



ABN: 52 000 005 550

Water Management Plan

for the

New Berrima Clay/Shale Quarry

PA 08_0212

Prepared by:

**Strategic Environmental & Engineering
Consulting (SEEC) Pty Ltd**

in Conjunction with:



R.W. CORKERY & CO. PTY. LIMITED

September 2020

Approved by
the Secretary's nominee, Matthew Sprott,
on 8 October 2020



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PA 08_0212

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COMMONLY USED ACRONYMS

AHD	Australian Height Datum
AS	Australian Standard
DECC	Department of Environment and Climate Change
DPE	Department of Planning and Environment
DPI-Water	Department of Primary Industries - Water
EC	Electric Conductivity
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ESCPs	Erosion and Sediment Control Plans
NATA	National Association of Testing Authorities
PA	Project Approval
SEEC	Strategic Environmental Engineering Consulting Pty Limited
SEPP	State Environmental Planning Policy
TSS	Total suspended solids
WMP	Water Management Plan

1. INTRODUCTION

This *Water Management Plan* (WMP) has been prepared by Strategic Environmental and Engineering Consulting (SEEC) Pty Ltd in conjunction with R.W. Corkery & Co. Pty Limited on behalf of The Austral Brick Company Pty Limited (Austral) for the New Berrima Clay/Shale Quarry (the Quarry). The Quarry is located within the “Mandurama” property approximately 1.5km east of New Berrima in the Southern Highlands of NSW (**Figure 1**). For the purposes of this document, the area of the approved Quarry is referred to as “the Quarry Site”.

This WMP represents the second revision of the WMP and has been prepared in satisfaction of Project Approval (PA) 08_0212 *PA Conditions 3(13) to 3(15), 3(18) and 5(3)*¹. The Environment Protection Agency (EPA), Department of Primary Industries – Water (DPI-Water) and Water NSW have been / previously been consulted. Further consultation has also been undertaken with DPI-Water / the Natural Resources Access Regulator (NRAR) (see **Appendix A**). Strategic Environmental & Engineering Consulting (SEEC) were also previously approved by the (then) Department of Planning and Environment (DPE) as being suitably qualified and experienced for preparation of this WMP.

In addition to this WMP, a range of other management plans have also been prepared to guide operations within the Quarry. These include the following.

- Environmental Management Strategy.
- Transport Management Plan.
- Air Quality Management Plan.
- Noise Management Plan.
- Landscape Management Plan.
- Aboriginal Heritage Management Plan.

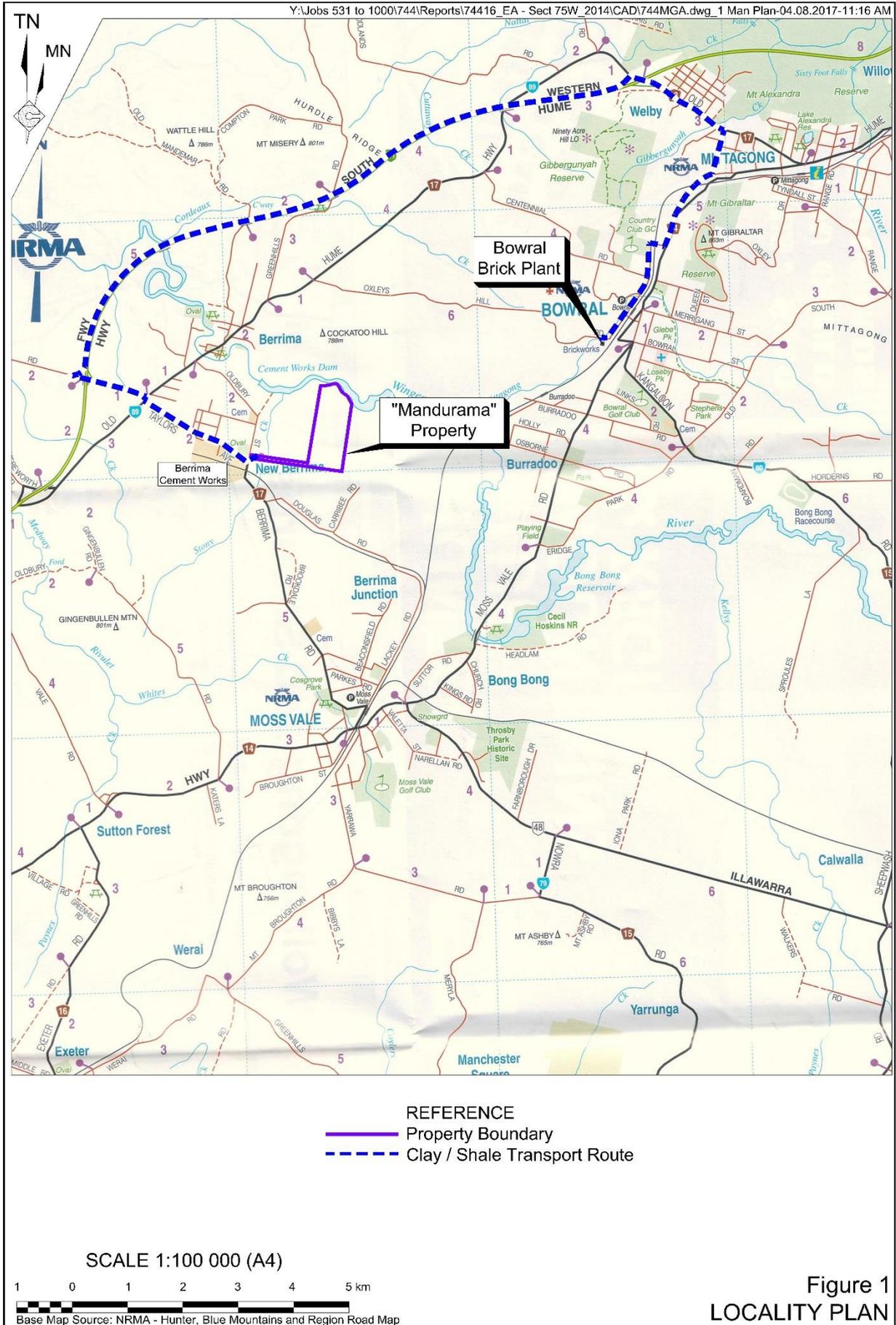
2. APPROVED ACTIVITIES AND STAGED OPERATIONS

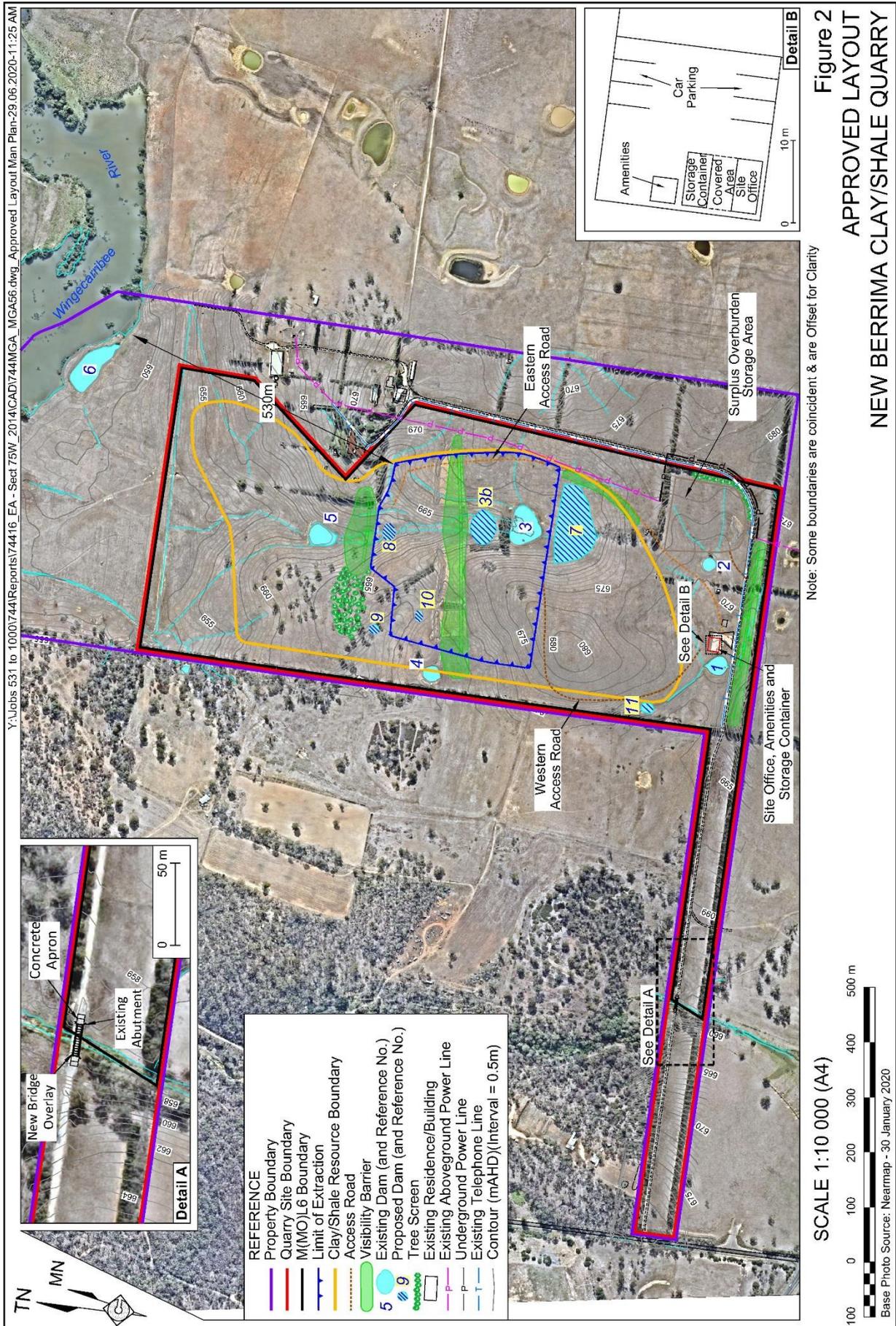
2.1 APPROVED ACTIVITIES

The principal activities approved at the Quarry (**Figure 2**) comprise the following.

- Construction of visibility barriers to provide visual screening for the quarry operations.
- Extraction and stockpiling of clay/shale from the extraction area using standard ripping, pushing and loading techniques.
- Transportation of up to 150 000t per year of quarry products via Berrima Road using articulated and rigid trucks not exceeding 19m in length.

¹ All conditions in Project Approval 08_0212 are referenced as the schedule number followed by the condition number in brackets, e.g. *PA Condition 3(13)*.





The relevant limitations upon the approved activities nominated in Conditions within Project Approval 08_0212 are as follows.

- “The Proponent must not carry out any development in the extraction area below a level of 640m AHD” *PA Condition 2(6)*.
- “The Proponent must not extract more than 150 000 tonnes of extractive materials from the site in any calendar year” *PA Condition 2(7)*.
- “The Proponent must not transport more than:
 - a) 150 000 tonnes of product from the site in any calendar year;
 - b) 68 laden trucks from the site in a day; and
 - c) 8 laden trucks from the site in an hour.

The approved quarry life is until 31 December 2045 and the approved hours of operation are outlined in **Table 1**.

Table 1
Hours of Operation

Day	Construction & Extraction Operations	Clay/Shale Transportation
Monday – Friday	7:00am to 5:00pm	7:00am to 4:00pm
Saturday	8:00am to 1:00pm	8:00am to 1:00pm
Sundays and Public Holidays	None	None

2.2 STAGED OPERATIONS

Figure 3 displays the staging sequence throughout the life of the Quarry. The southern section would be extracted in four stages, namely Stages 1 to 4. Once extraction ceases in the southern section, extraction would commence in the northern section with extraction undertaken in three stages, namely Stages 5 to 7. It is noted that, whilst the stages will progress sequentially, the actual timing for each stage will be largely dependent on the raw material requirements at the Bowral Brick Plant.

3. LEGAL AND OTHER REQUIREMENTS

3.1 PROJECT APPROVAL 08_0212

Austral was granted PA 08_0212 by the (then) Director-General of Planning and Infrastructure on 7 July 2012 pursuant to Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Modification 1 of PA 08_0212 was issued on 15 December 2015 to incorporate modifications to the Quarry associated with an alternate extraction area boundary. Modification 2 of PA 08_0212 was approved on 6 July 2017 to incorporate modifications to the Quarry associated with the construction of a new bridge over Stony Creek, the realignment of the western access road, the repositioning of the site office, amenities and storage container, and the installation of underground power and removal of a section of overhead power line. PA 08_0212 includes the conditions that Austral needs to comply with and sets out the matters that need to be addressed within this WMP.

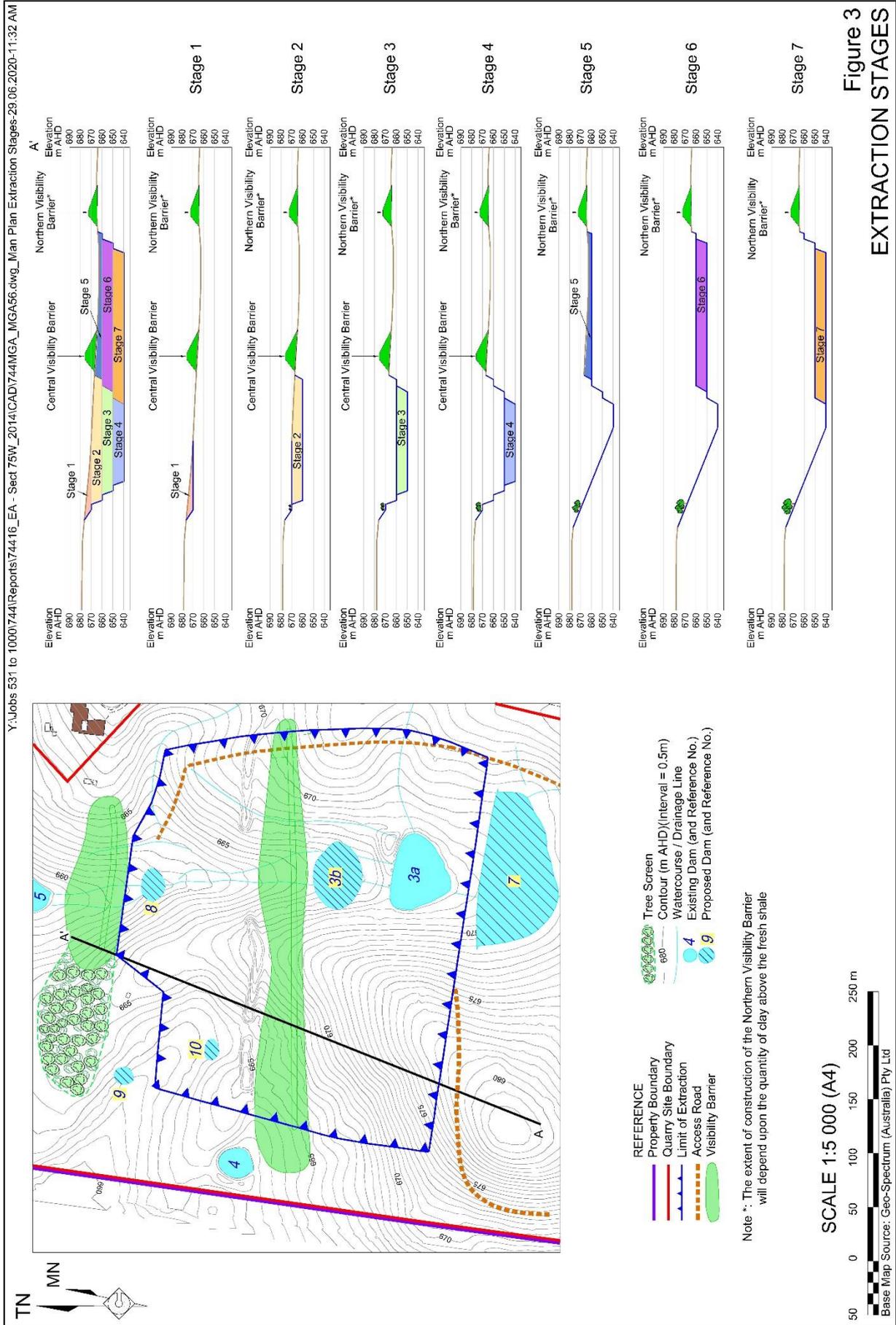


Figure 3
EXTRACTION STAGES

Relevant water-related conditions in PA 08_0212 are reproduced in **Tables 2** and **3** with a reference provided to the section(s) this document where each condition is addressed.

Table 2
Project Approval Requirements Relating to Water Management

Page 1 of 3

Cond No.	Requirement	Plan Section
3 (Soil & Water - Note)	The Proponent is required to obtain the necessary water licences for the project under the <i>Water Act 1912</i> and/or <i>Water Management Act 2000</i> .	12.3
3(13)	The Proponent must maintain a minimum buffer distance of 515m (measured from the top of bank) between extraction area and Wingecarribee River.	Figure 2
3(14)	The Proponent must ensure that all surface water discharges from the site comply with section 120 of the POEO Act or, if an EPL has been issued regulating water discharges from the site, the discharge limits (both volume and quality) set for the project in the EPL.	7.4.4.3 9.2
3(15)	The Proponent must ensure it has sufficient water for all stages of the project, and if necessary, adjust the scale of quarrying operations on site to match its available supply.	7.3
3(16)	The Proponent must manage on-site sewage to the satisfaction of Council and EPA.	11.1
3(17)	The Proponent must ensure all chemicals and/or petroleum products on site are stored in accordance with Australian Standard AS1940-2004, <i>The Storage and Handling of Flammable and Combustible Liquids</i> , and in appropriately bunded areas with impervious flooring and of sufficient capacity to contain 110% of the largest container stored within the bund. The flooring and bund(s) must be designed in accordance with: <ul style="list-style-type: none"> the requirements of relevant Australian Standards; and DECC's <i>Storing and Handling Liquids: Environmental Protection – Participants Manual</i>. 	11.1, 11.2
3(18)	The Proponent must prepare and implement a Water Management Plan for the project to the satisfaction of the Secretary. This plan must be prepared in consultation with the EPA, Water NSW and DPI – Water by suitably qualified and experienced persons whose appointment has been approved by the Secretary, and be submitted to the Secretary for approval prior to the construction [of] the visibility barriers on site.	This Document
	In addition to the standard requirements for management plans (see condition 3 of schedule 5), this plan must include a:	7
	(a) Site Water Balance that includes details of: <ul style="list-style-type: none"> sources and security of water supply, including contingency planning for future reporting periods; 	7.3
	<ul style="list-style-type: none"> water use on site; 	7.2
	<ul style="list-style-type: none"> water management on site; 	7.4
	<ul style="list-style-type: none"> reporting procedures, including comparisons of the site water balance each calendar year; and 	7.3.2
	<ul style="list-style-type: none"> describes the measures that will be implemented to minimise clean water use on site; 	7.4.7
	(b) Surface Water Management Plan, that includes: <ul style="list-style-type: none"> detailed baseline data on surface water flows and quality in the water-bodies that could be affected by the project; 	6.3 9.3.1.1
	<ul style="list-style-type: none"> a detailed description of the surface water management system on site, including the: <ul style="list-style-type: none"> clean water diversion systems; erosion and sediment controls; and water storages; 	Appendix B and 7.4
	<ul style="list-style-type: none"> a plan for identifying, extracting, handling, and the long-term storage of potentially acid forming material on site; 	Not Applicable
	<ul style="list-style-type: none"> detailed plans, including design objectives and performance criteria, for: <ul style="list-style-type: none"> the water storage dams; reinstatement of drainage lines on the rehabilitated areas of the site; control of water pollution from rehabilitated areas of the site; 	Appendix B and 7.4

Table 2 (Cont'd)
Project Approval Requirements Relating to Water Management

Page 2 of 3

Cond No.	Requirement	Plan Section
3(18) (Cont'd)	<ul style="list-style-type: none"> • performance criteria for the following, including trigger levels for investigating any potentially adverse impacts, for the following: <ul style="list-style-type: none"> - the water management system; - surface water quality of local water ways; and - ecosystem health of local water ways; 	9.2, 9.4
	<ul style="list-style-type: none"> • performance criteria for surface water quality attributes relevant to water quality impacts on biological diversity and aquatic ecological integrity, including salinity, heavy metals, sediment load, pH, hardness and biological oxygen demand; 	9.2, 9.4
	<ul style="list-style-type: none"> • a program to monitor <ul style="list-style-type: none"> - the effectiveness of the water management system; - surface water flows and quality in local water ways; and - ecosystem health of local water ways; 	9, Appendix B
	<ul style="list-style-type: none"> • a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the project; and 	12, 14, 15
	(c) Groundwater Management Plan, which includes:	
	<ul style="list-style-type: none"> • detailed baseline data on groundwater levels, yield and quality in the area, that could be affected by the project; 	10.1
	<ul style="list-style-type: none"> • groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts; 	10.2, 10.3
<ul style="list-style-type: none"> • a program to monitor: <ul style="list-style-type: none"> - groundwater inflows to the quarrying operations; - the impacts of the project on: <ul style="list-style-type: none"> o local alluvial aquifers; o any groundwater bores on privately-owned land that could be affected by the project; o the seepage/leachate from water storages or backfilled voids on site; and o groundwater dependent ecosystems; 	10.2	
<ul style="list-style-type: none"> • a plan to respond to any exceedances of the groundwater assessment criteria; 	10.3	
4(1)	As soon as practicable after obtaining monitoring results showing an: (a) exceedance of any relevant criteria in schedule 3, the Proponent must notify affected landowners in writing of the exceedance, and provide regular monitoring results to each of affected landowner until the project is again complying with the relevant criteria.	10.3
5(3)	The Proponent must ensure that the Management Plans required under this approval are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data;	6.3
	(b) a description of: <ul style="list-style-type: none"> - the relevant statutory requirements (including any relevant approval, licence or lease conditions); - any relevant limits or performance measures/criteria; and - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; 	3
	(c) a description of the measures that will be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	11
	(d) a program to monitor and report on the: <ul style="list-style-type: none"> - impacts and environmental performance of the project; and - effectiveness of any management measures (see (c) above); 	9.3 12
	(e) a contingency plan to manage any unpredicted impacts and their consequences;	14, 15
	(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	8.2.3, 12, 17

Table 2 (Cont'd)
Project Approval Requirements Relating to Water Management

Page 3 of 3

Cond No.	Requirement	Plan Section
5(3) (Cont'd)	(g) a protocol for managing and reporting any: <ul style="list-style-type: none"> - incidents; - complaints; - non-compliances with statutory requirements; and - exceedances of the impact assessment criteria and/or performance criteria; and 	12, 13, 14, 15
	(h) a protocol for periodic review of the plan. Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.	17
5(7)	The Proponent must notify, at the earliest opportunity, the Secretary and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. For any other incident associated with the project, the Proponent must notify the Secretary and any other relevant agencies as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent must provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.	15
5(8)	The Proponent must provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval.	16

Table 3
Statement of Commitments Relating to Water Management

Commitment			Plan Section
Desired Outcome	Action	Timing	
Minimisation of potential impacts on surface water quality and supply of the local watercourse system, particularly the Wingecarribee River.	4.1 Ensure early and progressive revegetation of amenity bunds and rehabilitation of completed extraction areas.	Ongoing.	8.2.1.1
	4.2 Use of any water sourced from the sedimentation basins for dust suppression within the upslope catchment of a sedimentation basin.	As required.	Not Applicable
	4.3 Install sediment control fencing around the amenity bunds under construction and other areas of exposed soil until vegetation has been established.	As required.	Appendix B
	4.4 Construct and operate various surface water management controls such as diversion structures and sedimentation basins in accordance with the Water Management Plan.	During the construction periods.	Appendix B
	4.5 Armour potential scour points (e.g. channel inlets / outlets and bends) with rock.	During the construction periods.	8.2.1.2
	4.6 Inspect diversion structures monthly and within 24 hours following any rain event that generates flow in the drains to identify areas of erosion, scour or damage. Repair any problem areas and/or take appropriate stabilising action.	Ongoing	8.2.2

3.2 OTHER APPROVALS, LEASES AND LICENCES

Other approvals and licences relevant to the site include Mining (Mineral Owners) Mining Lease 6 which was granted by the Department of Planning and Environment, Division of Resources and Geoscience on 27 June 2017 for the area displayed on **Figure 2** and Environment Protection Licence (EPL) 20377 issued by the Environment Protection Authority on 1 August 2016 and last varied 9 October 2019.

Mining (Mineral Owners) Mining Lease 6 does not contain any specific requirements relevant to this WMP. EPL 20377 contains a range of requirements relevant to this WMP which are summarised in **Table 4** with a reference to the section(s) in this document where the requirement is addressed.

Table 4
EPL 20377 Requirements Relating to Water Management

Cond No.	Requirement			Plan Section	
P1.3	The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.			9.3	
	Water and Land				
	EPA No.	Type of Monitoring & Discharge Point	Location Description		
	4	Water Quality Monitoring Discharge to waters	South west of the quarry void and labelled WS4 on map titled "EPL Monitoring Locations" dated August 2019 (DOC19/862266)		
5	Water Quality Monitoring Discharge to waters	North of the quarry void and labelled WS5b on map titled "EPL Monitoring Locations" dated August 2019 (DOC19/862266).			
L1.1	Except as provided in any other condition of this licence, the licensee must comply with section 120 of the <i>Protection of the Environment Operations Act 1997</i> .			9.2, 9.4	
L2.4	Water and/or Land Concentration Limits (Points 4,5)			7.4.5	
	Pollutant	Units of Measure	100th percentile concentration limit		
	Oil and Grease	Visible	Nil visible		
	pH	pH	6.5-8.5		
	Total Suspended Solids	Milligrams per litre	50		
M2.3	Water and/or Land Monitoring Requirements (Points 4,5)			9.3	
	Pollutant	Units of Measure	Frequency		Sampling Method
	Oil and Grease	Visible	Daily During Discharge		Inspection
	pH	pH			Grab sample
	Total Suspended Solids	Milligrams per litre			Grab sample

4. ROLES AND RESPONSIBILITIES

Table 5 presents the roles and responsibilities for the implementation of this WMP.

Table 5
Roles and Responsibilities

Page 1 of 2

Roles*	Responsibilities
NSW Manufacturing Manager	Ensure adequate resources are available to enable implementation of the WMP.
Raw Materials & Mining Manager	Accountable for the overall environmental performance of the Quarry operations, including implementation of all water management controls outlined in Section 8.

**Table 5 (Cont'd)
Roles and Responsibilities**

Page 2 of 2

Roles*	Responsibilities
Compliance & Environmental Coordinator <i>(also referred to as the Site Environmental Manager in Appendix B)</i>	Manage the implementation of the following components of this WMP. <ul style="list-style-type: none"> • Inspection, monitoring and maintenance of all erosion and sediment controls as outlined in Sections 9 and 10. • Evaluation of compliance as outlined in Section 12 and related follow-up actions. • Complaints handling and response as outlined in Section 13. • Incident reporting as outlined in Section 15. • Coordinate Environmental Monitoring and publishing of data as outlined in Section 16. • Review of this WMP as outlined in Section 17. • Conduct environmental component of site induction for all employees and contractors – see Section 5.
All personnel	<ul style="list-style-type: none"> • Ensure training and awareness induction has been undertaken. • Compliance with this WMP.

*Or equivalent position delegated these responsibilities.

5. COMPETENCE TRAINING AND AWARENESS

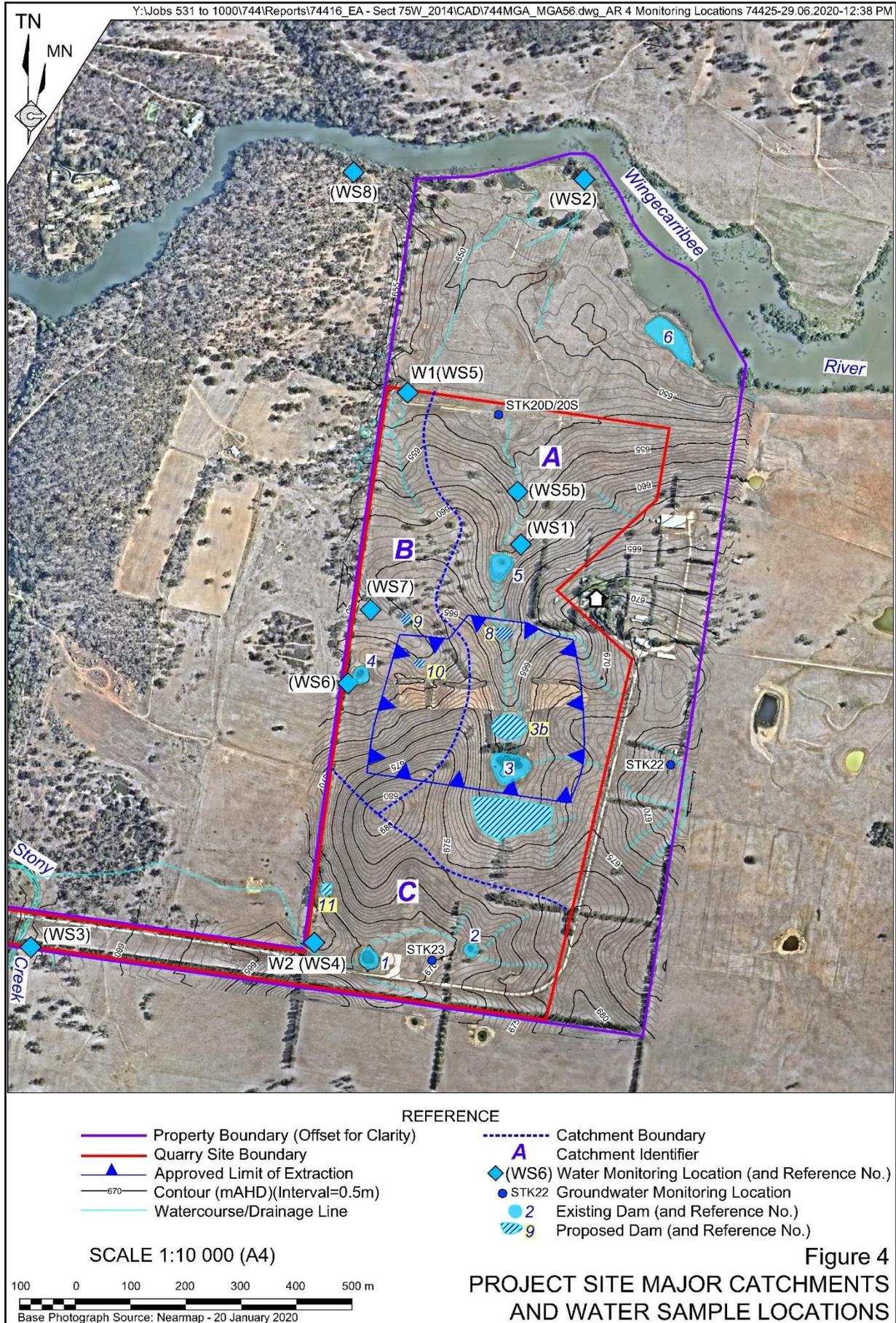
All Company personnel and contractors and their employees will undergo Company and site-specific inductions, incorporating basic information in relation to the operation of this WMP as a component of the site induction program. The Compliance & Environmental Coordinator or delegate will be responsible for ensuring that all relevant employees are appropriately inducted prior to undertaking any ground-disturbing works and are re-inducted on at least a 2-yearly basis.

6. EXISTING DRAINAGE, CATCHMENTS AND DAMS

6.1 EXISTING CATCHMENTS AND HYDROLOGY

The extraction area occupies the northern extent of a hillcrest position with radial drainage primarily towards the north and east. Although all surface runoff from the Quarry Site ultimately reaches the Wingecarrabee River, three small catchments are present within the Quarry Site. These are shown in **Figure 4** and are labelled as Catchments A, B and C.

Catchment A drains approximately 27ha within the Quarry Site boundary. Only a small area outside of Catchment A drains onto the Quarry Site from upslope; for the most part, the watershed of Catchment A is wholly within the Quarry Site. There are no defined channels within Catchment A, all drainage is via open grassy depressions. Catchment A drains into a man-made lateral drain. It is assumed this was constructed in the past to reduce waterlogging of the low-lying, flat areas adjacent to the river and so to permit grazing. This drain diverts flow into Catchment B.



Catchment B drains approximately 11.4ha of the Quarry Site via a series of open grassy depressions. Run-on from external lands west of the Quarry Site enter Catchment B in the northwest corner of the Quarry Site. Adjoining lands include agricultural activities with potential for sediment laden run off.

Catchment C drains approximately 12.7ha of the Quarry Site via a series of open grassy depressions. These join Stony Creek before eventually entering the Wingecarribee River. Approximately 5.8ha upslope of the Quarry Site in Catchment C currently drains into Catchment C but will be diverted following the construction of the southern visibility barrier. The site access road, connecting the extraction area with Berrima Road, traverses Stony Creek as shown in **Figure 4**.

Although there are first and second order streams marked on the topographic map, as described above, all drainage lines are in fact open grassy depressions with no bed or banks.

6.2 EXISTING DAMS

There are five existing farm dams within the Quarry Site and one off-site dam on the northern boundary of the property (Dam 6). All appear to be structurally sound and capable of holding water. The existing farm dams are numbered on **Figure 4** and their estimated capacities are shown in **Table 6**.

Table 6
Existing Dam Sizes

Structure Number	Approximate Surface Area (m ²)	Assumed Capacity (ML)
1	950	1.4
2	460	0.7
3	2,960	4.4
4	670	1.0
5	1,570	2.4
6	3,000	2.5
Total	9,610	12.4

The combined capacity of these existing dams is estimated to be 12.4ML which exceeds the Harvestable Right Capacity of 8.5ML. However, they were all built before 1999 and have been used for stock purposes and so they do not require a licence. Nevertheless, these dams were included in the assessment to build additional dams (see Section 8.4.1.2).

6.3 WATER QUALITY

Water samples were collected on 22 August 2008 at WS1, WS2 and WS3 prior to the preparation of the 2010 *Environmental Assessment*. Since May 2017, a regular water monitoring program has been commenced and samples are collected monthly (when water is present) at all monitoring sites (WS1 to WS8). The location of these sites is shown in **Figure 4** and summarised below.

- WS2 represents the upstream Wingecarribee River monitoring location and WS8 represents the downstream location,

- WS1, WS5, WS6 and WS7 represent monitoring locations within ephemeral drainage lines within the Quarry Site which ultimately report to the Wingecarribee River. WS5 is also located on the confluence with drainage lines from the property west of the Quarry Site. As a result, future monitoring is proposed to be undertaken at monitoring location WS5b, which is located upstream of this confluence and will not be affected by water runoff from the adjacent property.
- WS4 is located within an ephemeral drainage line in the southern part of the Quarry Site which reports to Stony Creek.
- WS3 is located within Stony Creek upstream of any Quarry activities.

The results of laboratory testing are summarised in **Table 7** and key parameters are graphed in **Charts 1** to **3**. These results from the baseline water monitoring data of the Quarry and will continue to be expanded as further monitoring is completed prior to commencement of operations. General conclusions that can be drawn from the baseline water quality monitoring are as follows.

- Water has not been present at WS4, WS6 and WS7 during any monitoring events and has not been present at WS1 since the August 2008 sampling event. Water has also only been present at WS5 on two occasions. As these are ephemeral drainage lines located in well vegetated catchments, run off events will be limited to short periods following adequate rainfall.
- At WS2 (Wingecarribee River upstream) and WS8 (Wingecarribee River downstream), water has been present during all monitoring events. As would be expected, the results for most parameters are very similar between these locations with near neutral pH ranging from 6.6 to 7.8 and low electrical conductivities ranging from 102 μ S/cm to 330 μ S/cm. Whilst generally low, total suspended solids (TSS) and turbidity tends to be slightly higher at WS2 (upstream) ranging from 3mg/L to 77mg/L with a median of 14mg/L and 5.3NTU to 75NTU with a median of 18NTU respectively. At WS8 (downstream) TSS and turbidity has ranged from 4mg/L to 250mg/L with a median of 11mg/L and 3.5NTU to 70NTU with a median of 12NTU respectively.
- At WS3 (Stony Creek upstream), water has also been present during all monitoring events and, similar to Wingecarribee River, has near neutral pH ranging from 6.8 to 8.0. However, the electrical conductivity, TSS and turbidity are higher, ranging from 215 μ S/cm to 970 μ S/cm, 2mg/L to 380mg/L and 0.6NTU to 180NTU and is likely reflective of agricultural and industrial activities further upstream.
- At WS5, sufficient water was present in June and July 2017 to collect samples for analysis. The pH was also near neutral at 6.4 and 6.7 and electrical conductivity was low at 120 μ S/cm and 135 μ S/cm. Similar to WS3, TSS and turbidity were elevated, at 61mg/L and 290mg/L and 80NTU and 180NTU respectively. As discussed above, future monitoring is proposed to be undertaken slightly upstream towards the Quarry to remove the influence of surrounding agricultural activities.

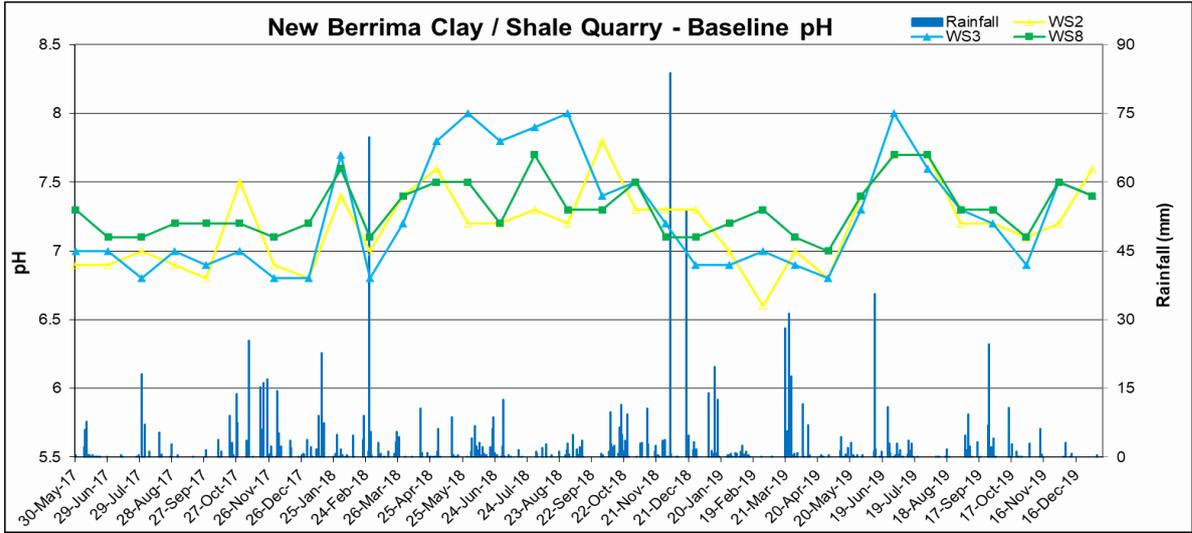


Chart 1 Baseline pH 2017 to 2019

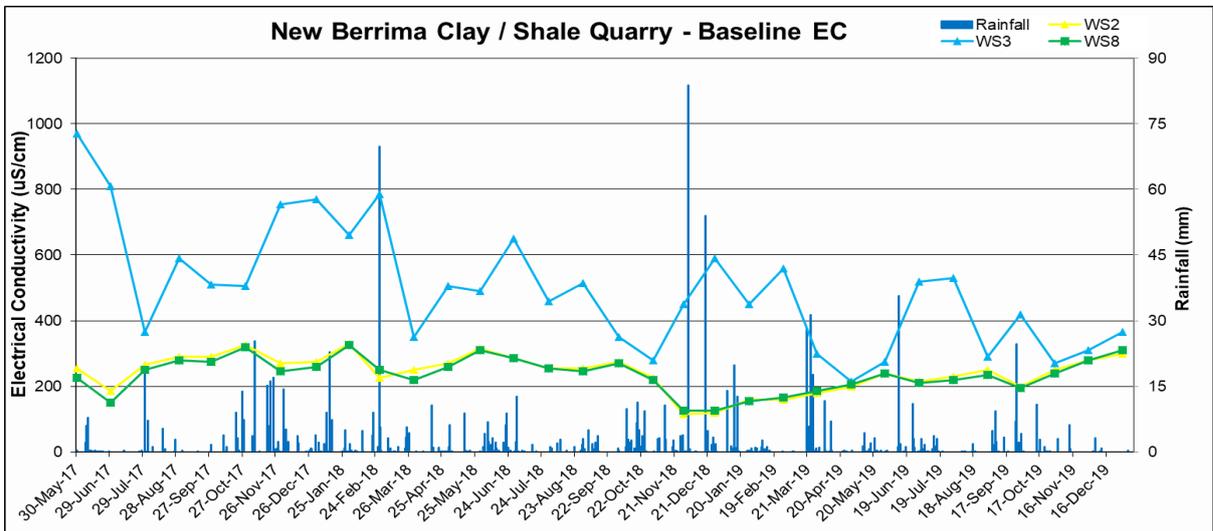


Chart 2 Baseline EC 2017 to 2019

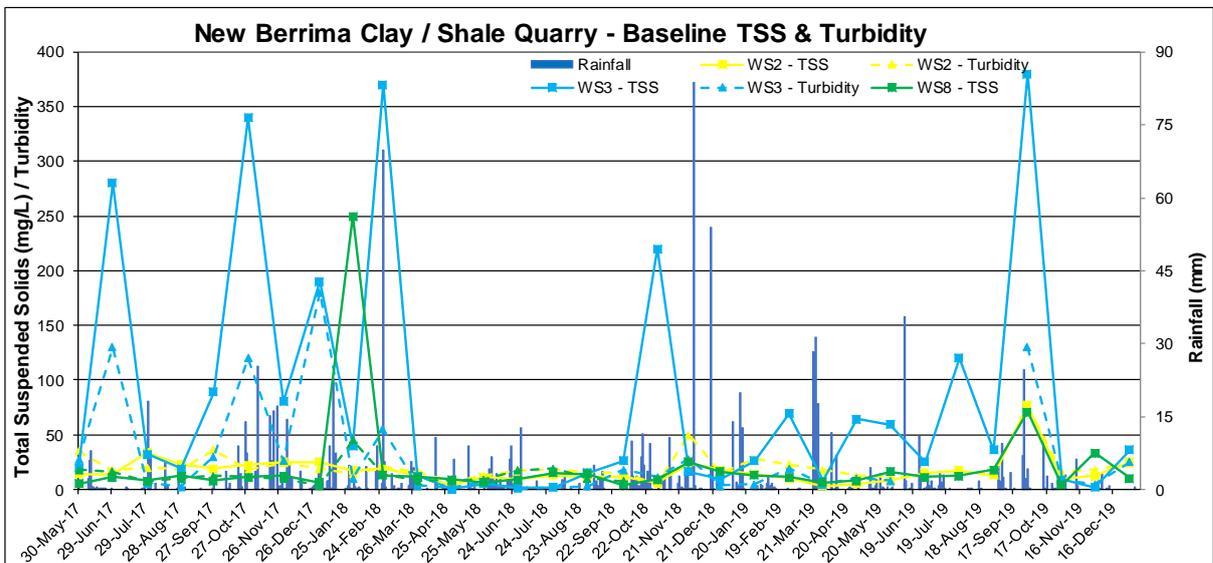


Chart 3 Baseline TSS & Turbidity 2017 to 2019

Table 7
Results of Water Quality Testing (2017 to 2019)

Parameter	Units	WS1		WS2		WS3		WS4		WS5		WS6		WS7		WS8			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
		Median		Median		Median		Median		Median		Median		Median		Median			
pH		7.7	7.7	6.6	7.8	6.8	8.0	NS		6.4	6.7	NS		NS				7.0	7.7
		7.7		7.2		7.2				6.6								7.3	
EC	µS/cm	393	393	102	330	215	970			120	135							125	325
		393		250.0		490.0			128		242.5								
Sodium	mg/L	26.9	26.9	10.0	39.0	10.0	80.0			17.0	18.0							12.0	37.0
		26.9		25.0		28.0			17.5		23.0								
Potassium	mg/L	27.1	27.1	1.2	8.6	1.8	26.0			2.1	4.8							2.1	8.6
		27.1		5.8		6.9			3.5		5.7								
Calcium	mg/L	13.6	13.6	3.6	19.0	24.0	92.0			3.9	4.6							5.0	22.0
		13.6		15.0		62.0			4.3		15.0								
Magnesium	mg/L	7.9	7.9	2.3	11.0	5.7	28.0			2.3	2.8							2.7	9.4
		7.9		6.0		9.5			2.6		6.0								
Chloride	mg/L	60	60	15	48	29	195			35	37							18	50
		60		34.0		51.0			36		33.5								
Sulfate	mg/L	2	2	2	82	3	285			0	0							4	81
		2		27.0		28.0			< LOR		26.0								
Bicarbonate	mg/L	NT	NT	29	77	17	280	NS		12	21	NS		NS				30	79
		NT		55.0		190.0	17			54.5									
Phosphate	mg/L	NT	NT	0.1	0.3	0.1	1.3			0.1	0.1							0.3	0.3
		NT		0.2		0.3			0.1		0.3								
Fluoride	mg/L	NT	NT	0.1	1.7	0.1	0.3			0.0	0.0							0.1	0.4
		NT		0.2		0.2			< LOR		0.2								
Nitrate	mg/L	NT	NT	0.1	4.6	0.1	4.7			0.0	0.0							0.1	4.4
		NT		1.6		0.4			< LOR		1.6								
Total Ammonia	mg/L	NT	NT	0.0	1.6	0.1	3.3			0.3	0.3							0.1	0.2
		NT		0.2		0.3			0.3		0.1								
TKN	mg/L	7.3	7.3	0.2	3.8	0.4	17.0			1.5	1.7							0.1	2.4
		7.3		1.3		1.8			1.6		1.2								
Total Phosphorus	mg/L	0.2	0.2	0.0	0.5	0.0	1.6			0.2	0.8							0.0	0.2
		0.2		0.1		0.4			0.5		0.1								
TSS	mg/L	32	32	3	77	2	380			61	290							4	250
		32		14.0		29.0			176		11.0								
Turbidity	NTU	NT	NT	5.3	75.0	0.6	180.0			80.0	180.0							3.5	70.0
		NT		18.0		10.0			130.0		12.0								

NS = No Sample

NT = Not Tested

6.4 AQUATIC HABITAT

There is no aquatic habitat within the Quarry Site nor any groundwater dependent ecosystems within the “Mandurama” property.

6.5 WATERFRONT LANDS

There are no works proposed within 40m of the Wingecarribee River and, although there are first and second order streams marked on the topographic map, all drainage lines at the site are in fact open grassy depressions with no bed or banks. Therefore, these are considered not to be classified as waterfront land.

7. SITE WATER BALANCE

7.1 INTRODUCTION

The following site water balance provides an overall description of where all water is sourced, where it is used, how much of it is used and where it ultimately ends up. It identifies the proposed storages and their volumes and whether they are used for dirty water (e.g. sediment basins, pumping dams, sumps) or for clean, useable, water (either as part of the works or for agricultural purposes).

7.2 WATER USES AND DEMAND

7.2.1 On-site Water Demand

There are three demands for water, namely:

- staff requirements and ablutions;
- dust suppression; and
- machinery washdown.

7.2.2 Amenities and Ablutions Supply

The site office and ablutions will be supplied by potable water imported by tanker or 20L bottles, i.e. no water collected on site will be used. Note: toilets are portable pump-out toilets.

7.2.3 Dust Suppression

Based on the distance of the unsealed access road between the edge of the extraction area and the Stony Creek bridge, allowing for an average width of 4m, approximately 4 800m² of internal roads will need dust suppression. On dry days, the required water application rates are expected to be 1L/m²/application with time between applications of 2 hours (watering up to 5 occasions per day) resulting in a daily water demand of 24kL. Dust suppression will only be required when extraction and haulage activities are underway, which is estimated to be approximately 90 days spread over a year (assuming haulage intensity occurs at ~80% of the maximum approved truck movements), equating to a water usage of 2.16ML per year. Alternatively, road sealing options may be investigated to reduce or remove the need for application of water during haulage.

However, haulage may occur at a greater intensity but over fewer days or a lower intensity over more days. In the first instance, the rate of water application would increase but would be required over fewer days. In the second instance, the rate of water application would decrease but occur over more days. As a result, a water cart will be kept on site at all times during extraction or haulage operations to enable watering of sections of the Site Access Road on an as required basis. To allow for fluctuations in dust suppression requirements, an extra allowance of 1ML per year is provided for this purpose so the annual total volume for dust suppression will be 3.16ML. The water requirement for dust suppression would reduce should additional road sealing or approved chemical suppressants be utilised.

7.2.4 Washdown

The requirement for washdown water (for machinery washdown) will be minimal but, if required, an additional 2,000L might be required each day that the Quarry is operational, i.e. 90 days per year. This equates to 0.18ML per year.

7.3 SOURCES AND SECURITY OF WATER SUPPLY

7.3.1 Water Supply

Water for dust suppression and washdown will be primarily sourced from the Quarry sumps (Dam 3b during Stages 1 to 4 and Dam 8 during Stages 5 to 7) (see **Figure 4**). If necessary in dry periods, or for water management purposes, water will also preferentially be supplied from one or more of the other dams (see Section 7.4.1.1 and **Table 8**).

Table 8
Water Management Structures

No.	Establish (Stages 1-4)	Operation (Stages 1-4)	Establish (Stages 5-7)	Operation (Stages 5-7)	Final Landform	Capacity (ML)^	Management
1	Dirty	Clean	Clean	Clean	Clean	Existing 1.4ML	Sediment Basin during Stage 1 establishment. No management or use when clean.
2	Dirty	Dirty	Dirty	Dirty	Clean	Increased to 1.8ML	Sediment basin throughout all operations.
3a	Dirty	NA (removed)	NA (removed)	NA (removed)	NA (removed)	Existing 4.4ML	Sediment basin during Stage 1 establishment then decommissioned and replaced with 3b as extraction continues.
3b	NA	Dirty	Dirty	Dirty	NA (removed)	1.2ML	Quarry Sump for Stages 2-4.
4	Dirty	Clean	Dirty	Clean	Clean	Increased to 1.4ML	Sediment basin during both establishment stages. No management when clean.
5	Dirty	Dirty	Dirty	Dirty	NA (removed)	Increased to 5.4ML	Sediment basin throughout all operations.
6	Clean	Clean	Clean	Clean	Clean	2.5ML	Not related to the Quarry Site operations.
7	Clean*	Clean	NA (removed)	NA (removed)	NA (removed)	8.65ML	Dam 7 will capture clean water that cannot be passively diverted around the extraction area. It will be pumped around the extraction area and released as clean water.
8	NA	NA	NA	Dirty	Clean	1.8ML	Quarry Sump for Stages 5-7. Farm dam in final landform.
9	NA	NA	Dirty	NA (removed)	NA	0.64ML	Sediment basin during Stage 5-7 establishment then decommissioned.
10	Dirty	NA (removed)	NA	NA	NA	0.23ML	Sediment basin during Stage 1-4 establishment then decommissioned.
11	Dirty	NA (removed)	NA	NA	NA	0.26ML	Sediment basin during Stage 1-4 establishment then decommissioned.

* Dam 7 will include a short period during which minor sediment laden water may report to it until disturbances are stabilised (see Section 7.4.2)

^ Dam sizing for sediment basins is the minimum required in accordance with Landcom (2004) and DECCW *2008)

7.3.2 Water Security

Section 4.6.3 of the 2015 *Environmental Assessment* (RWC, 2015) provides an assessment of the water supply confidence based upon a water balance spreadsheet developed by Strategic and Environmental Engineering Consulting (SEEC) Pty. Ltd. The spreadsheet was calibrated using 99.33 years of daily rainfall data from the Bureau of Meteorology’s Moss Vale rainfall station. The spreadsheet took into account inherent system losses (e.g. surface wetting) and used a 20% volumetric runoff coefficient for a 2.5ha vegetated catchment to Dam 7. These calculations determined that the Quarry water demand would, on average, be met by Dam 7 for 99% of the time.

However, following a review of the water management system during preparation of this WMP and, given the location of Dam 7 above the highwall, it is considered preferable to maintain Dam 7 as empty as practicable by pumping water captured in it around the extraction area. As a result, utilisation of Dam 7 as a water storage is now not proposed.

Therefore, water for dust suppression will be obtained from the Quarry sumps (Dams 3a/3b and 8), which will provide a beneficial use of ‘dirty’ water. These dams both have catchments larger than 2.5ha and their disturbed catchments would have a runoff coefficient higher than that previously assumed for the vegetated Dam 7 catchment. Therefore, the use of the Quarry sumps will provide a greater water security than Dam 7. Notwithstanding, if necessary, water could also be sourced from one of the other permanent Water Management Dams (e.g. Dam 1, Dam 4, or Dam 6) (Section 8.4). The Quarry does not require make-up water.

Volumes of water extracted for use on site will be logged with their date and use and reported in the Quarry’s *Annual Review*. The volumes will be compared each year to gauge their consistency or variability.

7.4 WATER MANAGEMENT

7.4.1 Pollution Risks

As noted within the 2010 *Environmental Assessment* and subsequent documentation, the greatest risk to water quality attributable to the Quarry is the flow of sediment-laden runoff to the Wingecarribee River. Additional sources of potential impacts on surface water quality include the potential for hydrocarbon spills such as fuels, oils and hydraulic fluids.

It is noted that there is no evidence of pyritic material or acid generation issues within the Ashfield Shale. As such, water quality issues associated with acid generation, such as generation of heavy metals, are considered to be very low risk. Notwithstanding, monitoring of pH will demonstrate that acid generation is not occurring.

Therefore, in order to protect water quality, biological diversity and ecosystem integrity, the principal matters to be managed and monitored included sediments, pH and hydrocarbons.

7.4.2 Storage

7.4.2.1 Introduction

There will be twelve water storages at the Quarry Site, although not all will be active at the same time. The storages are summarised in **Figure 5** and in **Table 8**. The use of an individual storage can change depending on the stage of works and so sometimes a storage might be used as a sediment basin while at other times it might be a clean water storage. When storages are used as a sediment basin, subject to meeting the required 5-day management period (see Section 7.4.2.1), captured dirty water will either be utilised for Quarry uses (i.e. dust suppression and wash down) or treated, if necessary, and discharged. Dam 5 will be the main water treatment dam and dirty water trapped in Dams 4, 9 and 10 will be sent to it for management. When storages are considered ‘clean’ they may be used for farm uses. It is noted that, at the time of preparation of this management plan, whilst PA 08_0212 has been commenced, for the purposes of water management, no site establishment / construction has occurred. As such, all existing dams are ‘clean’ and are currently managed as farm dams.

7.4.2.2 Harvestable Right

NSW harvestable right legislation permits landholders to build a certain volume of dams without requiring a licence. The total volume is called the harvestable right and there are two factors that determine it for a parcel of land, namely:

- the property’s geographical location; and
- the area of the property (ha).

The 100.2ha property was assessed using the harvestable right dam calculator at <http://www.water.nsw.gov.au/Water-Licensing/Basic-water-rights/Harvesting-runoff/Calculator/default.aspx> on 13th March 2015. The calculator shows the Property has a harvestable right of 8.5ML. This was exceeded by the existing dams but dams used for pollution control purposes (i.e. sediment dams and clean water dams used to prevent water entering ‘dirty’ catchment areas) are exempt from the harvestable right calculation. In summary:

- Dam 1 (1.4ML) will, at one time during the life of the quarry, be a sediment basin for the purpose of maintaining water quality. However, at other times it will remain for agricultural purposes so its volume is included in the harvestable right calculation. Dam 1 will remain in the final landform.
- Dam 2 will be in the Surplus Overburden Storage Area and will be enlarged to at least 1.8ML. It will collect sediment-laden runoff from the Surplus Overburden Storage Area. Water from Dam 2 may either be treated (if necessary) and discharged or pumped to the extraction area where it will drain by gravity to the active sump (either Storage 3b or 8). Because it is in the works area, and its use is to prevent sediment-laden water leaving the site, Dam 2 is exempt from the harvestable right calculation during the Quarry’s life. However, Dam 2 will remain in the final landform.

- Dam 3a will, for a short time, collect dirty water during establishment of Stages 1-4 and will overflow to Dam 5 and, as a result, is exempt from the harvestable right calculation during the Quarry's life. Dam 3a will quickly be removed and replaced with Dam 3b as extraction commences.
- Dam 4 will, at times during the life of the quarry, be a sediment basin for the purpose of maintaining water quality. During those periods water trapped in it will be pumped to Dam 5 for treatment. However, at other times it will remain for agricultural purposes and so its volume is included in the harvestable right calculation. The capacity of Dam 4 will be increased to at least 1.4ML. It will also remain in the final landform.
- Once the extraction area becomes internally-draining, Storages 3b and 8 will be sumps in the operational extraction area with water gravitating to them. Dam 3b will be removed following operations but Dam 8 will be retained as a clean water dam as part of the final landform. At that time, Dam 8 will be part of the harvestable right calculation.
- Dams 9, 10 and 11 will be constructed for the purposes of maintaining water quality (i.e. they will be sediment basins) and so they are exempt from the harvestable right calculation. All are temporary and none will remain in the final landform. Water trapped in Dams 9 and 10 will be pumped to Dam 5 for treatment.
- Dam 7 is located above the southern boundary of the extraction area and will capture clean water runoff that cannot be diverted around the extraction area due to the existing topography. Without Dam 7, the clean water would flow over the highwall into the extraction area and become dirty water. Therefore Dam 7 is considered a pollution control dam and is exempt from the harvestable right calculation during the Quarry life. Given the location of the dam above the highwall, for operational safety purposes it will be sized to capture the 100 year, 24 hour, rainfall intensity which is 9.62mm/hr (233mm/day). Assuming a runoff coefficient (C_{10}) of 0.7 and a catchment of 5.3ha its required volume is calculated as 8.65ML. Water captured in Dam 7 would be pumped around the extraction area and released to receiving waters within 10-days of a rainfall event that causes inflow into it. Dam 7 is not designed to store water for extended periods. Dam 7 will not remain as part of the final landform.
- Dam 5 will be utilised throughout Quarry operations as a sediment basin. During the early establishment stages it will have a catchment of about 18.5ha, most of which would be disturbed². Dam 5 will form the point of treatment for sediment laden water collected in the extraction area catchments and so its volume (at least 5.4ML) is not included as part of the harvestable right calculation. Dam 5 will not remain as part of the final landform.
- Dam 6 (off the Quarry Site but on the Property (**Figure 4**)) will be unaltered and will continue to be used for agricultural purposes. Therefore, its volume (2.5ML) is part of the harvestable right calculation. Dam 6 will remain as part of the final landform.

² Including the catchment to Dams 4, 9 and 10 which would be pumped to it for treatment.

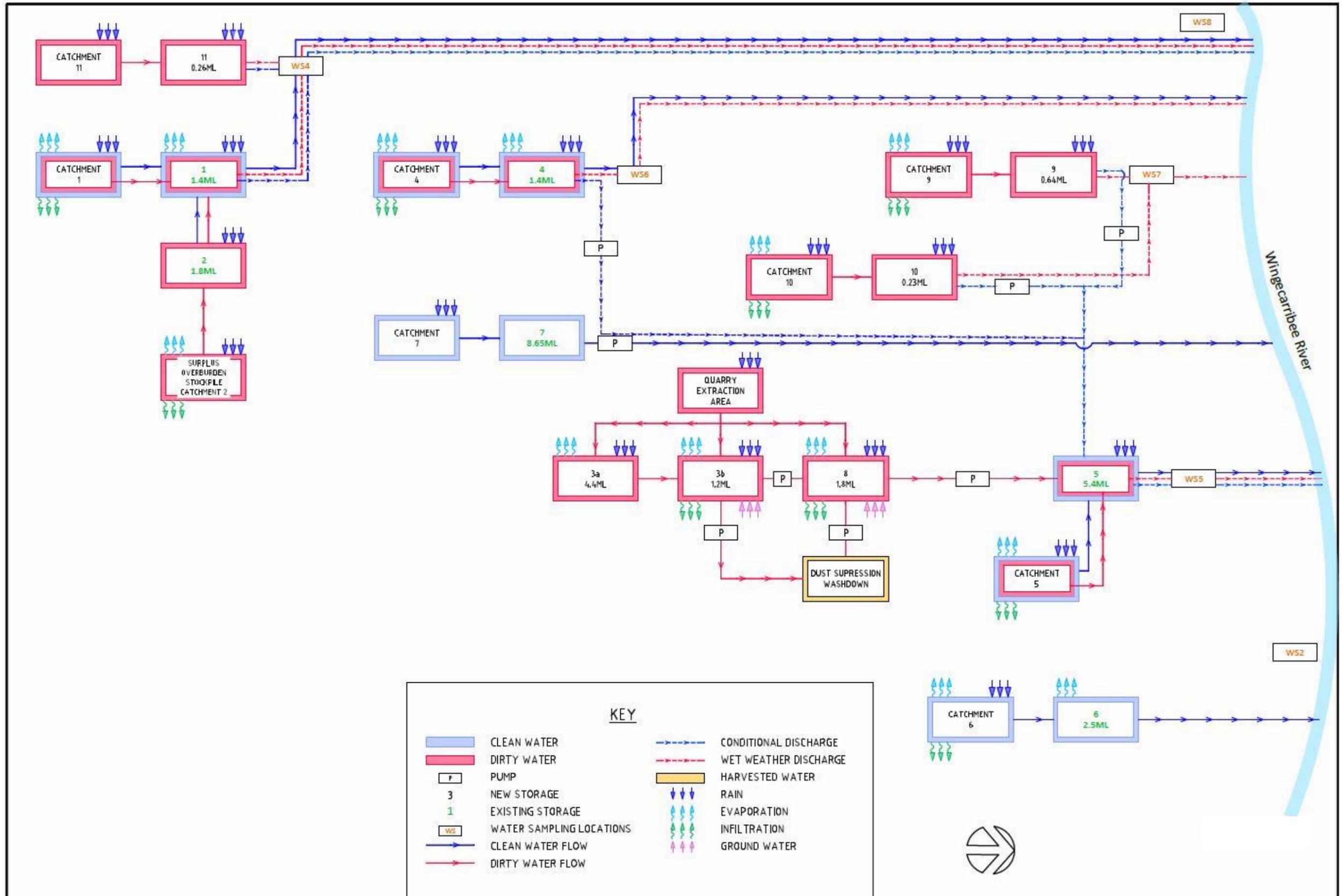


Figure 5 Site Water Balance Flow Chart

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In summary, the Water Management Dams and their capacities that are included within the harvestable right calculation are outlined in **Table 9**. As discussed above, Dams 3a, 5, 7, 9, 10 and 11 do not form part of the operational or final landform harvestable right calculations.

Table 9
Harvestable Rights Water Management Dams

Identifier	Operational Phases (ML)	Final Landform (ML)*
Dam 1	1.4	1.4
Dam 2	0.0 [^]	1.8
Dam 4	1.4	1.0
Dam 6	2.5	2.5
Dam 8	0.0 [^]	1.8
Total Volume	5.3	8.5
[^] Dam 2 and Dam 8 will remain as sediment basins during all operational phases and are therefore excluded from the harvestable right. *Should any dam volumes be increased during operations for sediment management, their storage capacity will be reduced to this volume for the final landform.		

In total, the combined capacity of the water management dams during the operational stages which are not utilised for pollution control equates to 7.7ML, whilst the capacity of dams retained as part of the final landform will equal 8.5ML. These capacities are less than or equal to the permissible harvestable right volume. How the dams are used throughout the Quarry life is discussed in more detail in the following sections.

7.4.3 Dirty Water

7.4.3.1 Sediment Basins

Where and when applicable, all the existing dams (excluding Dam 6) will be used as sediment basins at least once. However, depending on the stage of works, they will be supplemented by a number of other temporary sediment basins. The following four primary stages of work are identified.

- Establishment of Stages 1 – 4 (site access roads, southern part of the extraction area and construction of the visibility barriers).
- Operation of Stages 1 – 4.
- Establishment of Stages 5 – 7 (northern part of the extraction area).
- Operation of Stages 5 – 7.

Table 8 and **Figures 6** to **9** identify which dams and storages will be actively used as sediment basins during the above four stages of works. **Figure 10** shows which dams will remain in the final landform. When an existing dam is no longer required as a sediment basin, it will remain but the other temporary basins (Dams 9, 10 and 11) will be removed. **Table 8** details the minimum size of the dams during the various stages and indicates whether they will be considered clean water or dirty water dams.

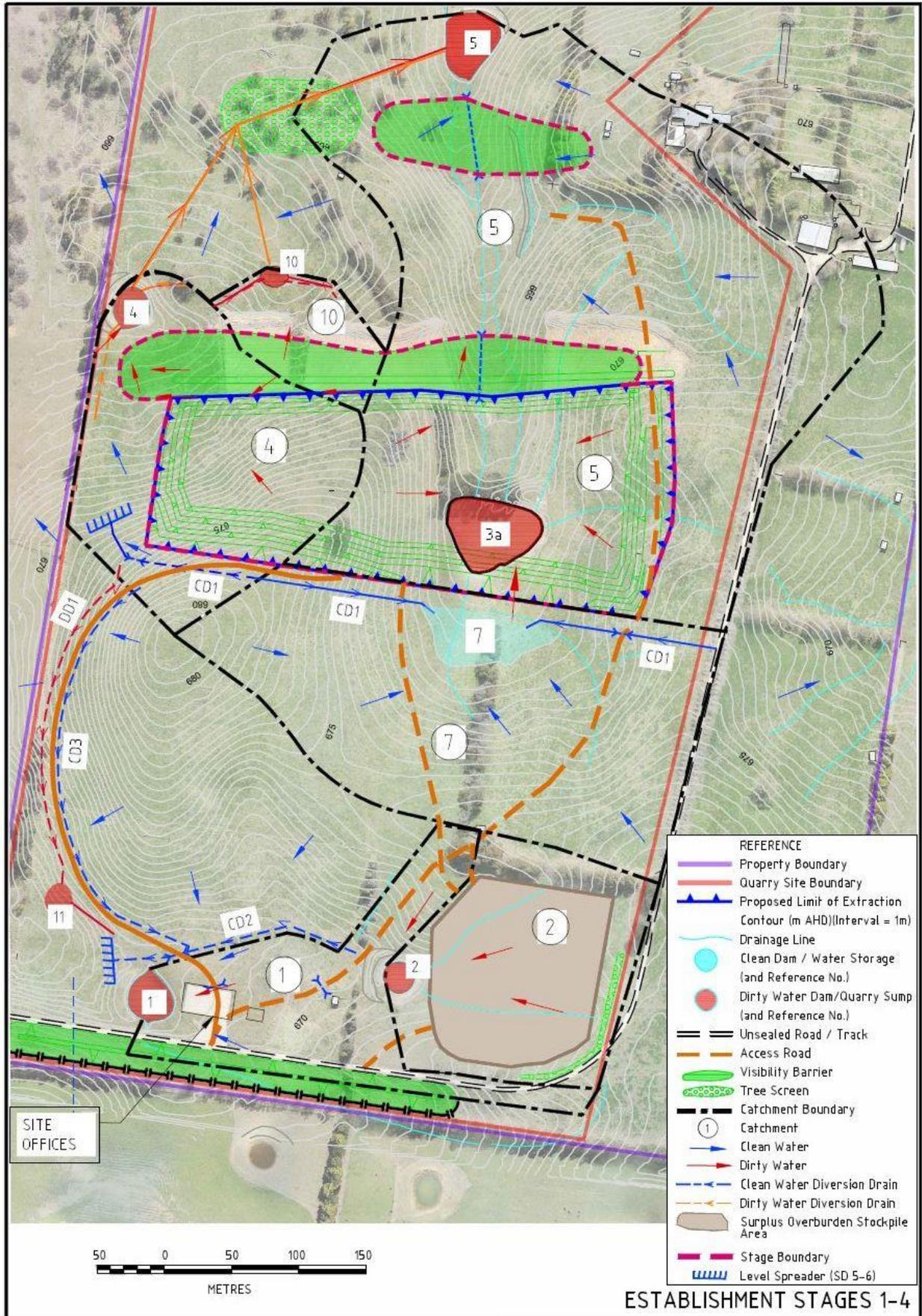


Figure 6 Water Management: Stages 1-4 Establishment

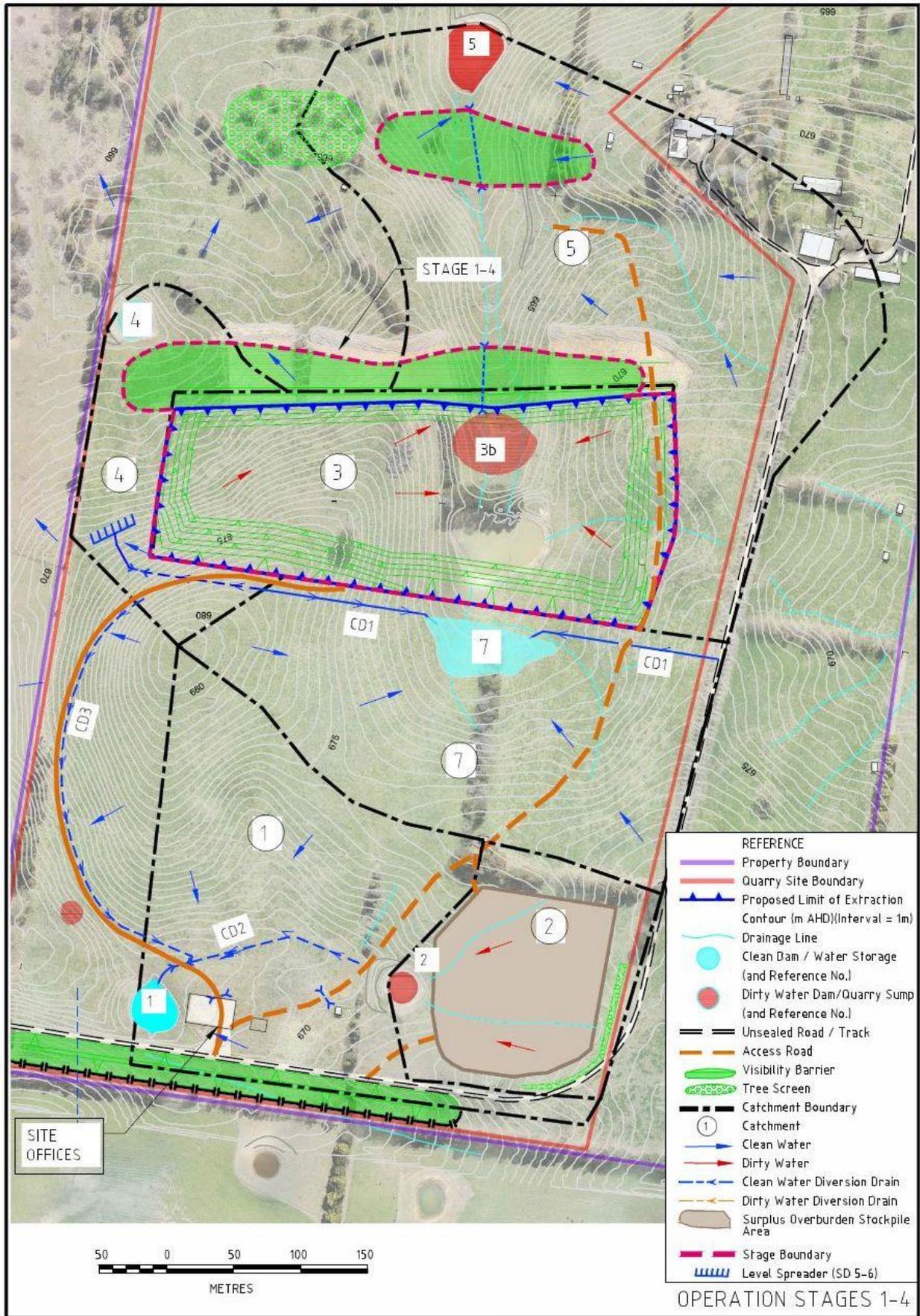


Figure 7 Water Management: Stages 1-4 Operation

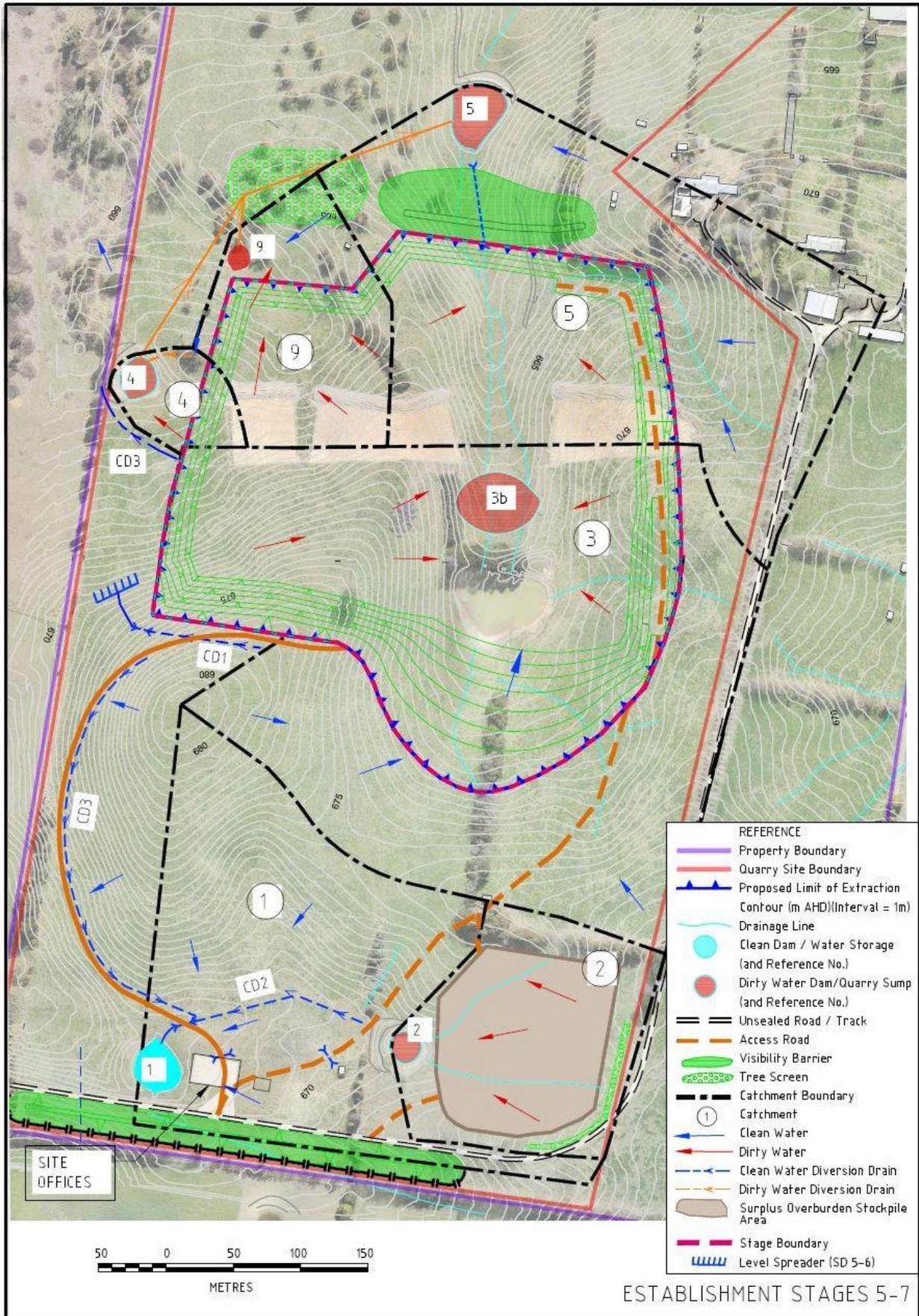


Figure 8 Water Management: Stages 5-7 Establishment

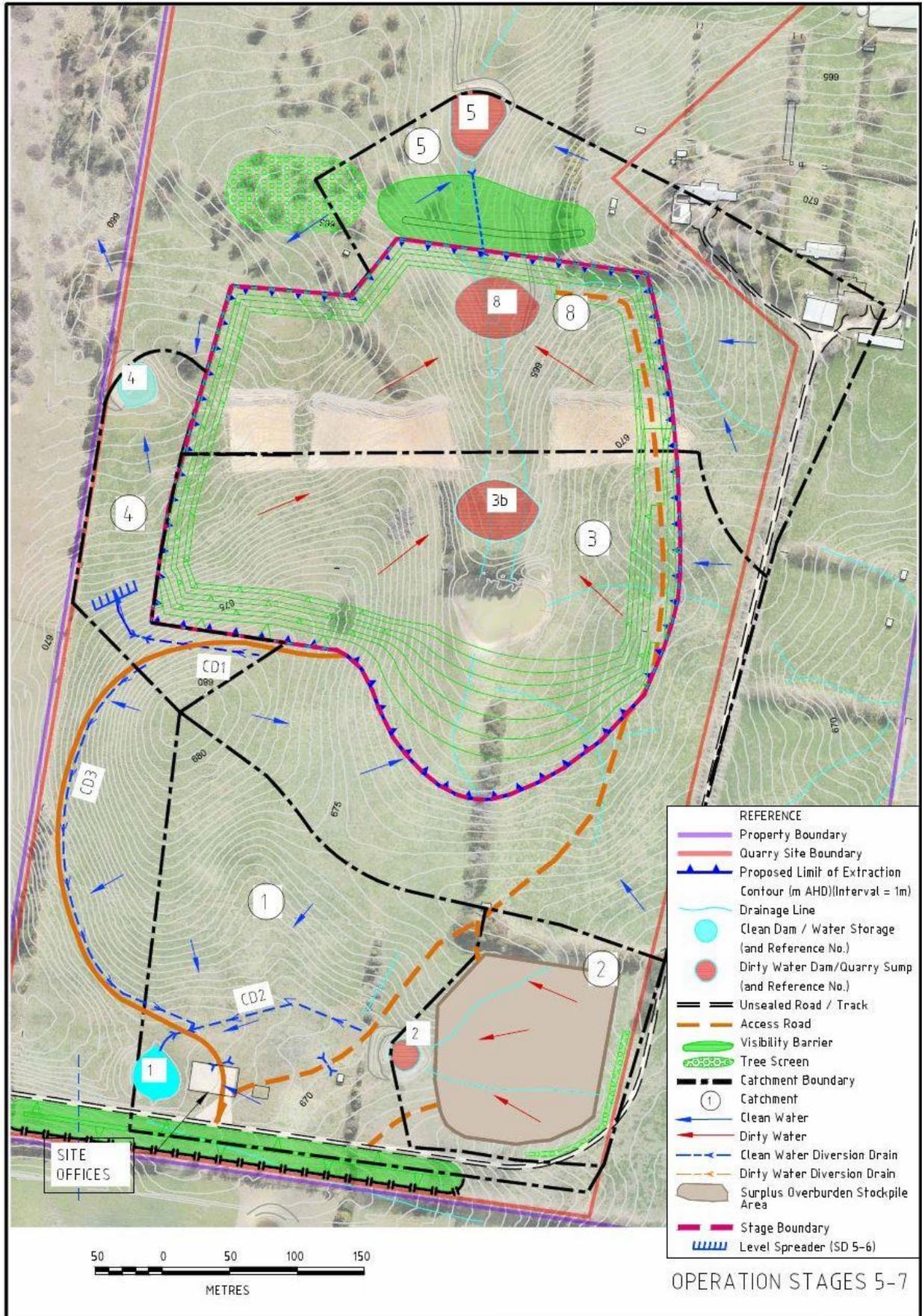


Figure 9 Water Management: Stages 5-7 Operation

Except Dam 2, all sediment basins are sized to capture the 5-day, 85th percentile rainfall depth (36.2 mm) (DECC, 2008 and Landcom, 2004). Dam 2 will be operational for more than three years and so it is designed for the 95th percentile 5-Day rainfall depth (75.2mm). Although Dam 5 would be operational for more than three years, it will not have its maximum catchment for that period of time; the excavations upstream would provide their own storage as they develop. Overflows from Dam 2 will be monitored through monitoring point WS4. Given the short-term use of Dams 4, 9 and 10 as sediment basins, controlled discharges from them will be piped into Dam 5 so as to maintain those discharges through a single monitoring point (WS5). Controlled discharges from Dam 2 and Dam 5 will be flocculated if necessary to meet water quality criteria.

Dam 1, 11 and 7 will also be utilised as sediment basins for a short period of time during initial establishment, whilst the site access roads and site office area is established and the initial overburden material is transported to the surplus overburden stockpile area. Should any discharges be required from these dams during that time, they will also be flocculated, if necessary, to meet water quality criteria. It is noted that Dam 7 has not specifically been denoted as a sediment basin give that the use of the temporary haul route would be utilised for only approximately 1 week and not involve any vegetation clearing or stripping.

Note: The total volume of a sediment basin comprises a sediment retention zone and a water (settling) zone, both sized in accordance with Landcom (2004) and DECC (2008). Details of the minimum sediment basin sizing is provided in **Appendix B**.

7.4.3.2 Extraction Area Sumps

Internal runoff from the extraction area will be collected in Dams 3b and 8 which will be about 1.2ML and 1.8ML respectively. These will also collect any groundwater seepage that might enter the excavation. They will be the principal water supplies for dust suppression and wash down water. If necessary, water will be pumped from the sumps into Dam 5 for treatment and controlled discharge.

7.4.4 Clean Water

Clean water derived from upslope will be diverted by clean water diversion drains as shown in **Figures 6 to 9**. Clean water diversions will outlet via a level spreader.

As disturbed lands are stabilised (**Appendix B**) the associated sediment basins will be removed or converted to clean water storage (**Table 8**).

7.4.5 Discharges

7.4.5.1 Discharge Locations

Figure 4 displays the existing catchments within the Quarry Site and the ephemeral watercourses on site.

Runoff from disturbed areas within the Quarry Site would discharge at two main locations, i.e. at monitoring locations WS4 (W2) and WS5b.

Monitoring location WS4 is located in Catchment C near the southwestern corner of the Quarry Site and will discharge runoff from the internal access road and the surplus overburden storage area, i.e. only after the runoff has passed through Dams 11 and 2 respectively (see **Figure 4**). It is noted that culverts will be provided beneath the western and eastern access roads to enable any outflows from Dam 2 without entraining additional sediments from the surface of the access roads.

Monitoring location WS5b is located within Catchment B, downstream of Dam 5, the principal water management point for drainage from the extraction area.

Monitoring locations WS6 and WS7 are located near the western boundary of the Quarry Site (see **Figure 4**). These locations are both located in Catchment B and drain extremely localised areas, including Dams 4, 9 and 10. Whilst these dams are being operated as sediment basins, controlled discharges will occur by piping the water into the catchment of Dam 5 which is located within Catchment A, thereby maintain all ‘dirty water’ discharge through monitoring location WS5b. As a result, except in the event of a rainfall event exceeding the design standard during times these dams are utilised as sediment basins, only clean water runoff will occur within Catchment B.

It is noteworthy that the location of monitoring location WS5b has been selected taking into account that runoff from the property west of the Quarry Site enters Catchment B immediately upstream at the former monitoring location WS5, confounding monitoring results.

As a result, licenced discharge points are located at monitoring locations WS4, and WS5b. Consideration is also given to wet weather discharge at monitoring locations WS6 and WS7 (see Section 7.4.4.2).

7.4.5.2 Wet Weather Discharges from Sediment Basins

Most sediment basins within the Quarry Site are designed for a 5-day, 85th percentile rainfall depth which is 36.2mm³. A rainfall event greater than that will cause a basin to overtop, unless it is built larger than required. Such events are referred to as “wet weather discharges”. On average, such discharges can be expected to occur four to six times a year (based on the design principals of DECC (2008)). Their occurrence and duration will be logged and reported in the Site’s *Annual Review*. Discharges from Dam 2 can be expected to occur, on average, once or twice a year (based on the design principals of DECC (2008)). A variation will be sought to EPL 20377 to specifically address such wet-weather discharges.

Basin water quality monitoring will be discontinued when the function of the basin is no longer for pollution control.

7.4.5.3 Quality Criteria for Conditional Discharges from Sediment Basins

Water collected in a sediment basin will be flocculated (if required to meet water quality criteria, see Section 8.2.1.3), settled and discharged within five days of the conclusion of a rain event which caused inflow into the basin. These are referred to as “Conditional Discharges” and they will be logged and reported in the Quarry’s *Annual Review*.

³ Dam 2 is designed for the 95th percentile 5-day rainfall depth (75.2mm)

Before a conditional discharge occurs, the water will be tested to ensure it meets the target water quality parameters given in **Table 10**. Most likely flocculation will be required to achieve these targets. This will be undertaken by either manual methods or use of an automatic flocculators.

Basin water quality monitoring will be discontinued when the function of the basin is no longer pollution control.

Table 10
Sediment Basin Discharge Water Quality Targets*

Parameter	Target
pH	Between 6 and 8.5
Total Suspended Solids (TSS)	Less than or equal to 50 mg/L
Oil and grease	Non-visible
* As specified by EPL 20377.	

7.4.5.4 Volumes of Discharge

The volumes of conditional discharges will be equal to, or less than, the associated sediment basin volume. The volumes of unconditional discharges will depend on the rainfall events that cause them. If necessary for operational purposes, conditional discharges will also be undertaken for water stored within Dams 3b and 8.

7.4.6 Contaminated Water

There is no anticipated need for management of contaminated water.

7.4.7 Water Flow Monitoring

Records of discharge values or flow rates would be collected at the time of any conditional discharges.

7.4.8 Water Use Minimisation Program

Water use will be minimised as much as practicable and be limited to dust suppression, machinery washdown and ablutions.

8. EROSION AND SEDIMENT CONTROL PLAN

8.1 SOURCES OF EROSION, SEDIMENTATION AND POLLUTION

8.1.1 Sources of Erosion and Sedimentation

8.1.1.1 Establishment Stages

During the establishment stages soils will be exposed to erosion when building the following.

- The visibility barriers
- The access and haul road(s)
- The temporary haul route.
- The sediment basins
- The extraction area
- Clean and dirty water diversion drains (e.g. CD1, CD2)

8.1.1.2 Operational Stages

During the operational stages soils will be exposed to erosion in:

- The Surplus Overburden Stockpile Area; and
- The Extraction Area.

8.1.2 Sources of Pollution and Water Contamination

There will be no sources of pollution and contamination other than sediment-laden water.

It is noted that the Ashfield Shale typically has very low concentrations of pyrite and therefore generation of acid is not expected to occur. Further, the Quarry is in excess of 600m above the elevation at which acid sulphate soils are formed. Hence, generation of acid from this source is not possible.

8.2 EROSION AND SEDIMENT CONTROL MANAGEMENT

8.2.1 Implementation Strategy

Erosion and sediment loss will be mitigated by implementing a series of staged Erosion and Sediment Control Plans (ESCPs) – see **Appendix B**. They are designed to the requirements of Landcom (2004) and DECC (2008). A summary of the implementation strategies is given in the following sections.

8.2.1.1 Erosion Control

Rapid rehabilitation of disturbed areas is the most effective form of erosion control (Landcom, 2004). As such, the following apply.

- Bare soil will be stabilised using soil binders/hydromulch or similar with a target of achieving a C-factor (runoff coefficient) of 0.15⁴ within 20 days of final shaping. Seeding will be done with the aim of achieving 70% vegetative cover within a further 40 days. If this target is not reached in these timeframes, supplementary stabilisation and seeding will be undertaken.
- During establishment (i.e. formation of the visibility barriers and access / haul roads), disturbed lands that are not finished and will not be re-worked within 20 days will be stabilised using a soil binder to achieve a C-factor of 0.15.
- Stockpiles of overburden material will be progressively stabilised through seeding of pasture species within 20 days of final shaping. Seeding will be done with the aim of achieving 50% vegetative cover within a further 40 days. If this target is not reached in these timeframes, supplementary seeding will be undertaken. This approach is acceptable given that the surplus overburden stockpile area will drain to Dam 2 and that the overburden material is not required as a growth medium. This will be conducted progressively as new overburden material is added to the stockpile area and shaped.
- Clay and shale material awaiting transport will be stockpiled on the floor of the extraction area. This ensures that any erosion of this material is confined within the extraction area with no further erosion controls required.
- Diversion drains will be stabilised against scour using vegetation. Rock rip-rap will also be utilised in any areas that are not successfully stabilised using vegetation.

8.2.1.2 Sediment Control

The primary measure for sediment control will be the Sediment Basins (Section 7.4.2). Most are designed to capture the 85th percentile rainfall, 5-day rainfall depth which is 36.2mm⁵. Dam 2 is designed for the 5-day, 95th percentile rainfall depth which is 75.2mm. It is noted that this is the minimum design to meet the requirements of Landcom (2004) and DECCW (2008). The sediment basins will be subject to the following design, monitoring and maintenance requirements.

- The design of the sediment basins will include an emergency spillway designed to safely convey the 100-year ARI flow (DECC, 2008).
- Waters will be discharged from a basin (after treatment if required) within five days after the conclusion of a rain event that causes flow into it and if that flow results in the basin water level encroaches into the required settling zone⁶

⁴ Equivalent to about 50% ground cover

⁵ Note: if it continues to rain after five days the 5-day period is re-set

⁶ An automated water level system may be utilised to determine this.

- Markers will be installed in each sediment basin showing the Storage Zone (i.e. the lower zone) and the Settling Zone (i.e. the upper zone) in the basin.
- After discharging treated water from any sediment basin, the level of retained sediment will be inspected. If retained sediment exceeds the marked level of the Storage Zone, sediment will be removed and placed within the Extraction Area.
- Any damaged components of the sediment basins will be repaired as soon as practicable.

Other sediment control measures e.g. rock filter dams, sediment fencing, mulch bunds etc. might be adopted throughout the site at the discretion of the Raw Materials & Mining Manager or Compliance & Environmental Coordinator. However, should any erosion or sedimentation occur outside of the dirty water management system, this will be stabilised as soon as possible.

8.2.1.3 Flocculation

If adequate setting of suspended solids is not achieved in the sediment basins within five days, flocculation will be required. Flocculation may be achieved using gypsum or another approved flocculent. Flocculent approval would be at the discretion of NSW EPA. All flocculants will be used at their recommended dilution rates and applied evenly to the water to ensure adequate settling. Automatic flocculation is an option that may be implemented.

8.2.2 Erosion and Sediment Control Monitoring

The performance of the erosion and sediment control measures will be measured by regular site inspections utilising a formal erosion and sediment control inspection checklist. In summary:

- The sediment basins and erosion and sediment controls will be inspected:
 - On a monthly basis irrespective of rainfall; and
 - Within 5-days of a rainfall event that causes inflow to a sediment basin that encroaches into the settling zone⁷; and
 - Flocculate (if necessary) and remove sediment-laden water in the sediment basins to re-gain their design settling capacity;
 - Inspect the integrity of any sediment-control measures, including sediment basins, sediment traps, etc.;
 - Look for any signs of erosion, particularly in areas that do not drain to a sediment basin or other sediment capture measure; and
 - Inspect any areas subject to stabilisation to ensure they are establishing an adequate cover of vegetation in a timely manner.
- Necessary repairs to sediment basins or erosion and sediment controls would be undertaken as soon as practicable.

⁷ This may be measured automatically using water level sensors.

- The management procedures for the sedimentation basins will be regularly reviewed to ensure ongoing efficient operation and protection of downstream water quality.
- Before a conditional discharge the water quality will be tested, treated if necessary and re-tested if necessary to meet the targets given in **Table 10**.

8.2.3 ESCP Review

The ESCPs submitted in **Appendix B** will be reviewed shortly before each establishment or operational stage. At the discretion of the Compliance & Environmental Coordinator, and in consultation with a Certified Professional in Erosion and Sediment Control, the plans will be revised if necessary. The ESCPs will also be revised during works if conditions, work practices or water quality monitoring dictate.

9. SURFACE WATER MONITORING PROGRAM

9.1 INTRODUCTION

This sub-section provides a description of the surface water monitoring that will be undertaken throughout and following the life of the Quarry. It is noted that the results of the previous water quality monitoring is discussed in Section 6.3 of this document. The approach to monitoring, both in terms of parameters analysed and frequency of sampling, reflects a realistic risk-based approach for the Quarry and not a generic approach.

9.2 SURFACE WATER IMPACT ASSESSMENT CRITERIA

The aim of the erosion and sediment control plan is to ensure that water leaving the site (other than wet-weather discharges) has a water quality no worse than:

- the water quality in the Wingecarribee River (the receiving water) (WS2); or
- the water quality within Stony Creek (WS3).

This criteria or objectives are drawn from State Environmental Planning Policy (SEPP) Sydney Drinking Water Catchment (2011).

Standard criteria imposed through Environment Protection Licences are as follows.

- pH = 6.5 to 8.5
- Total Suspended Solids = <50mg/L⁸
- Oil and Grease = not visible

These criteria are considered to be the key parameters required to assess ecosystem health.

⁸ Or equivalent turbidity (NTU) as agreed with the NSW EPA.

9.3 SURFACE WATER MONITORING PROGRAM

9.3.1 Monitoring Parameters, Frequency and Location

9.3.1.1 Baseline Monitoring

Limited opportunity has been available to monitor baseline water quality within the Quarry Site given:

- a) the extraction area is close to local catchment divides and hence runoff is often of short duration;
- b) the bulk of the Quarry Site is well vegetated and consequently has a low coefficient of runoff; and
- c) the dams on site that collect runoff have regularly been observed to be disturbed by stock causing high levels of suspended solids.

Notwithstanding this, and subject to flowing water being present, Austral will continue undertake sampling of water at monthly intervals from sites WS1, WS2, WS3, WS4, WS5b and WS8 from 31 May 2017 until site establishment activities commence. All samples would be analysed for pH, electrical conductivity, suspended solids, turbidity, cations/anions, total phosphorous (TP) and total nitrogen (TN). It is noted that these analytes are the key analytes to characterise the water quality that could change as a result of the approved quarrying operations or be influenced by existing agricultural activities.

Whilst not expected to be influenced by the approved quarrying operations, heavy metals (per **Table 11**), hardness, and biological oxygen demand will also be monitored from October 2020 in accordance with the requirements of PA 02_0212 *Condition 3(18)*.

9.3.1.2 During Establishment Stages

During the establishment stages, water quality will be measured:

- at all sediment basins (following their construction) prior to any required conditional discharge (Section 7.4.4.3 and **Table 11**); and
- opportunistically at the eight site locations identified on **Figure 4** at least four times a year (if water is present) and within 24 hours of any wet weather discharge.

It is noted that WS2 represents an upstream sample location within the Wingecarribee River and a further sampling location (WS8) has been established downstream of the Quarry Site (see **Figure 4**).

Sediment basin discharges will be tested for the suite of parameters given in **Table 11**. Estimates of controlled discharge flow rates or volumes would be recorded during the collection of samples.

It is noted that the parameters to be tested are in excess of those considered relevant to the nature of the clay/shale in which there is limited opportunities for the clay/shale to influence water quality. As such, these parameters will be reviewed over time and, when sufficient data is available, a modification sought to reduce the monitoring parameters to the most appropriate suite.

Table 11
Water Quality Parameters for all Water Quality Monitoring Locations

<ul style="list-style-type: none"> • Physical Parameters <ul style="list-style-type: none"> - pH - Electrical Conductivity - Total suspended solids - Turbidity⁹ (NTU) 		<ul style="list-style-type: none"> - Hardness - Dissolved Oxygen - Oil and grease (visual)
<ul style="list-style-type: none"> • Major cations <ul style="list-style-type: none"> - Sodium - Calcium - Magnesium - Potassium 	<ul style="list-style-type: none"> • Major anions <ul style="list-style-type: none"> - Chloride - Sulfate - Bicarbonate (hardness) 	
<ul style="list-style-type: none"> • Metals <ul style="list-style-type: none"> - Aluminium - Arsenic - Cadmium - Cobalt - Chromium 	<ul style="list-style-type: none"> - Copper - Iron - Lead - Manganese - Zinc 	
<ul style="list-style-type: none"> • Nutrients <ul style="list-style-type: none"> - Total phosphorus 		<ul style="list-style-type: none"> - Total nitrogen

9.3.1.3 During Operational Stages

During operational stages, water quality will continue be monitored at the monitoring locations identified on **Figure 4**. Samples will be taken opportunistically when there is sufficient rain to cause runoff. Sampling will occur at least four times a year (subject to there being a runoff event during each quarter). Notably, not all drainage lines might be flowing at one time. The samples will be tested for the parameters as specified in **Table 11**.

9.4 SURFACE WATER TRIGGERS

If water quality monitoring results at WS1, WS5b, WS6 or WS7 (on-site monitoring locations downstream of Quarry disturbance areas) exceed the water quality criteria in **Table 10**, this will trigger an investigation and incident reporting in accordance with Sections 14 and 15 of this WMP. However, it will not be considered a water quality trigger if this occurs during a wet weather event (see Section 7.4.4.2).

In the event that water quality monitoring at the Wingecarribee downstream monitoring site (WS8) exceeds the water quality criteria in **Table 10** and also exceeds the upstream monitoring site (WS2) for 3 consecutive months (where wet weather events have not occurred), this will trigger an investigation and incident reporting in accordance with Sections 14 and 15 of this

⁹ The target will be 50NTU or other approved value if there is sufficient data to provide a site-specific correlation between TSS and turbidity, TSS might not be required and so all three remaining parameters could be measured on site by appropriately trained staff.

WMP. To determine if the Quarry is having an adverse impact, the investigation will include review of water quality results against baseline data, review of any discharge monitoring data, erosion and sediment control inspection records and any activities observed on adjacent properties which may affect water quality.

9.5 STRATEGY MONITORING AND AMENDMENT

The results of the water quality monitoring will be collated and summarised within the Quarry's *Annual Review* (Section 16), with a copy also provided to Council, Water NSW, NRAR, and any other relevant government agency, if requested.

The Water Management Plan for the Quarry will be independently audited in accordance with the independent audit schedule of PA 08_0212 with upgrades or amendments made as required to ensure ongoing compliance with relevant environmental protection instruments.

10. GROUNDWATER MANAGEMENT

10.1 EXISTING GROUNDWATER ENVIRONMENT

The Quarry Site is located within the Sydney Basin Nepean Groundwater Source as defined by the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*. The geology of this groundwater source consists of sedimentary sandstone amid siltstone formations with intervening coal seams.

Previous drilling within the Quarry Site confirms the area is underlain by a sequence of shales and laminates belonging to the Ashfield Shale, a Triassic rock unit often outcropping in the Southern Highlands. The Ashfield Shale is the target resource for the Quarry. The Ashfield Shale is underlain by Hawkesbury Sandstone. Extraction will not extend into the Hawkesbury Sandstone.

Ashfield Shale is typically of very low permeability, although higher yields can occur where fractures are encountered. Austral's experience at the Bowral Quarry has shown that groundwater inflows from the Ashfield Shale are negligible and are typically limited to short-term seeps following rainfall. There are no groundwater bores recovering any groundwater supplies from within the Ashfield Shale in the Southern Highlands. Surrounding registered groundwater bores source water from the Hawkesbury Sandstone with reported yields ranging from 1.3L/S to 9.1L/S.

The extraction area also comprises a clay regolith profile that ranges from 2m to 10m in thickness. This profile will act to inhibit local groundwater recharge, thereby minimising the potential for significant or ephemeral perched aquifers to develop within the regolith profile.

Locally, the water table to the north of the extraction area is expected to be in equilibrium with the Wingecarribee River at approximately 648m AHD, with a shallow hydraulic gradient anticipated beneath the Quarry to the north towards the river. It is likely that the water table beneath the extraction area will be of the order of 1m or 2m above the level of the Wingecarribee River at approximately 650m AHD.

Due to the low permeability of the Ashfield Shale, the Quarry is considered to pose a very low risk to local or regional groundwater or to other groundwater users.

10.2 GROUNDWATER MONITORING PROGRAM

10.2.1 Monitoring Locations and Piezometer Details

PA Condition 18A nominates “The Proponent must install 3 pairs of nested piezometers prior to the quarry pit floor reaching 660m AHD in consultation with DPI-Water and to the satisfaction of the Secretary.”. Whilst extraction has not yet commenced, the following piezometers (see **Figure 4**) were proactively installed during July 2019 following advice from Jacobs hydrogeologist Greg Sheppard and in consultation with NRAR.

- STK20D – Forms the deep bore of a nested piezometer north of the extraction area and adjacent Wingecarribee River. Water bearing zone 640.9m AHD to 637.8m AHD (hole termination).
- STK20S – Forms the shallow bore of a nested piezometer north of the extraction area and adjacent Wingecarribee River. Water bearing zone 639.9m AHD to 626.3m AHD (hole termination).
- STK22 – Single piezometer east of the extraction area. Water bearing zone 656.8m AHD to 633.5m AHD (hole termination).
- STK23 - Single piezometer south of the extraction area. Water bearing zone 650.4m AHD to 635.3m AHD (hole termination).

Piezometer construction details are presented in **Figure 11**.

10.2.2 Assessment Criteria

Insufficient data has been collected to provide specific assessment criteria. The minimal impact considerations from the NSW Aquifer Interference Policy (2012) do not provide specific water quality criteria. Rather, the Policy requires that, for minimal impact, any activity should not lower the beneficial use category of the groundwater source.

As additional baseline water quality monitoring is undertaken the beneficial use category of the groundwater source will be defined and specific criteria developed. The early and proactive installation of groundwater monitoring bores prior to commencement of extraction will provide for collection of baseline data and definition of appropriate criteria well before the potential interception of groundwater.

Final impact assessment criteria will be defined and the WMP updated prior to extraction reaching a depth of 660m AHD (i.e. the depth at which groundwater monitoring bores were required to be installed). Notwithstanding, a Trigger Action Response Plan (TARP) is included as Section 10.3 and initial groundwater monitoring data is provided in Section 10.2.3.

10.2.3 Baseline Groundwater Monitoring Data

Since installation of the bores a single round of monitoring has been completed on 24 October 2019, the results of which are summarised in **Table 12**. Ongoing baseline monitoring will be undertaken and included within future revisions of the WMP.

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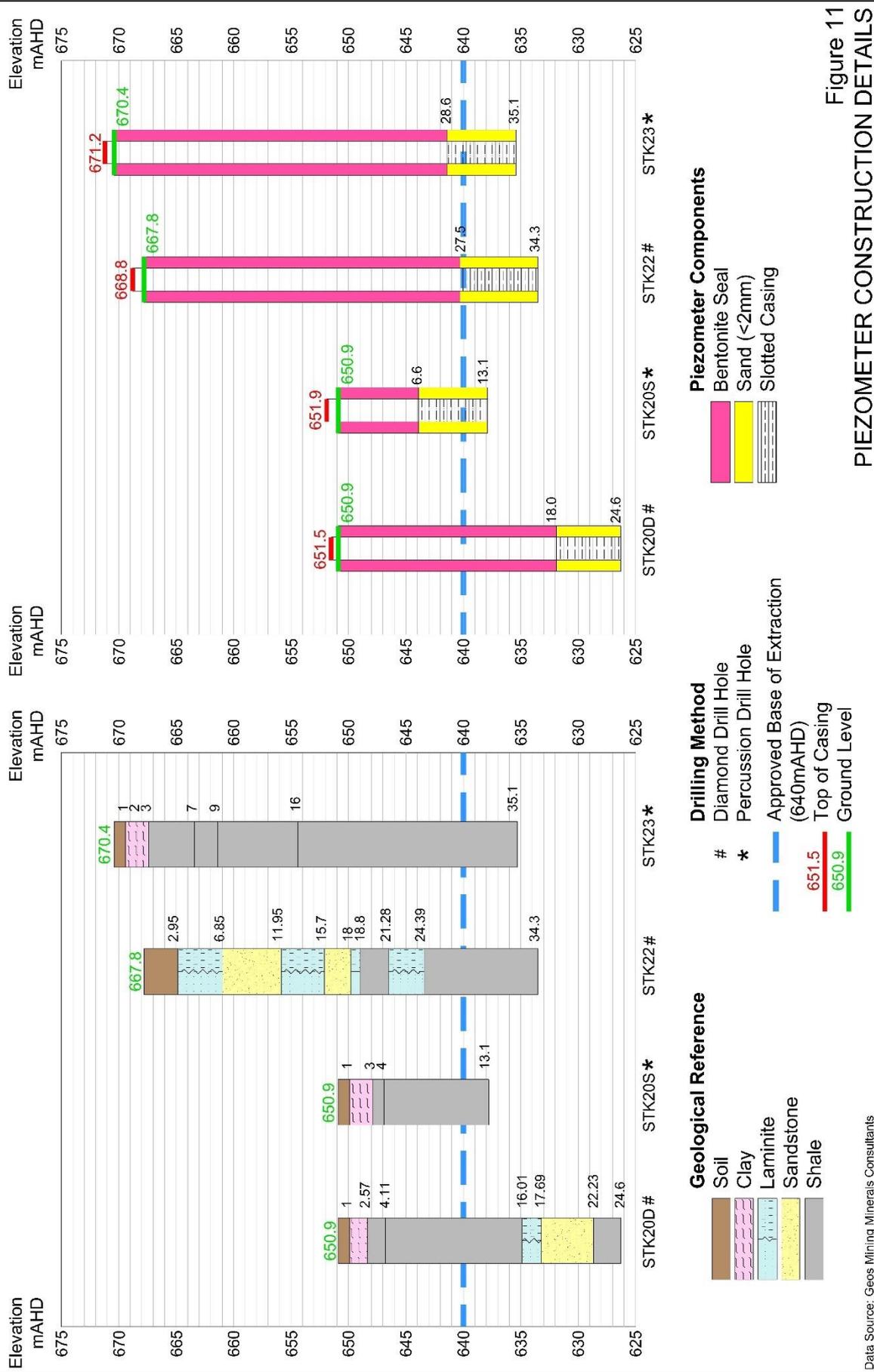


Figure 11
 PIEZOMETER CONSTRUCTION DETAILS

Data Source: Geos Mining Minerals Consultants

Table 12
Key Baseline Groundwater Quality Parameters – 24 October 2019

Location / Parameter	STK20S	STK20D	STK22	STK23
Physical Parameters				
Standing Water Level (m AHD)	643.03	641.01	663.05	666.08
pH	6.05	5.93	4.94	7.23
EC (µS/cm)	3660	776	896	5180
Major Anions and Cations				
Sodium (mg/L)	197	60	98	296
Potassium (mg/L)	8	16	19	35
Calcium (mg/L)	129	21	28	316
Magnesium (mg/L)	215	26	24	263
Chloride (mg/L)	1160	154	137	1420
Sulfate (mg/L)	20	<1	14	122
Bicarbonate (mg/L)	72	118	103	527
Fluoride (mg/L)	<0.1	0.1	0.2	0.2
Nutrients				
Nitrate (mg/L)	0.24	0.07	0.06	0.07
Total Ammonia (mg/L)	0.58	1.30	0.20	0.33
TKN (mg/L)	2.1	9.3	17.5	0.9
Total Phosphorous (mg/L)	4.43	0.96	2.68	0.19
Reactive Phosphorous (mg/L)	<0.01	0.03	0.03	<0.01
Metals				
Aluminium (mg/L)	<0.01	0.52	1.26	0.02
Arsenic (mg/L)	0.017	0.004	0.004	0.002
Cadmium (mg/L)	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (mg/L)	<0.001	0.004	0.009	0.002
Cobalt (mg/L)	0.033	0.003	0.006	0.004
Copper (mg/L)	<0.001	<0.001	<0.001	<0.001
Lead (mg/L)	<0.001	<0.001	<0.001	0.002
Manganese (mg/L)	3.08	0.968	0.930	0.202
Nickel (mg/L)	0.036	0.007	0.012	0.003
Selenium (mg/L)	<0.01	<0.01	<0.01	<0.01
Zinc (mg/L)	0.009	<0.005	0.010	0.015
Iron (mg/L)	58.4	21.9	19.6	0.09

Further monitoring is required to provide an adequate description of baseline water quality. However, initial monitoring indicates the groundwater is slight brackish to brackish with an acidic to neutral pH.

10.2.4 Ongoing Groundwater Monitoring Parameters and Frequency

The following analytes and parameters will continue to be monitored within the four monitoring bores.

- Standing Water Level (m AHD)
- pH
- Electrical Conductivity

- Major Cations
 - Sodium
 - Calcium
 - Magnesium
 - Potassium
- Major Anions
 - Chloride
 - Sulfate
 - Bicarbonate
- Iron
- Aluminium
- Total Phosphorous
- Total Nitrogen

Prior to the commencement of extraction, monitoring will be undertaken six-monthly. Following commencement of extraction, monitoring will be undertaken on a quarterly basis.

In addition to monitoring within the groundwater bores, following commencement of extraction, Austral will routinely monitor (at least quarterly) and record groundwater inflows from the walls or floor of the extraction area. This would be achieved through visual observations of the Quarry faces for seeping water and comparison of the estimated volume contained within the Quarry sump vs the rainfall and water usage for dust suppression as calculated on a quarterly basis.

The frequency of monitoring and parameters monitored will be reviewed annually as part of the Annual Review process and revised if necessary to ensure meaningful data is being collected.

10.3 GROUNDWATER TRIGGER ACTION RESPONSE PLAN

Whilst specific groundwater quality impact assessment criteria have not yet been developed, the principal potential for impacts upon groundwater quality would arise due to impacts upon groundwater levels. Therefore, the following TARP (see **Table 13**) has been developed focusing upon groundwater levels and inflows. Notwithstanding, provision is made for responding to any reports from adjoining landholders claiming impacts to groundwater quality. The groundwater quality triggers will be refined as baseline groundwater quality monitoring data is collected and assessment criteria developed.

It is noted that the triggers for groundwater levels have been derived through consideration of the minimal impact considerations from the *NSW Aquifer Interference Policy* (2012) for less productive porous and fractured rock water sources.

Table 13
Groundwater Tigger Action Response Plan

Page 1 of 3

Trigger Level	Alert Level	Action	Response
Groundwater Levels			
Groundwater levels remain within 1m of recorded levels over the past 6 months.	Green	No action required	Nil.

Table 13 (Cont'd)
Groundwater Tigger Action Response Plan

Trigger Level	Alert Level	Action	Response
Groundwater Levels (Cont'd)			
Groundwater level trends indicate a continuing decline in drawdown levels exceeding 1m over a 6 month period (or shorter).	Amber	Conduct investigation: Review and assess monitoring results and relevant activities within and surrounding the Quarry.	<ul style="list-style-type: none"> Review records of any groundwater inflows and confirm calculated sump water volumes and rainfall records to confirm whether undetected inflows may have occurred. Review trends in water levels over time and determine if there is likely a causal link to Quarry-related activities or any other known surrounding activities. Establish links (if any) between water levels and climatic conditions (e.g. rainfall). Determine the need for an additional 'non-routine' groundwater level monitoring.
Adjoining property owner reports impact upon their groundwater supply.	Amber	As above, plus consult with adjoining property owner and provide copy of monitoring data.	As above plus: <ul style="list-style-type: none"> Assess need for off-site groundwater monitoring and, if recommended, seek landholder's approval. Notify the landholder of their right to request a dispute resolution (in accordance with the Dispute Resolution Process within the Environmental Management Strategy).
Groundwater level trends indicate a continuing decline in drawdown levels exceeding 2m over a 6 month period (or shorter).	Red	Report as an incident and submit formal report to DPIE and relevant agencies in accordance with the incident response process outlined within the Environmental Management Strategy.	In addition to the responses outlined within the amber alert undertake the following. <ul style="list-style-type: none"> Seek a review of the monitoring data by a suitably qualified consultant. Review the need to temporarily increase the monitoring frequency. Review the need for further groundwater assessment and modelling. Update this GWMP as applicable.
Groundwater Inflows			
No groundwater inflows.	Green	No action required	Nil.
Minor groundwater inflows recorded (<2ML/year) .	Amber	Conduct investigation: Review and assess monitoring results and current hydrogeological information.	<ul style="list-style-type: none"> Review inflow observations and calculations to ensure correct methodology. Review inflow rate compared to depth of extraction and available hydrogeological information. Engage hydrogeological expert, if required, to prepare a conceptual hydrogeological model and further assess likely future groundwater inflows. Seek necessary water licencing.
Moderate or greater inflows recorded (>2ML/year) WITHOUT appropriate water licencing being held.	Red	Report as an incident and submit formal report to DPIE and NRAR and in accordance with the incident response process outlined within the Environmental Management Strategy.	<ul style="list-style-type: none"> Cease extraction below the depth of the current floor of extraction. Engage hydrogeological expert to undertake review and any necessary modelling. Obtain required water licencing.

Table 13 (Cont'd)
Groundwater Tigger Action Response Plan

Page 3 of 3

Trigger Level	Alert Level	Action	Response
Groundwater Quality			
Adjoining property owner reports water quality impacts upon their groundwater supply.	Amber	Consult with adjoining property owner and provide copy of monitoring data. Conduct investigation: Review and assess monitoring results and relevant activities within and surrounding the Quarry.	<ul style="list-style-type: none"> • Undertake groundwater levels investigation as per Amber response for groundwater levels. • Review records of groundwater quality within the Quarry groundwater monitoring network to establish any links. • Assess need for off-site groundwater monitoring and, if recommended, seek landholder's approval. • Notify the landholder of their right to request a dispute resolution (in accordance with the Dispute Resolution Process within the Environmental Management Strategy).

11. MITIGATION MEASURES

11.1 SURFACE WATER

In order to meet the water quality targets (see Section 9.4), statutory requirements (see Section 3) and to minimise the impact of quarry operations on surface water, mitigation measures principally relate to:

- i) the avoidance or control of sediment-laden runoff; and
- ii) the management of hydrocarbons and sewage.

As discussed in Section 8.1.2, there are no acid sulfate soils within the Quarry Site and the Ashfield Shale has very low concentrations of pyrite and therefore acid generation is not expected to occur. As a result, no specific management measures are required. Notwithstanding, contingency measures have been specified in Section 14 in the event low pH is recorded in water on site.

The management of sediment-laden runoff has been comprehensively addressed in Section 7 and **Appendix B**.

The potential for hydrocarbon spillages will be minimal given Austral will not be storing any fuel on site. All diesel used on site will be delivered to site on the day of use. Only small quantities of oils and greases will be stored on a bunded pallet inside a container. Any storage of hydrocarbons will be in accordance with *AS1940 The Storage and Handling of Flammable and Combustible Liquids*.

The potential for contamination of surface water by sewage will be negligible given all sewage will be collected in a pump-out waste water system (such as portaloos) and removed off site in accordance with relevant Council and EPA requirements. This will principally be achieved through the use of a licenced contractor to manage the collection and maintenance of the waste water system.

11.2 GROUNDWATER

Mitigation measures required to protect the expected groundwater resources in the underlying Hawkesbury Sandstone formation will be comparable with those relevant to surface water, i.e. with respect to contamination from hydrocarbons and/or sewage.

12. EVALUATION OF COMPLIANCE

Following commencement of extraction, surface water monitoring results will be entered into the water monitoring spread sheet within 7 days of the receipt of laboratory results relating to any discharge event. During entry to the spread sheet, the monitoring results will be assessed against the relevant criteria.

All monitoring results will be reviewed by the Compliance & Environmental Coordinator and a summary provided within each *Annual Review*.

In the event that monitoring identifies an exceedance of the triggers outlined in Sections 9.4 or 10.3 of this document, Austral will initiate appropriate corrective and preventative actions as discussed in Sections 10.3 and 14 and, if applicable, incident reporting as discussed in Section 15.

A copy of the investigation report and regular updates on the status of the identified corrective and/or preventative actions will be provided to DPE and EPA and, if required, the complainant, in accordance with the procedures identified in Section 14. In addition, a summary of the report will be included in the subsequent *Annual Review*.

13. COMPLAINTS HANDLING AND RESPONSE

In the event that a complaint related to water or sediment / erosion is received, this would be managed in accordance with the complaints management procedure as outlined within the Environmental Management Strategy for the Quarry (prepared in accordance with *PA Condition 5(1)*). Furthermore, should any complaints be received alleging impacts to surrounding groundwater bore levels or quality, this would be investigated in accordance with the TARP specified in Section 10.3.

14. CORRECTIVE AND PREVENTATIVE ACTIONS

In the event that water monitoring identifies an exceedance of the relevant criteria, the exceedance will be reviewed to determine the likely cause(s). The review will seek to determine:

- whether the exceedance of the criteria was directly related to a source associated with the Quarry or if environmental factors contributed to the exceedance;
- the primary cause of the exceedance;
- any contributing factors which led to the exceedance;
- whether appropriate controls were implemented to prevent the exceedance; and
- corrective and preventative measures that may be implemented to prevent a recurrence of the exceedance.

Follow up water quality sampling will include the full suite of baseline monitoring parameters as per Section 9.3.1.1 until water quality parameters return to below criteria or the additional parameters are determined to be irrelevant to the investigation.

Corrective and/or preventative actions / contingency measures will be assigned to relevant personnel of either Austral or its contractor. Actions will be communicated internally, such as through planning meetings and toolbox talks, and outstanding actions will be monitored for their effectiveness upon completion.

Example actions / contingency measures that could be adopted in response to an exceedance of water quality criteria are provided in **Table 14**. If the corrective actions / contingency measures are not effective, specialist advice will be sought.

Table 14
Example Corrective Actions / Contingency Measures

Water Quality Trigger	Potential Cause	Corrective Action / Contingency Measures
Total Suspended Solids or Turbidity Exceeds Trigger Level (see Section 9.4.2)	Insufficient residence time in sediment basins to settle clay particles.	Pump water back to Quarry sump or alternate on-site water storage (if holding capacity is available).
		Treatment with appropriate flocculants or coagulants to settle fine particles prior to discharge.
	Erosion / entrainment at discharge point / water released at too high velocity.	Release discharge waters at a lower velocity.
		Install additional stabilisation at discharge point – e.g. level spreader, rock armouring / check dam.
Excessive erosion or sediment generation within disturbance areas.	Review erosion and sediment control measures to confirm consistency with the Erosion and Sediment Control Plan.	
	Implement additional stabilisation / sediment reduction measures such as supplementary seeding of stabilising cover, hydromulching, addition of soil binder, additional sediment fencing, rock armouring, check dams, etc.	
The pH of water to be discharged is below 6.0.	Application of flocculants or coagulants to reduced sediment levels has caused a reduction in pH.	Addition of suitable alkaline amendments prior to discharge of water.
		Review flocculant / coagulant used and determine if suitable alternatives are available.
	A pocket of pyritic material is exposed within the extraction area ¹ .	Inspection of the exposed extraction faces and floor by a geologist or suitably qualified person for evidence of pyritic material and acid generation.
Define the extent of pyritic material and determine appropriate actions, e.g. remove from site, treat on-site with alkaline amendments or re-cover with clay material to prevent further oxidation.		
Hydrocarbons detected in discharge water or sediment basins.	Hydrocarbon leak from mobile equipment.	Stand down equipment item until repairs are completed and clean-up of contaminated materials.
	Hydrocarbon spill during refuelling or equipment maintenance.	Suspend refuelling or maintenance activity and clean up contaminated materials. Review operating procedure for refuelling or maintenance and implement additional controls as applicable to prevent reoccurrence.
Note: 1 There is no evidence of pyritic material or acid generation issues within the Ashfield Shale. This contingency has been included for completeness.		

15. INCIDENT REPORTING

In the event that routine water quality monitoring establishes that an exceedance of an environmental criterion was directly attributed to activities associated with the Quarry, the exceedance will be reported in accordance with the Incident Reporting Procedure outlined within the Environmental Management Strategy for the Quarry (prepared in accordance with *PA Condition 5(1)*).

16. PUBLICATION OF MONITORING INFORMATION

Austral will place a summary of all water monitoring results reports on Austral's website, which will be updated at least quarterly.

In addition, Austral will include a summary of all water monitoring data within each *Annual Review* for the period ending 31 December each year and address the relevant requirements of *PA Condition 5(4)*. That document, once approved by the relevant government agency, will also be published on Austral's website.

17. PLAN REVIEW

In accordance with *PA Condition 5(5)*, this Water Management Plan will be reviewed and, if required, revised within 3 months of:

- the submission of an *Annual Review* under *PA Condition 5(4)*;
- the submission of an incident report under *PA Condition 5(7)*;
- the submission of an independent environmental audit report under *PA Condition 5(9)*;
- any modification to the conditions of PA08_0212; and
- the completion of the installation of the 3 paired piezometers.

Any non-administrative updates to this WMP will be undertaken in consultation with Water NSW and the Department of Industry - Lands and Water and submitted to DPE for endorsement. Any administrative updates will be submitted directly to DPE for endorsement.

18. REFERENCES

DECC (2008). *Managing Urban Stormwater. Soils and Construction.* Volume 2e Mines and Quarries. NSW Department of Environment and Climate Change, Sydney.

Landcom (2004). *Managing Urban Stormwater. Soils and Construction.* Volume 1.

R.W. Corkery & Co. (2015). *Environmental Assessment to Support a Section 75W Modification of PA08_0212 for the New Berrima Clay/Shale Quarry.*

SEPP (2011). *State Environmental Planning Policy. Sydney Drinking Water Catchment.*

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Appendix A

Consultation and

Response

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Copies of consultation correspondence are provided as follows with a summary of how the consultation comments have been addressed provided in **Table A1**.

Table A1
Coverage of Consultation Comments – WMP

Page 1 of 3

Agency	Comment	Coverage
Water NSW 16/02/18	WaterNSW reviewed the first draft of the WMP in 2016 and found that it to be comprehensive in addressing the water related conditions in the development consent very well.	No further changes.
Department of Industry - Water 22 March 2018	Surface water monitoring schedules need to include heavy metals, hardness and biological oxygen demand in Section 9.2 to comply with Condition 18(b) of Schedule 3.	There have been no changes to the approved operations or other reasons for the status of this issue to have changed nor has DoI Water justified their change in position. Refer to responses to DoI Water for further information.
	Details of mitigation measures and response actions (other than simplistically reviewing causes and reporting incidents) are required in Section 12, 14 and 15 to comply with Condition 18(b) of Schedule 3.	Additional contingency response measures have been included in Section 14. Section 12 relates to the evaluation of compliance and Section 15 relates to incident reporting. Section 8.2.2 also outlines erosion and sediment control monitoring which will be undertaken at least monthly and also following certain rain events. Refer to responses to DoI Water for further information.
	An outline of proposed monitoring of the impacts of the project on groundwater-related receptors is required in Section 10.2 to comply with Condition 18(c) of Schedule 3.	Installation of groundwater monitoring bores is required prior to extraction exceeding a depth of 660m AHD. As such, the requirement for groundwater monitoring is not yet required. Refer to responses to DoI Water for further information.
	The mitigation measures described in Section 11 need to be more closely linked to the statutory requirements, limits or performance measures/criteria as required under Condition 3(c) of Schedule 5.	Additional text has been added to Section 11 to make the linkages clear. Refer to responses to DoI Water for further information.
	A contingency plan needs to be included in Section 14 to comply with condition 3(e) of Schedule 5.	A contingency plan has been included in Section 14.
	The statement in Section 10.1.2 needs to be amended in accordance with previous agency correspondence.	Section 10.1.2 has been updated to reflect the agency's correspondence dated 22 February 2016.
	The statement in Section 11.2 needs to be amended in accordance with previous agency correspondence.	Section 11.2 has been updated to reflect the agency's correspondence dated 22 February 2016.

Table A1 (Cont'd)
Coverage of Consultation Comments – WMP

Page 2 of 3

Agency	Comment	Coverage
NRAR 25 February 2019	The proponent must undertake the following prior to submission to the Department of Planning and Environment (DP&E) for their approval:	Refer to NRAR correspondence for further detail on matters raised. Key points and response provided below.
	1. Assess the project in terms of the NSW Aquifer Interference Guidelines (2012) (AIP).	The New Berrima Clay/Shale Quarry is an approved project, granted Project Approval 08_0212 on 6 July 2012, i.e. prior to the release of the Aquifer Interference Policy (AIP) in September 2012. The Project has already been assessed and approved under the <i>Environmental Planning and Assessment Act 1979</i> in accordance with the requirements applicable at that time.
	2. Include a geological and hydrogeological conceptual model in the above assessment.	The WMP is a post-approval document not an assessment document. Notably, PA 08_0212 does not include requirements for the preparation of a geological and hydrogeological model. Furthermore, given the current stage of the Quarry development (i.e. extraction operations have not yet commenced) there is no basis for NRAR to now require the preparation of a geological and hydrogeological model where such a model was not required in order to determine the development application nor requested in previous reviews of the WMP. Therefore, the preparation of a hydrogeological model is neither mandatory nor required. The need for a conceptual model will be considered as extraction operations progress and monitoring data is collected.
	3. Provide an updated WMP which states appropriate groundwater level and quality trigger criteria, developed from the NSW AIP and appropriate ANZECC water quality guidelines.	Appropriate assessment and trigger criteria have been included in Section 10.2.2 and 10.3 of the updated WMP. It is noted that it is not yet appropriate to specify specific water quality criteria. Notwithstanding, a TARP has been included for any alleged impacts to water quality at any surrounding groundwater bores.
	4. Include in the updated WMP a stated and appropriate groundwater trigger action response plan	A TARP has been included as Section 10.3.
5. Clarify that community consultation is an include item relating to issues raised in relation to local bore water levels and monitoring of local bores. Should this be included in the complaints management procedure outlined within the Environmental Management Strategy for the Quarry, this needs to be stated as such in the WMP	The WMP does not propose to undertake groundwater monitoring at surrounding local bores or undertake further community consultation regarding groundwater..	

Table A1 (Cont'd)
Coverage of Consultation Comments – WMP

Page 3 of 3

Agency	Comment	Coverage
NRAR 25 February 2019		Notwithstanding, Section 13 of the WMP specifies that any complaints relating to water would be managed in accordance with the complaints management procedure outlined within the Environmental Management Strategy and the TARP would apply for any complaints regarding impacts to water levels or quality
	6. The following point is not required to be undertaken prior to approval of this WMP; however it should be noted by the proponent. Implement the installation of the required three sets of nested piezometers in accordance to Condition 18A and commence the required groundwater monitoring as soon as possible.	The groundwater monitoring network was agreed with NRAR (refer to attached correspondence). The installed monitoring network is outlined in Section 10.2.

Scott Hollamby

From: Ravi Sundaram <ravi.sundaram@waternsw.com.au>
Sent: Friday, 16 February 2018 12:36 PM
To: Scott Hollamby
Cc: Peter Dupen
Subject: RE: 744: New Berrima Clay/Shale Quarry - Updated Water Management Plan

Hi Scott

WaterNSW appreciates the opportunity to comment on the second version of the WMP updated to address water related conditions of Modification 2 of PA08_0212 approved on 6 July 2017. Key elements of the Mod 2 proposal relevant to water management include the construction of a new bridge over Stony Creek and the realignment of the western access road. WaterNSW reviewed the first draft of the WMP in 2016 and found that it to be comprehensive in addressing the water related conditions in the development consent very well. Table 2 of the updated WMP summarises these project approval conditions related to water management and where in the document it has been addressed. The updated WMP indicates that the proposed site clean and dirty water management and soil and water management controls at various stages of quarry construction and operation have been designed in accordance with the best management practice (i.e. the Blue Book) and will be adequate in ensuring there is a neutral or beneficial effect on receiving water quality. There is also a sufficient buffer of over 700 m between the quarry site and the Wingecarribee River.

WaterNSW would appreciate receiving a copy of the quarry's annual review report when available.

Regards.

Ravi
Dr Ravi Sundaram
Mining Catchment Specialist
WaterNSW
Level 14 169 Macquarie Street
PO Box 398
Parramatta, NSW 2124
www.waternsw.com.au

p.: +61 2 9865 2507
m.: +61 428 226 152/ +61 451 510 194
email: Ravi.Sundaram@waternsw.com.au

From: Peter Dupen
Sent: Monday, 5 February 2018 8:46 AM
To: Ravi Sundaram
Subject: FW: 744: New Berrima Clay/Shale Quarry - Updated Water Management Plan

Could you please respond to Lisa on filing this?

Pete Dupen
Mining Manager



Level 14, 169 Macquarie Street
Parramatta NSW 2150
P: 9865 2509 **M:** 0438 729 164
peter.dupen@waterNSW.com.au
www.waterNSW.com.au

From: Lisa Mitchell
Sent: Monday, 5 February 2018 8:45 AM
To: Peter Dupen
Subject: FW: 744: New Berrima Clay/Shale Quarry - Updated Water Management Plan

Morning

One for your team, let me know what ARK file is most relevant.

Cheers

Lisa Mitchell
Business Support Officer, Land & Catchment



T: 02 9865 2514
www.waterNSW.com.au

From: Scott Hollamby [<mailto:scott@rwcorkery.com>]
Sent: Thursday, 1 February 2018 7:24 PM
To: Environmental Assessments
Cc: Peter.YoungWhitford@australbricks.com.au; Cassandra.Steppacher@australbricks.com.au; Matthew Wall; Cameron.McCormick@brickworks.com.au
Subject: 744: New Berrima Clay/Shale Quarry - Updated Water Management Plan

Dear Sir / Madam,

Please find attached letter and Water Management Plan for the New Berrima Clay/Shale Quarry.

Kind regards

Scott Hollamby
Senior Environmental Consultant
Mobile: 0437 858 511

RW Corkery & Co Pty Limited
Geological and Environmental Consultants



Brooklyn
Level 1, 12 Dangar Road
PO Box 239

Orange
62 Hill Street
ORANGE NSW 2800

Brisbane
Suite 5, Building 3,
Pine Rivers Office Park



Our ref: OUT18/4901

RW Corkery and Co

Email: scott@rwcorkery.com

Dear Mr Hollamby,

Berrima Clay/Shale Quarry – Water Management Plan

I refer to your email dated 1 February 2018 requesting comments on the Water Management Plan for Berrima Clay/Shale Quarry. Department of Industry (DoI) Water has reviewed the Water Management Plan and provides the following comments.

The revised Water Management Plan appears reasonable in most respects, however a number of non-compliances with the conditions of approval remain. In addition, amendments required by the then DPI Water to clarify errors within the plan have not been made. An appreciation of the water management legislation and policy applying to the extractive industry operation (as a deemed aquifer interference activity) also needs to be demonstrated within the plan.

The plan lacks reasonable mitigation measures and contingency response actions, relying significantly only on a review of the causes of exceedances in surface water monitoring and reporting of the incident if it is found to be caused by the quarrying activity. This is not adequate for a robust and meaningful water management plan intended to support the development of an aquifer interference activity with transparent environmental credentials located within the Sydney Drinking Water Catchment.

Notwithstanding the assertions of excessive monitoring for water-related impacts previously documented by the consultant in their correspondence dated 6 May 2016, the proponent needs to either comply with the conditions of approval as they are written or seek a modification of the consent to remedy the non-compliance issues. Furthermore, future versions of the Water Management Plan need to recognise the NSW Aquifer Interference Policy requirements attendant on extractive industry operations in demonstrating the level of their impact on water sources and ecosystems.

Recommendations

Prior to approval of the revised Water Management Plan:

- 1 Surface water monitoring schedules need to include heavy metals, hardness and biological oxygen demand in Section 9.2 to comply with Condition 18(b) of Schedule 3.
- 2 Details of mitigation measures and response actions (other than simplistically reviewing causes and reporting incidents) are required in Sections 12, 14 and 15 to comply with Condition 18(b) of Schedule 3.

Level 11, 10 Valentine Avenue, Parramatta | PO Box 3720 Parramatta NSW 2124
t (02) 8281 7777 | f (02) 8838 7554 | www.water.nsw.gov.au

- 3 An outline of proposed monitoring of the impacts of the project on groundwater-related receptors is required in Section 10.2 to comply with Condition 18(c) of Schedule 3.
- 4 The mitigation measures described in Section 11 need to be more closely linked to the statutory requirements, limits or performance measures/criteria as required under Condition 3(c) of Schedule 5.
- 5 A contingency plan needs to be included in Section 14 to comply with Condition 3(e) of Schedule 5.
- 6 The statement in Section 10.1.2 needs to be amended in accordance with previous agency correspondence.
- 7 The statement in Section 11.2 needs to be amended in accordance with previous agency correspondence.

In considering the amount of water to be taken by the project and the requirement for licensing, the proponent should note that it is a legal requirement for an authorisation to be obtained for the pumping of groundwater during dewatering unless an exemption applies.

The assessment of such volumetric take has to consider the potential interaction with both intermittent and permanent groundwater systems present beneath the subject site.

A DoI Water hydrogeologist will be made available should a meeting to discuss the recommendations be required.

Please contact water.referrals@dpi.nsw.gov.au if you have further enquiries regarding this matter.

Yours sincerely,



Irene Zinger
**Manager Regulatory Operations – Metro
Lands and Water
Department of Industry**



Our ref: OUT18/4901

RW Corkery and Co

Email: scott@rwcorkery.com

Dear Mr Hollamby,

Berrima Clay/Shale Quarry – Water Management Plan

I refer to your email dated 1 February 2018 requesting comments on the Water Management Plan for Berrima Clay/Shale Quarry. Department of Industry (DoI) Water has reviewed the Water Management Plan and provides the following comments.

The revised Water Management Plan appears reasonable in most respects, however a number of non-compliances with the conditions of approval remain. In addition, amendments required by the then DPI Water to clarify errors within the plan have not been made. An appreciation of the water management legislation and policy applying to the extractive industry operation (as a deemed aquifer interference activity) also needs to be demonstrated within the plan.

The plan lacks reasonable mitigation measures and contingency response actions, relying significantly only on a review of the causes of exceedances in surface water monitoring and reporting of the incident if it is found to be caused by the quarrying activity. This is not adequate for a robust and meaningful water management plan intended to support the development of an aquifer interference activity with transparent environmental credentials located within the Sydney Drinking Water Catchment.

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- 5 A contingency plan needs to be included in Section 14 to comply with Condition 3(e) of Schedule 5.
- 6 The statement in Section 10.1.2 needs to be amended in accordance with previous agency correspondence.
- 7 The statement in Section 11.2 needs to be amended in accordance with previous agency correspondence.

In considering the amount of water to be taken by the project and the requirement for licensing, the proponent should note that it is a legal requirement for an authorisation to be obtained for the pumping of groundwater during dewatering unless an exemption applies.

The assessment of such volumetric take has to consider the potential interaction with both intermittent and permanent groundwater systems present beneath the subject site.

A DoI Water hydrogeologist will be made available should a meeting to discuss the recommendations be required.

Please contact water.referrals@dpi.nsw.gov.au if you have further enquiries regarding this matter.

Yours sincerely,



Irene Zinger
**Manager Regulatory Operations – Metro
Lands and Water
Department of Industry**



Geological and Environmental Consultants

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Pine Rivers Office Park
205 Leitchs Road

BRENDALE QLD 4500
Phone: (07) 3205 5400
Email: brisbane@rwcorkery.com

EMAIL TRANSMISSION

TO: Irene Zinger EMAIL: water.referrals@dpi.nsw.gov.au

ORGANISATION: Department of Industry Water DATE: 28 November 2018

COPY: Lauren Evans (DPE) REFERENCE: 744
Austral Bricks

NO. OF PAGES (including attachments): Many

SUBJECT: New Berrima Clay/Shale Quarry Water Management Plan – Response to Department of Industry Water Comments

Confidential Please Reply For Follow-up Urgent For your information

MESSAGE:

Dear Irene,

Please see below a series of responses to the Department’s comments provided for the New Berrima Clay / Shale Quarry Water Management Plan together with the updated Water Management (insertions have been retained as red text). Please also see attached a groundwater monitoring review completed by Jacobs.

We look forward to the Department’s confirmation of the proposed groundwater monitoring approach and acceptance of the revised Water Management Plan.

If the Department has any further queries, we encourage the Department to first contact myself by phone (07 3205 5400) to discuss these.

Kind regards
Scott Hollamby
Senior Environmental Consultant

Attached: Jacobs Groundwater Monitoring Review
Updated Water Management Plan

Response to DoI Water Comments on 2018 Water Management Plan

1. Surface water monitoring schedules need to include heavy metals, hardness and biological oxygen demand in Section 9.2 to comply with Condition 18(b) of Schedule 3.

In addition to the above comment, the following comment was also included in the Department’s letter.

“Notwithstanding the assertions of excessive monitoring for water-related impacts previously documented by the consultant in their correspondence dated 6 May 2016, the proponent needs to either comply with the conditions of approval as they are written or seek a modification of the consent to remedy the non-compliance issues.”

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28 November 2018

Page 2

As the Department is clearly aware, this issue was raised and responded to previously. Furthermore, the Water Management Plan is already approved and the updated plan does not seek to change the surface water monitoring. The (then) DPI Water response to the 6 May 2016 response was “*This is a matter for DP&E consideration given that this is a condition of the development consent*”. There have been no changes to the approved operations or other reasons for the status of this issue to have changed nor has DoI Water justified their change in position. Therefore, it is respectfully asserted that no change to the surface water monitoring is required.

2. Details of mitigation measures and response actions (other than simplistically reviewing causes and reporting incidents) are required in Section 12, 14 and 15 to comply with Condition 18(b) of Schedule 3.

Additional contingency response measures have been included in Section 14 for completeness. Section 12 relates to the evaluation of compliance and Section 15 relates to incident reporting. These are not the appropriate sections to outline mitigation measures. The Department is also referred to Section 8.2.2 which outlines erosion and sediment control monitoring which will be undertaken at least monthly and also following certain rain events. This will provide a regular check of the erosion and sediment control measures (which are the primary measures required to mitigate potential impacts upon water quality) and is by no means a ‘simplistic review of causes and reporting incidents’. Proactive and preventative measures are outlined in detail in Section 8 and Appendix A of the Water Management Plan. Please refer to responses to items 4 and 5 below for further commentary on these matters.

3. An outline of proposed monitoring of the impacts of the project on groundwater-related receptors is required in Section 10.2 to comply with Condition 18(c) of Schedule 3.

The Department is referred to Condition 18A of Schedule 3 (as referenced in Section 10.2) which requires the installation of groundwater monitoring bores prior to extraction exceeding a depth of 660m AHD. As such, the requirement for groundwater monitoring is not yet required. Notwithstanding, Austral has commissioned hydrogeologists with Jacobs to complete a review and recommend an appropriate groundwater monitoring approach. A copy of this review is attached for the Department’s review and acceptance. Should this approach be accepted, Section 10.2 of the Water Management Plan will be updated to reflect this approach (as already noted in Section 10.2).

4. The mitigation measures described in Section 11 need to be more closely linked to the statutory requirements, limits or performance measures/criteria as required under Condition 3(c) of Schedule 5.

It is noted that Condition 3(c) of Schedule 5 states the following.

“a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria.”

Section 3 outlines the relevant statutory requirements, Section 9.4 outlines the relevant triggers and Section 11 does in fact outline the measures that would be implemented (notably the sequence of these sections provides a logical progression and breakdown of these topics). Additional text has been added to Section 11 to make this clear. It is noted that the principal risk to water quality resulting from the Quarry is sediment. The Erosion and Sediment Control Plan (refer to Section 8 and Appendix A), as referenced in the mitigation measures, is an extremely comprehensive plan. Therefore, the Department’s assertion that “*the plan lacks reasonable mitigation measures...*” is not understood. Austral considers that the mitigation measures included are in fact best practice for the nature and scale of operations and are certainly not lacking.

5. A contingency plan needs to be included in Section 14 to comply with condition 3(e) of Schedule 5.

A contingency plan has been included in Section 14.

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28 November 2018

Page 3

6. The statement in Section 10.1.2 needs to be amended in accordance with previous agency correspondence.

Section 10.1.2 has been updated to reflect the agency's correspondence dated 22 February 2016.

7. The statement in Section 11.2 needs to be amended in accordance with previous agency correspondence.

Section 11.2 has been updated to reflect the agency's correspondence dated 22 February 2016.

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R.W. CORKERY & CO. PTY. LIMITED

3 December 2018

Page 2

If you would like to discuss any matter relating to the above, please don't hesitate to contact me.

Kind regards
Scott Hollamby
Senior Environmental Consultant

Attached: Updated Water Management Plan

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Scott Hollamby
Senior Environmental Consultant
RW Corkery and Co Pty Limited
Level 1, 12 Dangar Road
PO Box 239
BROOKLYN NSW 2083

OUT19/2442

via email: scott@rwcorkery.com

Dear Mr Hollamby,

RE: New Berrima Quarry – Review of Updated Water Management Plan and Groundwater Monitoring Approach

Thank you for providing the Department of Industry – Water (DoI Water) and the Natural Resources Access Regulator (NRAR) the opportunity to provide comment on the Water Management Plan (WMP) for the New Berrima Quarry.

A number of shortfalls remain in the current version of the WMP which remains currently non-compliant with approval conditions. The proponent must undertake the following prior to submission to the Department of Planning and Environment (DP&E) for their approval:

- Assess the project in terms of the NSW Aquifer Interference Guidelines (2012) (AIP);
- Include a geological and hydrogeological conceptual model in the above assessment;
- Provide an updated WMP which states appropriate groundwater level and quality trigger criteria, developed from the NSW AIP and appropriate ANZECC water quality guidelines;
- Include in the updated WMP a stated and appropriate groundwater trigger action response plan; and
- Clarify that community consultation is an include item relating to issues raised in relation to local bore water levels and monitoring of local bores. Should this be included in the complaints management procedure outlined within the Environmental Management Strategy for the Quarry, this needs to be stated as such in the WMP.

The following point is not required to be undertaken prior to approval of this WMP; however it should be noted by the proponent:

- Implement the installation of the required three sets of nested piezometers in accordance to *Condition 18A* and commence the required groundwater monitoring as soon as possible.

NRAR notes that there is potential for passive take of water from the overlying sandstone (Groundwater) and also from the Wingecarribee River along fractures into the pit once the quarry is developed below the river. The Proponent is required to ensure it obtains the necessary water licences for the project under the Water Act 1912 and/or Water Management Act 2000. All take of water, including passive take, resulting from the modification must be licenced unless subject to an exemption.

Attachment A provides further detail on the issues requiring attention by the proponent.

A hydrogeologist can be made available if you wish to discuss any of the issues raised above.

Please contact Ryan Shepherd, Water Regulation Officer (Newcastle) on (02) 4904 2650 or ryan.shepherd@nrar.nsw.gov.au if you have further enquiries regarding this matter.

Yours sincerely,



Alison Collaros
Manager, Licensing and Approvals (East)
Natural Resources Access Regulator
Department of Industry, Lands and Water Division
25/2/2019

ATTACHMENT A

Further Detail on Issues with current Water Management Plan

General

- Insufficient data has been provided to support the position that there would be no groundwater inflow in the quarry, nor surface water induced flows. DoI note that the quarry floor is expected to be eight metres below Wingecarribee River. Induced flows through fractures have a potential to increase overtime and can result in impacts and licencing issues.
- The proposed groundwater monitoring network is not sufficient to allow for triangulation and groundwater flow direction characterisation.
- Water quality monitoring did not follow the requirements of the conditions of approvals. Iron flocculation in local waterways is always of considerable concern.
- No Trigger Action Response Plan (TARP) has been included and the WMP that "assessment criteria is "not yet applicable". This approach is not acceptable. DoI Water emphasise that this relates to having baseline data, baseline data analysis, defined assessment criteria and hence leads to proposed actions to prevent or mitigate any potential exceedances. Further, the NSW AIP guidelines supply broad groundwater assessment criteria, combined with ANZECC guidelines, trigger criteria plus an action and response plan can be developed for initial oversight planning.

Groundwater and Surface Water Inflows

- Planned quarry depth of 640 m AHD. This is 8 m below Wingecarribee River water level of 648 m AHD. Shale aquifer systems generally consist of groundwater contained within and infiltrating along fractures and bedding planes in the shale, below the base of weathering (usually between 1-10m depth)
- There is potential for water loss / infiltration from the river towards the quarry void as quarrying progresses.
- Operations are beyond the required setback distance to the river
 - It has not been demonstrated that there is no hydraulic connection (i.e. no significant fracture / structural planes developed) between the proposed quarry site and the river at depths below the river level and hence below the groundwater table.
- Exploration drilling logs (EIS, 2012) indicated that there were intersections of an overlying sandstone ("stone") unit in a number of drill holes in the modified proposed pit area
 - Unit has not been detailed nor included in the hydrogeology assessment
 - This overlying unit is near surface hence it can reasonably be interpreted to be a local aquifer recharged by rainfall events
 - Therefore there is potential for this overlying aquifer to contain groundwater
 - There is potential incidental take of low levels of groundwater from this overlying aquifer.
- Whilst exploration drilling did not have any recorded groundwater intersects during drilling and logging, this is not to mean that there is no groundwater at that depth. Groundwater could be low yielding and take time to appear in a bore.
- No incidental take of groundwater has been quantified in the WMP.
 - DoI Water roughly estimate incidental groundwater takes in the order of 0.2 to 2.4 ML / year from the portion of the overlying aquifer ("stone") unit to be quarried in the proposed modified pit area
 - In combination with the potential take from elsewhere in the proposed pit (e.g. the part below river level elevation), the amount of groundwater that is to be extracted could be much greater over time

Groundwater Conceptual Model

The WMP does not provide sufficient supporting assessable evidence to demonstrate:

- That there is no groundwater in the proposed shale to be quarried
- That the level of groundwater is below the level of the proposed pit floor as implied by the desk top study prepared by the proponent's consultants
- No record of monitoring for groundwater after exploration drilling has been demonstrated
- The stated dryness of the shale is only indicative of a single point in time and unlikely to be truly representative

This information is required to ensure the Water Management Plan is fit for purpose and consistent with the NSW Aquifer Interference Policy (2012) guidelines.

Trigger Action Response Plan

- The WMP states that a plan to respond to any exceedances of the groundwater assessment criteria is "not yet applicable".
- The WMP includes numerous statements of intent in relation to instigating a groundwater monitoring programme at development stage three and afterward setting groundwater trigger criteria, as well as developing a trigger action response plan for groundwater.
- The WMP states that a review of the causes of exceedance [water quality] will occur internally once the water criteria are triggered. Incident reporting procedure is actioned if quarry activities are found to be the cause.

DoI Water emphasise that the objective is to have baseline data, baseline data analysis, defined assessment criteria and hence leads to proposed actions to prevent or mitigate any potential exceedances. Further the NSW AIP guidelines supply broad groundwater assessment criteria, combined with ANZECC guidelines, trigger criteria plus an action and response plan can be developed for initial oversight planning.

DoI Water maintain that all recorded significant exceedances from monitoring locations need to be investigated as to its cause and reported whether determined to be instigated by 'quarry activities' or otherwise.

Condition 18(c) "*Groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts*" relates to having and assessing collated baseline groundwater data. Assessment criteria are able to be developed from the baseline data within appropriate ANZECC guidelines. Unfortunately there is no current data available to assess for the project. DoI Water refer the proponent to the NSW AIP (2012) which has broad criteria that must be met by any aquifer interference works, these, with the ANZECC Guidelines, could be used as an overarching groundwater assessment criteria. Site specific criteria can then be developed as the project progresses.

Monitoring

The proposed alternative groundwater monitoring programme does not meet criteria or the intent of the required three nested piezometers, PA08_0212 Condition 18A.

- The alternative monitoring network proposed by Jacobs (2018)
 - two (a southern and a northern) monitoring bores in the Ashfield Shale,
 - with a second northern monitoring bore in the Hawkesbury Sandstone
 - all positions yet to be determined

PA08_0212 Condition 18A, for installation of three nested piezometers is to enable a measure of groundwater elevation and determine flow direction (flow net) by triangulation for any potential groundwater in the Ashfield Shale and the groundwater in the underlying Hawkesbury Sandstone, plus potential connectivity. Hence monitor potential impacts or lack of impacts on groundwater by the project to be able to demonstrate practice against the NSW AIP guidelines.

With respect to water chemistry, biological oxygen demand has had no criteria set as required by the condition (18(b)). Surface water has been present at monitoring sites WWS2, WWS8 and WWS3 during all baseline monitoring, though no biological oxygen demand was measured, hence no criteria for this has been set. The proponent states that no organic matter (e.g. from sewerage effluent or dead plant material) is predicted to be added to local waterways from the shale quarry activities, hence biological oxygen demand is not predicted to be significantly changed.

DoI Water notes that iron is also not included in the cation analyses of surface water samples. As iron may potentially be released by quarrying activities (and because iron flocculation in local waterways is always of considerable concern) the proponent must consider chemical analyses for iron, heavy metals (as requested in *Condition 18 (b)*), and for dissolved oxygen for all water samples.

No private bore monitoring is included in the WMP. The closest neighbour bore, GW019078, is 680 m to the northeast of the proposed modified pit location, next to the Wingecarribee River. DoI Water suggests a process to manage potential impacts to private bores be implemented. DoI Water notes, this matter may be included in the complaints management procedure as outlined within the Environmental Management Strategy for the Quarry, which was not reviewed as part of this assessment.

END OF ATTACHMENT A



30 April 2019

Page 2

Notes on New Berrima Quarry Modified Monitoring Network

These notes have been prepared to provide the Natural Resources Access Regulator with a modified monitoring network at the approved New Berrima Quarry operated by The Austral Brick Co Pty Limited. Condition 18A of PA08_0212 requires:

The proponent must install three pairs of nested piezometers prior to the Quarry pit floor reaching 660m AHD, in consultation with DPI – Water and to the satisfaction of the Secretary.

A detailed review of the previous geological data assembled for the New Berrima Quarry by Jacobs Australia Pty Limited (Jacobs) has assisted in modifying the proposed groundwater monitoring network in a manner that will satisfy Condition 18A. The information from the monitoring network would provide a good baseline if groundwater is present and a range of information to be included in the proposed upgraded Water Management Plan.

The attached Figure A displays the locations of the previous reliable drill holes together with the proposed piezometers locations. It is noted that drill hole locations from the 2012 drilling are not shown as they have since been established to be unreliable. The rationale for the placement of the piezometers and the approach to the drilling and installation is as follows.

1. STK 20 would be a diamond drill hole drilled with a collar height of 650m AHD for a depth of approximately 15m (635m AHD) – It is anticipated, based on previous drilling, that only Ashfield Shale would be encountered in this drill hole drilled to this depth. Information from this drill hole would extend the geological knowledge of the clay/shale resource towards the northern boundary of the mining lease beyond the defined resource area identified in the EIS for the Project (see attached **Figure A**). This hole would be completed as a piezometer with a screen with a nominal length of approximately 8m placed at the base of the hole with the bore annulus above the screen interval fully grouted back to the surface.
2. STK 21 would be a percussion hole drilled to approximately 8m below the Ashfield Shale / Hawkesbury Sandstone contact on the northwestern side of the approved extraction area. This hole would be completed as a piezometer and effectively form a pair of holes with STK 20 on the northern side of M(MO)L6. This hole would be completed as a piezometer with the bore annulus above the screen interval fully grouted back to the surface.
3. STK 22 would be located on the eastern side of the ‘Mandurama’ property and comprise either one or two holes. The first hole would be a diamond hole drilled to 635m AHD to establish whether there is any Hawkesbury Sandstone at a depth of 5m below the approved floor of the extraction area (640m AHD) – if no Hawkesbury Sandstone is encountered, no paired hole would be required and the diamond drill hole will be completed as a piezometer with an 8m screen interval fully grouted back to the surface. In the event the Hawkesbury Sandstone is encountered at or prior to the 635m AHD elevation, the drill hole will need to be completed at a depth approximately 8m below the contact with the Ashfield Shale with the bore annulus above the screen interval fully grouted back to the surface. A further drill hole (a percussion hole) would be drilled to a depth approximately 8m above the Hawkesbury Sandstone / Ashfield Shale contact. This hole would be completed as a piezometer to pair with the deeper hole.
4. STK 23 would be located on the southern side of the Mandurama property in an area immediately south of the area previously rejected as the Approved Limit of Extraction on the property in favour of the modified limit of extraction in which extraction is soon to commence. It is proposed that an initial percussion hole would be drilled to 635m AHD, i.e 5m below the approved extraction limit of 640m AHD. This hole would be completed as a piezometer. In the event that little or no sandstone is encountered in the initial hole, an additional hole would not be required, however, if substantial thicknesses of sandstone are encountered (as contemplated by NRAR), a percussion hole to a depth of approximately 20m would need to be drilled for use as a piezometer to monitor whether there are any perched aquifers associated with the sandstone units.

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30 April 2019

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It is noted that all screen lengths and depths provided are nominal and will be confirmed based upon drilling results. All monitoring bores will be completed in accordance with the Minimum Construction Requirements for Water Bores Australia.

It is considered that the modified monitoring network would provide the required information for inclusion in the updated Water Management Plan in the future. It is noted that the installation of the piezometers is proposed well in advance of the extraction reaching 660m AHD, however, Austral Bricks is keen to obtain as much relevant data prior to extraction reaching this elevation.

Attached: Figure A

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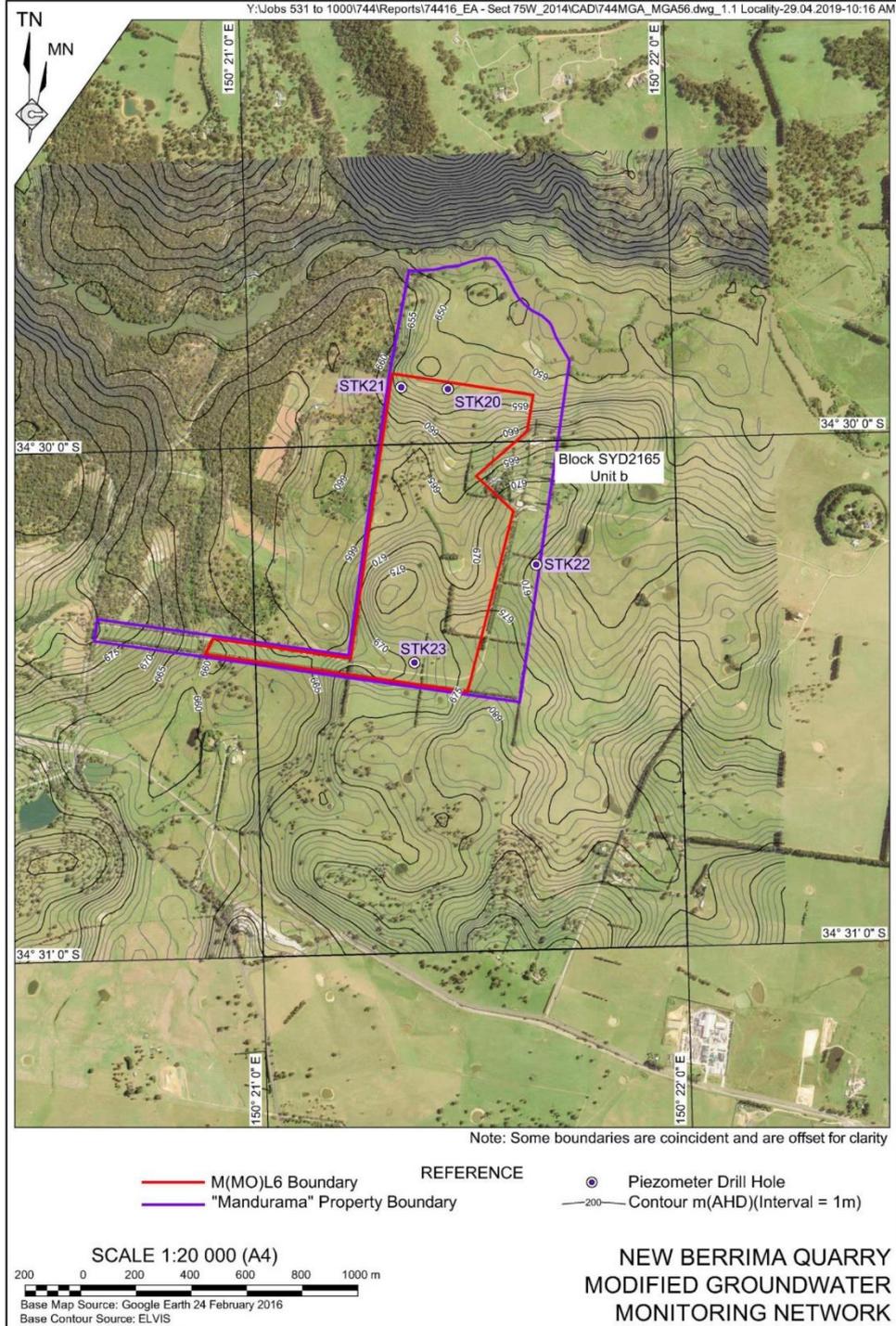
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30 April 2019

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Scott Hollamby

From: Rob Corkery
Sent: Monday, 27 May 2019 5:20 PM
To: Ellie Randall
Cc: Ryan Shepherd
Subject: 929_Berrima Road, New Berrima by Austral Brick Co

Greetings Ellie

Many thanks indeed for providing us this response today. I am pleased that the hydrogeologists have accepted the piezometer locations.

As requested, we will adjust the Water Management Plan in the manner nominated.

Regards
Rob

Robert W. Corkery
Principal/Managing Director

RW Corkery & Co Pty Limited

Geological and Environmental Consultants



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PO Box 239
BROOKLYN NSW 2083

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Suite 5, Building 3,
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Phone: (02) 9985 8511
Fax: (02) 6361 3622
Email: brooklyn@rwcorkery.com
Website: www.rwcorkery.com

Phone: (02) 6362 5411
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Email: brisbane@rwcorkery.com

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From: Ellie Randall <ellie.randall@nrar.nsw.gov.au>
Sent: Monday, 27 May 2019 11:26 AM
To: Rob Corkery <rob@rwcorkery.com>
Cc: Ryan Shepherd <ryan.shepherd@nrar.nsw.gov.au>
Subject: Re: 929_Berrima Road, New Berrima by Austral Brick Co

Hi Rob,

The hydrogeologists are happy with the piezometer locations.

Can you please update the Water Management Plan with the following details:

1. Drilling details, location information, and geology logs for the monitoring wells be included in the updated Water Management Plan. (As an appendix)
2. All collected and collated baseline data from the piezometers installed be included in an updated Water Management Plan

3. Updated hydrogeological cross sections or schematic sections be included in the revised Water Management Plan based upon the geology logs and groundwater data obtained from the monitoring bores.

Could you please provide clarity on the 'unreliable' location data (what is the nature of the unreliability of this data).

Give me a call if you have any questions.

Cheers

Ellie Randall | Water Regulation Officer

Natural Resources Access Regulator | Water Regulation (East)

Level 0 | 84 Crown Street | Wollongong NSW 2500

PO Box 53 Wollongong NSW 2520

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E: ellie.randall@nrar.nsw.gov.au

W: www.industry.nsw.gov.au



**Natural Resources
Access Regulator**

On Fri, May 24, 2019 at 10:10 AM Rob Corkery <rob@rwcorkery.com> wrote:

Greetings Ellie

Further to my earlier response, I would like to request that if the hydrogeologists reviewing this correspondence have any questions regarding the proposed methodology for the installation of the piezometers, I would appreciate it if they rang me directly (9985 8511) prior to finalising any correspondence so that the correspondence received does not require any further follow up – so that the drilling can be commissioned.

Regards

Rob

Robert W. Corkery

Principal/Managing Director

RW Corkery & Co Pty Limited

Geological and Environmental Consultants



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From: Ellie Randall <ellie.randall@nrar.nsw.gov.au>

Sent: Tuesday, 21 May 2019 6:36 PM

To: Rob Corkery <rob@rwcorkery.com>

Subject: Re: 929_Berrima Road, New Berrima by Austral Brick Co

Hi Rob,

I will attempt to obtain the response by the requested date. As I rely on input from our hydrogeologists I can not guarantee the date, however I have informed the team of the urgency of this request.

Kind regards

Ellie

On Tue, 21 May 2019, 17:25 Rob Corkery, <rob@rwcorkery.com> wrote:

Greetings Ellie

Many thanks for your advice that our request for urgent consideration of this matter is being considered.

It would be of considerable benefit if you can provide a response by COB Monday, 27 May 2019 as I have a planning meeting with our Client at 7am on Tuesday, 28 May 2019 at which we plan to set the date for the drilling of the piezometers for this Project.

Your assistance to achieve this would be greatly appreciated.

Regards

Rob

Robert W. Corkery
Principal/Managing Director

RW Corkery & Co Pty Limited

Geological and Environmental Consultants

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From: Ellie Randall <ellie.randall@nrar.nsw.gov.au>
Sent: Tuesday, 21 May 2019 7:15 AM
To: Rob Corkery <rob@rwcorkery.com>
Subject: Berrima Road, New Berrima by Austral Brick Co

Hi Rob,

I am currently reviewing (along with our hydro-geologists) your request regarding the groundwater bores for the above location.

It is expected we will have a response early next week.

Regards,

Ellie Randall | Water Regulation Officer

Natural Resources Access Regulator | Water Regulation (East)
Level 0 | 84 Crown Street | Wollongong NSW 2500
PO Box 53 Wollongong NSW 2520
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E: ellie.randall@nrar.nsw.gov.au
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Appendix B

Erosion and Sediment

Control Plan

Contents:

- ESCP000 – Cover sheet, Locality Plan and Drawing Schedule
- ESCP001 – General Notes – Sheet 1 of 2
- ESCP002 – General Notes – Sheet 2 of 2
- ESCP003 – Sediment Basin Schedule, Background Data and Calculations
- ESCP004 – Standard Drawings
- ESCP005 – Standard Drawings Continued
- ESCP006 – Informative Tables
- ESCP007 – Establishment Stages 1 – 4
- ESCP008 – Establishment Stages 5 – 7

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NEW BERRIMA SHALE QUARRY ESTABLISHMENT STAGE

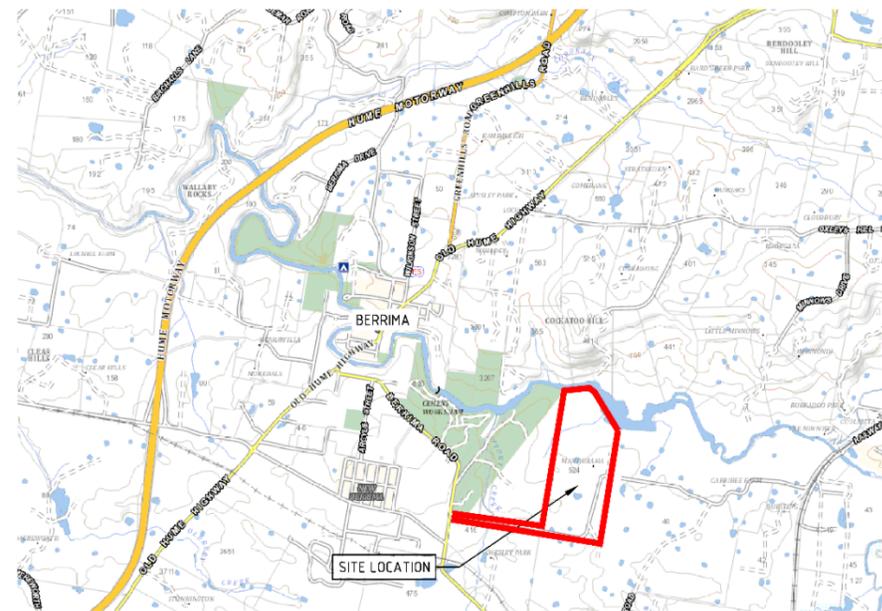
EROSION AND SEDIMENT CONTROL PLANS

FINAL

JANUARY 2018

DRAWING SCHEDULE

DRAWING NUMBER	DRAWING TITLE
14.000289_P01_ESCP000	ESCP - COVER SHEET, LOCALITY PLAN AND DRAWING SCHEDULE
14.000289_P01_ESCP001	ESCP - GENERAL NOTES - SHEET 1 OF 2
14.000289_P01_ESCP002	ESCP - GENERAL NOTES - SHEET 2 OF 2
14.000289_P01_ESCP003	ESCP - SEDIMENT BASIN SCHEDULE, BACKGROUND DATA & CALCULATIONS
14.000289_P01_ESCP004	ESCP - STANDARD DRAWINGS
14.000289_P01_ESCP005	ESCP - STANDARD DRAWINGS CONTINUED
14.000289_P01_ESCP006	ESCP - INFORMATIVE TABLES
14.000289_P01_ESCP007	ESCP - ESTABLISHMENT STAGES 1-4
14.000289_P01_ESCP008	ESCP - ESTABLISHMENT STAGES 5-7



LOCALITY PLAN
N.T.S.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS	DESIGN BY	DRAWING STATUS	North	CLIENT	PROJECT TITLE	DRAWING TITLE
						DESIGN BY M.P.	N.A.		AUSTRAL BRICKS	PO Box 1098, Berrima, NSW 2576 Sublots 7 & 8, 68-70 Station Street Berrima NSW 2576 (0) 02 4862 1633 (0) 02 4862 3088 email: reception@seec.com.au WWW.SEEC.COM.AU	ESCP COVER SHEET, LOCALITY PLAN AND DRAWING SCHEDULE
03	01/02/18	M.P.	M.N.	M.P.	AMENDED TO CLIENTS COMMENTS	FINAL APPROVAL M.P.					
02	14/12/17	M.P.	L.O.	M.P.	FINAL ISSUE	SCALE: (on A3 Original)					
01	14/11/17	M.P.	L.O.	M.P.	FINAL ISSUE		FINAL			NEW BERRIMA SHALE QUARRY	
00	6/04/16	M.P.	N.L.	M.P.	FINAL ISSUE						PROJECT NO. 14000289 SUB-PR NO. P01 DRAWING NO. ESCP000 REV 03
A	11/12/15	M.P.	M.R.	M.P.	DRAFT ISSUE - FOR CONSULTATION						

Plot Date: Thursday, 1 February 2018 11:26:06 AM CAD File Name: J:\14000289 New Berrima Shale Quarry\Drawings\14000289_P01_ESCP000_REV 03.dwg

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GENERAL REQUIREMENTS

EROSION AND SEDIMENT CONTROL DESIGN

The details shown on this drawing are primarily for construction stage erosion and sediment control requirements. This Erosion and Sediment Control Plan (ESCP) has been prepared in accordance with Blue Book Volume 1 (Landcom, 2004) and Volume 2E – Mines and Quarries and project approval conditions.

An erosion hazard assessment has been completed for the proposed works. The predicted soil loss has been determined in accordance with the following:

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

Where

- A = Annual soil loss due to erosion (t/ha/yr)
- R = Rainfall erosivity factor
- K = Soil erodibility factor
- LS = Topographic factor derived from slope length (SL) and slope gradient (S)
- C = Cover and management factor
- P = Erosion control practice factor

The following values have been used:

- R : 2580
- K : 0.064
- SL : Varies (200m MAX.)
- S : Varies (Typically 5 – 15% for general surfaces, up to 40% on bunds.)
- LS : Varies (Typically 1.19 to 5.96 for general surfaces up to 6.92 on bunds)
- C : 1.0 (Construction stage – i.e. no soil surface protection or ground cover applied)
- P : 1.3 (for general construction areas)

Based on the above data, the potential soil loss rate varies from 25t – 1656 t/ha/yr depending on the works.

DESIGN ASSUMPTIONS AND BACKGROUND INFORMATION

- Volumetric runoff coefficient (CV) = 0.64 (assuming hydrologic group D runoff coefficient – low infiltration, high runoff)
- 5-day, 80th %ile rainfall depth = 36.2mm
- Runoff coefficient (C_o) = 0.6 for pervious areas, 0.9 for disturbed areas.

EROSION AND SEDIMENT CONTROL INSTRUCTIONS

Before commencement of clearing, grubbing, 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 15 which are to be undertaken progressively as required throughout all stages of works. Clearing, grubbing, stripping and earthworks necessary to install the erosion and sediment controls are permitted but must be kept to an absolute minimum.

1. Barrier flagging (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.
2. Construct the site access road and seal it.
3. Ensure sediment fencing is in place downslope of stockpile areas and following Standard Drawing SD 6-8 (Refer to the 'Sediment Fencing' notes below).
4. Clean water diversions are to be constructed and stabilised. Refer to plans for details.
5. Sediment basins including the inlet and outlet dissipation structures are to be installed in the locations shown – refer to the 'Sediment Basin' notes and to the plan for details.
6. Onsite (dirty) water diversions (where applicable) are to be constructed and stabilised/lined – refer to plans for details. These might not be required depending on the exact locations of the basins.
7. Stockpile areas are to be established in the surplus overburden stockpile area and in accordance with the 'Stockpiling' notes below.
8. Once all of the above measures are complete and stable, construction works can proceed in accordance with the engineering plans. Topsoil should be managed in accordance with the 'Topsoil Stripping, Soil Management and Stockpiling' notes.
9. Slope lengths across disturbed lands to be maintained at the required intervals during all rainfall events (Refer to the 'Slope Lengths' notes).
10. Dust suppression to be carried out when required (Refer to the 'Dust Suppression' notes).
11. Temporary stabilisation of some lands prior to rainfall is to be undertaken in accordance with the 'Stabilisation' notes and the 'Rainfall Preparation Procedure'.
12. Treatment of dirty water is to be carried out as necessary in accordance with the 'Dirty Water Treatment and Discharge Requirements' notes.
13. Monitoring, maintenance and inspections are to be carried out regularly as required, in accordance with the 'Site Inspection and Monitoring and Maintenance' notes.
14. Undertake progressive stabilisation of lands as final earthworks are complete in each area (rather than waiting until the completion of works).
15. Final stabilisation is to be completed in accordance with the 'Stabilisation' notes and Table 1.

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 fences and/or site flagging 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 leaving the site pass over a stable access point to minimise bogging in these areas and minimise sediment tracking onto public roads.
- Barrier fencing is to be used at the discretion of the site manager to delineate all 'no go' areas.
- The soil erosion hazard on the site will be kept as low as practicable by minimising land disturbance and staging works. Some ways of doing this are outlined in Table 2.

TOPSOIL STRIPPING, SOIL MANAGEMENT AND STOCKPILING

Soils are to be stripped and managed in accordance with the following:

- Prior to topsoil stripping gypsum is to be spread over the ground surface at a rate of 1 tonne per hectare. The gypsum will be stripped up and premixed with the topsoil.
- As much as possible topsoils are to be stripped when moist (not wet or dry).
- Topsoils are to be stripped separately from the underlying subsoils. Topsoil depths may vary across the project site and care should be taken to avoid stripping underlying soil horizons (subsoils) with the topsoil layer.
- As much as possible subsoils are not to be worked when wet.

Stockpiles are to be established within the surplus overburden stockpile area. If additional or alternative locations for stockpiling are required they should be subject to approval prior to establishment. All stockpiles should incorporate clearly defined access controls and comply with the regulations outlined below.

All stockpiles must be constructed and maintained in accordance with Standard Drawing SD 4-1 and the following regulations:

- All stockpiles must have sediment fencing or equivalent installed around their bases as per Standard Drawing SD 4-1.
- Mulched vegetation, topsoil and subsoil (if applicable) are to be stockpiled separately wherever possible.
- Stockpiles are to be stabilised to achieve a C-factor of 0.5 (i.e. equivalent to 50% grass cover) within 2 days of formation using a temporary soil stabiliser (e.g. Vital P47/stonewall), geotextile, jute matting or equivalent. Also refer to Table 1.
- Topsoil stockpiles should be constructed to no more than 2 meters in height.
- Stockpiles should be battered at a maximum slope of 2H:1V wherever possible.

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 using the gypsum treated topsoil stripped during the initial stages of works (refer to the Topsoil Stripping, Soil Management and Stockpiling notes). 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)).
- Soils are to be treated with a slow release fertiliser to improve fertility. Fertiliser specifications and application rates are to be determined prior to final rehabilitation.
- Wherever possible, re-use cleared/mulched vegetation for either temporary or permanent stabilisation of disturbed areas. If mulch is not available or appropriate then the use of jute mesh, erosion control matting (ECM), soil stabilisers (e.g. Vital P47/stonewall) hydromulching or an appropriate approved alternative should be considered for provision of ground cover until vegetation has established.
- Diversion drains and table drains are to be stabilised to achieve the C-factors as detailed in Table 1, using jute matting, geotextile fabric, rock or TRM etc. Subsoil surfaces for all permanent drainage lines and concentrated flow areas and are to have gypsum applied at a rate of 5 tonnes per hectare prior to lining. Refer to the Table 5 for specific sizing and lining details for clean water drain stabilisation. Also refer to Standard Drawings (SD 5-6 and SD 5-7).
- Refer to the Stockpiling notes for stabilisation requirements on stockpiles. Also refer to Table 1 and Standard Drawing (SD 4-1).
- Sediment basin overflows and culvert inlets / outlets are to be stabilised in accordance with Table 4.
- As surfaces are stabilised (at least 90% of any finished area has at least 70% ground cover) and permanent drainage measures are installed, temporary erosion and sediment control structures and water management structures can be removed (e.g. sediment fence and diversion drains).
- Prior to forecast high rainfall or site shutdown (> 3 days) and in accordance with the 'Rainfall

Preparation Procedure', exposed soil areas will be 'locked down' using temporary ground covers such as biodegradable matting, geotextile matting, hydromulch, soil binders (e.g. Vital P47/stonewall) or similar. Refer to the 'Rainfall Preparation Procedure' for details.

- Highly trafficked areas (i.e. site access/haul roads, site compounds) will be stabilised where feasible with suitable trafficable materials such as DGB, roadbase, gravel or dustex to minimise erosion and provide stability to vehicle movements.

SEDIMENT FENCING

- Install sediment fences in the locations shown.
- 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.

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 (e.g. dustex, dustguard or equivalent) 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.
- Wherever possible access track running surfaces to be stabilised with crushed rock, aggregate, roadbase, a trafficable soil stabiliser or equivalent to assist with dust control on these surfaces.

SEDIMENT BASINS

- The required sediment basin sizes and details are shown on Table 3.
- The sediment basin/s have been sized (volumes determined) for the maximum area of disturbance (the worst case scenario) considering all stages.
- Sediment basin footprints shown on the plans are indicative only. A detailed survey analysis is to be undertaken prior to construction to ensure the required volumes can be achieved. If the required sediment basin volumes cannot be provided due to space or topographical restrictions additional basins/sumps are to be provided to supplement the basin volume and/or enhanced erosion control measures are to be carried out. This is to be undertaken by onsite survey in consultation with SEEC or an appropriately qualified soil conservationist (CPESC) prior to any land disturbance taking place once the workforce has mobilised to site. If full sized sediment basin volumes cannot be provided as shown on these ESCPs the plans are to be updated prior to commencing works.
- Sediment basins are to be constructed in accordance with engineering detail to ensure appropriate stability and compaction is achieved. Also refer to SD 6-4.
- The sediment basin/s are to be built to incorporate a primary outlet (weir overflow/spillway) sized to have a capacity to pass the 100 year peak flow – Refer to Table 4.
- An energy dissipater of equivalent width and lining to the spillway is to be constructed at each spillway outlet. Dissipater to extend onto stable, vegetated lands to ensure sheet flow.
- Gypsum is to be shallow ripped into the basin internal walls, spillway base and walls and dissipater ground surface during construction at a rate of 5t/ha.
- Safety controls are to be implemented around the sediment basins as required.
- Within 5-days of a rainfall event that causes in flow water in sediment basins 4, 9 and 10 will be pumped to storage 5 for treatment.
- Any release of water from sediment basins 1, 2 or 5 will need to be tested to comply with the water quality requirements prior to being discharged from site (Refer to the 'Dirty Water Treatment and Discharge Requirements' below for further details).
- Note if water is pumped into a tanker truck for later use, it cannot be discharged offsite without first being tested and if required, treated.
- Water in sediment basins 1, 2 or 5 must be effectively flocculated (if required), settled, tested to comply with the discharge requirements and discharged within 5-days or less following a rainfall event.
- All sediment basins inlets should be preloaded with gypsum (spread out over the inlet flow surface area) prior to rainfall. This will help to treat (floculate) site water.
- An automatic flocculation system at the sediment basin/s inlet may be necessary if water treatment is not being successfully achieved via manual methods.
- A sediment marker is to be installed within sediment basins indicating the sediment volume level.
- Sediment basins are to be desilted prior to reaching the indicated sediment volume levels.

(GENERAL REQUIREMENTS ARE CONTINUED ON THE FOLLOWING PAGE)

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS	DRAWING STATUS	North	CLIENT	PROJECT TITLE	DRAWING TITLE
						DESIGN BY DRAWN BY FINAL APPROVAL		AUSTRAL BRICKS	NEW BERRIMA SHALE QUARRY	ESCP GENERAL NOTES SHEET 1 OF 2
D3	01/02/18	M.P.	M.N.	M.P.	AMENDED TO CLIENTS COMMENTS	SCALE: (on A3 Original)				
D2	14/12/17	M.P.	L.O.	M.P.	FINAL ISSUE	N.A.				
D1	14/11/17	M.P.	L.O.	M.P.	FINAL ISSUE					
D0	04/04/16	M.P.	N.L.	M.P.	FINAL ISSUE					
A	11/12/15	M.P.	M.R.	M.P.	DRAFT ISSUE – FOR CONSULTATION	FINAL				

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GENERAL REQUIREMENTS CONTINUED

DIRTY WATER TREATMENT AND DISCHARGE REQUIREMENTS

- 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) or equivalent NTU based on approved correlation; and
 - pH 6.5 to 8.5; and
 - no visible trace of oil and grease.
- Flocculation might be achieved by using gypsum at a rate of approximately 30 kg/100 m3 of stormwater. Alternative flocculating agents can only be used if approval by EPA has been granted. Refer to manufacturers guidelines for dosage details.
- Ensure the flocculant/coagulant is thoroughly mixed/diluted with water prior to spreading evenly over the entire pond surface for proper treatment of water. Dirty water from the basins can be used for mixing the flocculant/coagulant.

SLOPE LENGTHS

- Ideally slope lengths should be restricted to maximum 80m intervals across all disturbed lands during rainfall. This will reduce the amount of sediment reaching a basin and so extend the de-silting period.
- Diversion bunds/drains, low flow earth banks (Standard Drawing SD 5-5) or sandbags/equivalent can be installed prior to rainfall event to achieve this.

RAINFALL PREPARATION PROCEDURE DURING SITE ESTABLISHMENT

- The weather forecast is to be monitored regularly (at least daily and hourly when rainfall is imminent) by the site environmental manager (or their representative).
- At least 48 hours prior to forecast rainfall (> 60% chance of 12mm or more over 24 hours), the site environment manager (or their representative) is to inspect (and record the condition of, and any action required) the condition of all erosion and sediment controls and undertake any works necessary to establish/maintain them.

SITE INSPECTION, MONITORING AND MAINTENANCE DURING SITE ESTABLISHMENT

- Regular site inspections are to be conducted by the site environment manager (or their representative) and records of all such inspections are to be made available for review. Inspections are to be undertaken:
 - At least weekly during construction hours; and
 - Prior to forecast significant (>12mm) 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 (if safe to do so).
- 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.
- Sediment or rocks tracked from the site will be removed from public roads as soon as possible (e.g. with street sweepers).
- After rainfall, sediment accumulated in trapping devices (e.g. filter dams, 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 at the site's weather station (AB02).
- Safe storage areas for wastes, fuels, excess concrete and other potential contaminants are to be delineated by the site manager in accordance with the project requirements.
- Adequate supplies of erosion control measures (e.g. geofabric rolls, jute matting, polymer soil binders) are to be maintained in the site compound for rapid deployment as required.
- Adequate supplies of flocculant (and flocculating equipment) are to be available as required.
- Dust suppression is to be undertaken as required to minimise the risk of offsite dust impacts. Refer to the Dust Suppression notes for details.

SITE INSPECTION, MONITORING AND MAINTENANCE DURING OPERATIONS

- The site will be operated on a campaign basis so staff will not be on site full-time.
- However, the site will be inspected within two-days after it receives rainfall sufficient to cause inflow into a sediment basin. This may be measured automatically.
- Sediment basins will be managed per the 'Sediment Basin' notes to re-gain the required settling volumes.
- Other water management measures (e.g. diversion drains, spillways, etc.) will be inspected and recorded.
- Areas of rehabilitation will be inspected.
- Erosion and sediment control measures will be maintained as necessary.

ORDER OF WORKS

STAGES 1 TO 4 ESTABLISHMENT

Install the following measures in order, except for items 23 and 24 which should be progressively implemented during works.

- Construct site office and stabilised access from Berrima Road.
- Construct clean water diversion drains CD2 and CD3 and stabilise and then their outlets.
- Pump out Dam 1 (which will initially be used as a sediment basin). Check its capacity and adjust if necessary. Construct a new spillway (if necessary); stabilise any disturbed lands.
- Build SB11.
- Construct dirty water drains to ensure all disturbed areas within Catchments 1 and 11 drain to SB1 and SB11.
- Pump out Dam 5 which will be used as a sediment basin. Check its capacity and adjust if necessary. Construct its spillway and stabilise any disturbed lands.
- Pump out and enlarge Dam 2. Construct the spillway and stabilise any disturbed lands.
- If necessary construct dirty water drains to ensure all disturbed areas within Catchment 2 drain to Dam 2.
- Install clean water diversion drain CD1 and stabilise it.
- Delineate lands south of the extraction area that will be filled and the haul road with barrier fences to restrict access – refer to Table 2 and to the Barrier Fence Notes.
- Strip the topsoil from these locations and stockpile it to the requirements of the Stockpiling Notes.
- Construct the haul road to provide access to the sites of the central and northern visibility barriers and the extraction area. Stabilise any disturbed lands.
- Construct Dam 10 which will be a sediment basin; stabilise any disturbed lands.
- If necessary construct dirty water drains to ensure all disturbed areas within Catchment 10 drains to SB10.
- Pump out Dam 4 (which will initially be used as a sediment basin) and construct a new spillway (if necessary); stabilise the disturbed lands.
- If necessary construct dirty water drains to ensure all disturbed areas within Catchment 4 drain to SB4.
- When all sediment basins and their associated drains and spillways are complete, general earthworks may begin. Ensure all dirty water drains to a sediment basin.
- Delineate the extent of all works with barrier fences to restrict access – refer to Table 2 and to the Barrier Fence Notes.
- Strip the topsoil from the work areas and the extraction area. Stockpile it to the requirements of the Stockpiling Notes.
- Construct Dam 7.
- Build the central and northern visibility barriers.
- Build the southern visibility barrier. This barrier requires special treatment as the southern face and the western part of the northern face will not be able to drain to SB1. In this location soil binder will be kept on hand and will be applied to all disturbed surfaces that don't drain to SB1 if rain is forecast (more than 60% chance of more than 10mm in 24 hours). Alternatively soil binder may be pre-emptively applied to completed surfaces.
- Ensure all dirty water drains to a sediment basin. For small areas (<2,500 m2) that can't, drain to a sediment capture device e.g. sediment fence, rock filter dam, sediment sump.
- Progressively stabilise all disturbed surfaces to the requirements of Table 1.
- Manage the sediment basins to the requirements of the 'Sediment Basin' and 'Dirty Water Treatment and Discharge Requirements' Notes.
- Once the disturbed lands are stabilised (Table 1) Storages 1 and 4 will be converted to clean water storages and CD2 can be removed.
- Once the disturbed lands are stabilised (Table 1) Sediment Basin 10 and any associated catch drains can be removed and the lands stabilised.
- Begin extraction.
- Remove SB11 and DD1 when Western Access Road is stable.

STAGES 1 TO 4 OPERATION

- The only dirty water storages in this stage are SB2 and SB5.
- Manage them per the Sediment Basin notes.
- During this period ensure diversion drains are stable and that any areas of rehabilitation are adequately stabilised (Table 1).
- Pump-out Dam 7 as necessary.

STAGES 5 TO 7 ESTABLISHMENT

- This stage involves the expansion of the extraction area north. As part of the works the central visibility barrier will be removed.
- Install clean water diversion CD3 at Dam 4 which will become a sediment basin while works occur.
- Pump out Storage 4.
- Install SB9; stabilise the lands.
- Strip the topsoil in the Extraction Area footprint and stockpile it according to the stockpiling notes.
- Water trapped in SB9 will be pumped to SB5 for treatment.
- When the extraction area is internally draining SB4 may revert to a clean water storage and SB9 may be removed; stabilise any disturbed lands.
- Progressively stabilise all disturbed surfaces outside of the extraction area to the requirements of Table 1.
- Manage SB5 to the requirements of the 'Sediment Basin' Notes.
- Dam 7 will be removed as part of the creation of the terminal batters on the southern boundary of the construction site.

STAGES 5 TO 7 OPERATION

- The only dirty water storages in this stage are SB2 and SB5.
- Manage them according to the requirements of the 'Sediment Basin' notes.
- During this period ensure diversion drains are stable and that any areas of rehabilitation are adequately stabilised (Table 1).

POST QUARRY

- Post Quarry works will be to:
 - Remove the Surplus Overburden Stockpile by transferring the material to the former Extraction Area.
 - Rehabilitate the former Surplus Overburden Stockpile area.
 - Remove the northern visibility barrier and stabilise the land there.
 - Rehabilitate the Extraction Area, although it will remain internally-draining to Dam 8.
- No new Sediment basins or water storages will be required, however:
 - SB2 will be used in the same manner as it was during operation until its catchment is stabilised. At that time it will be converted back to a clean water dam.
 - SB5 will be managed as a sediment basin during the removal and stabilisation of the northern visibility barrier. It will be pumped dry before works begin. Once its catchment is stabilised it will become a clean water dam.
- Progressively stabilise all disturbed surfaces to the requirements of Table 1.
- Manage the sediment basins to the requirements of the 'Sediment Basin' notes.

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03	01/02/18	M.P.	M.N.	M.P.	AMENDED TO CLIENTS COMMENTS	SCALE: (on A3 Original)				
02	14/12/17	M.P.	L.O.	M.P.	FINAL ISSUE	N.A.				
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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: - Batters, steep slopes (> 30%), works in and/or around concentrated flow paths, surfaces around culvert headwalls	C-factor = 0.1 (60% grass cover or equivalent ground cover ⁽¹⁾)	Applies 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 / m ² 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	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 soil stockpile surfaces with Vital P47/stonewall or equivalent ⁽¹⁾ . - Vital dilution rate = 1:10 (Vital:Water). - Application rate = 1L / m ² 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.
Disturbed lands on southern visibility barrier that do not drain to SB1	C-factor = 0.1 (60% grass cover or equivalent ground cover ⁽¹⁾)	Before rainfall	Soil binder (i.e. Vital P47/stonewall or equivalent ⁽¹⁾)	- Spray all exposed surfaces with Vital P47/stonewall or equivalent ⁽¹⁾ . - Vital dilution rate = 1:10 (Vital:Water). - Application rate = 1L / m ² 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.

TABLE 1 - STABILISATION REQUIREMENTS AND TREATMENT METHODS CONTINUED				
POST CONSTRUCTION				
LANDS	STABILISATION REQUIREMENT	TIMEFRAMES	TREATMENT METHODS - PRODUCTS	REMARKS
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 to moderate	- 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 / m ² 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.
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 / m ² 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 / m ² 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.

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. All thinning activities additional to the agreed scope must be approved by RMS prior to commencement.

TABLE 3 - SEDIMENT BASIN SIZING TABLE				
Sediment Basin Number	Total Catchment (ha)	Soil Storage Zone (m ³)	Settling Zone (m ³)	Total volume (m ³)
1	3.3	100	1,300	1,400 (existing)
2	2.8	175	1,625	1,800
4	3.8	500	900	1,400
5	18.5	1,100	4,300	5,400
9	2.1	150	490	640
10	0.75	60	170	230
11	1	30	230	260

TABLE 4 - SPILLWAY SIZINGS**			
Sediment Basin Number	Base Width (m)	Slope %	Lining
1	3	5	100 mm rock over geotextile for first 5 m thence grass
2	4	5	100 mm rock over geotextile for first 5 m thence grass
4	5	5	100 mm rock over geotextile for first 5 m thence grass
5	10	5	100 mm rock over geotextile for first 5 m thence grass
9	3.5	5	100 mm rock over geotextile for first 5 m thence grass
10	2	5	100 mm rock over geotextile for first 5 m thence grass
11	2	5	100 mm rock over geotextile for first 5 m thence grass

TABLE 5 - CLEAN WATER DIVERSIONS				
Drain Number	Base width (m)	Depth (m)	Grade %	Lining
CD1	0.5	0.6	4	Grass
CD2	0.5	0.75	1.5-2	Grass
CD3	0.5	0.6	4	Grass

Note: all side slopes at 1V:3H.

TABLE 6 - DIRTY WATER DIVERSIONS				
Drains	Base width (m)	Depth (m)	Grade %	Lining
All Dirty Water Drains	0.5	0.6	Varies	Jute Mesh & Bitumen

Note: all side slopes at 1V:3H.

**Note: minimum embankment height above spillway must be 1.2m

NOTE - Tables 1 & 2 do not apply to internally draining excavation areas

⁽¹⁾ - Equivalent cover/product must achieve the equivalent C-factor with proven research/documentation to verify this.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS	DRAWING STATUS
						DESIGN BY M.P.
						DRAWN BY M.R.
						FINAL APPROVAL M.P.
03	01/02/18	M.P.	M.N.	M.P.	AMENDED TO CLIENTS COMMENTS	SCALE: (on A3 Original) N.A.
02	14/12/17	M.P.	L.O.	M.P.	FINAL ISSUE	FINAL
01	14/11/17	M.P.	L.O.	M.P.	FINAL ISSUE	
00	6/04/16	M.P.	N.L.	M.P.	FINAL ISSUE	
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PROJECT TITLE

NEW BERRIMA SHALE QUARRY

DRAWING TITLE

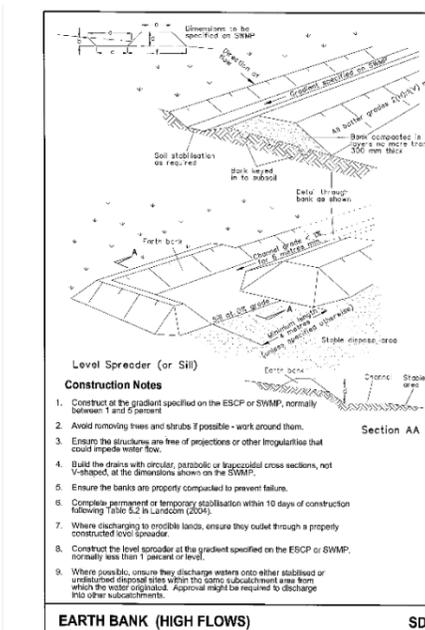
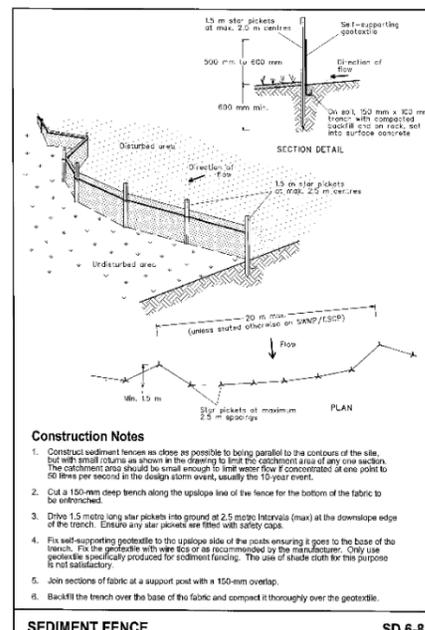
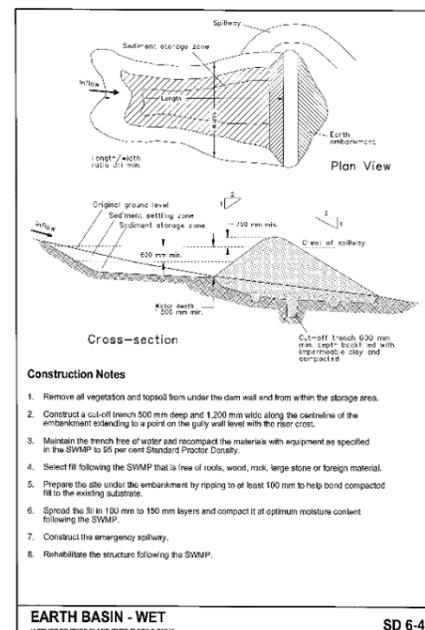
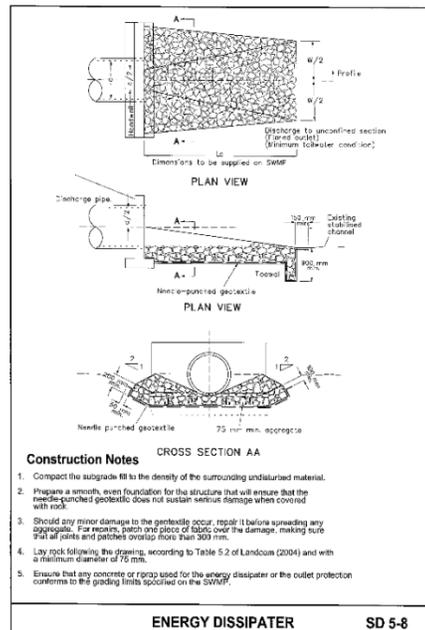
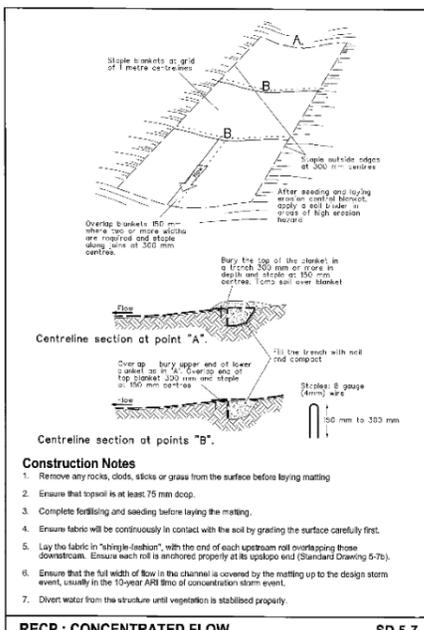
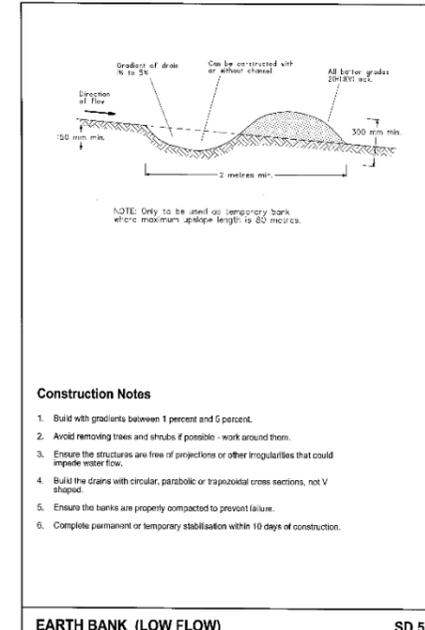
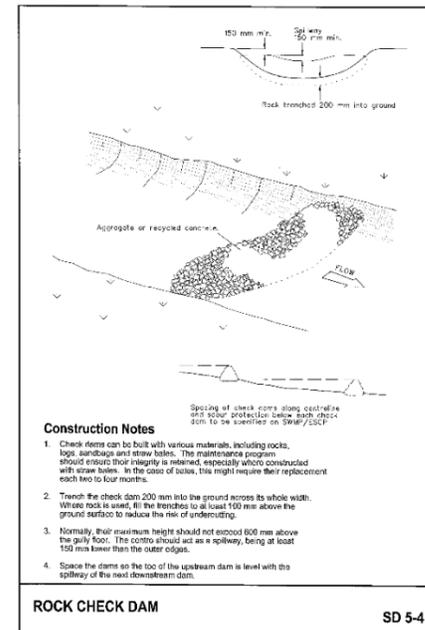
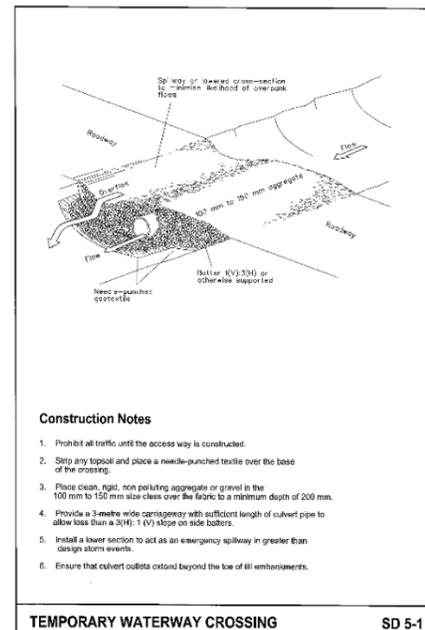
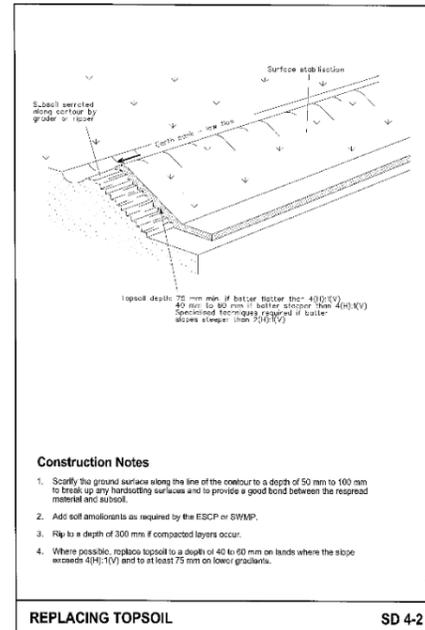
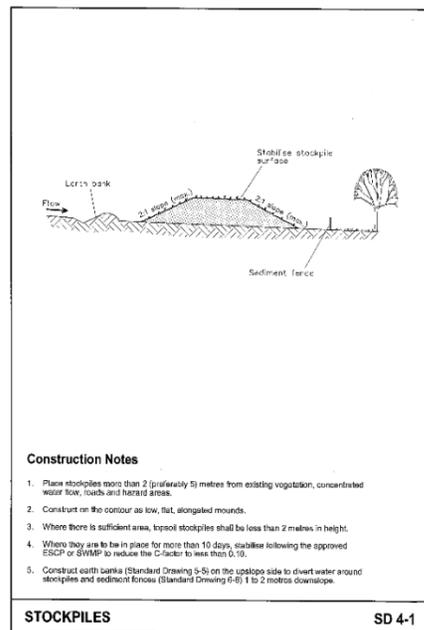
ESCP
SEDIMENT BASIN SCHEDULE,
BACKGROUND DATA AND CALCS

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
14000289	P01	ESCP003	03

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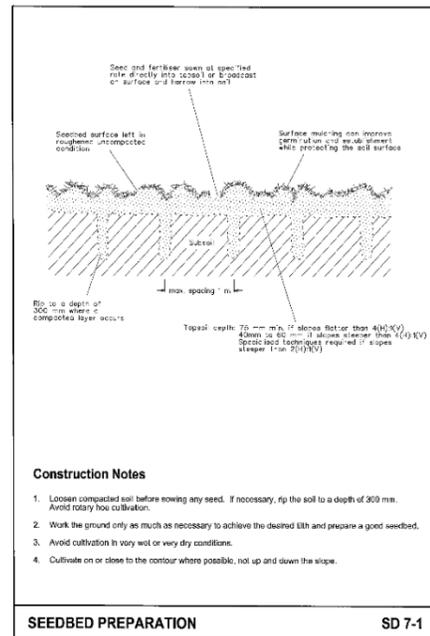
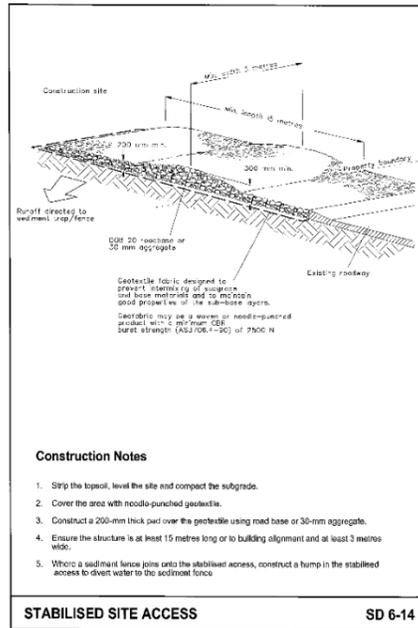
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						CLIENT
						DESIGN BY: M.P.
						DRAWN BY: M.R.
						FINAL APPROVAL: M.P.
						SCALE: (on A3 Original) N.A.
						FINAL

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PROJECT TITLE	DRAWING TITLE
NEW BERRIMA SHALE QUARRY	ESCP STANDARD DRAWINGS
PROJECT NO.	SUB-PR NO.
14000289	P01
DRAWING NO.	REV
ESCP005	03

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02	14/12/17	M.P.	L.O.	M.P.	FINAL ISSUE					
01	14/11/17	M.P.	L.O.	M.P.	FINAL ISSUE					
00	6/04/16	M.P.	N.L.	M.P.	FINAL ISSUE					
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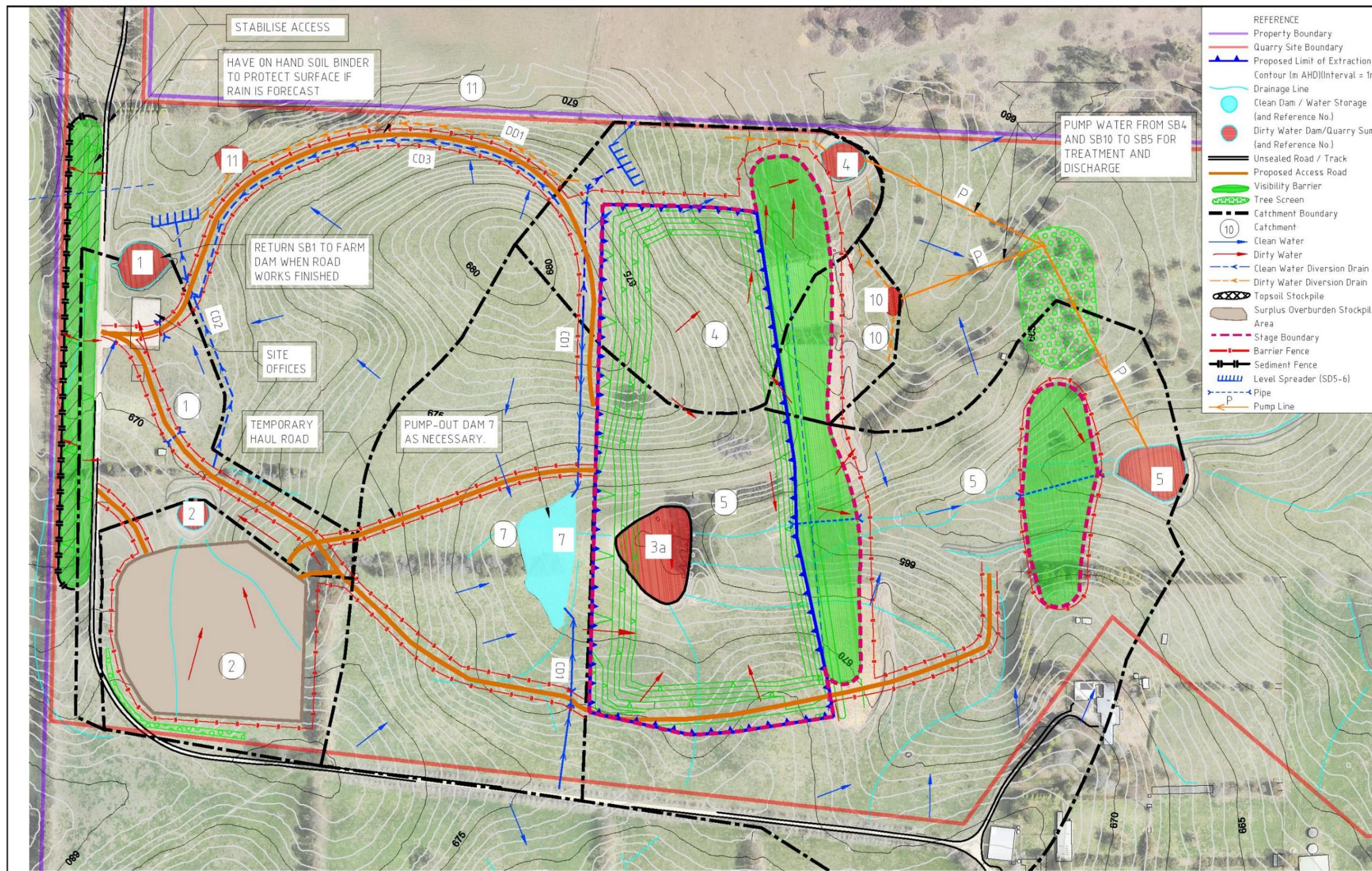
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PROJECT TITLE	NEW BERRIMA SHALE QUARRY
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DRAWING TITLE			
ESCP STANDARD DRAWINGS CONTINUED			
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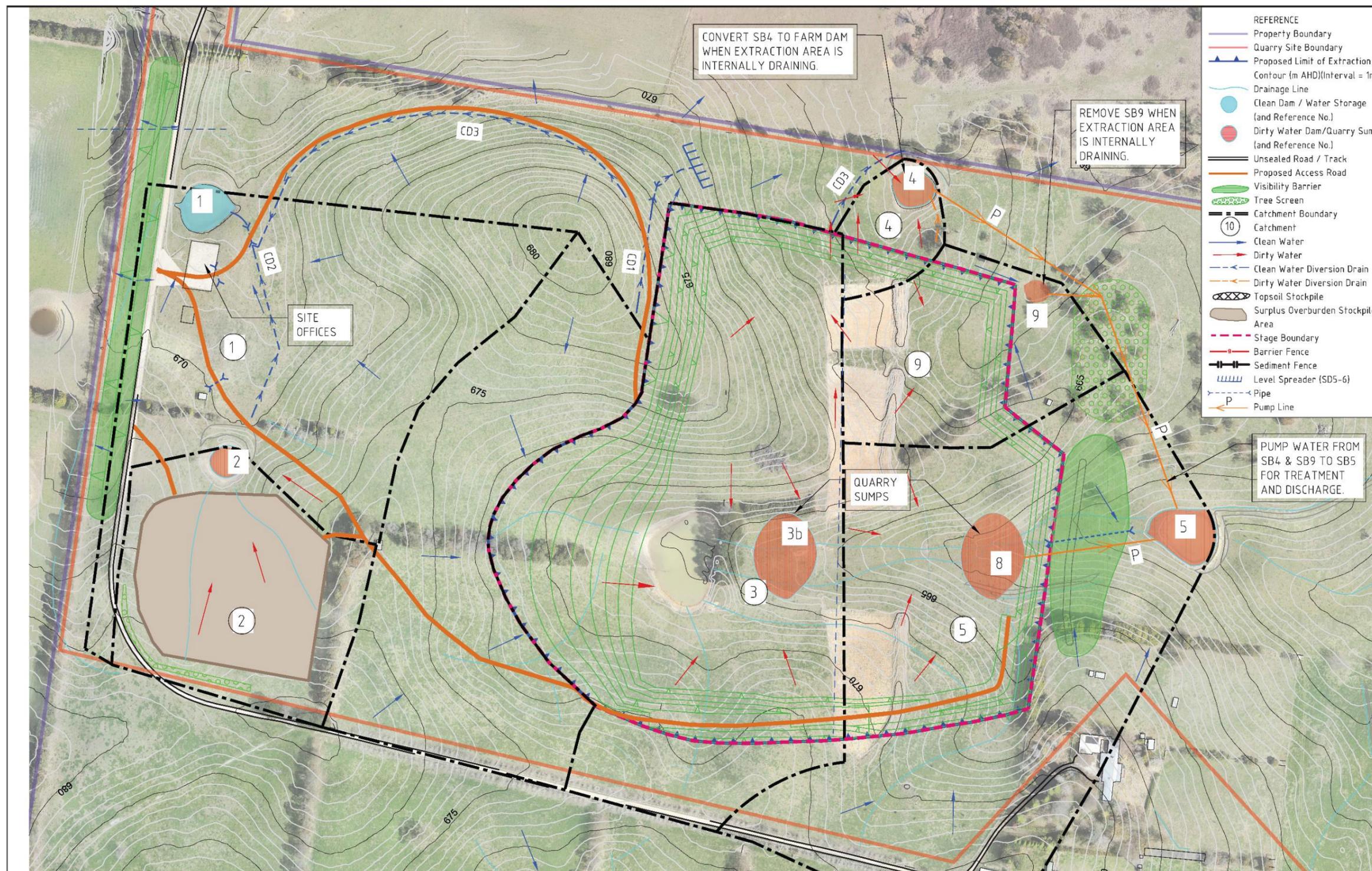
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Q2	14/12/17	M.P.	L.O.	M.P.	FINAL ISSUE				(on A3 Original)	FINAL				
D1	14/11/17	M.P.	L.O.	M.P.	FINAL ISSUE									
00	6/04/16	M.P.	N.L.	M.P.	FINAL ISSUE									
A	11/12/15	M.P.	M.R.	M.P.	DRAFT ISSUE – FOR CONSULTATION									

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- REFERENCE**
- Property Boundary
 - Quarry Site Boundary
 - Proposed Limit of Extraction Contour (m AHD)(Interval = 1m)
 - Drainage Line
 - Clean Dam / Water Storage (and Reference No.)
 - Dirty Water Dam/Quarry Sump (and Reference No.)
 - Unsealed Road / Track
 - Proposed Access Road
 - Visibility Barrier
 - Tree Screen
 - Catchment Boundary
 - Catchment
 - Clean Water
 - Dirty Water
 - Clean Water Diversion Drain
 - Dirty Water Diversion Drain
 - Topsoil Stockpile
 - Surplus Overburden Stockpile Area
 - Stage Boundary
 - Barrier Fence
 - Sediment Fence
 - Level Spreader (SD5-6)
 - Pipe
 - Pump Line

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS	DESIGN BY	DRAWING STATUS
03	01/02/18	M.P.	M.N.	M.P.	AMENDED TO CLIENTS COMMENTS	M.P.	FINAL SCALE: (on A3 Original) NTS
02	14/12/17	M.P.	L.O.	M.P.	FINAL ISSUE	M.P.	
01	14/11/17	M.P.	L.O.	M.P.	FINAL ISSUE	M.P.	
00	6/04/16	M.P.	N.L.	M.P.	FINAL ISSUE	M.P.	
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PROJECT TITLE

NEW BERRIMA SHALE QUARRY

DRAWING TITLE

ESCP ESTABLISHMENT STAGES 5-7

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14000289	P01	ESCP008	03

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