

Soil and Water Management Plan

Dolwende Quarry - Haul Road and Processing Area

transport | community | mining | industrial | food & beverage | energy



Prepared for:

Upper Hunter Holdings

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Date:

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- Appendix A: Erosion and Sediment Control Plan
- Appendix B: Standard Drawings

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1. Background

1.1 Purpose and Scope

The purpose of this SWMP is to describe how the haul road and processing areas of the quarry will be managed to minimise erosion, sedimentation and pollution risks to water quality beyond the land to which Development Consent SSD6519 applies - Lot 1 DP 1160936, Lot 2 DP 1160936, Lot 3 DP 1160936, Lot 4 DP 1160936 and Lot 1 DP 1178562 - whilst ensuring compliance with the Conditions of Consent SSD 6519, Environment Impact Statement (EIS) and other regulatory requirements. The SWMP will inform the soil and water management activities undertaken by the construction contractor.

This SWMP is applicable to all activities during the construction of the haul road and processing area. The SWMP is a working document that will be updated to address operational stages of the quarry.

1.2 Objectives

The key objective of the SWMP is to ensure impacts to soil, surface water are managed in accordance with the impacts and mitigation measures identified in the EIS. To achieve this, the following will be undertaken:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise potential adverse impacts to soils and surface water from construction of the Project;
- Ensure that where practicable, spoil that is suitable for reuse is reused within the Project;
- Ensure appropriate measures are implemented to address the safeguards detailed in the EIS; and
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements listed in Section 1.3.

1.3 Legislation and Guidelines

The main legislation relevant to the management of soil and water quality for the Project is:

- Protection of the Environment Operations Act 1997 (POEO Act);
- Environmental Planning and Assessment Act 1979 (EP&A Act);
- Water Management Act 2000 (WM Act);
- Water Act 1912 (Water Act); and
- Water Management (General) Regulation 2004 (WM Regulation).

Other relevant policies / specifications include:

- Guidelines for Controlled Activities on Waterfront Land (DPI 2012)
- Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition (Landcom 2004) (Blue Book);
- Managing Urban Stormwater: Soils and Construction, Volume 2A Installation of Services, 4th Edition (DECC 2008);
- Managing Urban Stormwater: Soils and Construction, Volume 2C Unsealed Roads (DECC 2008a);
- Managing Urban Stormwater: Soils and Construction, Volume 2E – Mines and Quarries (DECC, 2008).
- Best Practice Erosion and Sediment Control (IECA, 2008);

1.4 Consultation

EPA advise on 21/03 they do not review EMPs.

DPI Water consulted 26th February and 21st March 2019 but no response.

2. Consent and Licence Conditions

The development consent conditions relevant to this SWMP are provided in Table 2-1. Mitigation measures from the Environmental Impact Statement (EIS) relevant to this SWMP are listed in Section 8.

A cross reference is also included to indicate where the condition is addressed, either within this Plan or related documents.

Table 2-1 Development Consent Conditions Relevant to this SWMP

No.	Condition	Reference
1.	<i>In addition to meeting the specific performance measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation, or rehabilitation of the development.</i>	This Plan
16.	<i>The Applicant must comply with the discharge limits in any EPL, or with S120 of POEO Act.</i>	Section 6.6 and 6.8
17.	<p><i>The Applicant must prepare a Soil and Water Management Plan for the development to the satisfaction of the Secretary. This plan must:</i></p> <p><i>a) be prepared by suitably qualified and experienced person/s endorsed by the Secretary;</i></p> <p><i>b) be prepared in consultation with the EPA and DPI Water;</i></p> <p><i>c) be submitted to the Secretary for approval prior to commencement of development under this consent, unless otherwise agreed by the Secretary;</i></p> <p><i>d) include a:</i></p> <p><i>i. Site Water Balance that includes:</i> <i>details of:</i></p> <ul style="list-style-type: none"> <i>• sources and security of water supply;</i> <i>• water use and management on site;</i> <i>• any off-site water transfers; and</i> <i>• reporting procedures; and</i> <i>• measures that would be implemented to minimise clean water use on site;</i> <p><i>ii. Erosion and Sediment Control Plan that:</i></p> <ul style="list-style-type: none"> <i>• is consistent with the requirements of the Landcom’s Managing Urban Stormwater: Soils and Construction manual (Volume 2E Mines and Quarries);</i> <i>• identifies activities that could cause soil erosion and generate sediment;</i> <i>• describes measures to minimise soil erosion and the potential for the transport of sediment to downstream waters;</i> <i>• describes the location, function and capacity of erosion and sediment control measure structures; and</i> <i>• describes what measures would be implemented to maintain (and if necessary decommission) the structures over time.</i> <p><i>iii. Surface Water Management Plan that includes:</i></p> <ul style="list-style-type: none"> <i>• detailed baseline data on surface water flows and quality in water bodies that could potentially be affected by the development;</i> <i>• surface water impact assessment criteria;</i> <i>• a protocol for managing any exceedances of the surface water impact assessment criteria;</i> <i>• a description of any water licences used to account for take from surface water sources;</i> <i>• a detailed description of the surface water management system on site including the:</i> <ul style="list-style-type: none"> <i>○ clean water diversion system;</i> <i>○ dirty water management system;</i> <i>○ water storages, including their capacity to contain dirty water during flood events;</i> <i>○ irrigation areas; and</i> <i>○ design of creek and stream crossings; and</i> 	<p>Page iv. Section 1.4</p> <p>Section 5</p> <p>Section 6 Appendix A and Appendix B</p> <p>Section 3.3</p> <p>Section 7.2</p> <p>Section 7.3</p> <p>Sections 5.1 to 5.3</p> <p>Section 6 and Appendix A</p>

No.	Condition	Reference
	<ul style="list-style-type: none"> • a program to monitor and report on: <ul style="list-style-type: none"> ○ the effectiveness of the water management system; ○ any surface water discharges, including overflows from the sediment dam; ○ the quality of water discharged from the site to the environment, if any; ○ surface water flows and quality in local watercourses, if required; and ○ the quantity, duration and weather conditions under which water is obtained from the supplementary water supply; and ○ a procedure including trigger levels to inform decisions to scale back operations and/or stop extraction, processing and/or the transport of material to and from the site as may be required by condition 15 above; e) Groundwater Management Plan that includes: <ul style="list-style-type: none"> i. a description of water licences used to account for take from a ground water source; ii. a monitoring program of groundwater levels and quality that includes: <ul style="list-style-type: none"> • threshold water level criteria (and warning trigger levels); • contingency measures in the event of a breach of warning trigger levels and/or threshold criteria; and • a program to regularly report on the monitoring results, including any exceedances; and iii. requirement for the Applicant to consult with DPI Water in the event of any unforeseen groundwater inflows from the quarry face or floor and if required, obtain appropriate water licence(s) to cover the volume of water take. <p>The Applicant must implement the approved Soil and Water Management Plan as approved from time to time by the Secretary.</p>	<p>Section 7.1 and Section 7.4</p> <p>N/A – construction stages are unlikely to impact ground water.</p>
20.	<p>Prior to the commencement of quarrying operations under this consent, the Applicant must design and construct the proposed haul road:</p> <ul style="list-style-type: none"> a) in accordance with any applicable requirements of the Guidelines for Controlled Activities on Waterfront Land (DPI 2012) for the design of waterway crossings for access roads and any associated in stream works; b) to be aligned to intersect the Golden Highway at a 90-degree angle and be suitably paved for a minimum distance of 50 m extending from the boundary of the site; c) to ensure adequate stormwater drainage is provided to contain stormwater runoff within the site; and d) to ensure adequate measures are installed to contain sediment from entering Lynch’s Gully. 	<p>Section 6.8 and Appendix A and Appendix B</p>

3. Existing Surface Water Environment

3.1 Local Drainage

The dominant surface water drainage feature of the area is Wybong Creek, a tributary of Goulburn River, which occurs approximately 1 km west of the proposed quarry (Figure 3-1). The property drains to Wybong Creek mainly via sheet flow over gently sloping north, north-west and south-facing slopes. There are several small dams on the Dolwendee property and one large licensed dam on the adjoining Hollydeen property which any runoff from the quarry area would ultimately drain to.

To the south of the proposed quarry area a prominent rocky ridgeline ranging between 210m and 220m in elevation forms the main drainage catchment boundary influencing the proposed quarry area.

An intermittent creek (Lynch’s Gully) occurs in the southern part of the property and drains to the west to Wybong Creek. Lynch’s Gully is considered a 2nd order stream (Strahler classification) and displays some gully erosion and has been the subject of soil conservation works in the past. Lynch’s Gully would be considered as Class 4 - unlikely fish habitat with intermittent flows and no permanent aquatic habitat. The proposed haul road would cross Lynch’s Gully and a new culvert is proposed for this purpose.

The proposed extraction area is not located near any existing drainage lines. The nearest is >400m to the north. It is an intermittent 1st order watercourse, highly disturbed, with no appreciable riparian vegetation, and located within cleared land. Stormwater discharge from the site would need to travel overland >400m before reaching the nearest watercourse and then drain to the large licensed dam on the Hollydeen property owned by the Proponent. The nearest waterway with any intact riparian habitat is Wybong Creek.

There are approximately seven small dams spread across Lots 1 to 4 DP 1160936.

3.2 Existing Water Quality

Surface water samples were collected by RCA on 22 January 2015 and 6 May 2015 from two separate locations including Wybong Creek and the large dam west of the Project, both downstream of the proposed quarry activities. The surface water sampling sites are indicated in Figure 3-1 and Table 3-1. There was no available 'upstream' sampling site as the quarry is high in the catchment with no permanent water sources upstream. The samples were analysed for a variety of physical and chemical parameters including nutrients, dissolved metals, pH and electrical conductivity.

The results show significant differences in water quality between the dam (SW1) and Wybong Creek (SW2):

- Dissolved heavy metals concentrations in the dam are higher than in Wybong Creek. Several dissolved metals in the dam water exceeded the relevant criteria in ANZECC (2000) Australian and New Zealand Guidelines for Fresh Water Quality, for 95% level of protection. The metals concentrations also show some considerable variability. Metals concentrations in Wybong Creek were non-detectable;
- Salinity and Electrical Conductivity was significantly higher in Wybong Creek than in the dam. The dam water was non-saline with EC levels less than 200 $\mu\text{S}/\text{cm}$;
- Turbidity in the dam is much higher than in Wybong Creek.

The water quality results from SW1 and SW2 are presented in Table 3-1.

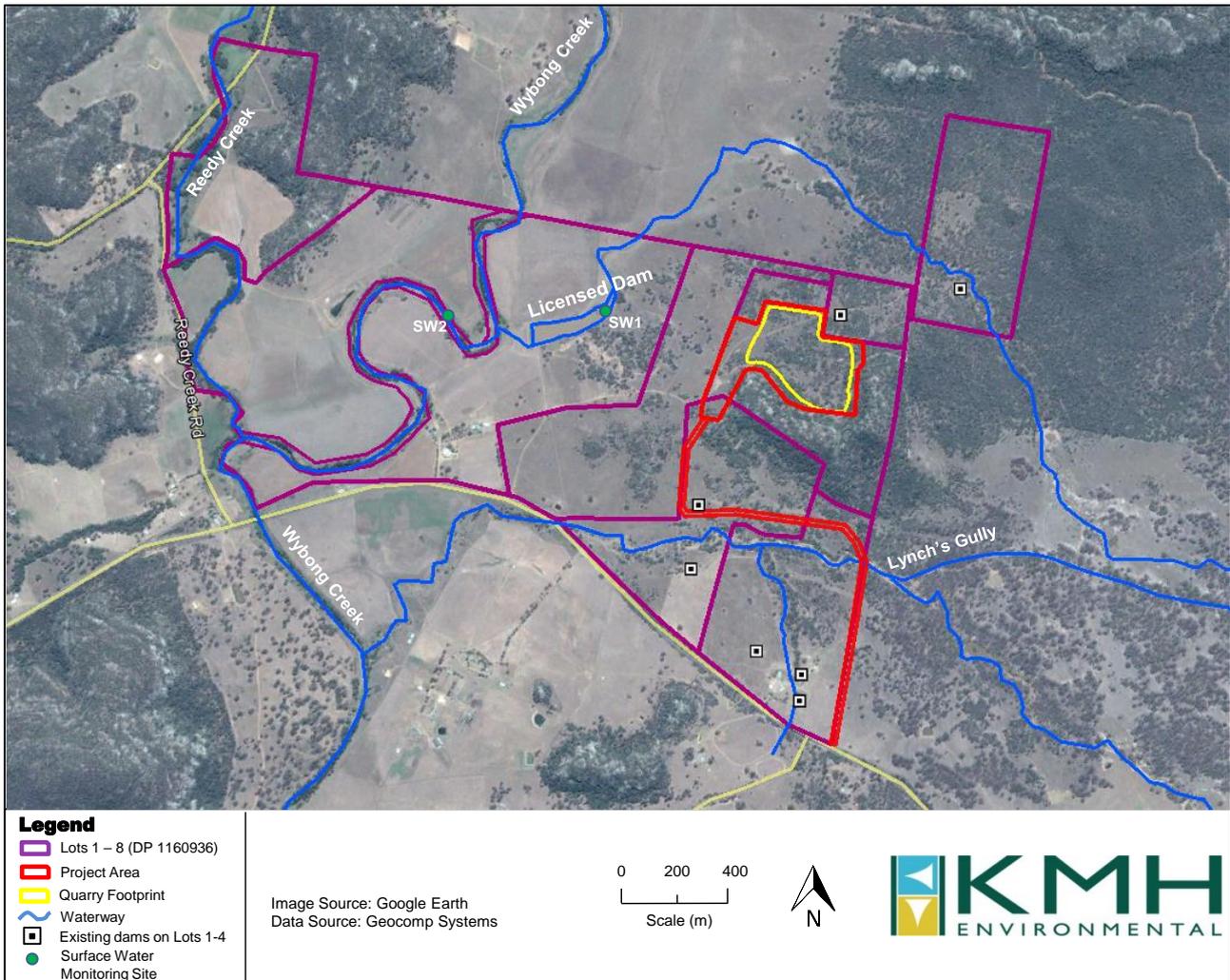


Figure 3-1 Local Surface Water Drainage Features and EIS Monitoring Locations

Table 3-1 Surface Water Quality Field and Laboratory Results

Analyte	Units	LOR	ANZECC Criteria	22/01/2015		6/05/2015	
				SW1 Dam	SW2 Wybong C.	SW1 Dam	SW2 Wybong C.
Field data							
Appearance				brown, turbid	clear	brown, turbid	clear
pH	-			7.67	8.26	7.29	7.85
Electrical conductivity	mS/cm			0.156	1.13	0.076	2.39
turbidity	NTU			122	11	140	19
Dissolved oxygen	mg/L			4.93	4.68	5.64	4.64
Temperature	°C			25.5	25.4	17.0	16.7
Salinity	%			0.00	0.05	0.00	0.11
Lab Data							
Hydroxide Alkalinity as CaCO3	mg/L	1		<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	1		<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	1		39	268	21	345
Total Alkalinity as CaCO3	mg/L	1		39	268	21	345
Sulfate -SO4-turbidimetric	mg/L	1		<1	21	<10	12
Chloride	mg/L	1		16	580	31	661
Calcium	mg/L	1		4	89	2	102

Analyte	Units	LOR	ANZECC Criteria	22/01/2015		6/05/2015	
				SW1 Dam	SW2 Wybong C.	SW1 Dam	SW2 Wybong C.
Magnesium	mg/L	1		3	116	2	124
Sodium	mg/L	1		18	234	15	231
Potassium	mg/L	1		8	6	3	5
Arsenic (dissolved)	mg/L	0.001	0.013	0.002	<0.001	<0.001	<0.001
Cadmium (dissolved)	mg/L	0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (dissolved)	mg/L	0.001	0.001	0.022	<0.001	0.004	<0.001
Copper (dissolved)	mg/L	0.001	0.0014	0.014	<0.001	0.004	<0.001
Lead (dissolved)	mg/L	0.001	0.0034	0.002	<0.001	<0.001	<0.001
Nickel (dissolved)	mg/L	0.001	0.011	0.025	<0.001	0.006	0.001
Zinc (dissolved)	mg/L	0.005	0.008	0.023	<0.005	0.038	<0.005
Mercury (dissolved)	mg/L	0.0001	0.0006	<0.0001	<0.0001	<0.0001	<0.0001
Ammonia as N	mg/L	0.01	0.9	0.2	0.03	0.06	0.04
Nitrate + Nitrite	mg/L	0.01	0.7	0.2	0.03	0.07	0.01
Total Kjeldahl Nitrogen as N	mg/L	0.1		2	0.3	1.4	0.3
Total Nitrogen as N	mg/L	0.1		2.2	0.3	1.5	0.3
Total Phosphorus as P	mg/L	0.01		0.44	0.17	0.28	0.12
Biochemical Oxygen Demand	mg/L	2		5	3	4	<2
Total Anions	meq/L	0.01		1.23	22.2	1.29	25.8
Total Cations	meq/L	0.01		1.43	24.3	0.99	25.5
Ionic Balance	%	0.01			4.66	----	0.62

- There has been no detailed baseline data on surface water flows and quality in water bodies that could potentially be affected by the development;

3.3 Additional water quality testing/monitoring

There has been no additional water quality testing or monitoring since 2015 (to inform the preparation of the EIS) as the proposed development poses a very low risk of impact to downstream water bodies. Wybong Creek is approximately 1 kilometre west of the site. The approved processing area and extraction area drain to sediment basins designed to capture and detain stormwater for subsequent reuse within the development. During large rain events, sediment basins may overflow and stormwater would be discharged as sheet flow to gentle, vegetated slopes to the north.

Stormwater discharge from the site would need to travel overland >400m before reaching the nearest watercourse and then drain to the large licensed dam on the Hollydeen property owned by the Proponent. Due to these conditions and the very low risk of water quality impacts to Wybong Creek, downstream water quality monitoring is considered unnecessary.

4. Project Activities

4.1 Construction

The activities listed in Table 4-1 have the potential to cause soil erosion, sedimentation and potential impacts during construction.

Table 4-1 Construction activities

Activity	Construction Activities
Topsoil stripping, land grading and site levelling	Establishment of construction and operation areas: <ul style="list-style-type: none"> • access / haul road and intersection works

Activity	Construction Activities
	<ul style="list-style-type: none"> • plant and equipment area • office and amenities area • “borrow pit” for road and work areas construction • Drainages, sediment basin and sedimentation control installation
Excavation and stockpiling	<ul style="list-style-type: none"> • Excavation and removal of gravel, soil and rock materials for the establishment of the haul road, intersection and site operational areas
Culvert works around Lynches Gully waterway	<ul style="list-style-type: none"> • Installation and upgrades to culvert under haul road • ERSED works
Installation of drainage structures	<ul style="list-style-type: none"> • Establishment of clean water drains, energy dissipaters and level spreaders to control surface runoff around the quarry
Road building and paving	<ul style="list-style-type: none"> • Establishment of the intersection, haul road and associated culverts • Asphalt paving in some areas
Materials haulage	<ul style="list-style-type: none"> • Hauling road building materials from the quarry area borrow pit to construction of the haul road other site areas. • Driving over dirt roads
Pouring concrete and concrete washout	<ul style="list-style-type: none"> • Establishment of concrete foundations

4.2 Operation

This Soil and Water Management Plan would be updated to include operational risks and management measures, prior to commencement of operations.

5. Site Water Balance

The site is located within the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*.

Water onsite would be used for the following purposes:

- site revegetation;
- material processing including washing or separation of extracted materials
- toilets and basins;
- vehicle and equipment washing;
- dust suppression on haul roads;
- dust suppression and moisture addition to stockpiled aggregates and
- dust suppression and general cleaning and maintenance at the crushing and screening plant; and
- supply of moisture in blended products.

5.1 Water Recycling and Re-Use

Based on EIS estimates, the estimated annual **non-potable** water demand is approximately 23.5 ML/year. The **potable** demand is 48 kL/year. This is expected to be an upper limit once the quarry is in full production.

Non-potable water would be sourced in the first instance from stormwater collected in sediment basins. The demand could be met by onsite water capture in a wet (90%ile) rain year providing the collection system is efficient and the dams are sufficiently large to minimise overflow losses.

During normal and dry years there will be a water deficit. Additional water may need to be supplied from alternate sources.

UHH would seek to amend the license to permit the use of water on Lot 2 and to install a suitable pipeline for a backup water supply for quarry operations.

5.2 Harvestable Rights

The maximum harvestable rights dam capacity was calculated for the Dolwendee property being Lots 1, 2, 3 and 4 in DP 1160936 (with a combined area of 161.48 hectares), on which the Project is located, using the NSW Government's Maximum Harvestable Right Farm Dam Capacity (MHRDC) Calculator.

The maximum harvestable rights dam capacity for Lots 1 – 4 is **10.5 Megalitres (ML)**. The seven existing dams on-site have an estimated total capacity of 7.7 ML. On this basis, the property may construct additional dams with storage totalling approximately 2.8 ML without exceeding the MHRDC.

It is noted that sediment basins constructed for water quality control would not count toward the harvestable rights allowance, providing water is not pumped or taken from those dams for use.

5.3 Water Licence

UHH holds water license 20CA212769 for water supply works comprising an 80mm centrifugal pump on Lot 6 DP 1160936 and authorising the abstraction of up to 142 ML per year from the Wybong Creek water source. The permitted use is Industrial and covers Lots 3 and 4 in DP 1160936.

The water license contains approval details, conditions and reporting procedures that would be met by UHH for the duration of the licence.

6. Erosion and Sediment Control Plan

These technical notes form part of the Dolwendee Quarry Erosion and Sediment Control Plan (ERSED Plan) and are to be read in conjunction with the plan drawings (**Appendix A**). ERSED controls are to be designed, installed and maintained in accordance with Landcom's:

- *Managing Urban Stormwater: soils and construction 4th Edition*, (Landcom, 2004), (the 'Blue Book'); and
- *Managing Urban Stormwater: Soils and Construction manual* (Volume 2E Mines and Quarries)

Appendix B contains copies of relevant Standard Drawings (SDs), including some directly reproduced from the *Blue Book* and from *Best Practice Erosion and Sediment Control* (IECA 2008).

The scope of construction activities includes:

- Construction of site access, laydown area and carpark
- Establishment of sediment and erosion controls
- Installation of perimeter / security fencing
- Topsoil stripping and clearing of groundcover where required
- Tree clearing
- Dewatering of several small farm dams and backfilling with soil
- Earthworks including some minor land forming to achieve consistent gradients and drainage
- Assembly of plant, equipment, office and other compound and amenity structures
- Trenching and installation of underground electrical services- backfilling of trenches
- Commissioning and testing of plant/equipment
- Removal of temporary construction facilities and revegetation in temporary areas.

This ERSED plan focuses on construction of the Project to enable commencement of operations of the main quarry.

6.1 General Staging of Works

Erosion and sediment controls shall be in place before earthworks/land disturbance is undertaken and shall remain in place until the disturbed areas have been stabilised / rehabilitated.

The installation of erosion and sediment controls will take place in the following order in all defined work areas with proposed disturbance/construction:

- 1) Identify the extent of works within the approved disturbance areas and the goal of minimising disturbance to the greatest extent practicable;
- 2) Install a stabilised site access/exit at the proposed new entry point(s) to the Golden Highway, prior to use of this entry;
- 3) Install perimeter controls (e.g. barrier fencing to delineate “no go” areas) to manage the disturbance footprint and avoid unnecessary vegetation and soil disturbance;
- 4) Install sediment basins and traps (e.g. silt fence) in suitable locations downslope of proposed work areas as indicated on the ERSED plans;
- 5) Install drainage controls including clean and dirty water diversion drains. Ensure clean water is diverted safely through (or around) the site. Divert dirty water runoff to sediment traps. Avoid mixing of clean and dirty waters;
- 6) Clear and grub the site, then strip and stockpile topsoil from work areas, ensuring weed infested topsoil is separated and designated not for reuse. Weed-free topsoil is to be saved for use later in rehabilitation. It may be stored in designated stockpiles or perimeter bunds, as appropriate;
- 7) Undertake construction works in accordance with the approved plans;
- 8) Inspect all erosion and sediment control weekly, and immediately after significant rain events. Undertake repairs as necessary and install new/modified erosion and sediment controls as necessary to mitigate erosion and pollution risks;
- 9) Maintain erosion and sediment control measures in a fully functioning condition until all earthwork activities are completed and the site is rehabilitated; and
- 10) Remove temporary soil conservation structures as the last activity in the final rehabilitation/revegetation program.

6.2 Management Control Notes

- 1) Install Vegetation Clearing and Disturbance Limits (i.e. No Go Zones)**
 - a) Mark off clearing and disturbance limits within the approved disturbance areas prior to clearing and grubbing.
 - b) Clearing limits and disturbance may not exceed the project boundary. Clearing limits and disturbance will be generally defined as no farther than 5 metres, preferably 2 metres, from the edge of any essential engineering/construction activity including required stockpiling areas and compounds.
- 2) Minimise advance stripping of vegetation and topsoil**
 - a) Plan the works in stages and only strip the minimum practicable areas in advance of construction works and quarry development
 - b) Preserve stripped topsoil for use in rehabilitation
- 3) Install a Stabilised Ingress / Egress Point**
 - a) Prior to using the proposed new intersection with the Golden Highway for construction purposes, install a stabilised site exit using a rock pad and cattle grid at the egress point to prevent tracking of sediment onto the Golden Highway. It is noted that depending on the construction staging sequence, this stabilised entrance may not be required until commencement of the intersection works under the WAD.

- b) The stabilised entrance will be monitored and maintained, and if necessary, adjusted to ensure it is effective in preventing tracking of sediment onto the Highway;
- c) Monitor the construction entry and ensure that any dirt tracking onto the Golden Highway is removed immediately (e.g. via sweeping). Adjust/add controls and maintain as necessary.
- d) Specifications and Technical Drawings for a suitable stabilised site entry are provided in **Appendix B**:
 - i) SD-Exit-1 Construction Exits Part-1 - Rock Pad;
 - ii) SD-Exit-2 Construction Exits Part-2 - Rock Pad;
 - iii) SD-Exit-4 Construction Exits Part-4 - Vibration Grid;
 - iv) SD-Exit-5 Construction Exits Part-5 - Vibration Grid; and

4) Clean water control

- a) Install clean water diversion drains per details provided in Section 6.4, following the details in SD5-6 (Earth Bank, High Flow).
- b) Stabilised diversion drains using vegetation and where necessary rolled erosion control products (eg jute mesh) to ensure they convey the design stormwater flows at non-erosive velocities.
- c) Install level spreaders at the outlet to clean water drains, to discharge water as sheet flow at non-erosive velocities. Installation of level spreaders require protection of the existing vegetation cover at the level spreader discharge location. Protect existing vegetation so this can contribute to erosion resistance and sediment control.

5) Install Sediment Controls

- a) Prior to clearing / grubbing and exposure of bare soils along the proposed haul road, construct a perimeter earth bund and/or sediment fence at the limit of clearance and downslope of disturbance. Sediment traps will be designed with capacity to detain dirty water and allow sediment to settle. Use check dams and/or “returns” within long sections of sediment fence to slow water and divide disturbed areas into smaller more manageable catchments.
- b) Install sedimentation basin(s) where indicated in the ERSED plans, downslope of larger disturbed catchments such as the quarry area and processing/administration area.
- c) Employ low-flow earth banks (SD5-5) as temporary drainage controls where necessary to divert construction runoff into sediment controls.
- d) Install permanent dirty water drains to divert dirty water runoff into sediment basins within larger disturbed catchments, where shown on the ERSED plans. Drains to be installed following the details in SD5-6 (Earth Bank, High Flow).
- e) Specifications and Technical Drawings are provided in **Appendix B**:
 - i) SD 6-3 Earth Basin dry
 - ii) SD 5-5 Earth Bank - Low Flow
 - iii) SD 5-6 Earth Bank – High Flow
 - iv) SD 6-8 Sediment Fence
 - v) SD 5-4 Check Dams
 - vi) SD 5-8 Energy Dissipator

6) Topsoil Stripping and Management

- a) Weather forecasts will be monitored and earthworks planned to minimise exposure to damaging storms.
- b) Soils will be stripped in a slightly moist condition (neither too dry nor wet) when practicable thus reducing dust generation and deterioration in topsoil quality.
- c) Topsoil shall be stockpiled only when disturbed areas are not available for immediate rehabilitation
- d) If stockpiling, use in perimeter earth bunds and/or designated stockpile areas away from concentrated water flow.

- e) Soil stockpiles shall be constructed to minimise the stockpile area in a discrete two-metre-high (maximum) pile, with a working face battered down at 30 degrees.
- f) Stockpiles shall be trimmed, lightly scarified and immediately sown with permanent appropriate species (as indicated in the approved Rehabilitation Plan) then maintained by watering and fertilising as required.
- g) Use topsoil to progressively restore completed areas as soon as practicable, but no later than shown in Table 6-7.
- h) Specifications and Technical Drawings are provided in **Appendix B**:
 - i) SD 4-1 Stockpiles
 - ii) SD 4-2 Replacing Topsoil.
 - iii) SD 7-1 Seedbed Preparation

7) Encountering Groundwater

- a) Groundwater is unlikely to be encountered by the construction stages of the Project due to existing groundwater depths and the shallow depths of earthworks during the construction stage. If groundwater is encountered all works must cease and the Site Manager be contacted immediately. A review of the associated groundwater risks will be undertaken before works can recommence.

8) Progressive Stabilisation

- a) Topsoil to be replaced at 100mm minimum depth over rehabilitated areas prior to revegetation.
- b) Spread topsoil along the contour of re-graded spoil by dumping at the top of slopes and grading downwards and across the contour – thus aiding runoff control, minimising erosion and increasing moisture retention.
- c) Level topsoil to an even surface and avoid a compacted or over-smooth finish.
- d) All prepared batters are to be seeded within 48 hours from the completion of formation.
- e) Temporary protection of soils using jute mesh, bidim, hydromulch or spray-on soil tackifier may be required to achieve adequate cover per Blue Book requirements.
- f) Revegetation shall be undertaken using a mix of existing native and/or pasture seed mix species, selected based on the soil and area climate requirements, as per the approved Rehabilitation Plan.
- g) Stop any vehicle traffic entering the area once topsoil is spread.
- h) If binder is used:
 - i) Polyacrylamide, Guar or bitumen emulsion – 25kg/ha
 - ii) Bitumen emulsion is **not to** be used within 40m of waterways or within drainage channels.

9) Sediment Basin Dewatering

- Sediment basins water levels will be managed to minimise the risk of uncontrolled discharges. In this regard, water captured in sediment basins would be reused for operational purposes such as dust suppression and material processing in the first instance.
- Monitoring of basins is to occur prior to controlled discharge of any water from the basins. Basins are to be dewatered promptly after rain events to restore capacity to receive runoff from subsequent events.
- Given the demand for process water at the quarry (e.g. for dust suppression, irrigation and moisture conditioning of earthworks), sediment basins may be dewatered to offline water storages to facilitate water reuse.
- Managed discharges from sediment basins will occur to well-grassed areas within the site to prevent the migration of sediments to watercourses.
- Water will be released only if the water quality meets standard Blue Book criteria, which would avoid pollution under Section 120 of the POEO Act and ensure water quality objectives are maintained. Discharge criteria are as follows:
 - < 50mg/L TSS (total suspended solids) or roughly <50 NTU (nephelometric turbidity units);

- No visible oil or grease;
- pH between 6.5 and 8.5.
- Flocculation of basin water will be undertaken as required to reduce suspended solids in basin water, to ensure managed discharges meet the aforementioned discharge limits. Flocculation will be undertaken in accordance with procedures in the Blue Book.

6.3 Sediment Basins

6.3.1 Soils

The soils have a moderate to high erosion hazard and propensity to structural breakdown once disturbed with a medium to low shrink swell characteristics. The soil type has been determined to be Type D (dispersible).

Table 6-1 summarises the results of soil testing on the site and Table 6-2 summarises the Revised Universal Soil Loss Equation (RUSLE) factors.

Table 6-1 Soil testing results

Sample Id	Depth	Dispersible Soils (Y/N)	K-factor
BH5	0.1-0.5 m	N	0.026
BH6	0.1-0.3 m	N	0.042
BH6	1.0-1.3 m	Y	0.031
BH7	0.1-0.3 m	N	0.030
BH7	0.9-1.0 m	N	0.027
BH8	0.1-0.3 m	Y	0.027
BH8	0.7-1.0 m	Y	0.031

Table 6-2 RUSLE Factors

Factor	Value	Description
R-factor	1500	Rainfall erosivity: related to average rainfall energy and intensity. Data taken from R-factor maps published in Annex B of the Blue Book
K-factor	0.042	Soil erodibility: conservative value calculated from soils data including texture, structure, organic matter content and permeability (refer Rosewell, 1993)
LS-factor	2.05	Slope length/gradient factor: describes combined effect of slope length and gradient on soil loss. Adopted slope length = 80m and slope gradient = 8%. Value taken from table A1 in Blue Book
P-factor	1.3	Practice-factor: related to site management practices and surface condition, and their relationship to runoff generation. A factor of 1.3 is standard on construction sites.
C-factor	1.0	Cover factor: describes the effect of surface cover in reducing exposure of soils to erosion. A nominal value of 1.0 is adopted for construction sites where soils are bare and compacted.
Annual est. soil loss	168	Soil loss (in T/ha/yr) calculated by RUSLE equation, as $A = R \times K \times LS \times P \times C$
Soil Loss Class	2 (Low)	Blue Book describes seven soil loss classes ranging from 1 (very low, 0-150 T/ha/yr) to 7 (extremely high, >1500 T/ha/yr). Blue Book also prescribes management requirements dependent on soil loss class.

6.3.2 Nominal Basin Sizing

Sediment basins will be designed to achieve the required water quality and based on a design capacity equivalent to the 5-day duration 90th percentile rainfall runoff event. Basins shall incorporate a stabilised outlet / emergency spillway designed to the 50-year ARI flow, per Blue Book specifications.

An indicative sizing of sediment basins is summarised in Table 6-3 based on various potential disturbed catchment area sizes. A range of sizes is provided as the quarry would be developed in stages. Quarry

planning shall ensure an adequate sediment basin is installed downstream of the main quarry operations. A high priority would be placed on reuse of water from sediment basins.

Table 6-3 Nominal sizing for disturbed catchments

Structures	Disturbed catchment area (ha)					
	1	2	3	5	7	10
Sediment basin storage, sediment storage volume (m ³)	22	43	65	108	151	215
Sediment basin, settling zone volume (m ³)	230	460	689	1149m	1608	2298
Sediment basin total volume (m ³)	252	503	754	1257	1759	2513
Basin Spillways Discharge Q (based on 50-year, tc) (m ³ /sec)	0.524	1.007	1.45	2.331	3.122	4.143
Drainage channels discharge Q (based on 20-year, tc) (m ³ /sec)	0.405	0.772	1.111	1.773	2.391	3.153

Sediment basins are to be constructed with a 3:1 ratio of length to width, as a minimum, and require stabilised inlets and outlets. Appendix B includes Blue Book specifications for wet (Type D) sediment basins (SD 6-4).

6.4 Clean Water Drains

A major clean water drain would be constructed around the southern (upslope) side of the proposed quarry, as close as practicable to the planned limit of extraction. This drain may be incorporated with the safety bund that would be in a similar location. The drain would be designed in accordance with the Blue Book, to convey flows up to the design storm event in a non-erosive manner. This may require hard armouring in certain areas. Level spreaders (or equivalent) would be installed at the drain outlet to manage erosion and return flows to a non-erosive velocity.

Slopes greater than 5% will need to employ rock linings or equivalent.

Figure 6-1 provides a sketch plan of the nominal drain segments for the major clean water drain, with catchment areas and slopes. Table 6-4 shows the estimated drain sizing for each segment. Detailed design of the clean water drain would be undertaken prior to construction.

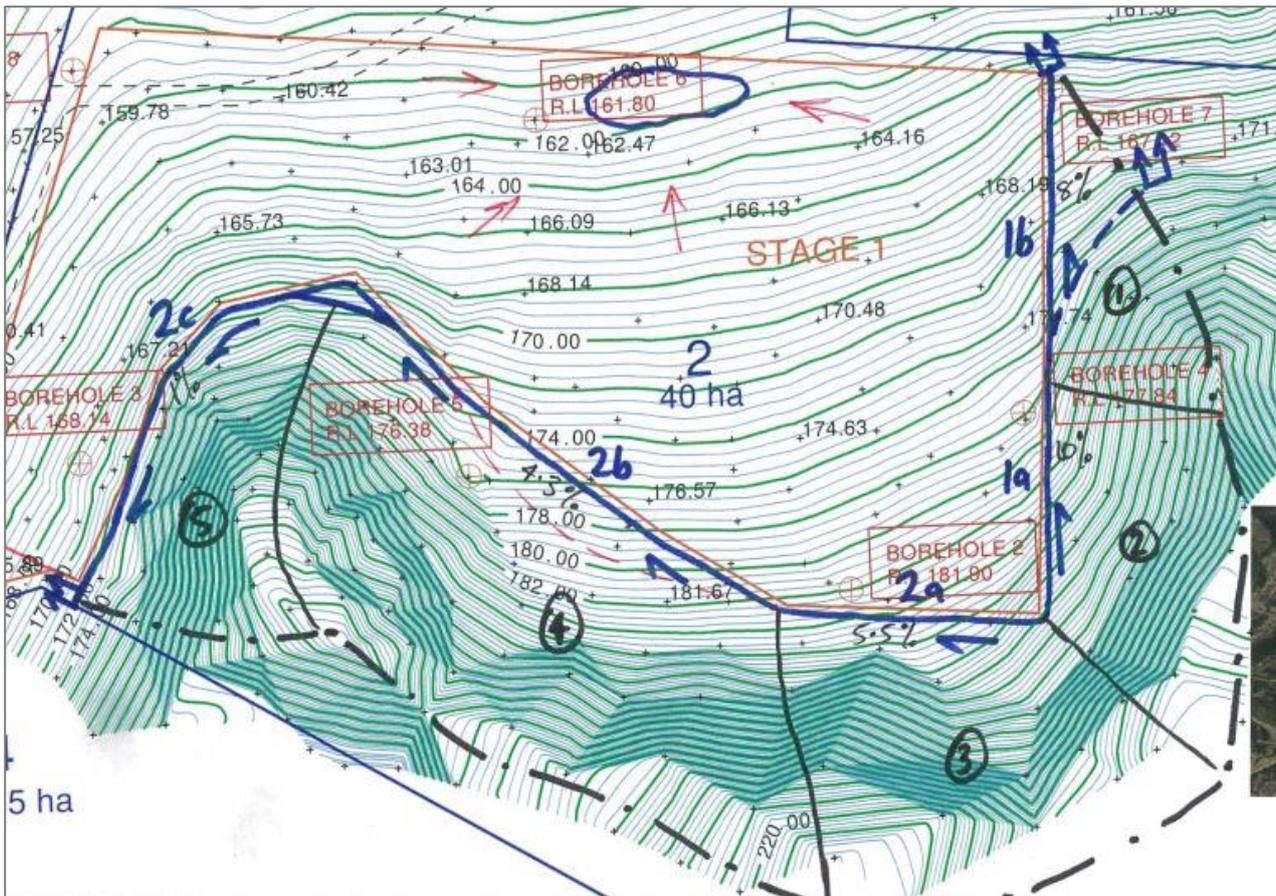


Figure 6-1 Clean water drain areas above the main quarry before extractive activities commence

Table 6-4 Clean water drain sizing

Drain Variable	Drain Segment				
	1a	1b	2a	2b	2c
Drain gradient (%)	8	10	5.5	4.3	1
Contributing catchments	1	1 + 2	3	3 + 4	3 + 4 + 5
Peak discharge (Q) m ³ /s (20ARI)	0.21	0.47	0.50	1.15	1.33
<i>Nominal trapezoidal drain dimensions:</i>					
base width (m)	1	2	2	2	2
flow depth (m)	0.11	0.12	0.14	0.25	0.4
velocity (m/s)	1.4	1.7	1.4	1.7	1.1
total depth (0.5m freeboard)	0.61	0.62	0.64	0.75	0.9
top width (3:1 batters)	4.66	5.72	5.84	6.5	7.4

6.4.1 Rock lined channels

Rock for rip rap shall be hard, tough and durable with a crushing strength of at least 25 MPa. The rock should be free of defined cleavage planes and not be adversely affected by repeated wetting and drying. Rock should preferably be predominantly angular in shape with not more than 25 per cent of rocks, distributed through the gradation, having a length more than twice the breadth and thickness. No rock should have a length exceeding 2.5 times its breadth or thickness. Geotextiles under rip rap are not recommended.

Table 6-5 outlines rip rap sizing recommendations.

Table 6-5 Rip rap grading recommendation

Equivalent spherical diameter	% (by weight) of rip rap of smaller size
1.5–2.0 times D_{50}^2	100%
D_{50}	50%
0.3 D_{50}	10–20%

6.5 Level Spreaders

The end of each clean water drain outlet will incorporate a level spreader per the IECA design guidelines. Design parameters are outlined in Table 6-6.

Table 6-6 Level spreader parameters

Structures	1b	2c
Estimated flow velocity (m/s) @ outlet	1.7	1.1
Gradient at discharge location (%)	4	6
Assumed grass cover	70%	70%
Sill length in m per unit discharge	4 (minimum)	7 (min)
Notes	Drain slope needs to level off to under 5% to achieve non-erosive velocities at the outlet prior to discharge.	N/A

6.6 Sediment Basin Discharge

Discharge of water from sediment basins within the lots is expected to be infrequent as the water management system would be designed to optimize storage for reuse for operational purposes (e.g. dust control, revegetation etc.). However, there occasionally could be significant rainfall events that require the treatment and discharge of collected water in sediment basins within the site.

Managed discharges of water from sediment basins would be undertaken in accordance with relevant best practice guidelines and the Blue Book. Water would be discharged to well grassed stable areas within the subject Site.

If a rain event occurs that is larger than the design storm event for sediment basin design, then unmanaged discharges may occur. Discharged stormwater will need to travel 400m overland before reaching the nearest watercourse to the north and then drain to the large licensed dam on the Hollydeen property owned by the applicant. The nearest waterway with intact riparian habitat is Wybong Creek west of the licensed dam. Accordingly, discharges from the sediment basins in the quarry would be captured by another larger sediment dam and are highly unlikely to impact on any natural waterways.

The site’s Environment Protection Licence does not include licensed water discharge points. As such, site stormwater would be managed to avoid pollution through implementation of appropriate erosion and sediment controls, including sediment basins in larger disturbed catchments, to satisfy Section 120 of the Protection of the Environment Operations Act. This would be achieved by ensuring managed discharges from sediment basins meet the following discharge criteria:

- < 50mg/L TSS (total suspended solids) or roughly <50 NTU (nephelometric turbidity units);
- No visible oil or grease;
- pH between 6.5 and 8.5.

Flocculation of basin water will be undertaken as required to reduce suspended solids in basin water, to ensure managed discharges meet the aforementioned discharge limits. Flocculation will be undertaken in accordance with procedures in the Blue Book.

6.7 Soil Stabilisation (rehabilitation)

Effective preparation of the soil is important to achieve rapid cultivation and growth of vegetation. The following should be considered when revegetating the site:

- Spread topsoil along the contour of re-graded spoil by dumping at the top of slopes and grading downwards and across the contour – thus aiding runoff control, minimising erosion and increasing moisture retention;
- Cultivate along the contour – tined implements, such as chisel ploughs or rippers, will create small furrows to retard runoff and promote infiltration
- Stop traffic passing over the area after cultivation, particularly up and down or diagonally across slope;
- Cultivate deep enough to penetrate the underlying spoil material and complete in a single pass – creation of a coarse seedbed promotes infiltration and resists the formation of a surface crust;
- A sterile cover crop (oats and/or Japanese millet) may be applied to assist with initial soil stabilisation, including temporary drains, and used in different ratios according to the season; and
- Larger bare areas may require re-ripping or some form of cultivation and complete re-sowing. If the topsoil has been completely removed by erosion, it should be replaced prior to cultivation.

The following guidelines for stabilisation of disturbed areas should not be exceeded and apply to land within the project boundaries. In some cases, hand seeding may not be enough to meet these conditions, in which case other methods may be used such as geotextiles and spray-on binders/tackifiers:

Table 6-7 Disturbed Land Cover Requirements

Lands	Maximum C-Factor	Notes
Waterways and other areas subjected to concentrated flows, post construction	0.05 (about 70% groundcover)	Applies after 10 working days from completion of formation and before they can carry concentrated flows
Stockpiles, post construction	0.10 (about 60% groundcover)	Applies after 10 working days from completion of formation
All lands, including waterways and stockpiles during construction	0.15 (about 50% Groundcover)	Applies after 20 working days of inactivity, even though works might continue later
Permanent rehabilitation	0.05	Aim to achieve a C-factor of less than 0.1 then drop to less than 0.05 within a further 60 days (approximately 70% ground cover.

6.8 Lynch's Gully Crossing

The design of the crossing of Lynch's Gully is subject to detailed design. The design and construction of the crossing shall be in accordance with the requirements of Condition 20(a) and 9d) of the consent, and shall incorporate the following requirements:

- Crossing shall be made via box culverts;
- Culverts shall align with downstream channel;
- Culverts shall incorporate elevated dry cells/recessed wet cells with invert at or below stable bed level;
- Culvert design must be certified by a suitably qualified engineer;
- The design and construction footprint and extent of proposed disturbances within the watercourse and riparian corridor are minimised;
- Existing/natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse shall be maintained;

- Natural geomorphic processes shall be maintained including:
 - Accommodating natural watercourse functions;
 - Maintaining natural bed and bank profile;
 - Ensuring the movement of sediment and woody debris is not inhibited;
 - Ensuring scour and erosion of the bed or banks in any storm events is not increased;
 - Where bed degradation has occurred, address bed degradation to protect the structure and restore channel and bed stability;
- Maintain natural hydrological regimes:
 - Accommodate site hydrological conditions;
 - Do not alter natural bank full or floodplain flows or increase water levels upstream;
 - Do not change gradient of the bed except where necessary to address existing bed and bank degradation;
 - Do not increase velocities by constricting flows, for example filled embankments on approaches;
- Protect against scour:
 - Provide any necessary scour protection, such as rock rip-rap and vegetation;
 - Ensure scour protection of the bed and banks downstream of the structure is extended for a distance of either twice the channel width or 20 metres whichever is the lesser;
 - If cutting into banks, protect cuttings against scour.
- Erosion and sediment controls shall be installed in accordance with Blue Book requirements for works within waterways. The controls shall include:
 - Limiting disturbance to the bed and banks of the waterway to the maximum extent practicable
 - Employing sediment traps either side of vehicle access tracks approaching the waterway
 - Stockpiles of erosive materials to be located further than 50m from the banks of the watercourse
 - Developing a specific Work Method Statement that outlines techniques for securing the site in the event of forecast rainfall that could lead to watercourse flow and/or flooding.
- Stabilise and rehabilitate all disturbed areas including topsoiling, revegetation, mulching, weed control and maintenance in order to adequately restore the integrity of the riparian corridor. Restoration techniques shall be appropriate for conditions of concentrated flow.

7. Monitoring and Exceedances

7.1 Monitoring and Inspection

The ongoing monitoring of soil and water management structures during their construction and operation will be undertaken by the construction contractor and site manager in accordance with Section 6. The site manager will have responsibility for ensuring that all structures are monitored and maintained after rain events and will include maintaining sediment fences and removing silt from sediment traps and sediment basins when 30% full.

7.2 Discharge Limit Criteria

Prior to discharging from sedimentation basins over the design storm, the following criteria will be achieved:

- 50 mg/L Total Suspended Solids (TSS)
- No visual oil and grease; and
- pH between 6.5 and 8.5.

7.3 Exceedances Protocol

In the event of exceedances of surface water impact assessment criteria, the site manager and/or construction contractor will identify the root cause of the exceedance, implement appropriate corrective actions and monitor the ongoing operation of the dams e.g flocculation and review erosion controls.

7.4 Water Quality Monitoring Program

When water is present in the sediment basins they will be monitored quarterly for compliance with discharge criteria in Section 7.2. This data will be recorded in a monitoring table for auditing purposes and be reported in the Annual Review.

7.5 Incident Reporting Protocol

The Development Consent defines an incident as a set of circumstances that:

- causes or threatens to cause material harm to the environment; and/or
- breaches or exceeds the limits or performance measures/criteria in this consent.

All incidents will be reported immediately (within 7 days) to the Department of Planning and Environment, NSW Environment Protection Authority and any other agencies relevant to the incident, in accordance with Condition 7 of Schedule 5 of the Development Consent.

Reporting to the Department of Planning and Environment would be completed via the Major Projects Portal. Dependant on the type of incident and its impacts, the EPA website includes contact details for the most relevant agency to the incident. The incident reporting will include the following information to identify the project and the incident:

- The project identity: Dolwende Quarry (SSD-6519)
- The location of the occurrence, including a plan or map, and
- The nature of the incident, including an estimate of the material harm caused.

8. Summary of Mitigation Measures

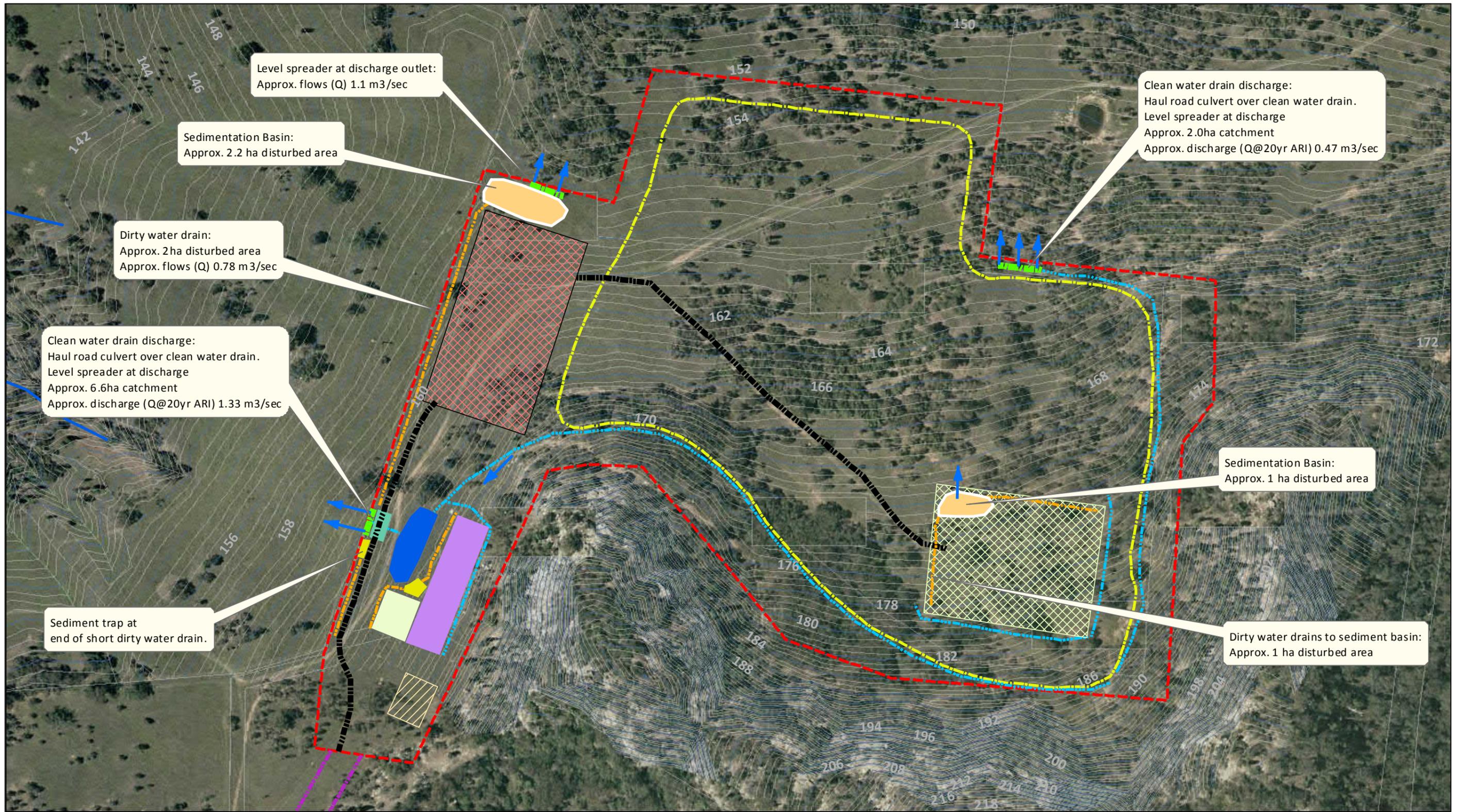
Table 8-1 Summary of Soil and Water Mitigation Measures

Measure No.	Mitigation measure	Responsibility	Timing
Surface Water			
SW1	A SWMP has been prepared in accordance with relevant best practice guidelines, in particular <i>Managing Urban Stormwater: Soils and Construction, Volume 1</i> (Landcom, 2004) (the “Blue Book”) and <i>Managing Urban Stormwater: Soils and Construction, Volume 2E – Mines and Quarries (DECC, 2008)</i> .	Site Manager	Prior to construction

Measure No.	Mitigation measure	Responsibility	Timing
SW2	Clean water diversion drains shall be established to catch and convey clean surface water around quarry and discharge this as overland flow into undisturbed areas below the Project area. Drains would be designed in accordance with the Blue Book.	Site Manager	Prior to construction
SW3	Dirty water runoff from operation areas shall be diverted to suitably sized sediment traps or basins, designed in accordance with the Blue Book, with captured water reused in quarry operations.	Site Manager	Prior to construction
SW4	Managed discharges of surplus water captured within the quarry site shall be undertaken. Discharged water quality would be equal to or better than: <ul style="list-style-type: none"> • 50 mg/L Total Suspended Solids (TSS) • No visual oil and grease; and • pH between 6.5 and 8.5. 	Site Manager	All Stages
SW5	A Discharge Procedure would be developed to describe the operational procedures for managed water discharges, including water quality targets, treatment procedures to achieve these targets and monitoring methods to demonstrate compliance.	Site Manager	Prior to construction
SW6	An erosion and sediment control plan (PESCP) would be prepared for construction of the haul road	Site Manager	Prior to construction
SW7	When water is present in the sediment basins they will be monitored quarterly for compliance with discharge criteria in Section 7.2. This data will be recorded in a monitoring table for auditing purposes.	Site Manager	Operations
Hazards			
H4	Spill kits will be maintained at storage, and refuelling areas. A mobile spill kit shall be kept where plant, machinery and equipment are stored and used during quarry operations.	Site Manager	All Stages
H5	All on-site staff shall be informed of the site's Emergency Response Plan procedures to be undertaken on-site as part of their training.	Site Manager	Prior to construction
H6	Refuelling of vehicles and plant on the project site shall be carried out in the designated and bunded refuelling area.	Site Manager	All Stages
H7	Bunding shall be installed for chemical, lubricants, fuels and oil storage areas in accordance with relevant guidelines and Australian Standards.	Site Manager	Prior to construction
Waste			
W3	Waste oil, hydraulic and other hazardous materials will be stored in secure containers and kept in bunded and covered area. Hazardous wastes shall be transported to a facility that is appropriately licensed to receive and recycle or treat hazardous wastes.	Site Manager	Prior to construction
Landscape Rehabilitation and Closure			
L2	Clean water diversion drains shall be established and maintained above the final quarry void to divert and drain upslope runoff safely and in a non-erosive manner around the final quarry void in accordance with the Blue Book.	Site Manager	Prior to construction
L3	Rehabilitation shall be undertaken progressively where appropriate in accordance with the Blue Book.	Site Manager	All Stages
L4	Fencing shall be established along the perimeter of the final benched quarry void.	Site Manager	Prior to construction

Appendix A

Erosion and Sediment Control Plan



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P

0 40 80 Meters

Map ref SY18262
Revision A
Author Elarson
Date 6/11/2018

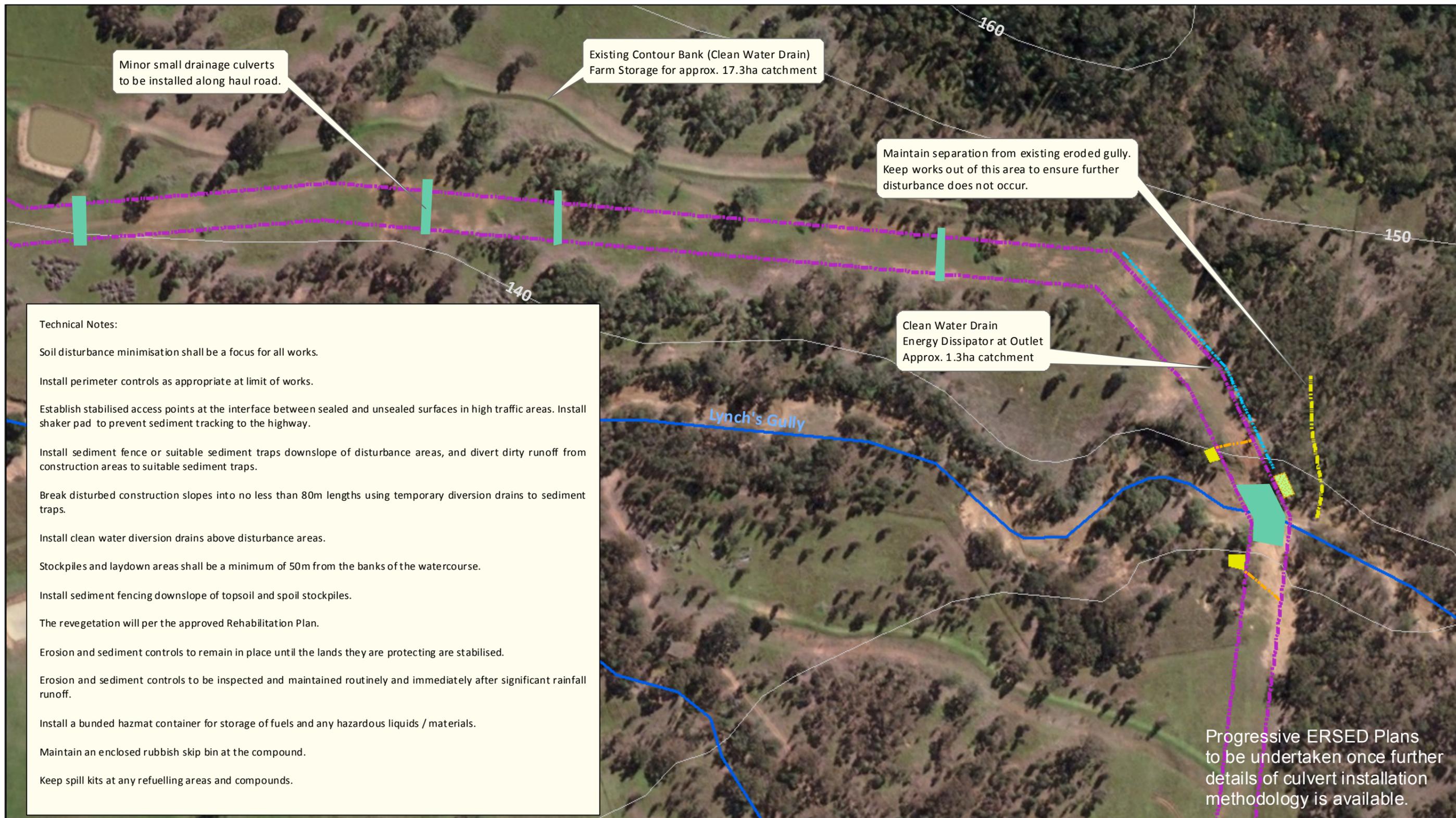
Legend

- - - Quarry Disturbance Area
- - - Quarry Extraction Area
- - - Haul Road Corridor
- - - Haul Road
- Processing & Stockpiling Area
- Offices
- Stage One Borrow Pit
- Parking
- Clean Water Drain
- Dirty Water Drain
- Effluent Infiltration
- Level_Spreader
- Culvert
- Sedimentation Basin
- Sediment Trap
- Clean Water Basin
- Waterways
- Major Countours
- Site Contours

Dolwende Quarry Upper Hunter Holdings Erosion and Sediment Control Plan

1:2,500
Coordinate System:
GDA 1994 MGA Zone 56
When Printed at A3





Technical Notes:

- Soil disturbance minimisation shall be a focus for all works.
- Install perimeter controls as appropriate at limit of works.
- Establish stabilised access points at the interface between sealed and unsealed surfaces in high traffic areas. Install shaker pad to prevent sediment tracking to the highway.
- Install sediment fence or suitable sediment traps downslope of disturbance areas, and divert dirty runoff from construction areas to suitable sediment traps.
- Break disturbed construction slopes into no less than 80m lengths using temporary diversion drains to sediment traps.
- Install clean water diversion drains above disturbance areas.
- Stockpiles and laydown areas shall be a minimum of 50m from the banks of the watercourse.
- Install sediment fencing downslope of topsoil and spoil stockpiles.
- The revegetation will per the approved Rehabilitation Plan.
- Erosion and sediment controls to remain in place until the lands they are protecting are stabilised.
- Erosion and sediment controls to be inspected and maintained routinely and immediately after significant rainfall runoff.
- Install a bunded hazmat container for storage of fuels and any hazardous liquids / materials.
- Maintain an enclosed rubbish skip bin at the compound.
- Keep spill kits at any refuelling areas and compounds.

Progressive ERSED Plans to be undertaken once further details of culvert installation methodology is available.



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P

0 30 60 Meters

Map ref	SY18262
Revision	A
Author	Elarson
Date	6/11/2018

Legend

Quarry Extraction Area	Energy Dissipator	Clean Water Basin
Haul Road Corridor	Clean Water Drain	Waterways
Processing & Stockpiling Area	Dirty Water Drain	contour
Offices	Existing Eroded Gully	
Stage One Borrow Pit	Culvert	
Parking	Sediment Trap	

Dolwende Quarry

Upper Hunter Holdings

Erosion and Sediment Control Plan

1:2,000
 Coordinate System:
 GDA 1994 MGA Zone 56
 When Printed at A3





Appendix B

Standard Drawings

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Draft Soil and Water Management Plan Dolwende Quarry

transport | community | mining | industrial | food & beverage | energy



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