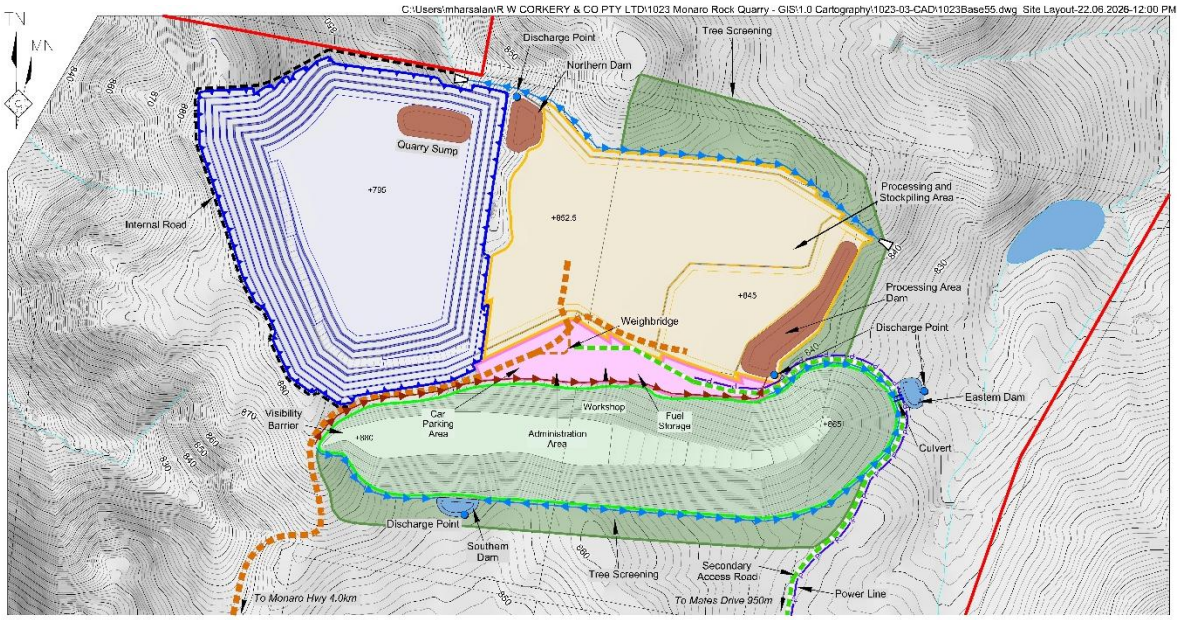
Appendix 4

Surface Water Management Report (Updated)

prepared by

Strategic Environmental and Engineering Consulting

(Total No. of pages including blank pages = 78)



(Source: RWC)

Surface Water Management Report

Monaro Rock Quarry Project

For:

Monaro Rock Pty Ltd

16 July 2026

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Any recommendations contained in this report are based on an honest appraisal of the opportunities and constraints that existed at the site at the time of assessment, subject to the limited scope and resources available. Within the confines of the above statements and to the best of my knowledge, this report does not contain any incomplete or misleading information.

Bill Johnson
Director and Principal Engineer
SEEC
16 July 2026

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1 INTRODUCTION

1.1 Project Terminology

- Monaro Rock Pty Ltd (MRPL)
- Monaro Rock Quarry Project (the Project)
- The site, site area, project area etc. within the larger property boundary that incorporates all quarrying-related infrastructure (Project site)

1.2 Project Overview

Monaro Rock Pty Ltd (MRPL) is proposing to construct and develop a new hard rock quarry in Royalla, NSW, on land located adjacent to the ACT/NSW border, approximately 5km north of the intersection of Monaro Highway and Old Cooma Road (hereafter referred to as the Project). Figure 1 presents the site locality and Property Boundary.

The Project site is to the northeast of Enchanted Hill and is directly to the west of Beatty Hill, two prominent local topographic features. The topography of the local area is characterised by rolling hills and cleared paddocks at elevations above 850m with northwest trending ridgelines that are incised by steep gullies. The land is predominantly used for low productivity grazing or large lot rural residential development, with little significant vegetation remaining except for the ridgelines to the west that are vegetated with native woodland[1].

The Project would initially be developed to provide hard rock aggregates and other products to concrete batching operations associated with the MRPL. However, it is planned that the operation would be expanded progressively to provide products to local and regional infrastructure and construction activities. The proposed rate of production would be scaled to meet demand.

The Project would be developed as a single open cut extraction area. Processing would commence within the extraction area using mobile equipment, with adjacent land progressively developed as a standalone processing and stockpiling area (all planned within the current Project site).

The principal components of the Project are shown in Figure 2 and the site layout is shown in Figure 3.

[1] PCT 999 – Nortons Box – Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion
PCT 1334 – Yellow Box grassy woodland of the northern Monaro and Upper Shoalhaven area, South Eastern Highlands Bioregion (Capital Ecology, 2024)

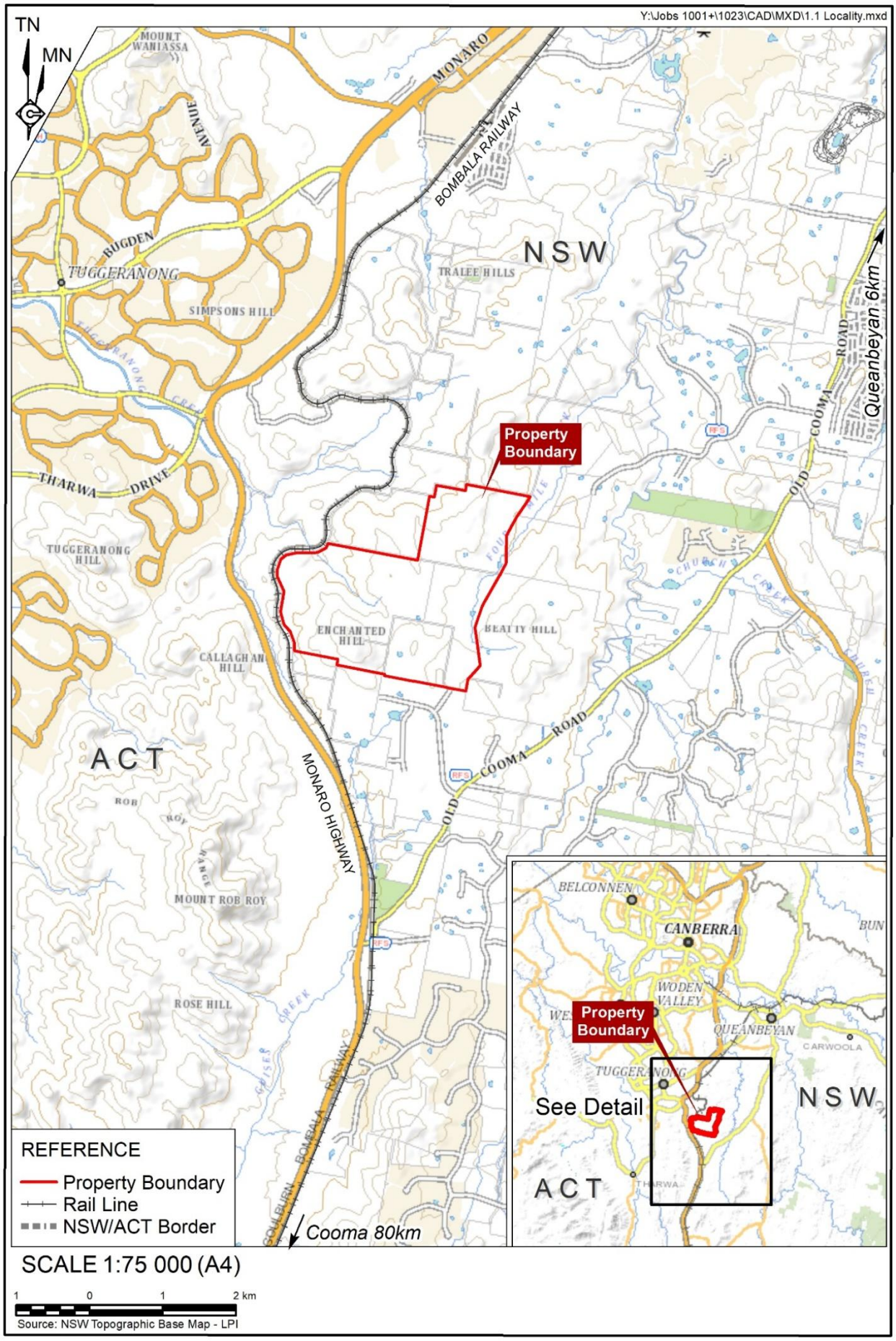

Figure 1: Site Location (Source: RWC).

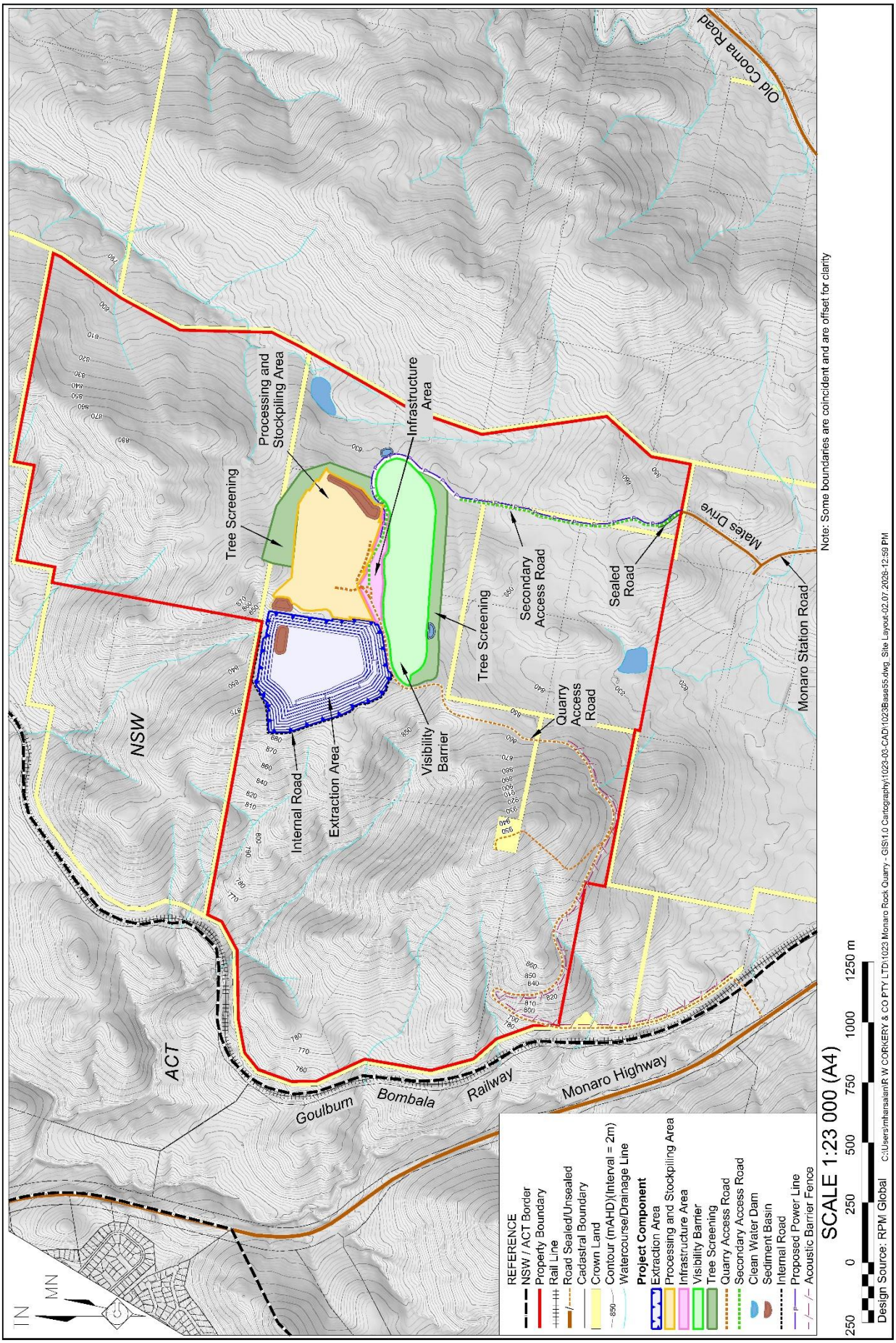

Figure 2: Principal Project Components (Source: RWC).

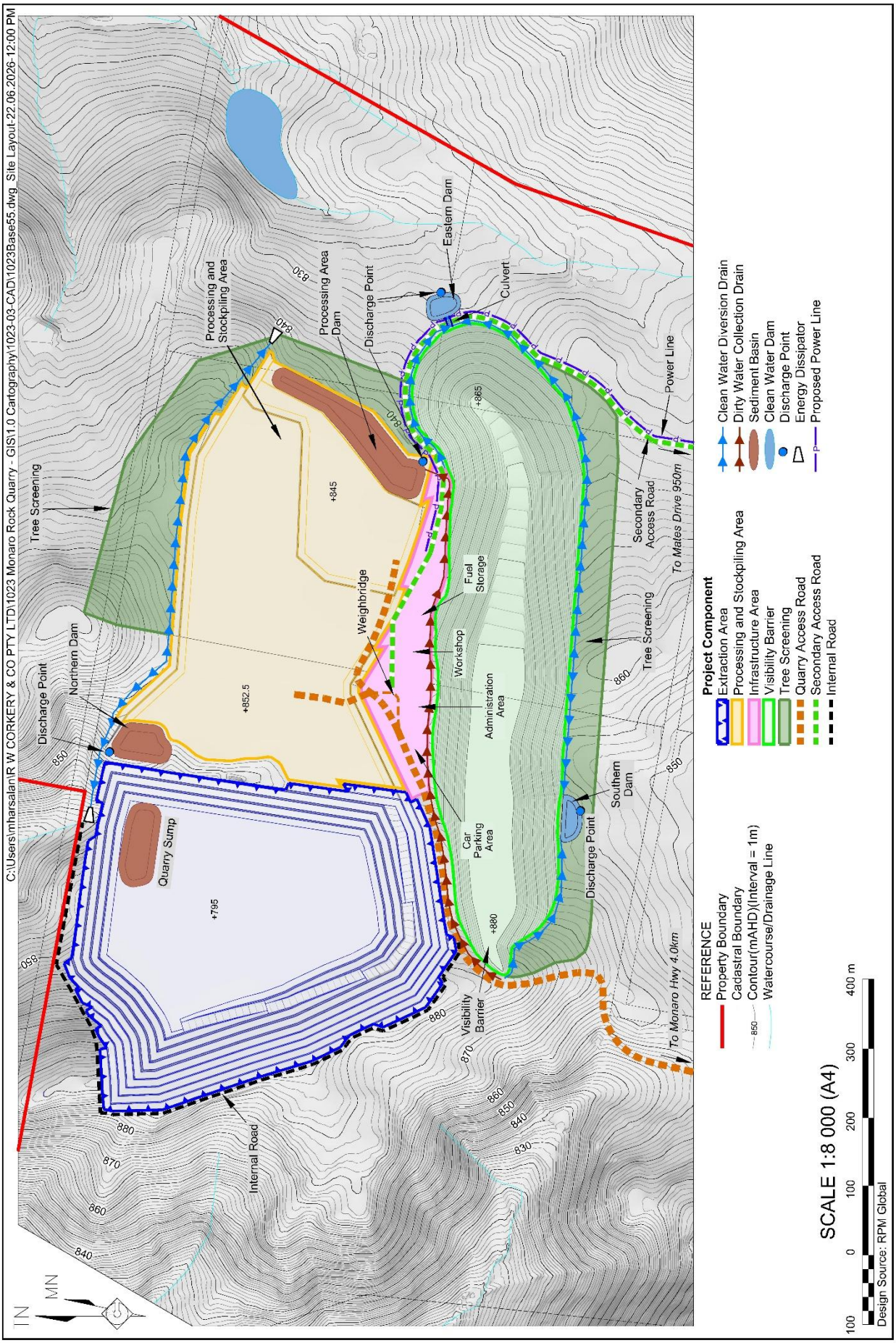

Figure 3: Site Layout (Source: RWC).

The Project is a State Significant Development and will be assessed by the Department of Planning, Housing and Infrastructure (DPHI). The consent authority is to be the Minister for Planning and Public Spaces (or their delegate). The then NSW Department of Planning and Environment (DPE) issued Secretary's Environmental Assessment Requirements (SEARs) for the Project on 18 August 2023.

This surface water management report has been prepared to address the relevant SEARs and inform the preparation of an environmental impact statement (EIS) for the Project.

1.3 Project Staging

The Project Extraction Area, Processing and Stockpiling Area and the Visibility Bund are expected to be staged. Each element can be staged independently based on production needs as described below, however, Section 1.3.5 describes the estimated production schedule in which this assessment is based upon.

1.3.1 Extraction Area Staging

The sequence for development of the Extraction Area is summarised as follows.

- Stage E1 – initial development within a footprint of 6.4 ha and to an elevation of approximately 852.5 m AHD.
- Stage E2 – lateral extension to the north of approximately 5.6 ha (11 ha total) and same floor elevation as Stage E1 (852.5 m AHD).
- Stage E3 – lateral extension to the south of approximately 6.0 ha (17 ha total) and to the same floor elevation (852.5 m AHD).
- Stage E4 – widening of the Extraction Area to the north east (an additional 3.1 ha to the full extent of 21.1 ha) and development to a final floor elevation of 795 m AHD.

1.3.2 Processing and Stockpiling Area Staging

The Processing and Stockpiling Area is to be used for raw material crushing, shaping and screening for various product sizes as well as product stockpiling and loading quarry products for despatch. The development of the Processing and Stockpiling Area would be staged to allow for the progressive expansion of the area which would reflect operational requirements identified during the development of the Project.

- Stage P1 Processing Area – Initial development of the Processing and Stockpiling Area over approximately 4.9 ha during site establishment. This area would be sufficient to support production levels up to approximately 250,000 tpa.
- Stage P2 Processing Area – Further extension of the Processing and Stockpiling Area to the east to a total area of 13.0 ha. This stage represents the indicative configuration of ongoing processing activities while the fixed plant, stockpiling area and water management structures are being constructed to the east. This stage would be expected to last approximately six months.
- Stage P3 Processing Area – The stage represents the final development of the Processing and Stockpiling Area. The Processing and Stockpiling Area would feature a fixed processing plant and would support production at the proposed limit of 1 million tpa.

1.3.3 Visibility Barrier Staging

A visibility barrier is to be located in the area to the south of the Extraction Area and Processing and Stockpiling Area. It would have a dual purpose of providing a stable and vegetated barrier to shield operational components of the Project from residences and public vantage points to the south and southeast and as a storage location for overburden material that may not be suitable for sale. The development of the Visibility Barrier would be staged as follows to ensure that impacts are mitigated to the greatest extent practicable during the progressive development of the Quarry.

- Stage V1 Visibility Barrier – construction of the initial barrier would commence during site establishment using weathered material removed from operational areas. The barrier has been designed to reach an elevation of 865m AHD with a footprint of 6.9ha and slopes of ≤3H:1V. The total volume of material required to construct the barrier would be approximately 556,000 m^3 loose cubic metres (lcm).
- Stage V2 Visibility Barrier – Extension of the Visibility Barrier to the northeast to obscure the development of the processing area and to the west to obscure further development of the Extraction Area. The barrier would extend the existing structure to an elevation of 880m AHD and cumulative area of 16.1ha. It would also have slopes of ≤3H:1V. Development of the Stage V2 Visibility Barrier would require 1.2Mm^3 (lcm) of material and is likely to commence with the extension of the Processing and Stockpiling Area (Stage P2 Processing Area).

1.3.4 Production Staging

The proposed rate of production would be progressively increased to meet demand. The triggers for production rates would coincide with the staging of development of the Processing and Stockpiling Area as the space available in this area would need to grow to provide stockpiling space for the management of various product types. Timing for each stage would be dependent on customer demand but it is anticipated that Stage 2 would be commenced within five years of approval.

- Project site Establishment - Processing and despatch of up to 100,000 tpa during site establishment using mobile processing plant which would initially be located within the Extraction Area.
- Stage 1 - Processing of up to 250,000 tpa using a mobile processing plant which would be located within the Stage P1 Processing Area. A Pugmill would also be used during this stage.
- Stage 2 - Once a production rate of 250,000 tpa is reached, the Stage P2 Processing Plant area would be constructed. The production rate would then be targeting up to 500,000 tpa.
- Stage 3 - Production using mobile processing equipment would continue up to a level of 750,000 tpa. At this level, or earlier if needed, a fixed processing plant would be commissioned and built. The fixed processing equipment would then be used for production up to the limit of 1 Mtpa.

Figure 4 shows the staged development layout for the site.

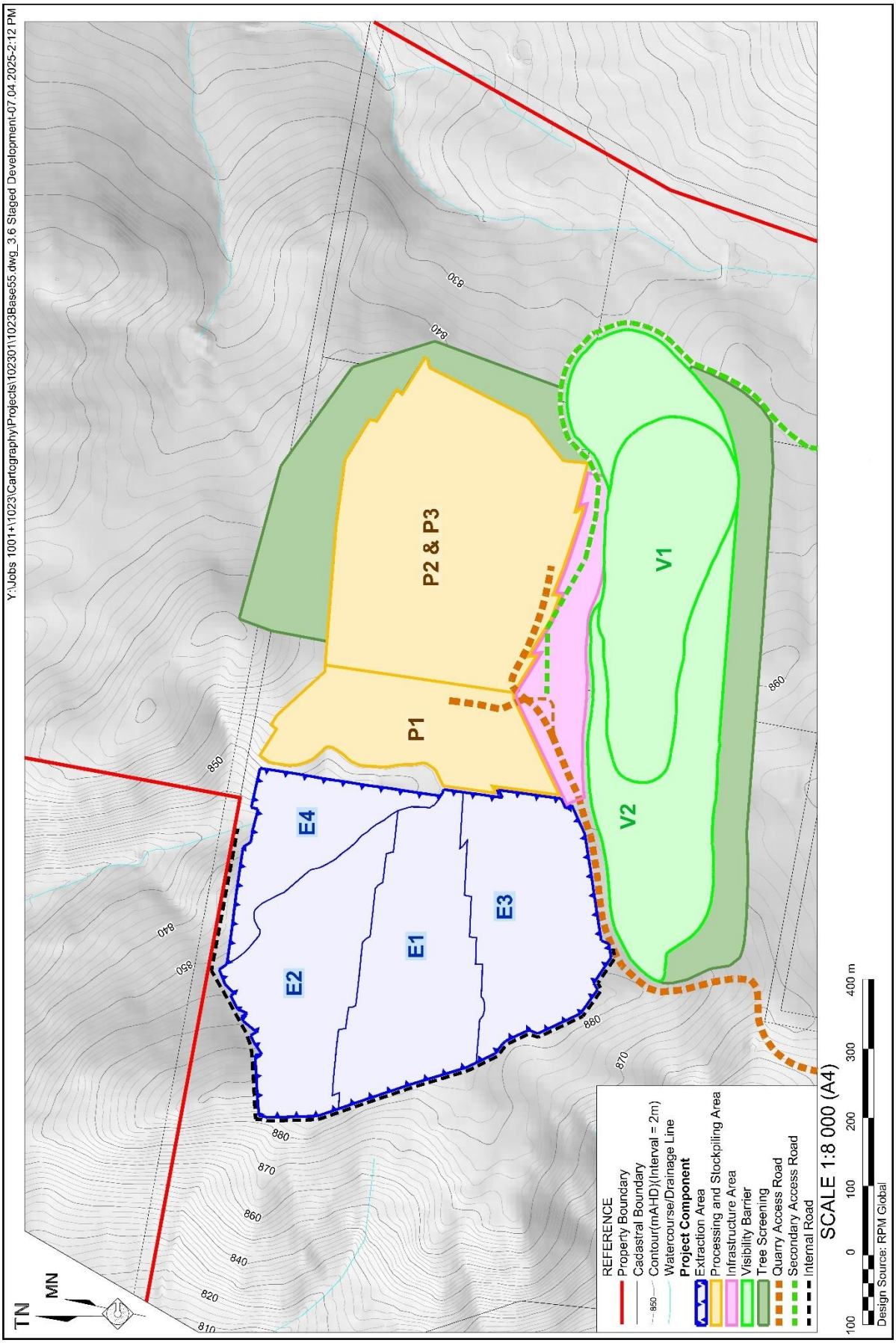

Figure 4: Staged development layout (RWC).

1.3.5 Estimated Production Schedule and Adopted Model Scenarios

The estimated production schedule for the Project is outlined in Table 1 with the associated Extraction Area and Production Area. For the purpose of this water management assessment, we have selected key years of quarry operations as model scenarios. The scenarios are Year 1 (Site Establishment), Year 4 (Processing Area P2), Year 8 (Extraction Area E2 & Processing Area P3), Year 15 (Extraction Area E4), Year 16 (Pit Inflow Begins) and >30 Years (Post Closure), as highlighted in Table 1. Note that groundwater inflow to the extraction area is expected to occur from Year 16. Table 1 includes expected groundwater flows into the pit and maximum groundwater bore extraction rates. Both are described in more detail in Section 7.4.4.

Table 1: Estimated production schedule, highlighting adopted model scenarios.

Year	Annual Production (ktpa)	Extraction Area	Processing Area	Pit Inflow Rate (m^3/d)	Well Extraction Rate (m^3/d)	Comment
1	**100**	**E1**	**P1**	**0**	**76.8**	**Site Establishment**
2	250	E1	P1	0	71.4	
3	250	E1	P1	0	70.3	
4	**500**	**E1**	**P2**	**0**	**69.8**	**Processing Area Increase**
5	500	E1	P2	0	69.4	
6	500	E1	P2	0	69.2	
7	500	E1	P2	0	69.0	
8	**750**	**E1/E2**	**P3**	**0**	**68.9**	**Processing & Extraction Area Increase**
9	750	E2	P3	0	68.8	
10	750	E2	P3	0	68.7	
11	750	E2/E3	P3	0	68.6	
12	750	E3	P3	0	68.6	
13	1,000	E3	P3	0	68.5	
14	1,000	E3/E4	P3	0	68.5	
15	**1,000**	**E4**	**P3**	**0**	**68.4**	**Extraction Area Increase**
16	**1,000**	**E4**	**P3**	**49.5**	**66.7**	**Pit Inflow Begins**
17	1,000	E4	P3	35.0	66.2	
18	1,000	E4	P3	32.9	66.0	
19	1,000	E4	P3	31.8	65.9	
20	1,000	E4	P3	31.1	65.9	
21	1,000	E4	P3	30.7	65.8	
22	1,000	E4	P3	30.3	65.8	
23	1,000	E4	P3	30.0	65.8	
24	1,000	E4	P3	29.8	65.8	
25	1,000	E4	P3	29.6	65.8	
26	1,000	E4	P3	29.4	65.8	
27	1,000	E4	P3	29.2	65.8	
28	1,000	E4	P3	29.1	65.7	
29	1,000	E4	P3	28.9	65.7	
30	1,000	E4	P3	28.8	65.7	
>30	**-**	**Lake**	**-**	**-**	**-**	**Post Closure**

1.4 Purpose of Report

This report has been prepared for Monaro Rock Pty Ltd by Strategic Environmental and Engineering Consulting (SEEC). The purpose of this report is to address the relevant Secretary's Environmental Assessment Requirements (SEARs) for the State Significant Development (SSD) application (SSD-27223807) issued by the then NSW Department of Planning and Environment (DPE) on the 18th of August 2023. An outline of how the SEARs have been addressed in this report is provided in Section 1.6.

1.5 Scope and limitations

This report has been prepared by Strategic Environmental and Engineering Consulting (SEEC) Pty Ltd for Monaro Rock Pty Ltd and may only be used and relied on by Monaro Rock Pty Ltd for the purpose agreed between SEEC and Monaro Rock Pty Ltd as set out in Section 1.4 of this report.

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1.6 SEARS

The requirement to prepare this Surface Water Management Report along with environmental performance conditions and monitoring at Monaro Rock Quarry are described in the SEARs. Table 2 references the report section where the SEARs are discussed.

Table 2: Secretary's Environmental Assessment Requirements related to this assessment.

Relevant SEARs	Report Section
Key Issues (Water)	
• detailed site water balances for the dry, average and wet rainfall years, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges) for all scenarios, water supply infrastructure and water storage structures;	Section 6.5
• identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000;	Not addressed in this report
• demonstration that water for the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP);	Section 6.5
• a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo;	Section 3
• an assessment of any likely flooding impacts of the development;	Not addressed in this report
• an assessment of the likely impacts on the quality and quantity of existing surface and groundwater resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality, flow objectives and sensitive downstream receiving environments;	Section 3.3 Section 5
• an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users in particular for domestic and commercial purposes; and	Not addressed in this report
• a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts;	Sections 6 and 8 Excluding sewage and groundwater impacts.
Key Issues (Land Resources)	
• potential impacts on soils and land capability (including potential erosion and land contamination);	Section 5

2 EXISTING ENVIRONMENT

2.1 Climate

Bureau of Meteorology (BoM) rainfall statistics for nearby Tuggeranong (station 070339) and evaporation statistics for Braidwood Wallace Street (station 069010) are contained in Table 3.

Table 3: Monthly rainfall statistics for Tuggeranong (BoM station 070339) and evaporation data for Braidwood (Wallace Street) (BoM station 069010).

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann-ual
Mean Rainfall (mm)	61.3	73.1	57.6	38.5	29.8	51.7	36.6	49.9	58.3	59.2	79.2	68.2	660.1
Mean no of days with rain >1mm	5.8	5.6	5.3	4.0	3.9	5.7	5.4	6.1	6.1	6.7	7.4	6.0	68.0
Evaporation (mm/day)	4.6	3.8	2.9	2.2	1.4	0.9	1.1	1.7	2.6	3.4	4.0	4.5	2.8

BOM data accessed 15 August 2024.

Rainfall is relatively consistent throughout the year, with lower falls around May-July and higher falls in November-February.

The relatively high average daily evaporation rates would contribute to significant losses of water from any surface storages. While this would limit the potential for onsite re-use of detained water, it would also limit the potential for any sediment basins to overflow in larger rainfall events.

The variance in annual rainfall at Tuggeranong (station 070339) is provided in Figure 5 below. It is noted that there are gaps in this data.

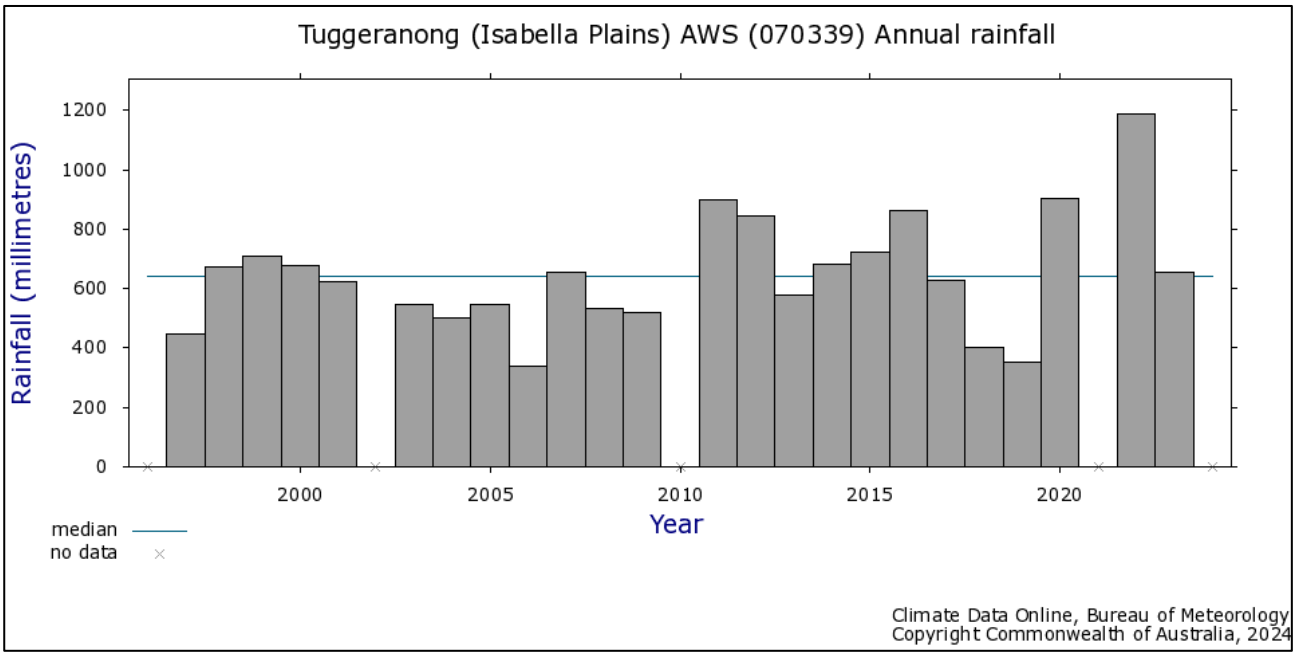

Figure 5: Annual rainfall 1966 to 2024 Isabella Plains AWS (Source: BoM, 2024).

The rainfall and evapotranspiration dataset used for water balance modelling needs to extend for a longer period and has been sourced from the SILO (Scientific Information for Land Owners) database at the nearest station locations, as outlined in Section 7.3. This dataset will have no gaps as it is created for the Project site with rainfall data infilled from the closest available rainfall stations.

2.2 Landscape Features and Topography

Four Mile Creek and Rocky Gully Creek, which are both included within the Murrumbidgee Water Sharing Plan (WSP) area, intersect the property boundary near to the proposed quarry area. The Quarry is located to the west of Four Mile Creek, approximately 200 m at its closest point, and to the north-east of the site, Rocky Gully is approximately 150 m at its closest point. Within the proposed quarry footprint, lands are mostly cleared for improved pasture, except for some remnant native woodland and native pasture on steeper slopes in the north-western quarter (PCT 999 and PCT 1334; Capital Ecology, 2024).

The topography over the footprint of the proposed quarry falls away from a ridgeline (approximately 892 m elevation) towards Rocky Gully Creek to the south-west, and gently to the East towards Four Mile Creek. The Soil and Land Capability assessment (SEEC, 2025) for the initial Quarry boundary determined that slopes range from around 3% in wide drainage depressions in the south-eastern quarter to around 30% (and locally steeper) in the north-western quarter. The local topography, drainage and catchments are shown in Figure 6.

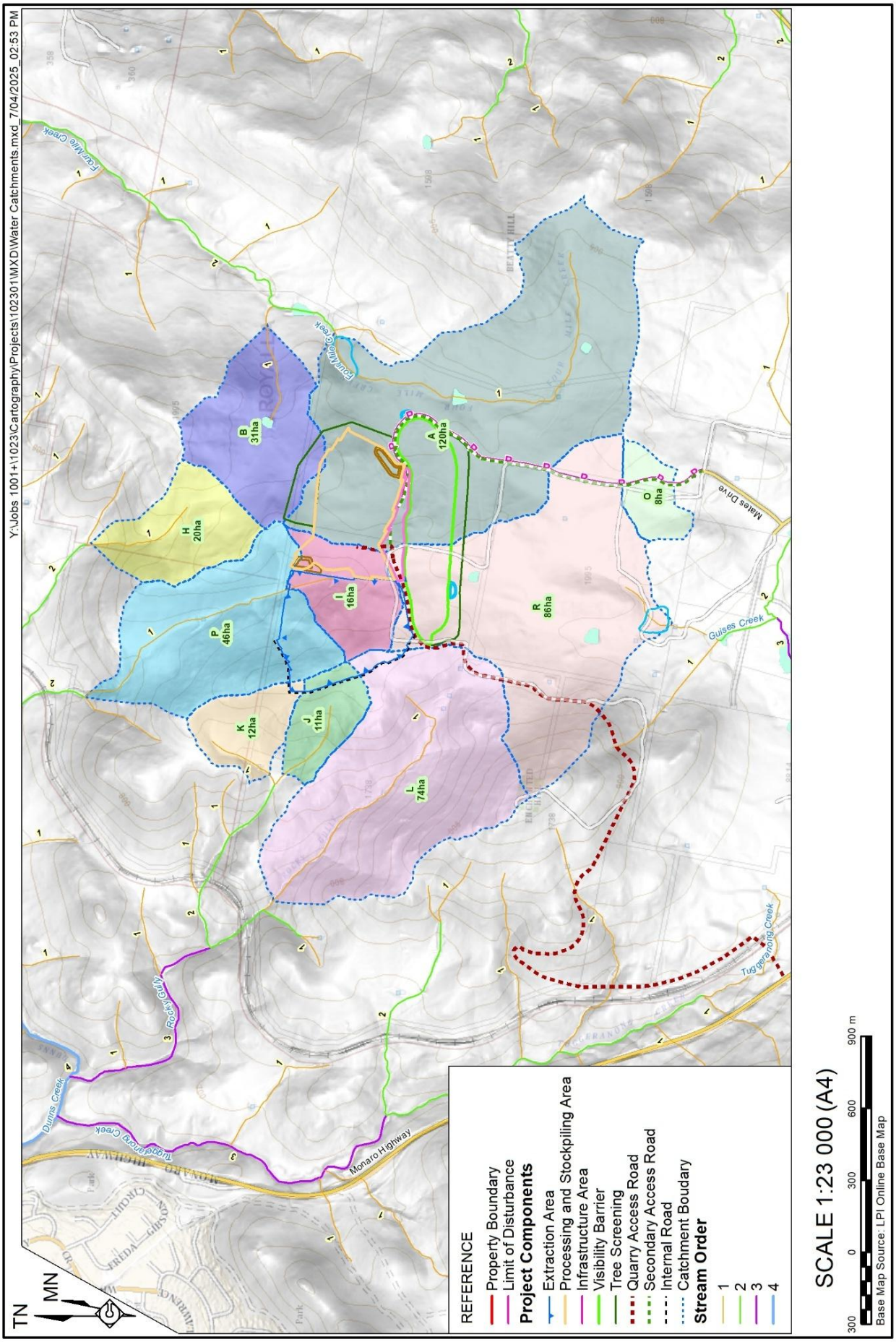

Figure 6: Local Topography and Drainage (RWC).

2.3 Soils

The Soil Landscape Mapping for the Canberra 1:100,000 map sheet shows the site lies on both the Campbell and Burra Soil Landscapes (Jenkins, 2000). Figure 7 shows the mapped extent of each soil landscape.

A Soil and Land Capability Assessment has been conducted by SEEC Pty Ltd (SEEC, 2025). Site observations by SEEC confirmed the accuracy of the soil landscape mapping. Table 4 contains a summary of key features and potential constraints that might influence soil and water management and erosion and sediment control during quarry operations.

Refer to the Soil and Land Capability Assessment for further information (SEEC, 2025).

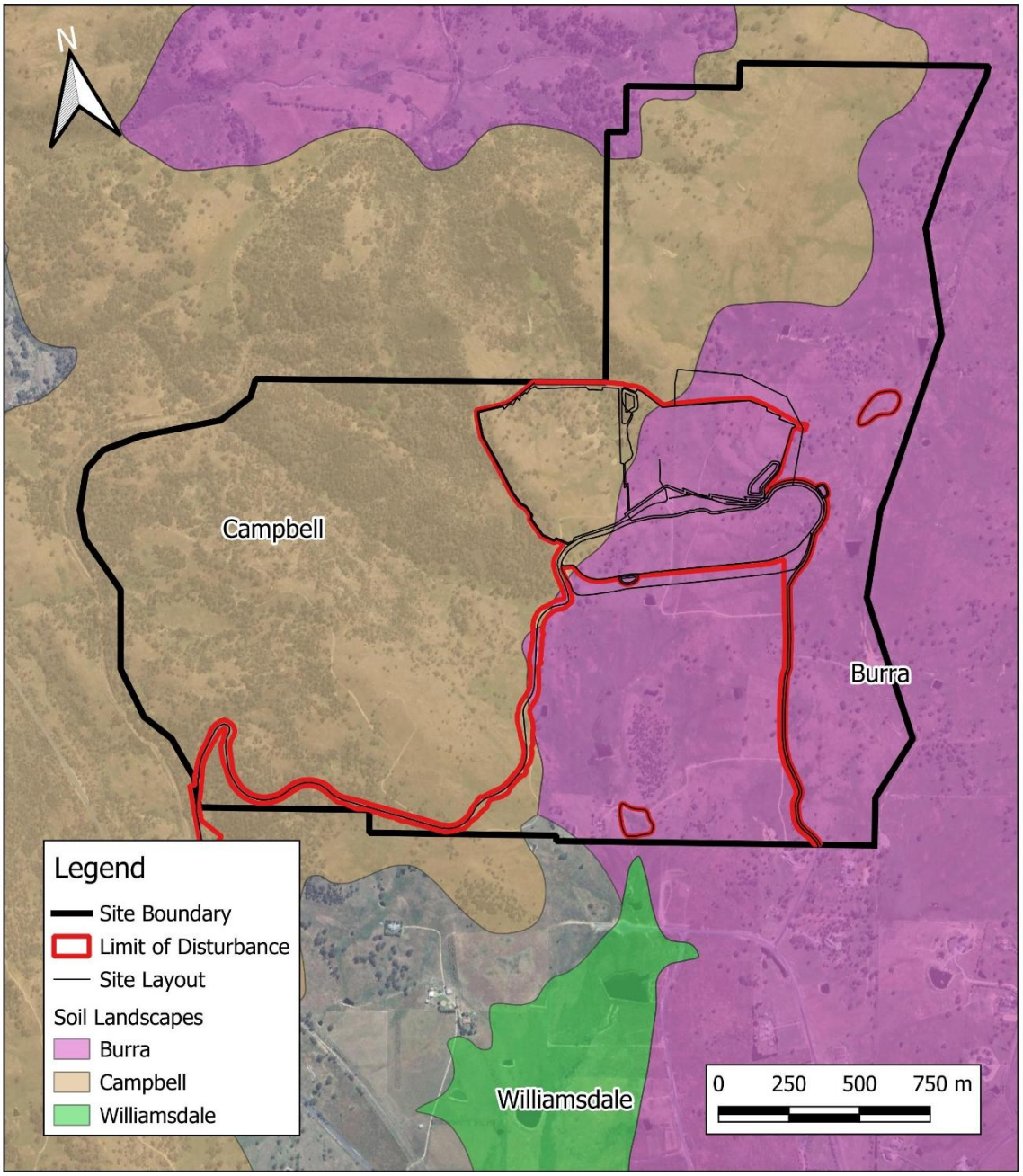

Figure 7: Soil landscape mapping across the site (from Jenkins, 2000, accessed via online eSpade portal).

Table 4: Soil Landscape Description (based on Jenkins, 2000) taken from (SEEC 2021).

Parameter	Campbell Soil Landscape	Burra Soil Landscape
Soil landscape description	Rounded steep to rolling hills and mountains on mixed Silurian volcanic and Canberra Block sedimentary geology.	Undulating to rolling low hills and alluvial fans on Silurian Volcanics. Waning and gently to moderately inclined hillslopes, footslopes and fans. Mostly cleared.
Typical soil conditions	Shallow, rapidly-drained Lithosols on crests and around rock outcrops. Moderately deep, moderately well-drained Red and Yellow Podzolic Soils on sideslopes. Moderately deep, imperfectly-drained Brown and Yellow Solodic Soils on lower slopes and around drainage lines.	Shallow, well drained Lithosols and Earthy Sands on crests. Moderately deep, moderately well-drained Red Podzolic Soils and Red Earths on mid- to lower slopes. Moderately deep, slowly drained Yellow Podzolic Soils and Yellow Earths on gentle footslopes and around drainage lines.
Common soil and landscape constraints	Steep slopes Common rock outcrop High sheet erosion risk Occasional springs Shallow, hardsetting soils Low fertility Low water holding capacity Acidic soils	High sheet erosion risk Low fertility Low water holding capacity Strongly acidic soils Subsoils have limited permeability.

2.4 Groundwater

A Groundwater Assessment has been provided by Hydrogeologist.com.au. The report provides an overview of the local groundwater regime and describes the hydrogeological conceptualisation for the quarry.

The testing undertaken by Hydrogeologist.com.au indicates that the local groundwater regime comprises the following hydrostratigraphic units:

- a weathered profile; and
- a fractured, basement aquitard/aquifer.

The assessment states that groundwater table is typically located at depths between 5 m and 50 m below drainage features within and adjacent to the Project site and the groundwater table does not intersect the ground surface. Hence, groundwater does not provide local baseflow to the drain features in the Project site. Additional details are provided in the Groundwater Assessment (Hydrogeologost.com.au, 2024).

3 LEGISLATIVE CONTEXT

3.1 Water Sharing Plan

The Project lies within the Murrumbidgee catchment above Burrinjuck Dam Extraction Management Unit (Murrumbidgee II Water Source) of the Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources 2012 (the Water Sharing Plan).

3.2 Harvestable Rights

In accordance with Part 5, Division 2, Clause 21 of the Water Sharing Plan, MRPL is entitled to capture and store water sources pursuant to the harvestable rights order made under Part 1 of Chapter 3 the Water Management Act 2000 (WM Act).

Section 53 of the WM Act permits landholders to harvest and use a portion of the total runoff from their land without requiring licence(s), provided that the total capacity of the harvestable rights water storages are less than the capacity permitted under the right. The Department of Climate Change, Energy, the Environment and Water (DCCEEW) states that harvestable rights dams can be located on;

- non-permanent minor streams
- hillsides
- gullies

but cannot be located:

- within 40 metres of a third-order or higher order stream
- within 3 kilometres upstream of a wetland of international importance (listed under the Ramsar Convention).

The Maximum Harvestable Right Dam Capacity (MHRDC) based on a Project site area of 553 ha, is 38.71 ML. The MHRDC has been calculated using the Maximum harvestable right calculator maintained by the Department of Primary Industries — Office of Water (DPI-Water) *Maximum Harvestable Rights Calculator - WaterNSW*.

Existing dam volumes were estimated based on Equation 1. Estimated volumes are outlined in Table 5. Existing dams that are to be filled in are marked with an asterisk.

$$Volume\ (ML) = \frac{Surface\ area\ (m^2)^{1.321}}{9600}$$ **Equation 1**

Table 5: Existing dams – estimated volumes.

Dam	Area (m2)	Dams to Remain	Dams to be Filled
		Volume (ML)	Volume (ML)
Farm Dam*	2253		2.80
Dam 2	1184	1.20	
Dam 3	706	0.60	
Dam 4*	559		0.44

Dam	Area (m2)	Dams to Remain	Dams to be Filled
		Volume (ML)	Volume (ML)
Dam 5*	907		0.84
Dam 6*	401		0.29
Dam 7*	322		0.21
Dam 8	153	0.08	
Dam 9*	895		0.83
Dam 10	793	0.70	
Dam 11	104	0.05	
Dam 12	277	0.18	
Dam 13	160	0.09	
Dam 14	513	0.40	
Dam 15	397	0.28	
Dam 16	796	0.71	
Dam 17	369	0.26	
Dam 18*	83		0.04
Dam 19*	923		0.86
Existing Total Storage (ML)		**10.84**	
Total Storage Excluding Filled Dams (Dams marked *) (ML)		**4.53**	
Maximum Harvestable Right Dam Capacity (MHRDC) (ML)		**38.71**	
Additional Storage Available for Use (ML)		**34.18**	

Existing dams around the site, excluding those being removed for the quarry development total 4.53 ML. Therefore, the remaining MHRDC is 34.18 ML. The proposed dams are outlined in Section 6.2.3, this includes the additional clean water dams that fall under the MHRDC.

The proposed dams are not located within 40 metres of a third-order or higher order stream or within 3 kilometres upstream of a wetland of international importance and therefore satisfy the construction location requirements outlined by DCCEW.

The proposed water management infrastructure is shown in Figure 8.

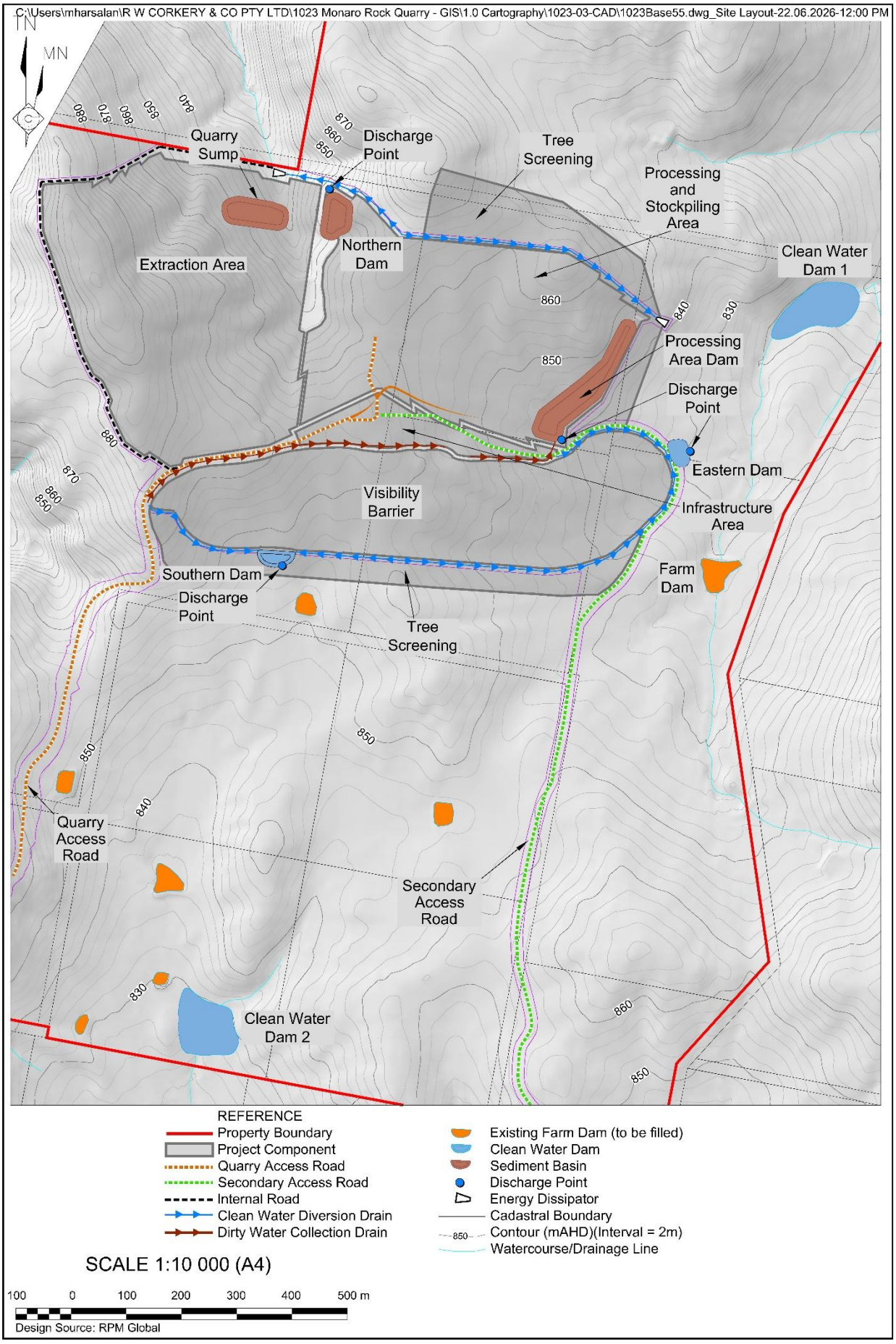

Figure 8: Existing dams to be filled.

MRPL would commence a program of dam closure and remediation upon approval of the Project to enhance its harvestable rights. This would apply to dams no longer required for agricultural activities. Dam capacity across the property must remain within the MHRDC at all times.

3.3 Downstream Licensed Water Users

The Water Sharing Plan for the Murrumbidgee Unregulated River Water Sources 2012, established under the Water Management Act 2000, includes the Project site which is within the Murrumbidgee Catchment. The site falls within the Murrumbidgee II Water Source sub-catchment. The sub-catchment has a total of 34 water access licences, including a total share component of 6,615 ML (based on a WaterNSW, 2024, available at *https://waterregister.waternsw.com.au*, accessed *November 2024*).

4 WATER QUALITY OBJECTIVES

4.1 Site Specific Environmental Values

Site specific Environmental Values (EVs) are expected to be developed for the project as part of the proposed ongoing surface water monitoring and reporting program. As described in Section 8, water samples would be collected from the two approved discharge locations (downstream of the northern dam and downstream of the processing dam) and tested for the following parameters:

- pH.
- Electrical Conductivity (EC).
- Total Suspended Solids (TSS).
- Turbidity.
- Oil and grease.
- Visible pollutants (e.g., sediment, discolouration, odours).

It is anticipated that site specific EVs would be developed based on recorded background data over a period of at least two years. However, until they are developed, the samples would be compared against the default trigger values described in Section 4.2 below.

4.2 Environmental Values

Environmental values are those values or uses of water that are desired by the community to be protected. These include, but are not limited to, protection of aquatic ecosystems, drinking water, primary and secondary recreation, visual amenity, and agricultural water for irrigation, livestock and growing aquatic foods.

The National Water Quality Management Strategy (NWQMS) including the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000 and ANZG, 2018) provides guidance on water quality planning and management. It highlights the need to adopt locally established community values where provided, by the relevant authorities. In NSW, interim water quality objectives have been established in consultation with the community. They help decision makers consider water quality in both big picture strategic planning such as State Strategic Plans and Regional Strategies and at the local level when assessing impacts of development.

Environmental values for each catchment in NSW are provided by the NSW Department of Planning, Industry and Environment (Environment, Energy and Science) (available at: *https://www.environment.nsw.gov.au/ieo/*).

The Project site lies within the Murrumbidgee River and Lake George Catchment within the regions classified as 'Uncontrolled streams'. The nominated protection of water quality objectives applying to waterways within the study area are outlined in Table 6.

No existing water quality data for waterways near to the study area was available at the time of reporting.

Table 6: Relevant NSW Water Quality Objectives.

Water Quality Objective	Description
Aquatic ecosystems	Maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term
Visual amenity	Aesthetic qualities of waters
Secondary contact recreation	Maintaining or improving water quality for activities such as boating and wading, where there is a low probability of water being swallowed
Primary contact recreation	Maintaining or improving water quality for activities such as swimming in which there is a high probability of water being swallowed
Livestock water supply	Protecting water quality to maximise the production of healthy livestock
Irrigation water supply	Protecting the quality of waters applied to crops and pasture
Homestead water supply	Protecting water quality for domestic use in homesteads, including drinking, cooking and bathing
Drinking water - Disinfection only, or Drinking water - Clarification and disinfection Drinking water - Groundwater	Refers to the quality of drinking water drawn from the raw surface and groundwater sources before any treatment
Aquatic foods (cooked)	Refers to protecting water quality so that it is suitable for the production of aquatic foods for human consumption and aquaculture activities.
	Industrial water supplies.

The water quality parameters most likely to be impacted in waters detained within the Project premises during construction include:

- Turbidity (and suspended sediment).
- pH.
- Oils and greases.

pH can be adjusted simply and easily in discharges to match ambient conditions and so is not included in this Assessment. Oils and greases in discharges, and the presence of

potential pollutants (e.g. heavy metals) would be managed via a dewatering protocol/procedure and are thus excluded.

The indicators of water quality are selected for the relevant pressures identified for the waterway system, their associated stressors and anticipated ecosystem receptors. The selected indicators for the water quality objectives listed in Table 6 include typical physical and chemical indicators such as turbidity and pH that can compromise waterway health. Potential nutrient pollution (primarily from phosphorus and nitrogen) in surface water are excluded from this Assessment because:

- The main source of turbidity and suspended sediment into sediment stores/basins would be from exposed subsoils, which are typically low in nutrients. Topsoils are higher in nutrients but they have been stripped from the construction area; and
- The majority of nutrients within soils are bound onto soil particles, so targeting sediment removal in stormwater translates to significant nutrient removal (Davis and Koop, 2006).

As such, this report focuses on turbidity (as caused by suspended sediment). The ANZECC Guidelines define upland streams as those above 150 m altitude which is applicable to this Project. As such, the relevant indicators to the Project are:

- Aquatic ecosystems: 2-25 Nephelometric Turbidity Units (NTU).
- Homestead water supply: 5 NTU; <1 NTU desirable for effective disinfection; > 1 NTU may shield some micro-organisms from disinfection.
- Primary contact recreation: A 200 mm diameter black disc should be able to be sighted horizontally from a distance of more than 1.6 m (approximately 6 NTU).
- pH: 6.5 – 8.0.
- Surface films and debris: Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour. Waters should be free from floating debris and litter.

5 EROSION AND SEDIMENT CONTROL

5.1 Erosion Hazard Assessment

Erosion and sediment control recommendations are provided in the conceptual Erosion and Sediment Control Plan (ESCP) (Appendix A). This section outlines the key controls.

An evaluation of the erosion hazard for each catchment was made using the Revised Universal Soil Loss Equation (RUSLE) as follows:

$$A = R \times K \times LS \times P \times C$$

The calculated soil loss is used to determine the appropriate sediment control standard in each affected catchment. Table 7 details the definition of each of the factors considered in the RUSLE, and the values adopted for each.

Table 7: Erosion hazard (based on Landcom, 2004)

Parameter	Definition	Adopted value
A	Total calculated soil loss (t/yr)	Varies, depending on LS-factor in each catchment.
R	Rainfall erosivity factor (annual)	1500*
K	Soil erodibility factor	0.028 (The most conservative K-factor from Site soil testing (SEEC, 2024)).
LS	Slope length and gradient factor	Varies. In each catchment, the natural slope and slope length was taken into account, as was the proposed design slope and slope length (e.g. of any large batters). A composite LS-factor was used when assessing erosion hazard in each catchment. This ranges from 2.08 (a composite of 55 m at 45 % and 80 m at 2.5 %) to 12.4 (80 m at 32 %).
P	Conservation practice factor	1.3 (compacted and smooth)
C	Ground cover factor	1.0 (no ground cover).

* Based on R-factor map for Project locality (from Landcom, 2004).

It is recognised that topsoils and subsoils have differing erosion hazards owing to a number of factors. While rain drop impact responsible for mobilising sediment, is minimised with the presence of vegetative or soil surface cover, uncompacted topsoil's generally allow for the infiltration of rainfall resulting in lower instances of scour and soil erosion.

Subsoils are generally more compacted, and while they may not have the same degree of sediment mobilised by rain drop impact, they allow for very little infiltration resulting in a higher potential for overland flow. This has an associated effect of high flow concentration, scour potential and mobilisation of bulk sediments.

5.2 Sediment Basins

5.2.1 Sediment Basin Design

In accordance with *Managing Urban Stormwater* (the Blue Book) Volumes 1 and 2E (Landcom, 2004 and DECC, 2008), sediment basins are required where the erosion hazard in any disturbed catchment exceeds the threshold of 150 m^3 (200 tonnes of saturated sediment) per year.

The basins are designed to capture runoff from disturbed catchments and store the runoff for a sufficient period of time to allow the sediment to settle out of suspension prior to discharging water of suitable quality to receiving environments.

A conceptual Erosion and Sediment Control Plans (ESCP) was prepared by SEEC (Appendix A). In addition to numerous other erosion and sediment controls, the ESCP shows several sediment basins to be used during construction to temporarily detain dirty onsite water generated when rainfall runs off disturbed areas.

Construction-phase sediment basins, would typically be sized based on Landcom, 2004 using a 5-day 95th percentile rainfall depth (33mm), however, as these sediment basins will remain for the duration of the project, a more stringent design criteria has been requested by the EPA (specifically a minimum 1 in 10 year 24 hour rainfall event). Therefore, the operational-phase sediment basins are sized based on the following criteria:

- Design rainfall depth: 96.5mm (10-year 24-hour rainfall depth);
- Basins designed for Type F/D (dispersible) sediment;
- Volumetric runoff coefficient (Cv): 0.79 (Hydrologic Group C) for all areas.

The minimum basin sizing to meet these requirements is listed in Table 8. Note that these are minimum sizes based on the largest catchment area that drains to each dam throughout their expected design life. These volumes may be increased to provide additional water storage on-site as identified by the water balance in Section 6.5.

The basins should be maintained within 5 days of the rain event with captured runoff treated and discharged ready to accept the settling volume listed in the table below. Should water be required for on site use, the water can be retained, however the basins must be capable of capturing the nominated settling volume prior to a rain event. Note that if rain occurs within the 5-day maintenance period, the 5-day treatment period resets.

The Eastern Dam and Southern Dam are constrained by the approved clearing extents and therefore cannot be expanded beyond their original footprint to satisfy the additional EPA requirements. To address this shortfall, supplementary storage volume has been incorporated into the Processing Area Dam. During rainfall events, water from the Eastern and Southern Dams will be pumped to the Processing Area Dam to achieve capture requirements for the nominated EPA design rainfall event.

The Extraction Pit Sump and Northern Dam have also been designed with increased total storage capacity above the minimum Landcom settling zone requirements to provide additional water availability to meet on-site operational demands (refer to Section 7).

Four time periods (year 1, year 4, year 8 and year 15) were reviewed to observe how the sediment basin catchments and subsequent required volumes would change over the life of the quarry as shown in Figure 9, Figure 10, Figure 11 and Figure 12. The extraction pit sump location shown is indicative only and may vary over the nominated periods.

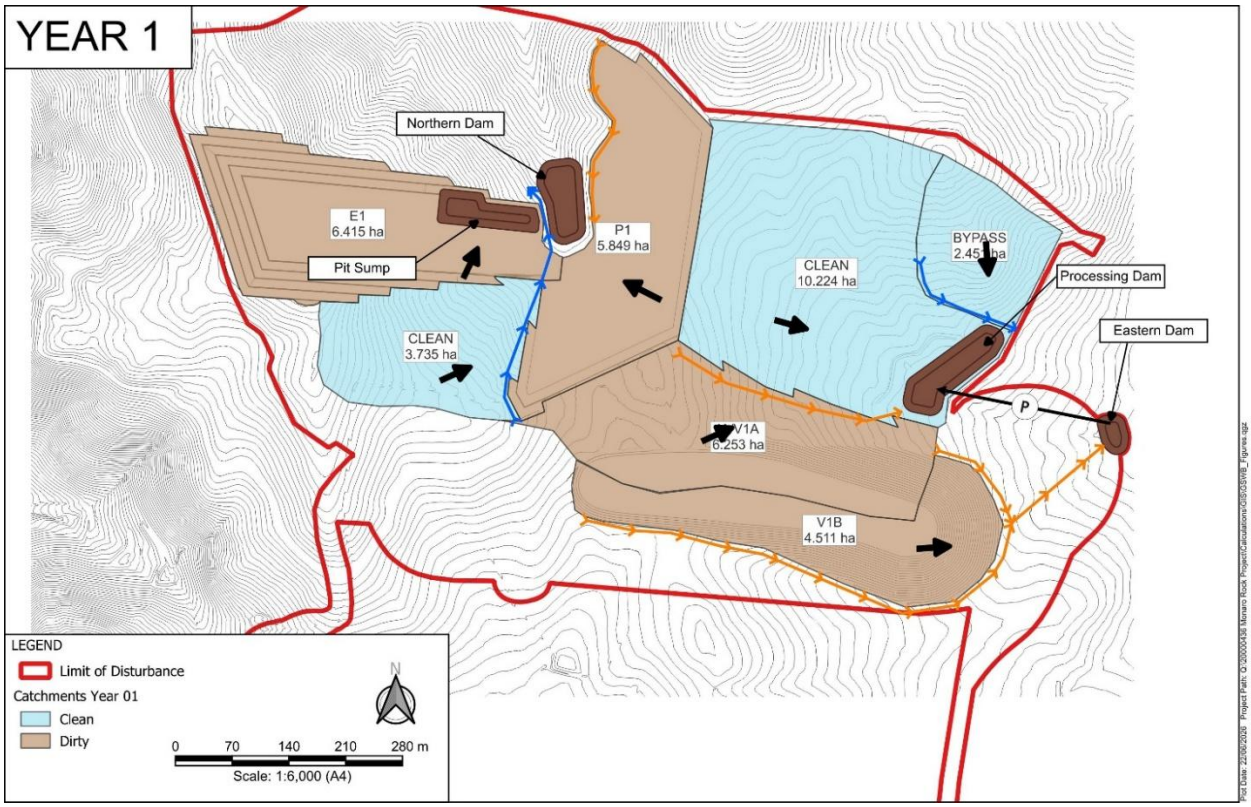

Figure 9: Catchment Layout - Year 1.

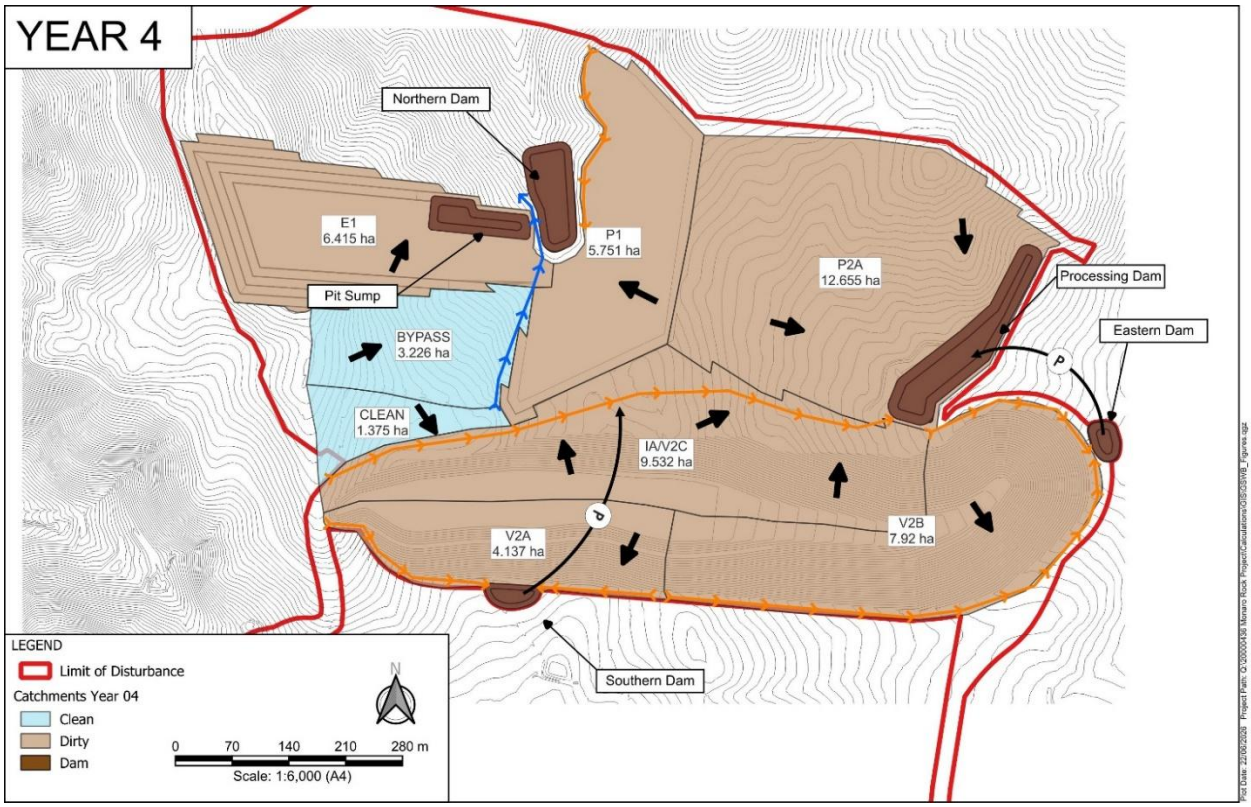

Figure 10: Catchment Layout - Year 4.

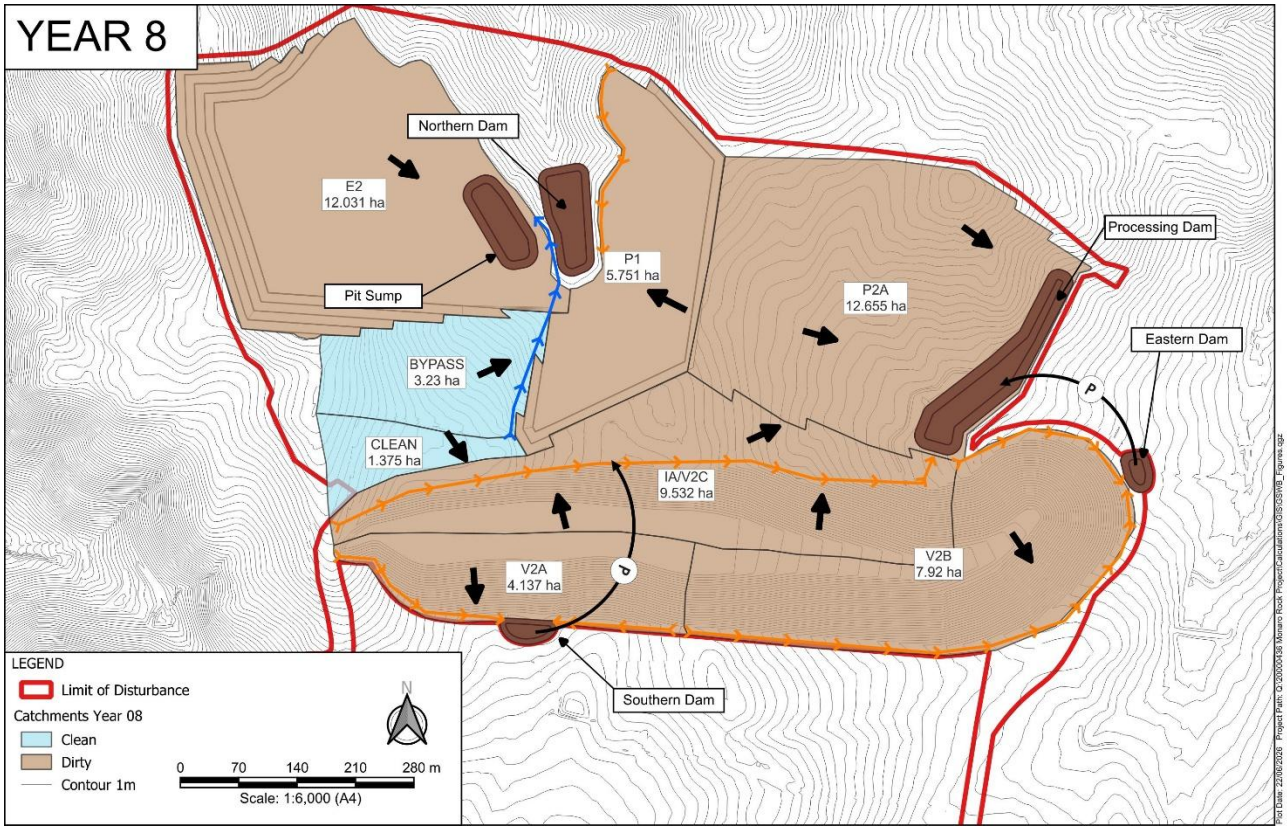

Figure 11: Catchment Plan - Year 8.

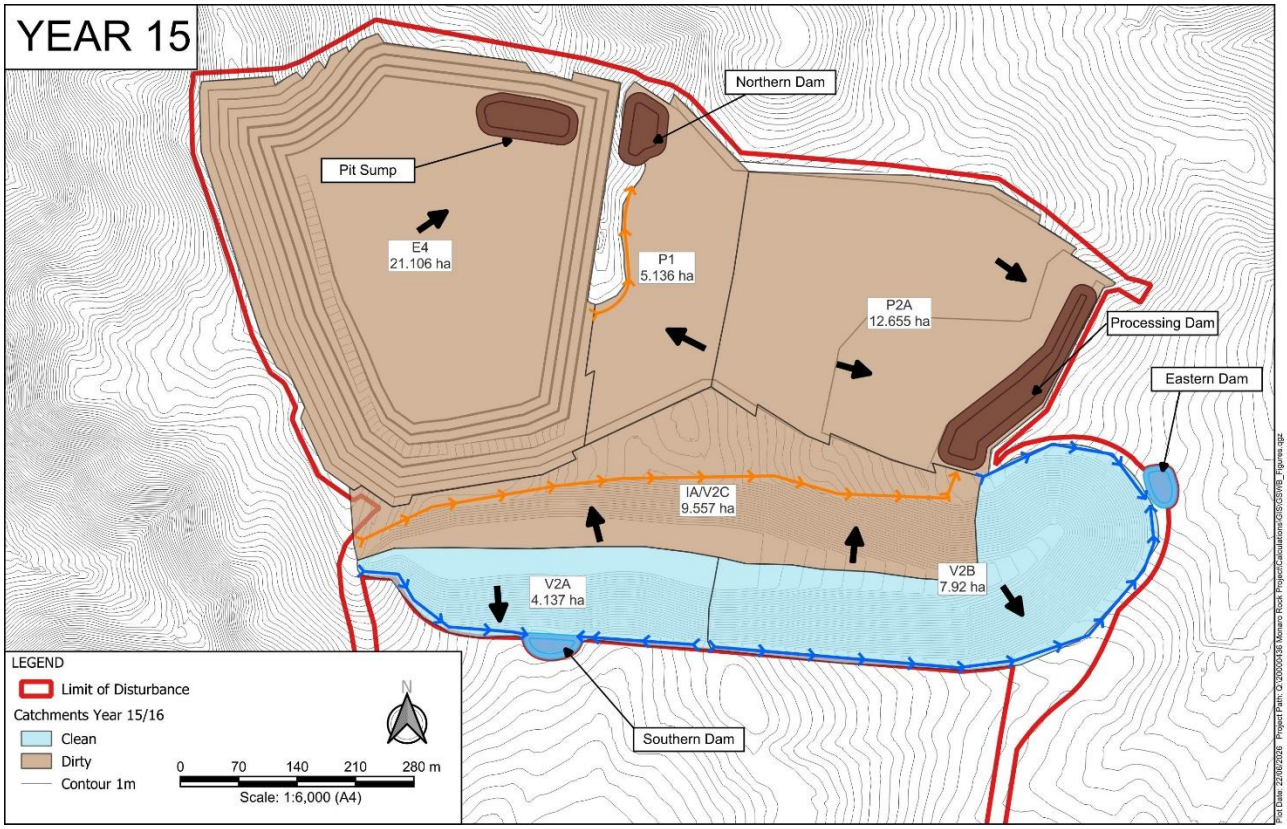

Figure 12: Catchment Plan - Year 15.

Table 8: Minimum Sediment Basin Sizing Requirements as per ESC Requirements.

Quarry Year	Total Catchment (ha)	Min. Soil Storage Volume (ML)	Min. Settling Zone Volume [1] (ML)	Adopted Settling Zone Volume [2] (ML)	Available Working Volume (ML)	Total Basin Volume [3] (ML)
Year 1						
Pit Sump	6.4	0.2	4.9	4.9	5.7	10.8
Northern Dam	5.9	0.2	4.5	4.5	6.0	10.7
Process Area Dam	16.5	1.6	12.6	14.2	0.3	16.1
Southern Dam	-	-	-	-	-	-
Eastern Dam	4.5	1.1	3.4	1.8	0.0	2.9
Sum	**33.3**	**3.1**	**25.3**	**25.3**	**12.0**	**40.5**
Year 4						
Pit Sump	6.4	0.2	4.9	4.9	5.7	10.8
Northern Dam	5.9	0.2	4.5	4.5	10.4	15.1
Process Area Dam	23.6	2.3	18.0	25.4	4.5	32.2
Southern Dam	4.1	0.8	3.2	0.8	0.0	1.6
Eastern Dam	7.9	1.9	6.0	1.0	0.0	2.9
Sum	**47.9**	**5.5**	**36.5**	**36.5**	**20.5**	**62.5**
Year 8						
Pit Sump	12.0	0.4	9.2	9.2	16.1	25.7
Northern Dam	5.8	0.2	4.4	4.4	10.5	15.1
Process Area Dam	23.6	2.3	18.0	25.5	4.4	32.2
Southern Dam	4.1	0.8	3.2	0.8	0.0	1.6
Eastern Dam	7.9	1.9	6.0	1.0	0.0	2.9
Sum	**53.4**	**5.7**	**40.7**	**40.7**	**31.0**	**77.4**
Year 15-30						
Pit Sump	21.1	0.7	16.1	16.1	8.9	25.7
Northern Dam	5.1	0.2	3.9	3.9	6.3	10.4
Process Area Dam	22.2	2.2	16.9	24.4	5.6	32.2
Southern Dam	4.1	0.8	3.1	0.8	0.0	1.6
Eastern Dam	7.9	1.9	6.0	1.0	0.0	2.9
Sum	**60.5**	**5.9**	**46.1**	**46.1**	**20.7**	**72.7**

[1] Minimum settling zones volumes based on the 10-year, 24-hour design rainfall event of 96.5mm.
[2] The Eastern and Southern Dams are constrained by clearing footprints and cannot be increased to cater for the 10-year, 24-hour rainfall depth. Therefore, the additional storage required will be provided with the Process Area Dam (PAD). With water being pumped into the PAD during a rainfall event to ensure capture.
[3] Adopted basin volume based on water balance modelling to meet demands and site constraints. Refer to Section 7.

5.2.2 Coagulants and Flocculants

Chemical coagulants and/or flocculants might be required to treat detained surface water and achieve the discharge limits determined in this Assessment and included in the EPL. The use of proposed flocculants or coagulants is to be assessed in consultation with the EPA prior to use to limit the risk of unexpected consequences.

The adoption of an effective chemical coagulant or flocculant to achieve rapid settlement of suspended sediment requires jar testing with soil samples or collected dirty runoff from the

specific site to confirm the chemical dosing rate, impacts to pH and relative time to form floccs and allow sediment to settle to the basin floor or sediment storage zone. This will be done prior to construction and will be ongoing as different soils are encountered across the site (spatially and at different depths).

Typical dosage rates for liquid coagulants and flocculants (e.g. aluminium chlorohydrate, chitosan) will depend on the adopted chemical and the characteristics of the soil but are expected to be in the order of 20-100ppm (dependant on actual site jar tests). A Safety Data Sheet (SDS) of a typical flocculant (Turbifloc - chitosan) is provided in Appendix B as an example only. The adopted chemical additive may change however any adopted chemical will be reviewed to confirm:

- A characterisation of the expected quality of pollutants potentially present that pose a risk of non-trivial harm to the environment if an overflow to receiving water was to occur.
- An assessment of the potential impact of discharges on the environmental values of the receiving waterway with reference to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality guideline values (the Water Quality Guidelines).
- The degradation rate of the flocculant and the potential for accumulation in bed sediments of the receiving waterway.
- Ecotoxicology testing of the flocculant and the treated discharge, by a NATA accredited laboratory.
- The ecotoxicology testing should contain representative test species across a range of taxonomic groups in order to provide data on the potential environmental risk.

Proposed monitoring program to demonstrate compliance with triggers and any water quality limits and demonstrate that treated water is safe for environmental discharge.

5.2.3 Management of Detained Water

The highest priority for the management of detained water would be to avoid the occurrence of uncontrolled discharge. The flow chart in Figure 13 shows how surface water management would occur on the Project site. This demonstrates how the Project aims to avoid discharge, if at all possible, through:

- Beneficial re-use of detained surface water from sediment basins, sumps and excavations; or
- Land application of detained surface water onto vegetated or rehabilitation areas.

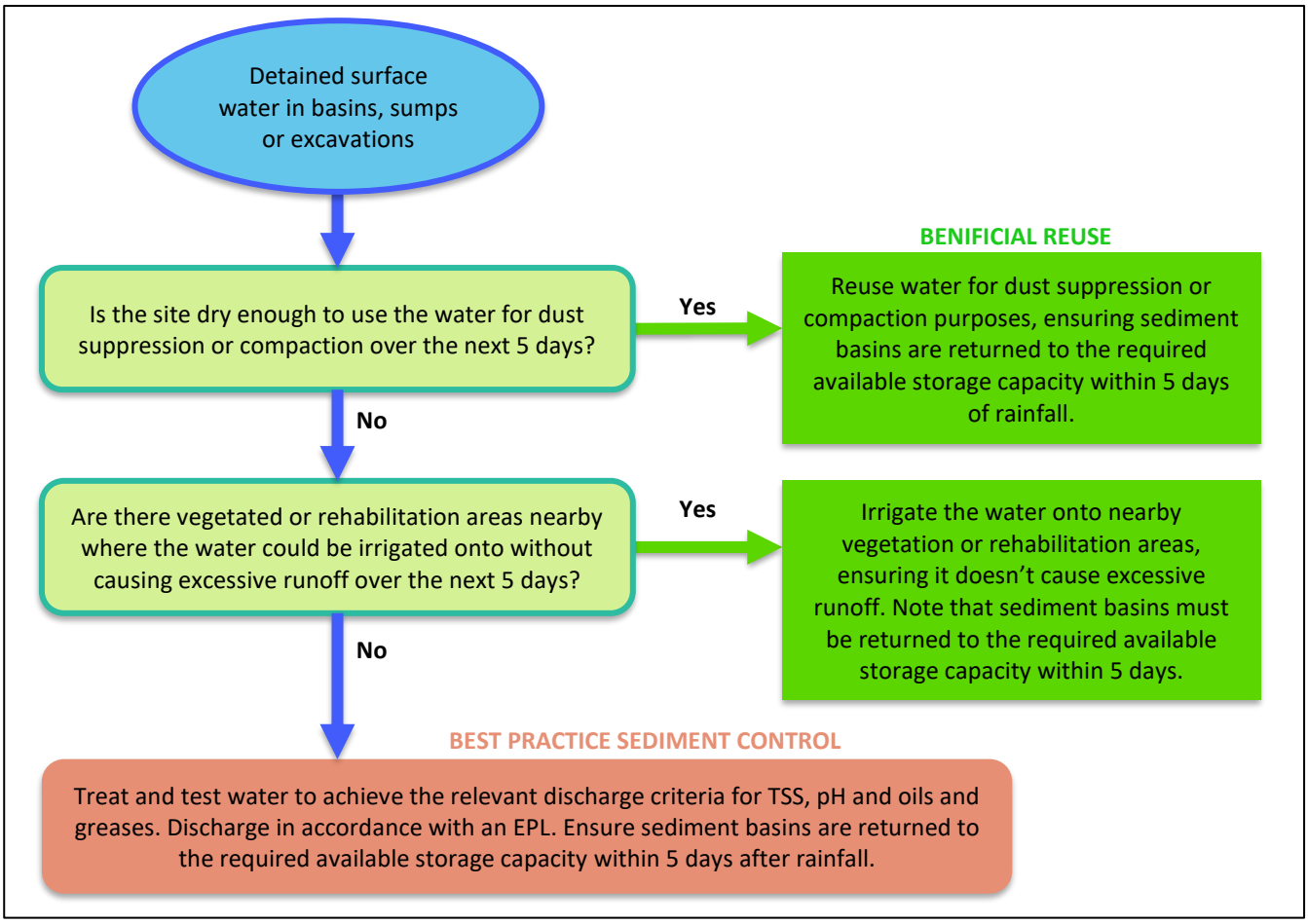

Figure 13: Flow chart for management of surface water on the project.

Managed or controlled discharge from the Project would only occur when the above options are exhausted. This typically occurs when:

- Heavy rainfall has made the site too wet for beneficial onsite re-use such as dust suppression; and/or
- The volume of detained surface water exceeds what can be feasibly re-used onsite prior to the next rainfall event; and/or
- Heavy rainfall has made land application onto nearby vegetated or revegetation areas impossible; and/or
- There are no suitable onsite re-use options available in reasonable proximity to the detained body of surface water.

Consequently, the capture and retention of sediment on site using the best practice management principles outlined in the Blue Book (Landcom, 2004 and DECC, 2008) decreases the potential for a range of other pollutants degrading the receiving environment.

5.3 Supplementary Erosion and Sediment Controls

Other erosion and sediment control measures would be installed as required to reduce the velocity of flows and capture sediments. Additional sediment protection may include the use of one or more of the controls outlined in Table 9.

Table 9: Supplementary Erosion and Sediment Controls.

Control	Description
Sediment Fencing	Sediment (silt) fencing consisting of geotextile filter fabric supported by wire and posts will be utilised in areas where: • the area draining to the fence is 0.6ha or less; • the maximum slope gradient behind the fence is 1:2 (V:H); and • the maximum slope length behind the fence is 60m. Sediment fences will generally be installed prior to disturbance activities (e.g. down slope of soil stockpiles) or downslope of areas being rehabilitated and maintained until stabilisation of the area.
Coir Log Filters and Check Dams	If additional erosion control is required at the outlet of a drain or across a swale or channel of a diversion bund, a temporary barrier of anchored coir logs laid end to end across the direction of flow may be utilised to reduce the water velocity and capture sediments. Check dams may also be utilised consisting of rock material. Check dams would primarily be utilised to reduce the velocity of water to minimise erosion rather than as a sediment retention structure.
Rock Armouring and Jute Mesh	In the event additional erosion controls are required, other options that will be considered include the use of rock armouring, whereby a channel or outlet is effectively lined with appropriately sized aggregate material to provide a physical barrier to erosion. Similar to rock armouring, jute mesh, a biodegradable erosion control blanket, may be installed, particularly where vegetation growth is preferable.
Supplementary Planting / Sowing of Cover Crop	Where a vegetated outcome is required but establishment has not been successful, following any corrective earthworks or soil amelioration, a fast growing, non-persistent cover crop should be sown for short term stabilisation together with the native species required for long-term ecosystem establishment. This measure may need to be undertaken in conjunction with other control measures.

These additional measures are applicable to water management structures, active disturbance areas and future areas to be rehabilitated.

6 WATER MANAGEMENT STRATEGY

6.1 Objectives

The objectives of the water management system include:

- Separation of clean water from externally draining catchments and dirty water from internally draining catchments.
- efficient recovery and use of natural water resources to minimise external water demand;
- effective management of available storage volumes that minimises the risk uncontrolled discharge to receiving environments; and
- effective water quality management strategies that limit the need for controlled discharge or uncontrolled discharge of impacted water to receiving environments.

6.2 Water Management

The following sections describe the proposed water management strategy assumed for water balance modelling. This section is to be read in conjunction with the Erosion and Sediment Control Plan (20000436_P02_ESCP) in Appendix A.

The ESCP outlines water management through each stage of the Quarry. This section will outline the principles of water management over the life of the Quarry.

Surface water can be categorised as either clean or dirty water. Clean water is surface water runoff from natural or rehabilitated surfaces with sufficient groundcover to minimise the disturbance and transport of sediment. Dirty water is any surface water runoff that flows over exposed soils, stockpiles etc that can increase the concentration of sediment in suspension and the transfer of sediment around and external from the site.

6.2.1 Clean Water Management

As per the ESCP, clean water drains are located upstream of the quarry, to direct upstream clean water around the Quarry Site.

Clean water drain CW01 directs the northwestern catchment to a Monks Gully Tributary, and CW02 directs the northeastern catchment to Four Mile Creek.

Clean water drains are also located to the south of the visibility barrier to direct water to the proposed clean water dams. Clean water drains CW03 and CW04 direct water to the Eastern Dam and drains CW05 and CW06 direct water to the Southern Dam.

Clean water from those dams can be used to supplement on site water use for dust suppression and process water.

6.2.2 Dirty Water Management

A series of low flow earth banks would be progressively constructed downslope of the extraction area as it is progressively developed. The banks would be in accordance with SD

5-5 of the Blue Book, and form flow paths/drain to capture and divert dirty water into a series of progressively constructed sediment basins.

Type F/D sediment basins will be adopted across the site, as outlined in Section 5.2. The location and minimum capacity requirements, based on Blue Book, of sediment basins on the Quarry Site are included in the ESCP and are outlined in Table 8. The actual dam sizes adopted for the Project are greater than those volumes (refer to Section 6.2.3) for water re-use on site and to ensure that the number of spills per year does not exceed the Blue Book requirements.

6.2.3 Water Storages

The Extraction Pit Sump and Processing Dam are within the disturbed quarry areas and contain dirty water to be treated or used within the quarry. Water within the Extraction Pit Sump is to be pumped to the Northern Dam for treatment or use. The Southern Dam and Eastern Dam store clean runoff from the visibility barrier. Two additional clean water dams were included in the water balance model to determine if it could improve water availability for the project. These water storages are outlined in Table 10.

Table 10: Water management storages.

Storage	Capacity (ML)	Land use	Catchment Area (ha) and Year					
			1	4	8	15	16-30	>30 Years
Extraction Pit Sump	10.8-25.7	Quarry	6.4	6.4	12.0	21.1	21.1	21.1
Northern Dam	10.4-15.1	Hardstand	5.9	5.9	5.8	5.1	-	-
Processing Dam	16.1-32.2	Natural	10.2	1.4	1.4	0.0	0.0	-
		Hardstand	6.3	22.2	22.2	22.2	22.2	-
Southern Dam	0-1.6	Natural	-	4.1	4.1	4.1	4.1	-
Eastern Dam	2.9	Natural	4.5	7.9	7.9	7.9	7.9	-
Farm Dam	4.9[3]	Natural	71.4	-				
Clean Dam 1	16	Natural	-	100.0				
Clean Dam 2	3.1	Natural	-			81.2		
Water Tanks	0.05	-	-					

[1] Extraction Pit Sump volume will vary throughout the quarry life, it has been modelled as 5 ML for all stages, note that a sump of this size is likely to spill in the later years.
[2] Extraction Pit Sump is assumed to overtop to the Northern Dam in this stage and has been modelled as such. The predicted water reliability in Table 17 assumes that these overflows are captured in the Northern Dam to ensure sufficient water availability and quality.
[3] Farm Dam capacity is approximately 2.8 ML. The dam capacity is proposed to be increased to 4.9 ML.

It is noted that the estimated capacity of the Northern and Processing Dams is considerably greater than the minimum basin capacity requirement for sediment control (Refer to Table 8). The increased size is to meet on-site usage requests such as dust suppression.

It is recommended that a marker level would be established within those basins to identify the water level which provides at least the required storage prior to rainfall event. In

accordance with Blue Book requirements, any water accumulated above this marker would be treated, tested and removed within 5 days. The water would be preferentially used for dust suppression, however, alternatively applied to areas being rehabilitated or undisturbed portions of the extraction area which do not drain from the Quarry site.

Note that all clean water dams, including the existing dams, need to be within the harvestable rights volume (a total of 38.71ML) – see Section 3.2.

6.3 Maximum Harvestable Right Dam Capacity

As provided in Table 5, the Maximum Harvestable Right Dam Capacity (MHRDC) for the project is 38.71ML. Existing clean water dams that are to remain on site total 4.53 ML leaving an available storage volume of 34.18ML. The staging of the dams that collect runoff from natural areas is provided in Table 10.

Table 11: Staging of MHRDC.

Storage	Dam Volumes (ML) and Year					
	1	4	8	15	16-30	>30 Years
Extraction Pit Sump	10.8	10.8	25.7	25.7	25.7	[6]
Northern Dam[1]	10.7	15.1	15.1	10.4	10.4	-
Processing Dam[2]	16.1	32.2	32.2	32.2	32.2	-
Southern Dam	-	1.6	1.6	1.6	1.6	-
Eastern Dam	2.9	2.9	2.9	2.9	2.9	-
Farm Dam[3]	4.9	-	-	-	-	-
Clean Dam 1[4]	-	16	16	16	16	16
Clean Dam 2[5]	3.1	3.1	3.1	3.1	3.1	3.1
Total Storage Volume	**28.6**	**23.6**	**23.6**	**23.6**	**23.6**	**19.1**
Balance MHRDC	**5.6**	**10.6**	**10.6**	**10.6**	**10.6**	**15.1**

[1] The natural catchment upstream of the Northern Dam assumed to be bypassing the dam.
[2] The Processing Dam has an upstream clean water catchment that bypasses the dam until the Processing Area reaches stage P2 (assumed Year 4).
[3] The Farm Dam will be increased in capacity from 2.8 ML to 4.9 ML and used in Year 1 until the Processing Area reaches stage P2 (assumed Year 4) and the Northern Dam is no longer included within the MHRDC. After this time Clean Dam 1 can be constructed.
[4] Clean Dam 1 will be constructed in Year 4, once the Processing Area reaches stage P2 (assumed Year 4) and the Processing Area Dam is no longer included within the MHRDC.
[5] Clean Dam 2 will be constructed in Year 1.
[6] A extraction pit void is left at the end of the quarry life.

As shown in Table 11, the MHRDC will not be exceeded in any stage of the quarry life.

6.4 Water Demands

Water demand for the Project would include the following.

- Dust suppression on exposed and trafficked areas.
- Concrete production.

Dust suppression water demand would be the highest priority use for the Project. While not 'used' for the development, water would also be lost from water infrastructure through infiltrative and evaporative process (see Section 7.4.2).

6.4.1 Dust Suppression

The water demand for dust suppression has been separated into two parts. The first being Haul Road dust suppression and the second being dust suppression for Stockpile and Processing Areas.

The adopted methodology for estimating watering requirements for trafficked areas is based on Buonicore & Davis (1992), which considers local evaporation rates, exposed (trafficked) areas, periods of operation and application cycling time. The formula is provided below.

$$C = 100 - \frac{0.8pdt}{i}$$

The variable definitions and adopted values for both areas requiring dust suppression are outlined in Table 12.

Table 12: Dust Suppression formula parameters.

Variable	Definition	Adopted Value	
		Haul Road Areas	Stockpile and Processing Areas
C	average control efficiency (%)	90%	
p	potential average hourly daytime evaporation rate (mm/h)	Based on daily pan evaporation data and pan coefficient	
d	average hourly daytime traffic (per hour)	25 veh/hr	1 veh/hr
t	time between applications (hr)	4 hr	24 hr
i	application intensity (L/m^2)	Calculated	

The formula was used with the parameters listed above with daily potential evaporation rates to determine a daily application intensity.

The daily application intensity for Haul Road Areas was then multiplied by the provided application area of 1.03 ha (assumed for all stages) to determine the water requirements for dust suppression for Haul Road Areas resulting in an average of 12 ML/yr.

The daily application intensity for Stockpile and Processing Areas was multiplied by the assumed application area (varying between 5.4 to 14.2 ha based on visibility barrier and stockpiling area stages), to determine the water requirements for dust suppression for

Stockpile and Processing Areas resulting in a range of 5.03 and 13.2 ML/yr, for the minimum and maximum areas, respectively.

6.4.2 Concrete Batching

A concrete batching plant would be developed within the Processing and Stockpiling Area. The plant would have capacity to produce and despatch up to 50,000m^3 of concrete per annum and up to 300m^3 of concrete per day.

An estimated 180L of water is required to produce 1m^3 of concrete. Assuming a maximum of 50,000m^3 of concrete is produced per year, the annual Concrete Batching water demand is estimated to be up to 9 ML/yr.

6.5 Off-site Water Discharge

The water management system consists of several dams designed to cater for clean and dirty water Detained water will be managed to avoid the occurrence of uncontrolled discharge. Some dams/basins may spill to adjacent dams while others have sufficient volume to minimise the risk of spills and must have pumped discharges. For example , water is unlikely to spill from any extraction pits as they have significant storage volume (>20m deep).

Clean water and sediment dams can spill if sufficient rain events occur (uncontrolled discharge). For this to occur at a sediment dam, rainfall would need to exceed the design rainfall depth of 96.5mm (10-year 24-hour rainfall depth) as described in Section 5.2.

Controlled releases may occur from the sediment basins, however, controlled release is a last resort and will be reduced by the extraction of stored water to meet process water requirements such as dust suppression as discussed in Section 5.2.3.

7 SITE WATER BALANCE

7.1 Model Approach

A site water balance model was developed for Monaro Rock Quarry, based on the water management strategy outlined in Section 6. The objectives of the water balance are to:

- Estimate the process water demands and water source volumes over the life of the Project for a full range of climatic conditions (dry year, median year and wet year).
- Demonstrate the ability of the proposed surface water management system to manage surface water runoff that would occur during periods of prolonged or extreme wet weather.
- Assess the drought security of the operation and identify the risk of process water shortages.
- Demonstrate that water would be managed effectively to meet the water quality objectives described in Section 4 and satisfy the requirements of the NSW EPA.

The following water balance includes the four stages outlined in the water management strategy (Section 6). This section details the modelling approach and assumptions.

As we cannot predict long term future rainfall accurately, the adopted approach is to undertake the water balance using a long-term historical rainfall record with the assumption that it will include a range of high, medium and low rainfall periods that could be expected at the site in the future. Model results are presented for the average of all years run plus the individual results for a dry year (10th percentile), median year (50th percentile) and a wet year (90th percentile). As the model run is continuous, the results will be based on the starting water level within each dam at the conclusion of the previous year.

The impact of climate change could be modelled by increasing the peak rainfalls and the number of dry days. However, there is limited information on appropriate data sets for water balance modelling unlike flood modelling where the rainfall data can be increased by a factor. This assessment has adopted the recorded historical data. An increased allowance for any make-up water should be included to account for potential climate change impacts. Model results are presented in Section 7.5.

Staging has been included in the water balance model as described in Section 1.3.

A schematic of the water balance model for the site is provided in Figure 14.

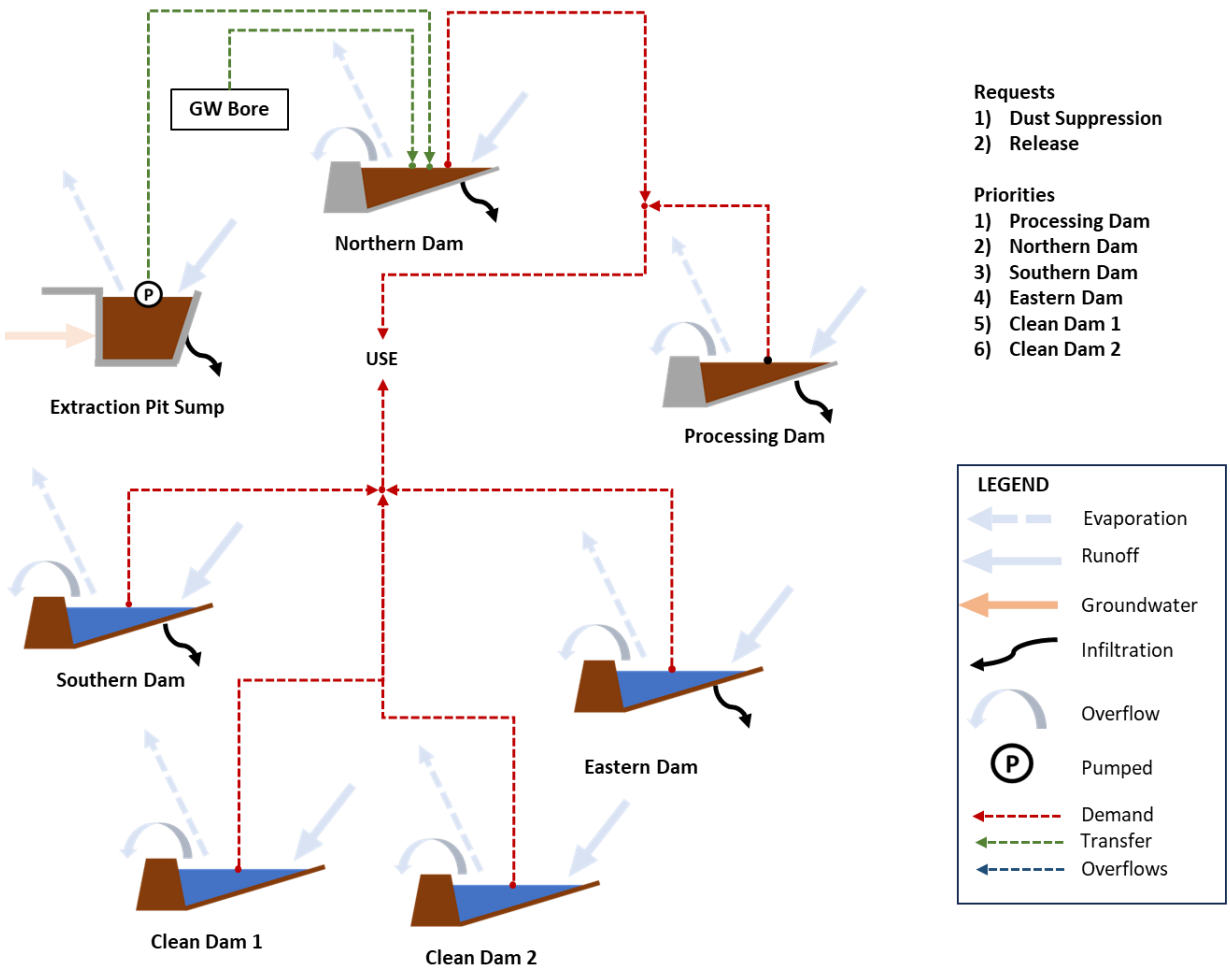

Figure 14: Site water balance schematic.

7.2 GoldSim

GoldSim was used to undertake a water balance of the proposed Monaro Rock Quarry. GoldSim is a powerful and flexible platform for visualizing and dynamically simulating complex systems in engineering. It is a "visual spreadsheet" that allows you to graphically create and manipulate data and equations. GoldSim allows you to create realistic models of surface water management systems for a range of development types in order to carry out risk analyses, evaluate potential environmental impacts, support strategic planning, and optimize operations.

GoldSim can incorporate the Australian Water Balance Model (AWBM) developed in the early 1990s by Walter Boughton for estimating runoff from industrial developments, mine sites and for other projects that simulate rainfall runoff in a watershed. AWBM relates daily rainfall and evapotranspiration to runoff and calculates losses from rainfall for flood hydrograph modelling. The model contains five stores; three surface stores to simulate partial areas of runoff, a base flow store and a surface runoff routing store. AWBM operates at a daily time-step.

The model will be used to estimate runoff into the water stores, using historical rainfall. This allows for a wide range of potential climatic events (high, low and median rainfall periods). It is assumed that the average water yields will be representative of what could be achieved during the life of the quarry.

A schematic of the AWBM runoff model is provided in Figure 15.

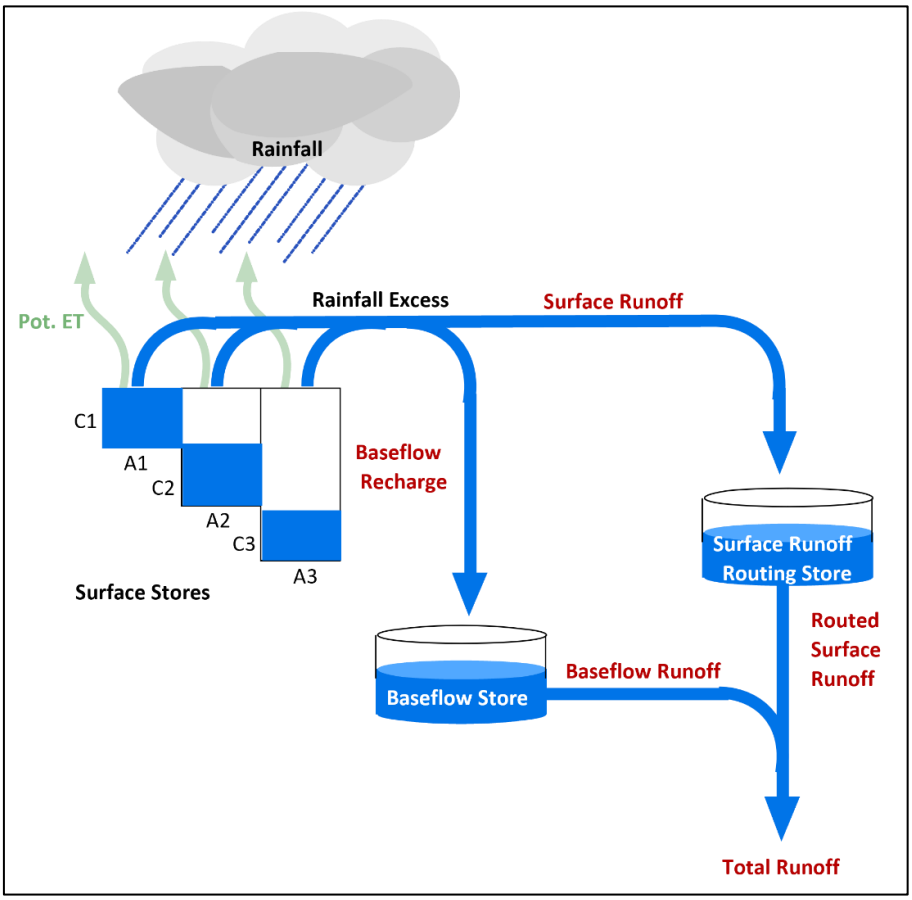

Figure 15: Australian Water Balance Model (AWBM) schematic (GoldSim).

Ideally AWBM parameters would be calibrated for each land use, however, adequate flow data is not available for this site. As such the assumed AWBM parameters used within this water balance are outlined in Table 13 below.

Table 13: AWBM parameters for each land use.

AWBM Parameters	Land Use		
	Natural/Stockpile	Quarry / Open Cut	Hardstand
A1	0.134	0.134	0.134
A2	0.433	0.433	0.433
BFI	0.2	0	0
Kb	0.82	0	0
Ks	0.17	0.1	0.1
C1	20	5	10
C2	75	10	25
C3	120	25	50

7.3 Climate Data

Rainfall and evapotranspiration data have been sourced from the SILO (Scientific Information for Land Owners) database for the closest available grid location to site (Latitude -35.45, Longitude 149.15).

The annual rainfall totals are provided in Figure 16. The highest annual rainfall of 1,271mm occurred in 1956, while the lowest rainfall of 241mm occurred in 1982. The median rainfall of 662mm occurred in 1957.

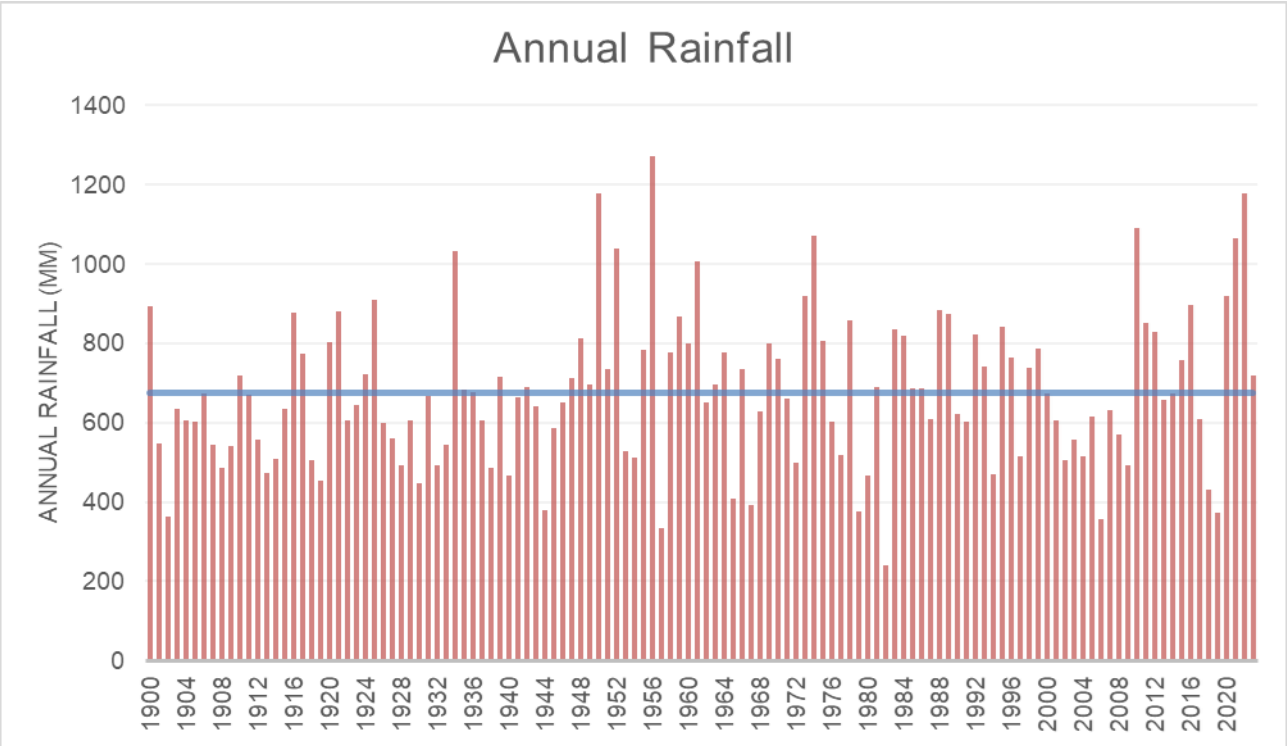

Figure 16: Annual Rainfall for the site.

Evapotranspiration (Morton's potential evapotranspiration) and Class A Pan Evaporation data has also been obtained from the same dataset.

Table 14 present long-term mean climate statistics at the site, along with annual values for selected reference years. The years represent the minimum, the 10th, 50th and 90th percentile annual rainfall years, and the maximum rainfall year.

Table 14: Rainfall and ET statistics for the site.

Statistic	Long-term Mean	Min Rainfall Year (1982)	10%ile Rainfall Year (1919)	50%ile Rainfall Year (1971)	90%ile Rainfall Year (2016)	Max Rainfall Year (1956)
Precipitation (mm)	675	241	453	660	896	1271
Evapotranspiration (mm)	1262	1505	1307	1374	1530	1313
Pan Evaporation (mm)	1501	1707	1637	1385	990	1352

7.4 Water Sources

The water stores adopted in the water balance are listed in Table 10 in Section 6.2.3. Each store has operating rules that define how water is distributed between the stores to efficiently manage excess water to limit spills and provide sufficient water to limit demand on external water supplies.

Water for use in dust suppression would be primarily sourced from the sediment basins (Northern and Processing dams), supplemented by the various clean water dams and the groundwater bore.

Water for use in concrete production would be sourced from water tanks within the processing and stockpiling area. The tanks would be filled from clean water dams and the groundwater bore with these sources supplemented by sediment basins, if needed.

It has been assumed that no water can be discharged directly from the extraction pit. All water will be directed to the pit sump and then pumped to the Northern Dam. The pit sump may spill into the extraction pit (which has substantial water storage) during large events. An additional drainage channel and/or bunding may be required in some stages to limit any off-site discharge and direct excess flows to the Northern Dam or store the runoff within the extraction area.

7.4.1 Operating Rules

All dams except the Pit Sump will be used to supply the water demands listed in Section 6.3. Once demands have been met, water can be pumped around the site to limit spills/overflows or release treated water providing the minimum sediment basin storage requirement for dirty water for future runoff events. Table 15 outlines the priority of each water storage to meet demands and the operating rules to direct flows between water storages included in the water balance.

Table 15: Water storage inflows and outflows (operating rules).

Storage	Volume (ML)	Transfer/Discharge Notes for Quarry Years				
		1	4	8	15	16-30
Extraction Pit Sump	10.8 - 25.7	• Transfer to Northern Dam at 3,000 L/min when available volume in the Northern Dam is greater than the adopted settling zone volume from Table 8[2] and Pit Sump > 1 ML.				
		• Spills to Northern Dam			• Spills to Quarry Pit	
Northern Dam	10.4 - 15.1	• Direct use • Transfer to Extraction Pit Sump to ensure adopted settling zone volume is available within the Northern Dam. • Controlled discharge at 3,000 L/min of water that meets water quality objectives when > 5 days no rainfall and the Northern Dam has less than the adopted settling zone volume from Table 8[2].				
Processing Area Dam	16.1 - 32.2	• Direct use • Transfer to Extraction Pit Sump to ensure adopted settling zone volume is available within Processing Area Dam. • Controlled discharge at 3,000 L/min of water that meets water quality objectives when > 5 days no rainfall and Processing Area Dam has less than the adopted settling zone volume from Table 8[2].				

<table>
<tr><th rowspan="2">Storage</th><th rowspan="2">Volume (ML)</th><th colspan="5">Transfer/Discharge Notes for Quarry Years</th></tr>
<tr><th>1</th><th>4</th><th>8</th><th>15</th><th>16-30</th></tr>
<tr><td>Southern Dam</td><td>1.6</td><td colspan="2" rowspan="2">• Direct use
• Pump to Processing Area Dam during rainfall event. [4]
• Transfer to Extraction Pit Sump to ensure adopted settling zone volume is available within Southern / Eastern Dam.
• Controlled discharge at 3,000 L/min of water that meets water quality objectives when > 5 days no rainfall and the dam has less than the adopted settling zone volume from Table 8[2].</td><td colspan="3" rowspan="2">• Direct use
• Transfer to Water Tanks at 3,000 L/min when Water Tanks < Full
• Natural uncontrolled discharge via spillway</td></tr>
<tr><td>Eastern Dam</td><td>2.9</td></tr>
<tr><td>Farm Dam/ Clean Dam 1[3]</td><td>4.9 / 16</td><td colspan="5" rowspan="2">• Direct use
• Transfer to Water Tanks at 3,000 L/min when Water Tanks < Full
• Natural uncontrolled discharge via spillway</td></tr>
<tr><td>Clean Dam 2</td><td>3.1</td></tr>
<tr><td>Water Tanks</td><td>0.05</td><td colspan="5">• Direct use</td></tr>
</table>

[1] Extraction Pit Sump volume will vary throughout the quarry life, it has been modelled as 5 ML for all stages, note that a sump of this size is likely to spill in the later years.
[2] The dams are required to provide the adopted settling zone volumes within 5 days after the cessation of a rainfall event as listed in Table 8.
[3] Farm Dam is filled and replaced with Clean Dam 1 in Year 4 onwards.
[4] Modelled as an overflow to the Processing Area Dam.

7.4.2 Losses

All dams would lose water through infiltration and evaporation. Infiltration is assumed to be 0.08 mm//hr. Evaporation from each dam is a function of the dam's surface area at a given timestep and daily Class A Pan Evaporation, as sourced from SILO.

7.4.3 Demands

Water demand is described in Section 6.3. The priority for on-site water use would be to source water for dust suppression from sediment basins, with additional water used as needed from remaining sources. For concrete production, water would be sourced from water tanks that are filled primarily from clean water dams but would be topped up from other sources as needed.

7.4.4 Groundwater

Pit extraction area stages E1, E2 and E3 will not intersect the groundwater table. Predicted inflows during stage E4 were estimated to be approximately 30 m^3/day with an expected short term inflow rate of up to 50 m^3/day, as shown in Figure 17.

The groundwater assessment notes that the actual volume of groundwater inflow would be less than the inflows predicted by the numerical model, as a large component of the groundwater inflow will be lost to evaporation, which is not accounted for by the model. A loss factor of up to 50% is typically applied to groundwater model inflow rates to account for evaporative losses in the calculation of quarrying dewatering rates (Hydrogeologist, 2024). The water balance has adopted an inflow rate of 20 m^3/day, as the groundwater inflow will be primarily into a pit sump, which is likely to have less evaporation than if the groundwater was spread over the surface of the entire quarry area.

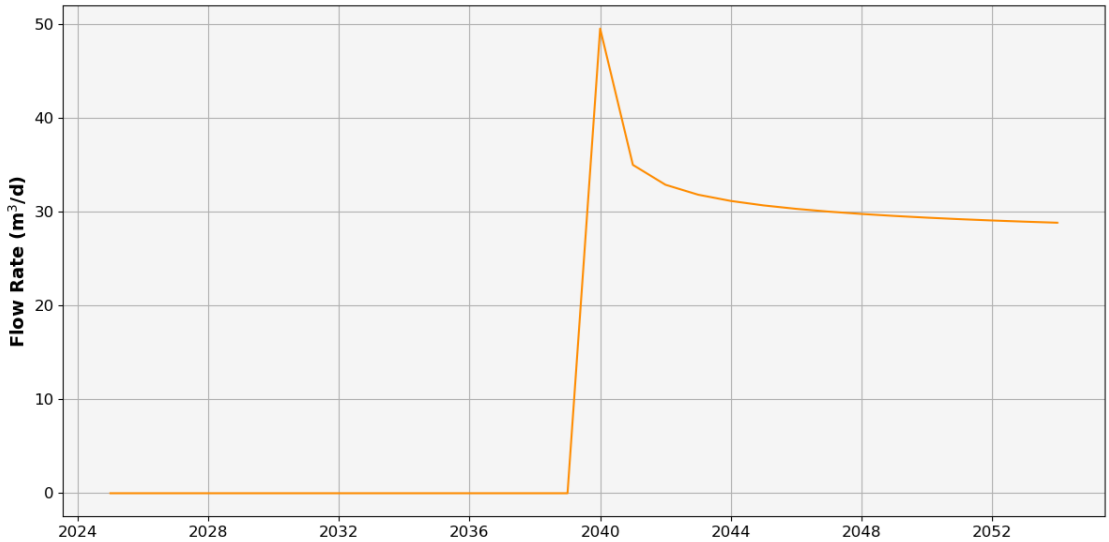

Figure 17: Predicted groundwater inflow into the pit throughout the project.

A groundwater bore has been included in the modelling to supplement the Northern Dam. The Groundwater Assessment (refer to Table 1) permits an extraction rate of up to 76.8 m³/day in Year 1, gradually declining to approximately 69.8 m³/day in Year 4, 68.4 m³/day in Year 15, and stabilising around 65.7 m³/day thereafter.

To align with the assessed bore yield and reduce the risk of over-extraction, the modelled bore flow rate is assumed to decrease from 1 L/s for 20 hours per day (equating to a daily volume of 72 m³/day or approximately 22.5 ML/year based on six working days per week) in Year 1 to 1 L/s for 18 hours per day (equating to a daily volume of 64.8 m³/day) by Year 15. Note that the adopted daily extraction rates are less than those outlined in Table 1.

7.5 Water Balance Results

Water balance results are outlined below. Results are shown for the entire water balance period of 123 years. Model results are presented for the average of all years run plus the individual results for a dry year (10th percentile based on rainfall), median year (50th percentile based on rainfall) and a wet year (90th percentile based on rainfall). The results are summarised in Table 17.

The results relate to the proposed site surface water management strategy as discussed in Section 6. Note that any changes to these assumptions will alter the results below. The stages relate to the 4 stages introduced in Table 1, and reiterated in Table 16 below.

Table 16: Adopted model scenarios.

Year	Annual Production (ktpa)	Extraction Area	Processing Area	Adopted Pit Inflow Rate (m^3/d)	Comment
1	100	E1	P1	0	Site Establishment
4	500	E1	P2	0	Processing Area Increase
8	750	E2	P3	0	Processing and Extraction Area Increase
15	1,000	E4	P3	0	Extraction Area increase
16-30	1,000	E4	P3	20	Pit Inflow Begins
>30	-	Lake	-	-	Post Closure

Table 17: Water balance results summary.

Quarry Year	Demand Request (ML/a)	Demand Shortfall (ML/a)	Uncontrolled Overflow Events[1] (num/a)	Uncontrolled Overflow Volume[2] (ML/a)	Controlled Release Volume (ML/a)	Reliability (%)
Year 1						
Entire Run (1900-2023)	26.01	0.19	1.14	5.60	15.05	99.3%
1919 (10%ile)	27.43	0.80	0.00	0.00	0.00	97.1%
1971 (50%ile)	27.70	0.00	2.00	0.87	14.68	100.0%
2016 (90%ile)	22.68	0.00	7.00	9.47	39.03	100.0%
Year 4						
Entire Run (1900-2023)	34.20	0.59	1.36	9.46	23.85	98.3%
1919 (10%ile)	36.31	3.08	0.00	0.00	0.00	91.5%
1971 (50%ile)	36.71	0.00	2.00	1.11	23.68	100.0%
2016 (90%ile)	29.27	0.00	10.00	17.11	59.66	100.0%
Year 8						
Entire Run (1900-2023)	34.20	0.32	1.44	11.17	24.27	99.1%
1919 (10%ile)	36.31	0.00	0.00	0.00	0.00	100.0%
1971 (50%ile)	36.71	0.00	2.00	1.11	23.75	100.0%
2016 (90%ile)	29.27	0.00	10.00	23.31	64.82	100.0%
Year 15						
Entire Run (1900-2023)	34.20	0.19	1.20	4.95	15.34	99.5%
1919 (10%ile)	36.31	0.00	0.00	0.00	0.00	100.0%
1971 (50%ile)	36.71	0.00	2.00	0.70	14.52	100.0%
2016 (90%ile)	29.27	0.00	7.00	5.66	38.50	100.0%

Quarry Year	Demand Request (ML/a)	Demand Shortfall (ML/a)	Uncontrolled Overflow Events[1] (num/a)	Uncontrolled Overflow Volume[2] (ML/a)	Controlled Release Volume (ML/a)	Reliability (%)
Years 16-30						
Entire Run (1900-2023)	34.20	0.07	1.23	4.97	15.66	99.8%
1919 (10%ile)	36.31	0.00	0.00	0.00	0.00	100.0%
1971 (50%ile)	36.71	0.00	2.00	0.70	14.52	100.0%
2016 (90%ile)	29.27	0.00	7.00	5.66	38.50	100.0%

[1] Number of cumulative uncontrolled overflow events from all sediment dams.
[2] Total uncontrolled overflow volume from all sediment dams.

Reliability listed in Table 17 is based on total water supplied divided by the total water demand (based on volume for the various run period).

Reliability has also been calculated based on days that have been supplied the full amount requested i.e. the percentage of days that received their full demand allocation. This has also been repeated for years as follows, and is summarised in Table 18.

$$Reliability\ \% = 1 - \frac{Shortage\ (volume, days, years)}{Total\ (volume, days, years)}$$

Table 18: Water balance results based on full demand supply.

Quarry Years	Full Reliability %		
	Volume	**Days**	**Years**
1	99.3%	99.3%	87.1%
4	98.3%	98.7%	84.7%
8	99.1%	99.3%	90.3%
15	99.5%	99.6%	96.0%
16-30	99.8%	99.9%	99.2%

The water use demands vary between stages but reaches in excess of 34.2 ML/a after Year 4. The model indicates that this demand could decrease to around 29.3 ML/a in a wet year. The water balance model results indicate that the quarry's process water requirements will be primarily met by extraction from the water management dams. During dry years, up to 3.1 ML/a may be required from an external supply in Year 4, however the average annual shortfall is predicted to be around 0.6 ML/a.

Uncontrolled releases from all sediment dams are limited to a total of less than 2 events per year (on average) in all stages however up to 10 uncontrolled overflow events could occur in a wet year, between all sediment dams. This is despite undertaking controlled releases of around 64.8 ML/a.

Note that the capacity of the Extraction Pit Sump has been modelled as 10.8 - 25.7 ML (as outlined in Table 8). In Extraction Pit stage E1-3, the pit sump has been assumed to overflow

to the Northern Dam. Therefore, it is required that an additional drainage channel and/or bunding be provided to allow overflows from the pit sump to be adequately conveyed to the Northern Dam without any off-site discharge directly from the extraction area.

Once the Extraction Pit reaches stage E4, a separate storage called Quarry Pit has been included with a nominal storage capacity of 1,500ML. Any overflows from the Extraction Pit Sump will spill into the Quarry Pit and then flow back into the pit sump when there is spare capacity ensuring no water is lost, and these are not included in 'uncontrolled overflow events' in the results table.

Records will be kept of all external water imported to the site as well as any necessary controlled water discharges. This data will be reported in the Annual Review.

The clean dams, Farm Dam, Clean Dam 1 and Clean Dam 2 (which have capacities of 4.9, 16 and 3.1 ML and catchments of 71.4, 100 and 81.2 ha, respectively), provide additional water when the quarry dams are dry, however, are not capable of ensuring complete reliability for all rainfall years. Note that water for dust suppression is a priority use. As a contingency, if water shortfalls occur for a period of time, the quarry will either:

- Reduce water usage through the use of chemical dust suppressants.
- Seek an external water source and tanker water to the quarry.
- Temporarily reduce the scale of the operation and limit concrete production, to ensure the dust management objectives are being achieved.

7.6 Post Closure Scenario

A post closure scenario was run to determine the behaviour of the final void after rehabilitation. The GoldSim model was adjusted to include the post closure pit inflow curve provided in the groundwater impact assessment (Hydrogeologist, 2024), as shown in Figure 18.

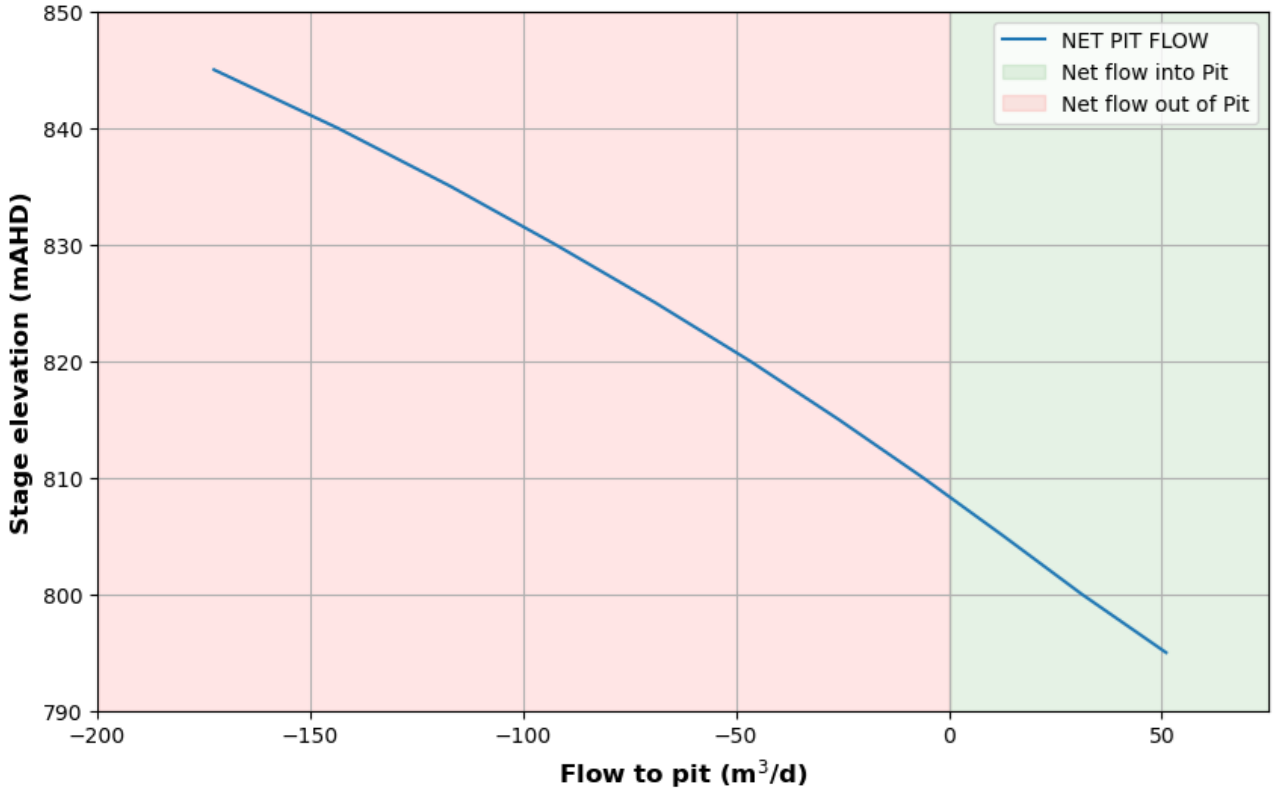

Figure 18: Post closure pit inflow curve (Hydrogeologist, 2024).

Figure 19 shows the lake elevation throughout the model simulation years. The base level of the pit lake is 795 mAHD and spillway level is 835 mAHD. A conservative initial lake elevation was adopted based on sensitivity testing, indicating that the pit lake level converges towards 800 mAHD. Based on an initial elevation of 800 mAHD, modelling indicates that the post closure pit lake level is typically between 799 mAHD to 803 mAHD.

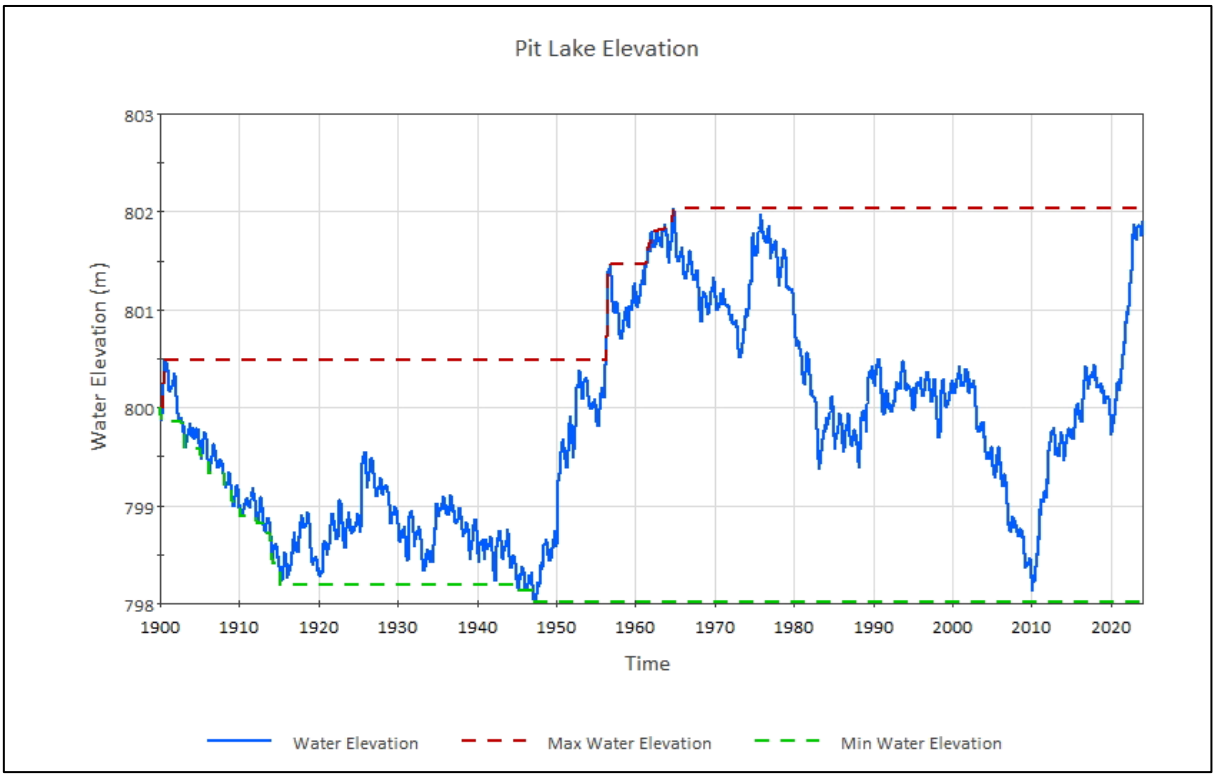

Figure 19: Lake elevation through simulation time.

8 SURFACE WATER MONITORING AND REPORTING

8.1 Objectives

The objective of the surface water monitoring program is to ensure compliance with relevant environmental regulations and conditions of approval. This is achieved by monitoring the quality and quantity of surface water leaving the site to detect any potential impacts of quarry operations on downstream watercourses. All monitoring results and reporting would inform ongoing water management decisions and improvements.

8.2 Monitoring Locations

Surface water monitoring would be conducted at the following key locations:

- Approved discharge point downstream of the northern dam.
- Approved discharge point downstream of the processing dam.
- Within all sediment dams including:
    - Northern dam
    - Processing dam
    - Eastern dam
    - Southern dam.

Visual observations would also be undertaken at diversions to identify they are operating as expected.

8.3 Monitoring Frequency

Routine monitoring would be conducted during the construction phase when water quality sampling would be undertaken monthly and the weather conditions noted i.e. dry or rain occurring.

Event based monitoring would be carried out within 24 hours of significant rainfall events (>15mm in 24 hours). For safety reasons sampling would not be undertaken during peak storm-flows. Sampling would be completed when flows are reasonably constant and monitoring points can be safely accessed, monitoring locations would be selected where possible to enable a safe monitoring location during all weather conditions.

Controlled release monitoring would be carried out prior to and controlled discharge from sediment basins.

Samples would be collected in accordance with AS/NZS 5667.1 and other relevant standards. All samples would be sent to a NATA-accredited laboratory for analysis where required. Field parameters (e.g., pH, EC, turbidity) may be measured using calibrated field meters.

8.4 Monitoring Parameters

Water samples would be tested for the following parameters:

- pH
- Electrical Conductivity (EC)
- Total Suspended Solids (TSS)
- Turbidity
- Oil and grease
- Visible pollutants (e.g., sediment, discolouration, odours)

Additional parameters (e.g., heavy metals, hydrocarbons) may be tested as required by site-specific conditions or regulatory approvals as quarry operations progress. It is anticipated that some additional parameters may be tested quarterly during the first two years of operation to determine whether they pose an ongoing risk to water quality. If testing indicates that they are not present at levels of concern, the frequency of testing for these additional parameters may be reduced or discontinued, subject to consultation with the EPA.

It is anticipated that site specific trigger values would be developed based on recorded background data over a period of at least two years. However, until they are developed, the samples would be compared against the ANZECC water quality trigger values or New South Wales Water Quality Objectives listed in Table 19 below.

Table 19: Water Quality Trigger Values.

Parameter	Units	ANZECC guidelines / NSW WQOs
pH	pH	6.5-8.0
Electrical Conductivity	µS /cm	30-350
Turbidity	NTU	2 - 25 (aquatic ecosystems)
Dissolved Oxygen	%	90 - 110
Visual clarity and colour	-	Natural visual clarity should not be reduced by more than 20%. Natural hue of the water should not be changed by more than 10 points on the Munsell Scale. The natural reflectance of the water should not be changed by more than 50%.
Surface films and debris	-	Oils and petrochemicals should not be noticeable as a visible film on the water, nor should they be detectable by odour. Waters should be free from floating debris and litter

8.5 Reporting

Surface water quality data would be collected, tabulated and assessed against baseline values and the relevant water quality criteria. Trends and anomalies would be reviewed to identify that the operations are limiting the potential environmental impacts. Key reporting requirements include:

- Internal Reporting: Monthly summary reports would be prepared for site management.
- Annual Review: A comprehensive annual water monitoring report would be included in the site's Annual Review.

- Regulatory Reporting: All monitoring results and exceedances would be reported to the relevant regulatory authorities as required by the site's Conditions of Consent or EPL

Should any exceedance of water quality trigger values be identified, they would be investigated promptly. Corrective actions would be implemented as necessary (e.g., upgrade sediment controls, modify water flow). Incidents would be reported in accordance with DPHI and NSW EPA requirements as described in the site's Water Management Plan and Pollution Incident Response Management Plan (PIRMP).

Monitoring data would be reviewed annually to assess the effectiveness of water management measures. The monitoring program would be updated as required based on site activities, monitoring outcomes, and changes to regulatory requirements.

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10 APPENDIX A – EROSION AND SEDIMENT CONTROL PLAN

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MONARO ROCK QUARRY

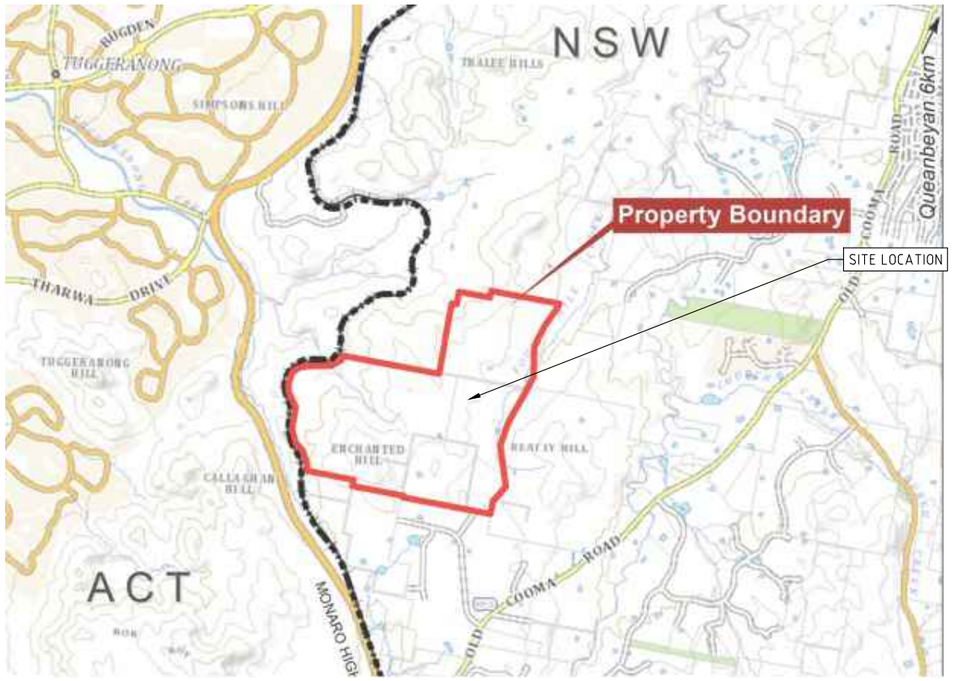
EROSION AND SEDIMENT CONTROL PLAN

FINAL

JUNE 2026

DRAWING SCHEDULE

DRAWING TITLE	DRAWING TITLE
ESCP000	ESCP - TITLE SHEET, LOCALITY PLAN AND DRAWING SCHEDULE - SHEET 1 OF 13
ESCP100	ESCP - BACKGROUND INFORMATION, INSTRUCTIONS, GENERAL NOTES - SHEET 2 OF 13
ESCP101	ESCP - INSTRUCTIONS AND TABLE 1 - SHEET 3 OF 13
ESCP102	ESP - TABLES 2, 3 & 4 AND DETAIL 1 - SHEET 4 OF 13
ESCP200	EROSION AND SEDIMENT CONTROL PLAN YEAR 1 - SHEET 5 OF 13
ESCP201	EROSION AND SEDIMENT CONTROL PLAN YEAR 4 - SHEET 6 OF 13
ESCP202	EROSION AND SEDIMENT CONTROL PLAN YEAR 8 - SHEET 7 OF 13
ESCP203	EROSION AND SEDIMENT CONTROL PLAN YEAR 15-30 - SHEET 8 OF 13
ESCP300	ESCP - LANDCOM STANDARD DRAWINGS - SHEET 9 OF 13
ESCP301	ESCP - LANDCOM STANDARD DRAWINGS - SHEET 10 OF 13
ESCP302	ESCP - LANDCOM STANDARD DRAWINGS - SHEET 11 OF 13
ESCP303	ESCP - ACCESS TRACK STANDARD DRAWINGS - SHEET 12 OF 13
ESCP304	ESCP - ACCESS TRACK STANDARD DRAWINGS - SHEET 13 OF 13



LOCALITY PLAN
N.T.S.

DOCUMENT CERTIFICATION

This plan has been developed based on agreed requirements as understood by SEEC at the time of engagement. It applies only to a specific task on the nominated lands. Other interpretations should not be made, including changes in scale or application to other projects. Changes to the project scope or extent might impact on the validity of this plan. This plan is not to be updated or modified except by consultation with SEEC.

Any recommendations contained in this plan are based on an honest appraisal of the opportunities and constraints that existed at the site at the time of investigation, or as advised to us. Such recommendations are potentially subject to the limited scope and resources available.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
01	24/06/26	R.J.	R.J.	B.J.	AMENDED AS PER EPA COMMENTS
00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS

DESIGN BY	R.J.
DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	N.T.S.

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: TITLE SHEET, LOCALITY PLAN & DRAWING SCHEDULE SHEET 1 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP000	01

Plot Date: Thursday, 25 June 2026 4:30:17 PM CAD File Name: Q:\20000436 Monaro Rock Project\Drawings\20000436_P02_ESCP_REV01.dwg

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BACKGROUND

EROSION AND SEDIMENT CONTROL DESIGN

The details shown within this plan are for concept erosion and sediment controls for the Monaro Rock Quarry. This plan is to provide guidance on the development and operation of the quarry. This Erosion and Sediment Control Plan (ESCP) has been prepared in accordance with 'Managing Urban Stormwater' (the Blue Book) Volumes 1 and 2e (Landcom, 2004), and project approval conditions.

The predicted soil loss across all site areas has been determined in accordance with the following:

A = R x K x LS x C x P

The following values have been used:

R : 1500 (Blue Book, Appendix B)
K : 0.028 (The most conservative k-factor from Site soil testing)
LS : ranges from 2.08 (a composite of 55 m at 45 % and 80 m at 2.5 %) to 12.4 (80 m at 32 %)
C : 1.0 (Construction stage - i.e. no soil surface protection or ground cover applied)
P : 1.3 (for general construction areas - assumes smooth and compacted)

Under Blue Book standards, sediment basins are required if the soil loss is > 200 t/yr. Sediment basins are required on this site as there are catchments with a soil loss greater than this threshold. The largest disturbed areas on the Project are:

1. Northern Dam maximum reporting catchment of 21.1 ha (soil loss 88 t/yr (approx.)).
2. Processing Area Dam maximum reporting catchment of 32.6 ha (soil loss 252 t/yr (approx.)).

DESIGN ASSUMPTIONS

- IFD: 2year, 6hour storm intensity = 6.95mm/hr
- Volumetric runoff coefficient (CV) = 0.79 (adopted maximum value for hydrologic group D runoff coefficient).
- Sediment design rainfall depth: 10-year 24-hour rainfall depth = 96.5mm.

GENERAL INSTRUCTIONS

1. This plan is to be read in conjunction with other relevant environmental documentation for the project (e.g. SWMP, CEMP etc.).
2. Weather forecasts are to be monitored daily and the site prepared to minimse erosion, control drainage, and maximise sediment capture during rain events. Erosion and sediment controls removed or damaged during construction are to be repaired or reinstated prior to forecast rain.
3. The controls are to remain in place and be maintained for the life of the quarry, unless the upstream catchments have been rehabilitated.
4. The ESCP has been split into 4 stages (Refer to ESCP200-203) corresponding to proposed expansions to the quarry.
5. The ESCP is to be reviewed and updated by a qualified CPESC (or equivalent) as required (i.e. annually, in response to environmental incidents, etc.).

ACCESS CONTROL

- Install barrier fences or suitable administrative controls to define the project works and clearing limits.
- Barrier fencing can simply be made from tape wound around star pickets or stakes. Alternatively, sediment fence, site fence or chain wire fences can be used for this purpose if so desired. Existing site fences can also be used where they are present in the relevant locations.
- Barrier and sediment fencing are to be used to ensure that all vehicles entering and leaving the site pass over a stable access point to minimise bogginess in these areas and minimise sediment tracking onto public roads.
- Barrier fencing is to be used to delineate all 'no go' areas.
- Barrier fencing is to be used at the discretion of the site manager to delineate other 'no go' areas.
- The soil erosion hazard on the site will be kept as low as practicable by minimising land disturbance. Some ways of doing this are outlined in Table 1.

SITE ENTRY AND EXIT POINTS

- Establish stabilised site access points anywhere where construction vehicles enter or exit a work area from a sealed public road. Refer to Standard Drawing SD 6-14 from Landcom (2004).
- Ensure that all vehicles entering and leaving work areas from a sealed public road pass over a stable access point to minimise bogginess in these areas and to minimise mud tracking onto public roads.

SOIL STRIPPING AND STOCKPILING

- Ideally, strip topsoil when it is moist, not too wet or too dry.
- Take care when stripping topsoil not to strip subsoil with the topsoil profile. Topsoil and subsoils should be managed separately.
- Stockpile areas are to be established within approved locations and as specified by the site manager.
- Wherever possible, stockpiles are to be established and maintained in accordance with Standard Drawing SD 4-1 (Landcom, 2004).
- As much as is feasible, mulched vegetation, topsoil and subsoil (if applicable) are to be stockpiled separately.
- Sediment fencing is to be installed around the lower edge of stockpiles as per Standard Drawing SD 4-1, unless the stockpile is immediately adjacent to a suitable alternative control such as a mulch bund or sediment basin.
- A diversion drain/bund is to be installed on the high side of stockpiles if run-on from upslope lands could impact on the stockpile.
- Stockpiles are not to be positioned within 5m of possible concentrated water flow (includes road gutters and table drains).
- Stockpiles are to be sited at least 50m from any watercourse, natural drainage line or creek and at least 2m from any trees to be retained.
- Stockpiles will not be located on flood prone lands below the 2 year flood level.
- Stockpiles will be positioned within the approved project construction boundary and away from protected areas (e.g. native vegetation).
- Wherever possible, site stockpiles on gently-sloped lands.
- Inactive stockpile faces are to be provided with at least 60 % cover (i.e. RUSLE C-factor of 0.1) within 10 days of formation. Stabilisation measures on stockpiles must be employed as per the requirements set out in Table 1.
- Stabilisation of stockpiles can be achieved by seeding and spraying with a soil stabiliser (e.g. Vital P47), covering with geotextile or matting or equivalent (note seeding is not required for stockpiles if they will be in place for less than 3 months or if they have an existing seedbank).
- Stockpiles of topsoil or mulch should be constructed to no more than 2 metres in height wherever possible (note this only applies to topsoil and mulch).
- Stockpiles should be formed to be no steeper than 2:1 (H:V) wherever possible.

DUST SUPPRESSION

- Dust suppression should be carried out whenever necessary to minimise sediment becoming air borne due to wind erosion.
- An appropriate water source for dust suppression and/or dust suppressant management system must be identified prior to starting construction works.
- Temporary stabilisers (e.g. Vital Bon-Matt P47), geotextile, jute matting or equivalent can be used in non-trafficked areas to assist with dust control.

STABILISATION

- Undertake progressive stabilisation of disturbed ground surfaces as they are completed rather than at the end of the works program (Refer to Table 1).
- Final stabilisation is to achieve the C-factors (ground cover) detailed in Table 1.
- Areas to be revegetated are to be topsoiled first. Refer to Standard Drawing (SD 4-2) for instructions regarding topsoil replacement.
- Appropriate seedbed preparation should be carried out when revegetating lands (See Standard Drawing (SD 7-1)).
- Permanent drains are to be stabilised in accordance with engineering design but must achieve the C-factors (ground cover) detailed in Table 1.
- Temporary diversion drains are to be stabilised to achieve the C-factors as detailed in Table 1, using seeding + Vital P47 + jute mesh/matting or alternatively geotextile fabric, rock or TRM. Refer to the plans for specific details. Also refer to Standard Drawings (SD 5-6 and SD 5-7).
- Refer to the 'Soil Stripping and Stockpiling' notes for stabilisation requirements on stockpiles. Also refer to Table 1 and Standard Drawing (SD 4-1).
- Sediment basin inlets/outlets are to be stabilised in accordance with Table 1 and as detailed on the plan and within the 'Sediment Basin Sizing Table'.
- Laydown/storage areas, access tracks and will be stabilised where necessary and as much as practicable with suitable trafficable measures (e.g. with aggregate, crushed rock, road base or a heavy duty trafficable soil stabiliser).
- As surfaces are stabilised and permanent drainage measures are installed, temporary water management structures can be removed (e.g. diversion drains).
- Wherever possible, re-use cleared/mulched vegetation for either temporary or permanent stabilisation of disturbed areas.

SLOPE LENGTHS

- To reduce potential erosion, it is recommended that slope lengths be maintained at maximum 80m intervals across all disturbed lands prior to rainfall (unless specified otherwise). To achieve this, diversion bunds/drains, low flow earth banks (Standard Drawing SD 5-5) or sandbags/equivalent should be installed prior to forecast rainfall.

SEDIMENT FENCING

- Install all sediment fencing in accordance with Standard Drawing SD 6-8.
- Sediment fences must be firmly trenched into the ground for their entire length.
- Sediment fences must include small 'returns' at maximum 20m intervals (see Standard Drawing 6-8) to minimise the risk of water flowing along them rather than through them.

SEDIMENT BASINS

- The design rainfall event for the sediment basins is 96.5mm ((10-year 24-hour rainfall depth) as per requirements of the EPA.
- The minimum sizing requirements for the sediment basins based on the Blue Book is available in Table 3. Refer to the Water Balance for the adopted basin/ dam practical sizing to meet site usage requirements.
- All disturbed areas that do not drain to a sediment basin will be managed with alternative sediment controls such as sediment fences, sediment sumps, mulch bunds or similar.
- If so desired, dirty water accumulating in excavations/cut sections can be pumped or carted to a sediment basin providing adequate capacity is available and the basin won't overflow as a result. Note that the 5-day maintenance requirement for basins to have sufficient available storage volume still applies (see below).
- Within 5 calendar days of the conclusion of any rainfall causing runoff, the sediment basins are to be returned to the required available capacity (i.e. freeboard equivalent to the settling zone volume), ready for the next rainfall event. This might include testing water, treating (e.g. flocculating), de-watering and de-silting basins. See notes below regarding de-watering. If rainfall (causing runoff) occurs again within 5 days of the previous rain event, the 5-day requirement re-sets.
- Dirty water accumulating in sediment basins can be used onsite for dust suppression or construction purposes. If this occurs it does not need to be treated first. Note that the 5-day maintenance requirement for basins to be emptied still applies.
- The sediment basins are to include outlets (weir overflow/spillway) sized to have a capacity to pass the 50 year peak flow. Outlets are to be onto stable lands or into a waterway.
- Water quality must be checked prior to any controlled release from sediment basins. Refer to the de-watering notes below.
- Additional volume can be provided in sediment basins for storing water if so desired (i.e. they can be made bigger than is required by this ESCP). Markers will need to be installed within basins to indicate the various volumes.
- As much as is feasible, gypsum (or similar alternative) should be included in sediment basin walls and at inlets to promote sediment settling.
- A marker peg (or similar) is to be included in every basin showing the top level of the Sediment Storage volume.
- Sediment basins are to be de-silted whenever sediment accumulates to more than 50% of the Sediment Storage Volume. Sediment removed from the basin can be taken to a stockpile area, buried onsite or used as general fill. Ensure sediment removed from basins is not placed where it could wash, blow or fall offsite.
- Sediment basins are to achieve at least 3:1 length:width from their inlet(s) to their spillway. If this is not achieved through the natural shape of the basin, a baffle is to be included.

Note: A geotechnical engineer is required to design, review, approve and certify all earthworks associated with sediment basins, embankments, weirs, chutes and dissipater outlet construction. A structural engineer is required to design, review, approve and certify all structural components associated with sediment basins, embankments, weirs, chutes and dissipater outlet construction.

DIRTY WATER TREATMENT AND DISCHARGE REQUIREMENTS

- Water accumulating in excavations or in any other low points onsite can either be:
  - Re-used for dust suppression or construction purposes; or
  - Pumped into a tank, truck or other holding area for later treatment; or
  - Treated (if required) and tested in situ, then released off site once it meets the required water quality discharge criteria (see below); or
  - Spread out and infiltrated onto well vegetated lands within the site boundary at least 50m away from any waterway, swale or drainage line. Ensure water is applied slowly and in a manner to avoid concentrated surface runoff and/or erosion.
- Any active discharge of water from the project (i.e. where water is moved offsite via direct action such as pumping rather than flowing off the project as a result of heavy rainfall) is to achieve:
  - 50mg/L or less TSS (Total Suspended Sediment); and
  - pH 6.5 to 8.5; and
  - <10mg/L oil and grease and no visible trace.
- Adequate water quality can be achieved by using gypsum at a rate of approximately 30 kg/100 m^3 of stormwater. Alternative flocculating agents can only be used if agreed prior to use. Refer to manufacturers guidelines for dosage details.
- Spread the treatment agent evenly over the entire pond surface for proper treatment of water.
- These de-watering requirements apply to dirty water accumulating in any sort of excavation, sump, or other ponded water body on the project.
- If the water is going to be used within the construction site for dust-suppression or construction purposes and will drain back into the sediment capture system it does not require treatment.
- Water may be pumped between dams as required to meet water demands and provide sufficient treatment volumes.

INSTRUCTIONS CONTINUED ON NEXT PAGE

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
01	24/06/26	R.J.	R.J.	B.J.	AMENDED AS PER EPA COMMENTS
00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS
DESIGN BY R.J.
DRAWN BY R.J.
FINAL APPROVAL B.J.
SCALE: (on A3 Original) N.T.S.
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PROJECT TITLE
MONARO ROCK PROJECT

DRAWING TITLE
BACKGROUND INFORMATION, INSTRUCTIONS, GENERAL NOTES SHEET 2 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP100	01

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INSTRUCTIONS CONTINUED

SITE INSPECTION, MONITORING AND MAINTENANCE

- Prior to forecast rainfall of 15 mm or more over 24 hours, the following will occur:
  - The quarry manager (or their representative) is to inspect the condition of all erosion and sediment controls and action any urgent repair, maintenance or improvement works. They are to keep a record all findings (including details of actions and their close outs); and
  - Slope breaks will be pushed up or cut in across large, exposed areas to slow down flows and minimise erosion;
- Regular site inspections are to be conducted by the quarry manager (or their representative):
  - At least weekly during normal construction hours; and
  - Prior to forecast rainfall (see above); and
  - Daily during rain events (if safe to do so); and
  - Within 24 hours of the cessation of a rain event that causes runoff.
- Additional erosion and sediment controls will be installed as necessary to ensure satisfactory outcomes in keeping with the project conditions and best-practice Blue Book guidelines.
- Progressive ESCPs will be updated and/or prepared if required.
- After rainfall, sediment accumulated in trapping devices (e.g. basin, sediment fence) will be removed to a secure location where it can't wash or blow offsite (preferably to an active stockpile).
- Weather conditions will be monitored onsite and daily rainfall will be recorded. A rainfall gauge will be installed at the site compound.
- Safe storage areas for wastes, fuels, excess concrete and other potential contaminants are to be delineated by the site manager.
- Adequate supplies of erosion control measures (e.g. geofabric rolls, jute matting, hydraulic soil binders) are to be maintained in the site compound for rapid deployment as required.
- If required water treatment chemical(s) and equipment are to be maintained onsite.
- Dust suppression is to be undertaken as required to minimise the risk of offsite dust impacts. Refer to the Dust Suppression notes for details.

TABLE 1 - STABILISATION REQUIREMENTS AND TREATMENT METHODS

DURING CONSTRUCTION – TEMPORARY STABILISATION
(During periods of inactivity when works are on hold)

LANDS	STABILISATION REQUIREMENT	TIMEFRAMES	TREATMENT METHODS – PRODUCTS	REMARKS
High Risk Areas Soil Loss Class 6 or above lands (where applicable)	C–factor = 0.1 (60% grass cover or equivalent ground cover [1])	Applies prior to rainfall and after 10 working days of inactivity (even though works might continue later)	Soil binder (i.e. Vital P47/stonewall or equivalent [1])	– Stabilise all exposed soils by spraying surfaces with Vital P47/stonewall or equivalent [1]. – Vital dilution rate = 1:10 (Vital: Water). – Application rate = 1L / m² of diluted Vital mixture. – Re–apply/maintain as necessary to ensure the required cover is provided.
			Geotextile, jute matting, black plastic or equivalent [1]	– Cover all exposed soils. – Re–apply/maintain as necessary to ensure the required cover is provided.
All lands (including waterways and stockpiles)	C–factor = 0.15 (50% grass cover or equivalent ground cover [1])	Applies after 20 working days of inactivity (even though works might continue later)	Soil binder (i.e. Vital P47/stonewall or equivalent [1])	– Spray all stockpile surfaces with Vital P47/stonewall or equivalent [1]. – Vital dilution rate = 1:10 (Vital: Water). – Application rate = 1L / m² of diluted Vital mixture. – Re–apply/maintain as necessary (approx. every 3–6 months without suitable vegetation cover) to ensure the required cover is provided.
			Geotextile, jute matting, black plastic or equivalent [1]	– Cover all exposed soils. – Re–apply/maintain as necessary to ensure the required cover is provided.

TABLE 1 – STABILISATION REQUIREMENTS AND TREATMENT METHODS CONTINUED

POST CONSTRUCTION

LANDS	STABILISATION REQUIREMENT	TIMEFRAMES	TREATMENT METHODS – PRODUCTS	REMARKS
Waterways, drainage lines and concentrated flow areas	C–factor = 0.05 (70% grass cover or equivalent ground cover [1])	Applies after 10 working days from completion of formation and before they are allowed to carry concentrated flows	Refer to the drain specifications detailed on the plan for specific lining/stabilisation requirements. Example treatment methods are shown below.	
			Temporary lining – Geotextile (i.e. Bidim A24 or equivalent [1])	– Complete any subsoil treatment before laying the matting. – Install matting in accordance with SD 5–7. – Re–apply/maintain as necessary to ensure the required cover is provided.
			Jute mesh, seeding and soil binder (i.e. Vital P47/stonewall or equivalent [1]) – Low flows	– Complete subsoil treatment (i.e. gypsum lightly ripped into surgrade at a rate of 5tonnes/ha). – Place topsoil to a depth of at least 75mm. – Complete any fertilisation and seeding before laying the matting. – Install matting in accordance with SD 5–7. – Spray all surfaces with Vital P47/stonewall or equivalent [1]. – Vital dilution rate = 1:10 (Vital: Water). – Application rate = 1L / m² of diluted Vital mixture. – Re–apply/maintain as necessary to ensure the required cover is permanently maintained.
			Jute matting (~350gsm) and seeding or equivalent [1] – Low to moderate flows	– Complete subsoil treatment (i.e. gypsum lightly ripped into surgrade at a rate of 5tonnes/ha). – Place topsoil to a depth of at least 75mm. – Complete any fertilisation and seeding before laying the matting. – Install matting in accordance with SD 5–7. – Re–apply/maintain as necessary to ensure the required cover is permanently maintained.
			Turf reinforcement matting (TRM) (e.g. TerraMat or equivalent [1]) – Moderate flows	– Complete subsoil treatment (i.e. gypsum lightly ripped into surgrade at a rate of 5tonnes/ha). – Place topsoil to a depth of at least 75mm. – Complete any fertilisation and seeding before laying the matting. – Install matting in accordance with SD 5–7. – Re–apply/maintain as necessary to ensure the required cover is permanently maintained.
			Rock lining – High flows	– Complete subsoil treatment (i.e. gypsum lightly ripped into surgrade at a rate of 5tonnes/ha). – Install geotextile underlay (if specified) in accordance with SD 5–7. – Install rock armouring (to the depth and size as specified on the plan). – Re–apply/maintain as necessary to ensure the required cover is provided.
Stockpiles	C–factor = 0.10 (60% grass cover or equivalent ground cover [1])	Applies after 10 working days from completion of formation	Seeding and soil binder (i.e. Vital P47/stonewall or equivalent [1])	– Apply seed to all stockpile surfaces (Note: seeding may not be required if existing seedbed is present). – Spray all stockpile surfaces with Vital P47/stonewall or equivalent [1]. – Vital dilution rate = 1:10 (Vital: Water). – Application rate = 1L / m² of diluted Vital mixture. – Re–apply/maintain as necessary to ensure the required cover is permanently maintained.
			Geotextile, jute matting, black plastic or equivalent [1]	– Cover all exposed soils. – Re–apply/maintain as necessary to ensure the required cover is provided.
General Surfaces	C–factor = 0.10 / 0.05 (60% / 70% grass cover or equivalent ground cover [1])	C–factor = 0.1 applies after 10 working days from completion of formation and C–factor = 0.05 applies within a further 60 days	Topsoil, seeding and soil binder (i.e. Vital P47/stonewall or equivalent [1])	– Refer to SD 7–1. – Complete subsoil treatment (i.e. gypsum lightly ripped into surgrade at a rate of 5tonnes/ha). – Place gypsum treated topsoil to a depth of at least 75mm. – Apply any fertilisers required. – Apply seed to all surfaces (Note: seeding may not be required if existing seedbed is present). – Spray all surfaces with Vital P47/stonewall or equivalent [1]. – Vital dilution rate = 1:10 (Vital: Water). – Application rate = 1L / m² of diluted Vital mixture. – Re–apply/maintain as necessary to ensure the required cover is permanently maintained.
			Hydromulch or equivalent [1]	– Refer to SD 7–1. – Complete subsoil treatment (i.e. gypsum lightly ripped into surgrade at a rate of 5tonnes/ha). – Place topsoil to a depth of at least 75mm. – Apply hydromulch to soil surfaces. – Re–apply/maintain as necessary to ensure the required cover is permanently maintained.

[1] – Equivalent cover/product must achieve the equivalent C–factor with proven reasearch/documentation to verify this.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
01	24/06/26	R.J.	R.J.	B.J.	AMENDED AS PER EPA COMMENTS
00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS: DESIGN BY R.J.; DRAWN BY R.J.; FINAL APPROVAL B.J.
SCALE: (on A3 Original) N.T.S.
FINAL

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: INSTRUCTIONS & TABLE 1 SHEET 3 OF 13

PROJECT NO.	SUB–PR NO.	DRAWING NO.	REV
20000436	P02	ESCP101	01

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TABLE 2 LIMITATIONS TO ACCESS DURING CONSTRUCTION

LAND USE	LIMITATION	REMARKS
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans	All site workers should clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope) or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones on site. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries
Remaining lands, including revegetation areas	Entry prohibited except for essential management works	Thinning of growth might be necessary, for example, for fire reduction or weed removal

DETAIL 1 - TEMPORARY DIVERSION DRAIN/BUND

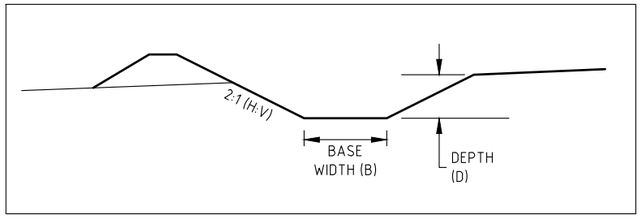

TABLE 3 TYPE D BASIN MINIMUM SIZING REQUIREMENT

Quarry Year	Total Catchment (ha)	Min. Soil Storage Volume (ML)	Min. Settling Zone Volume [1] (ML)	Adopted Settling Zone Volume [2] (ML)	Available Working Volume (ML)	Total Basin Volume [3] (ML)
Year 1						
Pit Sump	6.4	0.2	4.9	4.9	5.7	10.8
Northern Dam	5.9	0.2	4.5	4.5	6	10.7
Process Area Dam	16.5	1.6	12.6	14.2	0.3	16.1
Southern Dam	-	-	-	-	-	-
Eastern Dam	4.5	1.1	3.4	1.8	0	2.9
Sum	**33.3**	**3.1**	**25.3**	**25.3**	**12**	**40.5**
Year 4						
Pit Sump	6.4	0.2	4.9	4.9	5.7	10.8
Northern Dam	5.9	0.2	4.5	4.5	10.4	15.1
Process Area Dam	23.6	2.3	18	25.4	4.5	32.2
Southern Dam	4.1	0.8	3.2	0.8	0	1.6
Eastern Dam	7.9	1.9	6	1	0	2.9
Sum	**47.9**	**5.5**	**36.5**	**36.5**	**20.5**	**62.5**
Year 8						
Pit Sump	12	0.4	9.2	9.2	16.1	25.7
Northern Dam	5.8	0.2	4.4	4.4	10.5	15.1
Process Area Dam	23.6	2.3	18	25.5	4.4	32.2
Southern Dam	4.1	0.8	3.2	0.8	0	1.6
Eastern Dam	7.9	1.9	6	1	0	2.9
Sum	**53.4**	**5.7**	**40.7**	**40.7**	**31**	**77.4**
Year 15-30						
Pit Sump	21.1	0.7	16.1	16.1	8.9	25.7
Northern Dam	5.1	0.2	3.9	3.9	6.3	10.4
Process Area Dam	22.2	2.2	16.9	24.4	5.6	32.2
Southern Dam	4.1	0.8	3.1	0.8	0	1.6
Eastern Dam	7.9	1.9	6	1	0	2.9
Sum	**60.5**	**5.9**	**46.1**	**46.1**	**20.7**	**72.7**

[1] Minimum settling zones volumes based on the 10-year, 24-hour design rainfall event of 96.5mm.
[2] The Eastern and Southern Dams are constrained by clearing footprints and cannot be increased to cater for the 10-year, 24-hour rainfall depth. Therefore, the additional storage required will be provided with the Process Area Dam (PAD). With water being pumped into the PAD during a rainfall event to ensure capture.
[3] Adopted basin volume.

TABLE 4 CHANNEL MINIMUM SIZING REQUIREMENT

Structure Name	CW01	CW02	DW01	DW02	DW03/CW03	DW04/CW04	DW05/CW05	DW06/CW06	DW07/CW07	CW08
Max Catchment Area (ha)	1.4	2.7	3.0	10.2	2.2	8.9	12.3	1.7	2.1	5.4
Design Event ARI	20	20	20	20	20	20	20	20	20	20
Flow Rate (m3/s)	0.33	0.56	0.625	1.65	0.48	1.49	1.88	0.38	0.46	0.994
Flow depth (y) (m)	0.09	0.15	0.32	0.17	0.28	0.18	0.39	0.10	0.25	0.10
Channel/bund depth, D (m)	0.30	0.40	0.50	0.40	0.50	0.40	0.60	0.30	0.40	0.30
Channel base width, B (m)	2	2	1	5	1	4	2	2	1	5
Channel side slope (H:V)	3	3	3	3	3	3	3	3	3	3
Channel top width (m)	3.80	4.40	4.00	7.40	4.00	6.40	5.60	3.80	3.40	6.80
Drain slope (%)	8.3	4.3	1.0	4.4	1.0	4.5	1.6	7.6	1.5	8.8
Channel Lining	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils	Established grass - erosion resistant soils

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
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D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS
DESIGN BY R.J.
DRAWN BY R.J.
FINAL APPROVAL B.J.
SCALE: (on A3 Original) N.T.S.
FINAL

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PROJECT TITLE
MONARO ROCK PROJECT

DRAWING TITLE
TABLES 2, 3 & 4 AND DETAIL 1
SHEET 4 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP102	01

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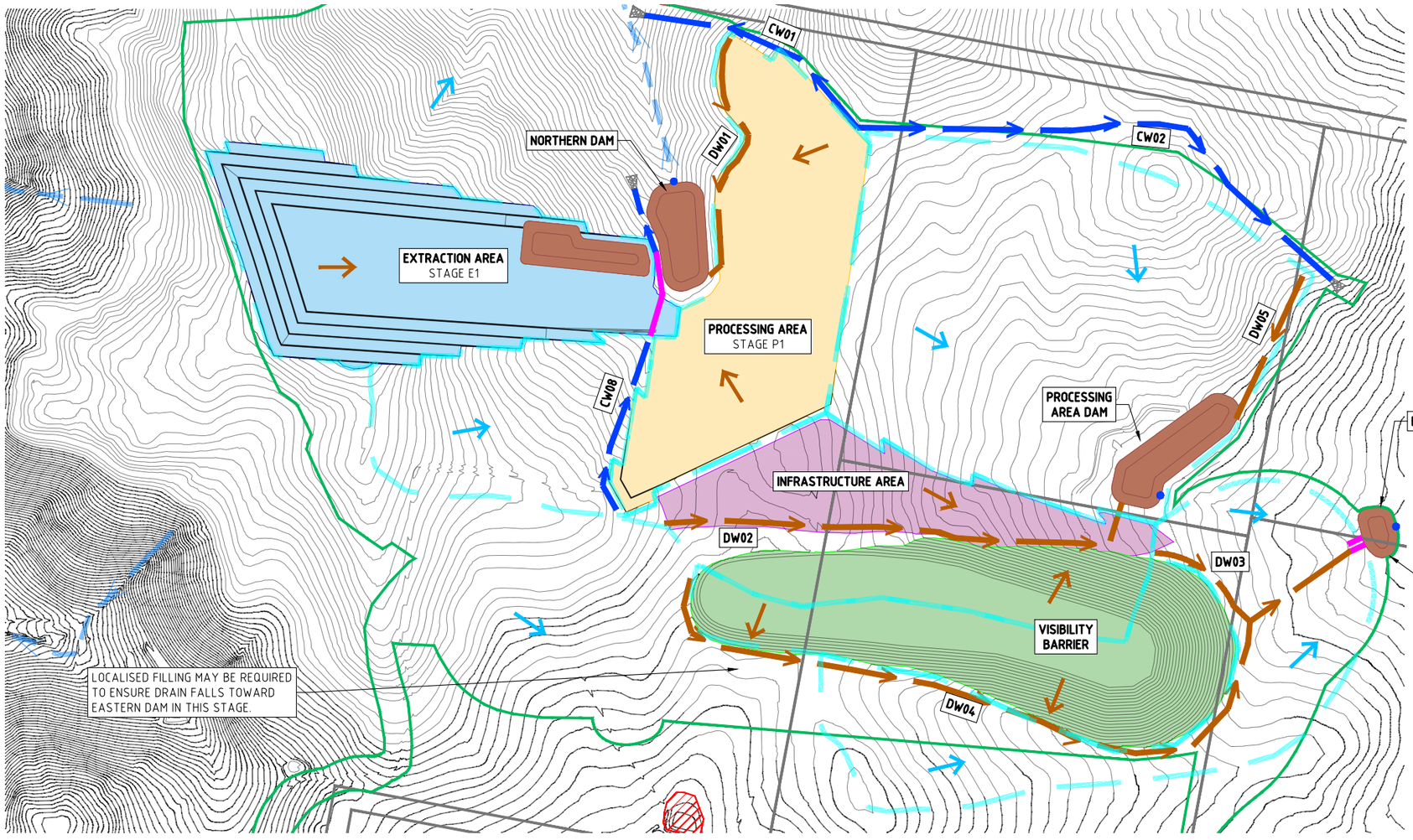
EROSION AND SEDIMENT CONTROL INSTRUCTIONS

Before commencement of clearing, topsoil stripping and earthworks in each area/section of works, the site is to be secured and the following erosion and sediment control measures installed in order, except for Items 10 to 14 which are to be undertaken progressively as required throughout all stages of works. Stripping and earthworks necessary to install the erosion and sediment controls are permitted but must be kept to an absolute minimium:

1. Barrier fencing (or alternative measures) should be in place around the edge of the construction boundary to restrict access and in any additional locations as required to minimise unnecessary disturbance - Refer to the 'Access Control' notes below.
2. Establish stabilised site entry/exit points (Standard Drawing SD 6-14) anywhere where construction vehicles exit a work area onto a public road. Locations TBC on Site.
3. Establish access tracks where required - locations TBC on Site. Refer to Details 2 - 5.
4. Establish a site office, amenities and parking area.
5. Offsite (clean) water diversions CW01, CW02 and CW03 are to be constructed and stabilised in the locations shown. Refer to Table 4 for minimum sizing requirements.
6. Sediment basins and their inlet and outlet structures are to be constructed and stabilised in the locations shown, Refer to Table 3 for sizing details (also refer to the 'Sediment Basin' notes on ESCP100).
   - 6.1. Ensure that flows from the work areas drain to sediment basins. Install additional bunds or scratch drains to the sized dirty water drains as required. For the extraction area, water is to be pumped to the Northern dam/ sediment basin for treatment.
   - 6.2. Install baffles as required to meet minimum 3:1 length to width ratio.
7. Onsite (dirty) water diversions DW01-DW05 are to be constructed and stabilised in the locations shown. Refer to Table 4 for minimum sizing and channel lining requirements.
8. Stockpile areas are to be established as specified by the site manager and in accordance with the 'Soil Stripping and Stockpiling' notes on ESCP100.
9. Once all of the above measures are complete and stable, construction works can commence in accordance with the engineering plans. Topsoil stripping is to be undertaken in accordance with the 'Soil Stripping and Stockpiling' notes.
10. Dust suppression will be undertaken as requirment to minimise offsite impacts.
11. Treatment of dirty water is to be carried out as necessary in accordance with the 'Dirty Water Treatment and Discharge Requirements' notes on ESCP100.
12. Monitoring, maintenance and inspections are to be carried out regularly as required, in accordance with the 'Site Inspection and Monitoring' notes.
13. Undertake progressive stabilisation of lands as final earthworks are complete in each area (rather than waiting until the completion of works) in accordance with the Table 1 on ESCP101.
14. Ensure all dirty water in extraction pit is directed either to the Northern Dam or to a localised sump and pumped to the Northern Dam.



LEGEND:

- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- EXISTING WATERCOURSE
- CATCHMENT BOUNDARY
- EXTRACTION AREA
- PROCESSING AREA
- INFRASTRUCTURE AREA
- VISIBILITY BARRIER AREA
- DIRTY WATER DAM/BASIN
- CLEAN WATER DAM
- DAM TO BE REMOVED
- DISSIPATER OUTLET
- DISCHARGE LOCATION
- PROJECT SITE BOUNDARY
- CLEARING EXTENTS
- CULVERT
- EARTH BUND TO DIRECT RUNOFF TO BASIN INLETS
- SITE CONTOURS 1m INTERVALS - PROVIDED BY CLIENT

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
01	24/06/26	R.J.	R.J.	B.J.	AMENDED AS PER EPA COMMENTS
00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE - FOR REVIEW

DRAWING STATUS

DESIGN BY	R.J.
DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	1:5000

FINAL

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN - YEAR 1 SHEET 5 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP200	01

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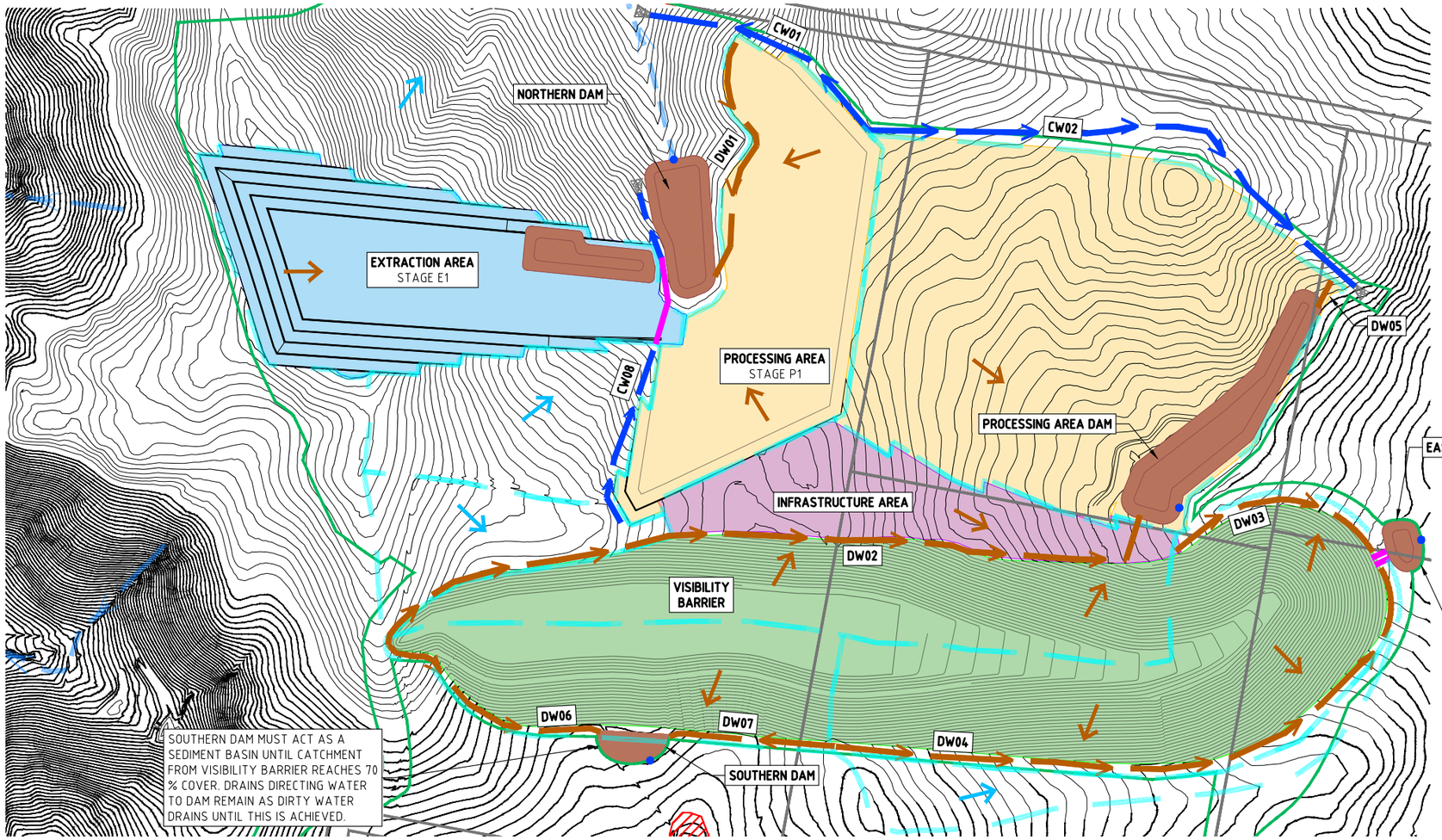
EROSION AND SEDIMENT CONTROL INSTRUCTIONS

Before commencement of clearing, topsoil stripping and earthworks in each area/section of works, the site is to be secured and the following erosion and sediment control measures installed in order, except for Items 9 to 13 which are to be undertaken progressively as required throughout all stages of works. Stripping and earthworks necessary to install the erosion and sediment controls are permitted but must be kept to an absolute minimium:

1. Barrier fencing (or alternative measures) should be in place around the edge of the construction boundary to restrict access and in any additional locations as required to minimise unnecessary disturbance - Refer to the 'Access Control' notes below.
2. Establish stabilised site entry/exit points (Standard Drawing SD 6-14) anywhere where construction vehicles exit a work area onto a public road. Locations TBC on Site.
3. Establish access tracks where required - locations TBC on Site. Refer to Details 2 - 5.
4. Maintain Offsite (clean) water diversions CW01, CW02 and CW03 in the locations shown. Refer to Table 4 for minimum sizing requirements.
5. Maintain sediment basins. Refer to Table 3 for sizing details (also refer to the 'Sediment Basin' notes on ESCP100).
   - 5.1. Ensure that flows from the work areas drain to sediment basins. Install additional bunds or scratch drains to the sized dirty water drains as required. For the extraction area, water is to be pumped to the Northern dam/ sediment basin for treatment.
   - 5.2. Install baffles as required to meet minimum 3:1 length to width ratio.
6. Maintain onsite (dirty) water diversions DW01-DW07 in the locations shown. Refer to Table 4 for minimum sizing and channel lining requirements.
7. Stockpile areas are to be established as specified by the site manager and in accordance with the 'Soil Stripping and Stockpiling' notes on ESCP100.
8. Once all of the above measures are complete and stable, construction works can commence in accordance with the engineering plans for Stage 2. Topsoil stripping is to be undertaken in accordance with the 'Soil Stripping and Stockpiling' notes.
9. Dust suppression will be undertaken as requirment to minimise offsite impacts.
10. Treatment of dirty water is to be carried out as necessary in accordance with the 'Dirty Water Treatment and Discharge Requirements' notes on ESCP100.
11. Monitoring, maintenance and inspections are to be carried out regularly as required, in accordance with the 'Site Inspection and Monitoring' notes.
12. Undertake progressive stabilisation of lands as final earthworks are complete in each area (rather than waiting until the completion of works) in accordance with the Table 1 on ESCP101.
13. Ensure all dirty water in extraction pit is directed either to the Northern Dam or to a localised sump and pumped to the Northern Dam.



LEGEND:

- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
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- DIRTY WATER DAM/BASIN
- CLEAN WATER DAM
- DAM TO BE REMOVED
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- PROJECT SITE BOUNDARY
- CLEARING EXTENTS
- CULVERT
- EARTH BUND TO DIRECT RUNOFF TO BASIN INLETS
- SITE CONTOURS 1m INTERVALS - PROVIDED BY CLIENT

0 25 50 75 100 125m
Scale: 1:5000 (A3 SHEET)

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
01	24/06/26	R.J.	R.J.	B.J.	AMENDED AS PER EPA COMMENTS
00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
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C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE - FOR REVIEW

DRAWING STATUS

DESIGN BY	R.J.
DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	1:5000

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN - YEAR 4 SHEET 6 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP201	01

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EROSION AND SEDIMENT CONTROL INSTRUCTIONS

Before commencement of clearing, topsoil stripping and earthworks in each area/section of works, the site is to be secured and the following erosion and sediment control measures installed in order, except for Items 9 to 13 which are to be undertaken progressively as required throughout all stages of works. Stripping and earthworks necessary to install the erosion and sediment controls are permitted but must be kept to an absolute minimium:

1. Barrier fencing (or alternative measures) should be in place around the edge of the construction boundary to restrict access and in any additional locations as required to minimise unnecessary disturbance - Refer to the 'Access Control' notes below.
2. Establish stabilised site entry/exit points (Standard Drawing SD 6-14) anywhere where construction vehicles exit a work area onto a public road. Locations TBC on Site.
3. Establish access tracks where required - locations TBC on Site. Refer to Details 2 - 5.
4. Maintain Offsite (clean) water diversions CW01 and CW02 in the locations shown.
   - 4.1. Once the visibility barrier has achieved > 70 % stabilisation, The Southern and Southeastern basins can be managed as dams, and drains CW03 - CW06 direct clean water to these dams. Refer to Table 4 for minimum sizing requirements.
5. Maintain the Northern Dam/sediment basin (Stages 1-3) and Eastern Dam/ sediment basin. Refer to Table 3 for sizing details (also refer to the 'Sediment Basin' notes on ESCP100).
   - 5.1. Ensure that flows from the work areas drain to sediment basins. Install additional bunds or scratch drains to the sized dirty water drains as required. For the extraction area, water is to be pumped to the Northern dam/ sediment basin for treatment.
   - 5.2. Install baffles as required to meet minimum 3:1 length to width ratio.
6. Maintain onsite (dirty) water diversions DW01 & DW02 in the locations shown. Refer to Table 4 for minimum sizing and channel lining requirements.
7. Stockpile areas are to be established as specified by the site manager and in accordance with the 'Soil Stripping and Stockpiling' notes on ESCP100.
8. Once all of the above measures are complete and stable, construction works can commence in accordance with the engineering plans for Stage 3. Topsoil stripping is to be undertaken in accordance with the 'Soil Stripping and Stockpiling' notes.
9. Dust suppression will be undertaken as requirment to minimise offsite impacts.
10. Treatment of dirty water is to be carried out as necessary in accordance with the 'Dirty Water Treatment and Discharge Requirements' notes on ESCP100.
11. Monitoring, maintenance and inspections are to be carried out regularly as required, in accordance with the 'Site Inspection and Monitoring' notes.
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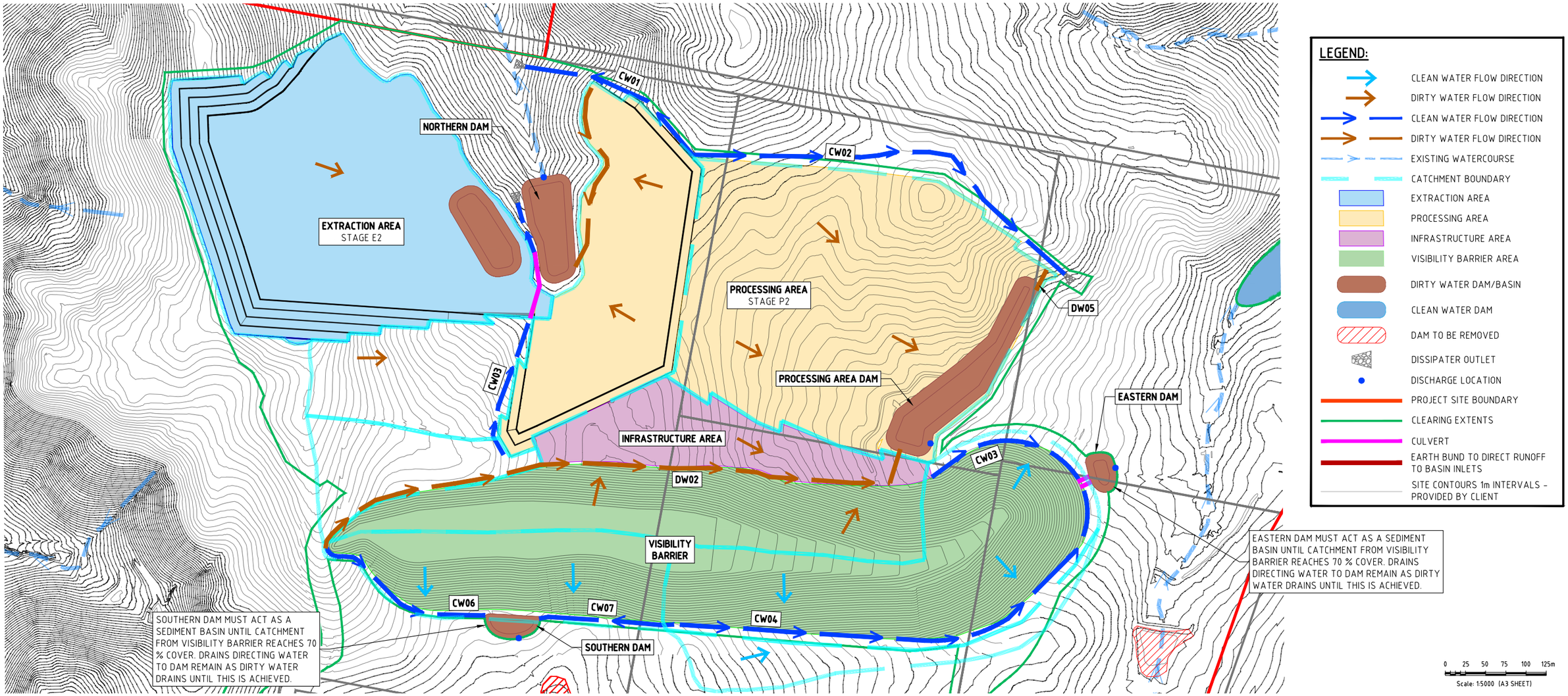

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A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE - FOR REVIEW

DRAWING STATUS

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DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	1:5000

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN - YEAR 8 SHEET 7 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP202	01

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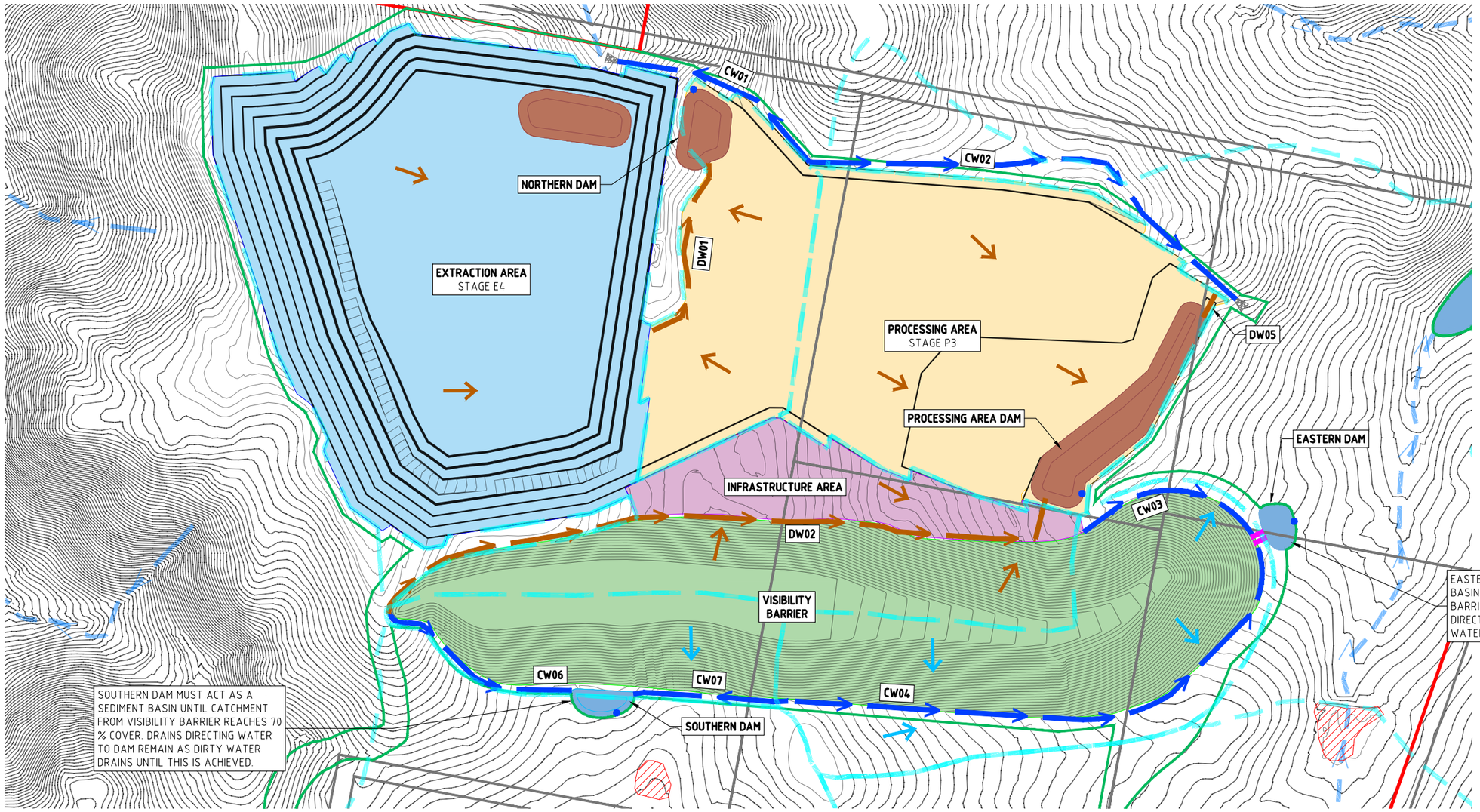
3. Establish access tracks where required - locations TBC on Site. Refer to Details 2 - 5.
4. Maintain Offsite (clean) water diversions CW01 -CW06 in the locations shown.
5. Maintain the Eastern Dam/ sediment basin. The Northern Dam/ sediment basin (Stage 1- 3) must be appropriately decommissioned, and the Northern Dam/ Sediment Basin Stage 4 constructed to facilitate the Extraction Area expansion. Refer to Table 3 for sizing details (also refer to the 'Sediment Basin' notes on ESCP100).
   - 5.1. Ensure that flows from the work areas drain to sediment basins. Install additional bunds or scratch drains to the sized dirty water drains as required. For the extraction area, water is to be pumped to the Northern dam/ sediment basin for treatment.
   - 5.2. Install baffles as required to meet minimum 3:1 length to width ratio.
6. Maintain onsite (dirty) water diversions DW01, DW02 & DW05 in the locations shown. Refer to Table 4 for minimum sizing and channel lining requirements.
7. Stockpile areas are to be established as specified by the site manager and in accordance with the 'Soil Stripping and Stockpiling' notes on ESCP100.
8. Once all of the above measures are complete and stable, construction works can commence in accordance with the engineering plans for Stage 4. Topsoil stripping is to be undertaken in accordance with the 'Soil Stripping and Stockpiling' notes.
9. Dust suppression will be undertaken as requirment to minimise offsite impacts.
10. Treatment of dirty water is to be carried out as necessary in accordance with the 'Dirty Water Treatment and Discharge Requirements' notes on ESCP100.
11. Monitoring, maintenance and inspections are to be carried out regularly as required, in accordance with the 'Site Inspection and Monitoring' notes.
12. Undertake progressive stabilisation of lands as final earthworks are complete in each area (rather than waiting until the completion of works) in accordance with the Table 1 on ESCP101.
13. Ensure all dirty water in extraction pit to be directed either to Northern Dam or to a localised sump and pumped to the Northern Dam.



LEGEND:

- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- EXISTING WATERCOURSE
- CATCHMENT BOUNDARY
- EXTRACTION AREA
- PROCESSING AREA
- INFRASTRUCTURE AREA
- VISIBILITY BARRIER AREA
- DIRTY WATER DAM/BASIN
- CLEAN WATER DAM
- DAM TO BE REMOVED
- DISSIPATER OUTLET
- DISCHARGE LOCATION
- PROJECT SITE BOUNDARY
- CLEARING EXTENTS
- CULVERT
- EARTH BUND TO DIRECT RUNOFF TO BASIN INLETS
- SITE CONTOURS 1m INTERVALS - PROVIDED BY CLIENT

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
01	24/06/26	R.J.	R.J.	B.J.	AMENDED AS PER EPA COMMENTS
00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE - FOR REVIEW

DRAWING STATUS

DESIGN BY	R.J.
DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	1:5000

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN – YEAR 15–30 SHEET 8 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP203	01

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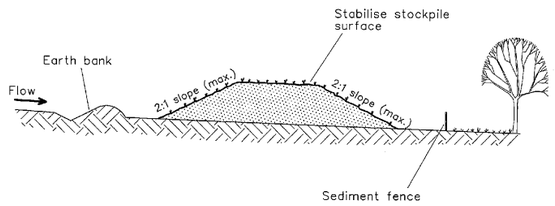
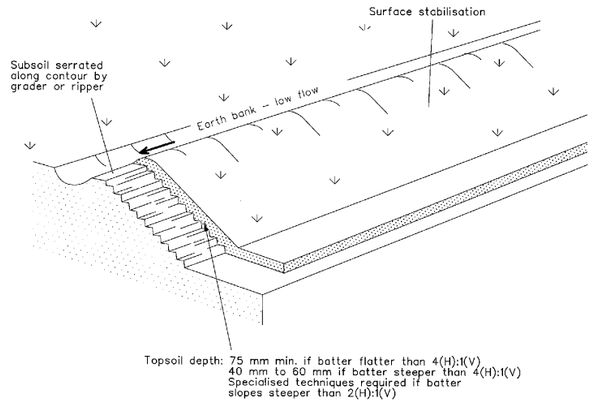


Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

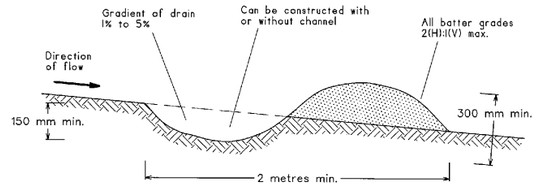
STOCKPILES **SD 4-1**



Construction Notes

1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any hardsetting surfaces and to provide a good bond between the respread material and subsoil.
2. Add soil ameliorants as required by the ESCP or SWMP.
3. Rip to a depth of 300 mm if compacted layers occur.
4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

REPLACING TOPSOIL **SD 4-2**



NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW) **SD 5-5**

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00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS

DESIGN BY	R.J.
DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	N.T.S.

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: ESCP LANDCOM STANDARD DRAWINGS SHEET 9 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP300	01

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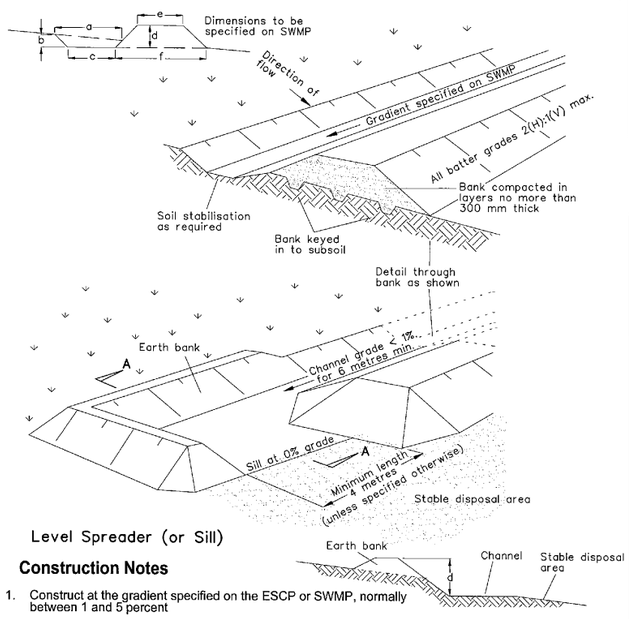
Plot Date: Thursday, 25 June 2026 4:30:33 PM CAD File Name: Q:\20000436 Monaro Rock Project\Drawings\20000436_P02_ESCP_REV01.dwg

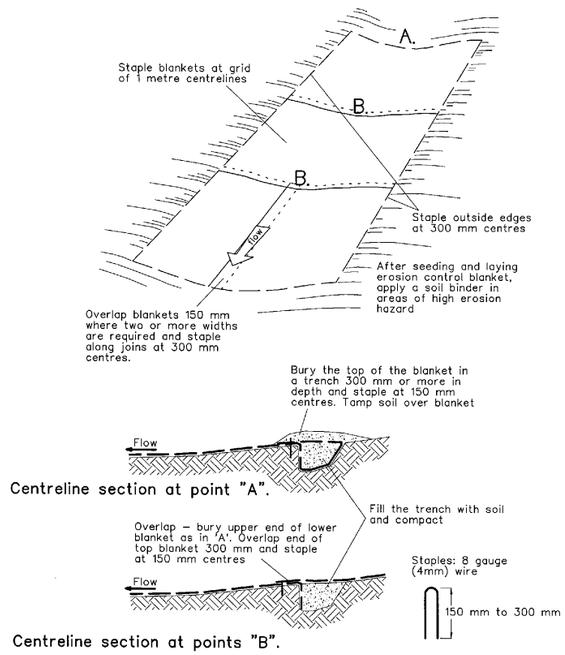


Level Spreader (or Sill)

Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

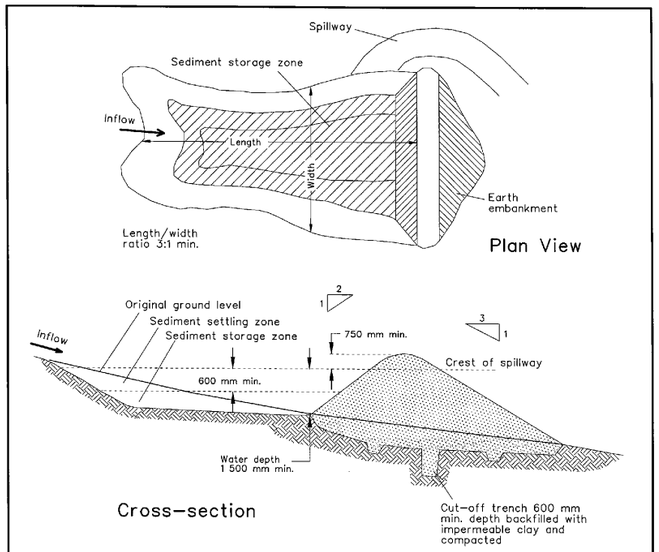
EARTH BANK (HIGH FLOWS) — SD 5-6



Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

RECP : CONCENTRATED FLOW — SD 5-7



Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET — SD 6-4

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

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C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS: DESIGN BY R.J.; DRAWN BY R.J.; FINAL APPROVAL B.J.

SCALE: (on A3 Original) N.T.S.

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: ESCP LANDCOM STANDARD DRAWINGS SHEET 10 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP301	01

Plot Date: Thursday, 25 June 2026 4:30:34 PM CAD File Name: Q:\20000436 Monaro Rock Project\Drawings\20000436_P02_ESCP_REV01.dwg

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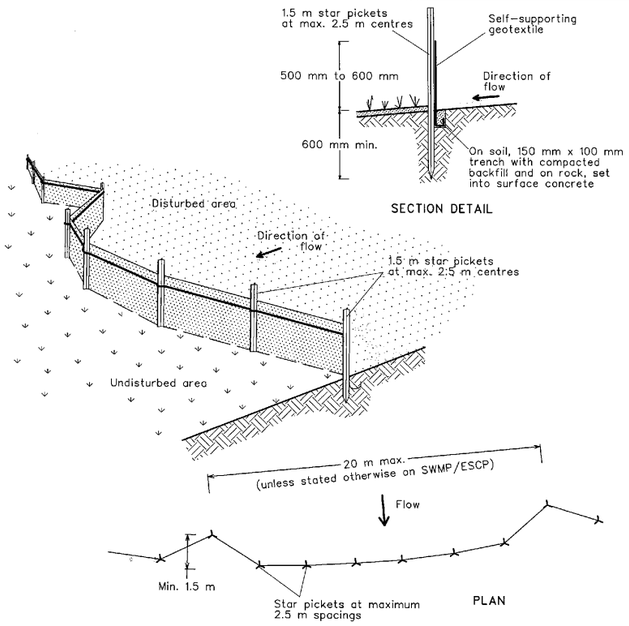
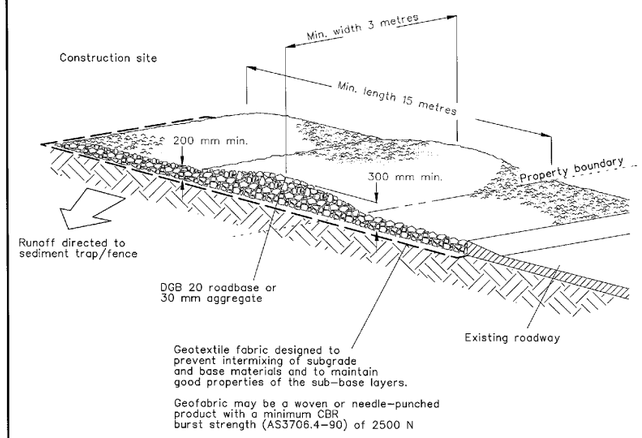


Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

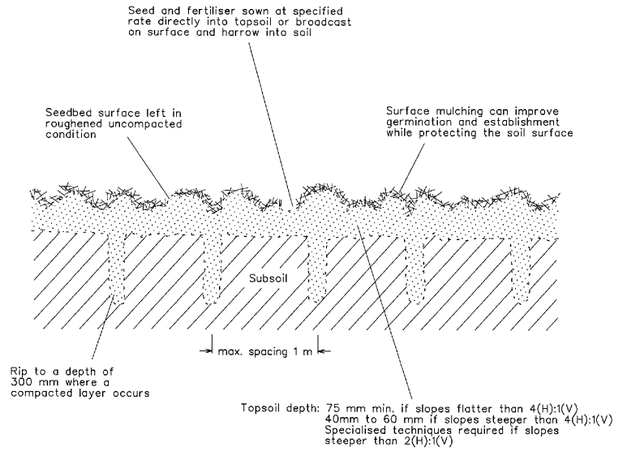
SEDIMENT FENCE **SD 6-8**



Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS **SD 6-14**



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

SEEDBED PREPARATION **SD 7-1**

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D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS	
DESIGN BY	R.J.
DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	N.T.S.

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: ESCP LANDCOM STANDARD DRAWINGS SHEET 11 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP302	01

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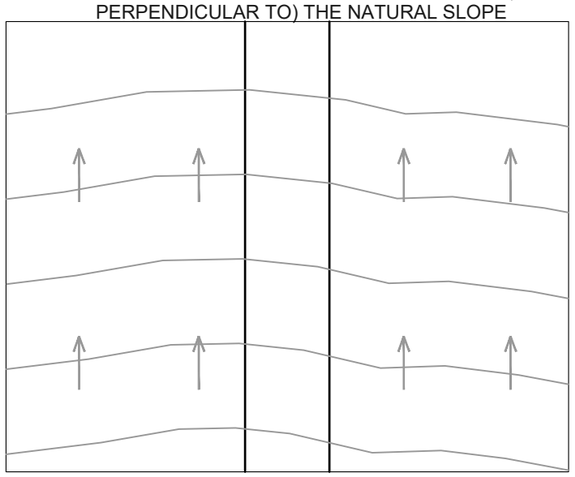
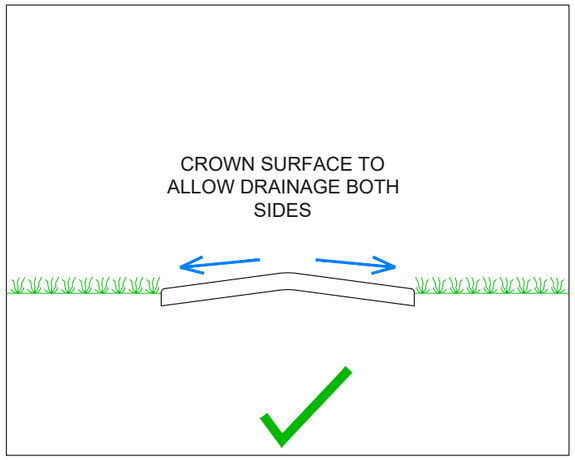
DETAIL 2

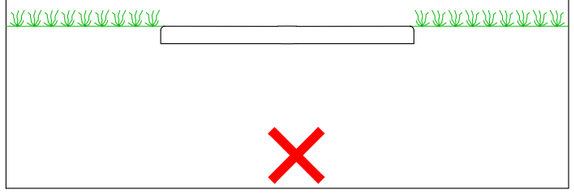
FOR ACCESS TRACKS RUNNING UP OR DOWN (i.e. PERPENDICULAR TO) THE NATURAL SLOPE



CROWN SURFACE TO ALLOW DRAINAGE BOTH SIDES



TRACK AT OR BELOW THE LEVEL OF SURROUNDING LANDS WILL FUNNEL WATER



WHEEL TRACKS AT OR BELOW THE LEVEL OF SURROUNDING LANDS WILL FUNNEL WATER, CAUSING RUTTING

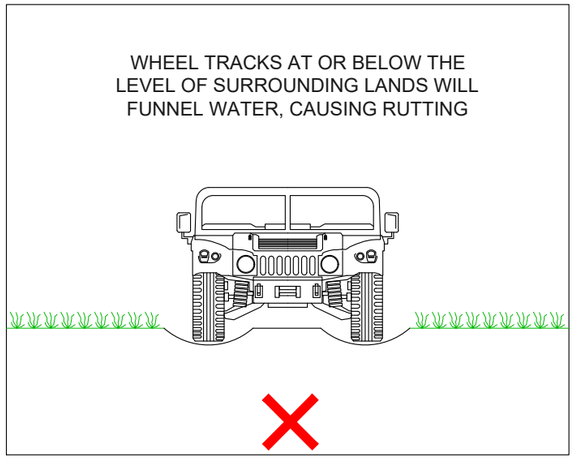
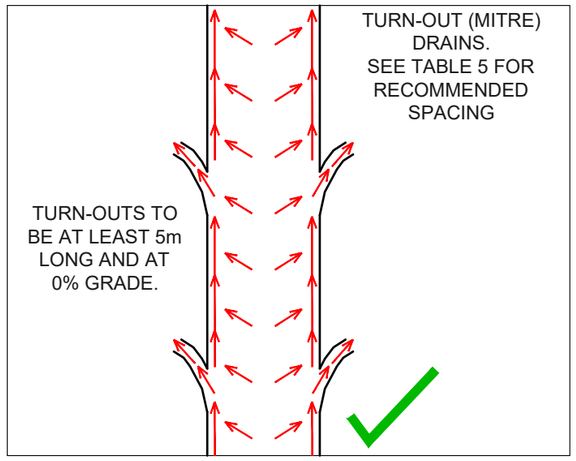


TABLE 5 - (FROM IECA, 2008)	
GRADE	MAX. SPACING OF TURN-OUT (MITRE) DRAINS
0-2%	120m
2-4%	60m
4-8%	30m
>8%	15m

TURN-OUT (MITRE) DRAINS. SEE TABLE 5 FOR RECOMMENDED SPACING

TURN-OUTS TO BE AT LEAST 5m LONG AND AT 0% GRADE.



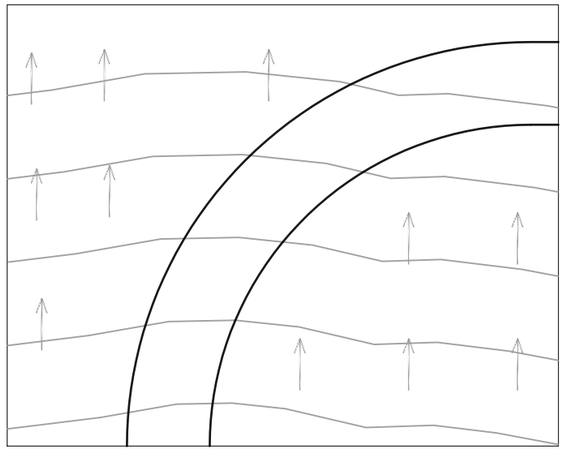
UNSEALED ROADS AND TRACKS DO NOT HAVE A PROTECTIVE HARD SEAL AND, AS SUCH, ARE HIGHLY PRONE TO EROSION AND DAMAGE. THE KEY TECHNIQUES TO MINIMISE EROSION AND DAMAGE TO UNSEALED ROADS AND TRACKS ARE:

- GOOD SHAPING (CAMBER, SUPER-ELEVATION ETC)
- GOOD DRAINAGE.

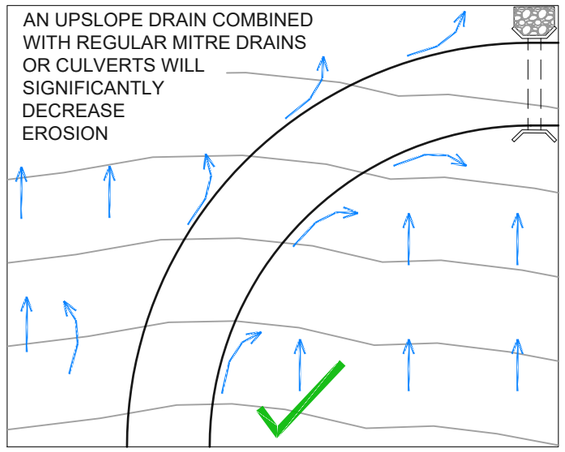
GOOD DRAINAGE IS PARTICULARLY IMPORTANT ON UNSEALED ROADS AND TRACKS, EVEN MORE SO THAN FOR A SEALED ROAD

DETAIL 3

FOR ACCESS TRACKS WRAPPING AROUND THE NATURAL SLOPE



AN UPSLOPE DRAIN COMBINED WITH REGULAR MITRE DRAINS OR CULVERTS WILL SIGNIFICANTLY DECREASE EROSION



REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
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C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
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A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS

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DRAWN BY R.J.
FINAL APPROVAL B.J.
SCALE: (on A3 Original) N.T.S.

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PROJECT TITLE: MONARO ROCK PROJECT

DRAWING TITLE: ESCP – ACCESS TRACKS STANDARD DRAWINGS SHEET 12 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP303	01

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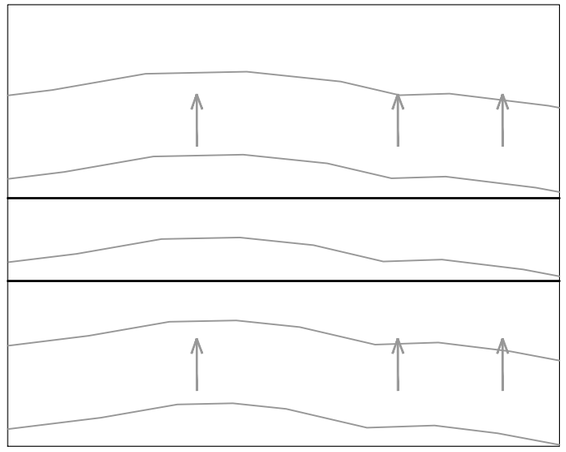
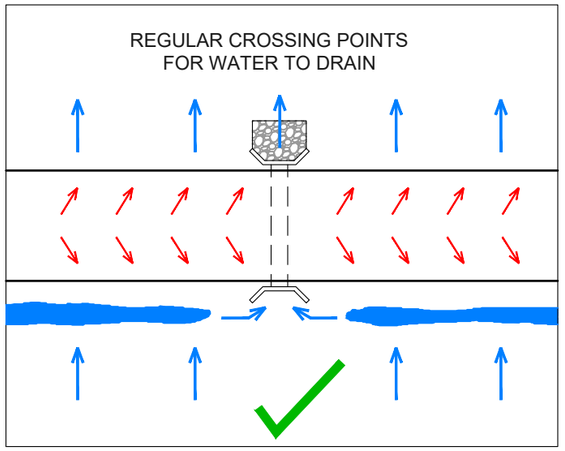
DETAIL 4

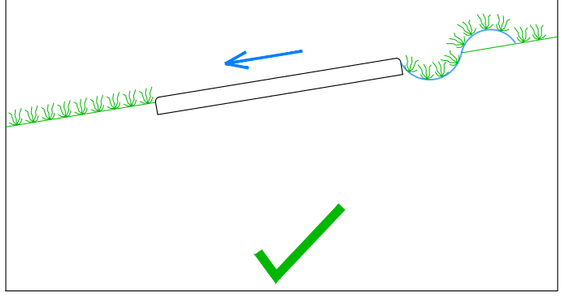
FOR ACCESS TRACKS RUNNING ACROSS
(i.e. PARALLEL TO) THE NATURAL SLOPE



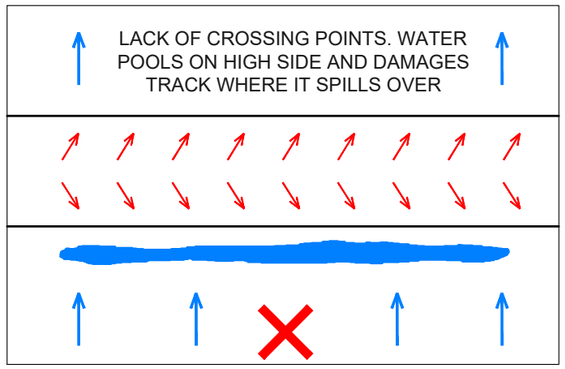
REGULAR CROSSING POINTS
FOR WATER TO DRAIN



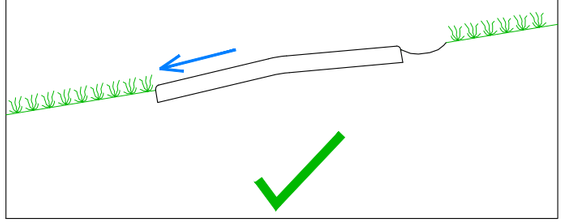
ON GENTLE SIDE SLOPES,
ROAD SURFACE CAN MIMIC
SURROUNDING LANDS.



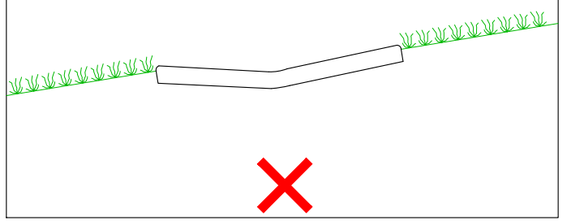
LACK OF CROSSING POINTS. WATER
POOLS ON HIGH SIDE AND DAMAGES
TRACK WHERE IT SPILLS OVER



DRAIN ON HIGH SIDE OF ROAD
REQUIRES REGULAR MITRE
DRAINS, PIPES OR CAUSEWAY
CROSSING POINTS.



WATER WILL FLOW ALONG ROAD
SURFACE, CAUSING EROSION



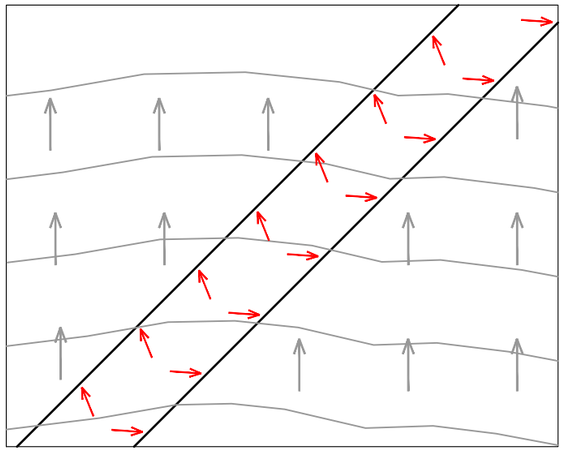
UNSEALED ROADS AND TRACKS DO NOT HAVE A PROTECTIVE HARD SEAL AND, AS SUCH, ARE HIGHLY PRONE TO EROSION AND DAMAGE. THE KEY TECHNIQUES TO MINIMISE EROSION AND DAMAGE TO UNSEALED ROADS AND TRACKS ARE:

- GOOD SHAPING (CAMBER, SUPER-ELEVATION ETC)
- GOOD DRAINAGE.

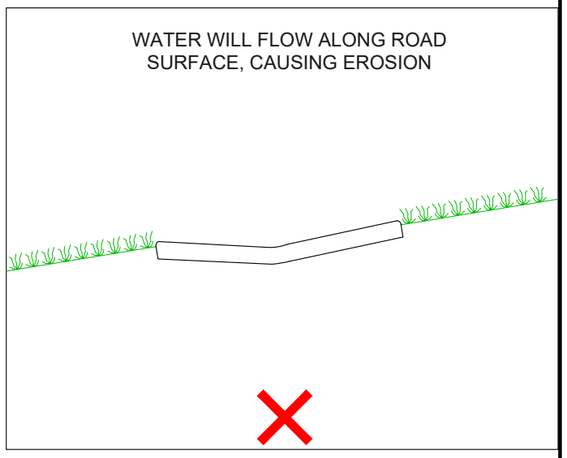
GOOD DRAINAGE IS PARTICULARLY IMPORTANT ON UNSEALED ROADS AND TRACKS, EVEN MORE SO THAN FOR A SEALED ROAD.

DETAIL 5

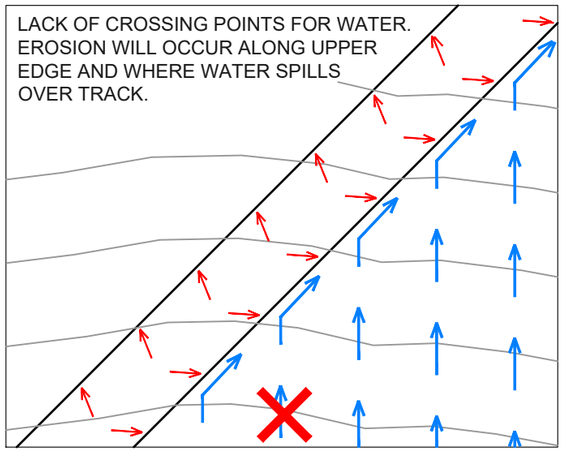
FOR ACCESS TRACKS RUNNING
DIAGONAL TO THE NATURAL SLOPE



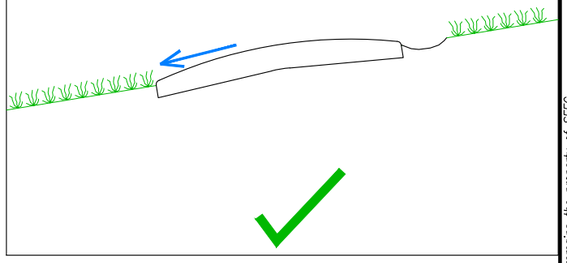
WATER WILL FLOW ALONG ROAD
SURFACE, CAUSING EROSION



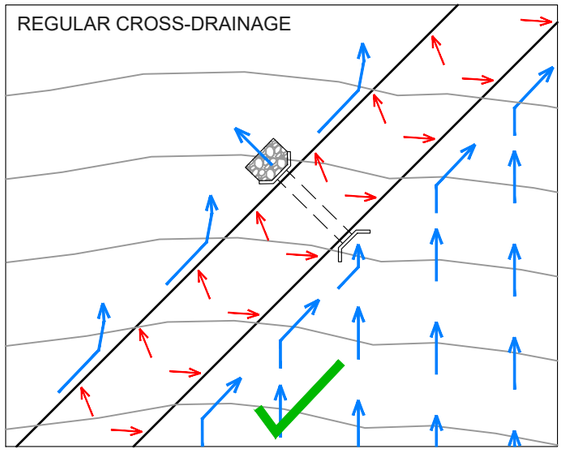
LACK OF CROSSING POINTS FOR WATER.
EROSION WILL OCCUR ALONG UPPER
EDGE AND WHERE WATER SPILLS
OVER TRACK.



GOOD SURFACE CROWN PLUS ADEQUATE
UPSLOPE DRAINAGE. REQUIRES
REGULAR MITRE DRAINS OR CULVERTS



REGULAR CROSS-DRAINAGE



REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
01	24/06/26	R.J.	R.J.	B.J.	AMENDED AS PER EPA COMMENTS
00	08/08/25	R.J.	R.J.	B.J.	FINAL ISSUE
D	30/05/25	R.J.	R.J.	B.J.	FINAL DRAFT ISSUE
C	07/05/25	R.J.	R.J.	B.J.	AMENDED BASIN LAYOUT
B	20/12/24	L.H.	R.J.	B.J.	AMENDED LAYOUT
A	08/07/24	L.H.	L.H.	B.J.	DRAFT ISSUE – FOR REVIEW

DRAWING STATUS

DESIGN BY	R.J.
DRAWN BY	R.J.
FINAL APPROVAL	B.J.
SCALE: (on A3 Original)	N.T.S.

FINAL

North

CLIENT

MONARO ROCK PTY LTD

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(t) 02 4862 1633
(f) 02 4862 3088
email: reception@seec.com.au
WWW.SEEC.COM.AU

PROJECT TITLE

MONARO ROCK PROJECT

DRAWING TITLE

ESCP – ACCESS TRACKS
STANDARD DRAWINGS
SHEET 13 OF 13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
20000436	P02	ESCP304	01

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11 APPENDIX B – FLOCCULANT SAFETY DATA SHEET (SDS)

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SAFETY DATA SHEET - Turbifloc

ABN: 49 158 485 039

5 Vision Court | Noosaville QLD 4566

t 07 5471 2290
e info@turbid.com.au |w turbid.com.au

1. IDENTIFICATION OF MATERIAL AND SUPPLIER

Product Name:	**Turbifloc**
Active ingredient:	**Chitosan**
Supplier:	**TURBID PTY LTD**

Emergency Contact Information

Telephone	(07) 5471 2290
Email	info@turbid.com.au
Address	5 Vision Court, Noosaville QLD 4566
Poisons Information Centre	Phone 13 11 26 from anywhere in Australia

2. HAZARDS IDENTIFICATION

STATEMENT OF HAZARDOUS NATURE

Classified as:	NOT HAZARDOUS according to the criteria of Safe Work Australia
Classified as	NON-DANGEROUS GOODS by the criteria of Australian Dangerous Goods Code (ADG Code) for transport by road and rail.
Risk phrases:	Not Hazardous – No criteria found
Safety phrases:	None allocated
ADG Classification:	None allocated. Not a Dangerous Good according to Australian Dangerous Goods (ADG) Code, IATA or IMDG criteria.
UN Number:	NONE. Not hazardous.

HAZARD STATEMENT:	May be irritating to eyes and skin
PREVENTION:	P102: Keep out of reach of children. P262: Do not get in eyes, on skin, or on clothing. P281: Use personal protective equipment as required.
RESPONSE:	P362: Take off contaminated clothing and wash before reuse. P301+P330+P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. P302+P352: IF ON SKIN: Wash with plenty of soap and water. P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P332+P313: If skin irritation occurs: Get medical advice. P337+P313: If eye irritation persists: Get medical advice.

RESPONSE (cont):	P370+P378: Not combustible. Use extinguishing media suited to burning materials
STORAGE:	P403+P233: Store in a well-ventilated place. Keep container tightly closed.
DISPOSAL:	Wearing protective equipment detailed above, and ensuring any ignition sources are eliminated, absorb with sodium carbonate - sodium bicarbonate, collect and dispose of to an approved landfill site. Contact the manufacturer/supplier for additional information (if required).
	Legislation Dispose of in accordance with relevant local legislation.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

Name	CAS Number	EC Number	Content
Non-Hazardous Ingredients	Not available	Not Available	Remainder
Organic Polymer (s)	-	-	<5%
Organic Acid (s)	-	-	<2%

This is a commercial product whose exact ratio of components may vary slightly. Minor quantities of other nonhazardous ingredients are also possible.

4. FIRST AID MEASURES

Eye contact:	If in eyes, hold eyelids apart and flush continuously with running water. Continue flushing until advised to stop by a Poisons Information Centre, a doctor, or for at least 15 minutes.
Skin contact:	If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water.
Inhalation:	If inhaled, remove from contaminated area. Apply artificial respiration if not breathing.
Ingestion:	For advice, contact a Poison Information Centre on 13 11 26 (Australia Wide) or a doctor (at once). If swallowed, do not induce vomiting.

5. FIRE FIGHTING MEASURES

Extinguishing media:	Use an extinguishing agent suitable for the surrounding fire.
Flash point (°C):	Material is non-flammable. May evolve toxic gases (acetic acid, hydrocarbons, carbon oxides) when heated to decomposition.
Special Procedures:	None.
Unusual hazards:	None known.
Conditions to avoid:	None known.
Decomposition products:	May evolve toxic gases (acetic acid, hydrocarbons, carbon oxides) when heated to decomposition.
Advice for firefighters	Evacuate area and contact emergency services. Toxic gases may be evolved in a fire situation. Remain upwind and notify those downwind of hazard. Wear full protective equipment including Self Contained Breathing Apparatus (SCBA) when combating fire. Use waterfog to cool intact containers and nearby storage areas.

6. ACCIDENTAL RELEASE MEASURES

General Response:	Personnel involved in the clean-up should wear appropriate protective clothing as listed in section 8. Slippery when spilt.
Clean Up Procedure:	Contain spillage, then cover / absorb spill with non-combustible absorbent material (vermiculite, sand, or similar), collect and place in suitable containers for disposal.

7. HANDLING & STORAGE

Handling:	Before use carefully read the product label. Use of safe work practices are recommended to avoid eye or skin contact and inhalation. Observe good personal hygiene, including washing hands before eating. Prohibit eating, drinking and smoking in contaminated areas.
Storage:	Store in a cool, dry, well ventilated area, removed from incompatible substances and foodstuffs. Ensure containers are adequately labelled, protected from physical damage and sealed when not in use. Store as a Class C2 Combustible Liquid (AS1940). Turbifloc has a shelf life of 12 months. Batches should be marked with production date and expiry date of 12months.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National Exposure Standards:	None Established
Engineering Controls:	Avoid inhalation. Use in well ventilated areas. Where an inhalation risk exists, mechanical extraction ventilation is recommended. Maintain vapour levels below the recommended exposure standard.
Personal Protective Equipment:	
Respiratory Protection:	General exhaust ventilation should be adequate.
Eye Protection:	Wear splash-proof goggles
Skin and body protection:	Disposable latex gloves, overalls or apron as appropriate. Rubber boots can be used in wet conditions but mainly as protection from the water

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear gel
Odour:	Slight odour
Boiling point (°C):	100 °C approximately
Melting point (°C):	0 °C approximately
Specific Gravity (H2O = 1):	1 approximately
pH:	3.0 – 5 at 25ºC
Vapour pressure (kPa):	Not applicable
Relative vapour density:	Not applicable

10. STABILITY AND REACTIVITY

Chemical Stability:	Stable under normal conditions of storage
Conditions to avoid:	Avoid heat, sparks, open flames and other ignition sources. Keep containers tightly closed
Incompatible Materials:	Incompatible with oxidising agents (e.g. hypochlorites), alkalis (e.g. sodium hydroxide), heat and ignition sources.
Decomposition products:	May evolve toxic gases (acetic acid, hydrocarbons, carbon oxides) when heated to decomposition.
Hazardous polymerization:	Will not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity:	This product is expected to be of low toxicity. Based on available data, the classification criteria are not met.
Irritation:	
Skin:	Not classified as a skin irritant. Contact may result in mild irritation, redness, pain and rash.
Eyes:	Not classified as an eye irritant. However, direct contact may result in mild irritation, lacrimation, pain and redness.
Chronic Toxicity:	No chronic effects
Aspiration:	Not classified as causing aspiration.
Target organs:	There is no data to hand indicating any particular target organs.

12. ECOLOGICAL INFORMATION

Environmental fate and distribution:
Chitosan is a derivative of Chitin, the world's second most abundant biopolymer after cellulose and readily biodegrades. It is commonly obtained from natural sources such as crustaceans and fungi.

Ecotoxicity:
Not expected to be harmful to aquatic organisms.

<u>Effective Concentration Method Assessment:</u>
Ecotoxicity screening carried out in March 2017indicated:

For the 96-hr acute toxicity test using the Eastern Rainbowfish (*Meloanotaenia splendida splendida*) the EC50 = >100mg/L

For the 48-hr acute toxicity test using the freshwater flea *Ceriodaphnia dubia* the EC50 = >100mg/L when diluted at a 1 in 2 ratio.

Bio accumulative Potential:

Does not bio accumulate.

13. DISPOSAL CONSIDERATIONS

Waste disposal method:
Refer to local waste disposal authority. Wearing protective equipment detailed above, and ensuring any ignition sources are eliminated, absorb with sodium carbonate - sodium bicarbonate, collect and dispose of to an approved landfill site. Contact the manufacturer/supplier for additional information (if required).

Dispose of product 12 months after production/batch date

14. TRANSPORT INFORMATION

This product does not carry a Dangerous Goods classification. NOT CLASSIFIED AS A DANGEROUS GOOD BY THE CRITERIA OF THE ADG CODE, IMDG OR IATA

15. REGULATORY INFORMATION

All components are listed on AICS or are exempt.

16. OTHER INFORMATION

This SDS was prepared in accordance with the Code of Practice for the Preparation of Safety Data Sheets for Hazardous Chemicals.

Acronyms:
ADG Code Australian Code for the Transport of Dangerous Goods by Road and Rail (7th edition)
AICS Australian Inventory of Chemical Substances
SWA Safe Work Australia, formerly ASCC and NOHSC
CAS Number Chemical Abstracts Service Registry Number
Hazchem code Emergency action code of numbers and letters that provide information to emergency services especially firefighters
IARC International Agency for Research on Cancer
NOS Not otherwise specified
NTP National Toxicology Program (USA)
R-Phase Risk Phrase
SUSMP Standard for the Uniform Scheduling of Medicines & Poisons
Un Number United Nations Number

References cited:

1. American Conference of Governmental Industrial Hygienists (ACGIH), Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th Edition, ACGIH, Cincinatti, Ohio, 1991.
2. Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003(1995)]
3. Registry of Toxic Effects of Chemical Substances (RTECS)
4. Sax's, Dangerous Properties of Industrial Materials, Edition 8, Ed. RJ Lewis Sr., van Nostrand Reinhold.

Revision 6: Issued 12 Jun 2024

This SDS summarizes to our best knowledge of health and safety hazard information of the product and how to safely handle and use the product in the workplace. Each user should read this SDS and consider the information in the context of how the product will be handled and used in the workplace including in conjunction with other products. Please contact the company if any further information is required.