# APPENDIX H

## Surface Water Report

STRATEGIC MINERALS
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egis

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BNE00504_0005-001

# STRATEGIC MINERALS CORPORATION PTY LTD

## BIG VEIN SOUTH GOLD PROJECT
## SURFACE WATER REPORT

*Version 1*

## Document information

### GENERAL INFORMATION

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# 1 INTRODUCTION

Engeny Water Management (Engeny) was commissioned by Strategic Minerals Corporation (SMC) to complete a surface water assessment as part of the Environmental Assessment Report (EAR) for the Big Vein South Gold Project (the Project).

## 1.1 Project Description

The Project involves the construction and operation of an open cut gold mine on a greenfield site in North Queensland. The Project site covers an area of approximately 2,281 ha and is located approximately 100 km north of Richmond and 380 km west of Townsville (Figure 1).

Open cut mining will be conducted using excavators and trucks. Gold ore will be processed on site to produce gold dore (solid bars containing gold alloy). The mine's peak production rate will be up to 1.95 million tonnes per annum (Mtpa) of run of mine (ROM) gold ore, yielding up to approximately 100,000 ounces of gold dore per annum. The mine life will be approximately 11 years.

The following mining and ore processing activities will be undertaken as part of the Project:

- Developing three open cut pits, as follows:
  - The main Big Vein South Pit (BVS Pit) located in the centre of the Project site (Figure 2). Waste rock from this pit will be hauled by truck and stored in the Central and Southern Waste Rock Dumps (WRDs).
  - Two small satellite pits, BV1 Pit and BV2 Pit, located in the northern part of the Project site (Figure 2). Waste rock from these pits will be stored in the Northern WRD.
- Transporting mined ore in haul trucks from the open cut pits to the ROM area ore stockpiles located near the mine processing facilities at the southern end of the Project site (Figure 2).
- Processing ore from the BV1 and BV2 Pits in the first 2 years of mining using Heap Leach Pads and gold elution.
- Processing ore mined from the BVS Pit in an on-site Carbon In-Leach (CIL) Plant from Year 3 onwards. The heap leaching process will generate spent heap leach residues. These residues will be reprocessed in the CIL Plant over the life of the mine. The CIL Plant will generate wet tailings and dewatered tailings. Wet tailings will be pumped to a Tailings Storage Cell. Dewatered tailings will be stored with waste rock in the Central WRD.
- Transporting dore bars from the site via plane to a refinery.

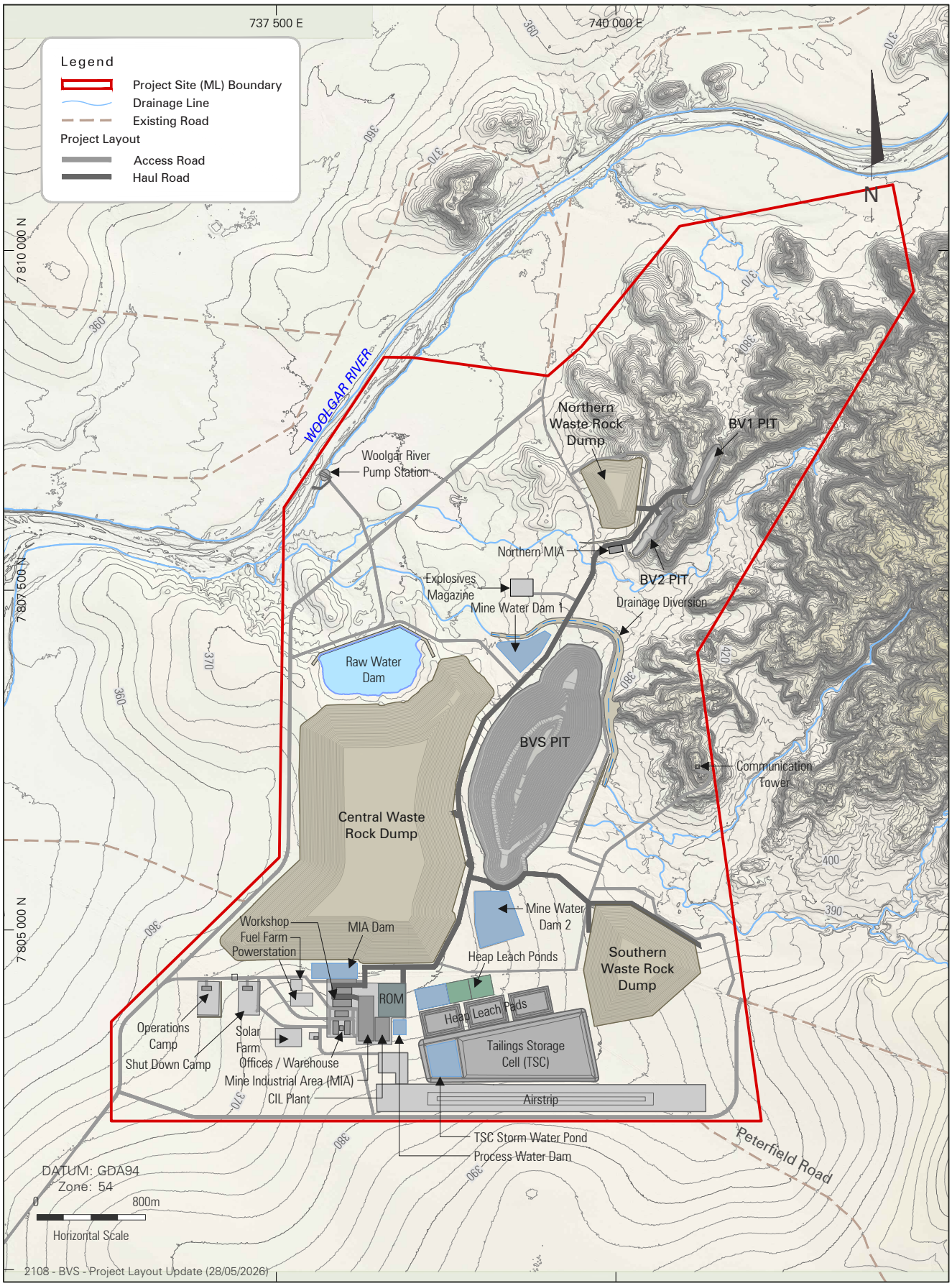
The majority of the mine infrastructure will be located at the southern end of the Project site (Figure 2). Key mine infrastructure will include ore processing facilities, workshop, warehouse, administration buildings, haul roads and access roads, vehicle servicing, refuelling and wash down facilities, fuel storage facilities, diesel and solar power station, water supply and water management infrastructure. Workforce accommodation and a private airstrip will also be located at the southern end of the Project site.




BIG VEIN SOUTH GOLD PROJECT

HANSEN ENVIRONMENTAL CONSULTING

Figure 1: Location Plan




BIG VEIN SOUTH GOLD PROJECT

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Figure 2: Project Layout

## 1.2 Report Scope and Methodology

The scope of work and methodology for the surface water assessment was as follows:

- A desktop study of the published mapping of drainage, surface geology and vegetation, site-specific topography data and relevant streamflow data (where available) to identify features relevant to the surface water assessment. The desktop study included:
  - Database searches to identify existing and historical water entitlements related to take or interference with flow in watercourses and overland flow areas/notifications.
  - Assessment of LIDAR data and aerial imagery to determine channel morphology throughout the Woolgar River and its associated tributaries.
  - A literature review, including a review of all available relevant surface water studies in the region. This included the Surface Water Technical Assessment Report for the St Elmo Vanadium Project EIS.
  - A review of geomorphology information provided information presented in the EAR Aquatic Ecology Report prepared by C&R Consulting in order to develop an understanding of the characteristics of the Woolgar River and its tributaries.
- A baseline surface water quality assessment including:
  - A review and analysis of surface water quality monitoring data collected from the Woolgar River and its tributaries as part of the proponent's baseline surface water quality monitoring program and surface water quality information presented in the EAR Aquatic Ecology Report prepared by C&R Consulting.
  - Development of interim surface water quality guideline values for the Woolgar River and its tributaries.
- A baseline assessment of the Woolgar River flooding extents in the vicinity of the Project site.
- Conceptual design of the site drainage arrangements and the Project mine water management system (WMS).
- Preliminary assessment of the consequence category of dams and other relevant structures that form part of the Project drainage arrangements and mine WMS.
- Validation, through a water balance modelling assessment, that the Project mine WMS meets stated performance objectives and estimation of Project water demands, external water supply and mine water discharge requirements.
- An assessment of the Project's effects on surface water flows and quality and the associated impacts on surface water users and environmental features reliant on surface water.
- Development of surface water monitoring and management measures.

## 1.3 Report Structure

This surface water report is structured as follows:

- Section 1 – Introduction.
- Section 2 – Baseline surface water setting, including the regional catchment setting and local drainage.
- Section 3 – Regulatory requirements for surface water.
- Section 4 – Site drainage arrangements and the proposed mine water management system, including the Project's water supplies and demands, and water discharges from the Project site.
- Section 5 – Water balance assessment.
- Section 6 – Final void hydrology assessment.
- Section 7 – An assessment of the surface water impacts of the Project.
- Section 8 – An overview of the surface water monitoring program for the Project.
- Section 9 – An overview of the environmental management plans relevant to the management of surface water impacts from the Project.

- Section 10 – Conclusions.

Appendix A describes the baseline flooding modelling methodology and results. Appendix B presents the baseline surface water quality monitoring results.

# 2 SURFACE WATER SETTING

This section provides a description of the surface water setting for the Project, including the regional catchment and local drainage. It is based on a desktop review of published information, site-specific surface water quality monitoring data presented in Appendix B, and baseline flood modelling presented in Appendix A.

## 2.1 Regional Catchment and Drainage

The Project is located in the Flinders River sub basin, part of the greater Finders River Basin (Figure 3) (Qld Gov, 2022d). The Flinders River Basin has a total catchment area of 109,507 $km^2$ and the Flinders Sub Basin has a total area of 51,873.1 $km^2$ (Qld Gov, 2022e).

The main rivers within the Flinders River Basin include the Cloncurry River, Saxby River and Flinders River which flow north-west towards the Gulf of Carpentaria. The main rivers within the Flinders River sub basin include the Flinders River, Stawell River and Woolgar River.

The Project is located directly south of the Woolgar River (Figure 3). The Woolgar River has a catchment area of approximately 1,312 $km^2$ upstream of the Project site and is a watercourse, of stream order 6. The Woolgar River commences approximately 46 km upstream of the Project site boundary and flows in generally a south-west direction until the confluence with the Stawell River, approximately 73 km downstream of the Project site boundary. The Stawell River subsequently flows into the Flinders River approximately 56 km downstream of the Woolgar River confluence.

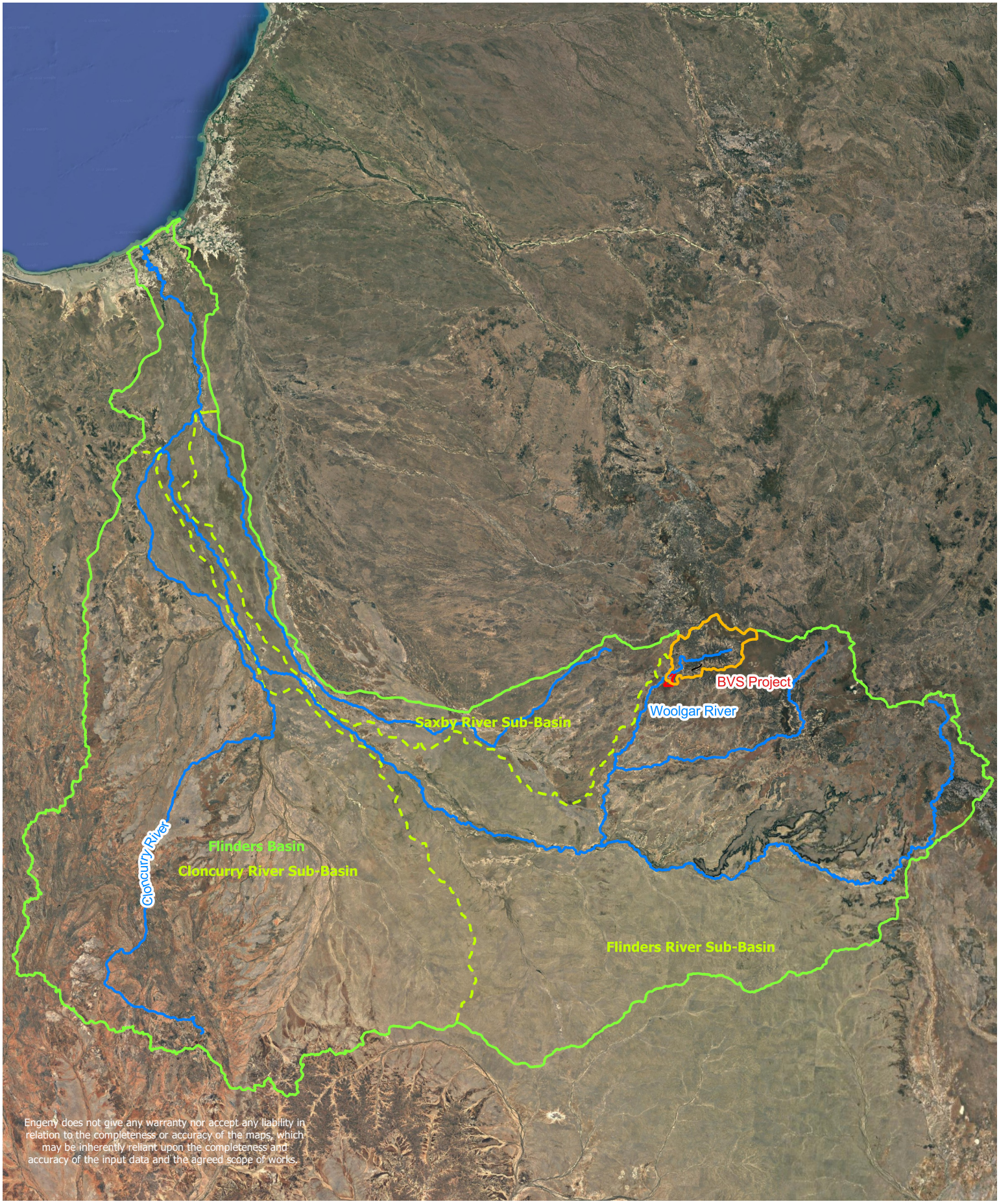



**Figure** 3:
BVS Gold Project
Surface Water Report
Drainage Basins

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**Legend**

- Relavent Rivers
- Flinders Sub-Basins
- Flinders Basin
- Woolgar River Catchment (Upstream of Project)
- BVS Project

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Kilometers

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## 2.2 Local Catchment and Drainage

The Project site is located within three tributary catchments of the Woolgar River which are referred to as the Northern catchment, Central catchment and Southern catchment in this report (Figure 4). Five main drainage features traverse the Project site as shown in Figure 5. Drainage Features 1, 2 and 3 flow from east to west, whilst Drainage Features 4 and 5 flow from south to north. All drainage features are tributaries of the Woolgar River (Figure 5).

A watercourse determination for the Project site was performed by the Department of Natural Resources, Mines and Energy in 2020 and determined that the Woolgar River is a watercourse as defined in the *Water Act 2000* (Qld) (Water Act) while the smaller drainage features within the Project site are all drainage features. These drainage classifications are now included in the Queensland Government's Watercourse Identification Map.

All waterways in the vicinity of the Project site are highly ephemeral and display significant variability in stream flow. The dominant land use within the Woolgar River catchment is grazing.

The key features of the Woolgar River and the local catchment drainage are discussed in the following sections.

### 2.2.1 Woolgar River

As shown in Section 2.1, the Woolgar River traverses the northern and western boundaries of the Project site, flowing in a south-westerly direction (Figure 4). There are two homesteads associated with grazing properties within 10 km of the Project site, located along the Woolgar River.

In the vicinity of the Project site, the Woolgar River has a well-defined channel that is set within a narrow, discontinuous floodplain. The river channel contains a braided low flow channel with sand sheet deposits, bars and islands that have been formed by the extensive suspended sediment deposition during flow events.

The Woolgar River is highly ephemeral and exhibits episodic, short duration, surface water flows that typically occur between January and March. Surface water flows typically occur during periods of heavy rainfall. Following rainfall, surface water flows rapidly recede and cease. The Woolgar River is expected to flow for less than 8 weeks per year, on average. There is also significant variation in the volume and timing of surface water flow between years depending on annual rainfall patterns.

### 2.2.2 Local Catchments and Drainage

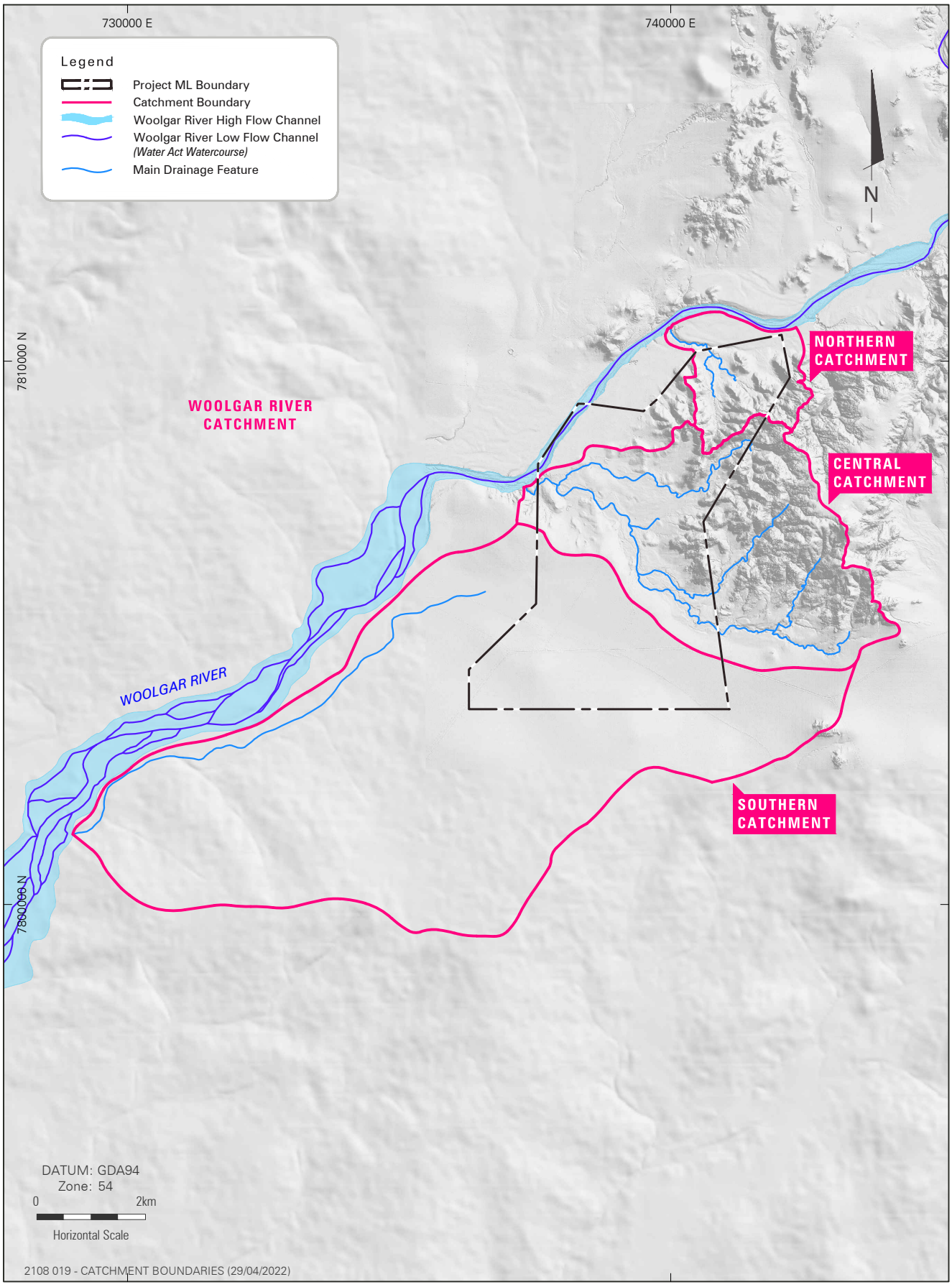
The local topography transitions from elevated rocky plateaus and ridgelines to the flatter, low-lying Woolgar River. Several plateaus and ridgelines extend into the Project site and form local catchment boundaries.

The local catchments within the Project site are all influenced by cattle grazing and land disturbance associated with mining exploration and access roads. Each catchment is summarised as follows:

- The Northern catchment covers an area of approximately 4.2 km2 and is drained by the unnamed Woolgar River tributaries of Drainage Feature 4 and Drainage Feature 5.
- The Central catchment covers an area of approximately 19.4 km2 and is drained by the unnamed Woolgar River tributaries of Drainage Feature 1, Drainage Feature 2 and Drainage Feature 3.
- The Southern catchment covers an area of approximately 53.7 km2. Runoff from this catchment drains to the southwest as overland flow and enters the Woolgar River approximately 15 km downstream of the Project site boundary. There are no defined drainage features associated with this catchment, traversing the Project site.
- Local catchment areas that drain directly to the Woolgar River channel.

The unnamed Woolgar River tributaries coalesce on the flatter ground that is located between the plateaus and ridgelines and drain towards the Woolgar River valley. The Queensland Department of Local Government, Water and Volunteers (DLGWV) have declared that the unnamed tributaries meet the Water Act definition of a 'drainage feature'.

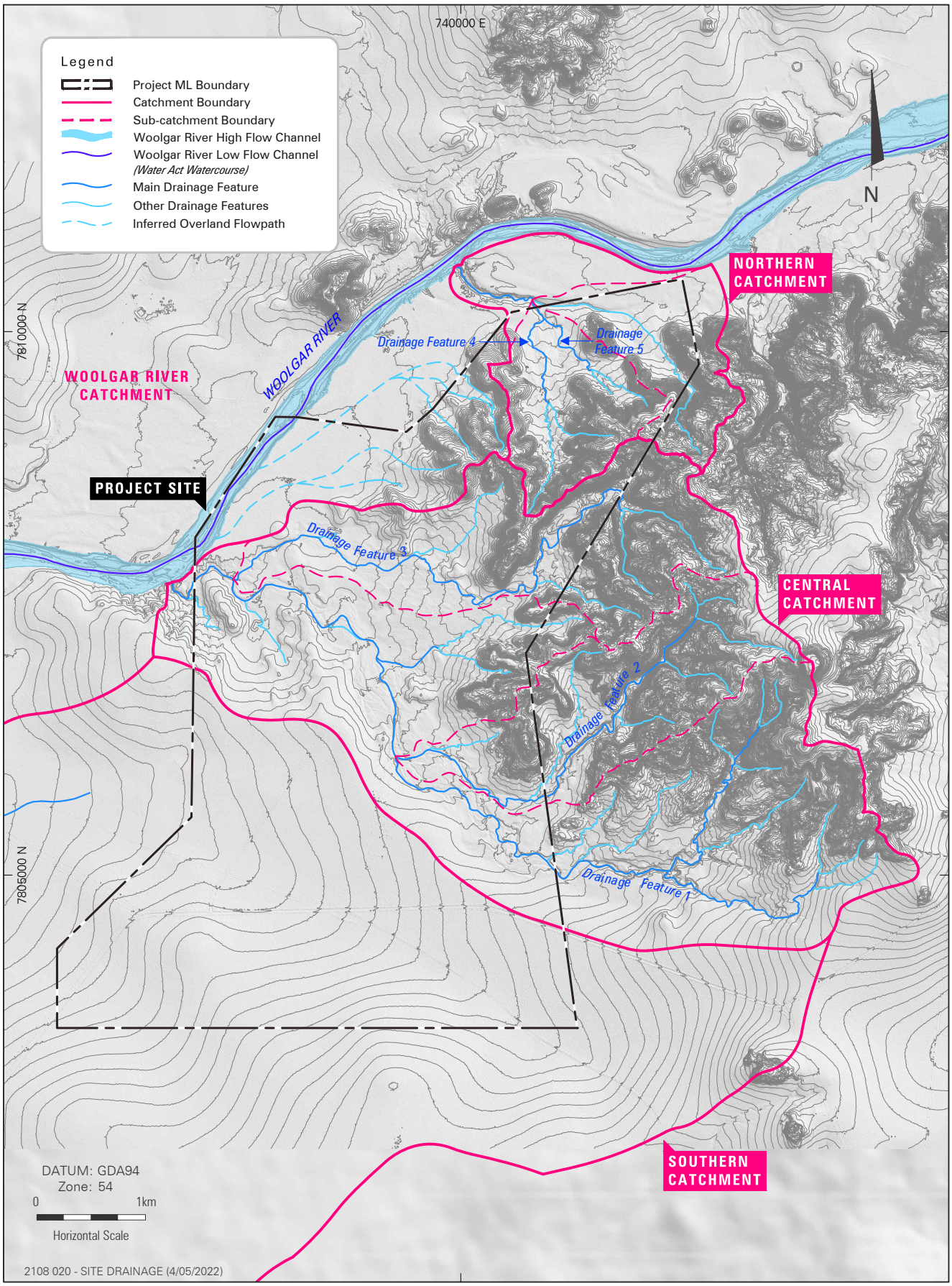
Surface water flow duration, frequency and quality in the drainage features have similar characteristics as the Woolgar River, being highly ephemeral, with short duration flows that contain elevated suspended sediment loads. This is expected given the catchment features and geology setting.




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Figure 4: Local Catchment Setting




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Figure 5: Site Drainage Plan

## 2.3 Climate

The Project site is located within a hot, semi-arid climate region (Koppen classification) characterised by hot dry summers and relatively warm winters.

A SILO Data Drill (longpaddock.qld.gov.au/silo) for lat./long: -19.80, 143.3 was obtained to describe climate statistics for the Project site and to inform the Project water balance model (Section 5.3.1).

### 2.3.1 Rainfall

Figure 6 below provides the monthly average, minimum and maximum rainfall for the Project site. Rainfall shows a strong seasonal distribution with a summer wet season and winter dry season. Mean monthly rainfall is typically highest in January at 166 mm, followed by February at 135mm. Through the dry season extending from April through October, mean monthly rainfall is typically less than 20 mm. The mean annual rainfall is 580 mm.

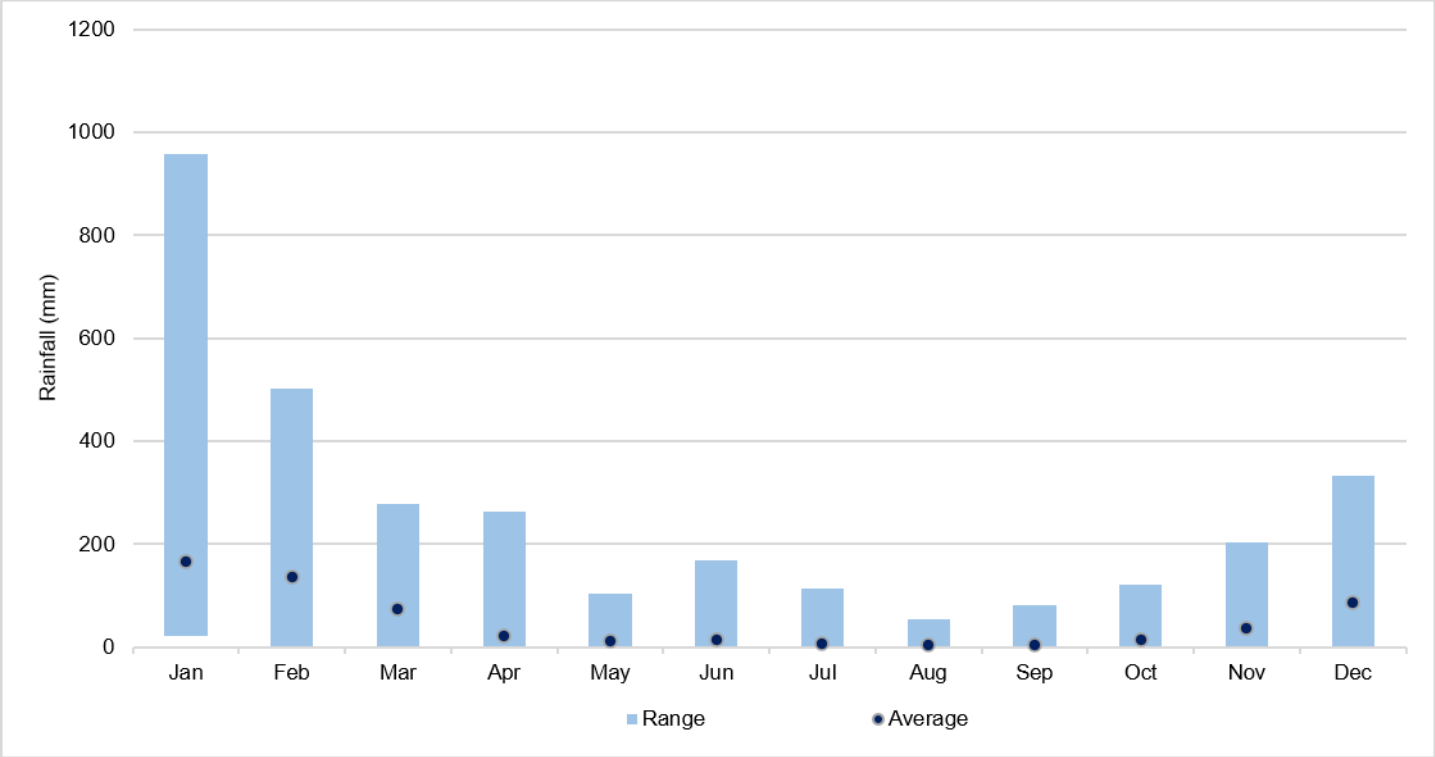



**FIGURE 6 – MONTHLY AVERAGE, MINIMUM AND MAXIMUM RAINFALL (SILO DATA DRILL)**

### 2.3.2 Evaporation

Figure 7 below shows minimum, maximum, and average evaporation rates (Mortons Lake evaporation) for the Project site. For all months, mean evaporation exceeds mean rainfall and is highest from October through March. November and December represent the highest rates of mean evaporation at 207 mm and 212 mm respectively. The mean annual evaporation is 1,930 mm.

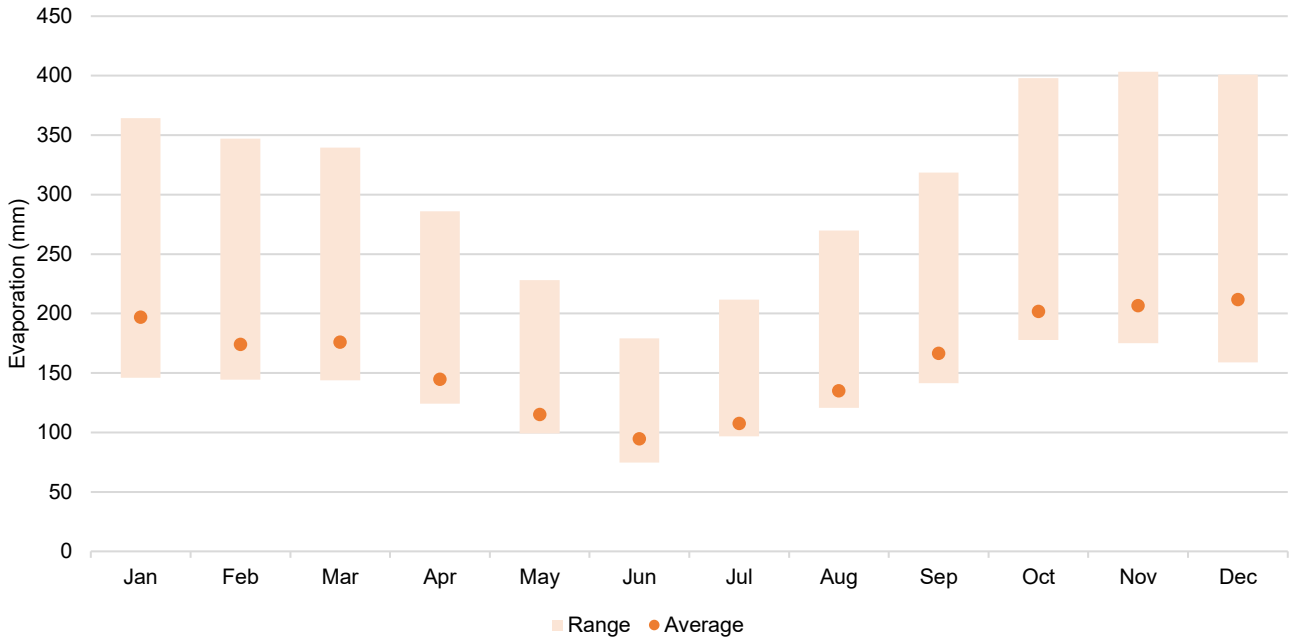



**FIGURE 7 – EVAPORATION MINIMUM, MAXIMUM AND AVERAGE (SILO DATA DRILL)**

### 2.3.3 Temperature

Figure 8 below shows mean minimum and maximum monthly temperature. From the figure it can be seen that summer mean maximum and minimum temperatures range from approximately 22 to 35°C respectively and decline to approximately 10 to 26°C in June and July.

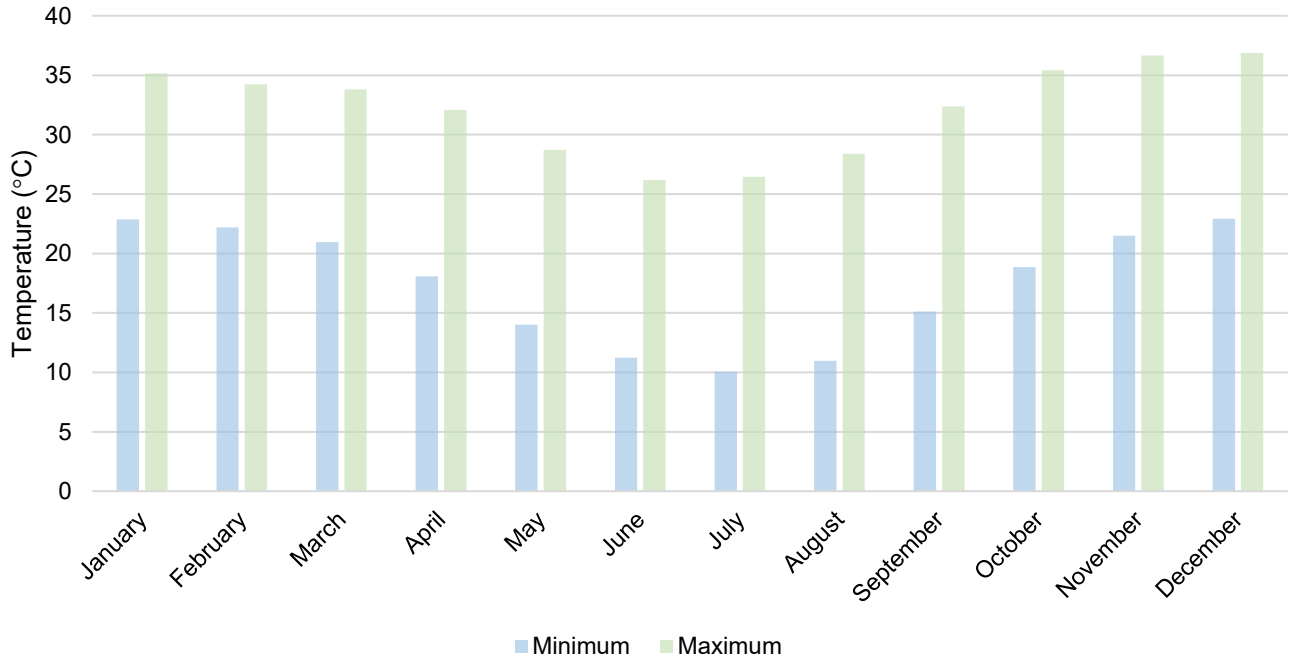



**FIGURE 8 – MINIMUM AND MAXIMUM TEMPERATURE (SILO DATA DRILL)**

## 2.4 Streamflow Monitoring

The Project site is situated in a very remote location and as such is difficult to access particularly during the wet season. The closest open Queensland Government streamflow monitoring site to the Project site is the Flinders River at Richmond (915008A) gauge (Refer to Figure 9), however, data from this gauge is unlikely to be representative of streamflow at the Project Site as:

- It is not located downstream of the Project site (i.e., located on the Flinders River upstream of the confluence with the Stawell River (of which the Woolgar River is a tributary).
- Has a reporting catchment area of 17,380 km2 which is significantly larger than the Woolgar River catchment area upstream of the Project site (approximately 1,089 km2).

Additional closed stream gauge stations are located closer to the Project site, however, of these only stream gauge 915009A (Woolgar River at Patience Creek) is located directly downstream of the Project site. This gauge also has a reporting catchment closer in area (3,391 $km^2$) to the Woolgar River catchment area upstream of the Project site. This gauge is located at the confluence of the Woolgar River and Patience Creek approximately 45km downstream of the Project site. It has a gauging record of 17 years from 1972 to 1988.

The Australian Water Balance Model (AWBM, (Boughton, 1993)) was calibrated to the Patience Creek stream gauge data using input daily evaporation and rainfall data obtained from SILO Data Drill. The calibrated AWBM parameters were subsequently used to generate a long-term streamflow dataset (130 years) for the Woolgar River at the Project site for use in the water supply assessment. Long term simulated streamflow data are summarised in Figure 10 (mean monthly flow) and Figure 11 (daily flow duration (representing the probability that streamflow of a specific rate is likely to be exceeded on any given day)) below:

- Streamflow in the Woolgar River at the Project site is strongly ephemeral with a short high flow season from December through March (Figure 10) where mean monthly flow ranges from approximately 1,671 ML to 10,256 ML per month.
- Cease to flow conditions are likely to occur on approximately 85% of all days (Figure 11), and
- Streamflow is highly episodic, typically limited to periods of high rainfall and subject to rapid flow recession.




Figure 9:

BVS Gold Project
Surface Water Report
Streamflow Monitoring Locations

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**Legend**

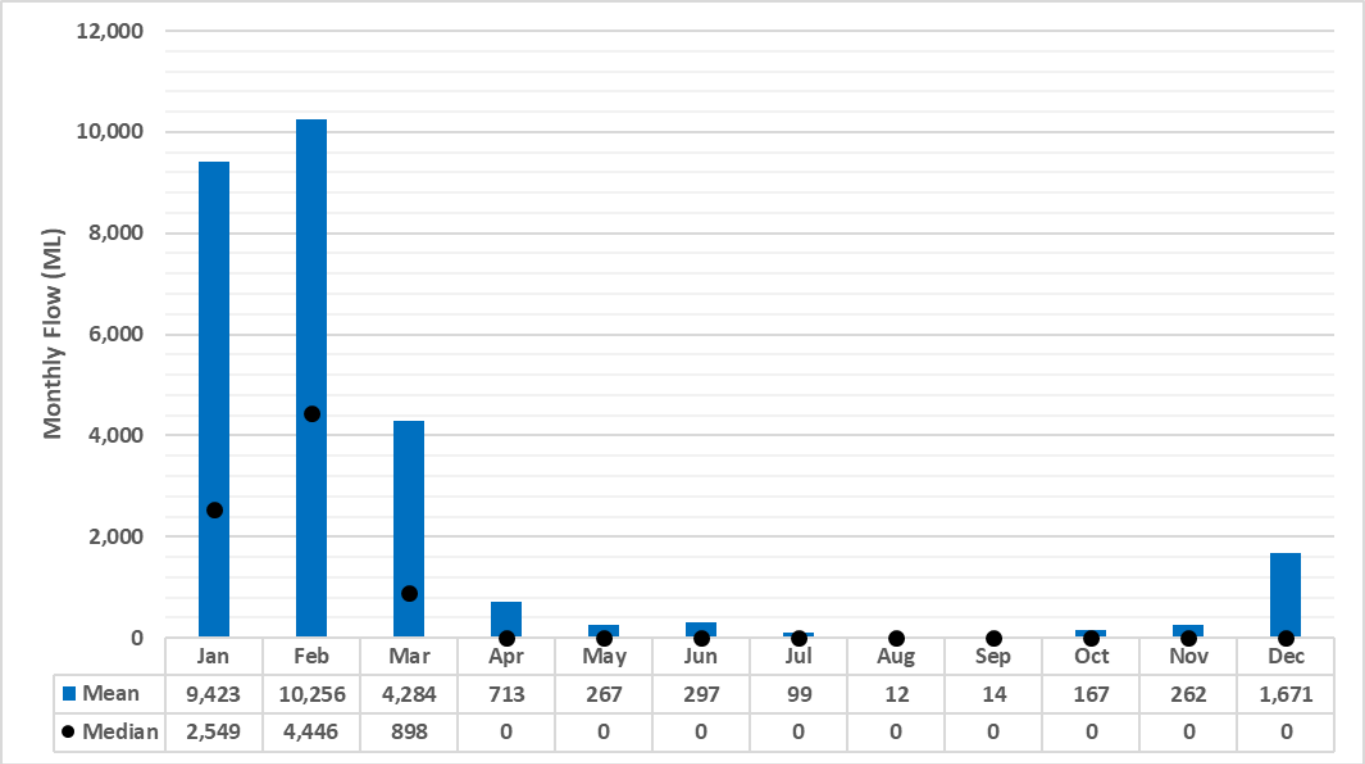
- Streamflow Monitoring Stations
- Relavent Rivers
- BVS Project

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| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 9,423 | 10,256 | 4,284 | 713 | 267 | 297 | 99 | 12 | 14 | 167 | 262 | 1,671 |
| Median | 2,549 | 4,446 | 898 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**FIGURE 10 – MONTHLY FLOW – WOOLGAR RIVER SIMULATED DISCHARGE AT PROJECT SITE**

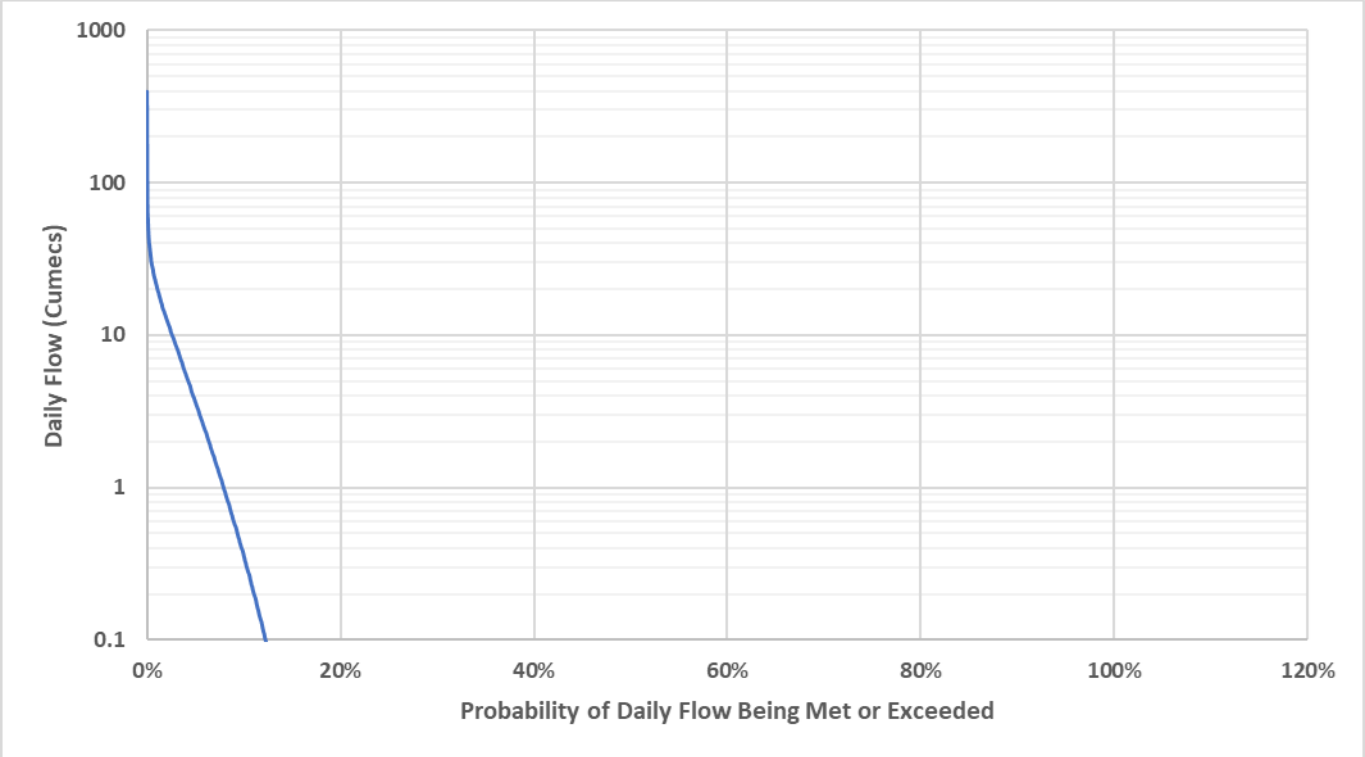



**FIGURE 11 – DAILY FLOW DURATION - WOOLGAR RIVER SIMULATED DISCHARGE AT PROJECT SITE**

## 2.5 Baseline Flood Assessment

Baseline flood modelling was undertaken for the Project site (refer to Appendix A) in accordance with the procedures described in the 2019 version of Australian Rainfall and Runoff: A Guide to Flood Estimation (ARR19) (Ball, et al., 2109) and the DETSI guidance document *Voids in Floodplains* (ESR/2019/4966) (Qld Gov, 2026).

Baseline hydrology modelling was undertaken for the Woolgar River using the URBS rainfall runoff modelling software, while hydraulic modelling of the Woolgar River flood plain was undertaken using the TUFLOW two-dimensional hydraulic modelling software. Flood modelling was conducted for the 1:1,000 Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF).

Figure 12 shows that the majority of the Project site is not affected by flooding of the Woolgar River during the 1:1,000 AEP flood event. A small portion of the western part of the Project site may be subject to some minor inundation. The PMF extends into the north-western portion of the Project site (Appendix A).

Woolgar River

BV1

BV2

BVS Pit

Legend

- Pit Extent
- ML Boundary
- Tuflow Model Boundary

Flood Level (m AHD)

- <356
- 356-361
- 361-366
- 366-371
- 371-376
- 376-381
- >381

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0 1,900 3,800

Scale in metres ( 1:77,000 @ A3)

Map Projection: Tranverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 54

| | |
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| JOB NO. | BNE00504_0004 |

STRATEGIC MINERALS CORPORATION

Big Vein South Gold Project
Regional Flood Assessment

1:1000 AEP Flood Level

A3 | Figure 12 | 1

## 2.6 Baseline Surface Water Quality

### 2.6.1 Regional Water Quality Data

The DLGWV maintains a network of regional surface water monitoring stations throughout the Flinders Basin. However, as described in Section 2.4, there are currently no active monitoring stations in the Woolgar River catchment.

Historically, DLGWV operated a monitoring station on the Woolgar River downstream of its confluence with Patience Creek (station 915009A) (Figure 9). Three water quality samples were collected from this monitoring station between 1973 and 1987. The water quality samples were tested for a range of quality characteristics including key physical parameters, nutrients, major ions and selected metals/metalloids. However, due to the limited amount of water quality data and its age, this data does not provide a representative contemporary baseline of catchment surface water quality.

### 2.6.2 Project Surface Water Quality Data

A baseline surface water quality monitoring program was undertaken to characterise the Woolgar River and its tributaries. Surface water quality data was collected from 11 monitoring sites, as shown in Figure 13, including:

- SW1 to SW4 located in the Woolgar River.
- SW10 and SW11 on Drainage Feature 2.
- SW7 and SW9 on Drainage Feature 1.
- SW8 on Drainage Feature 3.
- SW5 and SW6 located on Drainage Feature 3 and a tributary of Drainage Feature 1, respectively.

Monitoring was undertaken at each of these sites between April 2018 and February 2022. As discussed in Section 1.1, the Project site is situated in a very remote location and as such is difficult to access for sampling particularly during the wet season. In addition to this, monitoring was suspended during this period due to the coronavirus pandemic. Initially, regular scheduled monitoring was attempted at monthly, and then quarterly, intervals. However, this approach yielded limited data due to the remoteness of the monitoring sites, the intermittent occurrence of surface water at the monitoring sites and the challenging access conditions during the wet season when flows occur. Hence, SMC transitioned to a reactive monitoring program with automated sampling to overcome these issues and improve data collection.

Up to 30 samples were collected from each monitoring site from 14 monitoring rounds, with the monitoring sites found to be dry during the remaining monitoring rounds. Samples were tested in-field and dispatched to a NATA-accredited laboratory (ALS) to be tested for a broad range of quality characteristics. The raw laboratory water quality monitoring data is provided in Appendix B. Flow conditions were also recorded in the field at each monitoring site.

Samples were taken during a range of flow conditions including from shallow pools during cease to flow conditions. Due to the access limitations described above, not all monitoring locations were able to be sampled during each monitoring event.

The surface water quality monitoring data was collated and analysed using the following methodology:

- The monitoring sites have been grouped into Woolgar River Upstream (SW4), Woolgar River Midstream (SW2 and SW3), Woolgar River Downstream (SW1) and Tributaries (SW5-S12) for analysis purposes.
- The consolidated data from the four groupings was then analysed as well as identification of any obvious outliers. Summary statistics for each grouping were then calculated from the dataset, where sufficient data were available.
- Table 1 below shows the water quality results (average and median) for the relevant and key water quality parameters. Analysis of key water quality parameters for each group (upstream, midstream, downstream and

tributaries) are also provided as box and whisker plots to demonstrate the range and average results in Appendix B.

From this data analysis, the following is of note:

- Surface water quality in the Woolgar River and its tributaries have similar characteristics. This is expected given the similar catchment and geology setting of these watercourses and drainage features.
- A significant proportion of the water quality characteristics (including organics and most metals and metalloids) are present at concentrations below the limit of reporting.
- Surface water quality is circum-neutral with the pH values ranging between 6.8 and 7.3.
- Surface water quality is typically non-saline. Slightly higher salinity levels have been observed upstream in the Woolgar River however it should be noted that this is based on one sample and may not be reflective of the average or median concentrations.
- Dissolved metals are typically present at low concentrations, with the exception of Iron, Manganese and Calcium, which are present at slightly higher concentrations.
- Surface water turbidity levels range widely between 0.8 to 1,690 NTU. Turbidity can increase rapidly in response to pulses of suspended sediment that occur during flow conditions, as a result of natural/existing erosion processes in the catchment.
- Nutrient concentrations are generally low although increased concentrations can occur in remnant pools at the end of the dry season. Similarly, surface waters typically contain high levels of dissolved oxygen, but oxygen levels can become depleted in remnant pools at the end of the dry season.

**TABLE 1: BASELINE SURFACE WATER QUALITY**

| Parameter Type | Parameter | Units | Woolgar River - Upstream | | Woolgar River - Midstream | | Woolgar River - Downstream | | Tributaries | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Average | Median | Average | Median | Average | Median | Average | Median |
| **Physico-** | pH | pH unit | 6.85 | 6.85 | 7.056 | 7.11 | 7.16 | 7.07 | 6.98 | 6.85 |
| **Chemical** | Electrical Conductivity | µS/cm | 277.00 | 277.00 | 139.54 | 118.00 | 214.75 | 223.00 | 145.56 | 144.00 |
| **Parameters** | Dissolved Oxygen | % Saturation | 50.50 | 50.50 | 80.10 | 80.10 | 67.00 | 67.00 | 64.73 | 84.90 |
| **(Laboratory)** | Turbidity | NTU | 2.80 | 2.80 | 147.28 | 63.85 | 6.10 | 6.30 | 251.36 | 64.00 |
| | Ammonium | mg/L | - | - | - | - | - | - | 0.1000 | 0.1000 |
| | Nitrate | mg/L | - | - | 0.4911 | 0.0550 | - | - | 0.1800 | 0.1800 |
| | Total Phosphorus | mg/L | - | - | 0.4000 | 0.2300 | - | - | - | - |
| **Surface Water -** | Aluminium | mg/L | 0.0100 | 0.0100 | 4.8774 | 2.4700 | 0.1140 | 0.0430 | 4.6946 | 0.1600 |
| **Toxicants** | Arsenic | mg/L | 0.0020 | 0.0020 | 0.0027 | 0.0020 | 0.0016 | 0.0016 | 0.0049 | 0.0020 |
| | Barium | mg/L | - | - | 0.0370 | 0.0300 | 0.0443 | 0.0430 | 0.0895 | 0.0900 |
| | Boron | mg/L | - | - | 0.0338 | 0.0225 | 0.0227 | 0.0200 | 0.0325 | 0.0225 |
| | Cadmium | mg/L | - | - | 0.0008 | 0.0008 | - | - | 0.0001 | 0.0001 |
| | Chromium | mg/L | - | - | 0.0109 | 0.0060 | - | - | 0.0173 | 0.0040 |
| | Copper | mg/L | - | - | 0.0125 | 0.0060 | 0.0010 | 0.0010 | 0.0160 | 0.0080 |
| | Iron | mg/L | 1.2500 | 1.2500 | 8.0068 | 3.8500 | 1.0150 | 0.9650 | 12.1156 | 4.8000 |
| | Lead | mg/L | 0.0050 | 0.0050 | 0.0140 | 0.0040 | 0.0001 | 0.0001 | 0.0270 | 0.0045 |

| Parameter Type | Parameter | Units | Woolgar River - Upstream | | Woolgar River - Midstream | | Woolgar River - Downstream | | Tributaries | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Manganese | mg/L | 1.0200 | 1.0200 | 0.4627 | 0.0855 | 0.2670 | 0.3140 | 0.7503 | 0.1500 |
| | Nickel | mg/L | 0.0010 | 0.0010 | 0.0072 | 0.0035 | 0.0020 | 0.0020 | 0.0098 | 0.0030 |
| | Silver | mg/L | 0.0020 | 0.0020 | 0.0015 | 0.0015 | - | - | - | - |
| | Uranium | mg/L | - | - | 0.0036 | 0.0030 | - | - | 0.0050 | 0.0045 |
| | Zinc | mg/L | 0.0080 | 0.0080 | 0.0986 | 0.0240 | - | - | 0.0452 | 0.0160 |
| | Calcium | mg/L | - | - | 11.7333 | 10.0000 | 13.1000 | 12.0000 | 6.7250 | 7.9500 |
| | Hardness (as $CaCO_3$) | mg/L | 59.00 | 59.00 | 42.13 | 43.00 | 59.00 | 58.00 | 38.17 | 46.00 |

Table notes: '-' denotes all results are below the applied limit of reporting

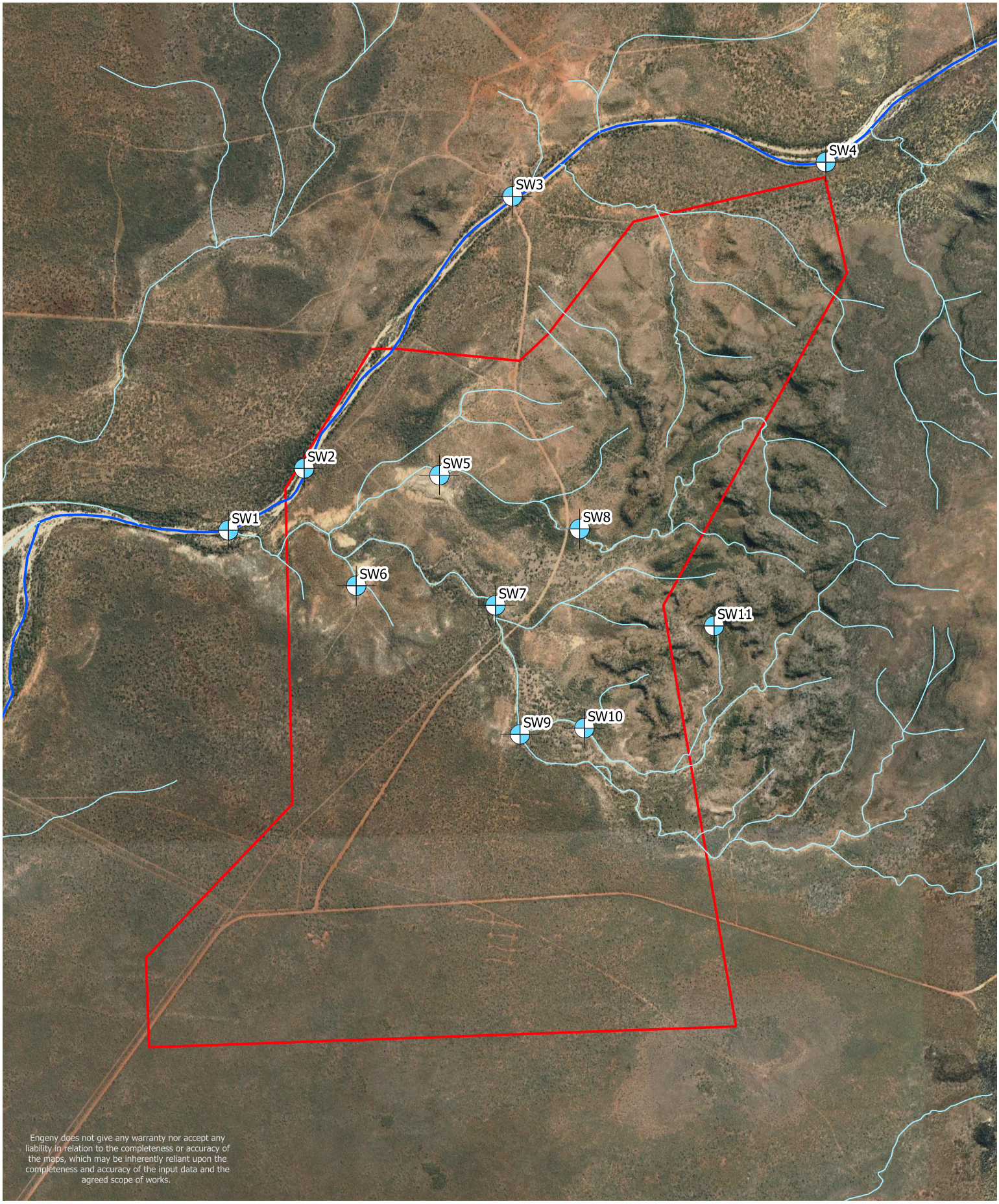



Figure 13:

BVS Gold Project
Surface Water Report
Surface Water Monitoring

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**Legend**

- Surface Water Monitoring Locations
- Watercourse
- Tributaries
- BVS Project

N

0 0.5 1

Kilometers

Scale @ A4 1:500,000
Date: 11/11/2022
Drawn By: EW

## 2.7 Potential Surface Water Users

The assessment of potential surface water users surrounding the Project found:

- The only notable dam is Sandy Creek Dam, located approximately 10 km northeast of the Project site, which is therefore not relevant to potential surface water users for the Project site as it is located upstream.
- A review of the Queensland Globe geospatial database indicates that there are no known lakes, reservoirs or dams located within 50 km downstream of the Project site.
- There are currently no active water licences to take or use water from the Woolgar River (Qld Gov, 2022c). The nearest licensed surface water user is located on the Stawell River approximately 60 km downstream of the Project site boundary. The surface water user holds two water licences attached to the same Lot Plan which are authorised for 'rural use' (Figure 14 and Table 2). Rural use is defined in the *Water Plan (Gulf) 2007* (Qld) (the Water Plan) as an umbrella term that could include stock, domestic, irrigation, stock intensive or agriculture use. Given the dominant land use for the catchment (grazing) and the ephemeral surface water flows it is assumed the two licences are not utilised for irrigation purposes.
- There are no current or approved future mining operations in the Woolgar River or Stawell River catchments. There are approved mining Projects further downstream within the Flinders River Basin including the Saint Elmo Vanadium Project (not yet active) which is located on the boundary of the Flinders River sub basin and Cloncurry River sub basin.

**Table 2: Closest Downstream Water Licence to the Project**

| Licence Number | Allocation Class | Authorised Purpose | Water Source | Annual Limit (ML) | Proximity to the Project Site |
|---|---|---|---|---|---|
| **618704** | Unsupplemented Water | Rural (stock, domestic, irrigation, stock intensive or agriculture) | Stawell River | 5500 | ~ 82 km |
| **618703** | Unsupplemented Water | Rural (stock, domestic, irrigation, stock intensive or agriculture) | Stawell River | 6500 | ~ 82 km |

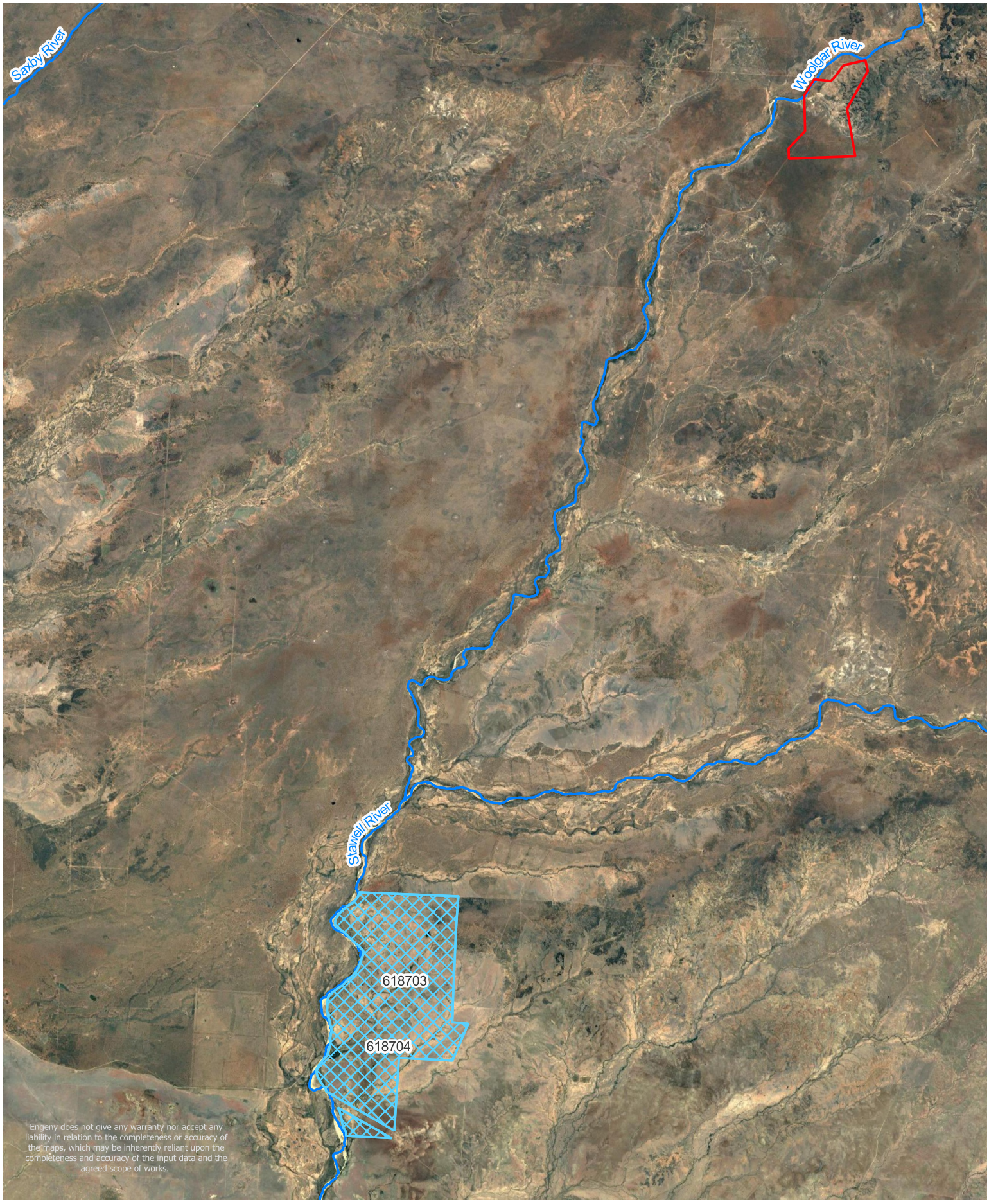



Figure 14:

BVS Gold Project
Surface Water Report
Surface Water Licences

**Legend**

- Surface Water Licence
- Relevant River
- BVS Project

N

0 4 8

Kilometers

Scale @ A4 1:350,000
Date: 11/11/2022
Drawn By: EW

ENGENY WATER MANAGEMENT

STRATEGIC MINERALS CORPORATION PTY LTD

# 3 REGULATORY REQUIREMENTS

## 3.1 Environmental Protection Act

The *Environmental Protection Act 1994* (Qld) (EP Act) was established to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains ecological processes. The Department of the Environment, Tourism, Science and Innovation (DETSI) is the administering authority of the EP Act. The EP Act requires that mining Projects be undertaken in accordance with an approved Environmental Authority (EA).

The EA conditions set the water management performance requirements for the mine. Failure to comply with the EA conditions is a breach of the EA and there are various compliance enforcement actions available to the DETSI under the EP Act.

The EA conditions will also:

- Require the proponent to develop and implement a series of management plans and monitoring programs for surface water, including a Water Management Plan, an Erosion and Sediment Control Plan and a Receiving Environment Monitoring Program (REMP). These management measures are outlined in Section 9.
- Impose conditions relating to structures that are classed as dams or levees constructed as part of the mining activities. The EA conditions will require that the consequences of a containment failure must be assessed for each structure to identify any 'regulated dams'. The EA conditions will impose specific requirements on the design, construction, operation and decommissioning of any regulated dams. An initial consequence assessment is presented in Section 4.4.14 and the results indicate that the Project will require several regulated dams. Section 4 provides a description of the regulated dams required for the Project.

The EP Act also establishes an Environmental Protection Policy (EPP) for water. The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (Qld) (EPP Water) provides a framework for the protection of environmental values (i.e., surface water uses) associated with Queensland rivers, streams, wetlands, lakes, aquifers, estuaries, and coastal areas. Under this framework, environmental values for specific catchments and drainage basins have been formalised through a process of statutory declaration. Environmental values formalised in this way are listed in Schedule 1 of the EPP Water. For other waters, a site-specific assessment of the potential environmental values is required.

To date, no environmental values have been declared for the Woolgar River catchment (or its tributary catchments).

Outcomes of the EAR Aquatic Ecology Report as well as findings from Sections 2.6 and 2.7 of this report have been used to present a site-specific assessment of the potential environmental values for surface waters relevant to the Project. These assessments show that:

- The Woolgar River and its tributaries are slightly disturbed surface water features that support aquatic ecosystems. The physical and chemical characteristics of these features have been modified by current and historical land use within the catchment, including vegetation clearing and cattle grazing.
- Most environmental values associated with human use of surface water[1] are not relevant because these uses are not undertaken or currently planned within the Project site or the downstream reaches of the Woolgar River. Specifically:

[1] *Environmental values associated with the human use of surface water include human consumption of aquatic foods, aquaculture, intensive agriculture, recreational uses (including swimming and aesthetic values), drinking water supply and industrial use.*

- Aquaculture and human consumption are not considered relevant to the Project as there are no known users of local surface water sources for aquaculture or the production of aquatic foods for human consumption surrounding the Project site.
- There are no known or mapped areas of cropping or irrigation (intensive agriculture) within or downstream of the Project.
- Industrial use is not considered to be a relevant environmental value for the Project, as there are no known users of local surface water supply for industrial purposes.
- Drinking water is not considered to be a relevant environmental value for the Project due to the following:
  - There are no dams or weirs related to bulk water supply located within 100 km downstream of the Project.
  - Drinking water of the closest township of Richmond is supplied by the Richmond Shire Council, which is sourced from groundwater. Therefore, it is unlikely that the Woolgar River is used as a drinking water source.
  - There are three homesteads associated with grazing properties located on the Woolgar River within 10 km of the Project site however, due to the unreliability of surface water flows and arid climate, it is unlikely that the surface water is utilised for drinking water purposes.

- However, primary, secondary and visual recreational use may be relevant environmental values as there are three homesteads associated with grazing properties located on the Woolgar River within 10 km of the Project site which may potentially use the surface water for primary or secondary recreational purposes.
- Agricultural use is considered relevant as under the Water Plan, the taking of surface water is permitted for stock or domestic purposes. As described in Section 2.7, there are two water licences located around 60 km downstream of the Project site that are approved for rural purposes. Whilst it is unlikely these licences are used for human use of surface water they may or could be used for grazing/stock watering.
- The proponent has consulted with representatives of the traditional owners of the Project site in relation to management of cultural heritage and there are no known significant cultural or spiritual values associated with the Woolgar River and its tributaries.

### 3.1.1 Water Quality Objectives

The EPP Water requires that slightly to moderately disturbed waters supporting aquatic ecosystems are maintained at levels that achieve the applicable water quality objectives (WQOs), or the waters are improved to a level that achieves the applicable WQOs.

WQOs are quantitative measures or narrative statements established to protect relevant environmental values. WQOs comprise water quality indicators and corresponding water quality guidelines. Water quality indicators are the physical, chemical or biological properties that can be quantitatively measured, and can include:

- Physico-chemical indicators (e.g. pH, nutrients, suspended solids, water clarity, dissolved oxygen and salinity).
- Biological indicators (e.g. in-steam biota, macroinvertebrates and aquatic macrophytes).
- Toxicant indicators (e.g. metals and pesticides).
- Geomorphic indicators (e.g. creek beds, banks, in-stream habitat, refuge waterholes and ground cover).
- Habitat indicators (e.g. riparian zone properties such as width, continuity and species composition) and,
- Hydrological indicators (e.g. surface water flow path, flow rate and seasonality).

Water quality guidelines are the quantitative measure for an indicator (i.e., a specific pH level, toxicant concentration or surface water flow rate). Guideline values may be derived from assessment of ecological effects (i.e., toxicity testing) and/or reference site data.

WQOs have been established for the catchments and drainage basins listed in Schedule 1 of the EPP Water (i.e. the waters that have been formally assigned environmental values). For other waters (not listed in Schedule 1 of the EPP Water), WQOs are determined in accordance with the Queensland guideline *Environmental Protection (Water and Wetland Biodiversity) Policy 2019: Deciding aquatic ecosystem indicators and local water quality guidelines* using site-

specific information and other relevant documents including the *Queensland Water Quality Guidelines* (Department of Environment and Resource Management [DERM], 2009), the *Australian and New Zealand guidelines for fresh and marine water quality* (Australian and New Zealand Governments [ANZG], 2018 as well as previous publication by Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, 2000), the *Australian drinking water guidelines* (National Health and Medical Research Council, 2011), and the *Guidelines for managing risks in recreational waters* (National Health and Medical Research Council, 2008).

To date, no WQOs have been declared for the Woolgar River catchment (or its tributary catchments).

In the absence of declared WQOs, water quality objectives must be derived from a set of water quality guidelines for all relevant indicators that will protect the environmental values of the water.

Interim guideline values have been prepared in accordance with the *Queensland Water Quality Guidelines* (DERM, 2009), the Queensland guidelines *Deciding aquatic ecosystem indicators and local water quality guidelines* (DES, 2021a) and *Using monitoring data to assess groundwater quality and potential environmental impacts* (DES, 2021b) and the *Australian and New Zealand guidelines for fresh and marine water quality* (ANZG, 2018). The interim water quality guidelines, have been developed based on the framework provided within Section 4.1 of the *Queensland Water Quality Guidelines*:

1. Determine spatial extent of waters that guidelines are to be developed.
2. Determine water types.
3. Establish reference sites in all defined water types.
4. Define indicators of interest.
5. Collect suitable reference dataset.
6. Use reference dataset to establish guideline values.

For slightly disturbed waters (Refer to Section 3.1), the *Queensland Water Quality Guidelines* recommends determining the guideline values or thresholds using the 20$^{th}$ and/or 80$^{th}$ percentile of reference data. However, this methodology can only be applied when there is sufficient representative data.

As described in Section 2.6, there is limited existing baseline surface water quality data due to the sometimes sporadic and interrupted frequency of sampling (due to remote location, ephemeral flows and the coronavirus pandemic). Therefore, the baseline site-specific surface water quality data cannot yet be relied upon to assess and assign localised guideline values.

Therefore, the interim water quality guideline values have been drawn from published guideline values relevant to the Project location and known or potential surface water environmental values and are presented in Table 3. These interim guideline values meet the management intent of the EPP Water for protection of environmental values associated with surface waters. The interim water quality guideline values are proposed to be used as interim WQOs until sufficient data is available from the Receiving Environment Monitoring Program (described in Section 9.3).

The proposed interim *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* guideline values for freshwaters and upland rivers are provided in Table 3 for the primary identified environmental values of aquatic ecosystems and agriculture (livestock drinking water) as well as recreational use. The latest Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZGFMWQ Online Platform, 2022) guideline values were used where available. In some instances, such as the values for livestock drinking water, updated guidelines are still being developed. In these instances, the ANZECC 2000 (ANZECC, 2000) guideline value are provided.

As can be seen in Table 3, the interim guideline values for the protection of aquatic ecosystems are typically the most conservative of the guideline values (i.e. when compared to those for livestock or recreational use). Therefore, application and adherence to these indicators will typically ensure the requirements for protection of the agricultural, recreational and amenity use environmental values are also considered and protected. The only exceptions are pH (lower bound), manganese and selenium. For these parameters, the corresponding recreational/visual guideline values are the most conservative guideline values and would be protective of the aquatic ecosystem and agricultural values.

**TABLE 3: INTERIM WATER QUALITY GUIDELINE VALUES**

| Type | Element | Default Australian and New Zealand Guidelines for Fresh and Marine Water Quality Threshold | | |
|---|---|---|---|---|
| | | **Aquatic Ecosystems – Freshwater/Upland Rivers, Slightly to Moderately Disturbed Waters (95% level of protection)** | **Livestock Drinking Water Quality** | **Recreational Use or Visual Amenity** |
| **Physico-Chemical Parameters** | pH | **6.0-7.5** | - | 6.5 - 8.5 |
| | Salinity (EC) | **250 µS/cm** | 4,000 mg/L Total Dissolved Solids (for beef cattle) which equates to approximately 5,970µS/cm EC. | - |
| | Sulphate | - | 1,000 mg/L however up to 2,000mg/L may be tolerable once stock become accustomed to the water. | 400 mg/L |
| | Dissolved Oxygen | **90 - 120%** | - | > 80% |
| | Turbidity | **15 NTU** | - | - |
| | Ammonium | **6 µg/L** | - | - |
| | Nitrogen Oxide | **30 µg/L** | - | - |
| | Nitrate | **-** | 400 mg/L Nitrate (90 mg/L Nitrate-N). | - |
| | Total Phosphorus | **10 µg/L** | - | - |
| **Surface Water - Toxicants** | Aluminium | **55 µg/L** | 5,000 µg/L | 200 µg/L |
| | Arsenic | **13 µg/L** | 500 µg/L | 50 µg/L |
| | Barium | **-** | - | 1,000 µg/L |
| | Boron | **940 µg/L** | 5,000 µg/L | 1,000 µg/L |
| | Cadmium | **0.2 µg/L** | 10 µg/L | 5 µg/L |
| | Chronium | **1 µg/L** | 1,000 µg/L | 50 µg/L |
| | Copper | **1.4 µg/L** | 1,000 µg/L | 1,000 µg/L |

| Type | Element | Default Australian and New Zealand Guidelines for Fresh and Marine Water Quality Threshold | | |
|---|---|---|---|---|
| | | **Aquatic Ecosystems – Freshwater/Upland Rivers, Slightly to Moderately Disturbed Waters (95% level of protection)** | **Livestock Drinking Water Quality** | **Recreational Use or Visual Amenity** |
| | Iron | **-** | - | 300 µg/L |
| | Lead | **3.4 µg/L** | 100 µg/L | 50 µg/L |
| | Manganese | **1,900 µg/L** | - | 100 µg/L |
| | Nickel | **11 µg/L** | 1,000 µg/L | 100 µg/L |
| | Selenium* | **5 µg/L** | 20 µg/L | 10 µg/L |
| | Silver | **0.05 µg/L** | - | 50 µg/L |
| | Uranium | **0.5 µg/L** | 200 µg/L | - |
| | Zinc | **8 µg/L** | 20,000 µg/L | 5,000 µg/L |
| | Calcium | **-** | 1000 mg/L | - |
| | Hardness (as $CaCO_3$) | **-** | - | 500 mg/L |
| **Surface Water - Biological Indicators** | Microalgal (Chlorophyll-a) | **5 µg/L** | - | - |

* 99% protection

## 3.2 Water Act

The Water Act is the principal legislation for the sustainable management of Queensland's water resources. The Water Act provides the framework within which surface water resources are planned, allocated and used in Queensland. The surface water provisions of the Water Act are administered by the DLGWV.

The management of surface water resources is achieved through the following key measures:

- Granting authorisations for taking or interfering with surface water; and
- Preparing water plans for any part of Queensland, reserving unallocated water resources, as well as prescribing processes for releasing unallocated water.

These surface water management measures are described in the sections below.

The Water Act also defines the properties of watercourses and drainage features. As discussed in Section 2.2, DLGWV has previously assessed the natural surface drainage within the Project site and its surrounds and determined that the Woolgar River meets the Water Act definition of a watercourse. Various other smaller drainage features were also identified within the Project site and its surrounds.

### 3.2.1 Water Act Authorisations

The Water Act authorises the take or interference with surface water under specific circumstances (e.g. emergencies, stock watering, etc). For mining activities authorised under an EA, the Water Act authorises:

- The take of overland flow (i.e., only water that is not in a watercourse or lake); and
- Interference with the flow of any surface water by impoundment (e.g., a dam, weir or excavated water storage) or diversion, provided that the impacts have been assessed as part of the EA approval process and the EA contains appropriate conditions.

The take of overland flow as part of the proposed site drainage arrangements is described in Section 7.3.1. The impoundment of surface water as part of the Project operations is described in Section 4.3.7. The Project's surface water flow effects and impacts are described in Section 7.3. The proponent will seek appropriate EA conditions in relation to the take of overland flow and interference with surface water. A separate authorisation (e.g., a water licence or a riverine protection permit) will not be required for these activities.

A separate authorisation will be required for any surface water take or interference that does not meet these requirements. The proponent will seek a water authorisation to access a share of the available water resources in the catchment to meet the Project's water demands. The available water resources, and the need for a water authorisation, are discussed below.

### 3.2.2 Gulf Water Plan

The Water Act allows for the Minister to prepare water plans for any part of Queensland, reserve unallocated water resources and prescribe processes for releasing unallocated water.

The Gulf Water Plan manages surface water resources within the Water Plan area. The Water Plan area comprises a total of eight catchments located in north Queensland. The Project site is located in the Flinders River catchment as defined in Schedule 3 of the Water Plan.

At the time of publication (2007), the Water Plan had reserves of 266,000 ML of unallocated water across the Flinders River catchment. The Water Plan provides a breakdown of the unallocated water by reserve type. The unallocated water is held in the following types of reserve:

- An indigenous reserve – Access to the indigenous reserve may be granted to enable indigenous communities in the Flinders River catchment area to achieve their economic and social objectives. The Water Plan indicates that 8,500 ML of unallocated water is held in the indigenous reserve.

- A general reserve – Access to the general reserve may be granted for any purpose. The Water Plan indicates that 239,650 ML of unallocated water is held in the general reserve.
- A strategic reserve – Access to the strategic reserve may be granted for 'State purposes' such as coordinated or regionally significant Projects, and other limited uses. The Water Plan indicates that 17,850 ML of unallocated water is held in the strategic reserve for State purposes.

The proponent submitted an application to DLGWV for the Project to be formally determined to be a 'Project of Regional Significance' under Section 27 of the Water Plan in December 2021. The application assessment process is ongoing.

As a Project of Regional Significance, the Project will be eligible to apply for a release of unallocated water from the strategic reserve to meet its water supply requirements. In order to access unallocated water from the strategic reserve, the proponent will obtain an agreed 'terms of release' with the State. The terms of release will specify the terms of any water entitlement. This will be given effect through a water licence issued by DLGWV in accordance with the Water Act.

The regulatory approval process for the Project of Regional Significance application and water entitlement application is set out under the Water Act and its subordinate legislation, and this process is entirely separate to the EA approval process. The proponent will progress the Water Act and EA approval processes concurrently. The Water Act approvals will be obtained prior commencement of the Project.

## 3.3 Secondary Approvals

### 3.3.1 Water Supply (Safety and Reliability) Act 2008

The *Water Supply (Safety and Reliability) Act 2008* (Qld) (WSSR Act) is the principal legislation for the regulation of dam safety in Queensland. The WSSR Act provides a framework for the identification, assessment and management of 'referable dams'. Referable dams are dams that pose a risk to human life. The DLGWV is responsible for regulating referable dams under the WSSR Act.

A dam is referable if a failure impact assessment demonstrates there would be two or more people at risk if the dam were to fail.

Initial work presented in Section 4.4.15 indicates that the Project does not involve the construction or operation of any referable dams or require approval under the WSSR Act.

# 4 SITE DRAINAGE AND WATER MANAGEMENT

Operation of the Project will inherently generate a range of water types that require management. This section describes the following aspects of the Project site drainage and water management:

- Section 4.1 – Key objectives for site water management.
- Section 4.2 – Water types generated by the Project.
- Section 4.3 – Key water management strategies.
- Section 4.4 – Mine water management system components.

## 4.1 Water Management Objectives

The key objectives for site water management are to:

- Maximise the re-use of mine affected water and avoid the need for any discharge of mine affected water.
- Minimise the demand for external water supply, and
- Ensure all sediment affected water is directed to appropriate sediment control structures to manage the potential for downstream sedimentation.

Section 4.3 details the key water management strategies that will support these key objectives.

## 4.2 Water Sources and Types Generated by the Project

The Project operations will generate the following waters that will require management:

- Open cut pit water (or 'pit water'), comprising runoff from open cut pit catchments and any groundwater inflows to open cut pits.
- Runoff from the heap leach pads.
- From the third year of mining operations, Tailings Storage Cell return water, comprising runoff from the Tailings Storage Cell catchment and supernatant water released from the deposited tailings.
- Runoff from the Mine Infrastructure Area (MIA), including the Run of Mine (ROM) ore stockpile area.
- Drainage from the WRDs including the Co-placement Cell (CPC) and temporary low grade ore stockpile areas located within the Central WRD footprint,
- Runoff from other cleared and disturbed areas, including:
  - Mine pre-stripping areas,
  - Soil stockpile areas.
  - Haul roads; and
  - Areas undergoing rehabilitation
- Runoff from undisturbed areas.

The key focus of water management for the Project will be the management and containment of pit water, tailings return water, runoff from heap leach pads, drainage from the WRDs, runoff from the MIA, including the ROM ore stockpile area. These waters are referred to as 'mine-affected water (MAW)' later in this report.

Table 4 below summarises the potential sources of water expected to be generated by the Project and their proposed classification. The key strategies and considerations for managing these waters are explained further in Section 4.3. Section 4.4 describes key components of the mine water management system.

**TABLE 4: POTENTIAL SOURCES OF WATER AND CLASSIFICATION SUMMARY**

| Potential Source of Water | Description | Classification |
|---|---|---|
| **Open Cut Pit Water (pit water)** | Runoff and groundwater ingress (groundwater inflows are to BVS Pit only as BV1 and BV2 Pits are located above the water table) from the open cut pits. | Mine affected water (MAW) |
| **Mine Infrastructure Area (MIA) and Run of Mine (ROM) Ore Stockpile Area.** | Runoff from the MIA and ROM ore stockpile area. | Mine affected water (MAW) |
| **Heap Leach Pads** | Runoff originating from the heap leach pads. | Mine affected water (MAW) |
| **Tailings Storage Cell Return Water** | Runoff from the Tailings Storage Cell catchment and supernatant water released from the deposited tailings. | Mine affected water (MAW) |
| **Waste Rock Dumps (WRDs)** | ■ Drainage originating from the Northern and Southern WRDs which will store only non-acid forming (NAF) waste rock.<br>■ Drainage originating from the NAF storage areas of the Central WRD. | Mine affected water (MAW)[2] |
| **Central WRD Eastern Slope and Co-Placement Cell (CPC)** | ■ All runoff and seepage from the potentially acid forming (PAF) mine wastes (PAF waste rock and dewatered tailings) stored in the co-placement cell (refer to Section 4.4.2.2).<br>■ Drainage from the eastern slope of the Central WRD will also be directed to MWD 2 for containment as a precautionary measure in the event of any spillage of PAF mine wastes. | Mine affected water (MAW) |
| **Runoff from Cleared and Disturbed Areas** | Stormwater runoff originating from:<br>■ Mine pre-stripping areas,<br>■ Soil stockpile areas; and<br>■ Areas undergoing rehabilitation. | Sediment affected water |
| **Haul Roads** | Runoff from mine haul roads. | Sediment affected water |
| **Runoff from Rehabilitated Areas and Undisturbed Areas.** | Runoff originating from undisturbed catchments and completed areas of rehabilitation. | Clean water |
| **Raw Water Supply** | Source, storage and use of raw water. | Raw water |

## 4.3 Key Water Management Strategies

In support of the water management objectives stated above (Section 4.1), the Project mine water management system (WMS) will adopt the following key strategies described below.

[2] Controlled release of excess water is proposed by SMC as an approval condition. The water balance modelling will be updated to include the containment, re-use and controlled release of WRD drainage during the development of the Mine Water Management Plan, prior to the commencement of mining activities. As such, the water balance modelling results (Section 6.2) have not considered the containment, distribution, reuse and potential release of WRD drainage. Refer to Section 4.4.2 for details.

### 4.3.1 Segregation of Waters Based on Source and Quality

Consistent with good practice for mine water management, it is intended, wherever practicable and achievable, to passively divert clean water runoff originating from undisturbed catchments around the mine WMS. The exclusion of clean, uncontaminated runoff will reduce the volume of MAW and sediment affected water generated onsite, reducing the requirement for additional containment and management. Runoff originating from mine disturbance areas that could contain contaminants other than sediment will be captured and contained within the WMS and selectively utilised to satisfy those mine water demands for which its reuse is deemed suitable.

Catchment drains, bunding and other devices will be used wherever feasible and practicable to reduce the risk of clean water flows entering the mine WMS.

### 4.3.2 Water Demands and Sources

Water is required to support both the construction and operation of the Project. During the Project construction phase, water will be sourced from the existing Sandy Creek Dam which is located approximately 10km northeast of the Project site (Figure 9). During operations MAW will be preferentially used to meet all demands for which reuse of MAW is suitable i.e., process water and dust suppression. This will ensure that the Project's reliance on an external water supply is reduced as much as practical. In addition, the continual draw on stored inventories of MAW will increase storage capacity for future rainfall runoff and pit dewatering events. Project water demands for which reuse of MAW is unsuited (e.g., potable) or when supply of MAW is unavailable, raw water will be sourced from the Woolgar River which will be stored in the Raw Water Dam (RWD, refer to Section 4.3.7 for more details on the Project raw water supply). In the event that raw water is unavailable from the RWD additional supply is available from Sandy Creek Dam (Figure 9).

Table 5 below summarises Project water demands, water sources and supply priorities. A detailed breakdown of water demands for the Project is provided in Section 5.3.5.

**TABLE 5: PROJECT WATER DEMANDS - SOURCE PRIORITY**

| Project Water Demand | Potential Water Source | | |
|---|---|---|---|
| | TSC Stormwater Pond | Mine Water Dam 2 | Raw Water Dam[1] |
| **Process Water** | First priority | Second priority (via Process Water Dam) | Third priority |
| **Dust Suppression and Construction water** | | First priority | Second priority |
| **Potable** | | | First priority |

1 Construction water will be taken from Sandy Creek Dam prior to the construction and filling of the Raw Water Dam

### 4.3.3 Minimise Volumes of Mine Affected Water Generated and Stored Onsite

Potential volumes of MAW generated onsite will be minimised wherever practical and, as noted above, stored volumes of MAW will be preferentially sourced to satisfy those Project water demands for which reuse of MAW is suitable. This will be achieved as follows:

- Dewatering of MAW from BVS, BV1 and BV2 pits will be transferred to MWD 1 which is a primary storage for MAW.

- Seepage and surface runoff from the Central WRD CPC Cell and the eastern slope of the Central WRD and MIA Dam dewatering will be transferred to MWD 2. MWD 2will also receive make-up supply from MWD 1.
  - MAW stored in MWD 2 will be preferentially sourced for Project water demands (refer to Section 5.3.5) wherever possible. This serves to provide a continual draw on the stored inventory of MAW, thus ensuring that the capacity to receive future pit dewatering is optimised and reliance on an external raw water source is minimised. Any excess water in MWD 2 will be transferred to MWD 1.
  - Following completion of mining activities in years 1 and 2, the BV1 and BV2 pit voids will be available for additional buffer MAW storage as required. MAW temporarily stored in the BV1 and BV2 voids will be transferred back to MWD 1 once storage capacity becomes available.
- Runoff and seepage from the heap leach pads will be captured in the heap leach pad stormwater pond which will subsequently be transferred to the Tailings Storage Cell (TSC) Stormwater Pond. Water from the TSC Stormwater Pond (including tailings decant and stormwater runoff) will be reused in the process water system.
- Raw water will be stored onsite in the Raw Water Dam (RWD) and will be used to satisfy those Project water demands for which reuse of MAW is unsuitable (e.g., potable demands) or when the stored inventory of MAW or process water has been exhausted.

#### 4.3.3.1 Containment of Waste Rock Dump Drainage

Runoff from the NAF storage areas of the WRDs (i.e. other than the Central WRD CPC and eastern slope, discussed above) and the Temporary Ore Stockpile area will be contained in a series of catch dams (CDs) and re-used for mine water supply as required. Any excess WRD drainage water will be released in accordance with EA controlled release conditions (refer to Section 4.4.2).

### 4.3.4 Containment and Release of Sediment Affected Water

Sediment-affected runoff originating from cleared, disturbed areas, and haul roads is expected to be suitable for discharge following primary treatment for suspended solids through an erosion and sediment control system. SMC will develop and implement an Erosion and Sediment Control Plan (Section 9.2) for all stages of the Project which will address the management of erosion and sedimentation within the Project site.

### 4.3.5 Containment and Release of Mine Affected Water

Water balance assessment (Section 5) of the conceptual mine WMS has confirmed that the capacity of the MAW storages and associated water transfer network detailed in Table 22 and Table 21 respectively) have been sized to ensure the containment of all potential pit dewatering volumes. SMC will conduct additional water balance modelling prior to the commencement of mining activities to define the controlled release requirements for MAW. As such, SMC will seek EA controlled release conditions designed to ensure any controlled releases do not result in environmental harm to the receiving environment.

### 4.3.6 Mine Affected Water Transfer System

The MAW transfer system serves to meet the following objectives:

- Dewatering and transfer of water from the open cut pits to MWD 1.
- Transfer of water from the MIA Dam to MWD 2.
- Balance transfers as required between:
  - MWD 1 and BV1/BV2; and
  - MWD 1 and MWD 2
- Transfer of stormwater from the Heap Leach Stormwater Pond to the TSC Stormwater Pond; and

- Supply of water to meet Project consumptive demands e.g., transfer from the TSC Stormwater Pond and MWD 2 to the Process Water Dam (PWD) for process demand, supply from MWD 2 to the dust suppression water fill point.

### 4.3.7 Raw Water Supply

The Project will require an external water supply. The external water supply will involve the abstraction of surface water from an offtake located on the Woolgar River. The Woolgar River offtake and associated infrastructure will be located in the north-western part of the Project site, on the southern bank of the Woolgar River channel (Figure 2).

The offtake will comprise:

- A small, excavated sump in the Woolgar Riverbank, adjacent to the riverbed. The off-channel sump will be approximately 10 m wide x 20 m long at its base. The internal batter slopes of the sump will be lined with rock and/or concrete. The sump inlet will be a small rock gabion weir. The rock gabion will reduce sediment accumulation in the sump.
- Pump suction pipes from the off-channel sump to the pump station at the top of the riverbank and an access ramp from the pump station to the river bed with a 10H:1V gradient.
- A pump station including a hardstand area, pumping equipment and access track located on the Woolgar River floodplain (outside of the river channel).

The offtake construction will occur during the dry season when the Woolgar River is not flowing, to ensure dry working conditions. As part of construction activities, vegetation will be cleared from the footprint of the offtake. Topsoil and subsoil will be stripped from this area and stockpiled for reuse in rehabilitation.

Once the offtake is commissioned, a shallow pumping pool will form in the sump at the start of the following wet season. The Woolgar River experiences significant flows that will inundate the sump and submerge the pumping equipment at the base of the riverbank. Due to the significant excess flow in the river, the water level in the river will remain high for extended periods during the wet season. At the end of the wet season, the volume of water flowing in the river will decrease. This will cause the water level in the river to fall. When the water level in the river falls below the sump inlet, water will cease to flow into the sump. Following the cessation of flow into the sump, the residual pumping pool will rapidly dissipate due to infiltration and evaporation. Hence, the presence of a pumping pool in the sump will be largely limited to the wet season when the Woolgar River is in flow.

During mining operations, water will be pumped to the Raw Water Dam via the pumping station and a dedicated pipeline. The rate, duration and volume of surface water abstraction will be controlled via a metered valve at the Woolgar River pump station in order to reduce its effects on low flows in the Woolgar River. The abstraction will be undertaken as follows:

- A 5 $m^3/s$ (i.e., 432 ML/day) trigger has been adopted for abstraction of surface water from the Woolgar River offtake. When flows are less than or equal to 5 $m^3/s$ there will be no abstraction of surface water from the offtake. The trigger has been adopted to ensure that potential abstraction of water will not impact low flows which are an important component of the hydrological flow regime in highly ephemeral systems such as the Woolgar River at the Project site.
- When flows in the Woolgar River are between 5 and 6.5 $m^3/s$, the abstraction rate will be adjusted to ensure that flows in the Woolgar River remain greater than or equal to 5 $m^3/s$.
- When flows in the Woolgar River are greater than 6.5 m3/s, the maximum abstraction rate will be 1.5 $m^3/s$. This will ensure that flows in the Woolgar River remain greater than or equal to 5 $m^3/s$.

On completion of mining, the offtake will be removed, the off-channel sump will be backfilled to reinstate the pre-mining riverbank surface and the disturbed areas will be rehabilitated.

As a contingency, additional raw water may also be supplied from the existing Sandy Creek Dam, if required.

## 4.4 Mine Water Management System Components

The Project involves developing three open cut mining pits and constructing mine infrastructure to support the mining activities. Figure 2 shows the conceptual location of pits and key mine infrastructure. The following sections provide a description of the key components of the mine water management system.

### 4.4.1 Open Cut Pits

No mining activities are proposed within the Woolgar River, and mining activities have been designed to avoid interference with this watercourse. Hence, a watercourse diversion will not be required for the Project.

The guideline *Structures which are dams or levees constructed as part of environmentally relevant activities* (Qld Gov, 2025) and the associated *Manual for assessing consequence categories and hydraulic performance of structures* (Qld Gov, 2025) require that a levee is constructed to prevent the ingress of flood water into open cut mining areas during flood events up to the 0.1% (1 in 1,000) AEP. The open cut mine layout has been specifically designed to avoid encroachment of the open cut pits on the 0.1% (1 in 1,000) AEP flood extents associated with this watercourse (Figure 29). On this basis, no mine flood protection levees are required to manage Woolgar River flood water or associated risks.

There is no requirement for levees to prevent the ingress of flood water into open cut mining areas during flood events larger than the 0.1% (1 in 1,000) AEP. The 0.1% AEP flood is a very rare flood event that has a 0.1% chance of occurring in any year and has an average recurrence interval of approximately 1,000 years. There is an extremely low probability (less than 0.1% in any year) that a larger flood will occur during the operating life of the mine or post mine closure. The potential risks of flooding to people and the environment are therefore extremely low.

#### 4.4.1.1 BVS Pit

BVS Pit water will comprise groundwater inflow and incident rainfall and runoff from contributing pit catchment.

The north-eastern part of the BVS Pit footprint is traversed by Drainage Features 1 and 2 (Figure 5) which have a confluence within the BVS Pit footprint. Drainage Feature 2 subsequently joins drainage feature 3 before entering the Woolgar River approximately 1km km downstream of the proposed pump station (Figure 2). Prior to commencement of mining operations, a permanent Drainage Diversion will be constructed to isolate the BVS Pit catchment and divert Drainage Features 1 and 2 around (and away from) BVS Pit.

Although not part of the approval requirements for the Project, the principles of Queensland guideline Works that Interfere with water in a watercourse for a resource activity were considered as part of developing a conceptual design for the Drainage Diversion. The conceptual Drainage Diversion layout is shown in Figure 2 –. The Drainage Diversion is a 2.1 km long diversion drain that extends around the eastern and northern sides of BVS Pit. Based on the conceptual design, the hydrological characteristics of the drain will be similar to the diverted reach.

Diversion inlet works will be constructed across Drainage Feature 1and 2 to prevent creek flows entering the BVS Pit. Surface water from upstream reaches of Drainage Feature 1 and 2 will enter the diversion inlet works during (and immediately following) seasonal runoff events. The inflowing surface water will be directed to the diversion drain located at the northern end of the inlet works (on Drainage Feature 2). Surface water will flow along the diversion drain to the diversion drain outlet on Drainage Feature 1.

The BVS Pit Drainage Diversion will remain in place after mine closure.

Construction of the BVS Pit Drainage Diversion will effectively:

- Remove a 0.5 km long reach of Drainage Feature 2 between the diversion inlet works and its confluence with Drainage Feature 1, and
- Replace a 1.8 km long reach of Drainage Feature 1 with a 2.1 km long drainage channel that exhibits similar characteristics.

The geochemical testing results indicate that runoff from pit catchments will be pH neutral, with low salinity and low concentrations of metals.

During operations, any pit water within BVS Pit will be pumped to MWD 1 and reused in the mine water management system as a water supply.

#### 4.4.1.2 BV1 and BV2 Pit

The EAR Groundwater Report concludes that BV1 Pit and BV2 Pit are located above the groundwater table and will not receive groundwater inflows.

Prior to commencement of mining operations, permanent clean water drains will be constructed to isolate the BV1 and BV2 Pit catchments and divert runoff from upstream areas around (and away from) the pits (Figure 15). These pits will only generate limited volumes of pit water during mining operations as a result of direct rainfall to the pits and limited runoff from the isolated pit catchments. These pits may also be used for contingency storage for pit water from BVS Pit.

The geochemical testing results indicate that runoff from pit catchments will be pH neutral, with low salinity and low concentrations of metals.

During operations, any pit water within BV1 Pit and BV2 Pit will be pumped to MWD 1 and reused in the mine water management system as a water supply.

### 4.4.2 Drainage from Waste Rock Dumps

#### 4.4.2.1 Northern and Southern WRDs

The Northern and Southern WRDs will store only non-acid forming (NAF) waste rock. The results of the geochemical testing (BVS EAR *Geochemistry Report*) indicate that drainage (runoff and seepage) from the NAF waste rock will be pH neutral to slightly alkaline, with low salinity and low concentrations of metals and metalloids.

The WRDs will have perimeter toe drains and collection dams that will collect and contain drainage from the stored waste rock (Figure 2). WRD drainage in collection dams will be re-used for mine water supply. Any excess WRD drainage water will be released in accordance with EA controlled release conditions.

The EA controlled release conditions will be designed to ensure any controlled releases do not result in environmental harm to the receiving environment. The controlled release water quality limits will align with the relevant *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018) limits for aquatic ecosystem protection or baseline receiving water quality, in order to ensure the protection of the receiving environment, including downstream aquatic ecology.

#### 4.4.2.2 Central WRD

The Central WRD will also store predominantly NAF waste rock but will also include a co-placement cell for the storage of potentially acid forming (PAF) mine wastes (PAF waste rock and dewatered tailings). The co-placement cell will be located in the centre of the WRD and will be surrounded by a large volume of NAF waste rock with significant excess acid neutralising capacity. The co-placement cell waste materials will make up approximately 15% of the total mine waste stored in the Central WRD. All runoff and seepage from the PAF mine waste stored in the co-placement cell will be collected and transferred to Mine Water Dam 2 (MWD 2) for containment and re-use as mine water supply. Drainage from the eastern slope of the Central WRD will also be directed to MWD 2 for containment, as a precautionary measure in the event of any spillage of PAF mine wastes.

Drainage from the NAF waste rock around northern, western and southern perimeter of the Central WRD will be collected in perimeter toe drains and directed to catch dams for storage (Figure 2). WRD drainage stored in collection dams will be re-used for mine water supply. Any excess WRD drainage water will be released in accordance with EA controlled release conditions.

SMC will update the mine water balance modelling to include the containment and controlled release of drainage from the WRDs and temporary ore stockpiles (Section 4.4.8) during development of the Water Management Plan, prior to the commencement of mining activities.

Table 6 below summarises key conceptual design information for the WRD catch dams.

**TABLE 6: WRD CATCH DAMS SUMMARY**

| Catch Dam | Waste Rock Dump | Availability | Max. Catchment Area (ha) | Conceptual Containment Capacity (ML) |
|---|---|---|---|---|
| **CD1** | Central WRD | Life of mine | 189 | 44 |
| **CD2** | Central WRD | Life of mine | 57 | 14 |
| **CD3** | Central WRD | Life of mine | 35 | 9 |
| **CD4** | Northern WRD | Life of mine | 21 | 5 |
| **MIA CD** | Northern MIA | Life of mine | 0.8 | 1 |
| **CD5** | Southern WRD | From year 8 | 61 | 14 |

[1] 1:1 AEP 5-hday storm volume.

[2] Equal to settling zone volume.

### 4.4.3 Heap Leach Pad Runoff

Ore mined from BV1 Pit and BV2 Pit during the first two years of mining will be processed on fully lined heap leach pads. The heap leaching process will produce spent heap leach residues. However, the spent heap leach ore will be reprocessed in the CIL Plant.

Runoff from the heap leach pads will be contained by perimeter bunds and collected in a dedicated fully lined stormwater pond. The pond lining will ensure that there is no potential for seepage to the receiving environment. The heap leach ponds will have sufficient storage capacity to ensure nil discharge. Stormwater from the heap leach stormwater pond will be reused in the heap leach process and/or pumped to the Tailings Storage Cell Stormwater Pond. The Heap Leach Pads Stormwater Pond has been sized through water balance assessment at 140 ML (Section 5.4) which is sufficient to prevent an uncontrolled (overflow) discharge under the range of assessed climatic conditions.

### 4.4.4 Tailings Return Water

The Tailings Storage Cell (TSC) will be a lined containment structure that will store approximately 3.15 GL of tailings (settled solids) produced in the CIL Plant. The Tailings Storage Cell (TSC) will be constructed in the southern part of the Project site, south of the BVS Pit. It will have a separate stormwater pond for the storage of tailings decant water and stormwater from the TSC.

Tailings water will comprise incident rainfall and runoff from the TSC catchment and water released from the stored tailings. Geochemical testing results show that water from the stored tailings will be pH neutral to slightly alkaline, with low salinity and low concentrations of metals and metalloids.

Tailings will be pumped to the TSC from the CIL Plant as a slurry. Tailings solids will settle out of suspension within the Tailings Storage Cell and will release water as supernatant and seepage. Water released from the deposited tailings will drain to a decant pond. Tailings return water will be pumped from the decant pond using a pontoon

mounted pump located on the pond surface. Tailings return water will be pumped to the TSC Stormwater Pond for reuse in the CIL Plant, via a dedicated pipeline.

The TSC has been designed with an internal embankment. The internal embankment includes an engineered spillway. The internal embankment partitions the TSC into two compartments – the tailings storage area (including the decant pond) and the TSC Stormwater Pond. During rainfall events, runoff from the surface of the stored tailings (as well as water released from the stored tailings) will accumulate in the decant pond. Excess stormwater that collects in the decant pond during extreme wet period will passively overflow to the Tailings Storage Cell Stormwater Pond via the spillway. The TSC Stormwater Pond has been sized through water balance assessment at 550 ML (Section 5.4) which is sufficient to prevent an uncontrolled (overflow) discharge under the range of assessed climatic conditions.

TSC stormwater, heap leach pad stormwater and tailings return water that collects in the TSC Stormwater Pond will be returned to the CIL plant over the life of the mine, via the Process Water Dam. The operation of the Process Water Dam is described in Section 4.4.5.

### 4.4.5 Process Water Dam

The Process Water Dam (PWD) is located adjacent to the CIL Plant and is the primary source of water for the Plant. The PWD will receive pumped inflow from the TSC Stormwater Pond and will subsequently supply the CIL Plant as required. The PWD has been sized at 10 ML which will provide approximately 1 weeks of process demand supply based on an annual process demand of 442 ML (Table 18, years 3-11).

### 4.4.6 Mine Industrial Area Runoff

The MIA catchment comprises an area of approximately 14.1 ha including the ROM ore stockpile area, the CIL Plant, the MIA area, a warehouse and office area and a workshop area. The MIA areas will remain constant over the mine life.

Runoff from the MIA may contain elevated levels of suspended sediment, hydrocarbons, and other potential contaminants associated with the servicing of mine plant and equipment. MIA catchments with special treatment requirements (e.g. workshops) will be isolated with diversion drains and/or bunding as required, with runoff treated using appropriate technologies (e.g. oil separators).

High-grade ore will also be stockpiled in the ROM area for processing during mining operations. The geochemical testing results presented in the EAR Geochemistry Report show that seepage and runoff from the ROM ore stockpiles is likely to be benign with low concentrations of metals. The ROM ore will be stockpiled on a dedicated pad within the MIA catchment. The stockpile pad will have a compacted base to minimise seepage. The pad will be graded to direct runoff to a collection drain that will be constructed around the perimeter of the pads to collect seepage and runoff from the stockpile.

Runoff from the MIA will be captured in collection drains and directed to the MIA Dam. The MIA Dam is a dedicated containment dam that has been sized through water balance assessment at 75 ML (Section 5.4) which is sufficient to prevent an uncontrolled (overflow) discharge under the range of assessed climatic conditions. Runoff from the MIA catchment that collects in the MIA Dam will be transferred to MWD 2 and reused for Project water demands such as process supply and dust suppression.

### 4.4.7 Runoff from Low Grade Ore Stockpiles

Low grade ore will be stockpiled within the temporary ore stockpile area prior to processing during mining operations. The temporary ore stockpile area will be located within an appropriate MAW catchment, generally at the southern end of the Central WRD footprint (Figure 2). Stockpile locations will have a compacted base to minimise seepage.

The geochemistry assessment presented in the *Geochemistry Report* concluded that all of the low-grade ore will be NAF with excess acid neutralising capacity. The low-grade ore will therefore have a high factor of safety with respect to potential for acid generation and drainage water will not contain any concentrations of contaminants that could pose a risk to the downstream receiving environment.

Temporary ore stockpile areas will be constructed in a manor the directs runoff to MAW dams for storage and re-use as mine water supply, or release in accordance with the EA controlled release conditions.

### 4.4.8 Runoff from Hydrocarbon and Chemical Storage Facilities

Hydrocarbon and chemical storage will be managed in accordance with standard practice at mine sites. Proposed management measures include adequate bunding or storage areas, and immediate clean-up of any spills. These measures are designed to prevent the contamination of surface water. Given the controls that will be adopted, the Project is not expected to give rise to surface water contamination as a result of hydrocarbon and chemical contamination.

### 4.4.9 Runoff from Pre-Stripping Areas and Soil Stockpiles

Runoff from areas cleared in advance of mining operations and soil stockpiles may contain elevated levels of suspended sediment. Runoff from these areas will be allowed to passively drain from site following the control of suspended sediment. This will include collecting runoff and directing it through sediment control structures, as necessary, to limit any potential downstream sedimentation or water quality impacts. Runoff from these areas will be managed in accordance with an Erosion and Sediment Control Plan (Section 7.2.2).

### 4.4.10 Haul Road Runoff

Runoff from the haul roads may contain elevated levels of suspended sediment. Runoff from the haul roads will be managed in accordance with an Erosion and Sediment Control Plan (Section 7.2.2). This will include measures such as collecting haul road runoff and directing it through sediment control structures prevent any potential downstream sedimentation or water quality impacts.

### 4.4.11 Runoff from Rehabilitated and Undisturbed Areas

Wherever possible, the mine layout has been designed to avoid collection of runoff from rehabilitated and undisturbed areas. Where necessary, runoff from rehabilitated and undisturbed areas will be diverted around (and away from) areas disturbed by mining activities and allowed to drain from site.

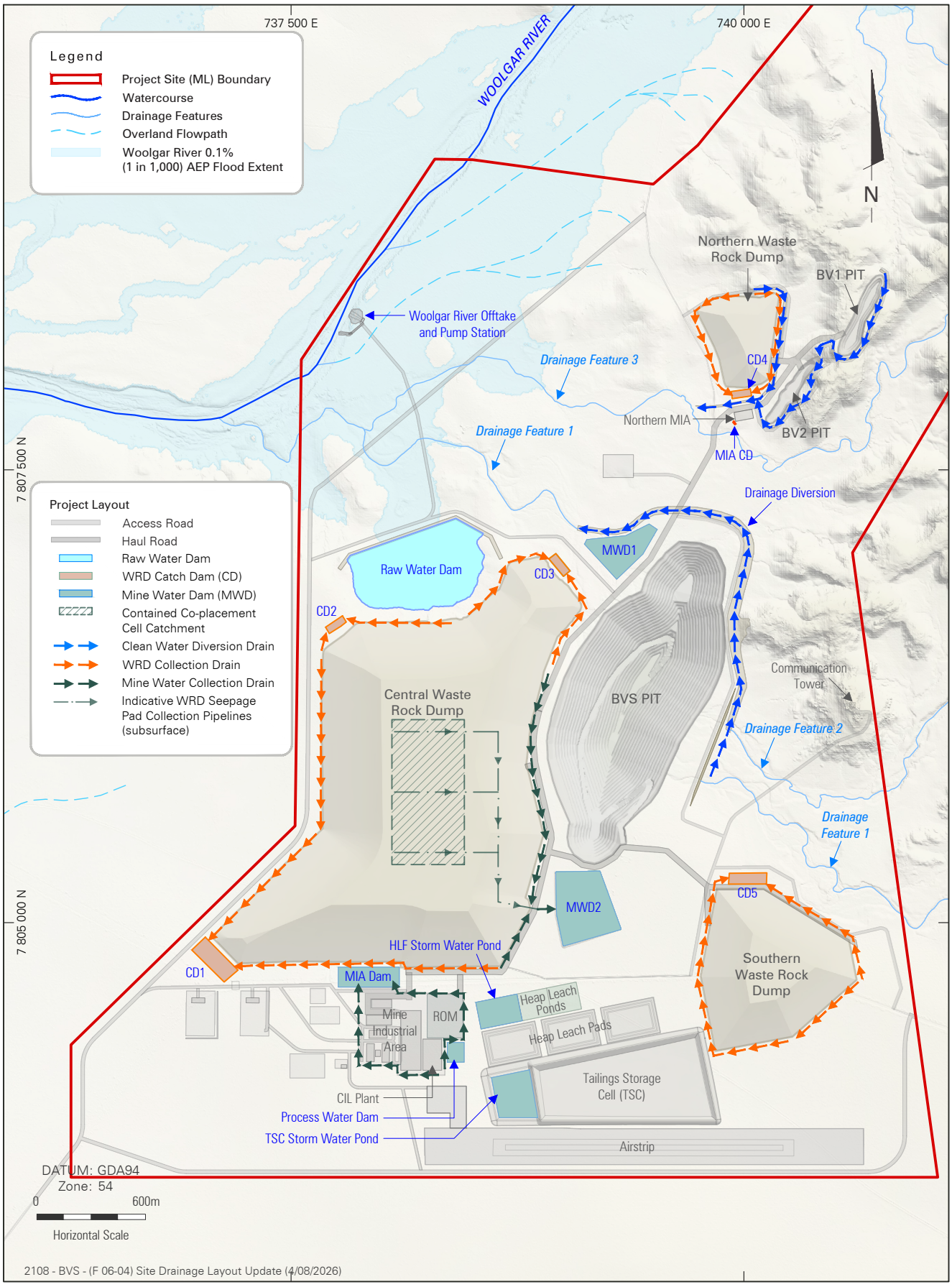
### 4.4.12 Mine Progression

Mine development and progression will be staged over the proposed 11-year Project LOM. The footprint associated with key Project activities such as the open cut pits and waste rock dumps will change as the mine progresses. Mine development will include the progressive clearance of land to facilitate open cut pit and waste rock dump progression, a period of operation and subsequent rehabilitation. Waste rock dump rehabilitation will commence though the later part of the Project operational phase and continue following cessation of active mining after year 11. Key water management infrastructure associated with the Project is shown in Figure 17 and listed in Table 7 below.

**TABLE 7: WATER MANAGEMENT INFRASTRUCTURE PLAN**

| Year | Mine Plan | Water Management Infrastructure |
|---|---|---|
| 1 | ■ BVS and BV1 Pits Active.<br>■ Central and Northern Waste Rock Dumps.<br>■ Tailings Storage Cell (TSC). | ■ Mine Water Dam 1 and 2.<br>■ Raw Water Dam.<br>■ MIA Dam. |

| Year | Mine Plan | Water Management Infrastructure |
|---|---|---|
| | | ■ Process Water Dam.<br>■ Heap Leach Ponds.<br>■ Tailings Storage Cell Stormwater Pond.<br>■ Northern MIA CD.<br>■ Catch Dams CD1 to CD4. |
| **2** | ■ Complete BV1 Pit Operations.<br>■ BV2 Pit Active. | BV1 pit available for MAW storage if required. |
| **3** | ■ Complete BV2 Pit Operation.<br>■ BVS Pit Active. | BV2 pit available for MAW storage if required. |
| **5** | Northern WRD Rehabilitation Completed. | |
| **8** | ■ Commence Southern Waste Rock Dump.<br>■ Commence Progressive Rehabilitation of Central WRD. | Catch Dam CD5. |
| **11** | ■ End of Mining Operations. | Decommission all water management infrastructure except MWD 2. |
| **11-22** | ■ Rehabilitation and Closure Activities. | Pumped transfer of excess water from MWD 2 to BVS Pit (ongoing management of seepage and runoff from the Central WRD CPC until cover is installed and functional). |




BIG VEIN SOUTH GOLD PROJECT

Figure 15: Site Drainage and Water Management
Infrastructure Layout

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### 4.4.13 Summary of key water management structures

Key water management structures are summarised below in Table 8.

**TABLE 8: KEY WATER MANAGEMENT SYSTEM STRUCTURES**

| Water | Key Infrastructure/Process |
|---|---|
| **Clean Water System** | ■ BVS Pit Drainage Diversion.<br>■ BVS, BV1 and BV2 Pits clean water diversion drains. |
| **Raw Water System** | ■ Woolgar River pump station and offtake.<br>■ Raw Water Dam.<br>■ Transfer and distribution pipelines. |
| **Mine Affected Water System** | ■ Mine Water Dams 1 and 2.<br>■ CD1 – CD5.<br>■ MIA Dam.<br>■ Northern MIA CD.<br>■ Heap Leach Ponds/Stormwater Pond.<br>■ Tailings Storage Cell/Stormwater Pond.<br>■ Process Water Dam.<br>■ Mine affected water transfer system. |
| **Sediment Affected Water System** | ■ Erosion and sediment control measures as required by the Project Erosion and Sediment Control Plan (ESCP, Section 9.2). |

### 4.4.14 Preliminary Consequence Category Assessment for Water Management Structures

A preliminary consequence category assessment (CCA) has been completed for all proposed Project water management structures as per guidance provided by the Manual for assessing consequence categories and hydraulic performance of structures ('the Manual', (Qld Gov, 2025)). Table 9 below summarises the preliminary CCA. In summary, the TSC, the heap leach ponds, the MIA Dam, the PWD, catch dams and Mine Water Dams 1 and 2 are assessed to be regulated structures. The Raw Water Dam is assessed as a low consequence structure and therefore is not a regulated dam. The diversion inlet works (levee) directing flow from Drainage Features 1 and 2 into the BVS drainage diversion (Figure 15) has been assessed as a regulated structure as per (Qld Gov, 2025) as flood modelling (Appendix A) indicates BVS Pit would be encroached by the 0.1% AEP flood event for the diverted drainage features (Figure 29). Final consequence categories will be determined through the certified system design plan (SDP). The SDP will be developed as the project design progresses and will draw upon specific information regarding dam sizes and designs as well as expected water quality.

**TABLE 9: PRELIMINARY CONSEQUENCE CATEGORY FOR WATER MANAGEMENT STRUCTURES**

| Dam | Harm to Humans | | | General Environmental Harm | | | General Economic Loss or Property Damage | | | Overall Consequence Category |
|---|---|---|---|---|---|---|---|---|---|---|
| | FC-S | FC-O | DB | FC-S | FC-O | DB | FC-S | FC-O | DB | |
| **MWD 1** | L | L | L | L | S | S | L | L | S | S |
| **MWD 2** | L | L | L | L | S | S | L | L | S | S |
| **MIA Dam** | L | L | L | L | S | S | L | L | L | S |
| **Tailings Storage Cell** | L | L | L | L | H | H | L | S | S | H |
| **TSC Storm Water Pond** | L | L | L | L | H | H | L | S | S | H |
| **Heap Leach Ponds** | L | L | L | S | H | H | L | S | S | H |
| **PWD** | L | L | L | L | H | S | L | S | L | H |
| **All Catch Dams** | L | L | L | L | S | S | L | L | L | S |
| **RWD** | L | L | L | L | L | L | L | L | L | L |

FC-S = Failure to contain – Seepage
L = Low Consequence

FC-O = Failure to contain – Overtopping
S = Significant Consequence

DB = Dam Break
H = High Consequence

### 4.4.15 Referrable Dams

A 'referable dam' is defined within the *Water Supply (Safety and Reliability) Act 2008* (Water supply Act) as a dam where:

- A failure impact assessment was required for the dam.
- The assessment found the dam has a failure impact rating, and
- The assessment has been accepted by the chief executive administering the Water Supply Act.

A dam is required to be failure impact assessed if, following construction, any of the following are applicable:

- The dam will be more than 10m in height and have a storage capacity greater than 1,500ML, or
- A height of more than 10m, a storage capacity greater than 750ML and a catchment area more than three times the maximum surface area at full supply level.

The Project does not involve the construction of any dams that meet these criteria, and as such, based on the information presented in this report, none of the dams required for the Project are considered referrable dams.

# 5 OPERATIONAL PHASE WATER BALANCE ASSESSMENT

## 5.1 Model Development

A dynamic water balance model (WBM) has been developed for the Project using the GoldSim probabilistic modelling software. GoldSim is a Monte Carlo simulation software package that is commonly used in the mining industry for water balance modelling. The purpose of the water balance assessment is to validate the proposed mine WMS under a range of historical climatic conditions, with the aim of:

- Estimating the potential quantity and quality of MAW that may be generated by the Project throughout the LOM;
- Estimating the storage capacity required for each of the WMS dams to meet the stated MAW containment objectives;
- Confirming that the proposed operational rules are supportive of the proposed MAW containment and reuse objectives;
- Identifying the required transfer capacities to move MAW around the mine WMS so that containment, productivity (process operations) and reuse objectives are met;
- Estimating the potential volumes of raw water required to satisfy Project water demands that either:
  - Cannot be satisfied through the reuse of MAW, or
  - Are required when stored volumes of MAW are unavailable following periods of prolonged low rainfall.
- Developing an understanding of the potential risk of overflow to the receiving environment.

## 5.2 Model Description

The WBM has been developed to dynamically simulate the 11-year planned LOM plus an additional up to 11 years during which rehabilitation of the Central WRD will continue, including the installation of the store and release cover on the CPC and initial establishment of revegetation. During this Central WRD rehabilitation period MWD 2 will continue to capture drainage from the Central WRD CPC and eastern slope with any excess water transferred from MWD 2 to BVS Pit. All other WMS storages are assumed to be decommissioned at the end of the 11-year operational period, and any residual water is dewatered and pumped to BVS Pit.

The dynamic nature of the WBM allows for key model inputs such as climate data, water demands, catchment area, groundwater inflow, etc. to vary with each simulated mine year. In this manner, the WBM provides for a more representative simulation of the Project as it allows for ready identification of critical WMS stress points such as maximum MAW containment requirements and peak raw water demand.

### 5.2.1 Modelling Approach

In order to validate the performance of the proposed mine WMS under a range of historical climatic conditions, multiple simulations (known as realisations) of the 22-year simulation (11-year LOM plus 11-year Central WRD rehabilitation period) were performed. The only difference between each realisation is the input climate data (rainfall and evaporation) which consists of 133 years (1889 to 2022) of data obtained from the BoM SILO Data Drill (refer to Section 5.3.1).

Running on a daily timestep, the first model realisation simulates the proposed 11-year LOM utilising climate data from 1889 to 1911. The second realisation then utilises climate data from the period 1890 to 1912, the third from 1891 to 1913, and so on. This process allows for a total of 133 model realisations (known as a Monte Carlo simulation) to be run from the available climate data and has multiple benefits such as:

- Each year of the mine is effectively modelled for each year of the available climate data such that all potential stress points are simulated under the full range of historical climatic conditions; and

- The cyclical nature of consecutive above average wet seasons that are present in the climate data are more readily captured and their impact on the proposed mine WMS assessed.

Key model simulation assumptions are shown below in Table 10.

**TABLE 10: KEY SIMULATION ASSUMPTIONS**

| Aspect | Assumption |
|---|---|
| **Length of Simulation** | ■ 11 years for life of mine<br>■ 11 years Central WRD rehabilitation<br>■ 22 years total simulation duration |
| **Simulation Type** | Probabilistic |
| **Number of Realisations** | 133 |
| **Start/end Months for Year** | Simulation based on hydrological year (1 July to 30 June) |
| **Storage Initial Conditions** | All dams assumed empty at start of simulation |

### 5.2.2 Rainfall-Runoff

In order to estimate the potential volumes of runoff entering the proposed mine WMS, the WBM utilises the Australian Water Balance Model (Boughton, 1993). The AWBM was selected for this purpose due to its simplicity, widespread usage in many similar applications and ease of parameterisation and calibration. This conceptual rainfall-runoff model uses three independently balanced surface stores to simulate partial areas of rainfall excess. The excess rainfall is then divided into surface and baseflow stores which are then allowed to discharge at rates governed by their respective recession constants.

In order to reflect the differences in land use and runoff depth within the Project site, the WBM utilises a number of different land use types. Each utilises the AWBM to simulate the different volumes of runoff generated by each land use and is managed within the mine WMS according to its runoff characteristics. The modelled land uses are as follows:

- Natural.
- Hardstand and open cut pits.
- Tailings.
- Waste rock dumps.

Adopted AWBM parameters for each land use type are shown below in Table 11and have been based on accepted industry values and experience with similar Projects in the region.

**TABLE 11: ADOPTED AWBM PARAMETERS**

| Parameter | Description | AWBM Landuse | | | |
|---|---|---|---|---|---|
| | | Natural | Hardstand/Pits | Tailings | Waste Rock Dump |
| **A1** | Partial area | 0.12 | 0.1 | 0.134 | 0.1 |
| **A2** | Partial area | 0.44 | 0.9 | 0.433 | 0.9 |
| **A3** | Partial area | 0.44 | 0 | 0.433 | 0 |

| Parameter | Description | AWBM Landuse | | | |
|---|---|---|---|---|---|
| | | Natural | Hardstand/Pits | Tailings | Waste Rock Dump |
| **C1** | Surface storage capacity | 43 | 12 | 1.1 | 12 |
| **C2** | Surface storage capacity | 750 | 38 | 11 | 110 |
| **C3** | Surface storage capacity | 750 | 0 | 22 | 0 |
| **BFI** | Base Flow Index | 0.5 | 0 | 0.01 | 0 |
| **Kb** | Base flow recession constant | 0.7 | 0 | 0.806 | 0 |
| **Ks** | Surface flow recession constant | 0.7 | 0 | 0 | 0 |

## 5.3 Model Input Data

### 5.3.1 Climate Data

Input climate data for the WBM consists of daily rainfall and evaporation records which were sourced from the BOM SILO Data Drill. This fully synthetic data set is derived from the BOM's extensive database of recorded observations taken from its network of weather recording stations. The WBM utilises 133 years of data representing the period 1889 to 2022. Rainfall data is used by the AWBM to estimate runoff depths and subsequent runoff volumes entering the mine WMS. Rainfall directly over the water surface within each dam is also added but without any loss.

Potential evapotranspiration (PET) is used to inform the AWBM rainfall-runoff model and lake evaporation is used to estimate dam evaporative water losses. Dam evaporative losses are calculated daily with each time step and are a function of each dam's water surface area. Key assumptions for the WBM input climate data are summarised below in Table 12.

**TABLE 12: CLIMATE DATA – KEY ASSUMPTIONS**

| Aspect | Assumption |
|---|---|
| **Data Source** | SILO Data Drill obtained for Lat, Long: -19.80, 143.30 (decimal degrees) |
| **Length of Record** | 1 January 1889 to 2022 |
| **Time Increment** | Daily |
| **Rainfall** | Daily total |
| **Evaporation** | Morton's lake evaporation (i.e., water surface evaporation) |
| **Evaporation (potential evapotranspiration)** | (Morton's potential) used by AWBM rainfall-runoff model) |

### 5.3.2 Climate Change

Sensitivity of the Projects' water management system to climate change has been assessed using estimated changes to rainfall and evaporation provided by the Qld Government Climate Change Dashboard (*https://www.longpaddock.qld.gov.au/qld-future-climate/dashboard/*). A representative concentration pathway (RCP) of 8.5 was adopted and represents the most conservative estimates of potential increases to radiative forcing when compared to pre-industrial levels. Table 13 shows key assumptions adopted for the climate change assessment and Table 14 summarises the relative changes to precipitation and pan evaporation adopted for the assessment. Relative changes were applied to the SILO Data Drill input climate data described above in Section 5.3.1.

**TABLE 13: CLIMATE CHANGE ASSESSMENT - KEY ASSUMPTIONS**

| Aspect | Assumption | Comment |
|---|---|---|
| **Adopted RCP (representative concentration pathway)** | RCP 8.5 | A future with little curbing of emissions, with a $CO_2$ concentration continuing to rapidly rise, reaching 940 ppm by 2100. This scenario most closely resembles 'business as usual'. |
| **Year (adopted period for Projections)** | 2030 (based on an averaged predictions over the period 2020-2039) | Based on 11-year life of Project. |
| **Region** | Local government area – Richmond Shire | Adopted level of spatial aggregation for future climate Projections. |

**TABLE 14: ADOPTED CHANGES TO PRECIPITATION AND PAN EVAPORATION FOR CLIMATE CHANGE ASSESSMENT**

| Season | Precipitation (% Relative Change)[1, 2] | Evaporation (% Relative Change)[1, 2] |
|---|---|---|
| **Summer** | -0.3 | 5.8 |
| **Winter** | -9.4 | 8.3 |
| **Autumn** | 1.3 | 6.9 |
| **Spring** | 5.4 | 6.5 |

[1] Data represents change (%) relative to reference period 1986-2005.

2 Average of all model predictions

### 5.3.3 Mine Catchment Data

The catchment areas reporting to each dam and open cut pit have been defined on the basis of the Project staged mine layout plans. Catchment land use has been classified on the basis of the activities (e.g., waste rock dump, open cut pit/hardstand, etc.) taking place within each catchment area as noted in Section 5.2.2.

Table 15 to Table 17 summarise adopted catchment areas and assumptions for the MAW storages and open cut pits. The catchment reporting to BVS Pit is subject to change as the Pit develops throughout the LOM. All other catchment areas remain fixed for the LOM. Locations of MAW dams, pits and catchments are shown in Figure 15.

**TABLE 15: CATCHMENT DATA - MAW STORAGES**

| Dam | External Catchment (Ha) | AWBM Land Use | Comment |
|---|---|---|---|
| **Mine Water Dam 1** | 0 | N/A | ■ Turkeys nest, no external catchment.<br>■ Direct rainfall applied to water surface area.<br>■ Operational for 11-year LOM only. |
| **Mine Water Dam 2** | 127.6 | ■ 31.0 – Natural<br>■ 32.0 – Central WRD CPC operating surface<br>■ 64.6 -- Central WRD eastern slope | ■ Also receives seepage from the Central WRD CPC which has been conservatively modelled as 6% of incident rainfall over the 32 Ha CPC footprint. |
| **Heap Leach Pads Stormwater Pond** | 18.3 | Hardstand/Pits | Fixed catchment for LOM |
| **MIA Dam** | 14.1 | Hardstand/Pits | Fixed catchment for LOM |
| **Tailings Storage Cell Stormwater Pond** | 44.3 | Tailings | Fixed catchment for LOM |

**TABLE 16: CATCHMENT DATA – BVS PIT**

| Year | AWBM Land Use (ha) | | |
|---|---|---|---|
| | **Natural** | **Hardstand/Pits** | **Total (ha)** |
| **1** | 33.8 | 47.6 | 81.4 |
| **8** | 24.9 | 66.3 | 91.2 |
| **11** | 33.0 | 102.4 | 135.4 |

**TABLE 17: CATCHMENT DATA – BV1 AND BV1 PITS**

| Year | AWBM Land Use (ha) | | |
|---|---|---|---|
| | **Natural** | **Hardstand/Pits** | **Total (ha)** |
| **BV1** | 0.6 | 4.0 | 4.6 |
| **BV2** | 1.1 | 2.8 | 3.9 |

### 5.3.4 Pit Groundwater Inflow and Seepage Losses

The EAR groundwater model was used to predict groundwater inflows to BVS Pit. The predicted groundwater inflow rates from the EAR groundwater model represent the theoretical volume of groundwater take from the groundwater regime. The actual volume of groundwater pumped from the BVS Pit (that requires consideration in the WBM model) will be less than the inflow predicted by the EAR groundwater model, as a component of the groundwater will be lost to evaporation and retained moisture within the mined ore and waste rock. The EAR groundwater model inflow rates presented in the EAR Groundwater Report do not account for the abovementioned losses. A loss factor of 40% is typically applied to groundwater model inflow rates to account for these losses in the calculation of mine dewatering rates. This loss factor has been adopted for the WBM modelling. The groundwater inflow rates presented in Table 18 below reflect the actual dewatering rates adopted in the WBM model.

BV1 and BV2 Pits will be located above the groundwater table and will not receive groundwater inflows. In both BV1 Pit and BV2 Pit, the base of the open cut pit is located in the Proterozoic basement. The Proterozoic basement is an aquiclude that is essentially a dry crystalline and metamorphosed rock mass with occasional disconnected cracks that can contain groundwater. It has very low permeability that will effectively prevent seepage of intermittent pit water to the underlying groundwater table. Hence, the rate of seepage from BV1 Pit and BV2 Pit is expected to be negligible. Seepage loss from the base of BV1 and BV2 Pits were estimated using Darcy's equation for saturated flow. Seepage assumptions are summarised in Table 19.

**TABLE 18: STAGED GROUNDWATER INFLOW FOR BVS PIT**

| Mine Year | BVS Pit Inflow (ML/yr.) |
|---|---|
| **1** | 19 |
| **2** | 109 |
| **3** | 52 |
| **4** | 53 |
| **5** | 55 |
| **6** | 49 |
| **7** | 53 |
| **8** | 54 |
| **9** | 58 |
| **10** | 68 |
| **11** | 83 |

**TABLE 19: SEEPAGE ASSUMPTIONS – BV1 AND BV2 PITS**

| Aspect | Assumption |
|---|---|
| **Head** | Estimated by water balance model (depth of water stored in the pit). |

| Aspect | Assumption |
|---|---|
| **Saturated Thickness** | 100m |
| **Infiltration Area** | Estimated by water balance model (ponded area of water stored in the pit). |
| **Hydraulic Conductivity** | 0.005 m/d |

### 5.3.5 Water Demands

Modelled water demands for the Project were provided by SMC and are shown in Table 20 below.

**TABLE 20: PROJECT WATER DEMANDS**

| Year | Net Process Demand (ML/yr) | Process Description | Dust suppression (ML/yr) | Construction water (ML/yr) | Potable (ML/yr) | Total (ML/yr) |
|---|---|---|---|---|---|---|
| **1** | 150 | Heap leach makeup demand | 250 | 50 | 40 | 490 |
| **2** | 150 | | 250 | 50 | 40 | 490 |
| **3** | 642 | ■ CIL process<br>■ 100% wet tailings to TSC | 250 | 0 | 40 | 932 |
| **4** | 442 | ■ CIL process<br>■ 80% tailings to filter press<br>■ 20% wet tailings to TSC | 250 | 0 | 40 | 732 |
| **5** | 442 | | 250 | 0 | 40 | 732 |
| **6** | 442 | | 250 | 0 | 40 | 732 |
| **7** | 442 | | 250 | 0 | 40 | 732 |
| **8** | 442 | | 250 | 0 | 40 | 732 |
| **9** | 442 | | 250 | 0 | 40 | 732 |
| **10** | 442 | | 250 | 0 | 40 | 732 |
| **11** | 442 | | 250 | 0 | 40 | 732 |
| **>11** | 0 | Post closure and rehabilitation | 0 | 0 | 0 | 0 |

Table note: While the Project does not include a discrete construction phase, a construction water supply will be required in the first two years of mining for dust suppression on earthworks.

### 5.3.6 Water Transfer Capacity

Basic operating rules suitable for concept level design have been incorporated into the WBM. Model water transfer rules dictate when transfers occur, where water is transferred to and at what rate the transfer should take place. Table 21 summarises adopted model transfer capacities for the MAW system.

**TABLE 21: WATER BALANCE MODEL WATER TRANSFERS**

| Source | Destination | Assumed Pump Rate (L/s) | Comment |
|---|---|---|---|
| **BVS Pit** | MWD 1 | 100 | Pit dewatering |
| **BV1 Pit** | MWD 1 | 100 | Pit dewatering/balance transfer |
| **BV2 Pit** | MWD 1 | 100 | Pit dewatering/balance transfer |
| **MWD 1** | BV1/BV2 | 100 | Balance transfer of excess water |
| **MWD 2** | PWD[1] | 35 | As per process water demand for year 3 (Table 20) |
| **MWD 2** | MWD 1 | 400 | Transfer of excess water |
| **HLP Stormwater Pond** | TSC Stormwater Pond | 100 | |
| **TSC Stormwater Pond** | PWD[1] | 35 | As per process water demand for year 3 (Table 20) |
| **MIA Dam** | MWD 2 | 100 | |

1 Process Water Dam not explicitly modelled

### 5.3.7 WMS Schematic Diagram

Figure 16 below shows the schematic for the conceptual mine WMS as represented by the WBM.

## Legend

**Mine Affected Water System**

- MAW Dam
- Pumped MAW
- Pumped Tailings (Slurry/Decant)
- Ground Water

**Sediment Water System**

- WRD Catchment Dam

**Raw Water System**

- Raw Water Dam
- Pumped Raw Water

*CD4*

**Northern Waste Rock Dump**

*MIA CD*

Year 2 onwards (excess MAW) 100 L/s

Dewatering XX L/S

Year 3 onwards (excess MAW) 100 L/s

Dewatering 100 L/S

Operates Yr 1 only

BV1 Pit

Operates Yr 2 only

BV2 Pit

1,500 L/s

Woolgar River (Not Modelled)

Varies

WFP (Haul Road Dust Suppression)

Raw Water Dam (Not Modelled)

Secondary Process Water Supply (Varies)

Excess MAW (100 L/s)

Mine Water Dam 1

*CD2*

*CD3*

Potable (Varies)

Makeup Process Water Supply

Central Waste Rock Dump

Contained Co-Placement Cell

Runoff/ Seepage

GroundWater (Varies)

100 L/S

*CD1*

Mine Water Dam 2

BVS Pit

Secondary Process Water Supply (Varies)

Southern Waste Rock Dump

*CD5 (from Yr 8)*

MIA Dam

WFP (Haul Road Dust Suppression)

Primary Process Water Supply (Varies): Tailings Decant & Stormwater

Heap Leach Pads (x3)

Tailings Co-Disposal in Waste Rock Dumps (Dry Stack) from yr. 4

Process Supply (Varies)

Process Water Dam (Not Modelled)

Stormwater

Tailings Slurry From yr.3 (Varies, Not Modelled)

100 L/s

Process Plant
Heap Leach (yrs 1 – 2)
Carbon in-Leach (from Yr 3)

Tailings Storage Cell Stormwater Pond

Heap Leach Pads Stormwater Pond

Operations Camp / Admin

Varies

Sandy Creek Dam (Not Modelled)

Notes:

- All dams assumed to overflow to Woolgar River
- Evaporation losses and direct rainfall not shown

| | | | | | | |
|---|---|---|---|---|---|---|
| **BVS MINE WATER MANAGEMENT** | SIZE A3 | Project BNE00504_005 | FIGURE 16- BVS Water Balance Model Schematic [2026 Revision] | DRAWN/CHECKED BY SS/TW | FILENAME Figure 16: SCHEMATIC.VSD | ENGENY |
| | SCALE N/A | Status: FINAL | SHEET 1 OF 1 | DATE 31/07/2026 | | |

## 5.4 Modelling Results

### 5.4.1 Conceptual MAW Dam Capacities

The Project WMS outlined in Section 4.4 has been assessed using water balance simulation to confirm the containment and release design objectives and criteria presented in Section 4.3 can be met. Sufficient system containment and transfer capacity has been provided to prevent the uncontrolled release (i.e., spillway overflow) of MAW to the receiving environment without the requirement for controlled releases of mine affected water. The design capacities for all MAW dams are given in Table 22.

**TABLE 22: PRELIMINARY STORAGE CAPACITIES**

| Mine Affected Water Storage | Capacity (ML) |
|---|---|
| **Mine Water Dam 1** | 320 |
| **Mine Water Dam 2** | 450 |
| **MIA Dam** | 75 |
| **Heap Leach Pads Stormwater Pond** | 140 |
| **TSC Stormwater Pond** | 550 |
| **Process Water Dam (not modelled)[1]** | 10 |
| **BV1 Pit (when operating as MAW Storage)** | 271[2] |
| **BV2 Pit (when operating as MAW Storage)** | 60[2] |

1 Preliminarily sized to provide approximately 1 week of process demand assuming 1.2 ML/d demand (442 ML/yr. for years 3-11 (Table 20))

2 Total capacity of pit at the end of mining operations

Figure 17 to Figure 23 show the modelled storage inventories of each MAW dam and open cut pit. Results are presented as percentile distributions and represent the distribution water contained in each dam or pit at each model timestep (i.e., each day). The plots may be read as follows:

- The blue line represents the 50$^{th}$ percentile (median) result.
- The yellow line represents the 95$^{th}$ percentile result.
- The orange line shows the 99$^{th}$ percentile result.
- The red line indicates the maximum result, and
- The solid and dashed black lines represent the total containment capacity or maximum operating volume (if relevant) respectively.

The results show that the design storage capacities are sufficient to prevent the uncontrolled discharge of MAW.

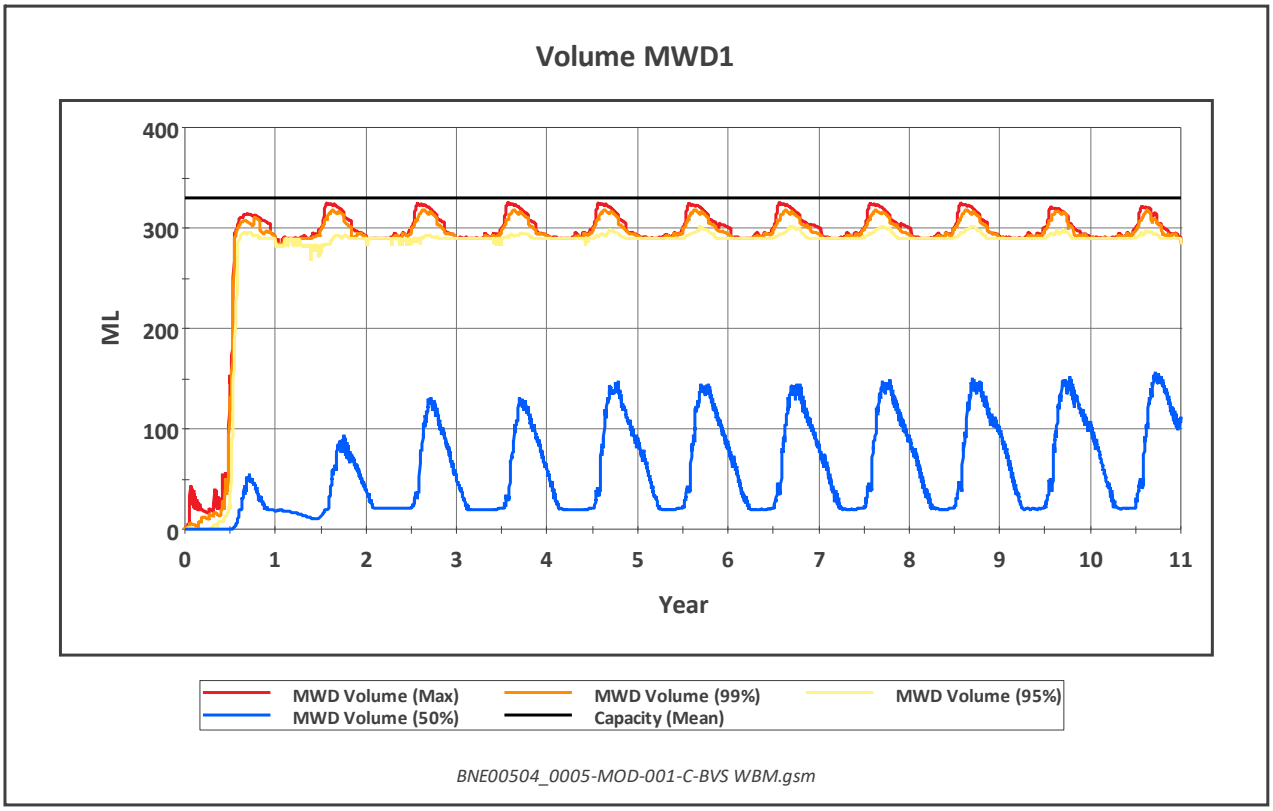



**FIGURE 17 – MINE WATER DAM 1 STORAGE PERFORMANCE**

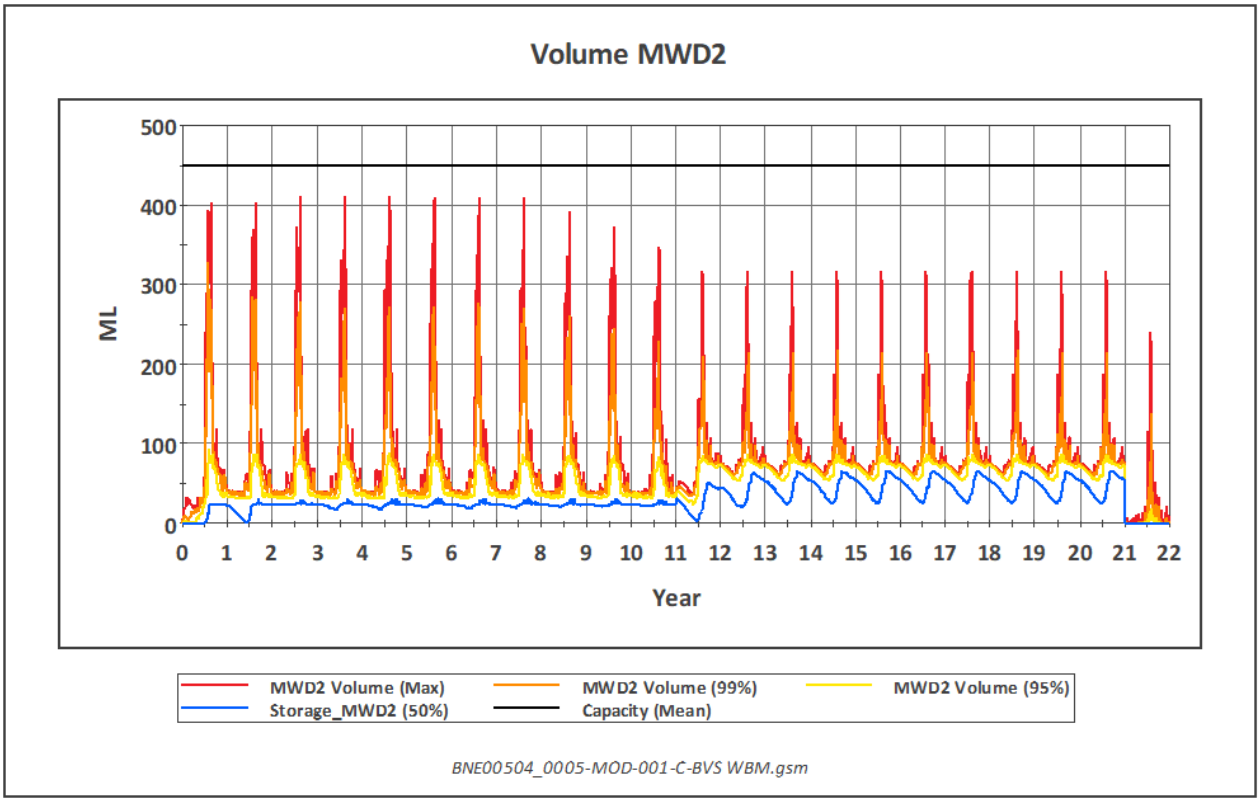



**FIGURE 18 – MINE WATER DAM 2 STORAGE PERFORMANCE**

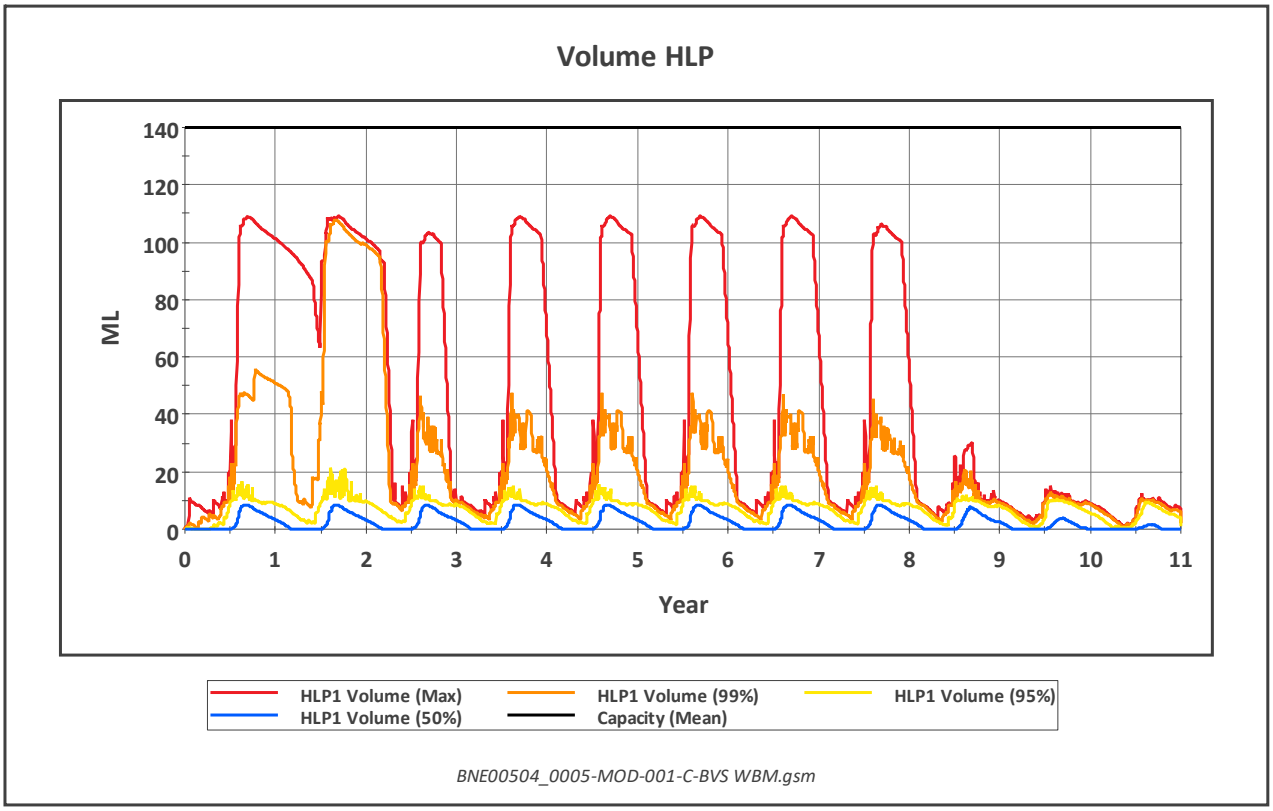



**FIGURE 19 – HEAP LEACH PADS STORMWATER POND STORAGE PERFORMANCE**

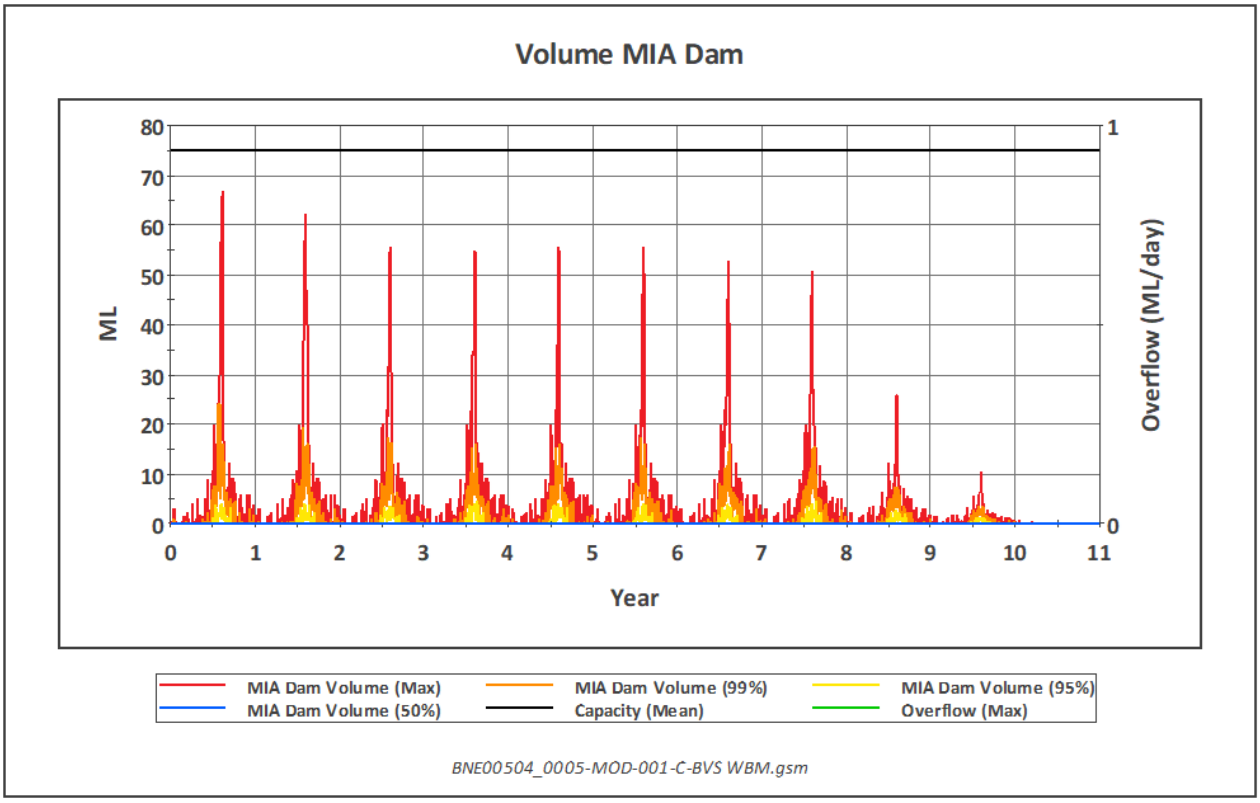



**FIGURE 20 – MIA DAM STORAGE PERFORMANCE**

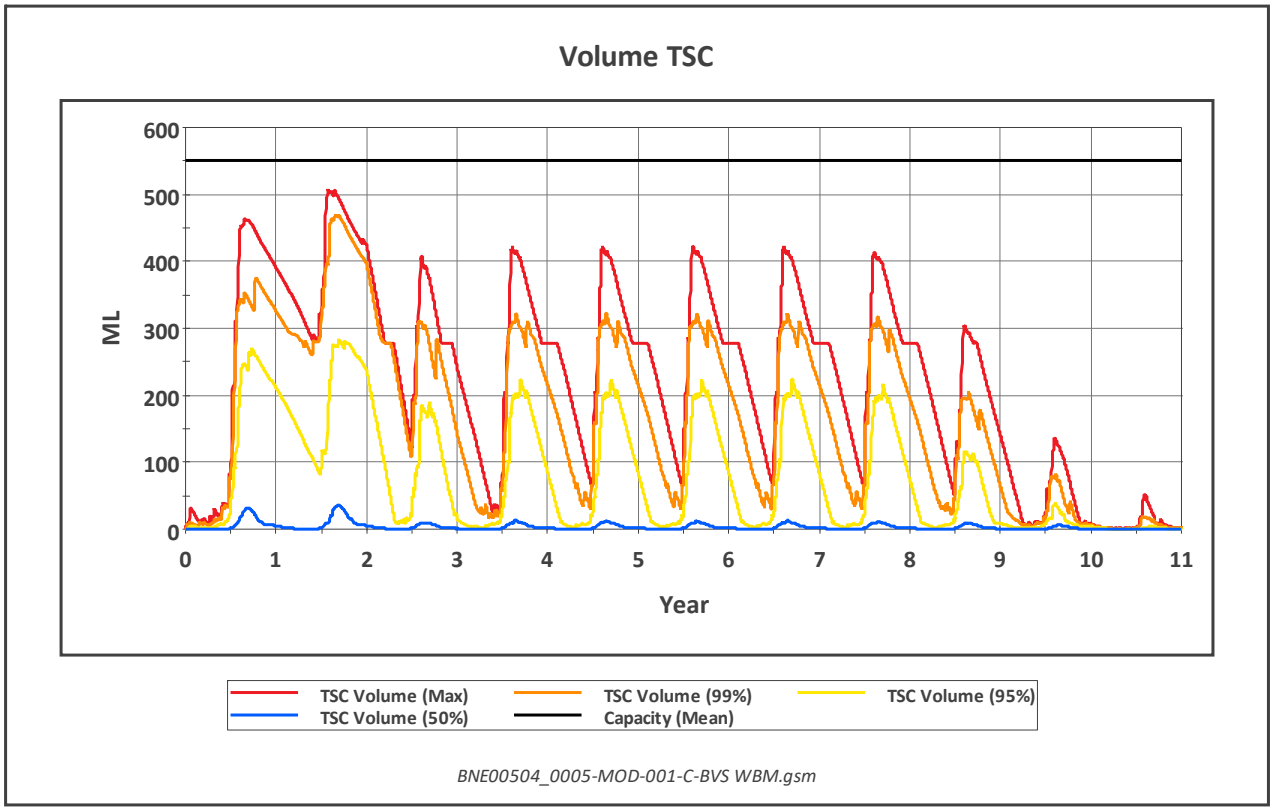



**FIGURE 21 – TSC STORMWATER POND STORAGE PERFORMANCE**

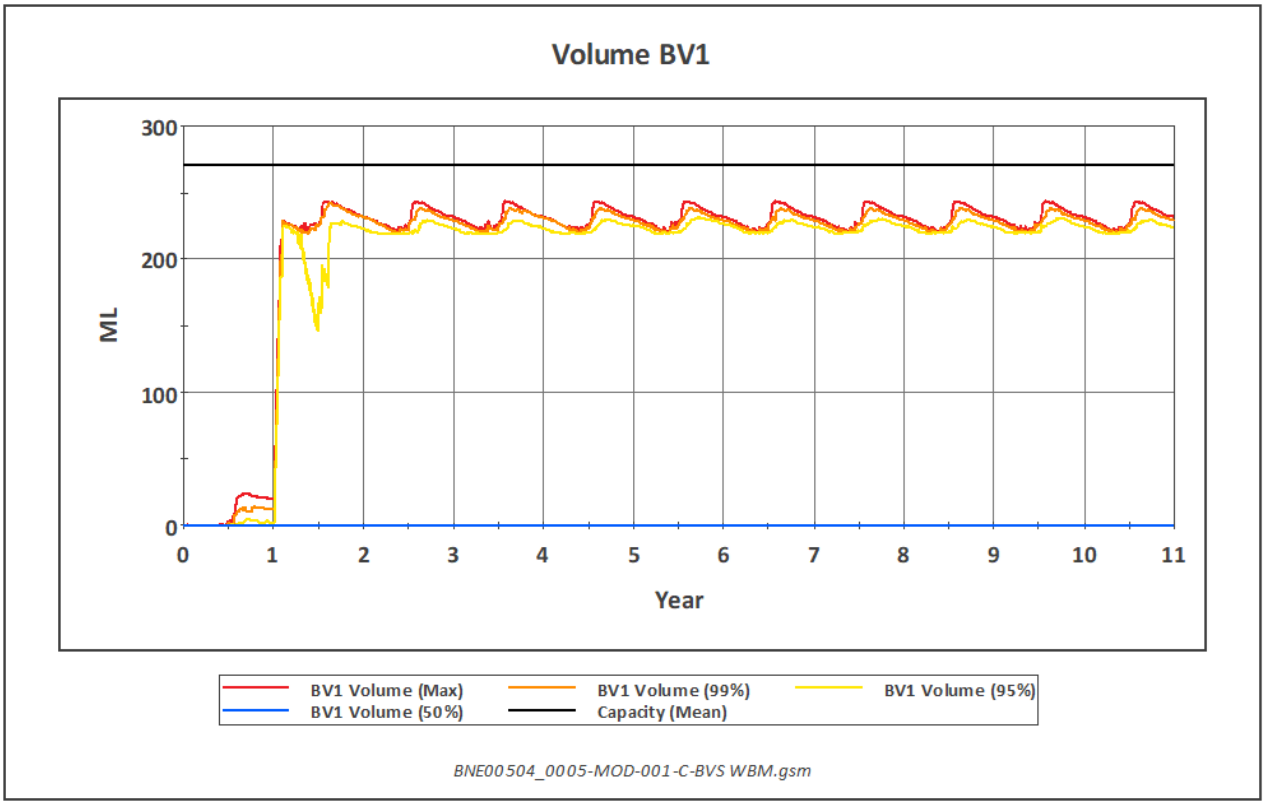



**FIGURE 22 – BV1 PIT MODELLED STORAGE**

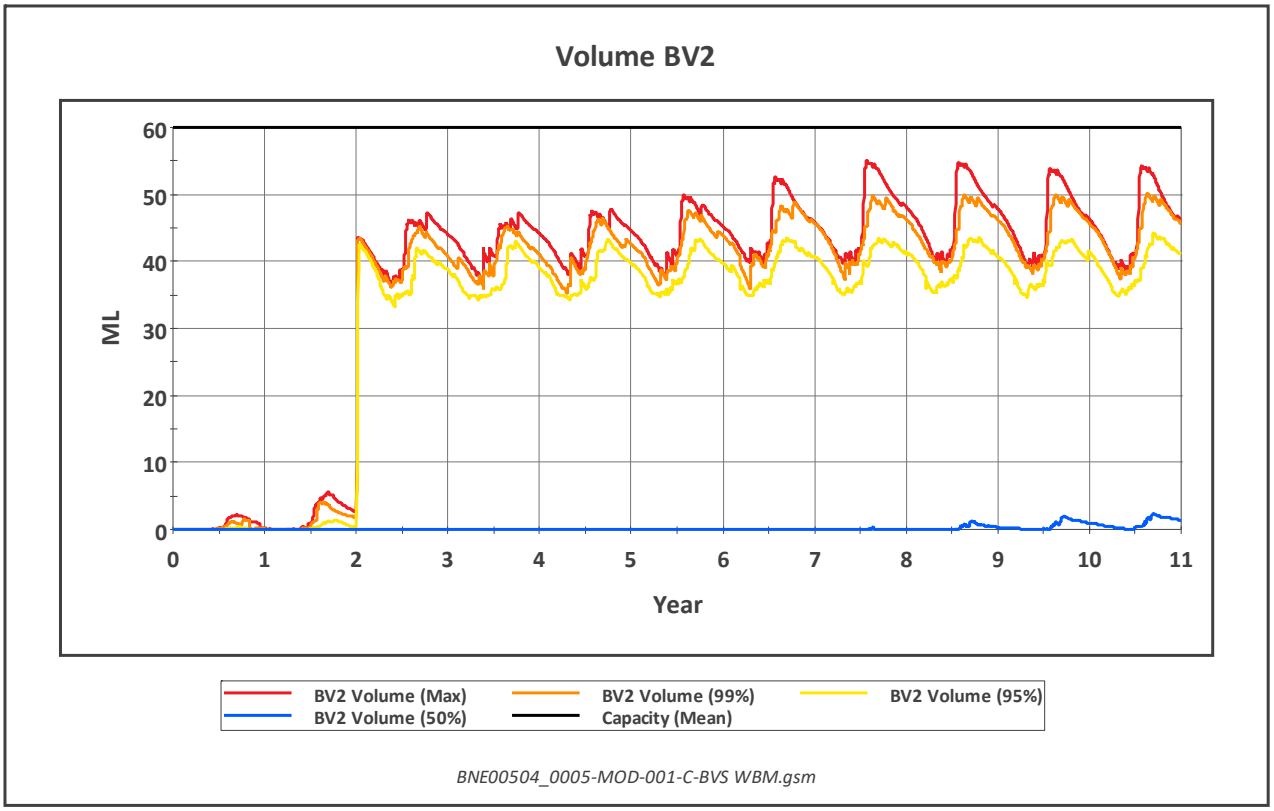



**FIGURE 23 – BV2 PIT MODELLED STORAGE**

### 5.4.2 Water Supply Reliability

#### Mine Water Reuse

As discussed in Section 4.3.2, reuse of MAW will be preferentially used to meet process, and dust suppression demands. Table 23 below shows than on average, reuse of MAW will meet 69% of the Project water demand (based on an annual demand of 732 ML/yr. (years 4-11, Table 20)). Under a worst- and best-case result the Project water demand is met by approximately 420 ML/yr. (57%) and 631 ML/yr. (86%) respectively of MAW.

#### External Raw Water Demand

As noted in Section 4.3.2, MAW will be used as the priority source of process water and dust suppression supply however when supplies of MAW are unavailable or unsuited (e.g., for potable demand) raw water will be used. Table 23 below shows predicted raw water makeup volumes:

- On average, raw water will be required to meet an estimated 31% (228 ML/yr) of the Project water demand (based on a total Project demand of 732 ML/yr); and
- Under a worst- and best-case result, approximately 312 ML/yr (43%) and 101 ML/yr (14%) respectively of raw water would be required to meet the total Project water demand.

**TABLE 23: ESTIMATED RAW WATER MAKEUP DEMAND**

| Result | Estimated Makeup (ML/yr) | Makeup as Approx. % of Demand @ 732 ML/yr. | Estimated Reuse of MAW (ML/yr) | Reuse of MAW as Approx. % of Demand @ 732 ML/yr. |
|---|---|---|---|---|
| **Min** | 101 | 14% | 631 | 86% |
| **P5** | 128 | 17% | 604 | 83% |
| **P10** | 163 | 22% | 569 | 78% |
| **Mean** | 228 | 31% | 504 | 69% |
| **P50** | 229 | 31% | 503 | 69% |
| **P90** | 294 | 40% | 438 | 60% |
| **P95** | 302 | 41% | 430 | 59% |
| **Max** | 312 | 43% | 420 | 57% |

### 5.4.3 Climate Change Effects

- To assess the impact of estimated changes to rainfall and evaporation resulting from climate change on the Project WMS, the model was re-run using the amended input climate data as described in Section 5.3.2. The results show that: The preliminary storage and water transfer capacities for the conceptual WMS (as detailed in Table 22 and Table 21 respectively) continue to provide sufficient capacity to ensure the containment of all potential pit dewatering volumes even under worst-case climate change predictions. SMC will conduct additional water balance modelling prior to the commencement of mining activities to define the controlled release requirements for MAW. As such, SMC will seek EA controlled release conditions designed to ensure any controlled releases do not result in environmental harm to the receiving environment.
- Due to the increased rates of evaporation and typically lower precipitation associated with the worst-case climate change predictions (refer to Table 11), the Project external raw water demand is predicted to increase slightly (by up to 10.3% under wet conditions and up to 1.4% under dry conditions). The prediction results are shown in Table 24.

**TABLE 24: PREDICTED EFFECTS OF CLIMATE CHANGE ON EXTERNAL RAW WATER DEMAND**

| Result | Estimated Raw Water Makeup (ML/yr) | | Change | |
|---|---|---|---|---|
| | Current Climate Conditions | Predicted Climate Change Conditions[1] | Absolute (ML) | Relative |
| **Min** | 101 | 111 | 10 | 9.9% |
| **WP5** | 128 | 139 | 11 | 8.6% |
| **P10** | 163 | 170 | 7 | 4.3% |
| **Mean** | 228 | 237 | 9 | 3.9% |
| **P50** | 229 | 237 | 8 | 3.5% |

| Result | Estimated Raw Water Makeup (ML/yr) | | Change | |
|---|---|---|---|---|
| | Current Climate Conditions | Predicted Climate Change Conditions[1] | Absolute (ML) | Relative |
| **P90** | 294 | 300 | 6 | 2.0% |
| **P95** | 302 | 308 | 6 | 2.0% |
| **Max** | 312 | 318 | 6 | 1.9% |

1 Representative concentration pathway (RCP) of 8.5

# 6 FINAL VOID HYDROLOGY ASSESSMENT

## 6.1 Modelling Approach and Assumptions

The final voids are shown in Figure 24 below. As discussed previously, the clean water diversion drains around BVS, BV1 and BV2 Pits will remain in the final landform.

**TABLE 25: KEY SIMULATION ASSUMPTIONS FOR FINAL VOID HYDROLOGY ASSESSMENT**

| Aspect | Assumption |
|---|---|
| **Length of Simulation** | Assessed over 1,000-year[1] duration for BVS Pit, 130 years for BV2 and BV1 Pits. |
| **Simulation Type** | Deterministic |
| **Number of Realisations** | N/A |
| **Pits Initial Condition** | ■ BVS Pit at P50 result at end of operational simulation (Section 5.4), 2,179 ML and 2,597 µS/cm.<br>■ BV1 and BV2 pits assumed empty at start of simulation. |
| **AWBM Landuse and Runoff Parameters** | As per Table 14 for Natural and hardstand/pit. |
| **Water Quality (Electrical Conductivity) (µS/cm)** | Natural – 208[2]<br>Pit and WRD – 700[3]<br>Groundwater inflow to BVS Pit – 1,223[4] |

1 Achieved by looping of the input climate data

2 Average of Project baseline water quality monitoring data

3 Adopted from calibrated water balance model for Ravenswood Gold Mine

4 Average for groundwater monitoring

Modelling of the final void water storages was completed to assess the likely final void water levels following mine closure. The assessment was undertaken using GoldSim modelling software, which considered a range of variables including the following;

- Rainfall runoff from the final void catchment. The model was simulated using 133 years of historical rainfall data that was resampled to assess long-term post closure void behaviour over a 1,000-year period for the BVS final void, and 130 years for the BV1 and BV2 final voids.
  - Seepage from the Central WRD CPC was assumed to continue reporting to BVS Pit for the entirety of the simulation. Seepage was conservatively estimated as 6% of incident rainfall falling on the 32 Ha CPC footprint.
- Evaporative losses from the surface of the final void lake. Evaporative losses are calculated using storage curves which relate water level to surface area. For some voids where a permanent water lake forms, the water surface area increases to the extent that it eventually becomes the limiting factor to additional water level rise.
- Seepage outflow via the base of the void (applicable to BV1 and BV2 Pit voids only).
- Groundwater inflows to the void (applicable to BVS Pit void only). The dynamic response of groundwater inflow as a function of the water elevation in the final void has been derived from the EAR groundwater model and is shown in Table 26 Below.

Similar to the operational phase modelling, a "groundwater loss factor" is applied to the groundwater inflow values derived from the groundwater model. This accounts for the fact that not all of the groundwater inflow into the pit determined by the groundwater model, will report to the lake (i.e., some groundwater inflow will pond on benches, evaporation from walls etc.).

Conceptually if a permanent void lake does form, the equilibrium water levels are reached when the following equation is balanced:

$$\sum rainfall + runoff + groundwater\ inflow\ (where\ relevant) \approx \sum evaporation + seepage\ loss\ (where\ relevant)$$

It should be noted that the equilibrium level will rise and fall with the seasonal variations in temperature and rainfall.

**TABLE 26: BVS PIT FINAL VOID GROUNDWATER INFLOW RELATIONSHIP**

| BVS Pit Void Lake Elevation (m AHD) | Net Inflow ($m^3$/day) |
|---|---|
| **152** | 63.7 |
| **160** | 63.7 |
| **170** | 63.7 |
| **180** | 63.7 |
| **190** | 63.6 |
| **200** | 63.5 |
| **225** | 62.4 |
| **250** | 59.0 |
| **275** | 51.3 |
| **300** | 38.9 |
| **325** | 18.9 |
| **350** | -3.9 |
| **364** | -5.5 |

### 6.1.1 Modelled Scenarios and Model Sensitivity

Multiple modelling runs were undertaken for each pit, for a range of key model inputs. This approach allows for an assessment of the risk of overtopping across a range of on the ground scenarios where key model inputs can vary (including base-case and worse case scenarios) and also provides information as to model sensitivity.

For the BVS pit the modelled scenarios are presented in Table 27, with the key variables being evaporation and "groundwater loss factor". The lowest evaporation and lowest "groundwater loss factor" provides the conservative or worst-case scenario (in terms of overtopping risk).

**TABLE 27: BVS PIT SCENARIOS ASSESSED**

| Scenario | Evaporation Factor | Groundwater Loss Factor |
|---|---|---|
| **BVS_0 (basecase)** | 1 | 40% |
| **BVS_1** | 0.9 | 40% |
| **BVS_2** | 0.8 | 40% |
| **BVS_3** | 0.7 | 40% |
| **BVS_4** | 1 | 50% |
| **BVS_5** | 1 | 30% |
| **BVS_6** | 1 | 20% |

For the BV1 and BV2 pits the modelled scenarios are presented in Table 28, with the key variables being evaporation and seepage. The lowest evaporation and seepage values provide the conservative or worst-case scenario (in terms of overtopping risk).

**TABLE 28: BV1 AND BV1 PITS SCENARIOS ASSESSED**

| Scenario | Evaporation Factor | Saturated Hydraulic Conductivity (m/d) |
|---|---|---|
| **BV_0 (basecase)** | 1 | 0.005 |
| **BV_1** | 0.9 | 0.005 |
| **BV_2** | 0.8 | 0.005 |
| **BV_3** | 0.7 | 0.005 |
| **BV_4** | 1 | 0.0005 |
| **BV_5** | 1 | 0.05 |