4. ASSESSMENT AND MANAGEMENT OF KEY ENVIRONMENTAL ISSUES

4.1 INTRODUCTION

This section provides an assessment of the impacts associated with those features of the local environment which could potentially be affected by the Proposed Modification. The proposed design and/or operational safeguards and an assessment of the level of impact the Proposed Modification may have after implementation of these safeguards is also described.

4.2 BIODIVERSITY

4.2.1 Introduction

As noted in Sections 2.3.1 and 3.3.2, the two stockpile extension areas require disturbance to approximately 2.4ha of the Quarry Site. The significance of the vegetation and fauna habitat disturbed has not been assessed to consider:

- the potential impact on Purple Copper Butterfly and its habitat; or
- the potential impact on other threatened flora and fauna;

Lesryk Environmental Pty Ltd was commissioned by the Proponent to undertake an ecological assessment of the Proposed Modification to assess these questions and provide advice and recommendations on biodiversity offset requirements to compensate for the disturbance (Lesryk, 2017). The following sub-sections provide a summary of the Lesryk (2017) assessment which can be reviewed in full as **Appendix 6**.

4.2.2 Assessment Methodology

4.2.2.1 Overview and Scope

It is acknowledged that the ecological assessment of the Proposed Modification represents a retrospective assessment of impact as clearing of the WSEA and ESEA was undertaken (without consent) in 2016. As a result Lesryk (2017) relies on desktop analyses of available biodiversity databases to establish the likely local setting and survey of surrogate sites in remnant native vegetation adjacent to the areas of disturbance.

4.2.2.2 Desktop Assessment

In order to establish the likely vegetation communities and diversity of flora and fauna of the local setting, Lesryk (2017) undertook a review of previous ecological studies and known databases. In completing this desktop review, Lesryk (2017) was better able to tailor field survey strategies to the detection of those plants and animals, their vegetation communities and/or necessary habitat requirements most likely to be present.

This approach ensures the field survey, and subsequent impact assessment, accounted for the potential presence of all known and likely native species, particularly any plants and animals that are of regional, state and/or national conservation concern, not just those identified as part of field survey (which provides a one off ‘snap-shot’ of local biodiversity).

4.2.2.3 Field Assessment Methodology

As the WSEA and ESEA had been cleared previously, Lesryk (2017) established three 50m x 50m survey plots within remnant vegetation on the Quarry Site and adjoining Lidsdale State Forest (see **Figure 13**). Data was collected from each plot, on 21 February 2017[5], in accordance with the methods detailed in the BioBanking survey manual (DECC, 2009). Specific information collected within each plot included the number of hollow-bearing trees, length of fallen logs and overstorey regeneration present was recorded, along with:

- all flora species, their growth form and abundance within a 20m x 20m plot; and
- groundcover at 1m intervals, shrub and canopy cover at 5m intervals, along a 50m transect.

Concurrent to the survey of vegetation plots, a fauna survey was conducted targeting those threatened species which were identified by desktop survey as likely to, or as having the potential to occur. Methods used during the fauna survey included:

- the direct observation of fauna species in or near the subject site;
- the identification of diurnal calls heard;
- the identification of indirect evidence including scats, scratchings and diggings;
- litter and ground debris searches for reptiles and amphibians; and
- habitat assessment.

4.2.3 Ecological Setting

4.2.3.1 Desktop Analysis (Predicted Occurrences)

Figure 13 presents the disturbance areas of the Proposed Modification over the vegetation mapping of the Western Blue Mountains region conducted by DEC (2006). Lesryk (2017) further analyses these vegetation communities based on the more recent Vegetation Information System of OEH (OEH, 2017) and considers whether these represent endangered ecological communities (EECs) (see **Table 5**).

Lesryk (2017) identified 21 species of threatened flora and 52 species of threatened fauna with the potential to occur on the Quarry Site. During the field investigation, efforts were made to target these species, or occurrences of their documented habitat types.

[5] Weather conditions experienced were clear skies, light to moderate winds and moderately warm temperatures (maximum of 25˚C)

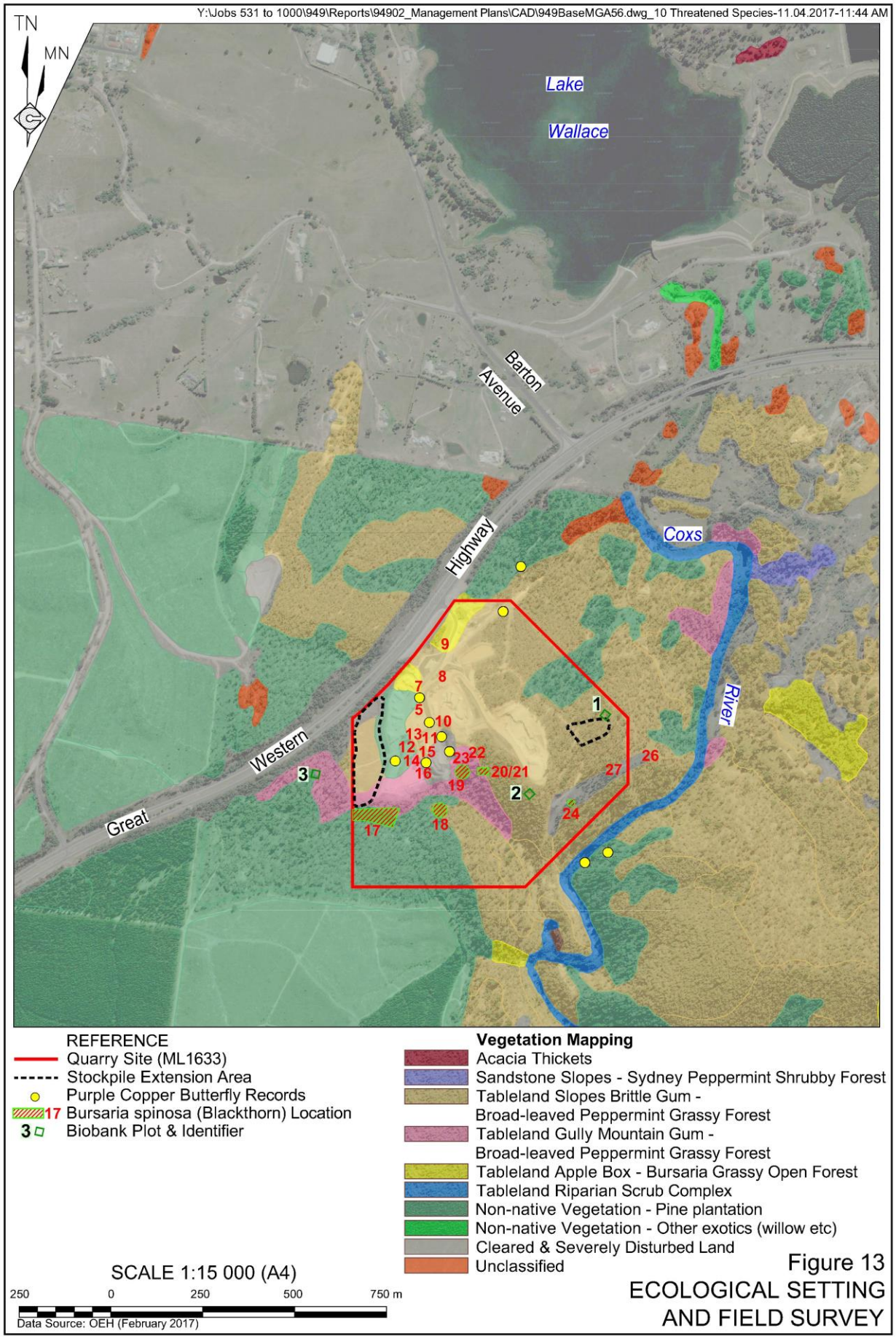


Figure 13
ECOLOGICAL SETTING AND FIELD SURVEY

Table 5
Vegetation of the Quarry Site

Project Component	Area (ha)	Regional Vegetation Community (DEC, 2006)	VIS Classification (OEH, 2017c)	EEC
WSEA	0.2	Map Unit 34 Tableland Gully Mountain Gum – Broad-leaved Peppermint Grassy Forest	PCT 732 (HN515) Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion.	N[1]
	1.7	Map Unit 35 Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest	PCT 1093 Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion	N
ESEA	0.5			
Note 1: Some equivalents of PCT 732 (Map Units 11 and 15) correspond to the TSC Act listed endangered ecological community Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions. However, Map Unit 34 is not mentioned in the final determination as being part of this endangered ecological community				
Source: Modified after Lesryk (2017) – Table 1				

4.2.3.2 Flora of the Quarry Site

Following field survey, Lesryk (2017) has revised the mapping of vegetation communities on the Quarry Site as follows.

- The 1.9ha of the WSEA corresponds to MU34 / PCT 732 (Broad-leaved Peppermint - Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion).
- The 0.5ha of the ESE corresponds to MU35 / PCT 1093 (Red Stringybark - Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion).

In total, 51 species of flora were identified by Lesryk (2017) within the vegetation plots. Of these:

- none were threatened or listed as Rare or Threatened Australian Plants (RoTAP);
- two were introduced; and
- one, Blackberry, is a declared noxious weed.

4.2.3.3 Fauna of the Quarry Site

In total, Lesryk (2017) identified 20 species of fauna including:

- two mammal species;
- 17 bird species; and
- one reptile species.

Of the species identified, Scarlet Robin is listed as vulnerable on the TSC Act. Previous field survey of the Quarry Site has identified the following threatened species.

- Varied Sittella (Lesryk, 2016).
- Yellow-bellied Sheath-tail Bat (Wildthing, 1999).
- Purple Copper Butterfly (Wildthing, 2002).

4.2.4 Potential Impacts

Following a review of the available habitat provided by the surrogate vegetation plots, Lesryk (2017) considers the clearing of 2.4ha has the potential to have impacted on habitat utilised by the following species.

- Purple Copper Butterfly (*Paralucia spinifera*)*.
- Gang-gang Cockatoo (*Callocephalon fimbriatum*).
- Powerful Owl (*Ninox strenua*).
- Barking Owl (*Ninox connivens*).
- Brown Treecreeper (*Climacteris picumnus*)
- Varied Sittella (*Daphoenositta chrysoptera*).
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*).
- Scarlet Robin (*Petroica boodang*).
- Flame Robin (*Petroica phoenicea*).
- Spotted-tailed Quoll (*Dasyurus maculatus*) (south-east mainland population)*.
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*).
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*).
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

The species identified with an * are Matters of National Environmental Significance (MNES) by virtue of their listing as threatened species under the Commonwealth EPBC Act.

The above listed species were subsequently assessed in accordance with the requirements under the TSC and EPBC Acts by Lesryk (2017) (refer to Section 4.2.6).

It is noted, Lesryk (2017) did not identify the Wollemi Mint-bush (*Prostanthera cryptandroides subsp. cryptandroides*), nor habitat for this species on the Quarry Site or adjoining surrogate vegetation plot. OEH requested in its environmental assessment requirements (see Section 3.2.1.2) that the potential for impact on this species be considered, however, on the basis that it was not identified and habitat absent, Lesryk (2017) has completed no further assessment.

4.2.5 Management, Mitigation and Offset Measures

4.2.5.1 Flora and Fauna Management Plan

Management of biodiversity at the Quarry is undertaken in accordance with a *Flora and Fauna Management Plan*, most recently updated in September 2016 (RWC, 2016b), which includes management measures to be implemented that will:

- ensure that remnant vegetation within the Quarry is documented and suitably protected and maintained;
- reduce risks to bushland adjacent to the Quarry, as much as practically possible;
- guide revegetation of disturbed areas no longer required for operations; and
- minimise potential impacts to native flora and fauna as a result of quarry operations.

A copy of the *Flora and Fauna Management Plan* is provided as **Appendix 9**, with the following summarising the central and most significant features of biodiversity management.

Vegetation Clearing Protocol

Vegetation clearing will be limited to approved areas only, with areas to be minimised to avoid impacts to native vegetation. Progressive clearing will ensure that vegetation is retained for as long as possible and only removed immediately before an area is required for operations.

Clearing campaigns will be scheduled to avoid spring to reduce the potential impact to roosting or breeding fauna species.

Vegetation clearing will occur in accordance with the following protocols.

- Areas to be cleared will be subject to a pre-clearing survey, including survey of individual trees specifically directed towards detecting any roosting or nesting fauna.
- Investigation of trees will be conducted on the day that they are to be cleared, to detect any individual animals present at the time.
- Where arboreal species are detected, a 10m buffer will be established around the tree and it will be left overnight to allow to animal to vacate the tree.
- Large habitat trees and those in which species have previously been identified will be carefully felled and any hollows checked at the end of the process for wildlife.
- Where fauna remains or is captured during vegetation clearing the animal will be released into nearby native vegetation where it is considered that doing so does not put the species at risk of injury.
- Should clearing activities result in injury to any native fauna species, the local WIRES organisation or a suitable alternative will be contacted immediately for assistance.

Hollow-bearing Tree Management

Tree hollows are an important resource for many native fauna species, and are vital for some species. The following specific protocols relating to hollow-bearing trees will be implemented.

- Hollow-bearing trees that have been felled will be placed in rehabilitation areas or undisturbed areas of the Quarry.
- A controlled felling technique will be used for clearing of hollowing-bearing trees that includes the following.
  - Initially nudging the tree to induce any fauna to vacate. This process should progressively increase in force.
  - Wait a period of five minutes to allow the fauna to vacate the tree. Repeat this step if necessary.
  - Select the preferred direction of fall and push the tree from a high point along the trunk towards the preferred direction of fall.
  - If the tree is too strong to be pushed with all roots intact, some of the roots on the restraining side will be cut and/or excavated.
  - The speed of fall and ground impact will be reduced where possible.

Salvage, Storage and Reuse of Materials

Large landscape features such as boulders, major tree trunks, major tree limbs and if possible minor branches will be salvaged and used directly in progressive rehabilitation activities or moved to undisturbed areas of the Quarry for temporary storage. This activity will create habitat with structural complexity and encourage many species into the rehabilitated areas.

Where possible, leafy materials will also be placed on rehabilitation areas or stockpiled in order to retain any existing seed bank.

Salvaged and stored material would selectively be placed on progressive or final rehabilitation areas.

Weed Management

All noxious weeds, including Blackberry which has been identified on the Quarry Site, will be managed and controlled in accordance with the requirements of the *Noxious Weeds Act 1993*.

Weed control within the Quarry Site will continue to focus upon the removal of Weeds of National Significance (WoNS), noxious weeds and reducing the risk of further weed invasion. This is will be achieved by deterring the growth of weeds in recently disturbed areas, and preventing the transportation of weeds onto the Quarry Site.

As cleared areas are removed from operations, they will be revegetated with a suitable groundcover to stabilise the surface and limit the potential for weed growth. Annual weed spraying and, where necessary, manual removal or slashing campaign will be continued to address any weeds that are evident. Any weed removal campaign will need to consider the weather conditions, soil conditions and time available for spraying. All herbicides will be handled and applied generally in accordance with the manufacturer's instructions.

Purple Copper Butterfly Management

Purple Copper Butterfly is known to be dependent on Blackthorn plant (*Bursaria spinosa ssp lasiophylla*) as a food source and has developed a symbiotic relationship with the ant species *Anonychomyrma nitidiceps* which are thought to offer the butterfly larvae some protection while they feed on the Blackthorn in return for nutritional secretions from the larvae (Dexter & Kitching, 1991).

Management of the species will continue to be directed towards protection of the Blackthorn. The following measures will be implemented to protect, conserve and re-establish Blackthorn within the Quarry Site.

- Operations will continue so as to avoid further removal of Blackthorn.
- Natural vegetation screenings will be developed for the existing Blackthorn populations within the Quarry Site to minimise dust impacts from operations.
- Existing Blackthorn populations will be marked so the site personnel may easily identify the species and avoid contact or unnecessary removal.
- Targeted monitoring of the Blackthorn and Purple Copper Butterfly will be undertaken by a qualified ecologist on an annual basis. Monitoring is further described in Section 4.2.7.
- Blackthorn populations will be included in revegetation activities associated with progressive rehabilitation of the Quarry Site. A suitably qualified person will be commissioned to provide advice on establishment of the Blackthorn to encourage development of suitable habitat for the Purple Copper Butterfly.

Other more general management measures associated with soil management, revegetation, erosion and sediment control and site access which will assist in the achievement of the biodiversity management objectives are also described in the *Flora and Fauna Management Plan*.

4.2.5.2 Biodiversity Offset Measures

The 2.4ha of disturbance associated with the WSEA and ESEA has occurred subsequent to the establishment of the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014) and hence this disturbance should be offset in accordance with this policy.

Lesryk (2017) has used the BioBanking credit calculator to establish the number of ecosystem and species credits required to offset the disturbance as follows.

- Ecosystem Credit Requirements.
  - PCT 732 (1.9ha) = 120.
  - PCT 1093 (0.5ha) = 34.
- Species Credit Requirements.
  - Purple Copper Butterfly = 146.

There are currently no market-based ecosystem or species credits available which can be immediately retired. Acknowledging this, on approval of the Proposed Modification the Proponent would proceed to offset the disturbance by one of the following methods.

- The establishment of an offset site on Lot 6 DP872230 (owned by the Proponent) or surrounding freehold land (in negotiation with the land owner).

  As illustrated by **Figure 13**, the vegetation types to be disturbed extend beyond the Quarry Site on Lot 6 DP872230 (which is owned by the Proponent) and adjoining freehold land. As the vegetation is not an EEC or over cleared in the catchment, it is likely sufficient area would be available for offsetting the ecosystem credit requirements (Lesryk, 2017).

  The Proponent would undertake further field investigations on Lot 6 DP872230 or adjoining freehold to confirm the available ecosystem and/or species credits available. As illustrated by **Figure 13**, Purple Copper Butterfly and its habitat has previously been identified in locations on and adjoining the Quarry Site.

  Noting the period for identifying Purple Copper Butterfly is restricted to between late August and November, the Proponent proposes to undertake the field survey between September and November 2017, with an offset to be established by September 2018.

- Contribution to the Biodiversity Conservation Fund in accordance with *Section 6.2(g)* of the *Biodiversity Conservation Act 2016*.

  This is considered particularly relevant to offsetting the species credits associated with the Purple Copper Butterfly as due to the specific habitat requirements of this species identifying suitable land of sufficient area may be difficult.

4.2.6 Assessment of Impacts

4.2.6.1 Matters of National Environmental Significance

Lesryk (2017) applied the *Matters of National Environmental Significance: Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999* (DoE, 2013) to assess the impact of the completed clearing on Purple Copper Butterfly and the Spotted-tailed Quoll. The assessment of Lesryk (2017), which can be viewed in full as *Attachment 5* of **Appendix 6**, concluded that the following for the two MNES.

Spotted-tailed Quoll

- Clearing is unlikely to have had a significant impact on the Spotted-tailed Quoll.

Purple Copper Butterfly

- The clearing of 1.9ha of identified and potential habitat (PCT 732) may have had a significant impact on the Purple Copper Butterfly.
- Contingent on the establishment of a suitable biodiversity offset, referral to the Federal Minister for the Environment to determine whether the clearing represents a controlled action requiring ministerial approval is not required.

4.2.6.2 NSW Listed Threatened Species

Seven-part tests were completed for the species identified in Section 4.2.4 in accordance with *Section 5A* of the EP&A Act (refer to *Attachment 6* of **Appendix 6**). The criteria of the Seven-part test are designed to determine whether there is likely to be a significant effect on the threatened species, or their habitats, and consequently whether a Species Impact Statement (SIS) is required.

In relation to the Purple Copper Butterfly, it was concluded that the clearing of 1.9ha of identified and potential habitat may have had a significant effect. However, on the basis that a suitable biodiversity offset is established, Lesryk (2017) conclude that the impact would be sufficiently offset and an SIS not required.

Lesryk (2017) notes that the remaining species have much broader distributions and larger territorial requirements, meaning they are less sensitive to small-scale habitat loss and modification. Lesryk (2017) concludes that the clearing associated with the Proposed Modification would not have had a significant effect on these threatened species, or their habitats and consequently the preparation of a SIS is not required.

4.2.7 Monitoring

Monitoring for Purple Copper Butterfly occurrence, habitat condition and general vegetation condition of the Quarry Site would continue to be undertaken in accordance with the Quarry Flora and Fauna Management Plan (refer to *Section 5* of **Appendix 9**).

4.3 SURFACE WATER RESOURCES

4.3.1 Introduction

As noted in Section 3.3.3, the Quarry is currently operated in accordance with a Water Management Plan (WMP) (RWC, 2016a) which includes the disturbance associated with the WSEA and water use and management associated with the operation of the fine aggregate and sand processing operations (and silt cells).

The following sub-sections provide:

- a review of the modified catchments of the Quarry Site associated with the ESEA;
- an update to the erosion and sediment control features of the Quarry to account for the ESEA and specific design of the WSEA;
- a review of the site water balance;
- additional surface water controls and management measures; and
- an assessment of the potential impacts on receiving waters which could result as a consequence of the Proposed Modification.

4.3.2 Hydrological Setting

4.3.2.1 Drainage and Water Storage

The Quarry Site is located within the Upper Coxs River sub-catchment of the Hawkesbury-Nepean Catchment (see **Figure 9**, p. 34).

Locally, the Quarry Site is located within a small catchment with flows from a small hill within Lidsdale State Forest to the north of the Great Western Highway and off the elevated hilltop of the Quarry Site itself flowing via first and second order streams into the Coxs River (see **Figure 14**).

Surface water drainage of the Quarry Site is divided into 11 separate catchments by site topography, drainage infrastructure or drainage bunds (see **Figure 14**). **Table 6** identifies and describes each catchment, nominates whether the runoff within each is clean, dirty or a combination and nominates the destination of runoff (either to sediment basin, storage dam or natural discharge). Where currently constructed, the storage capacity of each structure is identified. Structures to be constructed for the purpose of the Proposed Modification are referenced as in **bold** with the design capacities discussed in Section 4.3.4.2.

Table 6
Quarry Site Catchments

Name	Area (ha)	Type	Description	Storage	Volume (ML)
1	3.2[2]	Combined	Entrance road, west facing slope of the mining area, haul road and miscellaneous disturbance.	Bottom Working Dam (SB2). – Current. – Final.	 2.0 **2.8**
8	0.8	Clean	Runoff collected in roadside drains and culverts of the GWH adjacent to the Quarry Entrance.		
2	3.1[1]	Dirty	Mining area – eastern slope.		
E	1.6[2]	Dirty	Mining area – below surface area (no runoff).	In-pit.	N/R
3	0.5	Dirty	Site office, weighbridge area and selected haul roads.	Office Sediment Basin (SB5).	0.15
4	7.1	Dirty	Processing and stockpiling area, internal access roads and portion of WSEA (lower tier).	Main Sediment Basins (SB1).	2.1
5	7.5	Clean	GWH, undisturbed Quarry Site (north of office) and catchment of a gully to the north.	Captured upslope of WSEA and transferred to natural discharge by pipeline.	**N/R**
6	1.3	Dirty	Principal drainage of WSEA.	Western Sediment Basin (SB6).	**2.0**
7	0.5	Dirty	ESEA.	Eastern Sediment Basins (SB7a/b).	**0.5**

GWH = Great Western Highway

Note 1: Catchment to reduce in size as Catchment E increases in size

Note 2: Catchment to increase in size as the mining area is developed below surface elevation

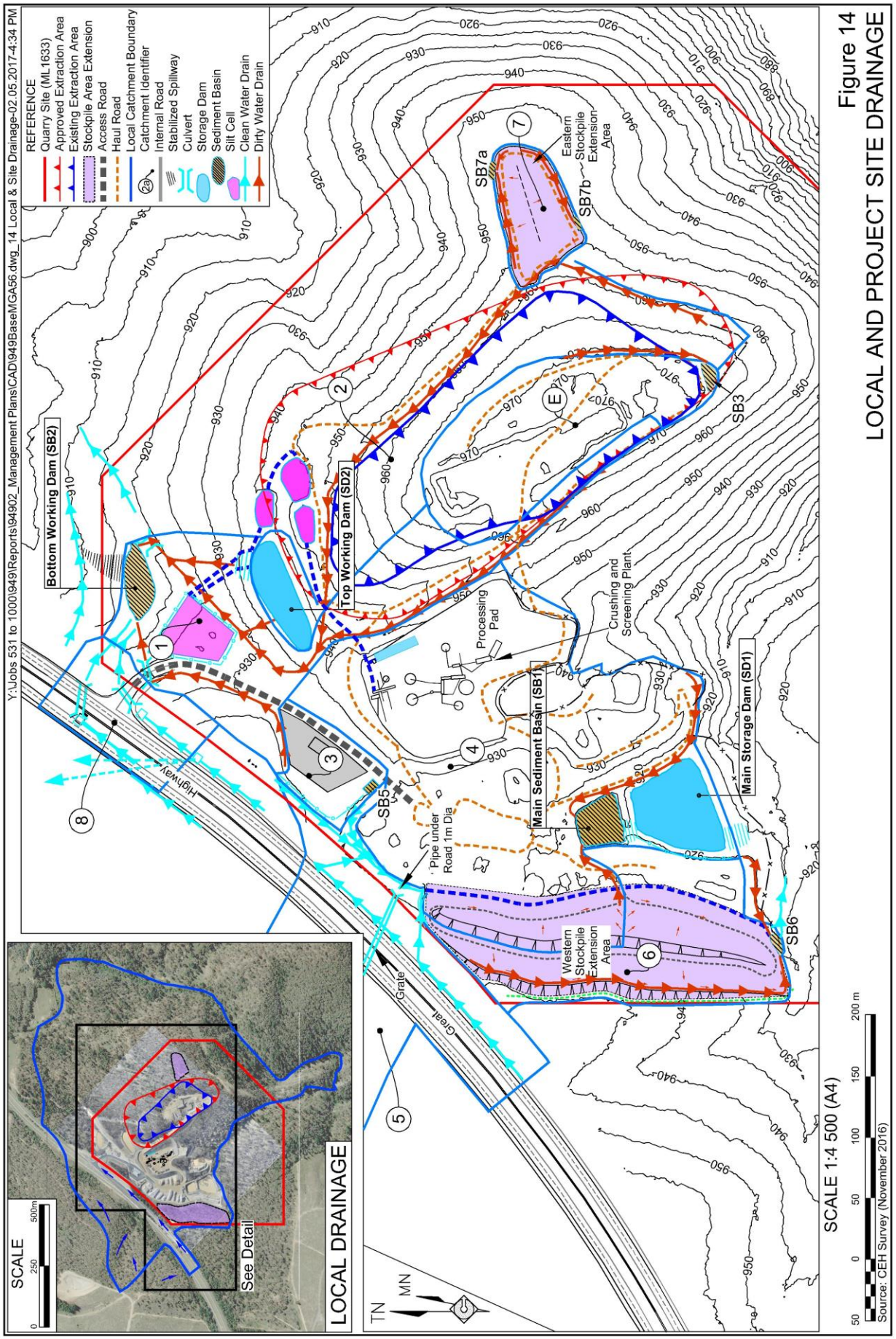


Figure 14
LOCAL AND PROJECT SITE DRAINAGE

With reference to the type of runoff identified in **Table 6**:

- dirty water refers to runoff from disturbed areas of the Quarry Site; and
- clean water refers to runoff from catchments unaffected by Quarry Site activities (regardless of water quality).

Where the water type is identified as 'Combined' this refers to catchments receiving both clean and dirty water runoff.

As shown in **Table 6**, seven catchments are considered to contain dirty water runoff. With the exception of runoff from Catchment E (the below ground level area of the open cut), this runoff is to be diverted to sediment basins for settlement prior to re-sue of the water or discharge (subject to achievement of water quality criteria). Additional capacity for water storage is provided by two storage dams (SD1 and SD2).

Two catchments are identified as carrying clean water (Catchments 5 and 8). By virtue of the construction of the Quarry Site intersection with the Great Western Highway, runoff from Catchment 8 is diverted via road side drains to a culvert below the Quarry Access Road which also accepts dirty water runoff from Catchment 1. This runoff is diverted to SB2. Clean water runoff from Catchment 5 is currently segregated from Quarry Site disturbance, captured within a clean water drain (CWD-5) and allowed to discharge to natural drainage to the south of the SD1.

4.3.2.2 Water Quality

Water quality of the Coxs River was monitored on a monthly basis between April 2016 and October 2016, reverting to an annual monitoring cycle on approval of the current Water Management Plan. The results of the monthly monitoring illustrate a reasonably consistent water quality upstream and downstream of the Quarry Site with:

- pH varying between 7.5 and 9.0;
- electrical conductivity (EC) of between 500µS/cm and 1 230µS/cm;
- total suspended solids (TSS) generally less than 5mg/L;
- sulphate (SO_4) of between 91mg/L and 208mg/L; and
- very low concentrations of dissolved metals.

While some samples are reasonably alkaline and towards the upper threshold for salinity (EC) of drinking water, the water quality is considered good and representative of water which flows with the Warragamba catchment of the Sydney Drinking Water Catchment.

Samples of water taken from the sediment basins following heavy rainfall have confirmed elevated concentrations of suspended sediment (>100mg/L). This is expected for dispersive type soils with the Proponent committed to containing dirty runoff within sediment basins and only discharging when TSS levels recede to <30mg/L or during rainfall events exceeding 56.4mm in 5 days.

4.3.2.3 Flooding

As identified in Section 3.3.3 and on **Figure 11**, the Quarry Site occurs at an elevation well above that considered at risk of flooding.

4.3.3 Management Issues and Constraints

4.3.3.1 Water Licensing

Water Sharing Plan

The Proposal lies within the Wywandy Management Zone of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* ("the Water Sharing Plan"). In accordance with Part 5, Division 2, Clause 22 of the Water Sharing Plan, the Proponent is entitled to capture and store water sources pursuant to the harvestable rights order made under Section 53 of the *Water Management Act 2000* (WM Act). Section 53 of the WM Act permits landholders to harvest and use a portion of the total runoff from their land without requiring licence(s), provided that:

- the total capacity of the harvestable rights water storages are less than the capacity permitted under the right; and
- that all storages are constructed either off-line or on first or second order, non-spring fed streams.

Waterfront Land

Waterfront land includes the bed and a distance inland of 40m from a river, estuary or lake where a river is defined the *Water Management Act 2000* (WM Act) as.

> *a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and*
>
> *b) any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and*
>
> *c) anything declared by the regulations to be a river,*
>
> *whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river*."

An accepted method to determine whether a topographic feature such as a gully represents a 'river' in accordance with the above definition is whether it is identified as a drainage line, i.e. a blue line, on a 1:25 000 scale topographic map. **Figure 14** identifies that the WSEA is located within 40m of several such drainage lines and as such could be identified as impact on waterfront land.

Notwithstanding the above, a Controlled Activity Approval (CAA) is not required by virtue of Section 89J(g) of the EP&A Act.

4.3.3.2 Erosion and Sedimentation

King (1994) identifies the stockpile extension areas of the Quarry Site as occurring over the Cullen Bullen and Mt Walker Soil Landscapes (see **Figure 15**).

More detailed soil assessment completed by Pacrim (2001) has provided fore some modification of the soil landscape boundaries based on the soil types identified as part of this study (see **Figure 15**). Both the colluvial based lithosol soils of the Mount Walker soil landscape and erosional based duplex soils o the Cullen Bullen soil landscape are identified as moderately to highly erodible soils (K-factors of 0.03 to 0.05) with moderate to high erosion hazard.

Based on the elevated erosion hazard, in the absence of appropriate controls the clearing of groundcover and stripping of surface soils associated with the Proposal could result in an elevated risk of erosion on the Quarry Site. This could lead to discharges of sediment from the Quarry Site and pollution within the Coxs River catchment. This would be contrary to the aims and objectives of the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011, as well as the general objectives of the Proponent to manage the Proposal in a way which minimises impact on the environment, and Section 120 of the POEO Act.

4.3.3.3 Salinity and Acidity

Neither soil landscape is identified as being saline and do not pose a risk of increasing the salinity of the local catchments. The Mount Walker soil landscape is identified as strongly acid, however, in the elevated location in the landscape there is not a high risk of acid runoff given the lack of inundation.

4.3.3.4 Pollution of Downstream Water Courses

The potential sources of water pollution from the activities within the Quarry Site would be as follows.

i) Runoff from stockpiles of topsoil, subsoil and excavated materials.

ii) Surface runoff from product stockpiles.

iii) Runoff from roads and hardstand surfaces.

iv) Surface runoff from rehabilitated areas prior to full stabilisation.

v) Leakage or spillage of hydrocarbons.

Based on the potential sources of pollution, suspended solids, i.e. sand, silt or clay particles in water, and hydrocarbons are likely to be the major sources of surface water pollution arising from the Proposal. In the event that fertilisers are used as part of progressive final landform rehabilitation, i.e. for areas returned to pasture, the discharge of water with elevated nutrient levels (nitrogen and phosphorous) may occur.

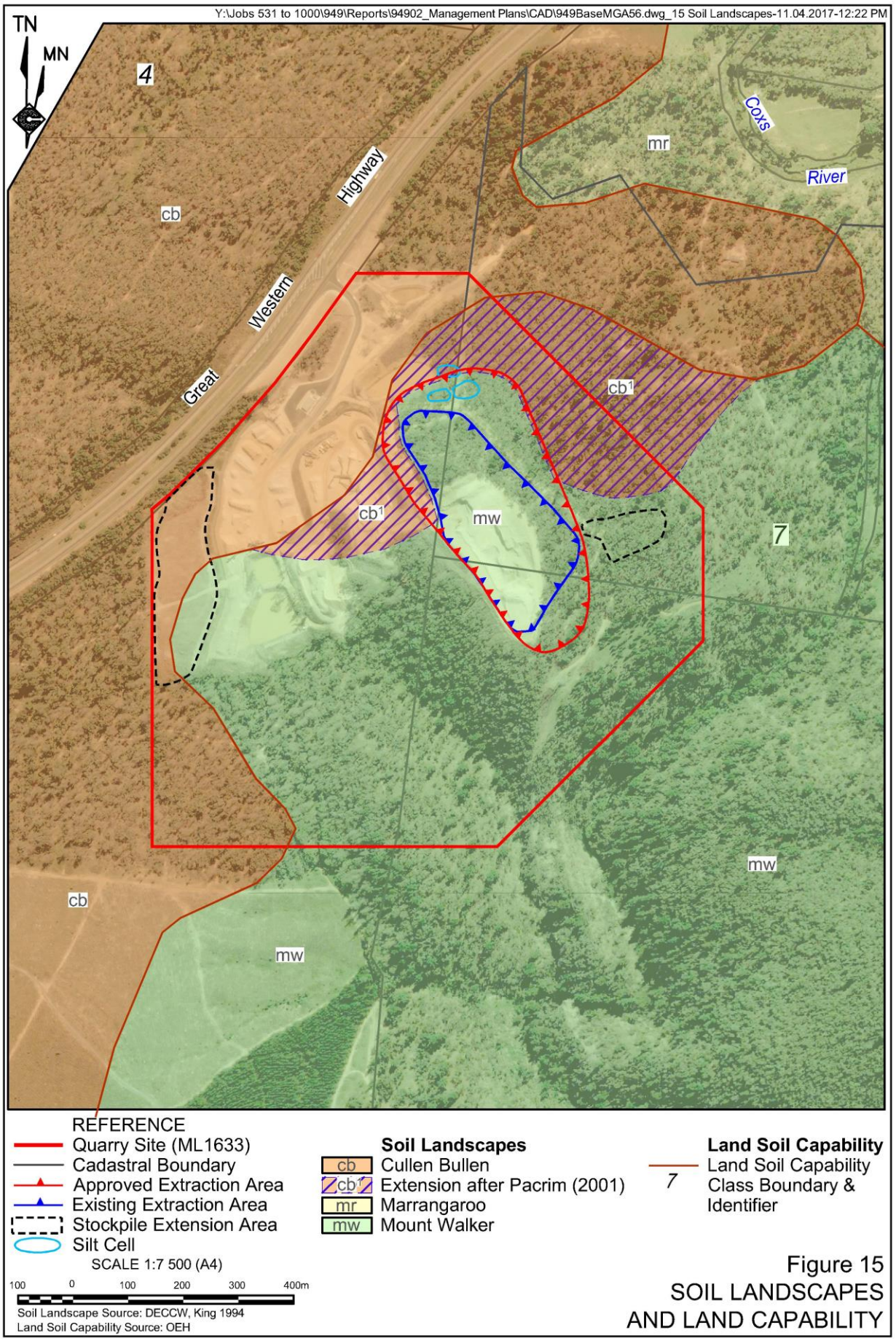


Figure 15
SOIL LANDSCAPES
AND LAND CAPABILITY

4.3.4 Controls and Operational Safeguards

4.3.4.1 Objectives

The principal objectives for management of surface runoff on and from the Quarry Site would be as follows.

- To divert run-off up-slope of disturbed areas ("clean water") to natural drainage unaffected by the Proposal.
- To control run-off over areas of disturbance ("dirty water") and prevent discharge off the Quarry Site until settlement of suspended sediments has occurred.
- To manage the use, storage and, in the event of a spillage, control and clean-up of hydrocarbons.

Sections 4.3.4.2 to 4.3.4.4 describe the proposed water management controls that would be implemented within and around the main areas of disturbance on the Quarry Site.

4.3.4.2 Erosion and Sediment Control

Figure 16 provides a conceptual Erosion and Sediment Control Plan (ESCP) for the modified Quarry Site. The ESCP updates the SWMP which has been approved for the Quarry to include water and sediment management features associated with the ESEA and WSEA. Standard Drawings (SDs) for the structures referenced on the ESCP are included on the ESCP and have been taken from *Managing Urban Stormwater: Soils and Construction Vol. 1* (Landcom, 2004) ("the Blue Book").

The following provides an overview of the additional structures to be constructed to manage runoff from and around the ESEA and WSEA, i.e. structures additional to those already in place.

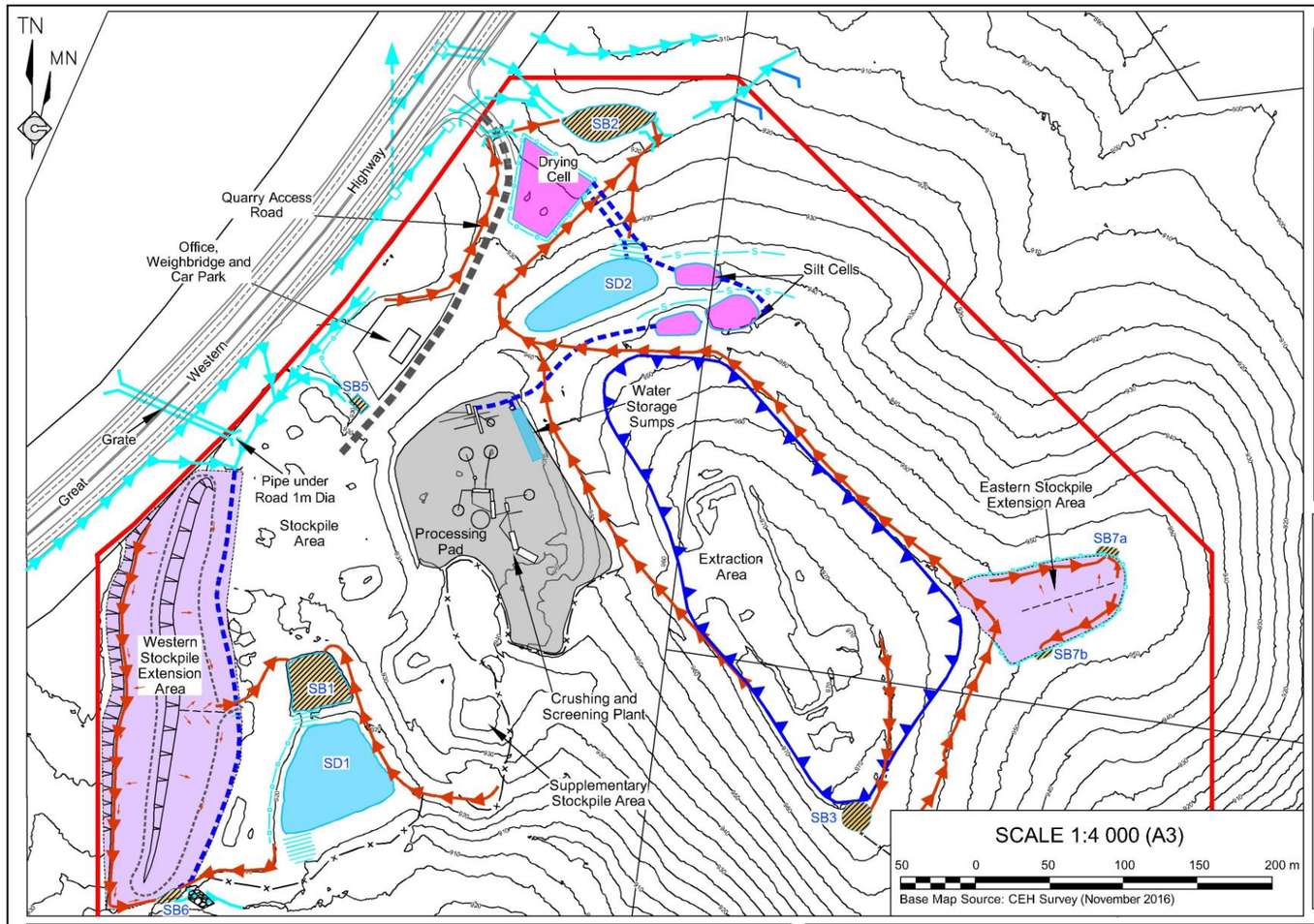
Clean Water Diversion Drains

Upslope of any disturbance, a series of low flow earth banks would be progressively constructed to divert clean water away from the developing mining area. A clean water diversion drain may be required upslope (west) of the WSEA during construction. Given the small catchment area, the drain would be constructed as an earth bank (low flow) in accordance with SD 5-5 of the Blue Book. A level spreader constructed in accordance with SD 5-6 of the Blue Book, which provides a flat discharge zone from the drain with a minimum width of 4m, would be included at the discharge point.

Clean Water Pipeline

Replacing the existing clean water drain to the west of the approved stockpile area, a pipeline would be installed. At the confluence of the three contributing catchments, a sump would be constructed to allow for initial settlement of flow. As water enters the sump it would slowly rise to the in-flow point of the pipeline (of 1 000mm in diameter) which would be protected from erosion by a concrete headwall and rock reinforced retaining wall.

At the discharge point, the water would discharge to an energy dissipation structure constructed in accordance with SD 5-8 of Landcom (2004) (see also **Figure 16**).



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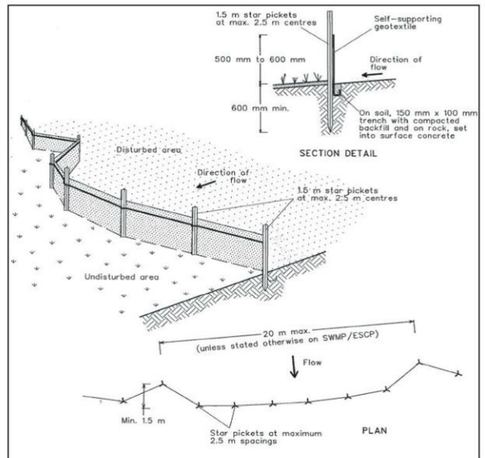
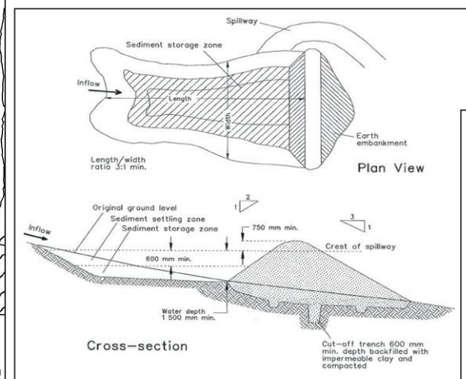
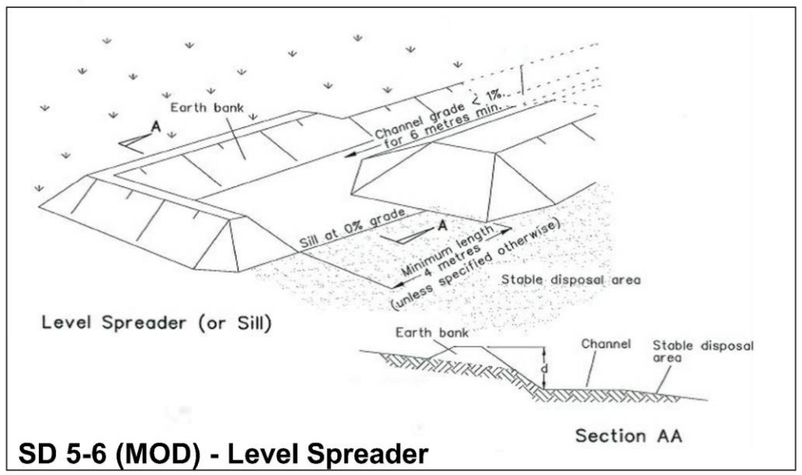


SD 6-8 Sediment Fence

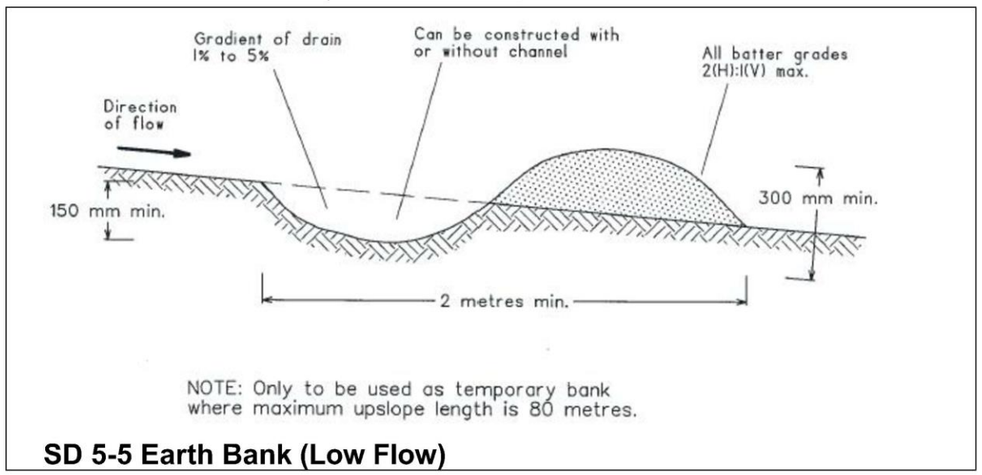


SD 6-4 Earth Basin - Wet

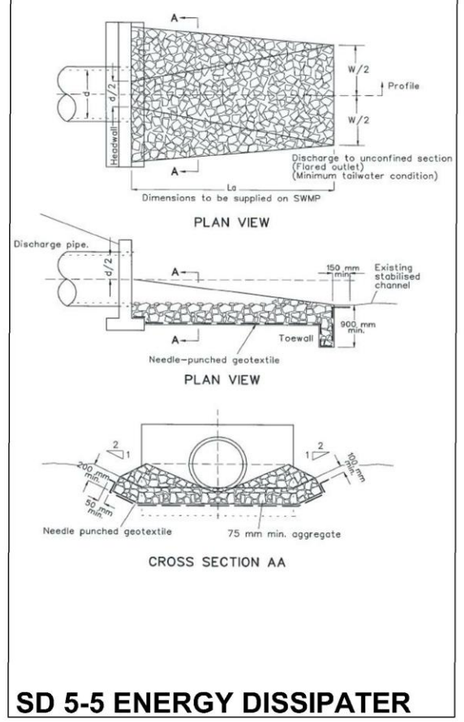
REFERENCE
- ML1633 Boundary
- Extraction Area
- Stockpile Extension Area
- Processing Pad
- Access Road
- Cadastral Boundary
- 920 Contour (mAHD)(Interval = 2m)
- Watercourse/Drainage Line
- S Sediment Fencing (SD 6-8)
- No Go Delineation
- Low Bund
- Stabilized Spillway
- Culvert
- Storage Dam
- Sediment Basin (SD 6-4)
- Silt Cell
- Clean Water Drain (SD 5-5)
- Dirty Water Drain (SD 5-5)
- Mitre Drain
- Water Pipeline
- Energy Dissipator (SD-8)



SD 5-6 (MOD) - Level Spreader



SD 5-5 Earth Bank (Low Flow)



SD 5-5 ENERGY DISSIPATER

Figure 16
EROSION AND SEDIMENT CONTROL PLAN

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All works would be undertaken in accordance with *Managing Urban Stormwater: Soils and Construction Volume 2A: Installation of Services* (DECCW, 2008a) with the Quarry Erosion and Sediment Control Plan (included as an appendix to the Quarry SWMP) to be updated prior to commencement.

Dirty Water Collection Drains

A series of low flow earth banks (in accordance with SD 5-5) would be constructed downslope within the stockpile extension areas as identified on **Figure 16**. These drains would capture and divert the dirty water into sediment basins for capture and settlement of water. The design features of the drain would be the same as described for the up-slope clean water drains (SD 5-5, although level spreaders would not be required as any discharge would be from the relevant sediment basin.

Sediment Basins

Sediment basin (SB) 4 would be constructed towards the southeastern point of the WSEA with runoff directed from the two tiers of the WSEA via the dirty water collections drains described above. Runoff from the ESEA would be to two smaller sediment basins (SB6a and SB6b) which accept runoff from the northern and southern portions of the stockpile area respectively. These sediment basins would be constructed as wet sediment basins, i.e. in accordance with SD 6-4 of the Blue Book.

Wet sediment basins provide for both a water settlement zone and sediment storage zone, the minimum volume of which is equivalent to the water and sediment generated by a specified rainfall event. In line with EPA recommendations, the design rainfall event is equivalent to the 5-day 95th percentile rainfall for the Lithgow area (56.4mm). In determining the minimum storage capacity for each basin, the maximum disturbance area within the catchment for each has been assumed as well as the following parameters.

- Erodibility (K) Factor of 0.05[6].
- Runoff Coefficient of 0.5[7].
- Design rainfall event 5-day 95th percentile rainfall conditions (56.4mm).

Table 7 provides the minimum water settlement and sediment storage volumes required for the sediment basins to be constructed, along with the actual proposed capacities. The calculation sheets used to determine these volumes are included as **Appendix 10**.

SB-4 and SB-7a/b (the new sediment basins) would provide capacities more than double the minimum requirement. A marker level would be established to identify the water level below which the minimum basin capacity is retained. In accordance with Blue Book requirements, any water accumulated above this marker would be removed within 5 days. To expedite settlement of sediment within the sediment basins, a flocculent HydroBond® HB-4118 would be added to any accumulated water. The MSDS of HydroBond® HB-4118 is included as **Appendix 8** which confirms the ecotoxicity of this product meets EPA nominated requirement's (LC_{50} <100mg/L).

[6] King (1994 notes the K-factor for the Mount Walker and Cullen Bullen Soil Landscapes as between 00.3 and 0.05.
[7] While the stockpile areas may have high runoff potential, the stockpiles themselves will reduce runoff potential significantly by virtue of water holding capacity.

Table 7
Minimum Sediment Basin Capacity Requirements

Basin	Catchment (ha)	Minimum Capacity			Proposed Capacity (m^3)
		Water Settlement Zone (m^3)	Sediment Storage Zone (m^3)	Basin Capacity (m^3)	
SB1 (WSEA and Existing Stockpile Area)	7.1	2 002	15	2 017	2 100
SB6 (WSEA)	1.3	367	2	369	1 000
SB7a / 7b (ESEA)[1]	0.5	141	1	142	500
Note 1: Both sediment basins have been sized to account for all runoff from the ESEA					
Source: refer to **Appendix 10**					

The water removed from the sediment basins would be preferentially used for dust suppression or transferred to one of the water storage dams (SD-1 or SD-2) for use in the washing circuit. Alternatively, the water would be applied to areas being rehabilitated, applied to undisturbed portions of the mining area which do not drain from the Quarry Site or, if water quality is demonstrated to meet the nominated criteria, discharged from the Quarry.

Sediment Fencing

Immediately downslope of stockpiles of erodible materials, temporary disturbance areas or areas of rehabilitation prior to the establishment of groundcover, sediment fencing would be installed in accordance with SD 6-8 of the Blue Book (see **Figure 16**).

The sediment fencing would be inspected at least monthly, or following significant rainfall event, with accumulated sediment or vegetation removed and repairs made as required. Once an established cover of grass is achieved, or the stockpile removed, the sediment fencing would be removed and/or relocated to another site to avoid the potential that this might be washed from the Quarry Site at a later date and pollute downstream waters and aquatic habitats.

4.3.4.3 Site Water Management System (Water Transfer and Discharge Management)

Water on the Quarry Site is managed in accordance with a Water Management Plan in a manner that maximises opportunities for reuse and recycling and minimises the possibility of uncontrolled discharge.

This is achieved by utilising strategies and infrastructure to transfer water around the Quarry Site for use in Quarry activities. Each water storage is utilised in a specific role in the site water management system so that the system may operate in an integrated manner to achieve the WMP objectives.

SB1: Main Sediment Basin

SB1 captures runoff from the Main Processing and Stockpiling Area of the Quarry (Catchment 4), which is diverted by a low bund constructed around the perimeter of the Main Stockpiling Area and various roadside drains (see **Figure 16**). The design of this storage incorporates provides 2.1ML of storage for the settlement of runoff and storage of sediment generated under 5-day 95th percentile conditions prior to discharging into the Main Storage

Dam (SD1). By ensuring that all runoff is directed to SB1, the water held in the Main Storage Dam is more likely to achieve the total suspended sediment concentration required of discharged water.

SB1 will be regularly emptied (to SD1 or SD2) with any accumulated sediment removed, stockpiled and either sold as fill or blended with other products prior to sale.

SD1: Main Storage Dam

SD1 will accept overflow, via a stabilised (rock-lined) spillway from SB1, or by pumping. SD1 provides 8.1ML of storage which allows significant settlement time for any accumulated water prior to discharge as well as providing a significant repository of water on-site to account for extended low rainfall periods.

Water held in SD1 may be transferred to the Top Working Dam (SD2) to supplement supply of water for dust suppression and sand washing.

SB2: Bottom Working Dam

SB2 captures runoff from:

- Catchments 1, via rock-lined roadside drains;
- Catchment H, via concrete drains and culverts of the Great Western Highway; and
- Catchment 2 via:
  - a drain which commences to the south of the mining area at an elevation of approximately 960m AHD and drains parallel to the contour before discharging at an elevation of approximately 955m AHD; and
  - a roadside drain to the east of the mining area, following the main haul ramp to the mining area (see **Figure 16**).

The design volume of SB2 would be increased to 2.8ML to provide sufficient settlement and storage volume for runoff generated under 5-day 95th percentile conditions. As water accumulates within SB1, it will be pumped to SD2, SD1 or the silt cells, or discharged subject to achieving the water quality criteria of DA 344-11-2001 and EPL 13172, within 5 days of accumulation. The transfer of captured runoff from this storage assists in managing the design storage requirements for sediment control and lowers the possibility of discharge.

SD2: Top Working Dam

This storage is operated as the principal point of draw for dust suppression and the washing circuit. It is constructed above ground, with no run-on catchment, and accepts overflow from the silt cells, as well as water pumped to it from the sediment basins and SD1.

SD2 also receives discharge from three silt cells (of combined 7.2ML capacity) which provide for the settling of silt from water used to wash sand and other quartzite products.

SD2 is the primary source of water for dust suppression and sand washing, and is kept at or close to full capacity as a result. Under rainfall conditions exceeding 5-day 95th percentile conditions, SD2 may discharge water via a rock-lined spillway which flows to SB2.

Silt Cells / Drying Cell

Section 2.4.2 provides a summary of the operation of the silt cells and drying cell to manage water from the fine aggregate and sand processing plant.

Additional Sediment Basins

Additional sediment basins are maintained within each dirty water catchment. Each sediment basin has been designed and will be maintained (by pumping of accumulated water to SD2 or SD1) to accept runoff and sediment following a 5-day 95th percentile rainfall event.

4.3.4.4 Hydrocarbon Contamination

Refuelling of equipment would be undertaken within a secured, sealed and bunded area where any spillage or leakage can be contained.

Refuelling of equipment or plant may also be necessary at other locations within the Quarry Site. This would be undertaken by a mobile fuel truck away from natural or artificial drainage lines. The mobile fuel truck, as well as the plant or vehicle being refuelled would maintain a hydrocarbon spill kit for use in the event of leakage or spillage. In the event of a hydrocarbon leak or spill, the Proponent would implement the following spill management procedure.

- Phase 1 – Source Control: isolate the source of spill or leak and stop the leak either by maintenance or placing the leaking item within or over the fuel/oil storage area.
- Phase 2 – Recovery: recover as much as possible at the source by pumping free hydrocarbon from the surface and excavating hydrocarbon-contaminated materials. Contaminated materials would be stockpiled on site under cover and on an impermeable surface, e.g. a high-density polyethylene sheet. This material would later be bio-remediated on site and/or transported to an approved waste facility.
- Phase 3 – Remediation: transport the contaminated material to a designated area within the Quarry Site (away from natural or created drainage) for on-site bio-remediation ("land farming") or to a facility licensed to accept and treat hydrocarbon contaminated material.

4.3.4.5 Final Landform

Figure 7 presents the proposed final landform of the Quarry Site, illustrating the integration of the retained void and profiled landforms of other disturbance. The clean water diversion drains would be retained to provide for ongoing stabilised flow paths for runoff from the north.

The sediment basins and associated diversion drains would be decommissioned as rehabilitation is completed within the affected catchment.

In order to prevent waterlogging within the retained void area, dams would be constructed across this part of the landform to collect and contain any rainfall and runoff. Given that natural evaporative rates exceeds rainfall, the landform would remain above the local groundwater table, and the likely localised fracturing of the rock below the mining area (as a result of blasting) it is expected that water will only accumulate for relatively short periods following significant rainfall.

4.3.5 Site Water Balance

4.3.5.1 Introduction

The site water management system at the Quarry has been developed in a manner that enables the:

- efficient recovery and use of natural resources;
- effective management of available storage volumes that prevents uncontrolled discharge to receiving environments; and,
- effective water quality management strategies that prevent discharge of impacted water to receiving environments.

4.3.5.2 Water Sources

Currently, the sole source of water on the Quarry is rainfall that generates surface runoff. The Proponent is currently investigating the potential acquisition of water licences to supplement the supply, however, this water balance has ben prepared on the basis that such supplementary water is not available.

4.3.5.3 Water Usage and Losses

Water captured from disturbed areas is recycled on site for reuse in the following site activities:

Fine Aggregate and Sand Washing

Based on the maximum operating capacity of the washing circuit, up to 100 000t of fine aggregate and sand may washed annually. Based on a wash ratio of 0.5 to 0.625kL water per tonne of sand, and a recovery / reuse rate of 85%[8] (pers. comm. Dukes Engineering), up to **9.4ML/yr** would be required.

Dust Suppression and Wheel Wash

16ML/yr of water is applied to potential dust emission sources to manage potential air quality impacts arising from Quarry activities, or the Quarry wheel wash.

Recycling captured runoff ensures the efficient use of the available water resource and allows for the proper management of sediment control dams, therefore lowering the possibility of uncontrolled discharge of water to the receiving environment in a rainfall event.

Evaporation

Water will also be lost through evaporation from dam / basin surface. To estimate annual losses, the National Centre for Engineering in Agriculture (NCEA), Ready Reckoner (for analysing evaporation and seepage from water storages) was applied to the location (http://readyreckoner.nceaprd.usq.edu.au/). Based on a combined dam surface area of 0.857ha of dam surface area, and an average evaporation of 1 527.7mm (varying between 47.2mm in June and 211.5mm in December) for the local setting, evaporation of **13.1ML/yr** is expected.

[8] Losses include evaporation, retained moisture content of sand products and silt, and pipe losses. Return of water is increased and accelerated by the use of flocculent.

4.3.5.4 Balance

4.3.5.4.1 Water Storage Inputs

As detailed in Section 4.3.5.2 above, all inputs to the site water balance are derived from rainfall and the capture of runoff. **Table 8** below details the runoff yield volumes calculated based on statistical analysis of the rainfall data collected by the Bureau of Meteorology (BoM) weather station 063132 (Lithgow) from the 1 January 1959 through 30 June 2016.

Table 8
Calculated Runoff Volumes (ML)

Storage	Annual Exceedance Probability				
	95%	**90%**	**50%**	**10%**	**5%**
SB2: Bottom Working Dam (Catchments 1, 2 & 8)	18.6	20.5	33.0	40.3	50.8
SD1: Main Storage Dam (Catchment 4)	13.5	14.9	23.5	28.6	36.2
Total	**32.1**	**35.4**	**56.5**	**68.9**	**87.0**

A runoff coefficient (C_v) of 0.48 has been applied to Catchments 1, 2a and 4. This accounts for variation in runoff between rainfall events of 10mm or less, when runoff will be very low (C_v <0.25), and more substantive rainfall (>10mm) when runoff from the hardstand surfaces and steep topography will be high (C_v ~0.74), reflecting 'soil' with high runoff potential (refer to *Table F2* of the Blue Book).

A C_v factor of 0.8 has been applied to Catchment H to reflect the fact that runoff is over an impermeable surface with a significant portion of the flow delivered by pipe culvert.

4.3.5.4.2 Water Storage Reuse and Evaporation (Site Water Demand)

Water used for processing activities, dust suppression and evaporation are effectively withdrawals from the available water stored on site. The anticipated annual volumes (ML) required to meet the demand from each of these parameters is as follows:

- Processing (make-up) 9.4ML.
- Dust Suppression 16ML.
- Evaporation 13.1ML.

4.3.5.4.3 Water Balance

Table 9 shows the expected water surplus or deficit for a range of AEPs. This indicates that rainfall greater than the median is sufficient to account for site water demand and evaporative losses. Based on the analysis of rainfall data collected at BoM 063132, rainfall in between 85% and 90% of years would be sufficient to meet site water demand and evaporative loss.

Table 9
Site Water Balance: Selected AEP Rainfall Years

Annual Exceedance Probability	Runoff (ML)	Site Water Demand (ML)	Surplus/Deficit
95%	32.1	38.4	-6.3
90%	35.4		-3.0
85%	40.5		2.1
80%	44.6		6.2
50%	56.5		18.1
10%	68.9		30.5
5%	87.0		48.6

The balance of **Table 9** is indicative as site water demand and evaporative losses will vary on an annual basis. Importantly, the balance illustrates that sufficient water will be available to account for dust suppression and evaporation (25.4ML) in greater than 95% of years.

4.3.6 Assessment of Impacts

4.3.6.1 Water Availability

The water balance confirms that sufficient water is likely to be available from the identified water storages under the majority of rainfall conditions, with a shortfall only expected when annual rainfall is within the 15th percentile or lower (see Section 4.3.5.4.3).

To ensure that water would always be available for dust suppression, it is recommended that should the combined capacity of SD-1 and SD-2 fall below 20% capacity, actions to obtain alternative water to 'top-up' these dams be commenced.

4.3.6.2 Water Quality

Construction and installation of the structures identified in Section 4.3.4.2 and illustrated on **Figure 16** would ensure that clean water is diverted away from areas of active disturbance and any additional rainfall and runoff within the areas of active disturbance is captured on the Quarry Site.

Given the reliance of the Proponent on harvested surface water for dust suppression and fine aggregate and sand production, controlled discharges from the sediment basin are not anticipated, with discharge primarily occurring under rainfall conditions exceeding 60mm in 5 days, i.e. greater than the 5-day 95th percentile rainfall event for the local setting.

The potential for hydrocarbon contamination of runoff would be minimised by careful management of refuelling on the Quarry Site (with contingency measures implemented immediately in the event of spill or leak).

Based on the above, it is assessed that the Proposal would be unlikely to impact on the quality of water within the Coxs River catchment. Section 4.3.6.4 reviews the specific.

4.3.6.3 Environmental Flows (Water Quantity)

The Proposed Modification would result in a small reduction (2.4ha) in the local catchment of the Coxs River. This small reduction would have no perceptible impact on local or regional flows as:

- there are no dams below the Quarry Site which collect this runoff; and
- the area represents a tiny proportion of the Upper Coxs River catchment and contribution to the flow of the Coxs River in this section of the catchment.

The proposed reduction in catchment is therefore unlikely to have any adverse impact on the local catchments or other users of surface water generated by runoff from the local catchment.

4.3.6.4 State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The SEPP requires that:

> "*A consent authority must not grant consent to the carrying out of development under Part 4 of the Act on land in the Sydney drinking water catchment unless it is satisfied that the carrying out of the proposed development would have a neutral or beneficial effect on water quality*."

A neutral or beneficial effect on water quality is defined as one that:

- has no identifiable impact on water quality; or
- contains any water quality impact on the development site and prevents it from reaching any watercourse, water body or drainage depression on site; or
- transfers any water quality impact outside of the site where it is treated and disposed of, to standards approved by the consent authority.

The following considers the potential impacts of the Proposed Modification on receiving water as detrimental, neutral or beneficial.

- No uncontrolled releases of water, other than those allowable in accordance with EPL 13172 and the Blue Book, would occur from the Quarry Site. Neutral Impact.
- Discharges under high rainfall conditions (exceeding 5-day 95th percentile rainfall) may occur. These discharges may contain sediment exceeding 30mg/L potentially impacting on the Environmental Values of the receiving waters. Notably, under high rainfall conditions suspended sediment concentrations in runoff will be elevated across the catchment. Furthermore, the proposed use of flocculent within sediment basins across the Quarry Site to accelerate the recovery of water for on-site use, would reduce the concentration of sediment in water discharged from the Quarry Site under these conditions. This provides for a net improvement in the quality of any runoff from the Quarry Site. Neutral – Beneficial Impact.
- The Proposed Modification provides for the separation of runoff from undisturbed catchments upslope of the WSEA, from the disturbed WSEA catchment. Beneficial Impact.

- The Proposed Modification provides for an increase in the capacity of SB-2, and construction and operation of SB-4 and SB-6a/b, in accordance with the recommendations of Landcom (2004) and DECC (2008b): Beneficial Impact.
- As is discussed further in Section 4.5, there would be no impact on local groundwater and therefore no discernible change to the flow of groundwater to surface water in the local setting. Neutral impact.

A neutral or beneficial impact on the affected catchments is therefore demonstrated and therefore the Proposal achieves the objectives of the SEPP.

4.4 VISUAL AMENITY

4.4.1 Introduction

As noted in Section 3.3.6, the Proposed Modification has the potential to impact upon visual amenity from vantage points on and to the north of the Great Western Highway. While it is noted that the Proposed Modification represents an extension of existing features of the Quarry, the following sub-sections consider the existing visual environment (Section 4.4.2), the likely changes to the visual amenity of the Quarry Site (Section 4.4.3), the management and mitigation measures that would be implemented (Section 4.4.4), and assesses the visual impact of the Proposal (Section 4.4.5).

It is noted at the outset that the value placed upon visual amenity and the impacts upon surrounding visual amenity varies from person to person and from location to location. As a result, a visual amenity assessment is, by its nature, is highly subjective. As a result, emphasis has been placed on providing a description of the existing visual amenity surrounding the Quarry Site and the measures that would be undertaken by the Proponent to minimise potential visual amenity-related impacts on surrounding residents and others. In addition, indicative descriptions and impressions of the anticipated visual landscape following completion of mining-related operations have been provided.

4.4.2 Existing Environment

As was discussed in Pacrim (2001), the hill which is the subject of mining is visible from a number of vantage points to the north and northeast of the Quarry Site, as well as from the Great Western Highway (in both directions). The management of visibility from these vantage points towards the mining area would not be altered by the Proposed Modification.

4.4.3 Changes to Visibility

The primary change to visual amenity resultant from the Proposed Modification would be the increased visibility of stockpiling operations on the Quarry Site. The currently cleared easterly facing slope where the WSEA is to be constructed (see **Plates 5** and **6**), which was previously vegetated with native open forest vegetation (refer to Section 4.2.3.2 and **Figure 13**) would be visible as a two tiered stockpile area. Notably, this area of the Quarry Site is not visible from private land to the north of the Great Western Highway.

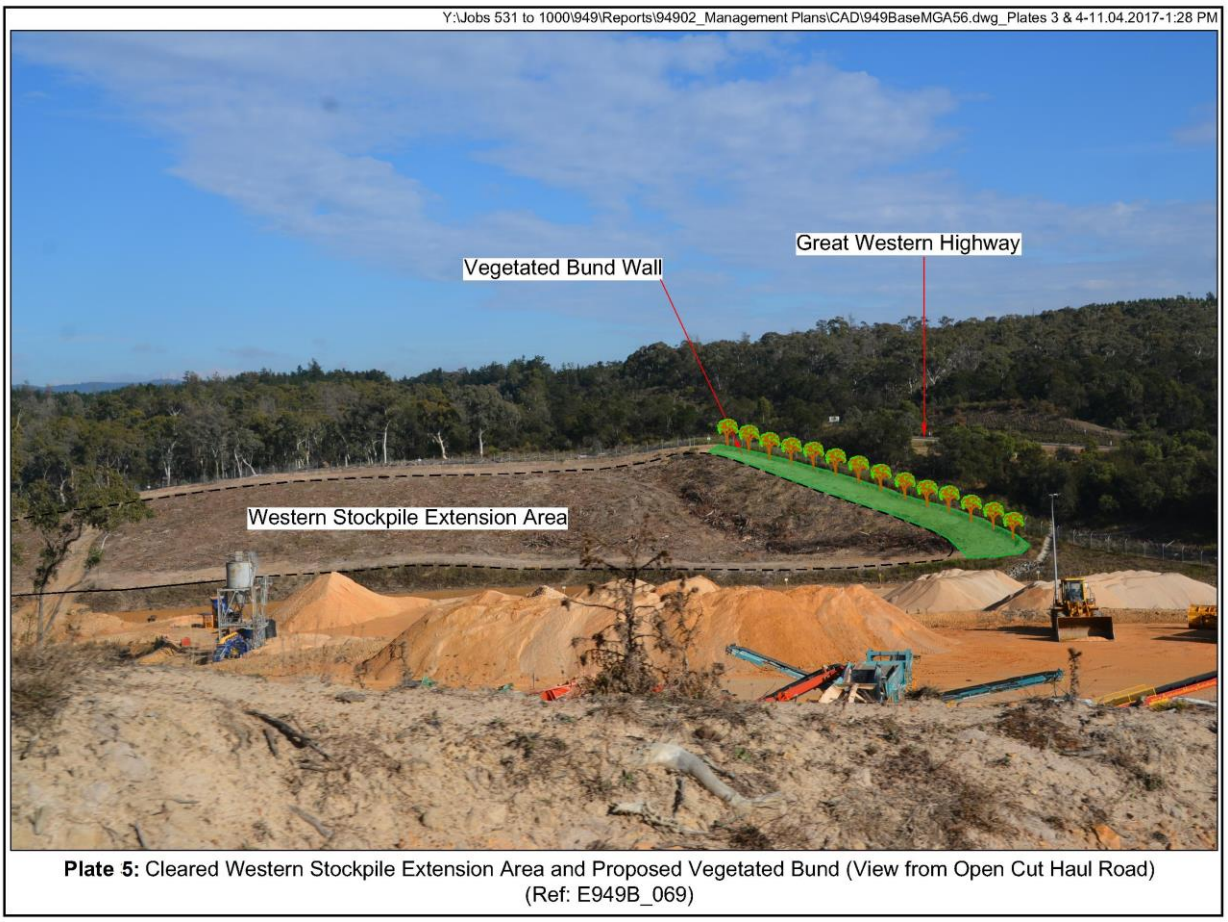

Plate 5: Cleared Western Stockpile Extension Area and Proposed Vegetated Bund (View from Open Cut Haul Road)
(Ref: E949B_069)

4.4.4 Design Features, Operational Controls and Management Measures

4.4.4.1 Design Features – WSEA

The two-tiered design of the WSEA avoids the create of a single steep back face which would be more visible to approaching vehicles on the Great Western Highway than two smaller faces. This is for two reasons.

1. The stockpiled products would rise to a height which partially screens the back face. While the stockpiles themselves would remain visible, these would be less intrusive than a single steep face.
2. By reducing the height of the faces, the ability to establish a coverage of grass (by hydroseeding or similar technique) would be improved.

Furthermore, the tiered structure of the WSEA would be more easily profiled to a landform which better resembles the pre-disturbance slope of the landform.

In addition, on construction of the WSEA, the Proponent would construct a vegetated bund along the northern perimeter of the Quarry Site (refer to Section 4.4.4.2).

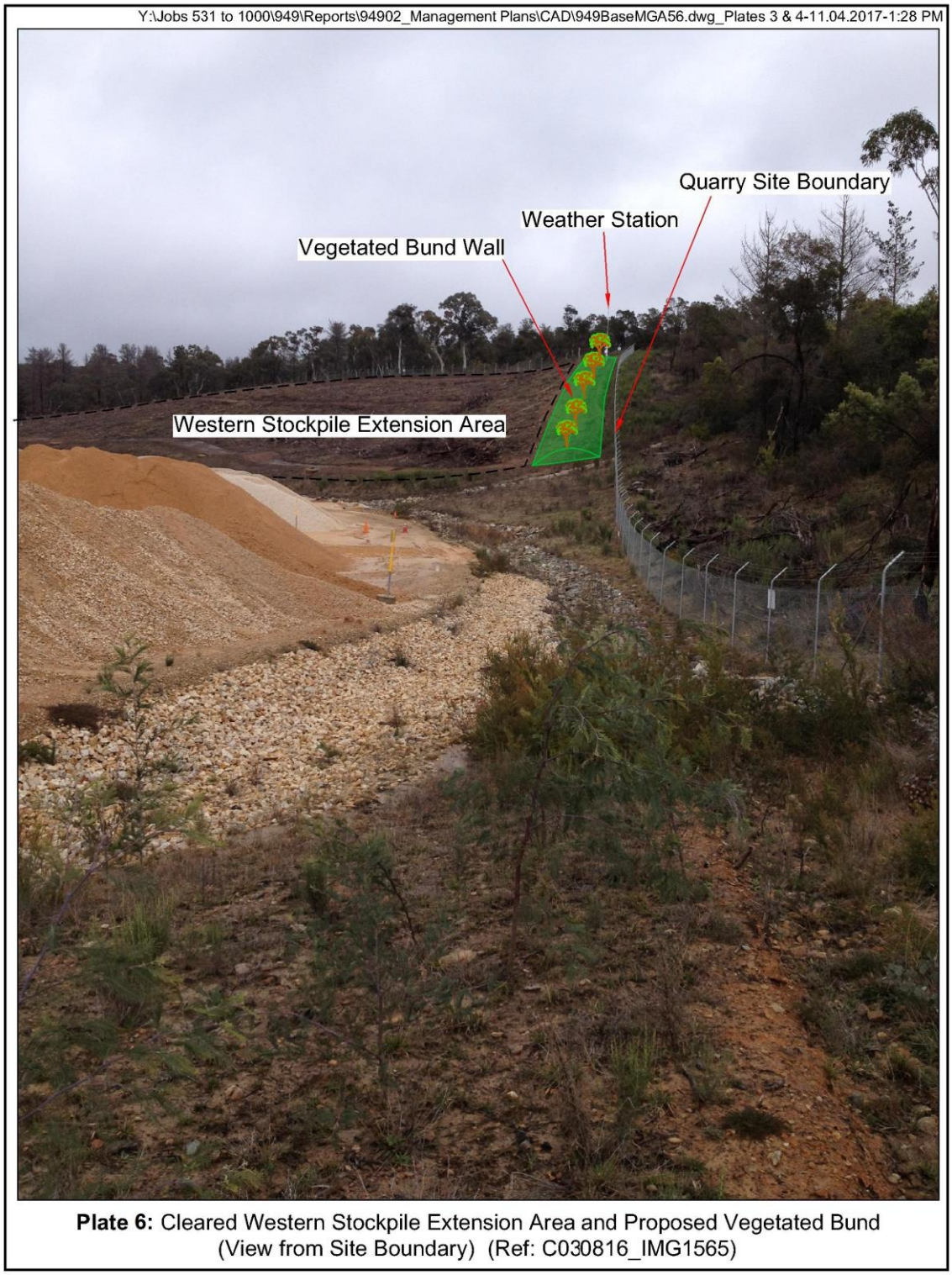

Plate 6: Cleared Western Stockpile Extension Area and Proposed Vegetated Bund (View from Site Boundary) (Ref: C030816_IMG1565)

4.4.4.2 Quarry Landscape Management

The visibility of the Quarry is currently enhanced due to a lack of landscaping along the highway perimeter of the Quarry Site and on exposed slopes within the Quarry Site. Noting landscape management of the Quarry is a requirement of DA 344-11-2001 (*Condition 2.48*), the Proponent has prepared a *Landscape Planting Plan* (LPP) (RWC, 2016c) for the Quarry (see **Appendix 7**).

Figure 17 identifies the locations on and around the Quarry Site where vegetation is to be planted to screen and/or obscure views of the Quarry Site from the Great Western Highway. **Figure 17** effectively modifies *Figure L1* of the LPP to include the vegetation of the tiered slopes of the WSEA and construction of a bund wall between the WSEA and Quarry Site boundary rising to a height of between 2m (at the western end) and 4m (at the eastern end). This bund would be initially covered with fast growing grass species to stabilise the structure and reduce the visual impact of the bund itself. Further plantings to establish shrubs and trees on this bund would then be undertaken as part of a modified *Landscape Planting Plan* (LPP) for the Quarry (see **Figure 17** and Section 4.4.4.2).

Plates 5 and **6** illustrate the placement of this vegetated bund wall which is aimed at reducing the visibility of the WSEA from the Great Western Highway, in particular from the east bound lanes. **Tables 10** and **11** provide an indicative list of species to be used in the landscape plantings (with this list to be modified depending on availability of stock from Lithgow District Community Nursery with whom the Proponent has arranged to purchase tube stock and seed).

Table 10
Landscape Planting – External Highway Batters and Bunds

Trees	Shrubs	Grasses
Ribbon Gum	Provenance Wattyl (acacia) and hakea species	Wallaby Grass
Mountain Gum		Kangaroo Grass
Snow Gum		Snow Grass
Black Sally		

Table 11
Landscape Planting – Internal Dam Walls

Grasses		Shrubs
Initial cover	**Perennial**	
Sterile exotic pasture or cover crop species	Wallaby Grass	Provenance Wattyl (acacia) and hakea species
	Kangaroo Grass	
	Snow Grass	

Bush Doctor has been commissioned to commence planting in April 2017 within Areas C and E (of **Figure 17**). The indicative planting and maintenance schedule is as provided as **Table 12**.

Table 12
Landscape Planting Schedule

Schedule	2017				2018			
	Apr	Jun	Sep	Dec	Mar	Jun	Sep	Dec
External Highway Batters and Bunds								
Area A								
Area B								
Area C								
Area G								
Internal Dam Walls								
Area D								
Area E								
Area F								
Monitoring (and In-fill Planting / Seeding As Required)								
Areas A/B/C/G								
Areas D/E/F								

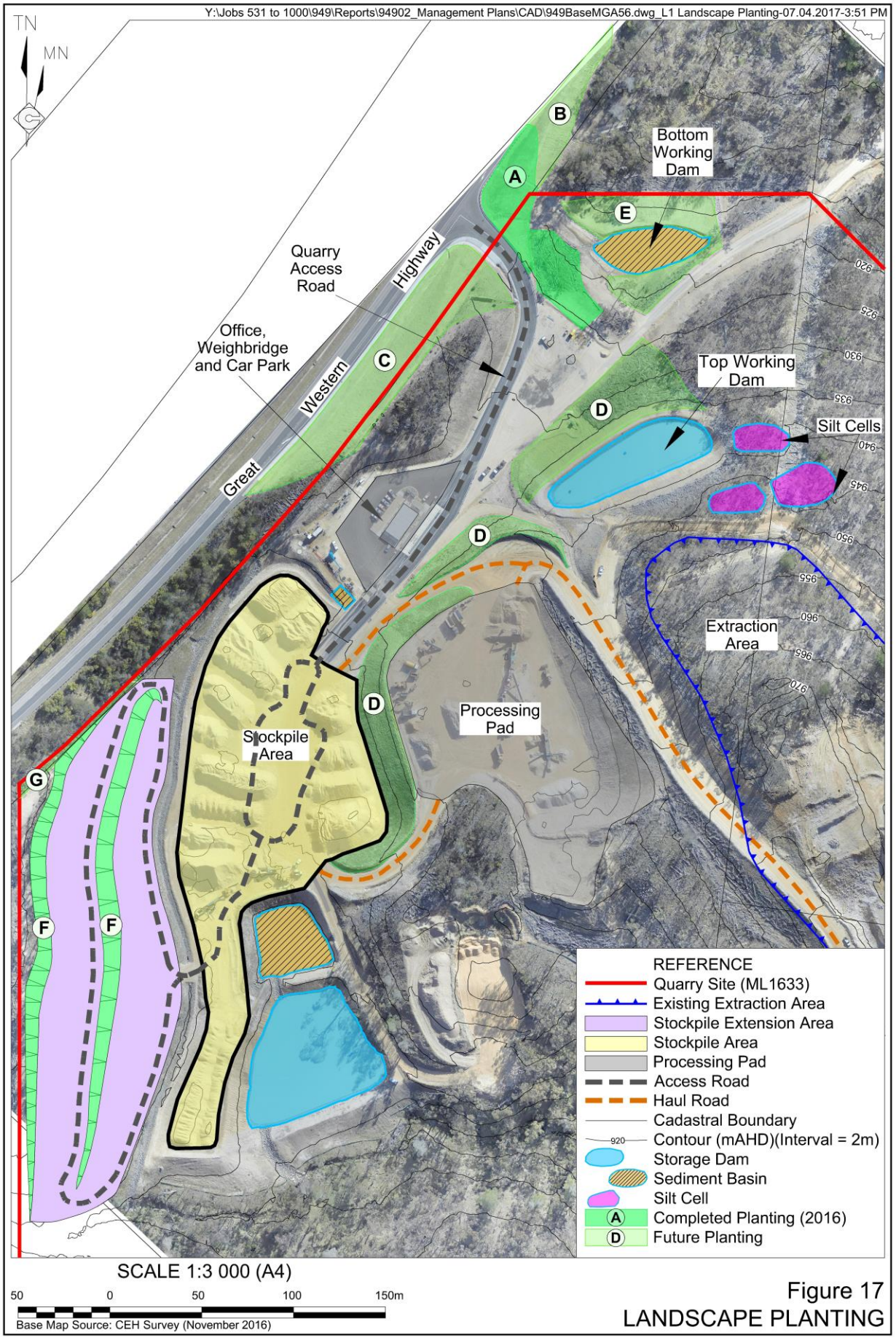

Figure 17
LANDSCAPE PLANTING

4.4.5 Assessment of Impacts

The construction and operation of the WSEA would be visible from the Great Western Highway, however, the impact of this extension of stockpiling activities would be mitigated by the following factors.

1. The two-tiered structure of the WSEA would reduce the visibility of the stockpile area by avoiding the creation of a single steep face along the western boundary which would rise above stockpiles, be difficult to vegetate and not conducive to the creation of a final landform replicating the pre-disturbance landform.
2. The vegetated bund between the WSEA and Quarry Site boundary would screen views of the WSEA from the eastbound lanes of the Great Western Highway and obscure views from the westbound lanes.
3. The amended LPP would provide for mitigation of impacts through the establishment of vegetation on slopes and bunds surrounding the operational areas.

It is also noted that both the WSEA and ESEA would be not be visible from privately owned land surrounding the Quarry Site.

Noting the WSEA represents an extension of disturbance already visible from the Great Western Highway, and noting the commitment to landscape planting on and along the perimeter of the Quarry Site to screen and obscure views of this and other disturbance on the Quarry Site, the minor increase in visibility is considered acceptable.

4.5 GROUNDWATER RESOURCES

4.5.1 Introduction

As noted in Section 3.3.4, the Proposed Modification would not result in any change to approved mining activities which Pacrim (2001) determined to remain above the local groundwater table. As a result, the Proposed Modification is not likely to impact on local groundwater.

The above notwithstanding, DPI-Water has requested a review of previously assessed impacts and the following sub-sections provide for:

- A review of the hydrogeological setting;
- A review of management issues and constraints;
- A summary of operational controls and safeguards; and
- An assessment of potential impact against the requirements of the NSW Aquifer Interference Policy (AIP).

4.5.2 Local Setting

Groundwater Occurrence

A review of the DPI Water online Continuous Water Monitoring Network database (http://allwaterdata.water.nsw.gov.au/water.stm) identifies 4 registered groundwater bores within 3km of the Quarry Site (see **Figure 18**).

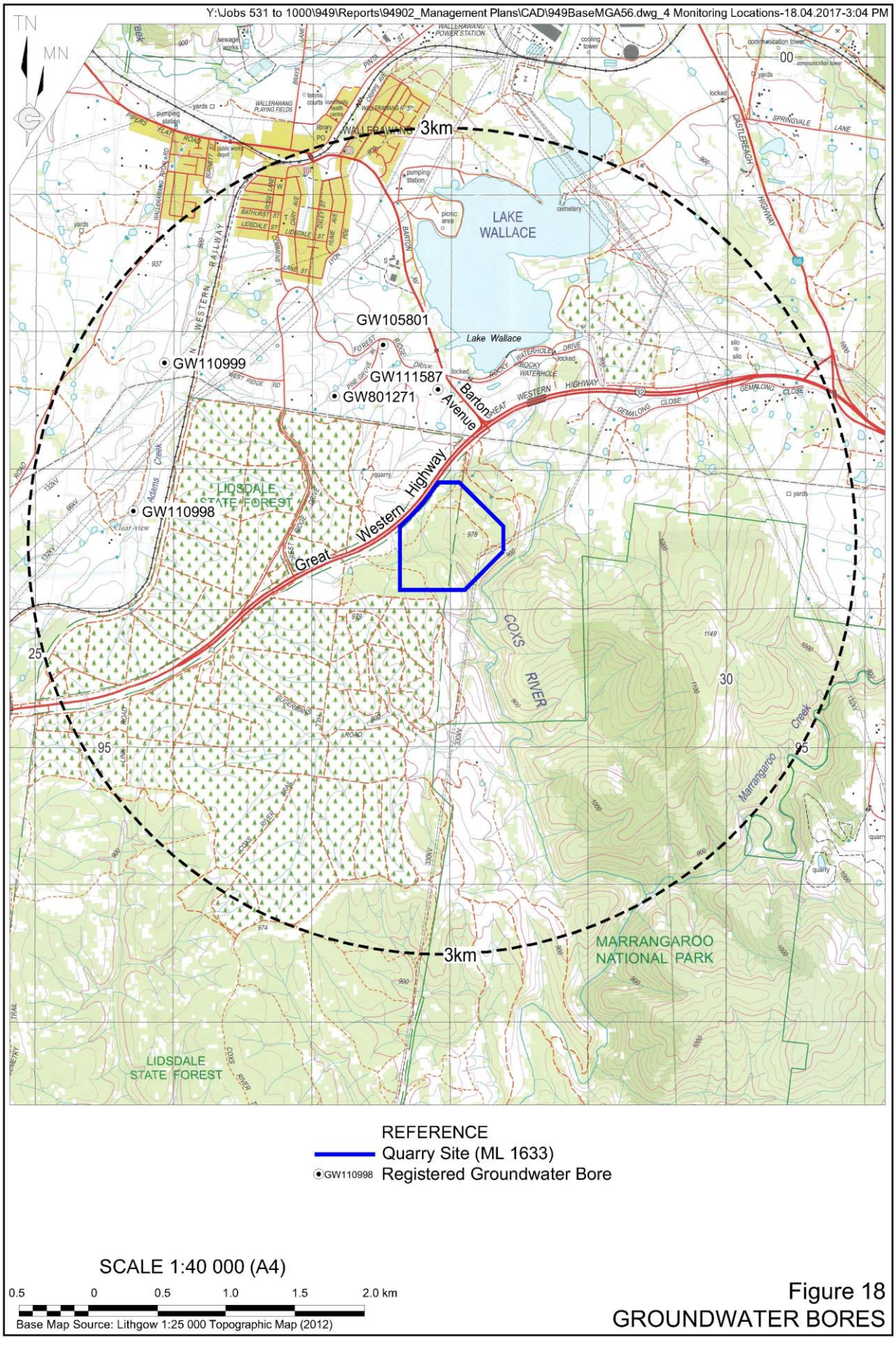

Figure 18
GROUNDWATER BORES

Table 13 provides a summary of the available information provided for each of these bores, including standing water levels, water bearing zones, geological descriptions and yields. Based on the surface elevation of these bores, the noted water bearing zones of these bores occur well below the maximum depth of mining of the Quarry (930m AHD).

Table 13
Groundwater Bores

Bore Reference	Elevation (m AHD)	Water Bearing Zone (m bgl)	Standing Water Level (m bgl)	Geological Properties / Description	Yield (L/s)
GW111587	915	8.00 – 14.00 48.00 – 50.00 60.00 – 61.00 72.00 – 73.00	8.00	Clay / Shale / Granite	N/A
GW105801	910	14.00 – 14.10 28.00 – 28.20	0.20	Clay / Shale / Granite	0.02 0.31
GW801271	865	27.00 – 27.40 29.00 – 29.30 40.00 – 40.20	27.00	Sandstone / Clay / Rhyolite	N/A
GW110998	920	24.00 – 24.50 32.00 – 35.00 40.00 – 40.50	20.00	Shale / Sandstone, Conglomerate	4.42
GW110999	920	8.00 – 10.00 23.00 – 23.50 37.00 – 37.30	8.00	Shale	N/A
N/A = Not provided on Groundwater Works Summary Sheet					
Source: DPI Water – Online Water Monitoring Network Database					

Further supporting the assessment that groundwater occurs below the maximum depth of mining is provided by Rangott Mineral Exploration (RME) who have conducted all recent exploration across the Quarry Site (ML1633). All drill logs have been reviewed with none referencing the interception of water. A representative of a second drilling company (Mr Phil Lord of Lord Bros Drilling) has also been contacted and he notes no water was encountered during drilling on the Quarry Site dating back to 1997.

Groundwater Dependent Ecosystems

Schedule 3 of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* (NOW, 2011) ("the Water Sharing Plan") identifies High Priority Groundwater Dependent Ecosystems (GDEs). None are located within 10km of the Quarry Site.

The Atlas of GDEs on the Bureau of Meteorology (BoM) website was accessed to identify the occurrence or probability of occurrence of GDE's on or adjacent to the Quarry Site. The Atlas of GDEs uses spatial environmental data to indicate potential interaction between groundwater and both terrestrial vegetation communities (phreatophytes) and surface aquatic ecosystems (base flow streams). The BoM Atlas of GDEs identifies Coxs River as a surface water ecosystem with a high potential for groundwater interaction, i.e. reliance on surface expression of groundwater.

4.5.3 Management Issues and Constraints

Groundwater occurs below the approved maximum depth of mining and therefore would not be intercepted as a result of mining activities.

While the Coxs River is identified as surface water ecosystem with a high potential for groundwater interaction, the lack of interaction between the extraction zone and local groundwater resources indicates the Quarry would have limited if any impact on groundwater expression to the Coxs River.

On the basis that there is unlikely to be any direct impact of the Proposal on groundwater or GDEs, the only identified groundwater-related management issue would be the potential contamination of local groundwater as a result of contaminants leaching from imported materials.

4.5.4 Controls and Operational Safeguards

Groundwater Quantity

In the unlikely event that groundwater is encountered during mining, work would be ceased immediately and consultation with DPI-Water would be undertaken to identify the appropriate mitigation measures to ensure the operations continue to comply with all licencing requirements.

Groundwater Quality

Section 4.3.4.4 documents the emergency spill procedures that would be implemented as required to minimise any contamination should a spill or leak occur during refuelling operations.

In the event that a hydrocarbon spill occurs, the contaminated material would be excavated and either treated by bioremediation or disposed of at a licenced waste facility.

4.5.5 Assessment of Impacts

4.5.5.1 Groundwater Availability, Quality and GDEs

Groundwater Quantity

It is not anticipated that groundwater would be encountered. This is supported by the records of registered groundwater bores of the local setting and evidence supplied by RME. As groundwater would not be intercepted, the Quarry and Proposed Modification would have no effect on the availability of groundwater to other users.

In the event that evidence of groundwater seepage to the Quarry is identified, DPI-Water would be immediately notified.

Groundwater Quality

Hydrocarbon spills or leaks not appropriately controlled and managed have the potential to contaminate groundwater. Given the implementation of these controls and management measures, the likelihood of contamination to groundwater is considered minimal.

Groundwater Dependent Ecosystems

Given that it is not anticipated that groundwater would be encountered, and considering the proposed operations would not prevent recharge to the Coxs River, the Proposal is unlikely to have any impact on the ecosystems which may partially rely on groundwater or groundwater expression.

4.5.5.2 NSW Aquifer Interference Policy

Evidence provided by the registered bore database maintained by DPI-Water, observations and records of exploration on the Quarry Site and observations during mining operations indicates that 'penetration of an aquifer', as defined by the *Water Management Act 2000* as an aquifer interference activity, is extremely unlikely.

In the unlikely event that groundwater is encountered, the potential impact of this has been assessed against the thresholds for Level 1 minimal impact considerations for Water Table, Water Pressure and Water Quality nominated in *Table 1* of the AIP for 'Less Productive Porous and Fractured Rock Water Sources'.

Water Table

The potential area of aquifer interference is located greater than 40m from high priority GDEs and culturally significant sites listed under the Water Sharing Plan. The mining area is also greater than 40m from the Coxs River (which has a high potential for reliance on groundwater expressions for flow). While an Aboriginal heritage site is located on the Quarry Site, this is not influenced by groundwater.

On the basis of the preceding, the critical threshold for impact is a maximum of a 2m decline cumulatively at any water supply work. As the approved mining area of the Quarry is restricted to a hilltop which is topographically isolated from water supply works in the local setting, even in the unlikely situation that isolated perched groundwater is present, this would have no influence on the water level within groundwater elsewhere in the local area. As a result, even in the unlikely event that groundwater was encountered this would not have any effect on the groundwater level of any surrounding water supply work.

Water Pressure

Following from the assessment above, even in the unlikely event that groundwater was encountered this would not have any effect on the groundwater level of any surrounding water supply work. As such, a head decline of greater than 2m would not occur.

Water Quality

There is limited information on the local groundwater quality, however, based on the very low potential for groundwater to be encountered, and the proposed management of potential contaminants on the Quarry Site (refer to Section 4.3.4.4), any change in water quality is highly unlikely.

On the basis of the preceding, the proposed exploration activities would not exceed the minimal harm threshold nominated by the AIP.

4.6 REHABILITATION, FINAL LANDFORM AND LAND USE

4.6.1 Introduction

Section 2.8 reviews the proposed rehabilitation of the Quarry in light of the Proposed Modification. This section considers the implications of the nominated changes to the final landform on the established rehabilitation and land use objectives approved by DA 344-11-2001 and consolidated within the MOP for the Quarry.

4.6.2 Rehabilitation Objectives and Completion Criteria

With mining only having commenced in 2015, and noting that the Quarry does not require the construction and rehabilitation of waste rock (or overburden) stockpiles, large areas of land have yet to become available for progressive rehabilitation. As a consequence, a complete evaluation of rehabilitation against the objectives and criteria of the MOP (namely *Table 6* of RME, 2016) is not possible. The Proponent has, however, remained cognisant of ensuring that rehabilitation planning remains central to overall Quarry scheduling and regularly reviews progress and plans with respect to rehabilitation.

The Proposed Modification requires some amendments to the final landform of the Quarry Site, namely Domain 3 - Processing and Stockpile Areas as described, along with the overall rehabilitation objectives for this domain, in Section 2.8.4.1. **Table 14** provides the specific objectives, performance indicators, measures and completion criteria for each individual rehabilitation phase for Domain 3 (with reference to the relevant columns of *Table 6 (Rehabilitation Table)* of the MOP).

Table 14
Rehabilitation Objectives, Performance Indicators and Criteria – Doman 3

Page 1 of 2

Phase	Objective	Performance Indicator	Performance Measure	Criteria
1 – Decommissioning	All plant is to be decommissioned and removed.	Removal of all fixed and mobile plant, pipelines and other water infrastructure, concrete footings and ancillary structures.	Inspection and final site audit.	Complete removal of all items and foundations.
	All remaining material is to be sold and despatched or used in final landform creation.	No stockpiles retained in the final landform.	Inspection and final site audit.	Complete removal ore reuse in landform creation of all stockpiled material.
2 – Landform Establishment	Stable landform established.	Final landform comparable to **Figure 7**.	Slope stability.	Slopes east of clean water drain <10°. Slopes west of clean water drain (WSEA) <25°.
	Effective surface water drainage.	Drains and bunds carry and discharge water at non-erosive velocities.	Erosion and sedimentation.	No identifiable erosion or sedimentation.
			Water quality (TSS).	TSS (on discharge) <30mg/L.

Table 14 (Cont'd)
Rehabilitation Objectives, Performance Indicators and Criteria – Doman 3

Phase	Objective	Performance Indicator	Performance Measure	Criteria
3 – Growth Medium Development	Soils and hydrology with maintenance needs no greater than those of surrounding, non-mine disturbed land.	Topsoil applied to final landform.	Soil depth.	Soil depth >100mm.
		Suitable surface water controls installed and operating effectively.	Erosion and sedimentation.	No identifiable erosion or sedimentation.
4 - Ecosystem and Land Use Development	Development of a native ecosystem that closely resembles surrounding bushland.	Fallen timber is spread over the landform to provide microhabitat for native fauna.	5 logs per hectare (2 containing hollows).	
		Native open forest species established with diversity and at density equivalent to that of the surrounding bushland.	Species diversity.	Within 20% of analogue in surrounding bushland. Grass, shrub and tree species represented.
			Vegetation coverage.	Within 20% of analogue in surrounding bushland.
			Occurrence of Blackthorn.	Present.
5 - Ecosystem and Land Use Stability	Establishment of a self-sustaining native ecosystem with maintenance needs no greater than the surrounding bushland.	Native open forest species established.	As above.	As above, confirmed by qualified ecologist.

Source: Modified after RME (2016) – Table 6

The Mine has not yet completed significant activities associated with Rehabilitation Phase 4 (ecosystem and land use development) to evaluate performance against revegetation and community establishment criteria.

4.6.3 Assessment of Impact

Rehabilitation

The Proposed Modification would not require any significant variation to the proposed rehabilitation of the Quarry. As nominated in **Table 14**, some review and amendment to the performance indicators and closure criteria for the affected domain would be required with these to be included in an amended MOP. This notwithstanding, and assuming the implementation of the maintenance and management measures for important rehabilitation resources, i.e. soil and cleared vegetation, nominated in the MOP (RME, 2016), there is no reason to suggest that the additional disturbance cannot be effectively integrated into the overall rehabilitation of the Quarry.

Final Landform

The final landform presented in **Figure 7** and described in Section 2.8.3 represents a sympathetic extension of the landform already nominated for the Quarry and approved as part of the MOP (RME, 2016).

The proposed landform, with slopes over the processing and stockpile areas of between 10° and 25°, would allow for the retention of applied soil resources and establishment of native open forest vegetation.

The proposed final landform does not rely on the importation of an additional materials, resources or specialist equipment.

Based on the above, it is assessed that the proposed final landform is appropriate for the intended final land use (see below) and achievable.

Final Land Use

The Proposed Modification does not propose to modify the intended final land use of the Quarry (management for the conservation of native vegetation).

As noted above, the proposed final landform would be conducive to the establishment of native open forest vegetation with the proposed slopes of 10° to 25° being a feature of the surrounding landforms where the nominated vegetation types are established.

Overall, the proposed modifications are effectively extensions to current activities on the Quarry Site and therefore, subject to the implementation of the rehabilitation procedures and strategies of the MOP, are unlikely to affect the likelihood of establishing native open forest vegetation as part of a final passive biodiversity conservation land use.

4.7 AIR QUALITY

4.7.1 Introduction

As noted in Section 3.3.8, the activities associated with the stockpile area extensions and continuing operation of the fine aggregate and sand processing plant have limited potential to result in increased air emissions.

The above notwithstanding, the following sub-sections provide for a review of existing environment and performance, consideration of operational controls and management measures and an assessment of likely impact.

4.7.2 Existing Environment and Performance

4.7.2.1 Emissions Sources

Deposited dust (which generally has a particle size or 30µm in diameter and settles from the atmosphere relatively quickly) would be the principal air contaminant generated on the Quarry Site and could be generated as a result of the following activities.

- Stripping of soil.
- Ripping and mining of friable materials.

- Blasting of competent quartzite.
- Vehicle movements within the Quarry Site.
- Wind erosion of open areas and stockpile areas.
- Respreading of topsoil.
- Loading and movement of road-registered trucks.
- Transportation of products off site.

Dust of diameter <30µm, which tends to remain airborne in the atmosphere, may also be emitted. Of the airborne dust, particular emphasis is placed on that proportion which has a diameter of <10µm (PM_{10}), as particles of this size are able to enter the sensitive areas of the human respiratory system and if the concentration is high enough for a sustained period of time result in health problems.

Other sources of air emissions would be nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and greenhouse gases which would be emitted as part of vehicle and mobile equipment exhaust fumes.

4.7.2.2 Performance Management

In order to ensure dust emissions are kept as low as possible, the Proponent has prepared and implements an *Air Quality Management Plan* (RWC, 2016d) ("the AQMP").

Deposited dust has been monitored at two locations on the Quarry Site since July 2014, with the locations of these dust gauges relocated in May 2016[9] when an additional two locations were added to the monitoring schedule (see **Figure 19**). In that time, compliance with dust deposition criteria of *Conditions 2.39* of DA 344-11-2001 has generally been met (see **Table 15**)[10].

In individual cases where the criterion was exceeded, the cause for the exceedance was investigated and in most cases was found to be unrelated to the operation of the Quarry or as a result of the inappropriate location of the original dust gauges.

No complaints related to air emissions have been received by the Proponent.

4.7.3 Operational Controls, Management Measures and Monitoring

4.7.3.1 Introduction

The Proponent has documented (in the AQMP) a series of proactive and reactive measures to manage the generation and dispersal of dust from the Quarry. The following summarises these measures.

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[9] In the case of original dust gauge D64, the location of this immediately adjacent to the mining area was not providing a representative indication of dust leaving the Quarry Site and was moved to the eastern boundary of the Quarry Site (where it is now referred to as D3). In the case of original dust gauge D62, the location amongst dense vegetation was considered unlikely to accurately reflect deposited dust levels at the Quarry Site boundary. D62 was subsequently moved to the property boundary of Lot 6 DP872230 (and now referred to as D2).

[10] Monitoring results are maintained on the Proponent's website:
http://walkerquarries.com.au/statutory-information/

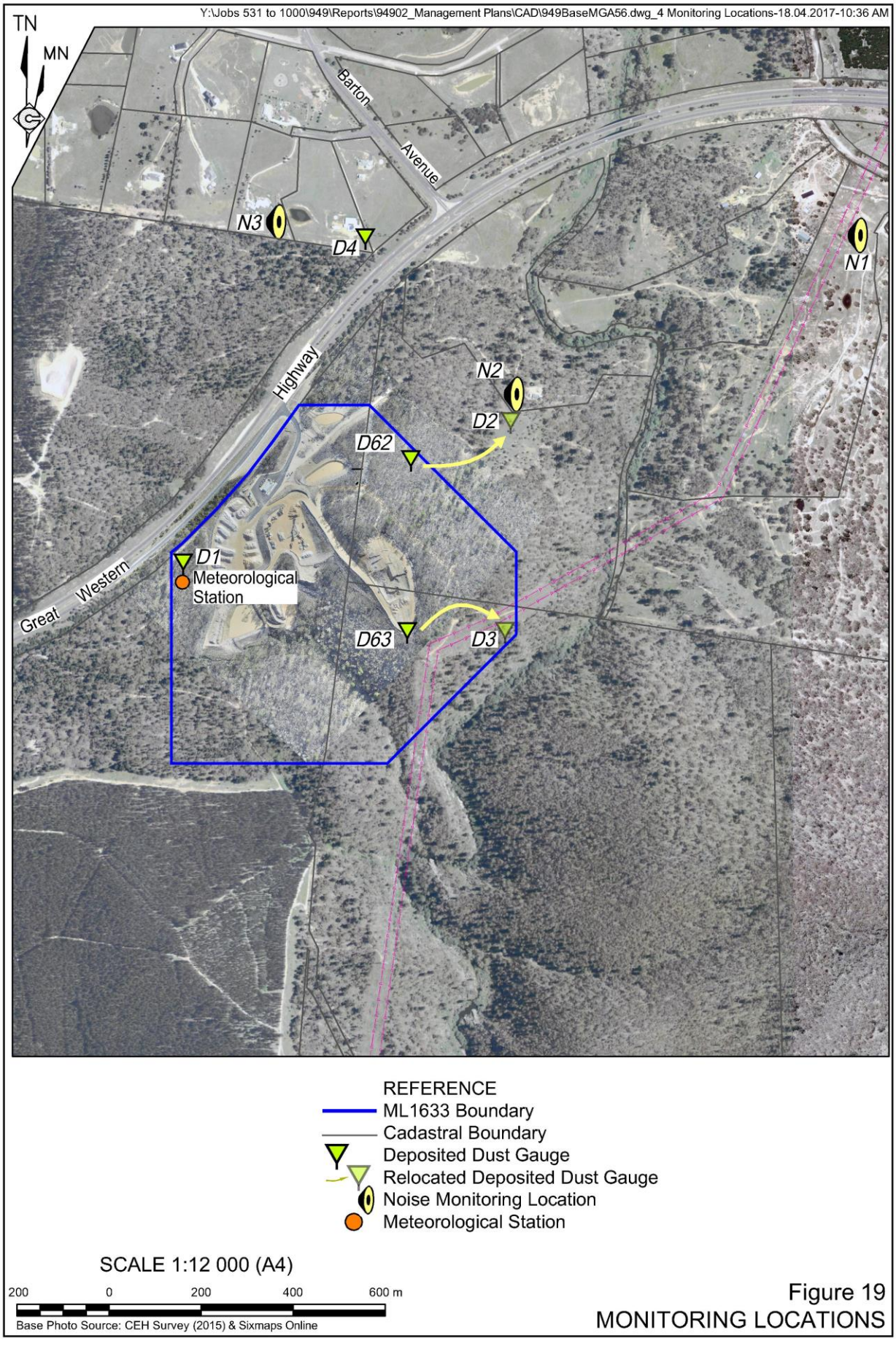

Figure 19
MONITORING LOCATIONS

Table 15
Dust Deposition Monitoring Results

Month	Gauge			
	D1	D2 (D62)	D3 (D63)	D4
2014 – 2015				
Jul-14		0	0.1	
Aug-14		0.6	0.4	
Sep-14		0.4	0.1	
Oct-14		0.3	1.4	
Nov-14		0.2	0.9	
Dec-14		1	1.2	
Jan-15		1.8	2.1	
Feb-15		0.3	1.7	
Mar-15		0.1	0.3	
Apr-15		0.2	0.3	
May-15		0.5	0.3	
Jun-15		0	2.6	
Average		**0.5**	**1.0**	
2015 – 2016				
Jul-15		0.7	0.3	
Aug-15		0.8	0.1	
Sep-15		0.2	1.6	
Oct-15		0	0.3	
Nov-15		3	0.8	
Dec-15		0.5	0.4	
Jan-16		0.8	5.6	
Feb-16		0.2	12.9	
Mar-16		0.3	1.1	
Apr-16		0.5	4.6	
May-16	0.8	0.1	0.7	0.3
Jun-16	0.4	1.7	0.9	
Average	**0.6**	**0.7**	**2.4**	**0.3**
2016 – 2017				
Jul-16	0.8	1.4	0.1	15.1
Aug-16	0.1	0.9	0.8	0.4
Sep-16	0	0.3	0	0.4
Oct-16	0	0	0.5	0.1
Nov-16	0	0.1	0	0.2
Dec-16	0	0	0.5	0.3
Jan-17	0	0	0	0
Feb-17	0.8	0.2	0.8	0.4
Mar-17	0.2	0.3	0.5	0.3
Apr-17		0.2	0.2	1.1
Average	**0.4**	**0.7**	**0.8**	**2.8**

Note: The results presented are for the non-combustible solid component of the material collected in each gauge, i.e. excluding combustible plant and other organic material

4.7.3.2 Proactive Management Measures

Dust Emission Management

To limit the generation of dust from potential sources of air contaminants, the Proponent implements the following design features, dust minimisation and impact mitigation practices.

- Surface disturbance activities are planned to limit the total surface disturbance at any one time.
- The seal on the Quarry Access Road between the Great Western Highway and the wheel wash is maintained to reduce dust tracking, degradation and surface dust lift-off.
- Progressive rehabilitation includes initial revegetation to provide a suitable groundcover that limits surface disturbance and the potential for dust lift-off.
- Blasting is scheduled to avoid higher wind conditions, especially when winds from the south or southeast prevail (which may result in a plume of particulate matter towards the most affected receiver to the north and northwest).
- A water cart is operated on the Quarry Site. Exposed areas will be watered under dry and windy conditions (visible dust plumes being the trigger for this action).
- Internal roads are surfaced with well graded materials to limit dust lift-off.
- All vehicles travelling on internal unsealed roads are limited to a speed appropriate for the conditions and safety, i.e. less than 40km/hr.
- Load sizes are limited to ensure product does not extend above truck sidewalls.
- Care will be taken to avoid spillage during loading.
- Dump heights from trucks, front-end loaders and conveyors will be minimised.
- Trucks entering and leaving the premises that are carrying loads will be covered at all times, except during loading and unloading.
- All trucks leaving the Quarry will make use of the wheel wash facility.
- Truck queuing and unnecessary idling of trucks and unnecessary trips will be reduced through logistical planning, where possible.

Gas Emission Management

The Proponent will continue to implement the following measures to minimise the emissions of greenhouse gases during the ongoing life of the Quarry.

- Optimise quarry design to minimise:
  - travel distances for equipment; and
  - rehandling of overburden, products and by-products.
- Use mobile equipment which is regularly maintained and serviced to maximise efficiency.
- Minimise the quarry footprint to reduce land disturbance and travel distances for mobile equipment.

4.7.3.3 Reactive Management Measures

The following four triggers will trigger the implementation of response and corrective action measures nominated below.

a) Air quality complaint.

b) Exceedance of air quality criteria established through emissions monitoring.

c) Extraordinary events or conditions.

d) Elevated deposited dust monitoring.

Air Quality Complaint

In accordance with a Complaints Management Procedure maintained by the Proponent (as *Section 6.2* of the Quarry *Environmental Management Strategy*), appropriate action will be taken within two working days to determine the cause of the complaint and identify appropriate actions to remediate the complaint source. The following details will be recorded following receipt of any dust-related complaint.

a) The date and time of the complaint.

b) The method by which the complaint was made.

c) Any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect.

d) The nature of the complaint.

e) The action taken in relation to the complaint, including any follow-up contact with the complainant.

f) If no action was taken, the reasons why no action was taken.

Complaints of a general nature, e.g. "dust from the Quarry" will be investigated and an appropriate response provided to the complainant.

Air Quality Criteria Exceedance

If emissions monitoring (refer to Section 4.7.3.4) indicates that the approved criteria has been exceeded, the following response and action plan will be implemented.

1. After obtaining exceedance information, the Quarry Manager (or delegated representative) will review meteorological conditions to assess whether these were a factor in the result.
2. The Quarry Manager will immediately investigate the source of the emissions, review the activities undertaken at the time and if necessary amend operations to reduce emissions.
3. As soon as is practical following a confirmed exceedance of air quality criteria[11], the Quarry Manager will notify DPE and the EPA of the exceedance and actions being taken to remediate the source of excessive dust.

[11] It is noted that dust deposition, while monitored monthly, is assessed against an annual average criteria. Therefore, only rolling 12 month average dust deposition level is assessed against compliance criteria (refer to Section 4).

4. Within 7 days of the date of the incident the Quarry Manager will provide a detailed report on the incident to DPE and the EPA.
5. Within two weeks of obtaining any data showing an exceedance of air quality criteria, the Quarry Manager will notify in writing any affected landowners or tenants.
6. Any exceedance of the approved air quality criteria will be reported to the EPA in the Annual Return and to DPE in the Annual Environmental Management Report (AEMR).

Extraordinary Events or Conditions

Extraordinary events relevant to the Quarry include events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary of DPE. Adverse weather conditions such as high winds and excessively dry periods will also be considered as triggers for reactive management.

During times when these conditions are forecast or observed it would be at the Quarry Manager's discretion to limit or modify operational activities to ensure that air quality impacts are limited as much as practically possible. This may require shutting down or equipment or relocation of activities, where practical, to limit potential dust impacts.

An exceedance of the air quality criteria during a period that is coincident with extraordinary events or conditions, will not be considered a non-compliance against the criteria where is can be determined that the exceedance relates to emissions recorded during the extraordinary events or conditions. The recorded emissions will be considered anomalous in these cases.

High Levels of Monitored Deposited Dust

Compliance with the deposited dust criteria described in Section 4 is measured as an annual average of monthly monitoring results (refer to Section 4.7.3.4.1). *Condition 2.41* of DA 344-11-2001 requires monthly monitoring of deposited dust, however, it is acknowledged that elevated deposited dust levels, i.e. approaching the criteria level, may also indicate the possibility of an exceedance of airborne particulate matter levels, i.e. TSP and PM_{10}. Therefore, should the rolling average of monthly deposited dust monitoring results reach a trigger level of 3.5g/m^2/month, a program of airborne particulate matter monitoring will be initiated (refer to Section 4.7.3.4.2).

4.7.3.4 Air Quality Monitoring

4.7.3.4.1 Deposited Dust

Four dust deposition gauges have been established to monitor ambient air quality (see **Figure 19**). Two of these D2 and D4 are located adjacent to the residences most likely to be affected by Quarry generated dust. Locations D1 and D3 have been established at the perimeter of the Quarry Site.

Deposited dust will be measured and documented on a monthly basis. Exposed gauges will be replaced on a three monthly basis with analysis conducted at a National Association of Testing Authorities (NATA) accredited laboratory for insoluble solids.

Deposited dust levels will need to be analysed by a NATA registered laboratory in accordance with *AS 3580.10.1 – 2003* and yield data on:

- total insoluble solids (g/m^2/month);
- ash fraction (g/m^2/month); and
- percentage ash (an indication of organic/inorganic component of dust).

4.7.3.4.2 Airborne Particulate

If airborne particulate matter monitoring is triggered, this would be undertaken at D4 (as identified on **Figure 19**) using a High Volume Air Sampler (HVAS) or equivalent equipment with an inlet to exclude particulate matter larger than 10µm in diameter.

Monitoring would be undertaken in accordance with the following documents.

- AS 29221987 Ambient Air – Guide for the Siting of Sampling Units (NSW DECCW Method AM-1).
- NSW DECCW Approved methods for the sampling and analysis of air pollutants in NSW (DECC, 2005).
- AS/NZS 3580.9.6:2015 Methods for sampling and analysis of ambient air Determination of suspended particulate matter – PM_{10} high volume sampler with size selective inlet – Gravimetric method.

Compliance with annual average PM_{10} criteria will be indicative of compliance with the criterion for Total Suspended Particulates (TSP) (noting PM_{10} generally represents greater than 35% of TSP). In the event that PM_{10} concentrations approach (within 20%) or exceed criteria, additional monitoring of TSP will be commenced. Under these circumstances, the inlet may be modified to allow for the collection of data of data on TSP.

Monitoring would occur for a 24-hour period, set to an automatic rotation of every 6 days. The filter paper would be collected between sampling days and stored individually prior to despatch to a NATA registered laboratory for analysis.

The program of monitoring would occur over an initial period of three months with the results reviewed at the end of this initial period to determine if the monitoring should continue. Should particulate matter monitoring results indicate minor particulate matter levels and the rolling average of monthly deposited dust monitoring results has fallen below the trigger level, the program of particulate matter monitoring will cease.

4.7.4 Assessment of Impacts

The Proposed Modification would not introduce any new dust emitting activity at the Quarry (noting that the fine aggregate and sand processing activities have been undertaken on the Quarry Site since mid 2016). In any event, these processing activities involve the use of water to wash fine particles from the <7mm and <5mm materials and as such have minimal potential to result in dust generation. Silts removed from the silt cells would either be processed through a filtering unit to remove the solid material for reuse on the Quarry Site or sale (after blending with other aggregate products), or removed from the drying cell for blending or application to

the landform as part of rehabilitation prior to it become dry enough to result in dust lift-off. The procedures for managing the silt drying cell would be included in an updated AQMP to be prepared following approval.

The increased stockpiling area would increase the area of exposed ground and stockpiles from which wind erosion could lead to increased dust emissions. However, on the basis that the current air quality management measures have been successful in reducing dust deposition to well below the 4g/m^2/month criteria, as demonstrated by monitoring (refer to **Table 15**), it is considered unlikely that the small increase in footprint would result in an increase to dust emissions that would result in non-compliance with criteria.

4.8 NOISE

4.8.1 Introduction

As noted in Section 3.3.7, the activities associated with the stockpile area extensions and continuing operation of the fine aggregate and sand processing plant have limited potential to result in increased noise emissions.

The above notwithstanding, the following sub-sections provide for a review of existing environment and performance, consideration of operational controls and management measures and an assessment of likely impact.

4.8.2 Existing Environment and Performance

4.8.2.1 Emissions Sources

Existing noise levels in the vicinity of the Quarry are influenced by a range of sources including traffic on the Great Western Highway and local roads, agricultural equipment, flow of the Coxs River, stock, wind in trees, wildlife, as well as noise associated with existing Quarry operations.

4.8.2.2 Environmental Performance

Attended noise monitoring is undertaken at three locations surrounding the Quarry (see **Figure 19**) on a six monthly basis to confirm compliance with the criteria with *Condition 2.1* of DA 344-11-2001 and *Condition L4.1* of EPL 13172 (see **Table 16**).

Table 16
Quarry Noise Criteria

Location	Day (dB(A) $L_{Aeq\ (15\ min)}$)	Evening (dB(A) $L_{Aeq\ (15\ min)}$)	Night (dB(A) $L_{Aeq\ (15\ min)}$)
All privately-owned residences	43	43	39

Note: For the purposes of assessing compliance:

- Day is defined as the period from 7:00am to 6:00pm Monday to Friday, and 7:00am to 1:00pm on Saturdays;
- Evening is defined as the period from 6:00pm to 10:00pm Monday to Friday; and
- Night is defined as 'all other times'.

These definitions are consistent with those provided in *Condition L4.1* of EPL 13172

Monitoring undertaken in June 2016 (by Atkins Acoustics Pty Ltd) and January 2017 (by Muller Acoustic Consulting Pty Ltd) has confirmed compliance with the nominated criteria is achieved during operations.

As noted in Section 3.2.3.2, complaints related to noise have been received but were quickly resolved. Notably, there have been no noise complaints related to general Quarry operations.

4.8.3 Operational Controls, Management Measures and Monitoring

4.8.3.1 Introduction

The Proponent manages the Quarry in accordance with a *Noise Management Plan* ("the NMP") (RWC, 2016e) which includes both proactive and reactive measures to manage noise emissions from the Quarry.

4.8.3.2 Proactive Management Measures

Design Features

- The mining area will be developed such that a highwall is retained throughout the life of the Quarry to limit sound promulgation to the northeast.
- Stockpiles and ancillary equipment are positioned to limit potential noise impacts.

Operational Safeguards

- All approved hours of operation (of *Condition 2.3* of DA 344-11-2001) will be strictly adhered to.
- Noise levels from all on-site plant and equipment are measured on an annual basis by a qualified acoustic consultant to ensure operations remain compliant.
- All equipment is regularly serviced to ensure Sound Power Levels (SPLs) of each item remains at a level to ensure compliance with noise criteria.
- Operations at exposed locations and under unfavourable weather conditions are modified, where necessary, to reduce potential noise-related impacts.
- The internal road network is maintained to limit body noise from empty trucks.
- Maintenance work on all plant and equipment is only undertaken outside the standard hours of operation if these are inaudible at all residential premises surrounding the Quarry Site.

Hydraulic Hammer Drill Operating Protocol

- Prior to commencement of the operation of the Hydraulic Hammer Drill, the Quarry Manager (or delegate) will complete a review of potentially noise enhancing weather conditions, namely:
  - Temperature inversion conditions greater than 3°C / 100m (under calm / neutral wind conditions: <0.5m/s) (most likely during the cooler months of May to August between 9:00pm and 9:00am); and
  - Southerly winds (135° to 225°) of less than 3m/s.

- The NMP documents procedures to be followed if use of the Hydraulic Hammer Drill is required prior to 9:00am during the months May to August (inclusive) or when winds are observed from the southern quadrant (135° to 225°).
- If noise complaints specific to the operation of the Hydraulic Hammer Drill are received, operation of the drill will be suspended subject to completion of reactive management (refer to Section 4.8.3.3).

4.8.3.3 Reactive Management Measures

The following three triggers will trigger the implementation of response and corrective action measures nominated below.

a) Noise Complaint.

b) Exceedance of noise criteria established through emissions monitoring.

c) Noise enhancing weather conditions or emergency events.

Noise Complaint

The same protocol and procedures with respect to a noise-related complaint will be followed as for a dust related complaint (refer to Section 4.7.3.3).

A complaint specific to the operation of the Hydraulic Hammer Drill will trigger supplementary noise monitoring to determine the operating SPL of the drill and noise level received at the complainant's residence (including any tonal factors). Recommencement of operation of the Hydraulic Hammer Drill (other than to enable noise monitoring), will only recommence on confirmation of a compliant noise level.

Noise Criteria Exceedance

If noise monitoring indicates that noise exceeds the approved criteria, the following response and action plan will be implemented.

1. After obtaining exceedance information, the Quarry Manager (or delegated representative) will review meteorological conditions to assess whether these represent conditions for which the noise criteria do not apply.
2. The Quarry Manager will immediately investigate the source of the noise, review the performance of equipment and if necessary make arrangements to alter the configuration of equipment, or stand down specific equipment, so that the noise levels are reduced.
3. If meteorological conditions were such that noise conditions did not apply (refer to Section 4), the Quarry Manager will document the exceedance including the relevant meteorological conditions.
4. As soon as is practical following a confirmed exceedance of noise criteria, the Quarry Manager will notify DPE and EPA of the exceedance and actions being taken to remediate the source of excessive noise.
5. Noise monitoring will be repeated to confirm compliance with the approved noise criteria.

6. Within 7 days of the date of the incident the Quarry Manager will provide a detailed report on the incident to DPE and EPA.
7. Within two weeks of obtaining any data showing an exceedance of noise criteria, the Quarry Manager will notify in writing any affected landowners or tenants.
8. Any exceedance of the approved noise criteria will be reported to EPA in the Annual Return and to DPE in the Annual Environmental Management Report.

Noise Enhancing Weather Conditions or Emergency Events

In the event that deliveries or despatch are requested at unusual times by Police or other authorities or in the event of an emergency, the Quarry Manager will act appropriately to ensure the general safety of employees and the local community. It is noted that these events are permitted outside the hours of operation required by *Condition 2.3* of DA 344-11-2001.

In accordance with *Condition 2.1* of DA 344-11-2001 or *Condition L4.3* of EPL 13172 noise criteria do not apply under the following conditions.

a) wind speeds greater than 3m/s at 10m above ground level; or

a) temperature inversion conditions greater than 3°C / 100m; and

b) under "non-significant weather conditions"[12].

Regardless of this, during times when these conditions are forecast or observed, the Quarry Manager will modify operations to minimise potential noise impacts as much as practically possible. This may include but is not limited to:

- turning off or limiting operations of mobile equipment or fixed plant;
- redirecting operations to more sheltered areas within the extraction area; and
- moving equipment to lower elevations to reduce the potential for noise to be carried over long distances.

4.8.3.4 Noise Monitoring

Attended noise monitoring is undertaken every six months at three locations surrounding the Quarry Site (see **Figure 19**) in accordance with the following documents.

- NSW *Industrial Noise Policy* (INP) (EPA, 1999).
- AS 1055.1-1997 "Acoustics – Description and Measurement of Environmental Noise – General Procedures".

In the event of a noise-related complaint, the Proponent will review the results of the noise monitoring program and make the results of that monitoring and/or subsequent investigation available to the complainant.

[12] Non-significant weather conditions are defined in Chapter 5 of the Industrial Noise Policy (EPA,2000) as those conditions estimated using default or directly measured parameters for temperature or wind conditions that directly impact perceived noise levels.

In the event that this does not resolve the complaint, or where the complaint specifically references the noise emissions of the Hydraulic Hammer Drill, the Proponent will undertake a supplementary attended noise survey.

The SPLs of equipment on the Quarry Site is measured annually using a calibrated hand-held noise meter at a distance of 10m from the operating plant. The SPL monitoring is to inform necessary maintenance or equipment upgrade requirements to ensure noise generated by the Quarry remains equivalent to that predicted and compliance with noise criteria is achieved

4.8.4 Assessment of Impacts

The Proposed Modification would not introduce any new noise emitting activity at the Quarry (noting that the fine aggregate and sand processing activities have been undertaken on the Quarry Site since mid 2016). In any event, these processing activities involve the 'washing' of already crushed materials and hence have limited potential to generate noise.

The construction and operation of the stockpile extension areas would not require any additional equipment at the Quarry and therefore would not introduce any new noise emission sources. With respect to the location and operation of each stockpile extension area, the following is noted.

- The ESEA is only small in area and would only be used on occasionally for the stockpiling or loading of low volume, more specialised products. Noise levels during operation would be reviewed at locations to the north of the Quarry, however, given the mining activities are located immediately adjacent, it is not expected to contribute significantly to noise levels received to the north.
- The WSEA is located further away from all receivers surrounding the Quarry Site and therefore as no additional equipment is required, would not result in an increase in noise emissions received at surrounding receivers.

Give the Quarry has operated to date without significant noise issues, supported by the results of noise monitoring and resolution of noise complaints, and the limited potential for the modified operations to increase noise levels, it is assessed that the Proposed Modification is highly unlikely to lead to exceedance of noise criteria.

5. EVALUATION AND JUSTIFICATION OF THE PROPOSED MODIFICATION

5.1 INTRODUCTION

The Proposed Modification would serve several important functions.

1. Allow for the continued production of washed aggregate and sand products, which has been identified as critical to increasing production at the Quarry.
2. Provide additional area for the stockpiling of Quarry products, which is important given the increasing reliance of the Proponent in producing a wide range of aggregate, sand and other construction and landscaping products.

This *Environmental Assessment* has been prepared to assist in the assessment of the likely environmental impacts associated with the Proposed Modification. The potential impacts have been identified and carefully assessed following consideration of the design features, operational controls and management measures currently in place or proposed.

On the basis of the assessment of each potential impact, the Proposal can be justified as the residual impacts on the biophysical environment are either understood and determined to be acceptable, or can be predicted and appropriately managed, there would be no notable additional socio-economic impacts and the consequences of not proceeding are considered more adverse than proceeding. Each of these factors considered in the justification of the Proposal are presented below.

5.2 BIOPHYSICAL CONSIDERATIONS

The Proposed Modification would result in the regularization of DA 344-11-2001 to include the 2.4ha of disturbance associated with the WSEA and ESEA (see **Figures 2** and **4**).

The most significant impact associated with this increased disturbance footprint is the impact on local biodiversity which includes:

- 1.9ha of PCT 732 (Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north east of the South Eastern Highlands Bioregion); and
- 0.5ha of PCT 1093 (Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion).

While neither of these communities represents an EEC, the removal of this vegetation may have had an impact on a local population of the threatened Purple Copper Butterfly. Lesryk (2017) conclude that on the basis that an offset is established, no further assessment or referral is required.

The additional disturbance would require an amendment to the final landform of the Quarry, however, this change would be minor and the landform would remain in sympathy with the surrounding topography. Currently planned rehabilitation methods could be used with the Proposed Modification not resulting in any change to the planned final land use. Minor and targeted amendments to the Quarry *Landscape Planting Plan* incorporating a vegetated bund wall along the northern perimeter of the Quarry Site would minimise any impacts of the additional disturbance on the visibility of the Quarry.

The Quarry *Water Management Plan* would require updating to include additional water diversion and collection infrastructure to ensure pollution of receiving waters by suspended sediment is avoided. The Quarry water balance, previously prepared and included in the *Water Management Plan* to include the aggregate and sand washing operations, has been reviewed and confirms sufficient water would be available for on-site requirements for all but very dry years. Under these conditions, water would be purchased or obtained under appropriate licence (either from a water supply work to be established or by trading on the commercial market).

Groundwater, air emissions and noise emissions are unlikely to be affected by the Proposed Modification.

5.3 SOCIO-ECONOMIC CONSIDERATIONS

The Proposed Modification would have little effect on the socio-economic setting surrounding the Quarry. The Proponent would continue to provide employment within the Lithgow LGA and contribute to the local economy through payment of wages and purchase of goods and services. Given the Proposed Modification is assessed as unlikely to impact on features of the biophysical environment likely to affect surrounding land owners, i.e. noise, dust, water availability, detrimental social impacts are unlikely.

On balance, by providing employment locally and minimising impacts on surrounding land owners, the impact of the Proposed Modification on the social-economic setting would be neutral to beneficial.

5.4 CONSEQUENCE OF NOT PROCEEDING

Should, the Proposed Modification not proceed, the impacts on local biodiversity associated with clearing could not be reversed, however, rehabilitation of these area could commence.

However, should the modification to the Caloma Open Cut not proceed, there is the potential that:

- the ability of the Proponent to maximise production of a range of aggregate and sand products could be jeopardised (by a lack of stockpile area) which could impact on the competitiveness of the Quarry;
- this in turn could prevent the additional employment which would follow an increase in production or lead to a loss in employment should the Quarry cease to operate; and
- as a result the contributions to the local, regional and state economies would be reduced or ceased.

5.5 CONCLUSION

The Proposed Modification can be justified as the residual impacts on the biophysical environment are understood and where unavoidable can either be managed to reduce the impact as far as practically possible or have been offset. No significant socio-economic impacts are expected as a consequence of the Proposed Modification, however, when considering the Proposed Modification is important to the ongoing viability of the Quarry the consequences of not proceeding are considered more adverse than proceeding.

6. REFERENCES

Department of Environment and Climate Change (DECC) (2008). *Managing Urban Stormwater: Soils and Construction, Vol. 2C,* DECC, NSW, Sydney.

Department of Environment & Climate Change (DECC) (2009). *BioBanking Assessment Methodology and Credit Calculator Operational Manual*.

Department of the Environment (DoE) (2013). *Matters of National Environmental Significance: Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999*.

Dexter E. M. and Kitching R. L. (1991b). *The Bathurst Copperwing, Paralucia spinifera Edwards and Common – in The Conservation Biology of Lycaenidae (Butterflies)* Ed T. New Occasional Paper of the IUCN Species Survival Commission No 8.

Environment Protection Authority (EPA) (1999). *NSW Industrial Noise Policy*.

King D.P. (1994). *Soil Landscapes of the Katoomba 1:100,000 Sheet map and report*, NSW Department of Land and Water Conservation, Sydney

Landcom (2004). *Managing Urban Stormwater: Soils and Construction, Vol. 1 2nd eds,* Landcom, NSW, Sydney.

Lesryk Environmental (2016). *Purple Copper Butterfly Targeted investigation Walker Quarry, Wallerawang, NSW*, October 2016

Lesryk Environmental (2017). *Ecological Investigation: Walker Quarry, Wallerawang, NSW*, March 2017

NSW Office of Environment and Heritage (OEH) (2014). *NSW Biodiversity Offsets Policy for Major Projects*. September 2014. Office of Environment and Heritage for the NSW Government, September 2012.

NSW Office of Water (NOW) (2012). *NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities*.

Office of Environment & Heritage (OEH) (2014). *NSW Biodiversity Offsets Policy for Major Projects,* September 2014.

Pacrim Environmental (Pacrim) (2001). *Environmental Impact Statement Proposed Wallerawang Quarry*. Prepared for Sitegoal Pty. Limited, November 2001 (report 01/206.1).

Pacrim Environmental (Pacrim) (2002). *Supplementary Report to the EIS for the Proposed Wallerawang, Quarry*, Prepared for Sitegoal Pty. Limited, July 2002 (Report 02/206.1).

Rangott Mineral Exploration Pty Ltd (RME) (2016). *Wallerawang Quarry Mining Operations Plan, for the period 14 August 2016 to 14 August 2018.*

RW Corkery & Co. Pty Limited (RWC) (2016a). *Water Management Plan for the Wallerawang Quarry*. September, 2016.

RW Corkery & Co. Pty Limited (RWC) (2016b). *Flora and Fauna Management Plan for the Wallerawang Quarry*. September, 2016.

RW Corkery & Co. Pty Limited (RWC) (2016c). *Landscape Planting Plan for the Wallerawang Quarry*. September, 2016.

RW Corkery & Co. Pty Limited (RWC) (2016d). *Air Quality Management Plan (incorporating an Air Quality Monitoring Program) for the Wallerawang Quarry*. September, 2016.

RW Corkery & Co. Pty Limited (RWC) (2016e). *Noise Management Plan (incorporating a Noise Monitoring Program) for the Wallerawang Quarry*. September, 2016.

Silcox, R. (2000). *Archaeological Assessment for a Proposed Hardrock Quarry, Wallerawang*. Report to Pacrim Environmental Pty Ltd.

Sitegoal Pty Ltd (Sitegoal) (2006). *Mining Operations Plan for the Wallerawang Quarry, October 2006*.

SLR Consulting Australia Pty Ltd (SLR) (2016). *Independent Environmental Audit: Wallerawang Quarry, 18 March 2016*.

Wildthing Environmental Consultants (Wildthing) (1999). *Statement of Effect on Threatened Flora and Fauna over land proposed for development of a Hard Rock Quarry within EL 44473 near Wallerawang NSW*.

Wildthing Environmental Consultants (Wildthing) (2002). *Paralucia spinifera (Bathurst Copper Butterfly) Survey for the Proposed Wallerawang Quarry near Wallerawang NSW*.

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