Water Balance Assessment

1848 Castlereagh Highway, Tallawang, NSW

Final Report

P2410271JR01V02

September 2024

Outline Planning Consultants Pty Ltd

environmental science & engineering

Project Details

Report Title	Water Balance Assessment: 1848 Castlereagh Highway, Tallawang, NSW
Client	Outline Planning Consultants Pty Ltd
Document	P2410271JR01V02
Director	Daniel Martens
Manager	Terry Harvey
Principal Author	Huzaifa Rizwan

Document History

Issue	Issue Date	Status	Description / Comment	Author	Reviewer	Approved
1	2/08/2024	Review	Development Application	HR	AVG	TH
2	23/09/2024	Final	Development Application	HR	AVG	TH

Suite 201, 20 George St, Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
P +61-2-9476-9999 | mail@martens.com.au | www.martens.com.au

Contents

Tables

1 Introduction

1.1 Overview and Scope

Martens & Associates Pty Ltd (**MA**) have prepared this water balance assessment report to support a development application (**DA**) for a proposed quarry at 1848 Castlereagh Highway, Tallawang, NSW (the **site**).

This report provides evidence of compliance with Secretary's Environmental Assessment Requirements (SEAR's) 1894 as they relate to the requirements for sediment and erosion control and a water balance assessment and the documentation of the results of the assessment.

1.2 Relevant Guidelines

This report has been prepared in accordance with the following standards / guidelines:

- BMT WBM (2015) NSW MUSIC Modelling Guidelines.
- Department of Environment & Climate Change (2008) Managing Urban Stormwater: Soils and construction, Volume 2E Mines and quarries.
- Landcom (2004) Managing urban stormwater: Soils and construction, Volume 1.
- NSW Health (2012) Septic Tank and Collection Well Accreditation Guideline.

2 Site Description

2.1 Site Description and Location

A site description has been provided in Table 1.

Table 1: Site description summary.

Item	Description
Site	1848 Castlereagh Highway, Tallawang, NSW
Legal identifier	Lot 1 DP 1239728
Local government area	Mid-Western Regional Council
Quarry Area	Stage 1: 4.98 ha (approximately) Stage 2: 7.34 ha (approximately)
Existing Site Development	The existing site comprises a cleared area with stockpiled materials, surrounded by grassy terrain with scattered shrubs and trees.
Neighbouring Environment	To the north of the proposed quarry are a few existing rural residences, the closest being approximately 800 m away. Castlereagh Highway is to the east of the site.
Site Topography	The site has undulating slopes. Elevation ranges from 550 m AHD to below 520 m AHD.
Site Drainage	The site drains east via overland flow towards Tallawang Creek.

Figure 1 shows the location and extent of the proposed quarry.

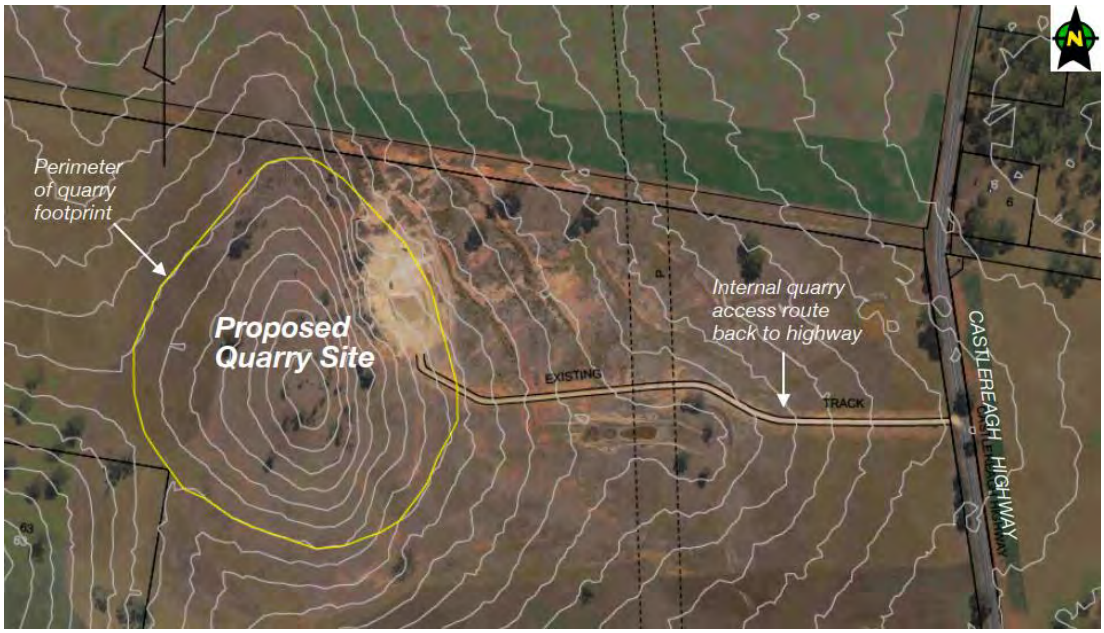


Figure 1: Extents of the proposed quarry shown in yellow (picture provided by Outline Planning Consultants).

2.2 Proposed Development

The proposed development will include the construction of a new quarry, to be executed across three stages, described below:

- Stage 1: Initial quarry operations (approximately 4.98 ha and approximately 40 m of excavation) and associated sediment basin.
- Stage 2: Expansion of the quarry area (approximately 7.34 ha) and an enlarged sediment basin.

Refer to Appendix A for the conceptual design of these stages.

3 Sediment and Erosion Control

3.1 Overview

A sediment basin is proposed to be constructed to collect and treat runoff from disturbed areas during each stage of the project.

The sediment basin will be constructed prior to the commencement of Stage 1 quarry operations. It will be expanded before each subsequent stage, as per the proposed size for each stage of the project. This approach ensures that all contaminated water generated onsite is effectively collected and treated. Water collected in the sediment basin will be used for process water and dust suppression on the haul road. Refer to Section 4 for the water balance assessment of the site, including the sediment basin.

3.2 Sediment Basin Sizing

For each stage of operations, a separate basin has been sized. The minimum capacity of the proposed sediment basin for each stage to control expected sediment loads has been determined using guidelines provided in Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004) and Volume 2E Mines and Quarries (DECC, 2008).

Consistent with Section 6.1 of Volume 2E Mines and Quarries (DECC, 2008), the following parameters were adopted:

- Type D soil classification
- Soil hydrologic group D
- Erodibility (K-factor) of 0.05

Based on these parameters a sediment basin for Type D soil classification can be sized from Section 6.3.4 of Volume 1 (Landcom, 2004) as follows:

Basin Volume = Settling Zone + Sediment Storage Zone

Settling Zone = $10 \times C_v \times A \times R$

Sediment Storage Zone = 50 % of the Settling Zone

Refer to Table 2 for the summary of the values used in the sediment basin calculations. The calculations for the sediment basin for Stages 1 and 2 are detailed in Table 3.

Table 2: Parameters and values.

Symbol	Description	Value	Source
Cv	Volumetric runoff coefficient	0.74	From Table F2 for soil hydrologic group D and rainfall depth 51-60 mm
A	Area	Stage 1: 4.98 ha Stage 2: 7.34 ha	Provided by Outline Planning Consultants
R	5-day 95th percentile rainfall depth	50.7 mm	From Table 6.3a for Dubbo

Table 3: Basin Volume Calculations for each stage.

Stage	Calculation Step	Formula and Calculation	Result
Stage 1	Settling Zone	= 10 x C_v x A x R = 10 x 0.74 x 4.98 x 50.7	= 1868 m³
	Sediment Storage Zone	= 0.5 x Settling Zone = 0.5 x 1868	= 934 m³
	Total Basin Volume	= Settling Zone + Sediment Storage Zone = 1868 + 934	= 2803 m³ ≈ 2900 m³
Stage 2	Settling Zone	= 10 x C_v x A x R = 10 x 0.74 x 7.34 x 50.7	= 2754 m³
	Sediment Storage Zone	= 0.5 x Settling Zone = 0.5 x 2754	= 1377 m³
	Total Basin Volume	= Settling Zone + Sediment Storage Zone = 2754 + 1377	= 4131 m³ ≈ 4200 m³

4 MUSIC Water Balance Assessment

4.1 Methodology

4.1.1 Overview

The Model for Urban Stormwater Improvement Conceptualisation (*MUSIC*, Version 6.3) developed by the CRC for Catchment Hydrology was used to undertake the site water balance assessment to detail potable and non potable water supply and demands for the development.

Modelling has been undertaken in accordance with NSW MUSIC Modelling Guidelines (2015) with the developed site based on design briefs.

4.1.2 Approach

The water balance is assessed considering the following components:

1. Site Water Demand: Consideration of quarry operational water demands.
2. Site Water Supply: Assessment of site water supply (surface water runoff).
3. Site Water Balance: The balance of supply and demand is assessed based on a range of climatic conditions to determine the need for additional supply or to detail the excess water released to the environment.

The details of the MUSIC model inputs are presented in Appendix B.

4.1.3 Climate Data

The water balance is to assess the following range of rainfall scenarios:

1. Average year – with annual rainfall equal to average rainfall of all years (616.7 mm).
2. Dry year – with annual rainfall equal to 10th percentile rainfall of all years to assess 'severe' water deficit (389.8 mm).
3. Wet year – with annual rainfall equal to 90th percentile rainfall of all years to assess 'severe' water surplus (886.8 mm).

Rainfall climate data was sourced from the Bureau of Meteorology (**BOM**) weather station located at Dunedoo Post office (Station No. 64009). The data for the following years was used as a proxy for the three different scenarios listed above:

- Average year (1970): recorded rainfall 622.7 mm
- Dry year (2017): recorded rainfall 389.8 mm
- Wet year (2021): recorded rainfall 886.8 mm

4.1.4 Input Parameters

Refer to Appendix B for listed input parameters. The sediment basin volumes for each stage were based on the minimum basin sizes calculated in Section 3.

4.1.5 Model Parameters

Base and storm flow concentration inputs were adopted based on NSW MUSIC Modelling Guidelines (2015) and MUSIC defaults for the proposed quarry.

4.1.6 Catchment Area

The catchment sizes draining to the proposed sediment basins are:

- 4.98 ha for Stage 1
- 7.34 ha for Stage 2

4.1.7 Site Water Demand

Water demands for the quarry are summarised in Table 4.

Table 4: Summary of site water demand / losses for all stages.

Activity	Water Demand ML/year
Dust suppression	0.90
Production	10.00
Staff amenities	0.05
Total non potable water demand	**10.90**
Total potable water demand	**0.05**

The non potable water demands for the site are based on the water required for quarry operations and dust suppression, the estimates above have been provided by Outline Planning Consultants Pty Ltd.

The potable water demand for the site is estimated as 27 L/person/day (based on NSW Health (2012) guidelines for industrial use). Based on information provided by Outline Planning Consultants Pty Ltd, up to 6 employees will be on site for 6 days a week (excluding public holidays) providing an annual demand of 0.05 ML/yr.

4.1.8 Site Water Supply

Non potable water supply is to reuse stormwater runoff which is captured in the sediment basin. Water supply is based on the MUSIC modelling using the climate data detailed in Section 4.1.3.

The site is not serviced by town water supply therefore, potable water can be provided via collected roof water and/or water tanker delivery.

4.1.9 Site Water Balance Results

4.1.9.1 Stage 1 Quarry Operations

The site water balance for the proposed quarry at Stage 1 is summarised in Table 5 (average year); Table 6 (dry year) and Table 7 (wet year).

Table 5: Summary of site water balance (Stage 1) – average year.

Supply	ML/year	Demand	ML/year
Non-Potable			
Runoff to sediment basin	24.46	Road dust suppression	0.90
Storage (evaporative & seepage) looses	-1.36	Production	10.00
Non-Potable Balance			12.20
Potable			
		Staff amenities	0.05
Potable Balance			-0.05

Note:
Positive number demotes a surplus / negative number denotes a deficit.

Table 6: Summary of site water balance (Stage 1) – dry year.

Supply	ML/year	Demand	ML/year
Non-Potable			
Runoff to sediment basin	15.03	Road dust suppression	0.90
Storage (evaporative & seepage) looses	-1.36	Production	10.00
Non-Potable Balance			2.77
Potable			
		Staff amenities	0.05
Potable Balance			-0.05

Note:
Positive number demotes a surplus / negative number denotes a deficit.

Table 7: Summary of site water balance (Stage 1) – wet year.

Supply	ML/year	Demand	ML/year
Non-Potable			
Runoff to sediment basin	35.75	Road dust suppression	0.90
Storage (evaporative & seepage) looses	-1.36	Production	10.00
Non-Potable Balance			23.49
Potable			
		Staff amenities	0.05
Potable Balance			-0.05

Note:
Positive number demotes a surplus / negative number denotes a deficit.

4.1.9.2 Stage 2 Quarry Operations

The site water balance for the proposed quarry at Stage 2 is summarised in Table 8 (average year); Table 9 (dry year) and Table 10 (wet year).

Table 8: Summary of site water balance (Stage 2) – average year.

Supply	ML/year	Demand	ML/year
Non-Potable			
Runoff to sediment basin	36.06	Road dust suppression	0.90
Storage (evaporative & seepage) looses	-1.97	Production	10.00
Non-Potable Balance			23.19
Potable			
		Staff amenities	0.05
Potable Balance			-0.05

Note:
Positive number demotes a surplus / negative number denotes a deficit.

Table 9: Summary of site water balance (Stage 2) – dry year.

Supply	ML/year	Demand	ML/year
Non-Potable			
Runoff to sediment basin	22.16	Road dust suppression	0.90
Storage (evaporative & seepage) looses	-1.97	Production	10.00
Non-Potable Balance			9.29
Potable			
		Staff amenities	0.05
Potable Balance			-0.05

Note:

Positive number demotes a surplus / negative number denotes a deficit.

Table 10: Summary of site water balance (Stage 2) – wet year.

Supply	ML/year	Demand	ML/year
Non-Potable			
Runoff to sediment basin	52.69	Road dust suppression	0.90
Storage (evaporative & seepage) looses	-1.97	Production	10.00
Non-Potable Balance			39.82
Potable			
		Staff amenities	0.05
Potable Balance			-0.05

Note:

Positive number demotes a surplus / negative number denotes a deficit.

5 Conclusion

The minimum required sediment basin volumes for each stage have been calculated to be:

- Stage 1: 2600 m³.
- Stage 2: 4200 m³.

The calculated sediment basins for each stage have been modelled to assess water supply adequacy. The water balance assessment (for each stage) demonstrates that for all modelled years (average, dry and wet) the site shall generate, capture and store sufficient runoff to provide for all non potable water demands (10.9 ML/year).

A potable water deficit is estimated at 50 kL/year based on site staff requirements which can be provided via collected roof water and/or tanker delivery.

6 References

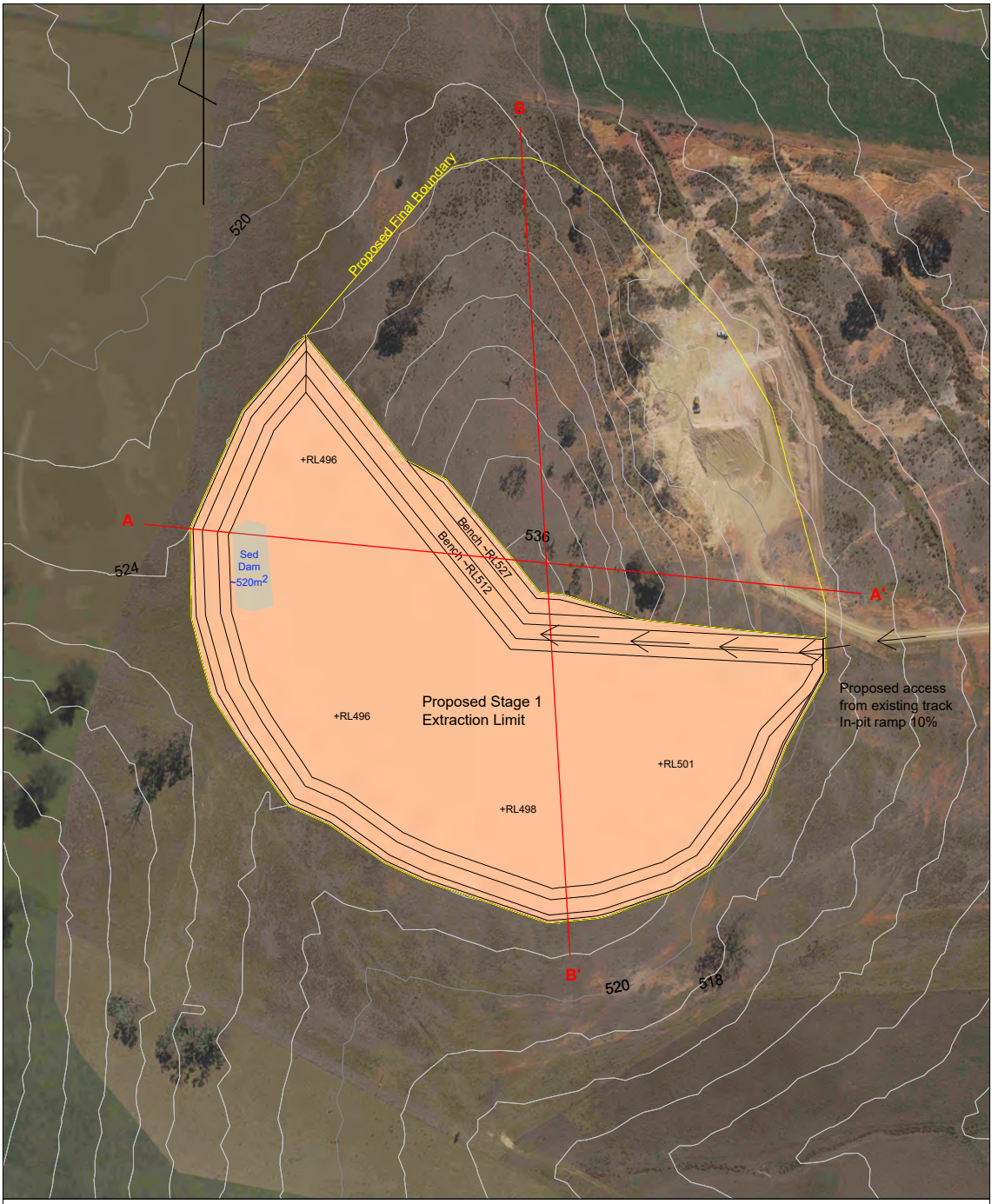
BMT WBM (2015), *NSW MUSIC Modelling Guidelines.*

Department of Environment & Climate Change (2008), *Managing Urban Stormwater: Soils and construction, Volume 2E Mines and quarries.*

Landcom (2004), *Managing urban stormwater: Soils and construction, Volume 1.*

NSW Health (2012), *Septic Tank and Collection Well Accreditation Guideline*

Appendix A Conceptual Staging Plan



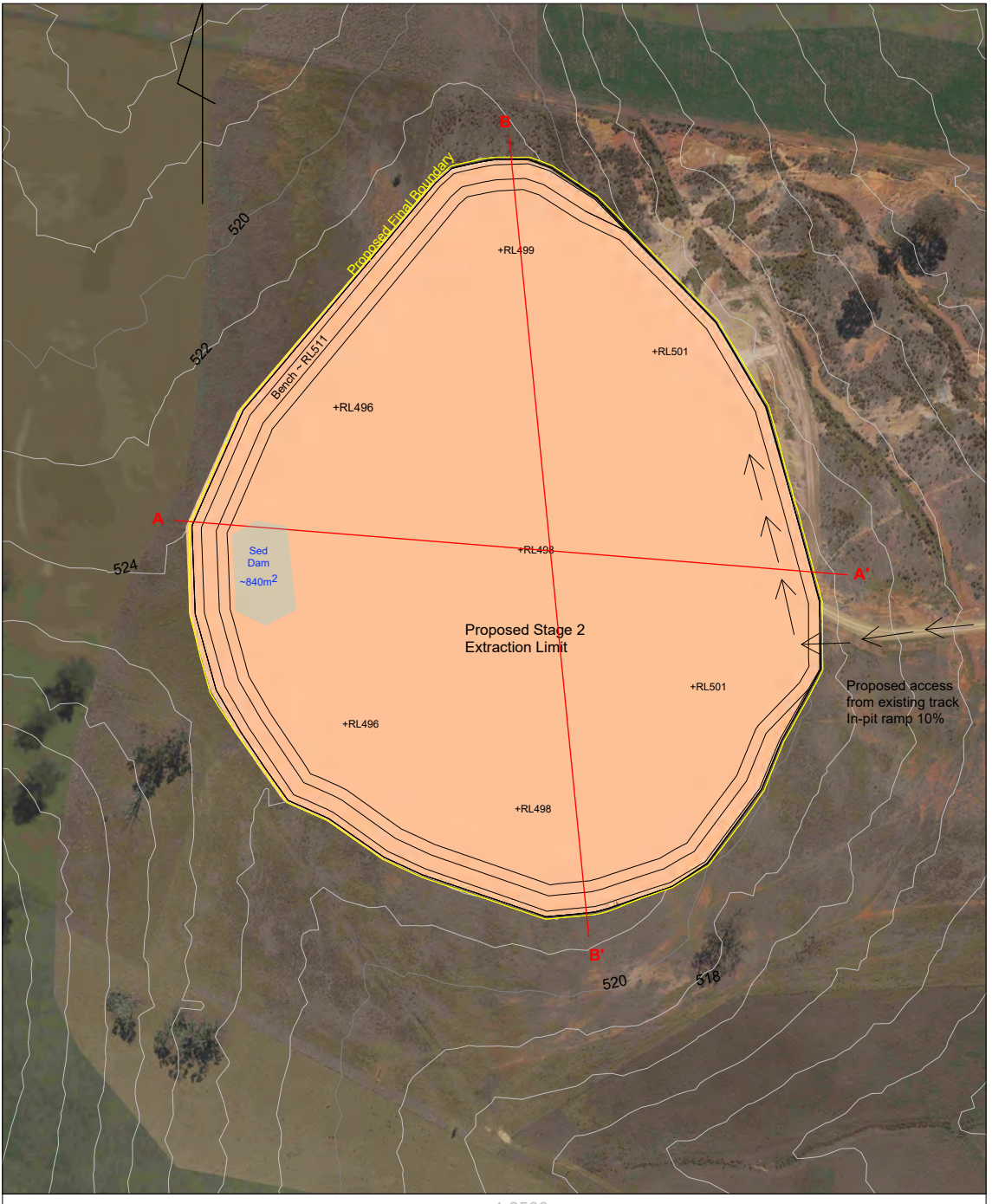
Gulgong Quarry Conceptual Design Stage 1

1:2500

0 125 250

Disclaimer:
- This plan is a conceptual design only
- This plan is not suitable for operational use
- This plan should be used for visual reference only

Drawn by: A Richards	Date: 06/09/2024
Approved by:	Date:
Date of Survey: unknown	
Project: Gulgong Quarry Conceptual Design	



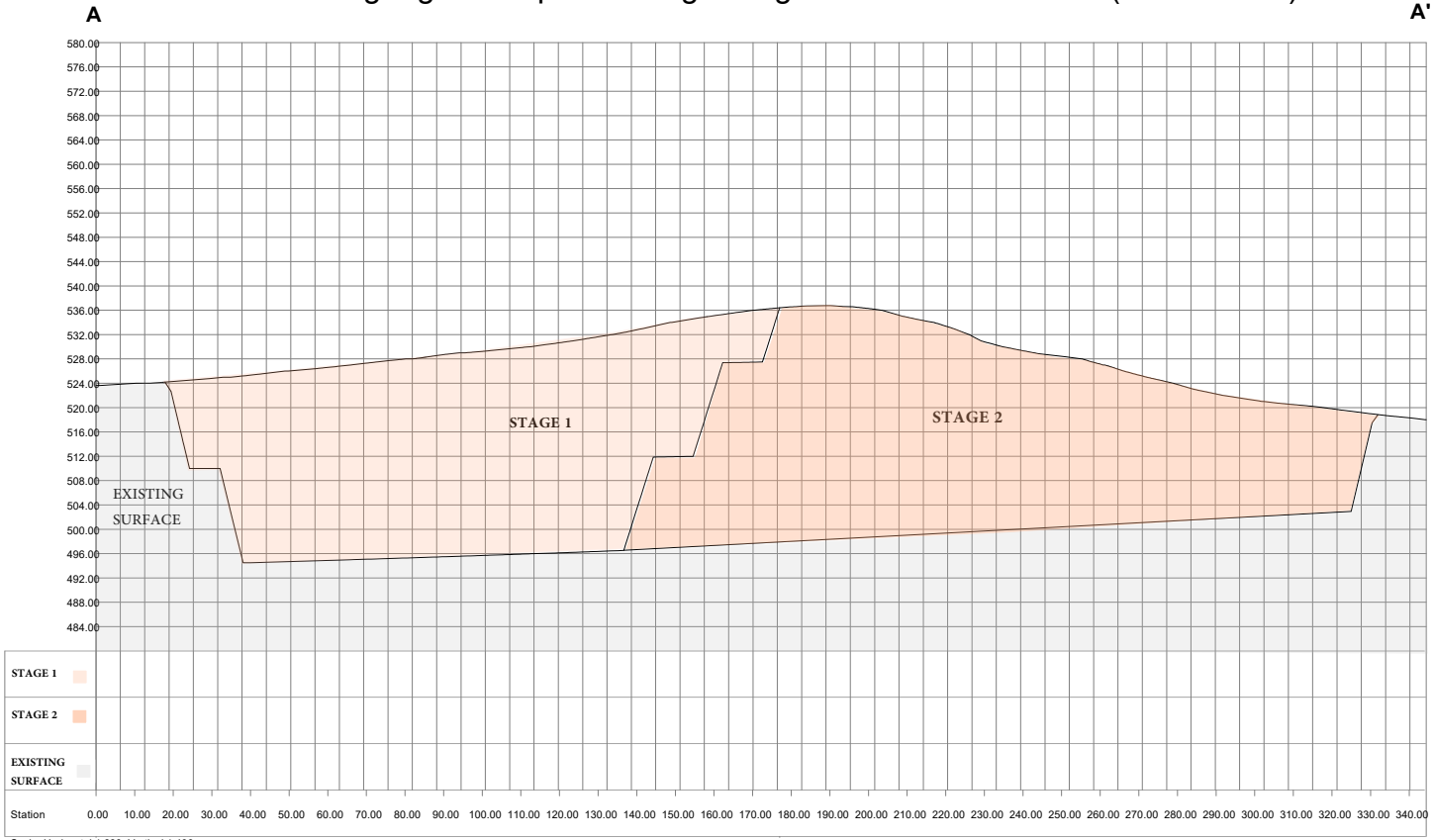
Gulgong Quarry Conceptual Design
Stage 2

0 1:2500 125 250

Disclaimer:
- This plan is a conceptual design only
- This plan is not suitable for operational use
- This plan should be used for visual reference only

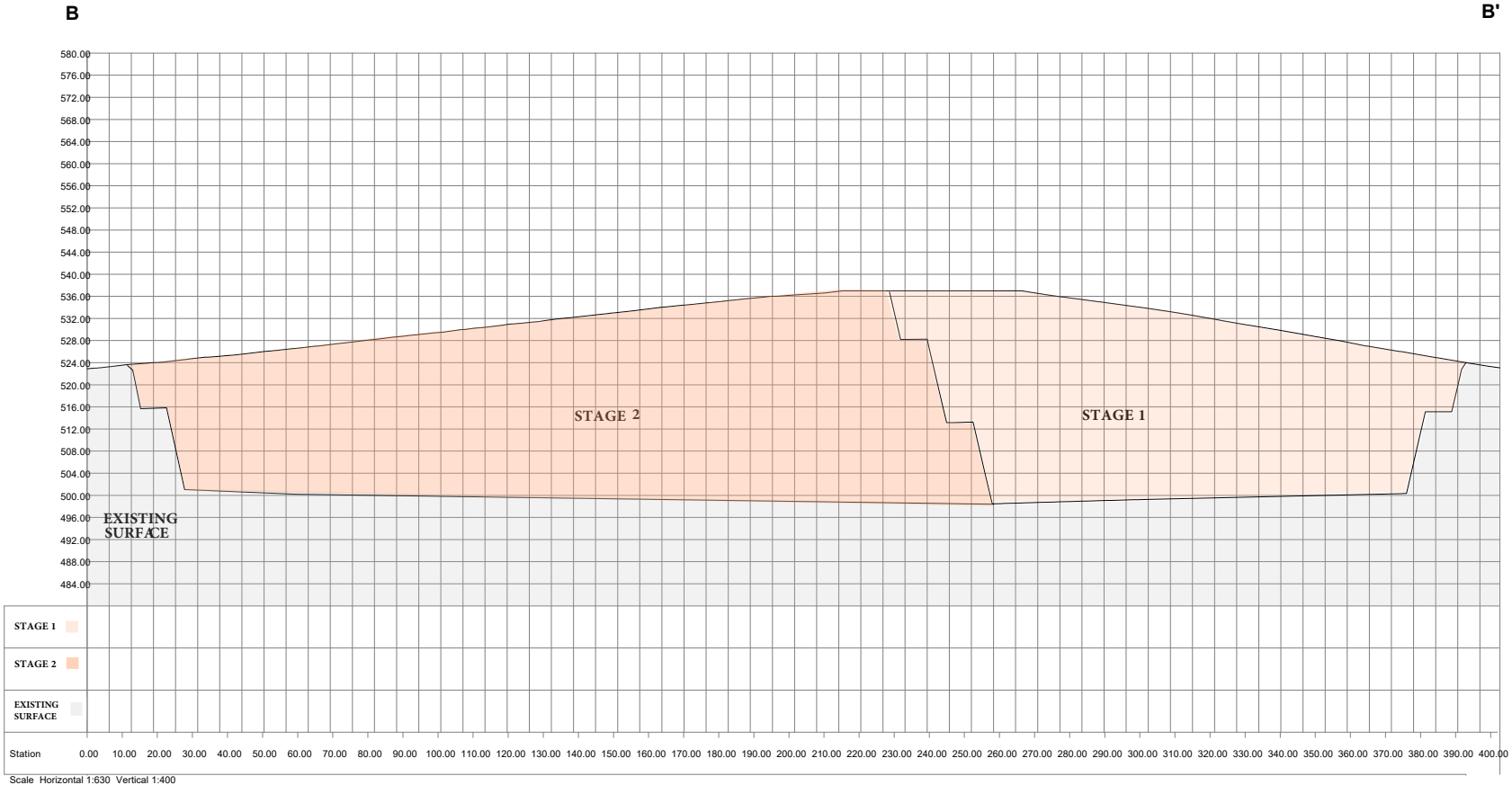
Drawn by: A Richards	Date: 06/09/2024
Approved by:	Date:
Date of Survey: unknown	
Project: Gulgong Quarry Conceptual Design	

Gulgong Conceptual Design Stages - AA' Section View (East - West)



Scale Horizontal 1:630 Vertical 1:400

Gulgong Conceptual Design Stages - BB' Section View (North - South)



Scale Horizontal 1:630 Vertical 1:400

Appendix B MUSIC Modelling Inputs

Parameter	Description	Input	Reference
Setup	Climate File	Rainfall data from BOM (Dunedoo Post Office, Station No. 64009) and PET data from eWater (Dubbo) were used to create the MLB files for each scenario in Section 4.1.3	BOM and eWater
Source Nodes	Rainfall Threshold	Based on surface type specified in Table 5-4 of NSW MUSIC Modelling Guidelines	BMT WBM MUSIC Modelling Guidelines (2015)
	Base & Storm flow Parameter	As per Table 5-6 & 5-7 of NSW MUSIC Modelling Guidelines	BMT WBM MUSIC Modelling Guidelines (2015)
	Estimation Method	Stochastically generated	BMT WBM MUSIC Modelling Guidelines (2015)
Sediment Basins	Low Flow By-Pass	0 m^3/s	Assumed no bypass
	High Flow By-Pass	100 m^3/s	Assumed no bypass
	Extended Detention Depth	0.01 m	Nominally zero (no detention depth modelled)
	Surface Area	1450 m^2 (Stage 1) 2100 m^2 (Stage 2)	By design, basin assumed to be approximately 2 m deep
	Permanent Volume	2900 m^3 (Stage 1) 4200 m^3 (Stage 2)	By design
	Initial Volume	2900 m^3 (Stage 1) 4200 m^3 (Stage 2)	By design
	Exfiltration Rate	0.0 mm/hr	By design
	Evaporative Loss	75 %	MUSIC default
	Equivalent Pipe Diameter	300 mm	MUSIC default
	Overflow Weir width	2 m	MUSIC default