonable and feasible divert clean runoff to downstream creeks.

The design objectives for the approved WMS are described in detail in the WMP. Details relevant to the SWB and model parameters are provided in the following sections.

### 3.1 Existing Water Management System

The existing water management system is described below and shown in Figure D-1 and schematically in Figure D-5, Appendix D. A summary of the existing storage characteristics is provided in Appendix C.

#### 3.1.1 Key WMS Storages and Features

MW5 was completed in late 2018 to cater for predicted pit dewatering requirements and has an approximate capacity of 2200 ML.

MW3 has a capacity of 153.50ML and can be utilised to dewater surplus water from SD10. The total out-of-pit MWD storage in MW3 and MW5 is 2353.5 ML.

Fill points for dust suppression currently operate from SD23. This dam also receives water transfers from in-pit dewatering.

SD10 is used to supply water to the CHPP and also acts as a transfer point from the MIA to the mine water dams and fill points at SD23.

A licensed discharge point (LDP) is located at SD6, which receives overflows and pumped transfers from several MIA dams. Overflows to the external environment occur from SD6 when dirty water dams in the MIA have exceeded the design capacity. A diversion drain diverts discharge from Tarrawonga Coal Mine's Licenced Discharge Point (EPL 12365- LDP 1) around the BCOP's MIA and discharges into SD6.

SD12 was upgraded in 2015 to a capacity of 206.56 ML (previous capacity 25.9 ML). The upgrade to SD12 catered for the expanded MIA and CHPP and haul road catchments.

Sediment dam SD3 was upgraded in 2015 to a capacity of 102.3ML (previous capacity 31.8 ML). This upgrade catered for the expanding overburden catchment from 2015 to 2021. As the topography of the overburden dump does not allow for water stored in SD7 to be released to the creek system, water stored in SD7 is reused onsite. Until late 2020, SD7 was used as a fill point for water trucks for dust suppression usage. As mining has progressed, this fill point is no longer utilised.

Table C-1 in Appendix C provides capacities for all WMS storages and Table C-2 lists pumped transfers between all WMS storages.

A diversion drain constructed ahead of the mining void previously diverted runoff from undisturbed areas to the north of the mining void into the Nagero Creek catchment. During 2018, this diversion drain was

mined through. Remnant undisturbed catchments to the east of the pit void drain directly into the mining void and this water is managed within the contaminated water management system.

### **3.1.2 Licensed Discharge Points**

BCOP currently have three approved LDPs. These are the existing discharge points and types listed in Section P1.3 of the EPL (12407, 5 Feb 2021).

### **3.1.3 Water Sources**

BCM receives water from rainfall/runoff and from licensed water imports (discussed below). Clean water runoff from the undisturbed areas upslope of the mining void is currently intercepted by the pit and transferred to MW5 for re-use on site. Licensing of this runoff is partially covered by Harvestable Rights Provision under the Water Management Act, with the balance to be covered by Water Access Licences, which is currently under review.

#### **3.1.3.1 Water Source Prioritisation Strategy**

Water required to satisfy the site demands will be sourced from onsite surface water storages and supplemented with imported water, in order of priority, from:

1. Surface water stored in water storages (consisting of contaminated water stored in mining water storages and pit void, and dirty water in sediment dams).
2. Imported water (consisting of groundwater from the Upper Namoi Zone 4 Groundwater Source via the borefield and river water from the Lower Namoi Regulated River Water Source via the pump station on the Namoi River).

Over the long term, contaminated and dirty water will be used for mining activities in preference to imported water. However, on occasion imported water may be sourced while stored water is present onsite to meet operational demands.

The water quality of contaminated and dirty water make it unsuitable for some water uses in the CHPP and washdown facilities, therefore, imported water will be used for the supply of water for use on site facilities (i.e. administration buildings and bathhouses) and for washdown facilities.

#### **3.1.3.2 Groundwater Entitlements**

BCOP currently holds licences for the Upper Namoi Zone 4 Namoi Valley Groundwater Source, the Upper Namoi Zone 11 Namoi Valley Groundwater Source and the Gunnedah-Oxley Basin. Details of these water access licences (WALs) are provided in Table 3-1.

**Table 3-1 Summary of Groundwater WALs Currently Held by BCOP**

| Source                                 | WAL category | WAL No.   | Share (units) | Expiry     | Current reliability (%) |
|----------------------------------------|--------------|-----------|---------------|------------|-------------------------|
| Upper Namoi Zone 4 Groundwater Source  | Aquifer      | WAL 15037 | 172           | Perpetuity | 95-100                  |
| Upper Namoi Zone 4 Groundwater Source  | Aquifer      | WAL 24103 | 275           | Perpetuity | 95-100                  |
| Upper Namoi Zone 4 Groundwater Source  | Aquifer      | WAL 12691 | 457           | Perpetuity | 95-100                  |
| Upper Namoi Zone 4 Groundwater Source  | Aquifer      | WAL 12767 | 3             | Perpetuity | 95-100                  |
| Upper Namoi Zone 4 Groundwater Source  | Aquifer      | WAL 36547 | 37            | Perpetuity | 95-100                  |
| Upper Namoi Zone 4 Groundwater Source  | Aquifer      | WAL 37519 | 84            | Perpetuity | 95-100                  |
| Upper Namoi Zone 11 Groundwater source | Aquifer      | WAL 42234 | 20            | Perpetuity | 95-100                  |
| Gunnedah-Oxley Basin MDB               | Aquifer      | WAL 29562 | 700           | Perpetuity | 100                     |
| Gunnedah-Oxley Basin MDB               | Aquifer      | WAL 29473 | 142           | Perpetuity | 95-100                  |

A total of 1028 unit shares of groundwater would be available to BCOP from the aquifer access licences for the Upper Namoi Zone 4 Groundwater Source and 20 shares for Upper Namoi Zone 11. The actual volume of groundwater available depends on the Available Water Determinations (AWD) made under the Water Sharing Plan (WSP), these are likely to be at or close to 1 ML per unit share from the water access licences. Water derived from the pit inflows can be reused onsite under WAL29562 providing further capacity for supplementation.

BCOP currently uses groundwater pumped from Lovton, Cooboobindi and Victoria Park Bores for existing operations. Groundwater pumped from Lovton and Victoria Park bore are currently used onsite for potable water, vehicle washdown, amenities and fire suppression. Groundwater pumped from Cooboobindi bore is used for dust suppression.

Groundwater can also be traded on a temporary or permanent basis within the greater Gunnedah-Oxley Basin Groundwater Source, and within Zone 4 of the Upper Namoi Valley (Keepit Dam to Gins Leap) Ground Water Source, subject to local impact considerations.

No temporary transfers of WALs were required for the 2021 calendar year.

### 3.1.3.3 Surface Water Entitlements

BCOP currently holds general security and supplementary water access licences for the Lower Namoi Regulated River Water Source. Details of these water access licences are provided in Table 3-2. The total share component under these licences is 422 unit shares of general security water and 32.2 unit shares of supplementary water. The actual volume of river water available to BCOP from the general security licences depends on the Available Water Determinations (AWD) made from time to time in accordance with the Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2003. Supplementary access is also 'announced' from time to time and is dependent on the presence of unregulated flows in the regulated river, and on the operation of the WSP rules.

**Table 3-2 BCOP Water Access Licences for Lower Namoi Regulated River Water Source**

| Source            | Water Access Licence category | Water Access Licence number | Share component (units) |
|-------------------|-------------------------------|-----------------------------|-------------------------|
| Lower Namoi River | General Security              | WAL 2571                    | 51                      |
| Lower Namoi River | General Security              | WAL 2595                    | 243                     |
| Lower Namoi River | Supplementary Water           | WAL 2596                    | 26.6                    |
| Lower Namoi River | Supplementary Water           | WAL 2572                    | 5.6                     |
| Upper Namoi River | General Security              | WAL 37067                   | 128                     |

The Namoi Regulated River water sharing plan estimates that there are in total 256,400 unit shares of general security access licences and 115,000 unit shares of supplementary water access licences. Access to entitlement will vary from year to year depending on climatic conditions and water availability.

A continuous accounting system is used in the Namoi Valley for general security entitlements. The maximum that may be held in an account is 2.0 ML per unit share. The amount carried over from one year to the next is unlimited (maximum account balance effectively limits carryover volumes). The maximum usage (including trade) in any season is 1.25 ML per unit share. The maximum water use over any 3 consecutive years is 3.0 ML per unit share (Ribbons, 2009).

BCOP can access surface water from the Namoi River in accordance with its surface water licences via a pump station from the Namoi River. BCOP can also trade additional water, either temporarily or permanently, to make up shortfalls on a contingency basis. Typically, water from the Namoi River is not used due to a lack of water availability and the reliability of groundwater sources.

## 3.2 Proposed WMS

The BCOP Mine Operation Plan (MOP) Amendment A forecasts the mine progression to 2024 including land use, overburden progression and forecast coal production. The existing MOP is currently being revised to reflect recent regulatory reforms and will be replaced by a rehabilitation management plan for the site.

The SWB is updated in accordance with the MOP out to 2024. From 2025 to 2033, the mine plan from Year 21 in The Project EA is used to forecast pit and overburden progression and the associated catchments. Sediment dams are proposed based the expected requirement for runoff control or dewatering demands based on this forecast mine plan.

The following sections outline the proposed WMS for years 2024 and 2033. Water management system indicative layout plans for existing, 2024 and 2033 are provided in Figure C-2 to Figure C-4, Appendix C. Schematic diagrams showing the general connectivity between water sources, demands and storages for existing, 2024 and 2033 are also provided in Figure C-5 to Figure C-7, Appendix C.

### 3.2.1 Design Criteria

#### 3.2.1.1 Dirty Water Sediment Dams

Dams required to manage dirty water runoff have been sized based on the criteria recommended in the guidelines Managing Urban Stormwater - Soils and Construction - Volume 2E Mines and Quarries (DECCW, 2008) (The Blue Book). The criteria require dams to be sized to capture the 90<sup>th</sup> percentile 5 day rainfall event and the sediment zone be sized at 50% of the settling zone volume.

Dirty water sediment dams are to be maintained in a drawn down state as much as practical, thus ensuring that sufficient capacity is available in the 'settling zone' to capture water from subsequent storm events. Water will only be stored in the 'settling zone' of dirty water sediment dams on a temporary basis (i.e. the nominated 5 day management period) following a rainfall event large enough to result in runoff entering the sediment dam. If water stored in the sediment dam is not suitable for discharge or is to be reused onsite. The sediment dam water would need to be pumped to the much larger MWDs for long term storage and onsite reuse.

#### **3.2.1.2 Contaminated Water Dams**

Contaminated water dams (also called coal contact dams) capture runoff from the coal stockpile pads in the CHPP. Water stored in contaminated water dams is reused onsite for dust suppression or CHPP process water or pumped to MWDs for storage.

Contaminated water dams have been designed to store runoff from a 100 year ARI 72 hour duration design storm event, with a 20% allowance for sediment storage.

The design of MW5 was based on previous water balance modelling to the criteria of achieving retention of contaminated water generated within the site based on pit dewatering under historical climate conditions. The results of the water balance modelling indicate that the MWDs, as designed, are not expected to overflow. Boggabri Mine MWDs are not prescribed dams listed under the NSW Dam Safety Regulation so are not subject to specific design requirements under this regulation.

#### **3.2.1.3 Clean water dams**

Four clean water highwall dams are proposed to be constructed by 2033 to capture runoff from undisturbed catchments ahead of the pit where reasonable and feasible to reduce inflows to the pit and maintain more natural flows in the downstream creek system. The highwall dams are to be maintained in a drawn down state and are to be pumped out following a rainfall event of sufficient depth to result in runoff entering the dam. Where water quality meets the EPL discharge quality criteria highwall dams will be pumped out to the creek system.

Clean water highwall dams are sized to capture runoff from the 100 year ARI 24 hour storm event for the remnant catchment, assuming a runoff coefficient of 0.4 for undisturbed areas. Extreme events more than this capacity will spill into the pit. The pump-out systems for highwall dams are sized to empty the dam within 10 days. Clean water highwall dams are only present for the 2033 conceptual layout plan. In 2033 water from the clean water dams will be pumped to the east and then south around the edge of the mine disturbance area. The pumped clean water will be discharged into an existing drainage line/natural depression, which flows back to Nagero Creek north of the rail loop. Where required erosion sediment control measures will be used to minimise the potential for erosion at the pump outlet.

### **3.3 2024 Water Management System**

An indicative layout of the proposed water management system is shown in Figure D-2 and schematically in Figure D-5, Appendix D.

The topography of the overburden dump will allow water stored in SD7 to be released to the creek system following settling (assuming that the EPL is modified to allow for discharge in this location and that discharge criteria is met).

SD3 may be upgraded in 2024 to a capacity of 209 ML (from existing capacity of 100 ML). The upgrade to SD3 in 2024 may be required as it is no longer proposed to commission sediment dam SD13 (as proposed in the EA) within the overburden emplacement area and storage capacity previously allocated to SD13 is now provided in SD3. Alternatively, if SD3 remains at 100 ML in 2024, it may be necessary to provide the appropriate additional storage capacity elsewhere (such as MW5 or its replacement). This will be examined as part of the review of the surface water management plan.

### **3.4 2033 Water Management System**

An indicative layout of the proposed water management system is shown in Figure D-3 and schematically in Figure D-6, Appendix D.

New dirty water sediment dams, SD19, SD20, SD21, SD22 and SD24, will be provided to cater for runoff from the expanded spoil dump. SD7 will be decommissioned by 2033 as the overburden catchment draining to this sediment dam is expected to be fully rehabilitated.

New clean water highwall dams, CD5, CD6, CD7 and CD8, will be provided to minimise inflows from the natural catchment to the mining void. The highwall dams will be pumped out to the Nagero Creek system, however, they will overtop to the mining void during storm events that exceed the design capacity.

## 4. Site Water Balance

The SWB model is built in the GoldSim software package and was originally developed as part of the Continuation of Boggabri Coal Mine Project Surface Water Assessment (WSP, 2010). The model is updated annually to reflect the mine as it has developed and simulate on-site conditions.

The model is used to quantify the water inflows (rainfall, catchment runoff, groundwater inflows, water imported from the borefield and the Namoi River) and outflows (evaporation, CHPP usage, dust suppression usage), and likely range of water deficits, surpluses and discharges from Boggabri Coal Mine.

The SWB model is used as a strategic planning tool to assess the performance of the water management system for the Boggabri Coal Mine under a wide range of climate scenarios (sampled from a historical rainfall record) that may occur over the life of the Project.

This section outlines the process of the update of the SWB model, the review of the validation and the forecast model process and results.

A full description of the model parameters and data is provided in Appendix B.

### 4.1 Model Updates

As part of the SWB annual report update, the following elements are reviewed and updated and the validation reviewed as necessary:

- Catchments;
- Landuse;
- Pump rates and connections;
- Storage data (including capacity and operating levels); and
- AWBM runoff parameters.

During the 2019 SWB review, several model elements were identified to be reviewed and updated in the 2020 review (refer to Section 8.1.1 of the 2019 SWB Report: BCOP, 2020). These updates included:

- Incorporation of a spoil seepage model for the pit backfill;
- Integration of a model dashboard;
- Review and update of stage storage curves for all dams;
- Review and update the water use data for the CHPP to use newly available metered data; and
- Review of the water import model.

The addition of several of these items, most notably the spoil seepage model and water import model, resulted in the AWBM parameters requiring revision to better reflect modelled inflows, particularly for the pit catchment. Section A.2 in Appendix A summarises the AWBM parameters and the development of the spoil seepage model. These parameters were further refined in this 2021 update.

### 4.2 Model Validation

This report presents the review of the model validation for the 2021 year.

The validation of the model is undertaken by comparing modelled results against observed results for the following key model elements:

- Total site inventory;
- Inventory at key storages;

- Modelled imported water; and
- Dust suppression demands.

## 4.2.1 Water Inventory

BCOP survey dam levels on a weekly basis which has been used for the validation of this model. The model was validated against the total observed volume for all major storages.

Figure 4-1 to Figure 4-3 to show the modelled total inventory and inventory at key storages against the observed values at those storages.

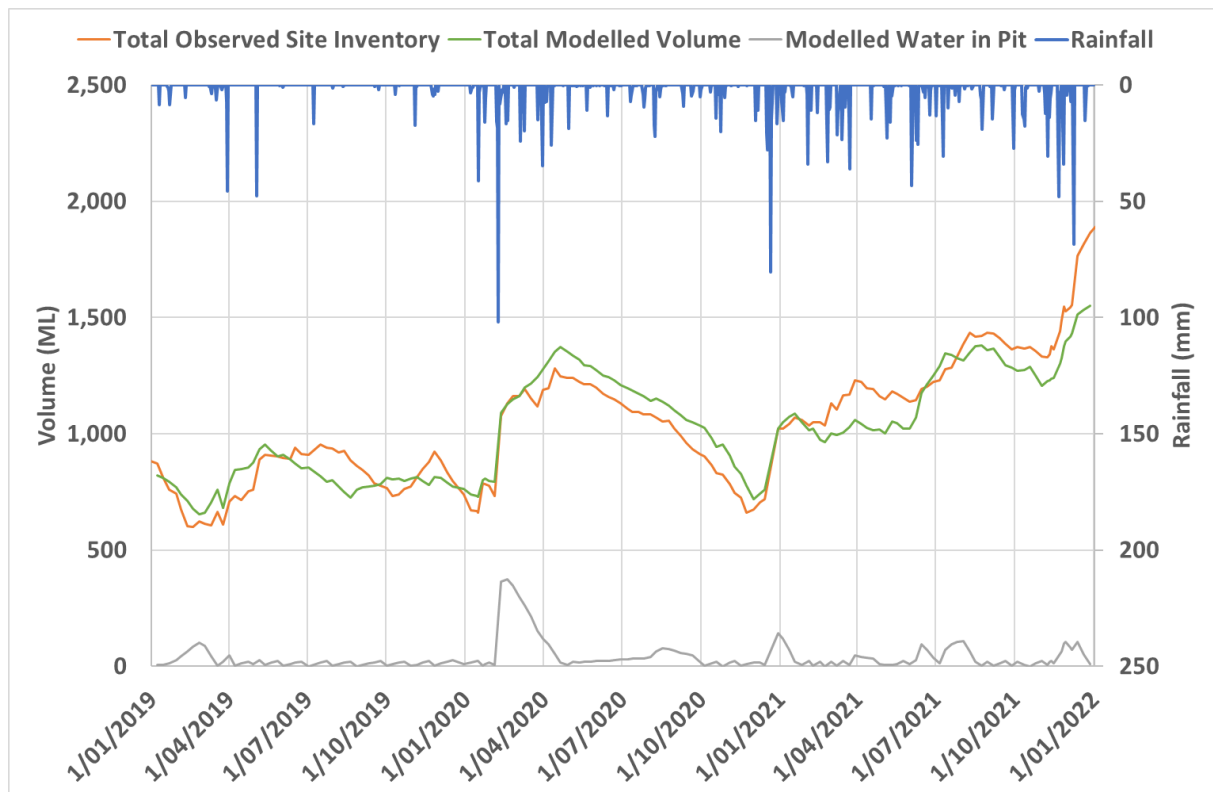


**Figure 4-1 Observed vs Modelled Total Site Inventory**

Overall, the model shows an acceptable fit for total inventory, with the modelled rate of drawdown after flood events correlating well with the observed data. The magnitude of inflows from flood events is also captured by the runoff model.

During 2019 there are several jumps in total water inventory which the model does not reproduce. These did not occur during large rainfall events and are considered to be as a result of the bulk import of water in a campaign which the model logic (refer to Section A.4) does not replicate.

During several periods, a significant volume of water (up to 400 ML) was estimated to have accumulated in pit following high rainfall periods. This volume has not been accounted for the in weekly water volume surveys but has been anecdotally confirmed by site and is gradually drawn down over time.

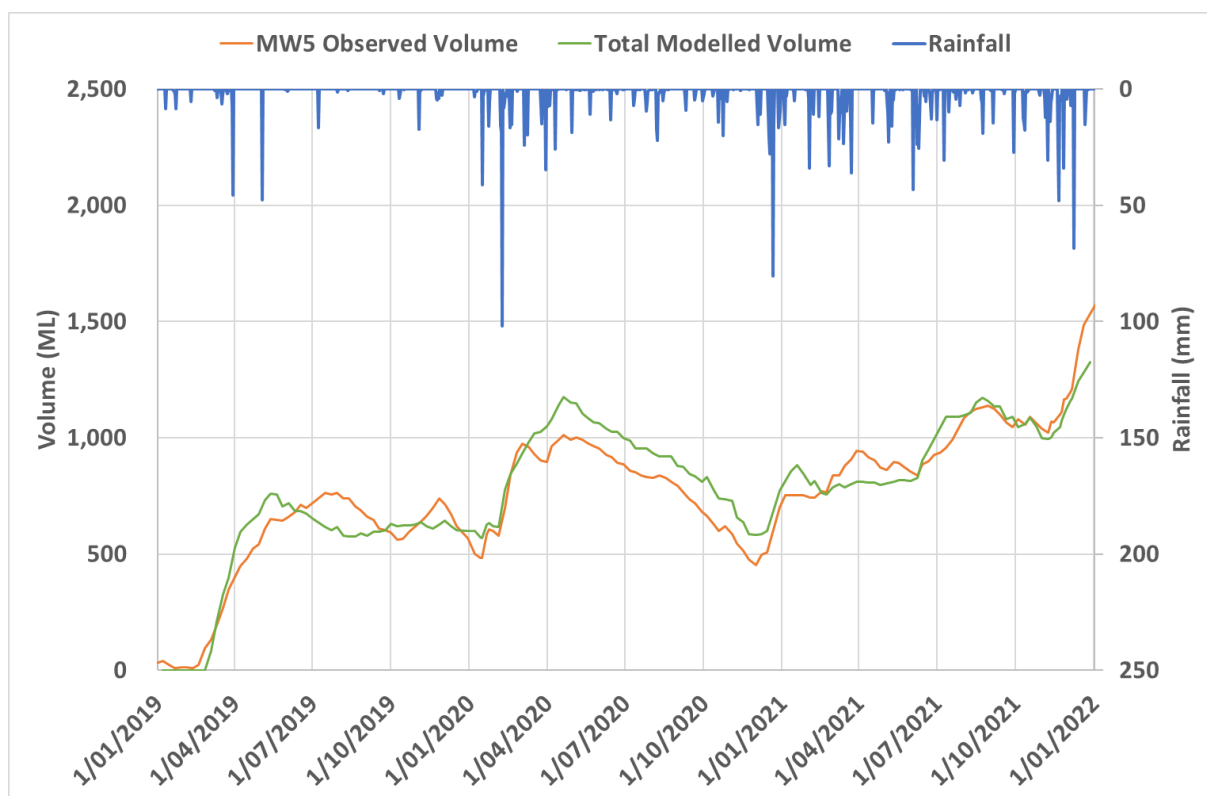


**Figure 4-2 Modelled vs Observed Volumes in MW5**

SD10 operates as a transfer point for water to and from MW5 as well as supplying water the CHPP. Modelled and observed volumes for SD10 are presented in Figure 4-3. Modelled levels for SD10 are operating within the range of observed levels and it is considered that the modelled operating logic is capturing the operating of SD10 adequately.

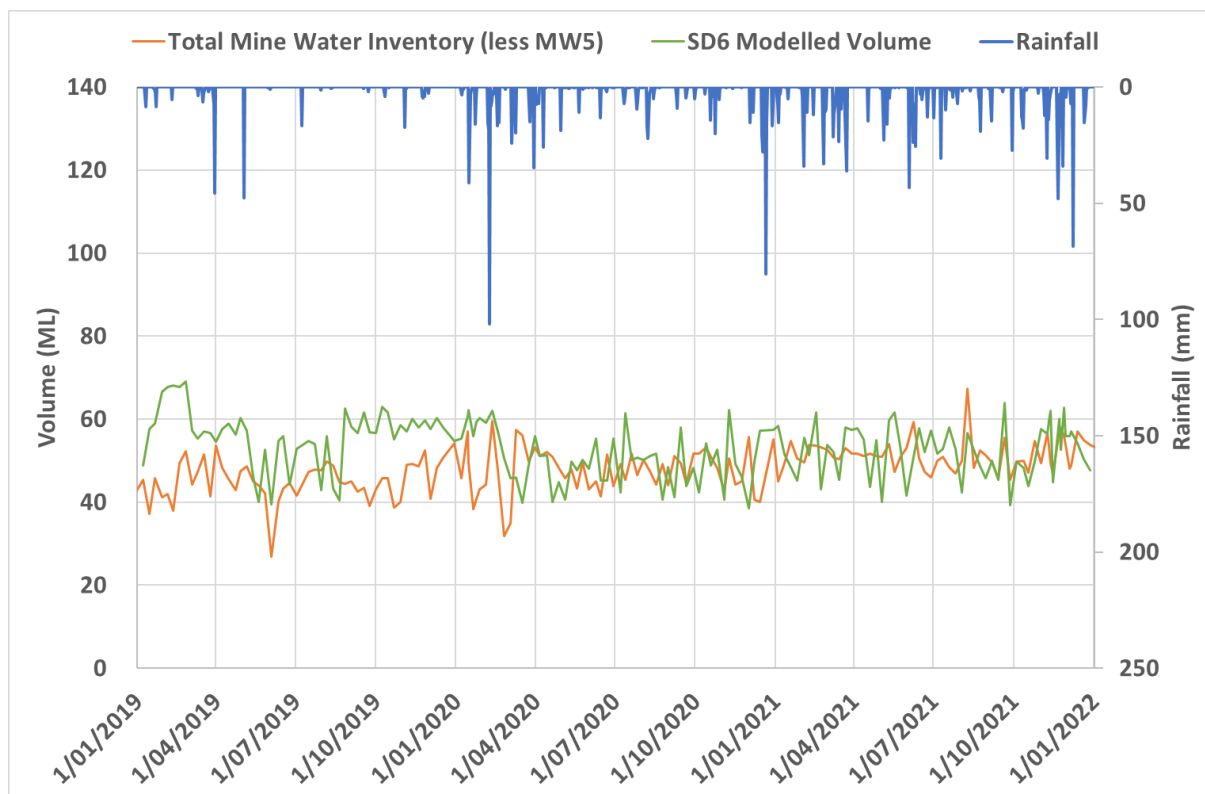


**Figure 4-3 Modelled vs Observed SD10 Volumes**

Modelled levels in key storages generally match observed levels and the behaviour of dams well. Typically, where modelled results differ from observed results (such as the peak in MW5 not rising to modelled levels), this is due the model operating rules (refer to Appendix B) assuming this storage is still operational for the duration of the calibration, however, in practice this water has been retained in the other dirty water storages for operational efficiency.

## 4.2.2 Water Import

The model sources water preferentially from groundwater sources and then from the river once this allocation has been exhausted. As discussed in 3.1.3, this allocation is unlikely to be available due to a lack of flow in the Namoi River. As a result, modelled water import has been classified as either groundwater import or additional import, where the additional import is assumed to either be sourced from the purchase of additional temporary groundwater licenses.

Figure 4-4 shows the modelled vs observed imports from external sources.

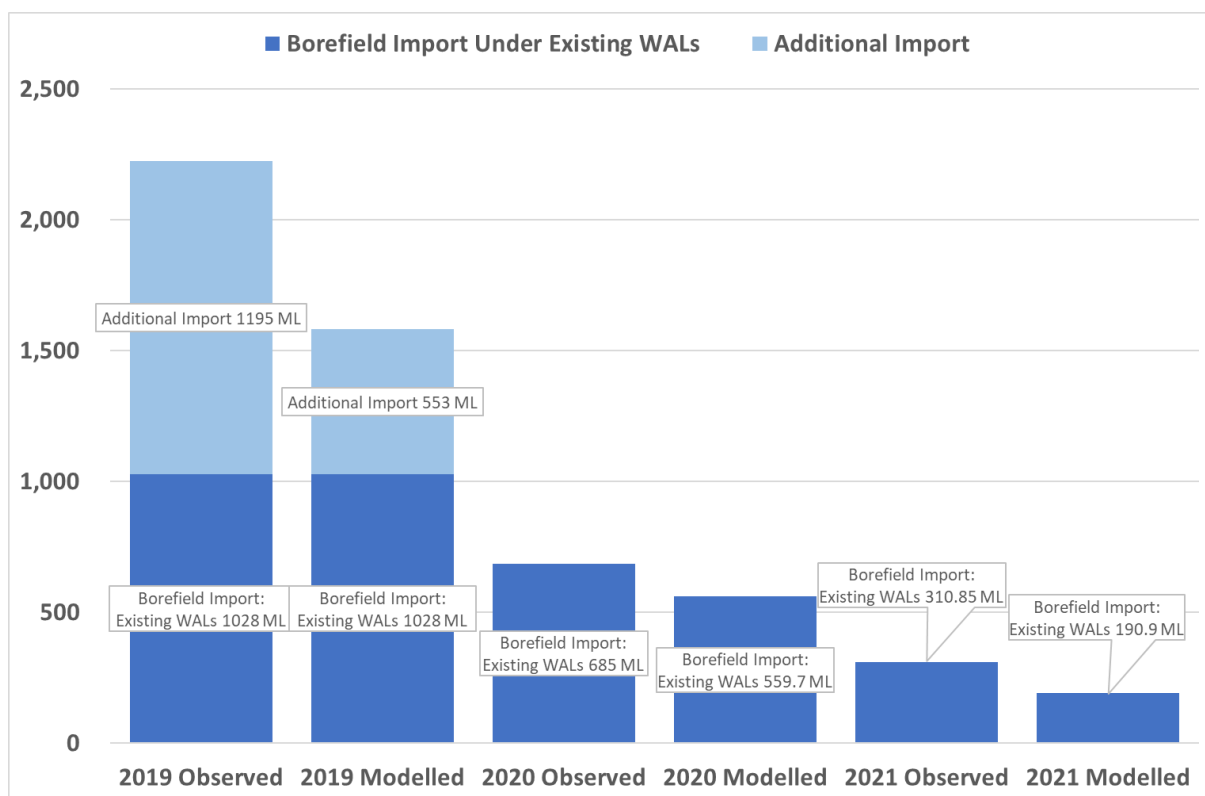


**Figure 4-4 Modelled vs Observed Water Import**

Generally, the model provides a good estimate for total modelled water import is therefore considered to be suitable for the forecast model. There is a small underestimation of imported water in 2020 and 2021, however, this correlates with the peak in observed volumes in late 2020 that the model does not capture (refer to Water Inventory 4.2.1), this indicates that extra water was imported by BCOPL that wasn't reflected in the modelling. Modelled import for 2021 is within 10% of the observed volume.

### 4.2.3 Dust Suppression

Modelled dust suppression was compared to observed values for the period from 2019 to 2021. Figure 4-5 shows the comparison between observed and modelled values. The methodology for modelling dust suppression is outlined in Section A.6 of Appendix A.

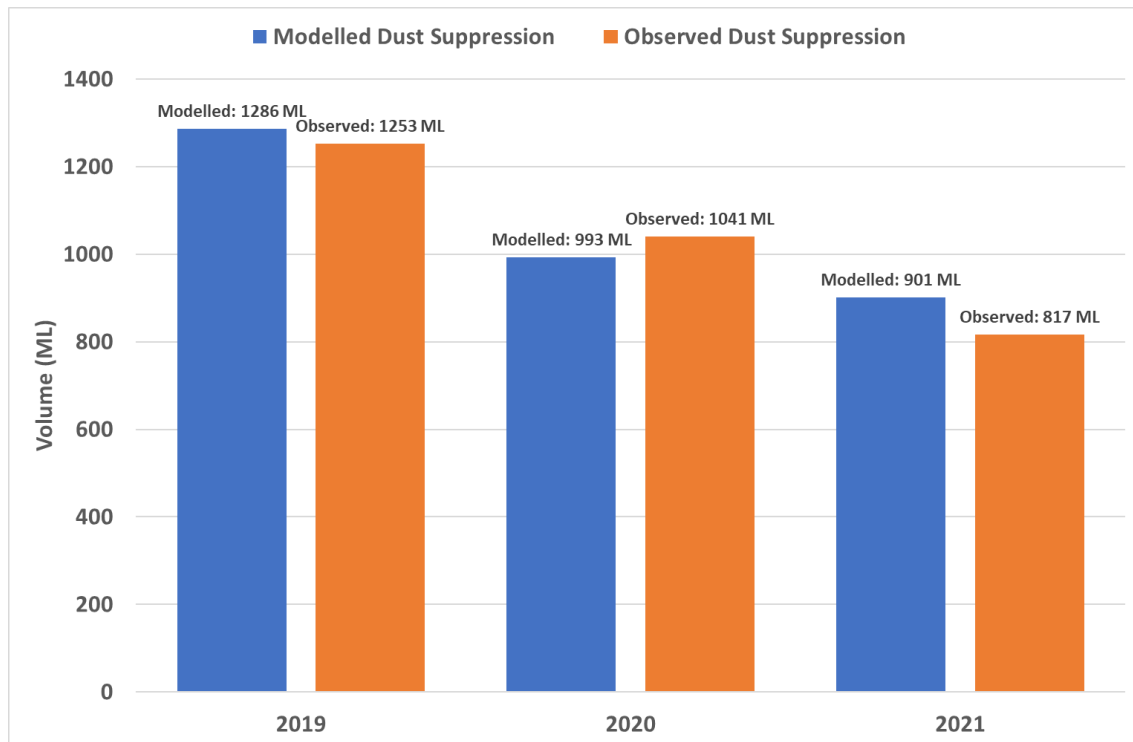


**Figure 4-5 Modelled vs Observed Dust Suppression**

Modelled dust suppression usage generally shows a good match to observed values. Total modelled usage for 2021 was 10% higher than observed volumes, while total modelled usage for 2020 was 4.6% lower. Total haul road area and the applied evaporation rate both have a degree of uncertainty around them when estimating dust suppression, as such the small variance from observed usage is acceptable for the SWB model.

#### 4.2.4 Validation Outcome

The parameters for the spoil seepage model were updated during the validation review to better capture the increased runoff due to the wetter than average conditions during 2021. This caused the small decrease in modelled water import volumes due to the increased modelled runoff. Even with the increase in the seepage and runoff volumes, the total modelled volume is less than the totalled observed volume on site at the end of 2021. It is not considered that this difference is significant at this stage, however if further divergence is observed during the 2022 SWB review, it is recommended that both the AWBM and spoil seepage model parameters be reviewed further.

The validation of the model against total and key storage volumes, as well as water import, and demands was found to provide a suitable estimation of the observed values. Overall, the SWB model validation, was considered to be adequate and suitable for use to forecast conditions for the different mine horizons.

### 4.3 Forecast Model Results

Using the validated runoff parameters and model logic, the model was forecast for the life of mine to determine medium term conditions and assess the risk of shortfall or water excess and to allow for mine planning to be undertaken to mitigate potential risks.

The model was run for a total of 127 times using simulated climatic conditions sampled from the historical record (refer to Section A.1). The results of the simulation were statistically summarised and presented in the following sections.

### 4.3.1 Model Results

The median annual site water balance is provided in Table 4-1 for the 2022, 2023, 2024 and 2033 'snapshot' year landforms.

**Table 4-1 Median Site Water Balance for Each of the Snapshot Years**

|                                       | 2022  | 2023  | 2024  | 2033  |
|---------------------------------------|-------|-------|-------|-------|
| <b>Inflows (ML)</b>                   |       |       |       |       |
| Runoff and direct rainfall:           |       |       |       |       |
| Clean Water Highwall Dams             | -     | -     | -     | 6     |
| Dirty water sediment dams             | 199   | 207   | 210   | 194   |
| Contaminated water dams, MWDs and pit | 566   | 578   | 576   | 656   |
| Groundwater make                      | 329   | 348   | 355   | 271   |
| Imported water from borefield         | 191   | 778   | 798   | 1,028 |
| Import water from additional sources  | -     | -     | -     | 160   |
| <b>Total Inflows (ML)</b>             | 1,285 | 1,911 | 1,938 | 2,315 |
| <b>Outflows (ML)</b>                  |       |       |       |       |
| <i>Demands</i>                        |       |       |       |       |
| Dust suppression - haul roads         | 1,076 | 1,058 | 1,044 | 1,417 |
| CHPP                                  | 539   | 539   | 541   | 539   |
| MIA and potable water                 | 183   | 183   | 183   | 183   |
| <i>Evaporation:</i>                   |       |       |       |       |
| Clean Water Highwall Dams             | -     | -     | -     | 0     |
| Dirty water sediment dams             | 98    | 94    | 95    | 142   |
| Contaminated water dams, MWDs and pit | 260   | 209   | 211   | 195   |
| <i>Uncontrolled Discharges</i>        |       |       |       |       |
| Clean Water Highwall Dams             | -     | -     | -     | -     |
| Dirty water sediment dams             | -     | -     | -     | 10    |
| Mine water dams and pit               | -     | -     | -     | -     |
| Controlled Discharge of Clean Water   | -     | -     | -     | 6     |
| <b>Total Outflows (ML)</b>            | 2,156 | 2,082 | 2,072 | 2,492 |
| <b>Change in storage (ML)</b>         | -871  | -171  | -134  | -177  |

Due the complex interaction of the different natural and operational processes in the SWB model, the median values of the different inflows and outflows do not coincide. Therefore, unlike mean values, the median of the total inflows and total outflows do not balance exactly. Nonetheless, median values have been shown as they are a more representative measure of central tendency for processes with skewed distribution, such as rainfall.

There is a small decrease in both modelled inflows and outflows from the 2020 SWB Report, this is likely due to the revision of the runoff model parameters (refer to Appendix B). This has resulted in lower total runoff volumes, controlled and uncontrolled discharges, and evaporation from WMS storages.

Modelled total site inventory is predicted to remain relatively stable as the mine progresses. Captured runoff remains steady as the pit progresses and rehabilitated areas are released. In the median modelled results, it is predicted that the maximum entitlement of 1028 ML/year will be required to be imported from the borefield. A small amount of additional import may be required in median years, this volume increases in drier years. Figure 4-6 shows the modelled total site volume.

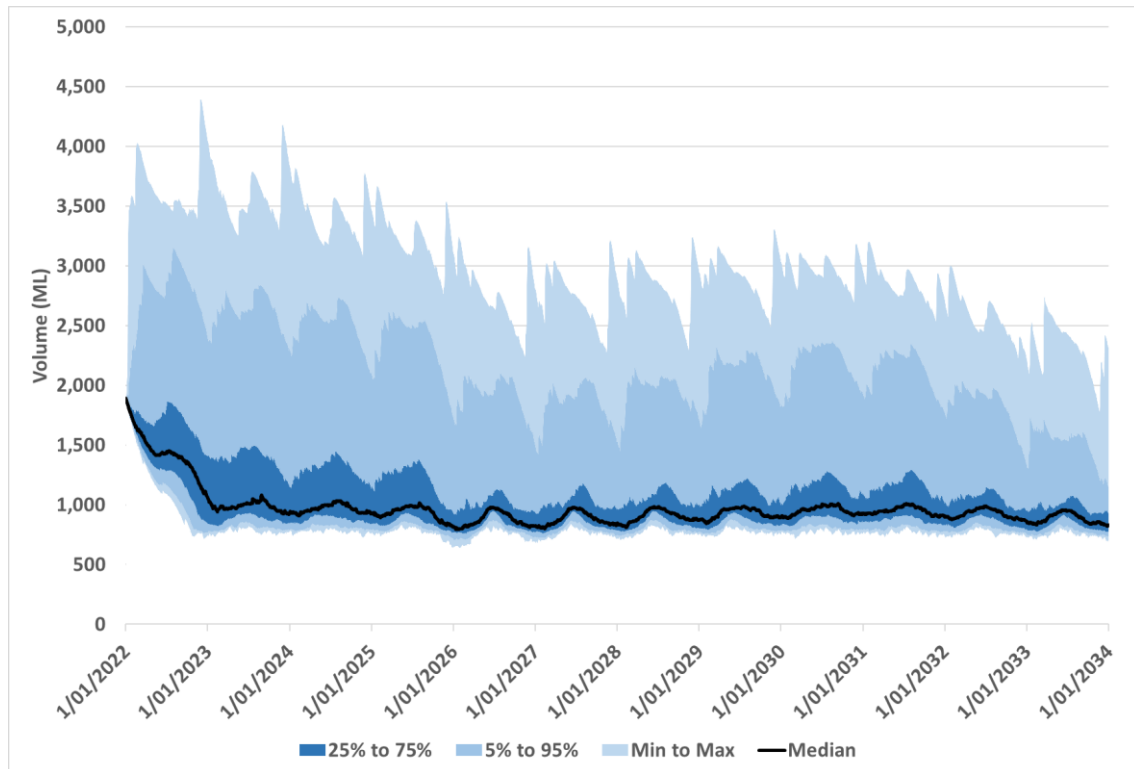


**Figure 4-6 Modelled Forecast Total Site Volume**

### 4.3.2 Contaminated Water Storage and Pit Availability

Water balance modelling indicates that no overflows from mine water dams MW5 and MW3 or contaminated water dams SD10, SD11, SD12, SD28 are expected over the life of BCM.

Summaries of the simulated daily time series of water stored in the mining void (pit sumps) and MW5 over the life of BCM are provided in Figure 4-7 and Figure 4-8, respectively. Note that the percentiles shown in the daily time series plots are daily percentile ranks of the daily results, whereas the percentile shown in Table 4-1 is the percentile ranks of the annual results.

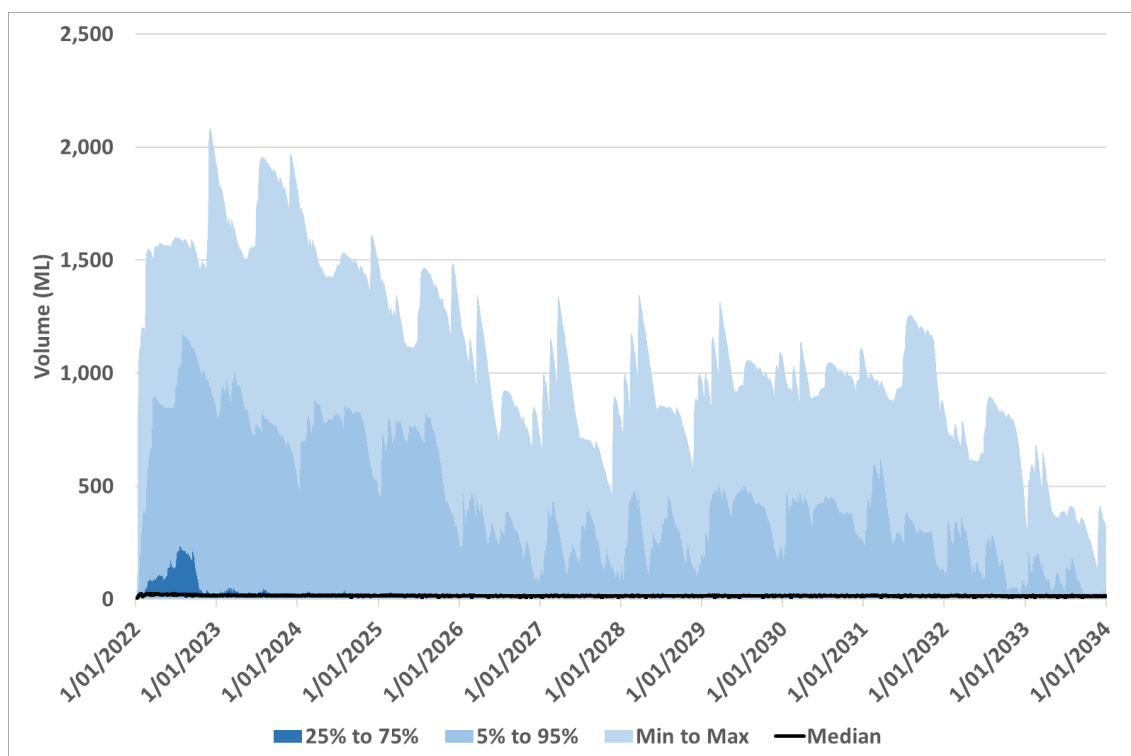


**Figure 4-7 Simulated Time Series of Water Stored In-Pit**

Figure 4-7 shows that the pit void is predicted to be empty most of the time, however, the volume stored at any one time may reach approximately 1,500 ML. This maximum volume may reduce following 2024 as the catchment area reporting to the pit void is reduced.

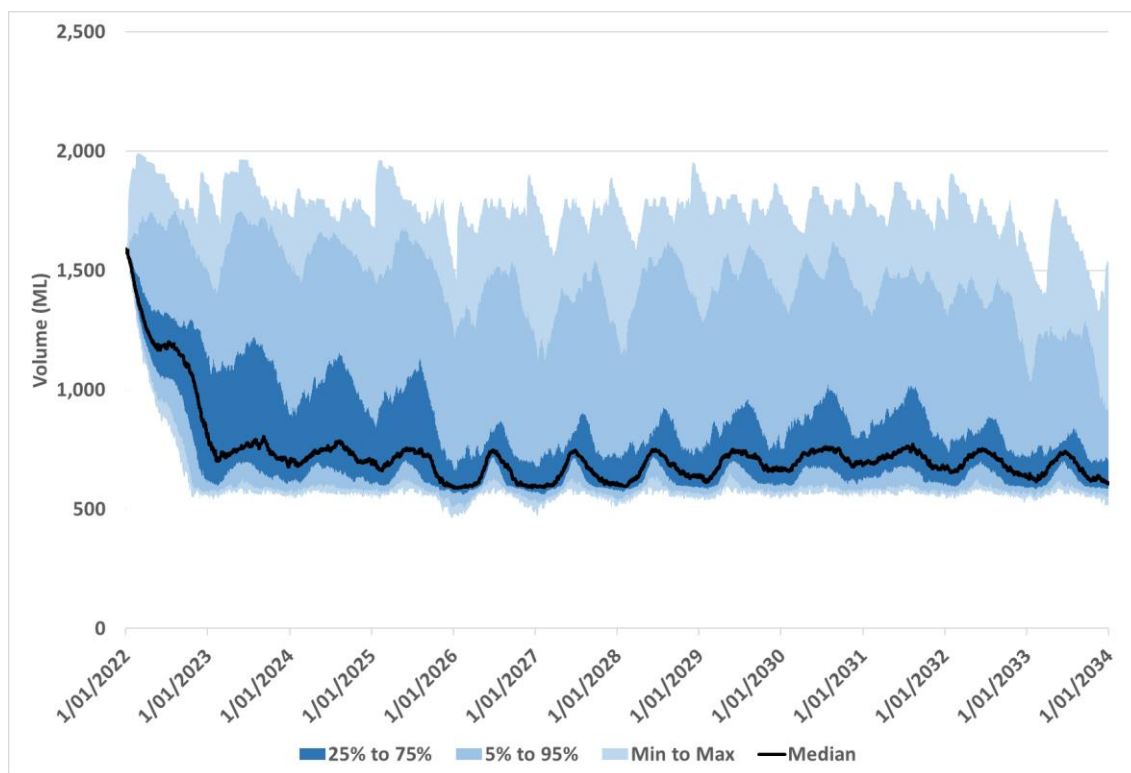


**Figure 4-8 Simulated Time Series of Water Stored in MW5**

Due to above average recent rainfall, the starting volume in MW5 is approximately 1,500 ML. Figure 4-8 shows that the volume stored in MW5, in median modelled rainfall conditions, is predicted to gradually reduce over the course of a year and then remains close to the assumed normal minimum operating volume of 700 ML but may fluctuate the low and high operating volume depending on rainfall conditions.

### 4.3.3 Water Supply Reliability

A summary of the simulated water imported to site over the life of the Mine is provided in Figure 4-9 and Figure 4-10. And a summary table for the snapshot years is provided in Table 4-2. Note that the values in Figure 4-9 and Figure 4-10 are not limited by the existing entitlements held by BCOP and the additional modelled supply is potentially required to avoid shortfalls in supply to on site demands.

Predicted import for 2022 and some of 2023 is lower than subsequent years due to the large amount of water currently stored in MW5. The model uses this water in preference to imported borewater (aside from the 0.5 ML/day required in the CHPP). Once this volume has been drawn down, modelled imported water requirements increase.

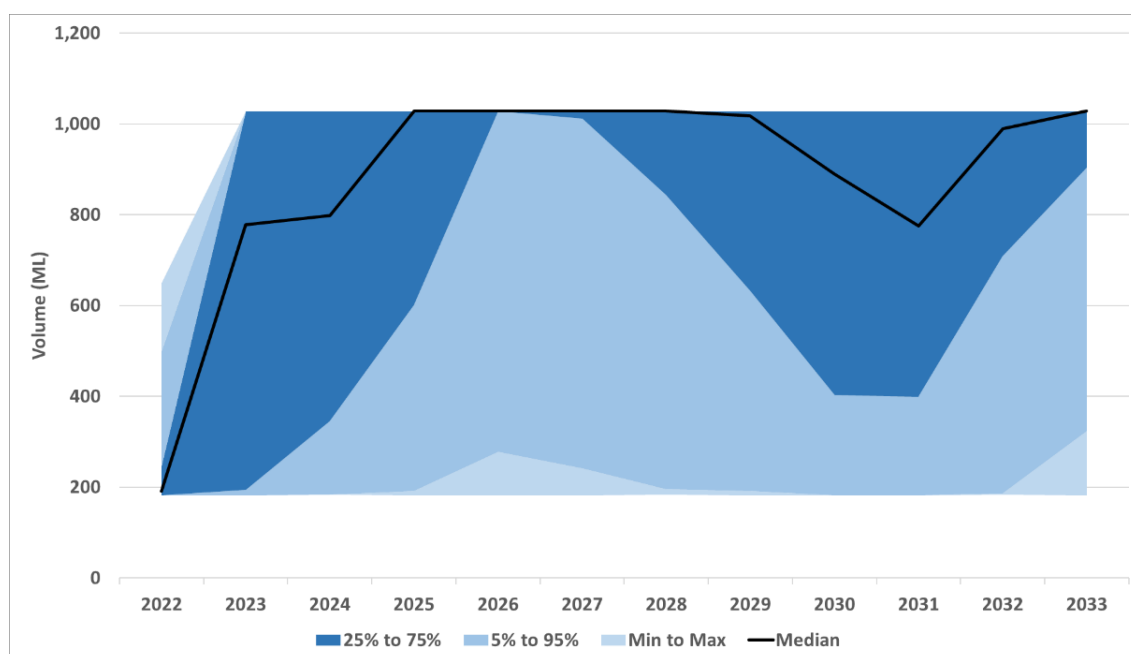


Figure 4-9 Simulated Time Series of Annual Borewater Imported to Site

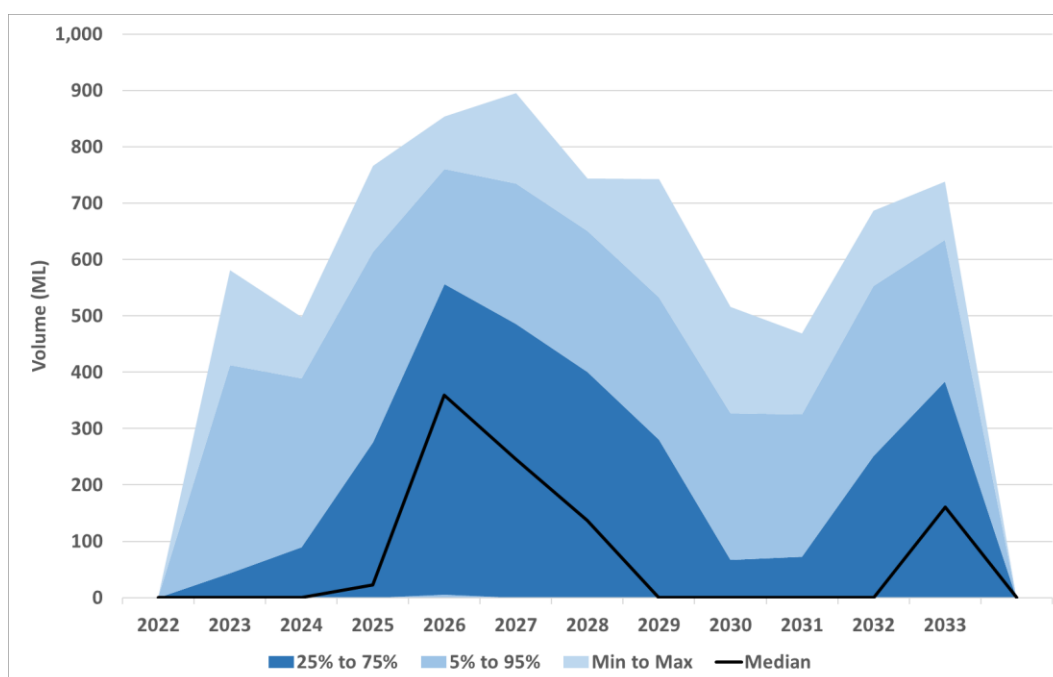


**Figure 4-10 Modelled Annual Additional Import Required**

**Table 4-2 Annual Totals of Imported Water Requirements**

|                                    | Annual total (ML) |       |       |       |
|------------------------------------|-------------------|-------|-------|-------|
|                                    | 2022              | 2023  | 2024  | 2033  |
| 5th percentile (wet)               | 183               | 183   | 183   | 323   |
| 25th percentile                    | 183               | 194   | 345   | 904   |
| 50th percentile (median)           | 191               | 778   | 798   | 1,188 |
| 75th percentile                    | 247               | 1,071 | 1,117 | 1,411 |
| 95th percentile (dry)              | 500               | 1,441 | 1,417 | 1,662 |
| Greatest result (driest on record) | 649               | 1,609 | 1,526 | 1,766 |

Supplementary water will be imported to the BCM to meet dust suppression and CHPP process water demands. Even when the BCM is in a contaminated water surplus, high-quality imported water is required to meet the potable water, washbay demands and fire water tanks for the CHPP.

#### 4.3.4 Modelled Overflows

Figure 4-11 show the modelled overflows from dirty water sediment dams. There were no modelled overflows in the median modelled results until 2033 where 6.5 ML was discharged. This is largely due to the design capacity of MW5 and the ability to store water there as flood storage in larger rainfall events.

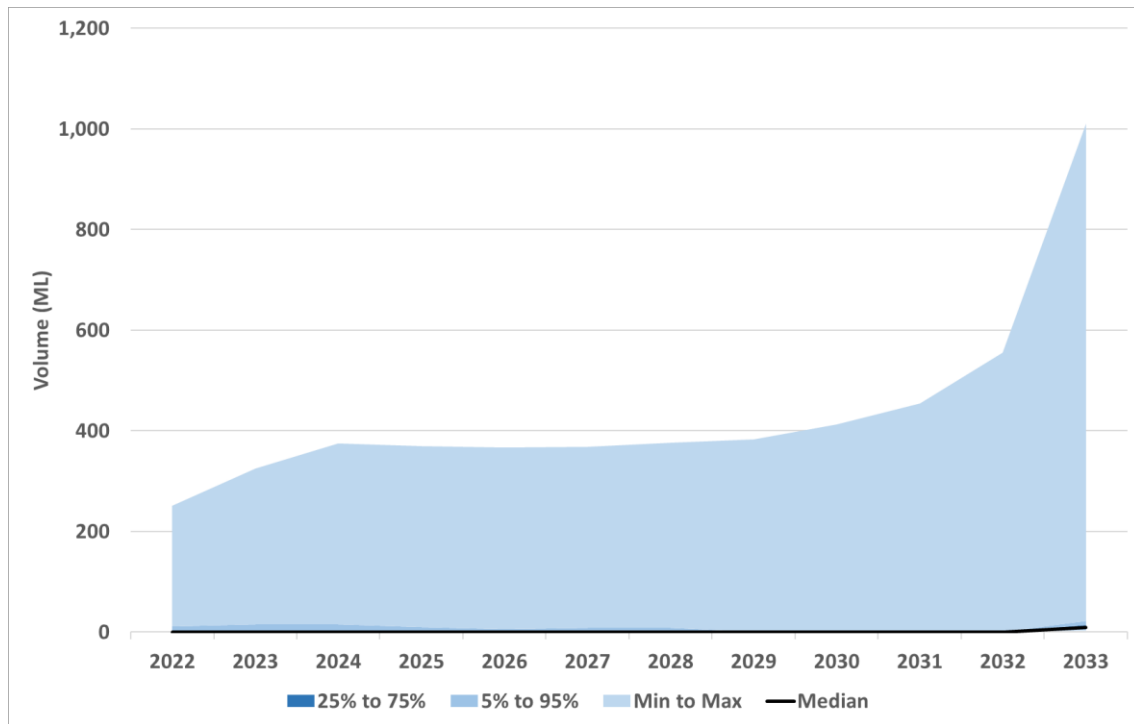


**Figure 4-11 Modelled Dirty Water Overflows**

## 5. Water Efficiency Initiatives

The action plan to implement water efficiency initiatives and the recommendations (Advisian, 2016) referenced in Appendix 6A of the Project Approval are provided in Table 5-1.

**Table 5-1 Water Balance Initiatives Action Plan**

| <b>BCOP Water Efficiency Initiatives</b>                                                                                                                                                                                                                                                               |                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Action Plan                                                                                                                                                                                                                                                                                            | Schedule                                                                              |
| Propose water efficiency initiatives during the SWB annual review process.                                                                                                                                                                                                                             | Annually during the SWB annual review process                                         |
| Report on the effectiveness of water efficiency initiatives.                                                                                                                                                                                                                                           | Annually in the AR                                                                    |
| <b>Water Efficiency Initiatives Project Approval Appendix 6A</b>                                                                                                                                                                                                                                       |                                                                                       |
| Action Plan                                                                                                                                                                                                                                                                                            | Schedule                                                                              |
| Install meters for all major water flows including:                                                                                                                                                                                                                                                    |                                                                                       |
| Water transfers from sediment dams and mine pits into mine water storages.                                                                                                                                                                                                                             | Completed                                                                             |
| All water-cart fill points.                                                                                                                                                                                                                                                                            | Completed                                                                             |
| All elements of the anticipated water demand for various purposes associated with CHPP (as identified in Table 4 of the letters dated 8 July)                                                                                                                                                          | Completed                                                                             |
| All water imports including any bore water obtained onsite.                                                                                                                                                                                                                                            | Completed                                                                             |
| Install water level meters on all significant water storage as a check on inflows and outflows and a means of assessing evaporation and seepage losses. This data will also provide a basis for improving estimates of the runoff from different surface types (hardstand, mine pit, "raw" overburden) | In progress                                                                           |
| Collect moisture content data for all coal flows associated with the CHPP to permit full water balance accounting                                                                                                                                                                                      | In progress                                                                           |
| Record all flow meters and water levels at least weekly (preferable by means for continuous recording) and analyse the data on a monthly basis to develop a full accounting of all water sources and losses.                                                                                           | In progress                                                                           |
| Compare monitored gains from rainfall and losses by evaporation from water storages to the rainfall and evaporation data from the weather station.                                                                                                                                                     | Comparison of modelled storage levels compared with observed, outlined in Section 5.2 |
| Update the site water balance annually bases on monitored data and provide details in the annual report to the Department.                                                                                                                                                                             | Annual SWB revision as outlined in Section 6.3                                        |

## 6. Improvement and Reporting

### 6.1 Review and Improvement

BCOP undertakes annual reviews to identify and address deficiencies and improvements within monitoring, measurement and calculation methods presented in the SWB. This includes a review of the monitoring, measurements and calculation methods used in the SWB and where required outline any improvements to address deficiencies in these. The results of the improvement program will be incorporated into the annual revision of the SWB.

#### 6.1.1 Recommended Improvements

It is recommended that the following elements of the water balance are reviewed as part of the 2022 SWB review:

- Model calibration;
- Review of AWBM parameters; and
- Review of the spoil seepage model – against observed data (e.g. estimated volumes in pit and dewatering).

Input data improvements including:

- Review and update the water use data for the CHPP to use metered data; and
- Staging and operational improvements including review the staging of previously recommended upgrades to dams (e.g. SD3).
- Metering of dewatering from the pit to inform spoil seepage estimation.

### 6.2 Validation Program

BCOP will perform a validation of the SWB model on an annual basis. The existing model will be used to simulate the water management system for the previous year using observed site rainfall. The observed borefield extraction, river water extraction, CHPP usage, dust suppression usage, potable/washdown usage, catchment areas, discharge events and storage volumes (in SD10, MW3, MW5, and in-pit) will be compared to modelled results on a monthly basis.

As the BCM is predicted to be in water deficit under most climatic conditions and the contaminated water system is designed to contain and manage the 100 year ARI 72 hour rainfall event, discharges from the BCM are expected to be only from sediment dams following significant rainfall events. Therefore, the discharge volumes from the BCM may be estimated and validated using observations of the incidence of discharge events.

If the SWB model is found to not be realistically representative of the management system, an investigation will be undertaken that may involve a calibration process, similar to that described in Section 4.2, to identify the source of the discrepancy. The updated SWB model will be used to update predictions described in Section 4.3.

A summary of the validation will be incorporated into the annual revision of the SWB presented as part of the Annual Review.

## 6.3 Annual Review

The Annual Review summarises the environmental performance of the mine for the previous calendar year. In accordance with Schedule 5, condition 4 of the Project Approval, the relevant monitoring data will be used to revise the SWB annually and a summary will be provided in the Annual Review.

The Annual Review is publicly available on the Boggabri Coal Mine website ([www.idemitsu.com.au/operations/boggabri-coal/approvals-plans-reports/](http://www.idemitsu.com.au/operations/boggabri-coal/approvals-plans-reports/)).

## 7. Review and Revision

### 7.1 Review

Review of the SWB will be undertaken by BCOP in accordance schedule 5 condition 5 of the Project Approval within 3 months of the submitting the following:

- Annual Review under condition 4 of the Project Approval.
- An incident report under condition 8 of the Project Approval.
- An audit under condition 10 of the Project Approval.
- A modification to the Project Approval.

## 8. References

- Australasian Groundwater & Environmental Consultants (AGE), October 2010. Continuation of Boggabri Coal Mine Project Groundwater Water Assessment.
- Boggabri Coal Pty Limited (BCPL), March 2012. Mine Water Balance Review – Boggabri Coal Project.
- Department of Environment, Climate Change and Water (DECCW), 2008. Managing Urban Stormwater - Soils and Construction - Volume 2E Mines and Quarries.
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- Stephen J. Jeffrey, John O. Carter, Keith B. Moodie, Alan R. Beswick, Using spatial interpolation to construct a comprehensive archive of Australian climate data, *Environmental Modelling & Software*, Volume 16, Issue 4, June 2001, Pages 309-330, ISSN 1364-8152, [http://dx.doi.org/10.1016/S1364-8152\(01\)00008-1](http://dx.doi.org/10.1016/S1364-8152(01)00008-1).

## Appendix A:

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### Climate Data

## A.1 Climate Data

BCOPL maintains a rainfall gauge on site with data available from 2013 to present. There are 2 operating Bureau of Meteorology (BoM) rainfall gauges within the vicinity of the Project area and several discontinued gauges. Table A.-1 shows the available rainfall data for key rainfall gauges in close proximity to the. Typical rainfall and evaporation rates are included in Figure A-1 and Figure A-2.

**Table A.-1- BCM Nearby Weather Stations**

| Gauge                              | Owner | Type        | Period of Record       | Distance from Site (km) |
|------------------------------------|-------|-------------|------------------------|-------------------------|
| Site                               | BCOP  | Rainfall    | 8 years                | -                       |
| Boggabri Post Office (055007)      | BoM   | Rainfall    | 137 years              | 15.1 km                 |
| Boggabri (Kanownda) (055076)       | BoM   | Rainfall    | 122 years              | 12.8 km                 |
| Boggabri (Mayfield) (055033)       | BoM   | Rainfall    | 52 years (1934 – 1986) | 8.7 km                  |
| Gunnedah Research Station (055024) | BoM   | Evaporation | 71 years (1948 - 2019) | 42 km                   |

Site rainfall data is considered to be the most suitable for use in the model. Prior to the site gauge data becoming available, rainfall data from the Boggabri Post Office gauge was used due to the length of the data record and proximity to site. Where data from the Boggabri Post Office Gauge was not available, SILO Data Drill (1889 to 2022) was used to represent the long term evaporation data set. The SILO data drill is a derived data set from a combination of interpolated recorded data between weather stations and derived long-term average values. A comparison of nearby gauged rainfall mean to the Silo Data Drill mean is presented in Figure A-1.

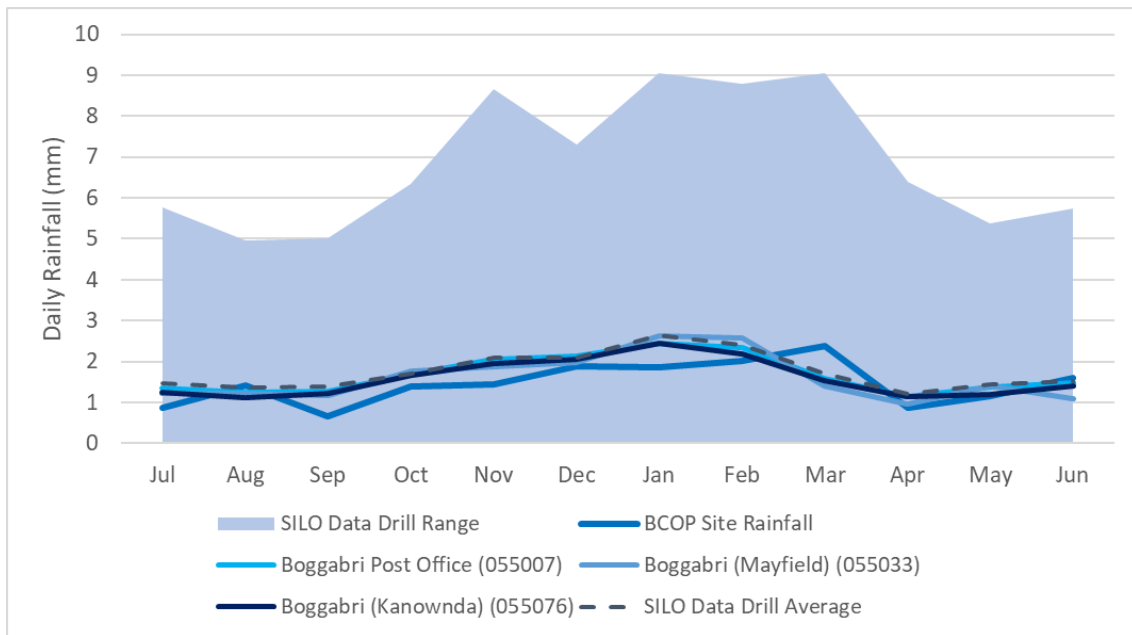


**Figure A- 1- Daily Rainfall comparison (range and mean)**

Due to the limited distribution of evaporation monitoring stations near the BCM, there is a potential that the interpolated evaporation data at the location of BCM may be inaccurate. To address this the long-term pan evaporation derived from the SILO data drill has been compared against the average daily recorded data from the Gunnedah Research Station (055024) (nearest station available) to validate the SILO data, presented in Figure A-2. The long-term average data from the SILO data drill matches well with the data recorded at Gunnedah Research Station (055024) for the period 1948 to 2019.

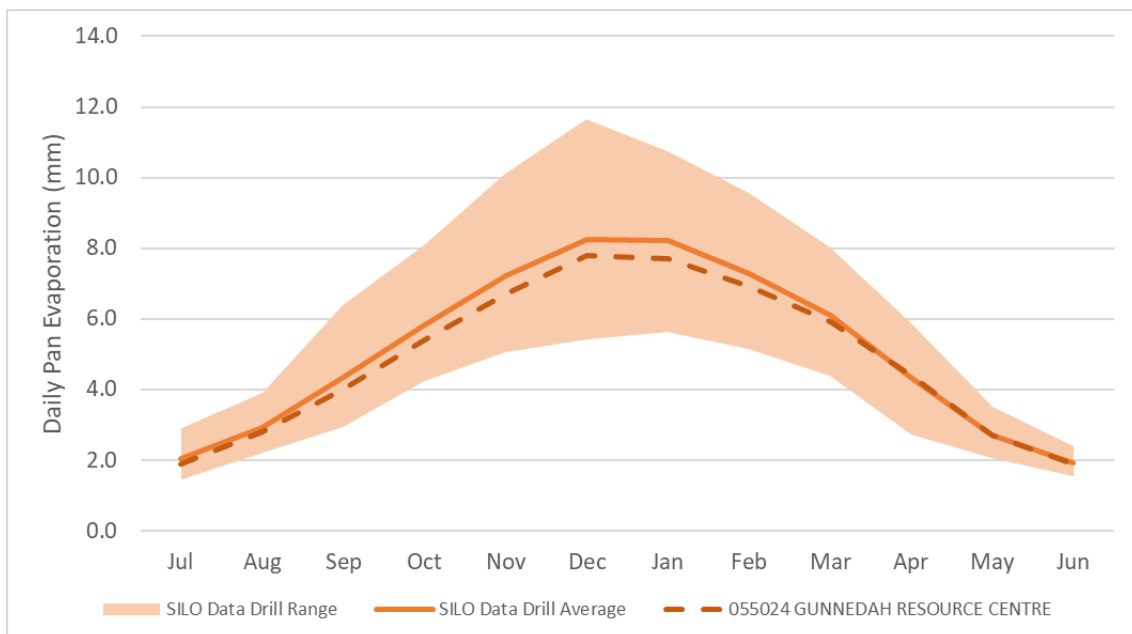


**Figure A- 2 - Daily evaporation (range and mean)**

## **Appendix B:**

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### Water Balance Methodology

## B.1 Modelling Assumptions and Methodologies

The following assumptions are included in the water balance model:

- Pumping operations based on the existing and proposed infrastructure has been included in the water balance model. It is assumed that pumping occurs at an average pump rate and no allowance has been made for changes of flow rate with changes in head.
- Low flow outlets from dirty water sediment dams are opened after a period of two days of no rainfall. This was assumed to be sufficient period for water quality criteria to be met. Low flow outlets have been represented in the water balance model such that the dams empty over a period of three days.
- The bottom half of the 'sediment zone' of dirty water sediment dams and contaminated water dams is half full of sediment throughout the simulation. Water that ponds in the top half of the 'sediment zone' evaporates over time and is not be used to supply dust suppression water or CHPP process water.
- No allowance has been made for seepage from water storages.
- Diversion drains capture all runoff from their local catchments and there is no bypass of diversion drains.
- Adequate surface water allocations or alternative water sources are available to make-up the external water requirement. Where the annual external water requirement exceeds BCOP's current water entitlements, it was assumed that BCOP would secure additional water to make up the difference.
- It is assumed that the Tarrawonga Coal Mine (TCM) catchment area to Nagero Creek discharging across the western boundary of mining lease 1579 (at Tarrawonga's LDP1) discharges directly to Nagero Creek. However, it is understood that these discharges are captured within SD6, this will be reviewed and confirmed as part of the next revision of the surface water management plan.
- While the model assesses the performance of the system under historical extremes that may reasonably be expected to recur in the future. It does not explicitly consider the potential impact of future climate change.
- SD7 is diverted to SD3 at 1 January 2025 and the capacity of SD3 is increased from 100 ML to 209 ML at 1 January 2022 or MW5 if additional capacity is not provided.
- The borefield, as approved as part of MOD 5, was commissioned on 1 July 2017.

## B.2 Model Inflows

### B.2.1 Modelled Runoff

Contaminated surface water runoff is captured in dams or the mining void and stored for onsite reuse. Dirty water runoff is also captured in sediment dams for settling of suspended solids prior to discharge from licenced discharge points (if EPL criteria are met).

The volume of inflows into each storage was calculated as the sum of the direct rainfall on to the water surface and the surface water runoff. The volume of direct rainfall was calculated as the product of the simulated rainfall depth (refer to A.1) and area of water storages, calculated from the surveyed stage-storage-area relationship. The volume of catchment runoff was calculated as the product of the catchment area (refer to Section C.2.2) and the runoff depth calculated using the AWBM runoff model.

## B.2.2 AWBM Runoff Model

The volume of surface water runoff in the mine site catchment has been estimated using the Australian Water Balance Model (AWBM) rainfall-runoff model that has been incorporated into the site water balance model.

The AWBM (Boughton, 1993) was used to estimate catchment runoff from various land uses in the catchment area of the site. The catchment area reporting to each surface water storages at the site was distributed spatially to different land use categories. The land use categories considered were undisturbed, rehabilitated spoil, industrial (hardstand and infrastructure areas), mining void (pit), active spoil and pre-strip.

The AWBM is a partial area saturation overland flow model. The use of the partial area saturation overland flow approach is simple and provides a good representation of the physical processes occurring in most Australian catchments (Boughton, 1993). This is because daily infiltration capacity is rarely exceeded, and the major source of runoff is from saturated areas. A schematic layout of the AWBM is provided in Figure B-1.

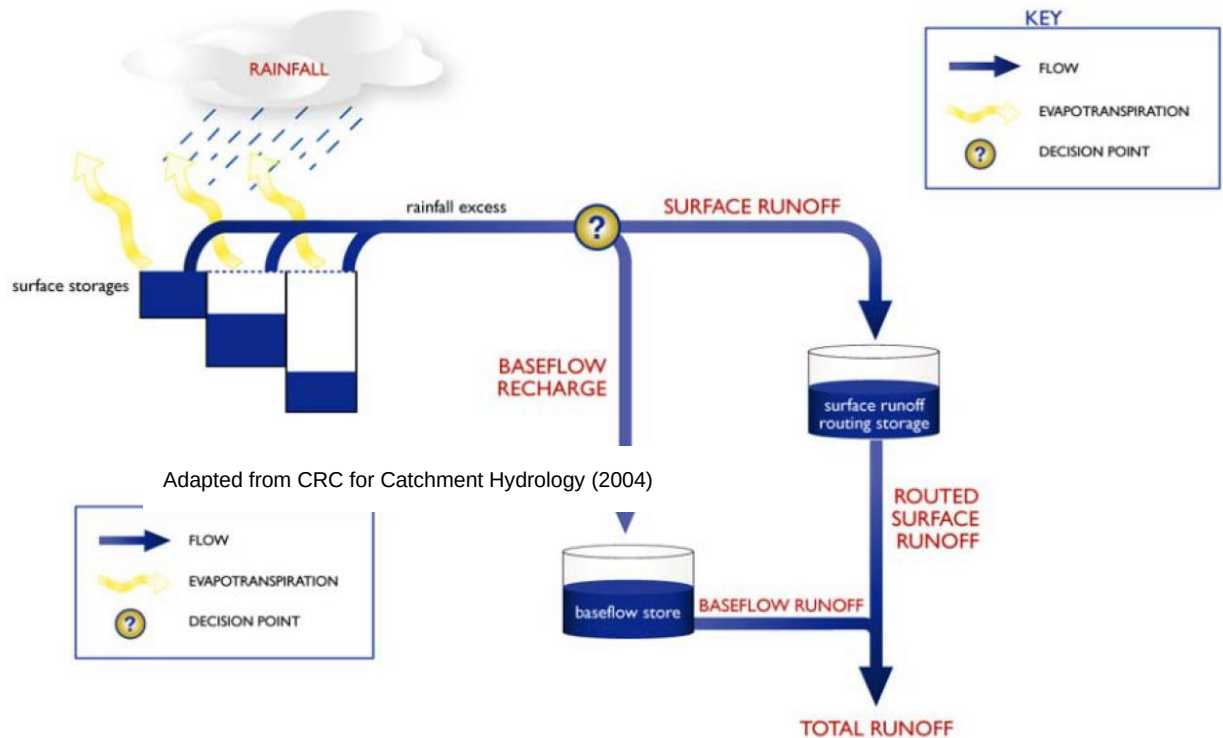


**Figure B- 1 - Schematic Layout of the AWBM Rainfall-Runoff Model**

To implement the AWBM in a given catchment, a set of nine parameters must be defined as summarised in Table B-1. These parameters define the generalised model for a catchment. The model parameters were calibrated to produce the best match between the site observations and corresponding modelled variables. The calibration process and the adopted parameter values are described in Section 4.2.

**Table B- 1 - AWBM Parameters**

| Parameter  | Description                                   |
|------------|-----------------------------------------------|
| A1, A2, A3 | Partial areas represented by surface storages |
| C1, C2, C3 | Surface storage capacities                    |
| $K_s$      | Daily surface flow recession constant         |
| BFI        | Baseflow index                                |
| $K_{base}$ | Daily baseflow recession constant             |

Table B-2 shows the calibrated AWBM parameters used for this model.

**Table B- 2 - Model AWBM Parameters**

| Parameter  | Description                                   |
|------------|-----------------------------------------------|
| A1, A2, A3 | Partial areas represented by surface storages |
| C1, C2, C3 | Surface storage capacities                    |
| $K_s$      | Daily surface flow recession constant         |
| BFI        | Baseflow index                                |
| $K_{base}$ | Daily baseflow recession constant             |

### B.2.3 Spoil Seepage Model

A spoil seepage model was incorporated into the SWB model to account for seepage through overburden and rehabbed areas into the mining void. The seepage model captures infiltration from other surface catchments which reports to the pit. A conceptual representation of the model is presented in Figure 8.4.

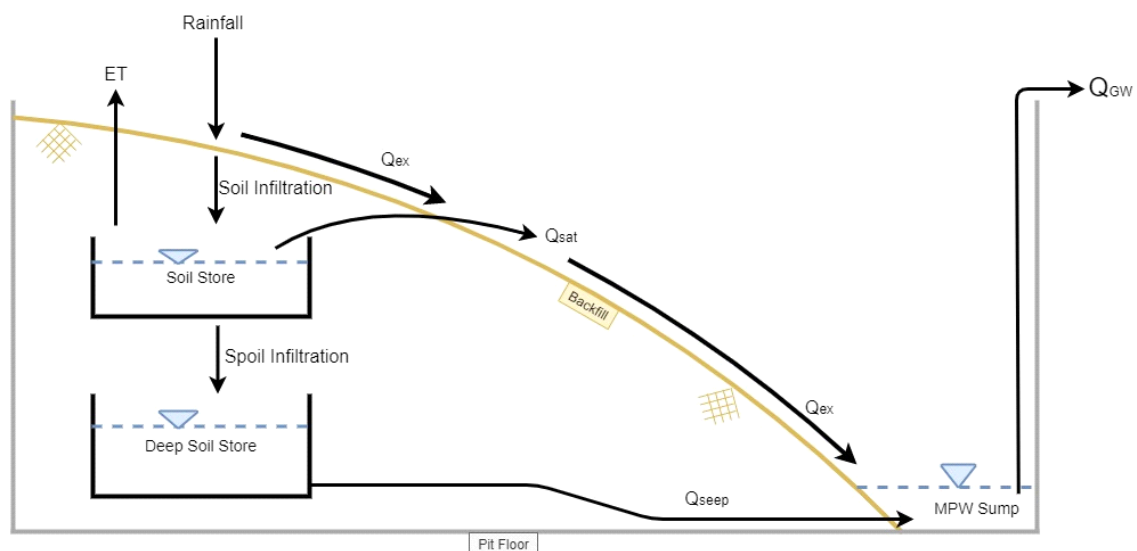


**Figure B- 2 - Conceptual Spoil Seepage Model**

The key model assumptions and parameters are summarised below:

- Seepage occurs from the historical footprint of the mining void extent.
- Allowance for a pseudo infiltration excess overland flow by including a soil infiltration capacity ( $P_i$ ) – a limit to how much rain can enter the soil storage zone. The remaining enters the pit as runoff ( $Q_{ex}$ ):
- Soil Infiltration = Minimum of rainfall or  $P_i$  allowance.
- Infiltration from the soil storage to the deep storage is defined as a fraction ( $K_i$ ) of the soil store depth:
- Spoil Infiltration = Soil Store Depth \*  $K_i$ .
- Allowance for a pseudo saturation excess overland flow by including a soil storage capacity ( $C_s$ ) – soil storage zone “spills” back to the surface when full and enters the pit as runoff ( $Q_{sat}$ ):
- $Q_{sat}$  = Soil Store Depth + Soil Infiltration – Pan ET – Spoil Infiltration – Soil Store Capacity ( $C_s$ ).
- Daily site seepage flow to the mining void is calculated as a fraction ( $K_s$ ) of the deep soil store, limited by the saturated conductivity of the spoil material ( $K_{sat}$ ). This is in line with the initial spoil seepage model methodology:
- Seepage = minimum of Deep Soil Store Depth \*  $K_s$  or  $K_{sat}$ .

The seepage model parameters are shown in Table B-3.

**Table B- 3 - Spoil Seepage Model Parameters**

| Parameter                                        | Description                                                                              | Value       |
|--------------------------------------------------|------------------------------------------------------------------------------------------|-------------|
| Infiltration Excess Runoff Coefficient ( $P_i$ ) | Any rainfall more than $P_i$ immediately becomes runoff ( $Q_{ex}$ )                     | 90 mm/day   |
| Soil Store Capacity ( $C_s$ )                    | Soil moisture more than $C_s$ immediately becomes runoff ( $Q_{sat}$ )                   | 102 mm      |
| Minimum Soil Store Moisture ( $C_{sm}$ )         | No infiltration occurs below this level                                                  | 0 mm        |
| Infiltration Fraction ( $K_i$ )                  | Fraction of soil moisture storage that migrates to the deep soil store, per time step    | 0.89 1/day  |
| Seepage Fraction ( $K_s$ )                       | Fraction of the deep soil storage that reports as seepage to the open pit, per time step | 0.007 1/day |
| Recharge Fraction ( $K_d$ )                      | Fraction of seepage that recharges to groundwater, per time step                         | 0.13 1/day  |
| Saturated Recharge Rate ( $K_{sat}$ )            | Maximum spoil seepage rate                                                               | 44.3 mm/day |

## B.2.4 Water Imports

Due to the approximations required to model the importation of water into the site, the import of water from the borefield and the Namoi River was modelled according to the following rules:

If the volume in either SD10 or MW5 fell below the LOV, water was supplied from the borefield to meet the simulated CHPP and dust suppression demand and the simulated evaporative losses at up to the maximum borefield extraction rate. SD10 was given the first preference in the assignment.

The effect of this was to maximise the use of available extraction capacity of borefield until the site had exhausted the storages on site, before importing water from the river.

## B.2.5 Groundwater

Seepage rates of groundwater into the mining void have been estimated from the results of the Continuation of Boggabri Coal Project Groundwater Assessment (AGE, October 2010). The estimate adopted was a worst-case cumulative groundwater impact assessment considering cumulative impacts associated with the concurrent operation of the Boggabri, Tarrawonga and Maules Creek coal mines. A summary of the groundwater inflows adopted in the water balance model is provided in Figure B-3.

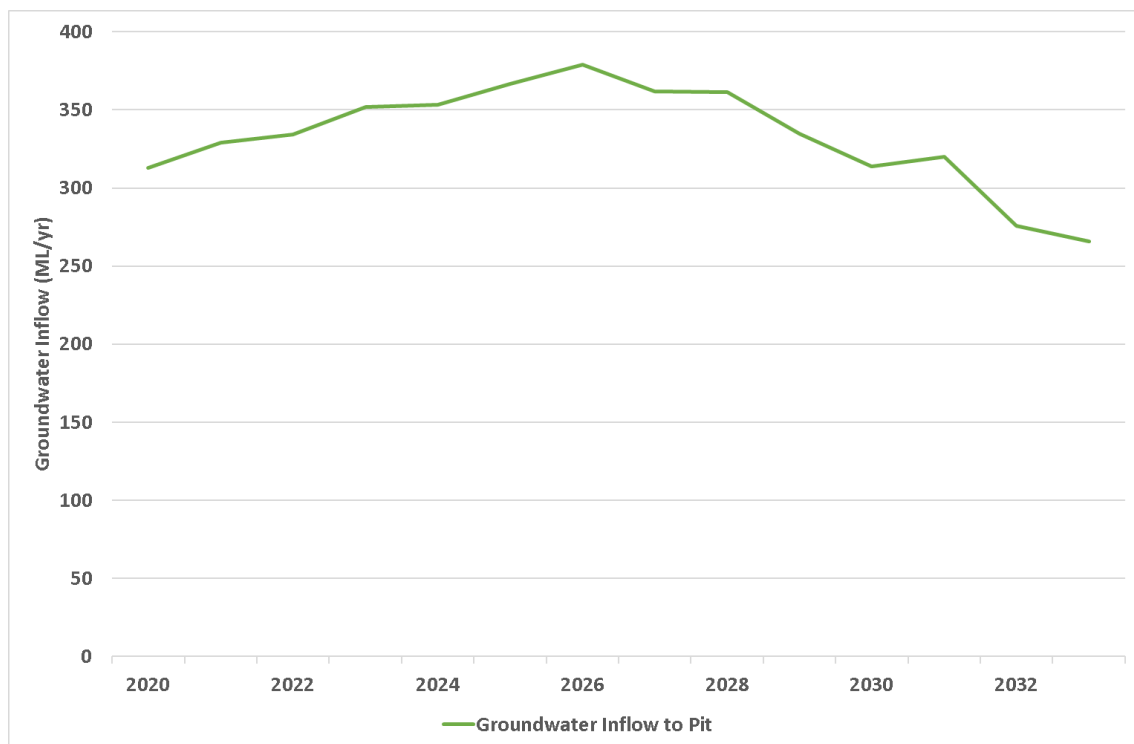


**Figure B- 3 - Estimated Groundwater Inflows to Mining Void**

From Figure B-3 it can be seen that groundwater inflow to the mining void is expected to increase until approximately 2026. After 2026, it is predicted that groundwater make within the mine void at Boggabri may be reduced by up to 40 % due to cumulative impacts from operations at Tarrawonga and Maules Creek coal mines. Some of the predicted pit inflows will be lost through evaporation, however, inflows that collect in the mine void will be pumped to mining water storages for onsite reuse.

## B.3 Model Outflows

### B.3.1 Evaporation

Evaporative losses from storages were calculated as the product of the evaporation depth for open water, as described in above, and the water surface area of the storage (refer to stage area curves in Appendix C).

### B.3.2 Dust Suppression

Water is required for dust suppression on haul roads and other disturbed areas. Dust suppression for the CHPP coal stockpiles, coal crushing areas, and coal loading areas and MIA are accounted for in the CHPP demands (see below).

Daily modelled dust suppression is calculated as a factor of haul road surface area multiplied by the daily evaporation rate. An effective width of 50 m was assumed for all haul roads and historic and forecast haul road length was supplied by BCOP in GIS format.

It is assumed that dust suppression water will not be required on days with a total rainfall depth for more than 5 mm. On average, approximately 35 days per year have more than 5 mm of rainfall based on the historical rainfall record.

Water used for dust suppression at the mine site is sourced as a priority from recycled contaminated water from various mine water dams depending on the mine progression. Currently, there are fill points at MW8 and SD23. There is also a fill point located at SD7 which is not currently being utilised.

Observed historical dust suppression usage is presented below in Figure B-4.

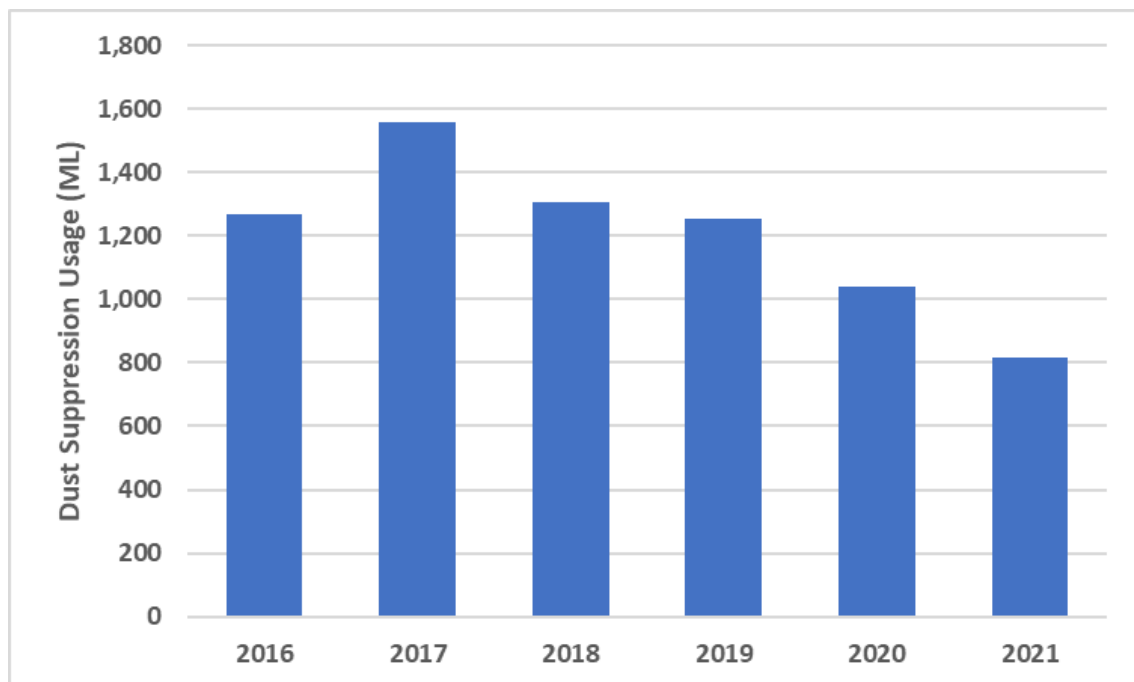


Figure B- 4 - Observed Annual Dust Suppression Usage

### B.3.3 MIA and Potable

Water is required for vehicle washdown in the MIA. Washdown water is recycled, however, water is required to make-up evaporative losses. Make-up water for vehicle washdown is currently sourced from groundwater pumped from Victoria Park and Lovton bore.

Potable water is used in the administration building and amenities during operations. Potable water is currently sourced from groundwater entitlements (WAL 29473) assigned to the Lovton Bore. Wastewater from the administration building and amenities will be treated in an onsite Envirocycle treatment plant. Wastewater generated by the onsite Envirocycle treatment plant has not been considered in the water balance analysis.

BCOP estimates that approximately 0.5 ML/day of water will be required for the MIA and potable water. This net demand is simulated in the model as a constant flow rate to account for drawdown against the groundwater WALs annual entitlement.

### B.3.4 CHPP Usage

The CHPP was commissioned in 2015 and processes up to 4.2 Mtpa of coal from Boggabri Coal Mine.

BCOP have calculated the net CHPP water requirement to be approximately 4 ML/day (equivalent to 1461 ML/annum). This water is required for coal washing, dust suppression and MIA washdown water. This is the net demand and accounts for water that is reused within the process. This net demand is simulated in the model as a constant flow rate. The assumption of constant flow rate is of suitable accuracy for the purpose of the SWB model as actual day to day variations in operations will be attenuated by the water storage on site.

### B.3.5 Seepage

Typically, losses from seepage are minor compared to evaporation and pumped outflows. Therefore, water balance modelling has assumed seepage losses to be negligible. This assumption is intended to be conservative from the perspective of containment performance but may not be conservative for other outcomes of operational simulation modelling (such as water supply reliability).

## Appendix C:

---

Storage Data

## C.1 Storage Summary

Table C-1 provides a summary of all site storages and their key operating volumes. The in pit MWD corresponds to several in pit storages located in the pit void. These storages are relatively temporary and vary with open cut mining operations whilst largely operating in a similar fashion. As such they have been grouped as a nominal storage which include all other such storages that may exist in the future as the open cut pit void develops.

**Table C- 1 - Storage Summary**

| Storage                   |      | Dead Storage Volume<br>(ML) | LOV<br>(ML) | HOV<br>(ML) | Capacity<br>(ML) |
|---------------------------|------|-----------------------------|-------------|-------------|------------------|
| <b>Existing Storages</b>  |      |                             |             |             |                  |
| MW3                       |      | 1.0                         | 5.0         | 131.0       | 153.5            |
| MW5                       |      | 1.0                         | 600.0       | 1,961       | 2,200            |
| In pit MWD                |      | 1.0                         | 87.7        | 166.1       | 52.93            |
| Pit                       |      | 1.0                         | 5.0         | 10.0        |                  |
| SD3                       |      | 16.7                        | 33.3        | 34.3        | 102.5            |
| SD6                       |      | 8.7                         | 17.4        | 18.4        | 55.20            |
| SD7                       |      | 11.7                        | 23.3        | 24.3        | 95.1             |
| SD8                       |      | 1.6                         | 3.3         | 4.3         | 13.39            |
| SD10                      |      | 9.7                         | 19.4        | 61.7        | 116.40           |
| SD11                      |      | 1.4                         | 2.7         | 3.7         | 16.40            |
| SD12                      |      | 17.2                        | 34.4        | 35.4        | 206.56           |
| SD23                      |      | 1.6                         | 3.2         | 4.2         | 16.96            |
| SD28                      |      | 1.0                         | 0.6         | 1.6         | 3.5              |
| <b>Date Online</b>        |      |                             |             |             |                  |
| <b>Proposed Storages</b>  |      |                             |             |             |                  |
| Clean Water Highwall Dams | 2030 | 1.0                         | 0.0         | 1.0         | 166.5            |
| SD19                      | 2033 | 30.0                        | 60.0        | 61.0        | 179.9            |
| SD20                      | 2033 | 7.0                         | 13.9        | 14.9        | 41.8             |
| SD21                      | 2033 | 9.3                         | 18.5        | 19.5        | 55.6             |
| SD22                      | 2033 | 1.0                         | 0.8         | 1.8         | 2.4              |
| SD24                      | 2033 | 1.2                         | 2.4         | 3.4         | 7.3              |

## C.2 Pump Transfers

### C.2.1 Operating Rules

The modelled rules for the operation of the pumps and outlets are summarised in **Table C-2**. The pumps were modelled to switch on and the valves modelled to open when the *on trigger* occurred if the *conditions* were true. The pump remained on and the valve remained open until the *off trigger* occurred or the *conditions* became false. The low operating volumes (LOV) and high operating volumes (HOV) are summarised in Table 8-6. These operating volumes do not include the 1000 ML of total freeboard required by the EPL to cater for a 5 day 90 percentile rainfall event.

The dewatering and release of sediment basins was subject to the following condition:

- *Contaminated water excess*: the site was in contaminated water excess if the total volume of contaminated water exceeded the capacity of the contaminated water storages. Effectively, this prevented reuse of dirty water if there was water in pit.

The dewatering of contaminated storages to MW5 (and MW2 for historical validation modelling) was not constrained by the volume in these storages. If the volume in MW5 exceeded the HOV, the transfer was diverted to Strip #9 prior to being mined through in March 2019 (calibration runs only) and afterwards to the pit.

**Table C- 2 - Operating Rules**

| Pump / Valve           | Pump rate (ML/day)                      | On trigger            | Off trigger        | Conditions                                   |
|------------------------|-----------------------------------------|-----------------------|--------------------|----------------------------------------------|
| Dewater SD10 to MW5    | 10.0                                    | SD10 greater than HOV | SD10 less than HOV | MW5 less than HOV                            |
| Dewater SD10 to MW3    | 10.0                                    | SD10 greater than HOV | SD10 less than HOV | MW3 less than HOV<br>MW5 greater than HOV    |
| Dewater SD10 to or Pit | 10.0                                    | SD10 greater than HOV | SD10 less than HOV | MW3 greater than HOV<br>MW5 greater than HOV |
| Dewater SD11 to SD10   | 2.0                                     | SD11 greater than HOV | SD11 less than LOV | SD10 less than HOV                           |
| Dewater SD12 to MW5    | 20.0                                    | SD12 greater than HOV | SD12 less than LOV |                                              |
| Dewater SD28 to SD11   | 1.0                                     | SD28 greater than HOV | SD28 less than LOV | SD11 less than HOV                           |
| Dewater Pit to MWD     | 5.0 (10.0 if pit volume exceeds 200 ML) | Pit greater than HOV  | Pit less than LOV  | MWD less than HOV                            |
| Dewater Pit to SD23    | 5.0 (10.0 if pit volume exceeds 200 ML) | Pit greater than HOV  | Pit less than LOV  | SD23 less than HOV                           |
| Dewater Pit to MW5     | 5.0 (10.0 if pit volume exceeds 200 ML) | Pit greater than HOV  | Pit less than LOV  | MW5 less than HOV                            |

| Pump / Valve        | Pump rate (ML/day) | On trigger                                    | Off trigger                                   | Conditions                                          |
|---------------------|--------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------------|
| Makeup MW5 to SD10  | 5.0                | SD10 less than LOV                            | SD10 greater than HOV                         | MW5 greater than LOV                                |
| Makeup MW3 to SD10  | 3.5                | SD10 less than LOV or<br>MW3 greater than HOV | SD10 greater than HOV or<br>MW3 less than LOV | MW3 greater than LOV and<br>SD10 less than HOV      |
| Dewater SD3 to SD12 | 5.0                | SD3 greater than HOV                          | SD3 less than LOV                             | SD12 less than HOV<br>Not contaminated water excess |
| Dewater SD19 to MW5 | 20.0               | SD19 greater than HOV                         | SD19 less than LOV                            | Not contaminated water excess                       |
| Dewater SD23 to MW5 | 3.0                | SD23 greater than HOV                         | SD23 less than LOV                            | Not contaminated water excess                       |
| Dewater SD6 to SD10 | 2.0                | SD6 greater than HOV                          | SD6 less than LOV                             | SD10 less than HOV<br>Not contaminated water excess |
| Dewater SD8 to SD6  | 1.0                | SD8 greater than HOV                          | SD8 less than LOV                             | SD6 less than HOV<br>Not contaminated water excess  |

## C.2.2 Catchment Areas

Catchment areas adopted in the water balance model are provided in Table C-3. The study catchment was Nagero Creek to the point where the creek meets the floodplain approximately 1 km downstream of Boggabri Coal Mine.

**Table C- 3 - Catchment Areas (ha)**

| System                                   | Storage                          | 2021         | 2024          | 2033         |
|------------------------------------------|----------------------------------|--------------|---------------|--------------|
| BCM contaminated water dams <sup>1</sup> | MW3                              | 10.7         | 10.7          | 10.7         |
|                                          | MW5                              | 208.1        | 208.1         | -            |
|                                          | SD10                             | 31.4         | 31.4          | 31.4         |
|                                          | SD11                             | 3.9          | 3.9           | 3.9          |
|                                          | SD12                             | 46.2         | 46.2          | 173.8        |
|                                          | SD28                             | 0.7          | 0.7           | 0.7          |
|                                          | Pit                              | 1,414.2      | 1,259.8       | 438.0        |
|                                          | <i>Subtotal</i>                  | <i>1715</i>  | <i>1560.8</i> | <i>658.5</i> |
| BCM dirty water dams                     | SD3                              | 194.6        | 314           | 639.9        |
|                                          | SD6                              | 65.1         | 65.1          | 65.1         |
|                                          | SD7                              | 210          | 245.1         | -            |
|                                          | SD8                              | 11.2         | 11.2          | 31.4         |
|                                          | SD19                             | -            | -             | 357.2        |
|                                          | SD20                             | -            | -             | 95.2         |
|                                          | SD21                             | -            | -             | 116.4        |
|                                          | SD22                             | -            | -             | 7.0          |
|                                          | SD23                             | 51.5         | 51.5          | 70.7         |
|                                          | SD24                             | -            | -             | 16.5         |
|                                          | <i>Subtotal</i>                  | <i>532</i>   | <i>687</i>    | <i>1,399</i> |
| <i>BCM Clean Water Dams</i>              | <i>Clean water highwall Dams</i> | -            | -             | <i>162.1</i> |
| Undisturbed Nagero Creek catchment       |                                  | 1,540        | 1,540         | 1,364        |
| <b>Total</b>                             |                                  | <b>4,795</b> | <b>4,641</b>  | <b>3,387</b> |

<sup>1</sup> Excludes approved irrigation area draining to Bollol Creek catchment.

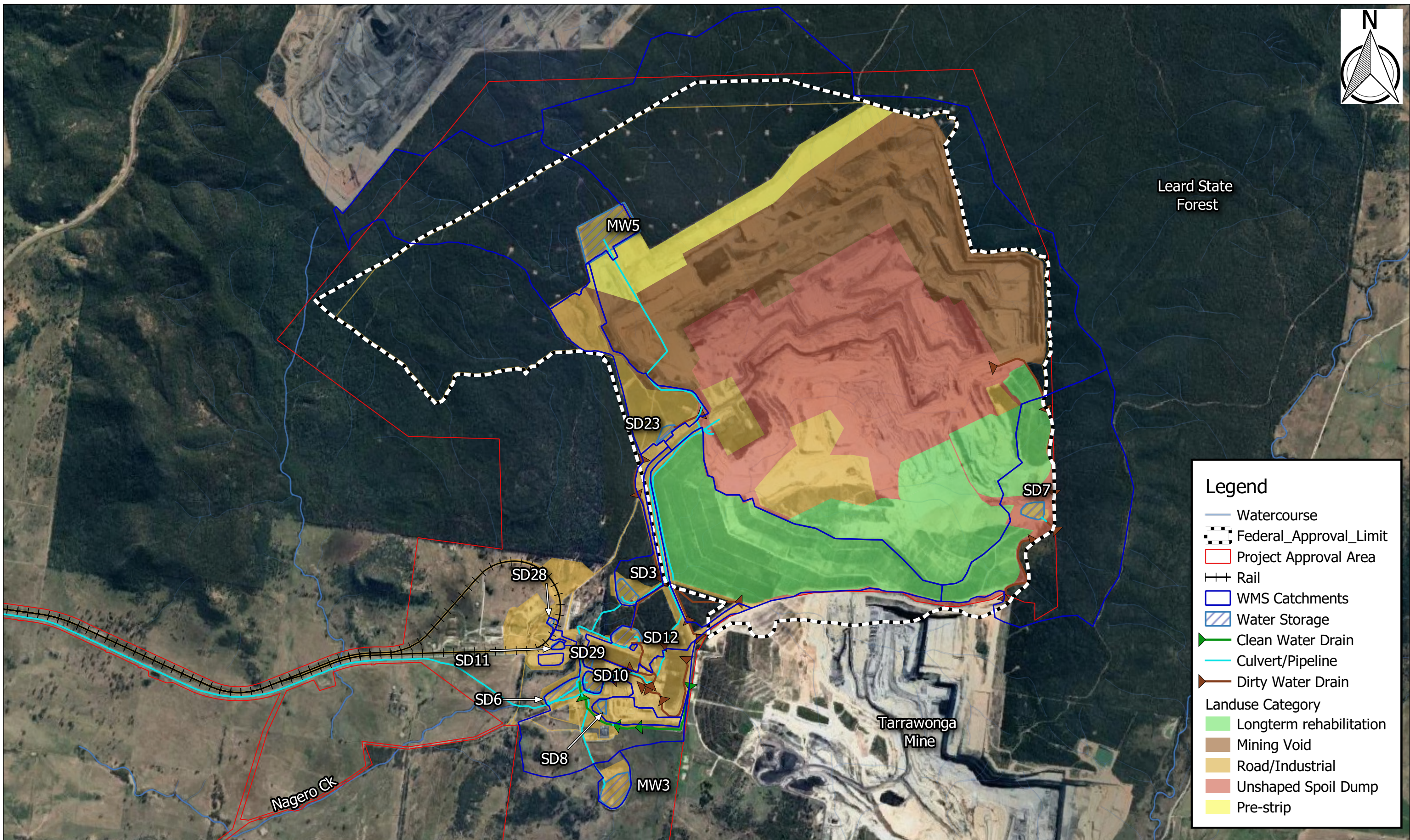
<sup>2</sup> TCM lease area within Nagero Creek catchment assumed based on proposed operations at TCM.

The area of rehabilitated catchment increases from existing conditions to 2033. Progressive rehabilitation is undertaken and where the landform is stable with no sediment laden or otherwise polluted runoff, then runoff from catchment areas is returned to the natural system. While some of the rehabilitated areas have been rehabilitating for approximately five years, this rehabilitated area is unable to be segregated from the remaining overburden dump. For this reason, runoff from rehabilitated areas occurs only in 2033 when the clean water can be segregated from the dirty water runoff, captured, and released.

## **Appendix D:**

---

Water Management System Plans and  
Schematics



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700 0 700 m

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

## BCOPL Site Water Balance 2021

Figure D.1 - Existing Water Management System - 2021

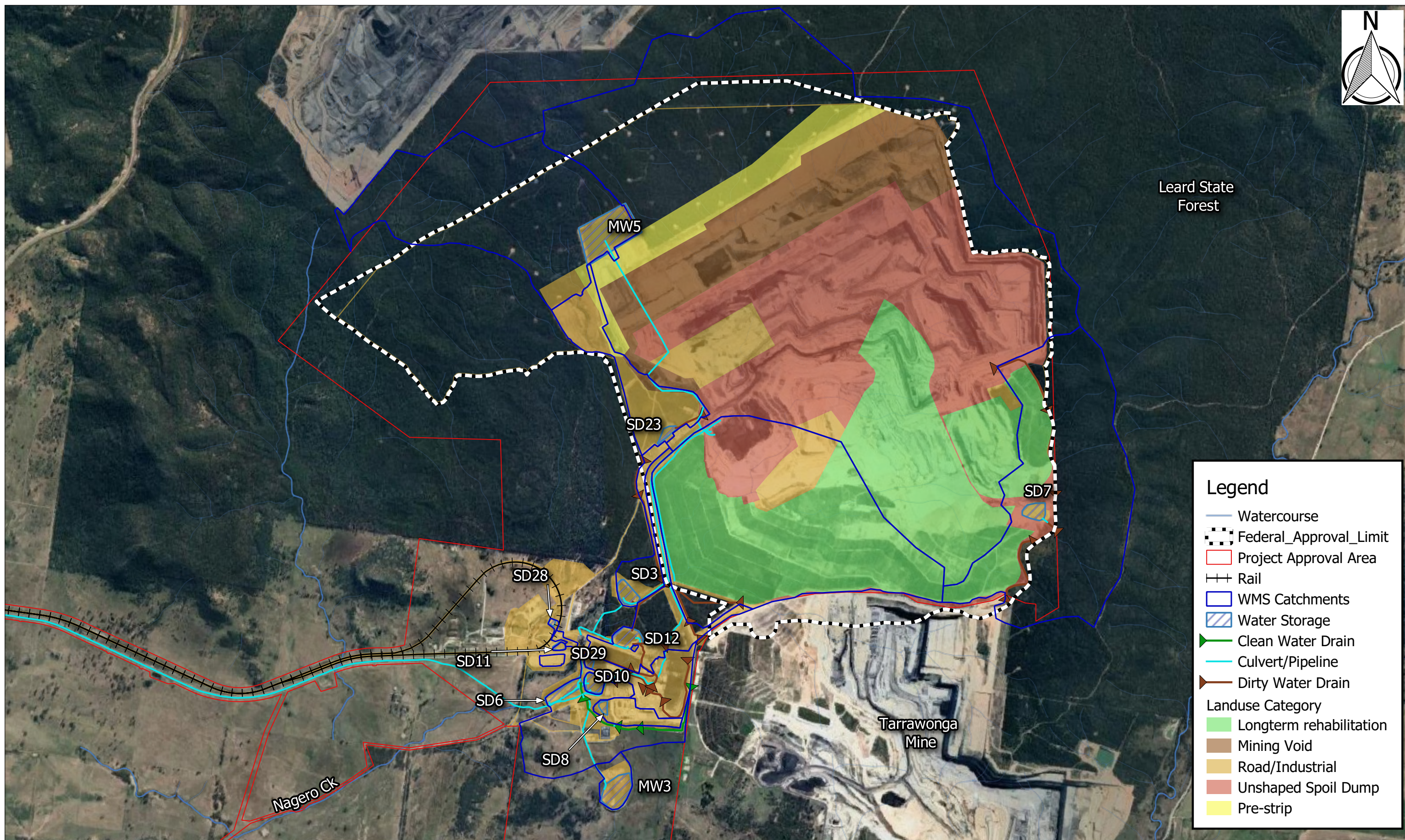
Job Number: N1003\_010

Revision: 0

Drawn: GC

Checked: MB

Date: 7/4/2022



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Grid: Map Grid of Australia, Zone 56

## BCOPL Site Water Balance 2021

### Figure D.2 - Water Management System Indicative Layout - 2024

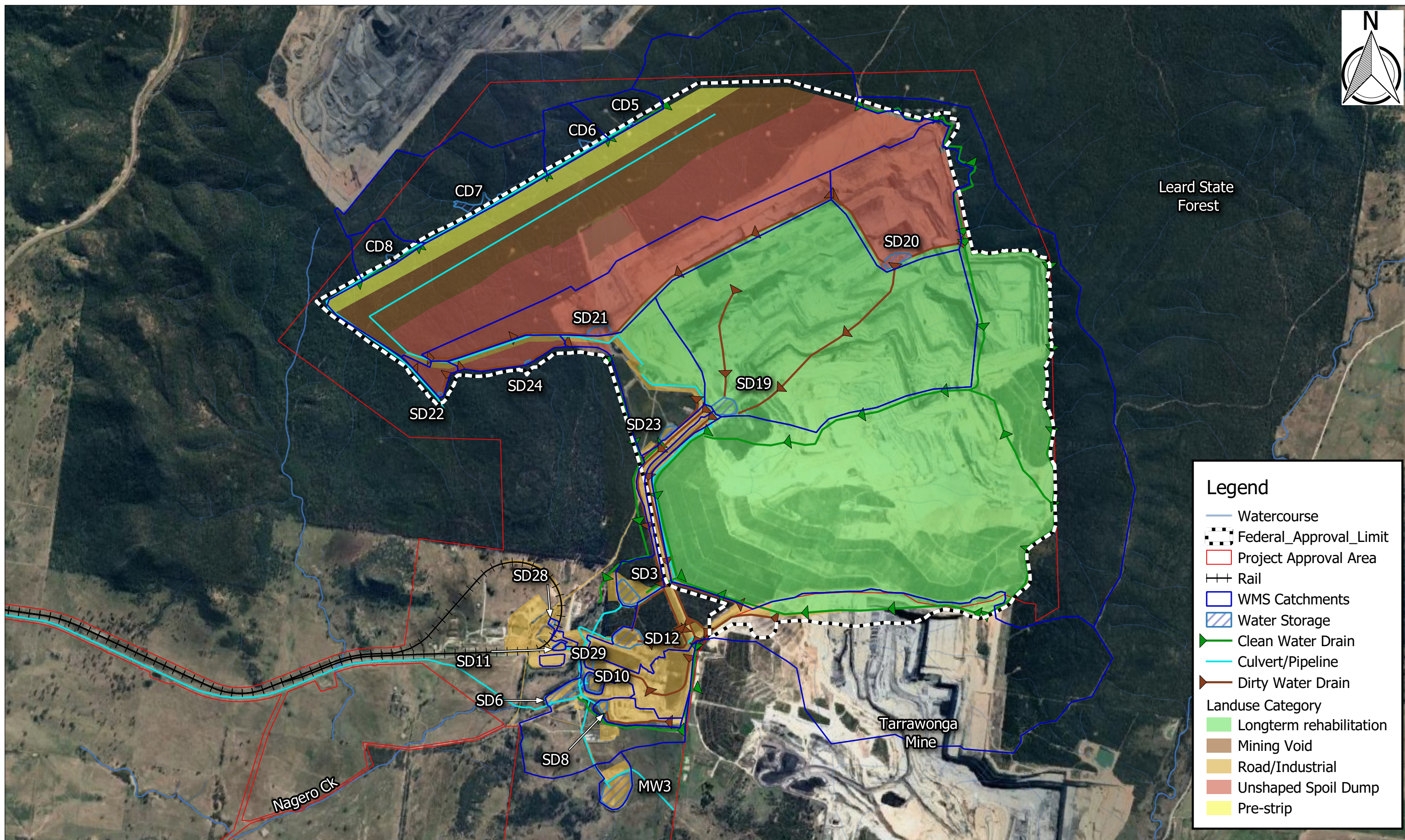
Job Number: N1003\_010

Revision: 0

Drawn: GC

Checked: MB

Date: 7/4/2022



**Legend**

- Watercourse
- Federal\_Approval\_Limit
- Project Approval Area
- Rail
- WMS Catchments
- Water Storage
- Clean Water Drain
- Culvert/Pipeline
- Dirty Water Drain

**Landuse Category**

- Longterm rehabilitation
- Mining Void
- Road/Industrial
- Unshaped Spoil Dump
- Pre-strip

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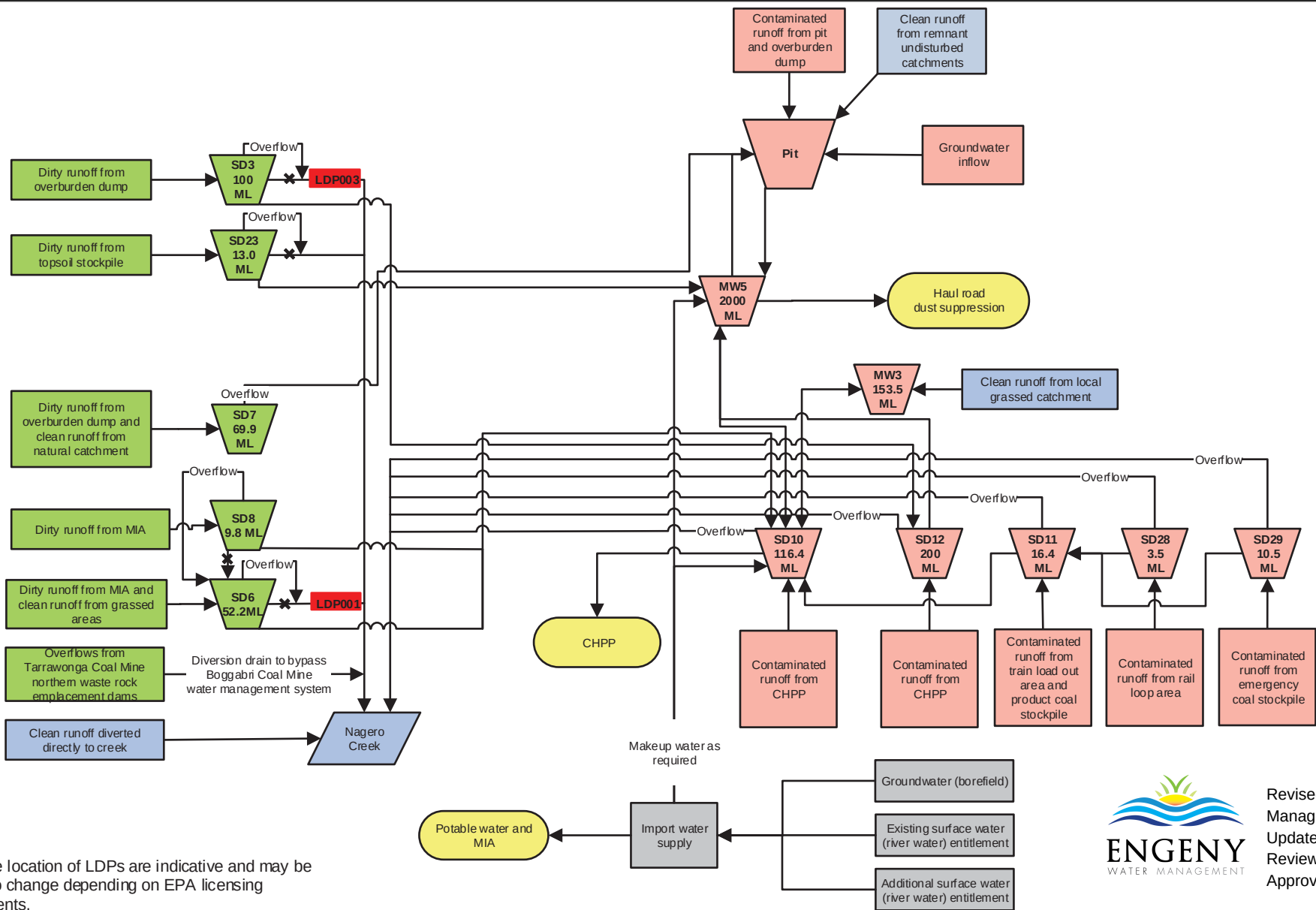
700 0 700 m

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

## BCOPL Site Water Balance 2021

### Figure D.3 - Water Management System Indicative Layout - 2033

Job Number: N1003\_010  
Revision: 0  
Drawn: GC  
Checked: MB  
Date: 7/4/2022



Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.



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Updated by MB  
Reviewed by AW  
Approved by SES



#### LEGEND

- Surface Water Transfer
- Storage
- Manually operated valve
- Import water system
- Dirty water system
- Contaminated water system
- Clean water system
- Usage

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| LOCATION | BCM |
|----------|-----|
| DRAWN    | TT  |
| CHECKED  | AW  |
| APPROVED | SG  |
| SCALE    | NTS |

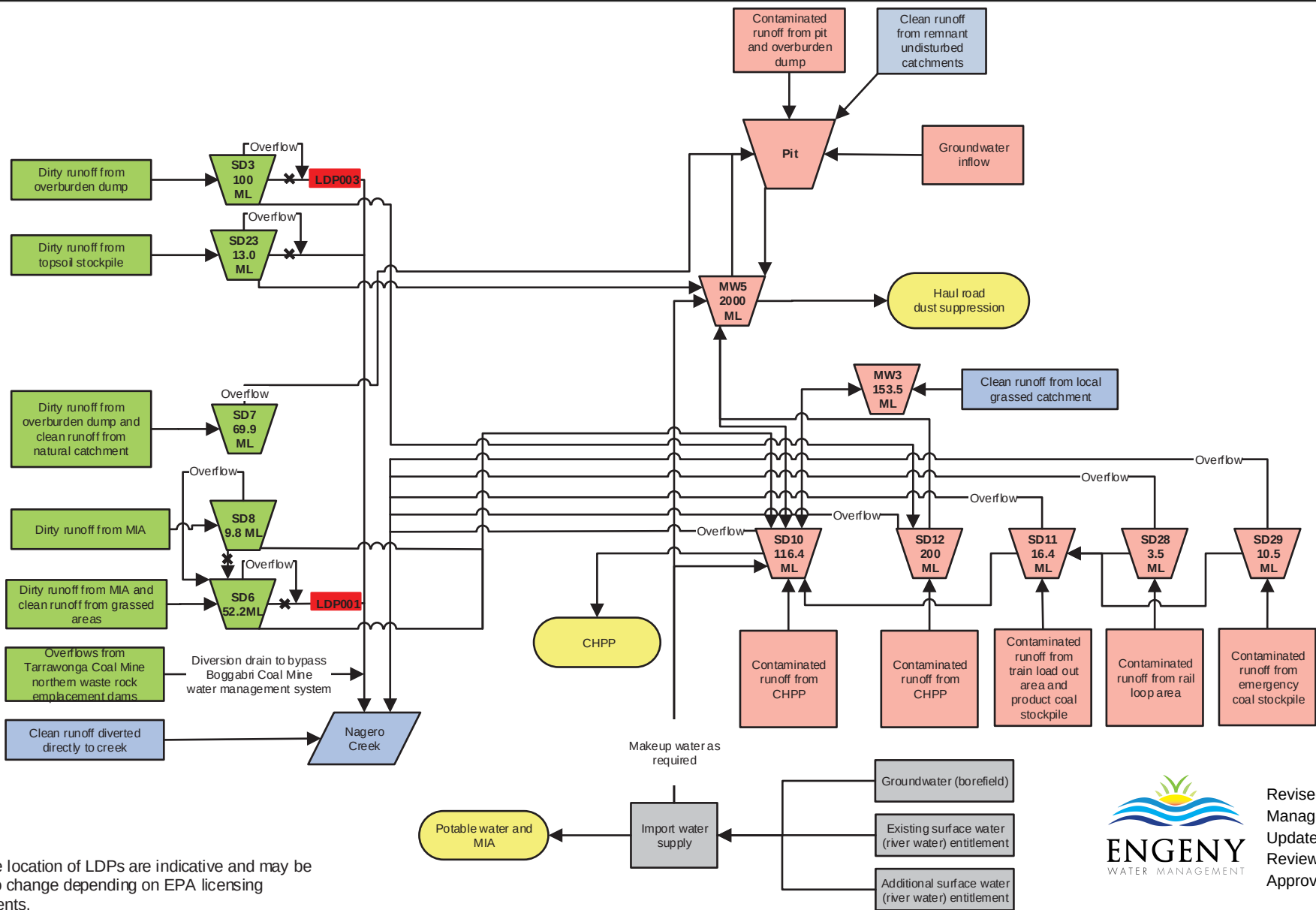
Boggabri Coal Operations Pty Ltd  
Boggabri Coal Mine  
Site Water Balance

Water balance model schematic  
Indicative conditions (2020)



DATE 15 Jun 2018

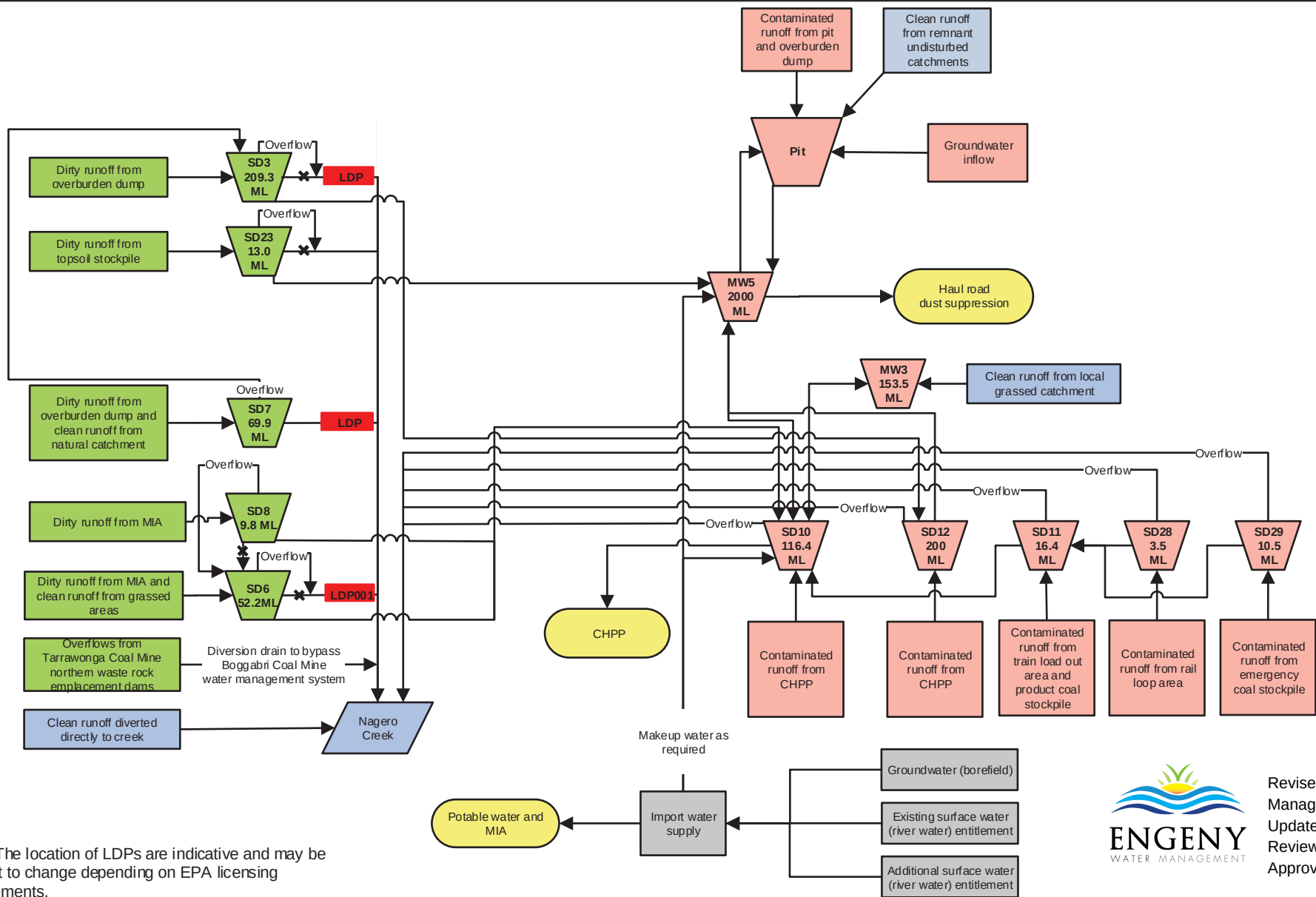
Figure B-6



Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.

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|                                                                                     |                                                                                                             |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |            |                                                                                                                                                             |                                                                                       |                                                                              |      |             |            |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|-------------|------------|
|  | <b>LEGEND</b>                                                                                               |  Import water system       | <p>© 2018. Whilst every care has been taken to prepare this figure, GHD make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the figure being inaccurate, incomplete or unsuitable in anyway and for any reason.</p> | <b>LOCATION</b> | <b>BCM</b> | <p>Boggabri Coal Operations Pty Ltd<br/>Boggabri Coal Mine<br/>Site Water Balance</p> <p>Water balance model schematic<br/>Indicative conditions (2021)</p> |  | <table><tr><td>DATE</td><td>15 Jun 2018</td><td>Figure B-7</td></tr></table> | DATE | 15 Jun 2018 | Figure B-7 |
|                                                                                     | DATE                                                                                                        | 15 Jun 2018                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Figure B-7      |            |                                                                                                                                                             |                                                                                       |                                                                              |      |             |            |
|                                                                                     |  Surface Water Transfer  |  Dirty water system        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>DRAWN</b>    | <b>TT</b>  |                                                                                                                                                             |                                                                                       |                                                                              |      |             |            |
|                                                                                     |  Storage                 |  Contaminated water system |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>CHECKED</b>  | <b>AW</b>  |                                                                                                                                                             |                                                                                       |                                                                              |      |             |            |
|                                                                                     |  Manually operated valve |  Clean water system        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>APPROVED</b> | <b>SG</b>  |                                                                                                                                                             |                                                                                       |                                                                              |      |             |            |
|                                                                                     |  Usage                   | <b>SCALE</b>                                                                                                  | <b>NTS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |            |                                                                                                                                                             |                                                                                       |                                                                              |      |             |            |



Note: The location of LDPs are indicative and may be subject to change depending on EPA licensing requirements.



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Reviewed by AW  
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#### LEGEND

- Surface Water Transfer
- Storage
- Manually operated valve
- Import water system
- Dirty water system
- Contaminated water system
- Clean water system
- Usage

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| LOCATION | BCM |
|----------|-----|
| DRAWN    | TT  |
| CHECKED  | AW  |
| APPROVED | SG  |
| SCALE    | NTS |

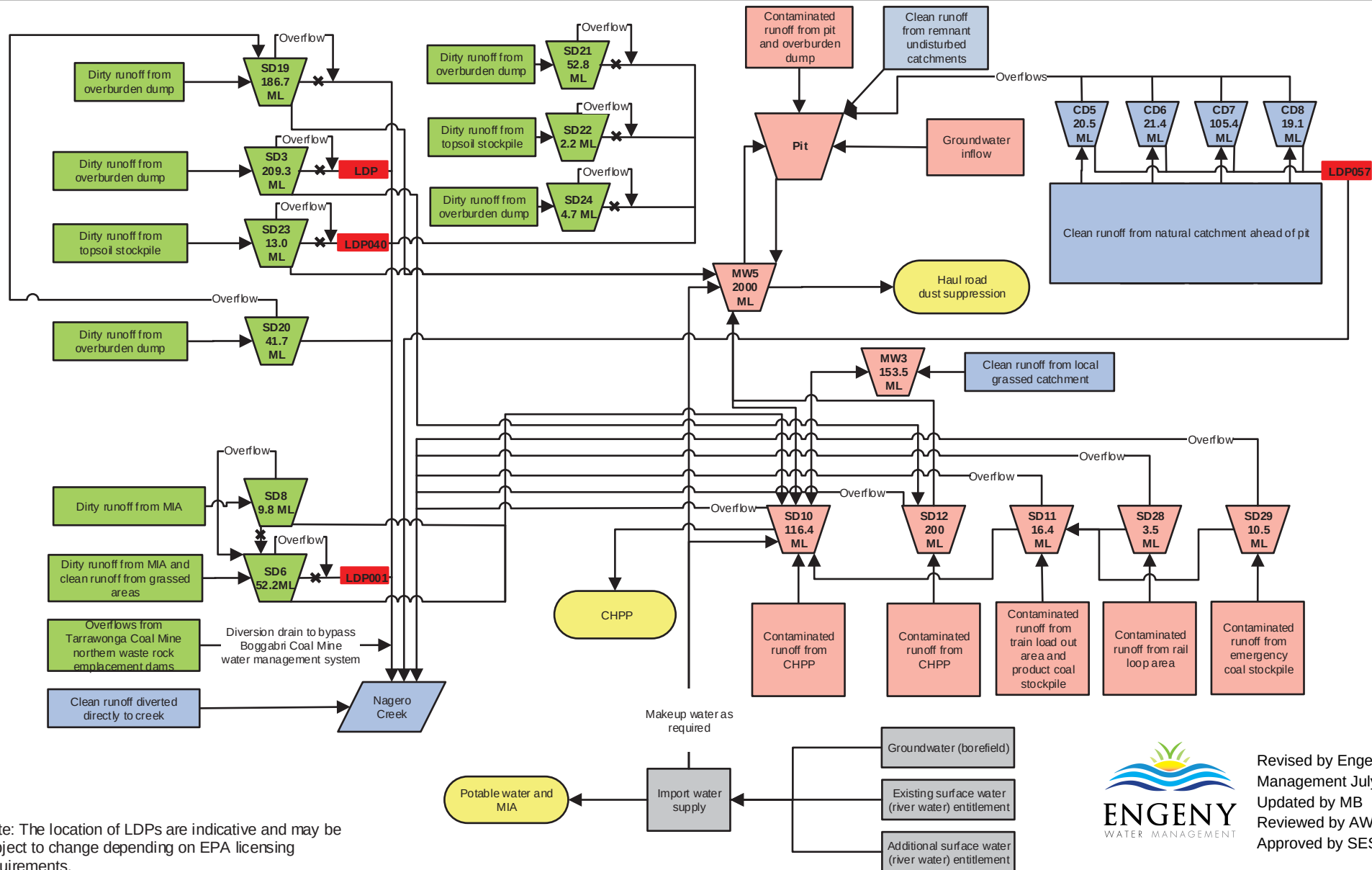
Boggabri Coal Operations Pty Ltd  
Boggabri Coal Mine  
Site Water Balance

Water balance model schematic  
Indicative conditions (2024)



DATE 15 Jun 2018

Figure B-8



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 Reviewed by AW  
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#### LEGEND

- Surface Water Transfer
- Storage
- Manually operated valve

- Import water system
- Dirty water system
- Contaminated water system
- Clean water system
- Usage

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| LOCATION | BCM |
|----------|-----|
| DRAWN    | TT  |
| CHECKED  | AW  |
| APPROVED | SG  |
| SCALE    | NTS |

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 Boggabri Coal Mine  
 Site Water Balance

Water balance model schematic  
 Indicative conditions (2033)



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Figure B-9



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**P: 02 4926 1225**

**Level 5, 6 Bolton Street, Newcastle NSW 2300 | PO Box 787 Newcastle NSW 2300**