Section 5

Environmental Safeguards and Impacts

PREAMBLE

Based on the identification and prioritisation of environmental issues provided by Section 3, this section describes the environmental features of the Quarry Site and its surrounds that could be affected by the Proposal. The proposed design and/or operational safeguards and an assessment of the level of impact the proposed activities may have after implementation of these safeguards is described. Where appropriate, monitoring programs are outlined.

Given the location of the Bogo Quarry, i.e. isolated from other similar quarries or industries and in close proximity to the Hume Highway, there are no opportunities for cumulative impacts arising from the Proposal.

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5.1 INTRODUCTION

The *Environmental Impact Statement* is required to assess a range of potential key environmental issues that may be encountered throughout the life of the Proposal and present the design and operational safeguards together with the management procedures that would minimise any potential environmental impacts that may occur.

Section 3.3 provided a summary of the risk of environmental impact associated with the “key” environmental issues. This assessment of risk took a highly conservative approach, considering the risk of impact without the adoption of any environmental controls or mitigation measures. In reality, the risk associated with each of the nominated potential environmental impacts would be considerably lower, as environmental controls are currently implemented at Bogo Quarry to manage and reduce impacts on the environment.

Notwithstanding the reduced level of environmental risk posed by the Proposal, the following sub-sections consider the existing environment, potential environmental impacts, operational safeguards and controls and predicted residual impacts for the following environmental parameters.

- Soil and Water.
- Ecology.
- Pre-European History.
- Noise and Blasting.
- Air Quality.
- Transport.
- Visibility.
- Hazards and Site Security.
- Land Use.
- Socio-economic Impacts.

5.2 LAND AND WATER

5.2.1 Introduction

The SEARs identify land and water as key issues for assessment in the *Environmental Impact Statement*. Based on an analysis of environmental risks undertaken for the Proposal (see Section 3.3), the specific land and water-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- pollution of downstream waters as a result of discharge of dirty, saline or contaminated water (high risk);
- erosion of rehabilitated areas and/or final landform of the Quarry Site (high risk);
- changes to hydrology of creeks and drainage line (moderate risk);
- reduction in the quality of soil resources on the Quarry Site (moderate risk).

This section focusses upon the management of the soil resources and surface water within the Quarry Site. The Proposed base of extraction, i.e. 545m AHD, is well above the regional groundwater table and as such groundwater resources are not required to be addressed.

5.2.2 Soil Management and Assessment of Impacts

5.2.2.1 Quarry Site Soils

Much of the soil resources within the extraction area were stripped and sold by the previous quarry operator, with only those soils of the undeveloped extraction area remaining. No specific sampling or testing of the remaining soils has been undertaken with descriptions based on:

i) a general inspection of the environmental setting of the Quarry Site undertaken in February 2008;

ii) consideration of a geology report prepared by Rangott Mineral Exploration Pty. Ltd (RME, 2008) (see **Appendix 3**); and

iii) consideration of the NSW Soil Landscape Mapping Program commenced by the Department of Conservation and Land Management and currently managed by the Office of Environment and Heritage (OEH) and comparison to soils located within a similar environmental setting and on similar geology.

Wherever uncertainty over soil parameters has been encountered, a conservative assumption has been made.

General inspection of the Quarry Site confirmed that there is only a very thin layer of soil over weathering rock on the slopes of the hill within the extraction area. This is supported by the geological assessment of RME (2008) which identified significant areas of out-cropping, or near out-cropping rock within the extraction area.

Given no sampling or analysis of the minimal soil layer on the Quarry Site was undertaken, reference has been made to the NSW Soil Landscape Mapping Program to gain an understanding of the general characteristics of the soils that occur.

The characteristics of the Quarry Site soils have been identified or conservatively assumed to be as follows.

- Location: Hillslope and hilltop of a moderately sloped (<30º) and rounded hilltop.
- Texture: Very Shallow (<30cm), where present at all. Sandy loam or clayey sand depending on the degree of weathering of the sub-surface Ignimbrite rock.
- pH: Likely to approach neutrality (7.0±1.0).
- Permeability: Permeable with low water holding capacity.
- Fertility: Likely to display low fertility due to thin layer and high permeability.
- Erodibility: Likely to be moderately to highly erodible. A Universal Soil Loss Equation (USLE) K factor of 0.05 has been assumed (in accordance with Volume 2E of "*Managing urban stormwater: soils and construction – mines and quarries*" (DECC, 2008).

- Hydrologic Group: The soil has been assumed to be of Soil Hydrologic Group C, i.e. weakly structured soils with a clay component that impedes infiltration of water and results in water shedding during moderate rainfall events.
- Sediment Type: It is likely that like most soils of inland Australia, the soil contains dispersible (Type D) sediments.

Based on this description of the soil, careful management is required to reduce the erosion hazard.

5.2.2.2 Soil Management Issues and Constraints

Erosion and Sedimentation

Despite the fact that the soil layer over the Quarry Site is minimal, the characteristics of the soil described in Section 5.2.2.1 indicates that if exposed or placed in stockpiles subject to overland flow of water it would be likely to erode. Appropriate soil and water management controls are therefore required to prevent the formation of erosion gullies as a consequence of the extraction activities and poor soil management.

Rehabilitation

The soil stripped from the extraction area represents an important resource in the rehabilitation of the Quarry Site. Specifically, the stripped soil material would ultimately be replaced over the final landform to provide a growth medium for vegetation. As a consequence, appropriate stripping and stockpiling controls and procedures would be required to maximise the value of the stripped soil for use in rehabilitation to enhance the probability of rehabilitation success.

5.2.2.3 Soil Disturbance and Management

The Applicant is conscious of the need to conserve all soil resources available on those areas of the Quarry Site yet to be disturbed, and to ensure they are responsibly managed, are not eroded in either their natural or stockpiled state, and are available for the rehabilitation of disturbed areas within the Quarry Site.

Soil Erosion Controls

In most cases, water management controls duplicate as a means of soil erosion control. A range of water management and drainage controls are outlined in Section 5.2.3.4 and would be implemented to either divert “clean” water (via non-scouring drains / banks) around disturbed areas or direct runoff from disturbed areas (“dirty” water) to detention structures. Where appropriate, the controls would incorporate silt-stop fencing and straw bale protection.

In addition to localised sediment control, the following general management procedures are proposed to limit the potential for soil erosion.

- Areas stripped of soil at any one time would be minimised consistent with operational requirements. All areas to be stripped of topsoil would be clearly identified in advance and the depth of topsoils and/or subsoils available identified.

- Wherever possible, topsoil would be directly transferred onto areas requiring rehabilitation. This approach would encourage the germination of the contained propagules, maximise the success of rehabilitation and reduce the need for soil stockpiling.
- Soil stockpiles to be retained for in excess of 3 months would be sown with a cover crop to stabilise the soil surface and encourage continued biological activity in the soil.

Soil Stripping and Stockpiling Practices

The Applicant would implement the following safeguards with respect to the stripping and stockpiling of soil materials.

- Soil stripping would be undertaken preferentially in late spring or early summer, where practicable (when soil conditions are likely to be at their most amenable for excavation and transfer).
- Preferential direct replacement of soil materials onto surfaces awaiting either temporary or final rehabilitation.
- Soil stockpiles would be aligned generally parallel with the contour in low mounds not exceeding 2m in height.
- Where appropriate, the stockpiles would be isolated from up-slope runoff by the construction of diversion embankments.
- Silt-stop fencing would be positioned down-slope of stockpiles until an adequate level of stabilisation is achieved.

Soil Respreading Practices

The Applicant would implement the following controls with respect to the respreading of soil materials.

- Stripped soil would be immediately respread over completed section of the final landform.
- Prior to respreading of the topsoil layer, the combined subsoil / imported VENM profile layer would be ripped or scoured to allow keying of the topsoil. This would be especially important given the proposed sloping nature of the final landform.
- A phosphate based fertilizer would be added to the respread soil immediately at a rate to be determined at the time of rehabilitation (likely to be between 100kg/ha and 300kg/ha).

5.2.2.4 Assessment of Impacts

With the emphasis on directly transferring topsoil from source to final rehabilitation destination, the potential impact on soil structure and biological activity is likely to be relatively minor. As it is the intention to isolate any soil to be stockpiled, with appropriate down-slope sediment control structures, and establish a cover crop on any stockpile maintained for in excess of 3 months, the erosion risk and potential detrimental impact on soil structure would also be minimal.

Ripping the replaced subsoil (or imported VENM) and keying the respread topsoil would aid in the settlement of the soil layer and maximise water infiltration and subsequent growth of vegetation.

5.2.3 Surface Water Management and Assessment of Impacts

5.2.3.1 Local Hydrological Setting

Local Drainage

The Quarry Site is located within the Stony Creek Catchment, which flows into Bogolong Creek then Jugiong Creek to the northwest and eventually the Murrumbidgee River (see **Figure 5.1**).

Quarry Site Drainage

The southern and southeastern side of the Quarry Site drains to the south towards a small tributary of Stony Creek (Catchment SC-S) whilst the northern side of the Quarry Site drains to the north towards Stony Creek (Catchment SC-N). Stony Creek and the tributary join about 0.5km west of the Quarry Site. Drainage from the western side of the hill within the Quarry Site drains down the hill slope directly towards the roadside drainage network adjoining the Hume Highway and then into Stony Creek (Catchment SC-W). Each of the drainage lines flow for short periods during and immediately following intense rainfall events.

Figure 5.1 presents the three sub-catchments of the Quarry Site. These sub-catchments are categorised as either clean or disturbed, where each category is as follows.

- **Clean catchment**. Catchments that exclude quarry related disturbance.
- **Disturbed catchment**. Catchments which include areas of quarry related disturbance.

Catchment SC-W is, and would remain a clean catchment, with the catchment boundary progressively relocated to align with the western perimeter of the extraction area. Catchments SC-S and SC-N would accept water flowing over or through areas of quarry-related disturbance and accordingly are classified as dirty water catchments.

A number of dams are maintained on the Quarry Site (see **Figure 5.1**). Dams 1 and 2 receive surface flow from the disturbed areas of the Quarry to the south (Catchment SC-S), Dams 3 to 6 accept surface flow from the disturbed areas of the Quarry to the north (Catchment SC-N), whilst Dams 7 and 8 accept the small volume of surface flow from the disturbed areas of the Quarry to the east (also Catchment SC-N). The water from the settlement dams is used to suppress dust generation from the internal road network and product stockpiles and during crushing and screening activities.

Water Quality

Water quality monitoring undertaken for three of the on-site settlement dams (Dams 1, 4 and 5) indicated that water quality was slightly alkaline pH (7.79 to 8.12) and fresh (electrical conductivities of between 181µS/cm and 195µS/cm). Oil and grease was detected in one dam but was found to be less than 5mg/L, i.e. below accepted levels.

5.2.3.2 Surface Water Management Issues and Constraints

Erosion and Sedimentation

In light of the moderately to highly erodible nature of the soils of the Quarry Site, preventing erosion on the Quarry Site remains an important management consideration for the Proposal. Ultimately, elevated erosion could lead to increased discharge of sediment, given the soils of the Quarry Site are also likely to be dispersible, into Stony Creek and potentially the Murrumbidgee River downstream.

Salinity and Acid Sulfate Soils

Given the near neutral pH of the Quarry Site soils, and the neutral to alkaline nature of the water held in the dams accepting runoff from the exposed surfaces of the Quarry Site, it is assessed that the Quarry Site soils would not pose a salinity or acid sulfate soil hazard.

Pollution of Downstream Watercourses

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

i) Runoff from stockpiles of soil and overburden.

ii) Surface runoff from product stockpiles.

iii) Runoff from hardstand areas including roads and processing areas.

iv) Leakage or spillage of hydrocarbons.

v) Spillage of raw materials particularly cement or flyash and suspended solids generated from pre-mixed concrete that may be spilled on areas around the plant.

Storage facilities for chemicals on the asphalt plant pad would be designed to contain any chemicals in the event of a spill. A bund would contain any contaminants that would be deposited in the batching plant work areas and hence it is not considered that there would be a risk of potential contamination of surface water quality beyond the Quarry Site.

Therefore, 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 potential sources of surface water pollution arising from the Proposal.

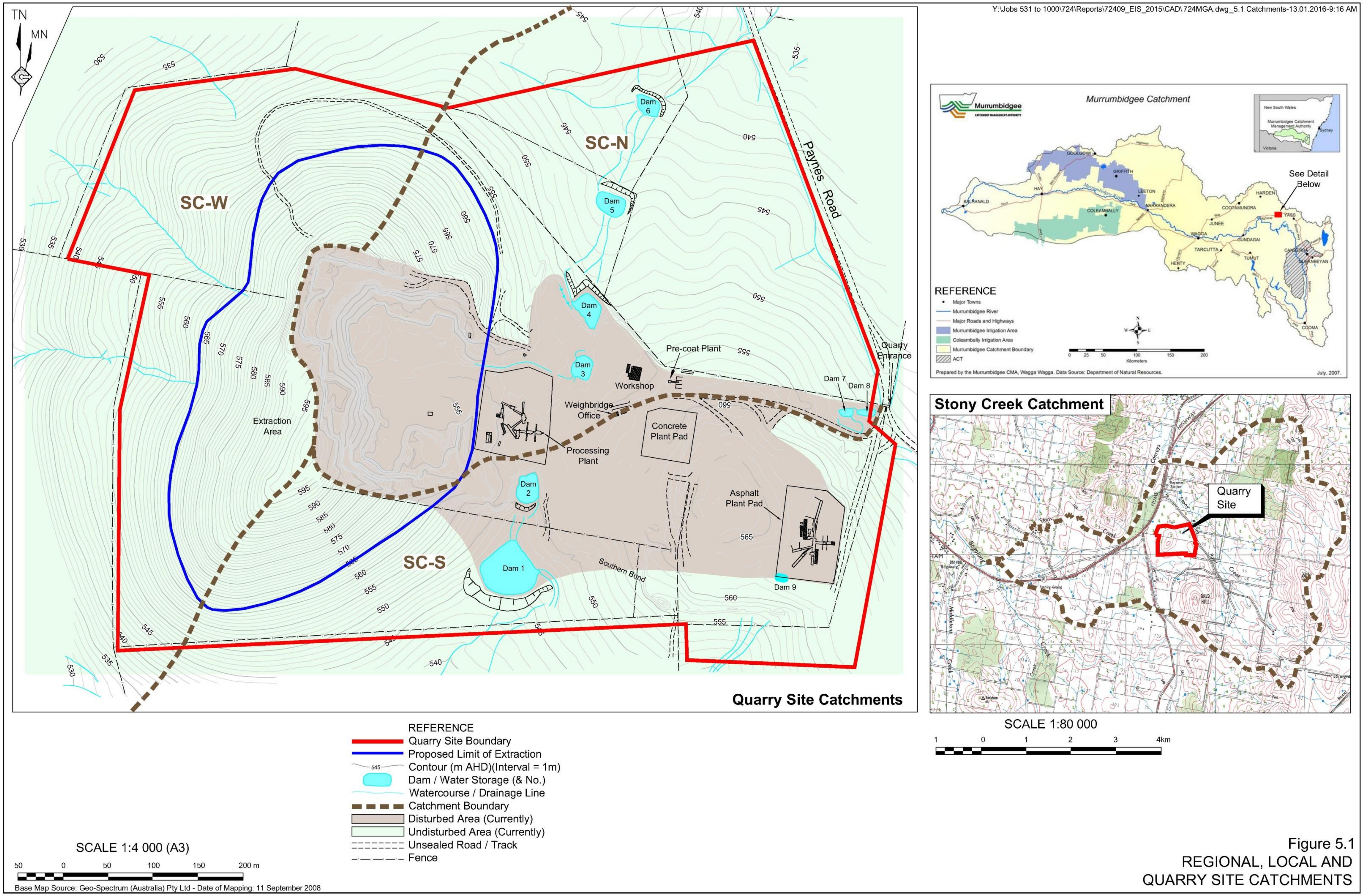

Figure 5.1
REGIONAL, LOCAL AND
QUARRY SITE CATCHMENTS

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Maximum Harvestable Right Dam Capacity

When considering water availability, it is important to recognise that every property has a Maximum Harvestable Rights Dams Capacity (MHRDC). The MHRDC for a property exempts small rural type dams located on minor watercourses capturing a small proportion of a catchment from licensing requirements. The "Stony Creek" property on which the Quarry Site is entirely located covers an area of approximately 128ha. Using the DPI – Water MHRDC calculator, the MHRDC for the property is 8.96ML**.**

Pollution control structures, i.e. those required to capture water which may be contaminated with high sediment levels or other pollutants, are exempt from the MHRDC consideration, which assumes that excess water detained in these structures is not re-used on site and is eventually released to downstream waters. The water stored within Dams 1 to 9 may be re-used for dust suppression and vegetation watering.

Details on the construction and capacity of Dams 1 to 9 is provided in **Table 5.1**.

Dams 1 to 9 are all located outside of flood zones and are therefore unlikely to be affected by flood flows. The use of the water from these dams is reserved for dust suppression and potentially vegetation watering on the Quarry Site, i.e. there are no shared use or other land owner entitlements associated with these structures. With the exception of the minor sediment and erosion control works, no further work is required to maintain the integrity of each dam which will remain for the life of the quarry.

As identified in **Table 5.1**, the combined capacity of the dams is approximately 18 000m^3 (18ML). Up to 8 960m^3 (8.96ML) of that storage volume can be made available for use on the Quarry Site.

Table 5.1
Dams of the Quarry Site

Dam Reference*	Date of Construction	Storage Capacity (m^3)	Location	Catchment(s)	Legal Status/ Approval
1	Unknown	~8 300	Immediately downstream of Dam 2 at the southern Quarry Site boundary.	• Overflow from Asphalt Plant Pad and Dam 2. • Limited clean water catchment (sheet flow).	None
2	Unknown	~2 000	To the south of the processing plant and adjacent to the southwestern corner of the Southern Stockpile Area.	• Southern Stockpile Area.	None
3	Unknown	~1 400	Southeastern corner of the Northern Stockpile Area.	• Processing plant area, concrete batching plant pad, and weighbridge and office area.	None
4	Unknown	~2 100	Northeastern corner of the Northern Stockpile Area.	• Workshop and pre-coat plant area, and Northern Stockpile Area.	None
5	Unknown	~2 000	On first order tributary of Stony Creek downstream of Dams 3 and 4.	• Overflow from Dams 3 and 4. • Clean water catchment (sheet flow).	None
6	Unknown	~1 300			None
7	Unknown	~400	Adjacent to quarry entrance.	• Site entrance catchment.	None
8	Unknown	~400	Immediately downstream of Dam 7.	• Overflow from Dam 7.	None
9	2009	~300	Sump on the Asphalt Manufacture Plant pad.	• Asphalt Manufacture Plant pad	None
Total		**~18 000**			

*See Figure 5.1

5.2.3.3 Criteria for Impact Assessment

No impact assessment criteria are specified for discharge of surface waters from licenced discharge points in EPL 4219. However typical surface water quality criteria specified in environmental protection licences are as follows.

pH	: 6.5 to 8.5 or within 0.5 units of existing quality
Suspended Solids	: 50mg/L
Oils and Grease	: Not visible or contain more than 10mg/L grease and oil.
Biochemical Oxygen Demand	: 20mg/L

5.2.3.4 Surface Water Controls

5.2.3.4.1 Objectives

The principal objectives of water management at the Bogo Quarry would involve:

- diverting surface water flows away from active areas of disturbance;
- controlling the flow of surface water over areas of disturbance within the Quarry Site; and
- managing the use, storage and, in the event of a spillage, control and clean-up of hydrocarbons.

This section describes the proposed water management controls that would be implemented within and around the main areas of disturbance on the Quarry Site. **Figure 5.2** identifies the location of the various structures and controls nominated within Section 5.2.3.4. **Figure 5.2** also provides the relevant design features of the proposed surface water management structures.

5.2.3.4.2 Extraction Area

The extraction area would be effectively water holding with any water falling onto the active extraction area held within the created void. In order to assist in the operational management of extraction, temporary sumps would be excavated within the active extraction area allowing for any water captured within the area to be stored away from active extraction operations and potentially pumped back to the main storage dams for use in dust suppression operations.

As the extraction area progresses, land preparation activities such as vegetation clearing, soil stripping and overburden removal would be undertaken at surface level. During this stage of the extraction process, rainfall and runoff over these areas have the potential to discharge from the Quarry Site. In order to prevent the discharge of any dirty water flows during this phase of operations, silt-stop fencing would be installed in accordance with the design detail provided by Standard Drawing (SD) 6-8 of the Landcom (2004) document "*Managing Urban Stormwater: Soils and Construction – Volume 1*".

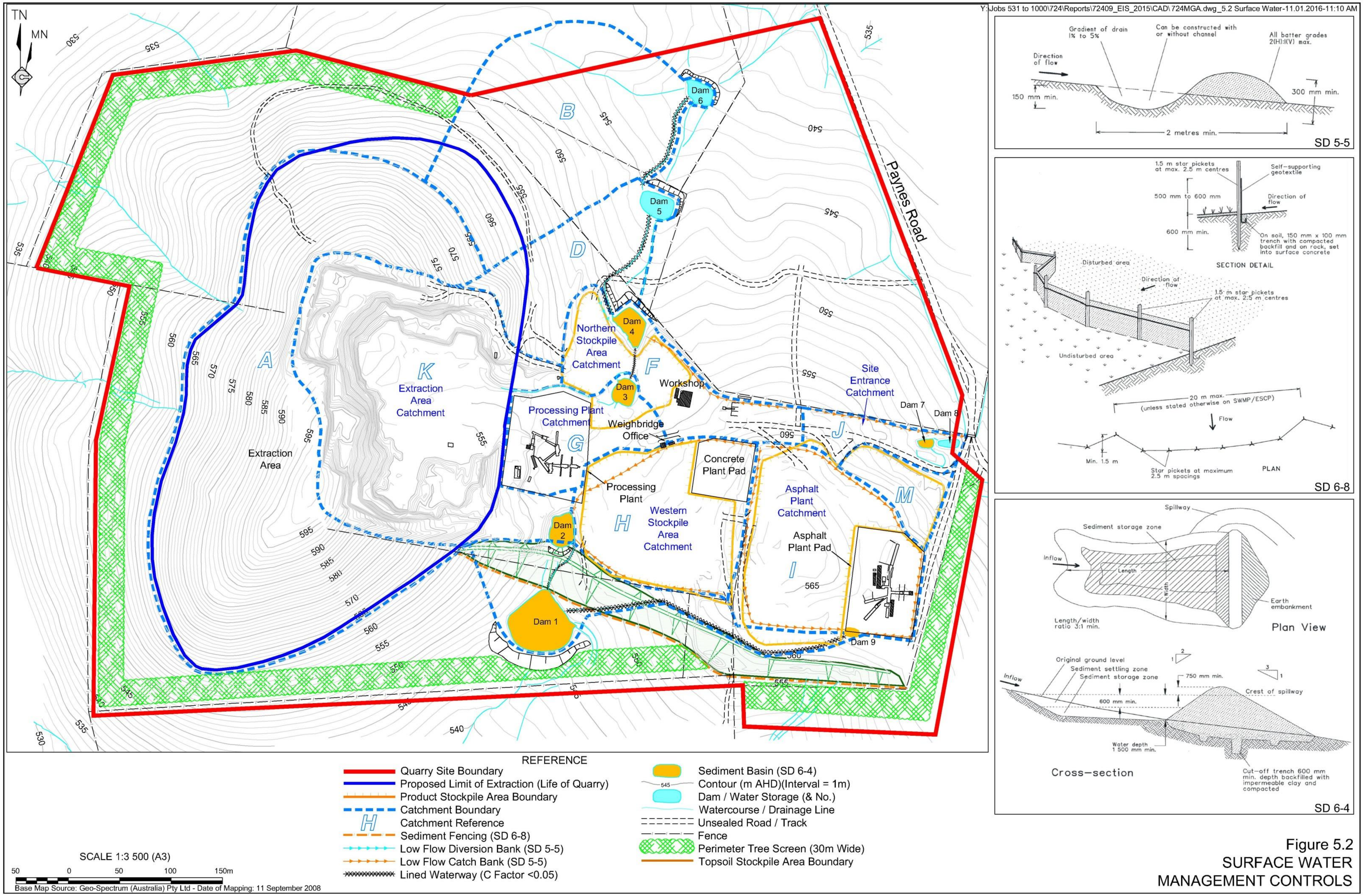

Figure 5.2
SURFACE WATER MANAGEMENT CONTROLS

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5.2.3.4.3 Processing and Stockpiling Area(s)

Surface water flows on the hardstand surface of the processing and stockpiling areas of the Quarry Site would be diverted to Dams 2, 3, 7 and 9 via existing channels of low flow contour banks (see **Figure 5.2**) constructed in accordance with SD 5-5 of Landcom (2004). Overflow from these dams would be to Dams 1, 4, 8 and 1 respectively, which provide a secondary sediment settlement capacity.

To demonstrate these sediment retention structures (Dams 1, 2, 3, 7 and 9) provide for sufficient sediment storage and settlement capacity, a calculation of sediment basin minimum capacity has been completed in accordance with DECC (2008) using the calculations of *Section 6.3.3* of the document "*Managing Urban Stormwater – Soils and Construction Volume 1*" (Landcom, 2004), otherwise referred to as the 'Blue Book'. The minimum basin volume is calculated as follows.

Basin Volume (BV) = Settling Zone Volume (V1) + Sediment Storage Zone Volume (V2)

The settling zone volume for Type D Soils is calculated to provide capacity to contain all runoff expected from the 95th percentile 5 day rainfall event.

The settling zone volume (***V1***) can be determined by the following equation.

$$V1 = 10 \cdot Cv \cdot A \cdot R_{95th\ ile,\ 5\ day}\ (m3)$$

where:

- 10 = a unit conversion factor.
- C_v = the volumetric runoff coefficient, defined as that portion of rainfall that runs off as stormwater over the 5-day period.
- R = the 5-day total rainfall depth (mm) which is not exceeded in 95 percent of rainfall events (see *Table 6.3a* in *Section 6.3.3* of the Blue Book).
- A = the area of catchment in hectares.

- The 95th percentile, 5-day rainfall depth for Bogo (R) = 40.8mm (see *Table 6.3a* in *Section 6.3.3* of the Blue Book).
- Soil hydrologic group C has been assumed, therefore, a review of *Table F2* of the Blue Book determines the runoff coefficient (C_v) to be 0.51.

The Sediment Storage zone volume (***V2***) can be determined by the following equation.

$$V2 = \frac{0.17x\ A\ (R \times K \times Ls \times P \times C)}{1.3}$$

where:

- A = Disturbed Area (ha)
- R = Rainfall factor (taken from *Appendix B* of the Blue Book).
- K = Soil erodibility factor (assumed to be 0.05 in accordance with DECC (2008)).
- Ls = Length/slope gradient (80m default assumed from *Table A1* of the Blue Book).

P = Conservation practices (default value of 1.3 used as per recommendations of the Blue Book).

C = Ground cover (default value of 1.0 used as per recommendations of the Blue Book).

A = Cover factor (default value of 1.0 used as per recommendations of the Blue Book).

1.3 = Bulk density of the deposited sediment

Given the use of default values for P & C, the Sediment Storage zone volume (***V2***) in each case would be determined by the following equation.

$$V2 = \frac{0.17x\ A(1170 \times 0.05 \times Ls \times 1.3 \times 1.0)}{1.3}$$

$$V2 = \underline{0.17x\ A(1170 \times 0.05 \times Ls)}$$

The following sediment basins have been nominated for each of the disturbed catchments of the Quarry Site (see **Figure 5.2**). (The available storage of each of these dams is also provided – see also **Table 5.1**.)

- Catchments F, G & K: Dams 3 & 4 (1 750m^3).
- Catchment H: Dam 2 (1 000m^3).
- Catchment I: Dams 9 and 1 (9 250m^3).
- Catchment J: Dam 7 (250m^3).

Assuming the above, the minimum sediment basin capacity within each of the four disturbed catchments would be as follows.

- Catchments F, G & K = 1 750m3.
- Catchment H = 475m3.
- Catchment I = 590m3.
- Catchment J = 115m3.

Appendix 9 provides the detailed data entry and calculations used to determine the basin volumes.

5.2.3.4.4 Mobile Asphalt Plant Pad

The following safeguards and management measures relating to the asphalt plant would be implemented to reduce potential impacts upon water quality.

- Water from the area of the asphalt plant would be directed to Sediment Basin 9 via low flow contour banks from where the water would be allowed to settle (see **Figure 5.2**).
- All plant and truck cleaning and pre-spraying of trucks would occur within the asphalt plant area.

- Any asphalt spilt during the operating process would be picked up and fed back into the processing plant.
- The bitumen storage tanks and diesel storage tank would be steel tanks placed within impermeable bunds (of capacity in excess of 110% of each tank).

Continued water quality monitoring would also be undertaken to ensure that the surface water management system is effective and properly maintained. Sampling would be undertaken following the first substantial rainfall event resulting in visible runoff from the asphalt plant area. Samples would be analysed for pH, electrical conductivity and oil and grease.

5.2.3.4.5 Soil Stockpiles

Low flow contour banks (as per SD 5-5 of Landcom (2004)) would be constructed upstream and silt-stop fencing installed down slope of all stockpiled material (as SD 6-8 of Landcom (2004)) (see **Figure 5.2**).

5.2.3.5 Hydrocarbon Contamination

Diesel and other hydrocarbon products would be stored within the designated impermeable bund of the fuel/oil storage area. All oil drums and hydrocarbon products would be stored within this area, which would have a capacity of at least 110% of the largest container.

In the event of a hydrocarbon leak or spill, the Applicant 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 of 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.

5.2.3.6 Preliminary Site Water Balance

Based on the water use for maximum production at the Bogo Quarry (500 000t aggregate and 20 000m^3 concrete), a balance of water requirements against available water from surface catchments in average (mean rainfall), dry (10^{th} percentile rainfall) and wet (90^{th} percentile rainfall) years was prepared.

The following assumptions have been made.

- All water falling over the extraction, processing and stockpiling areas would drain to one of the sediment retention structures (Dams 2, 3, 4 and 9).

- The total catchment of the active Quarry Site is currently 130 000m^2 increasing to approximately 200 000m^2 once the extraction area reaches it maximum size.
- A constant fraction runoff coefficient for each catchment is assumed to be high (K = 0.7) as the majority of the catchment is hardstand.
- Based on a review of evaporation statistics from the Bureau of Meteorology Stations at Burrinjuck Dam (No. 073007) and Goulburn TAFE (No. 070263) (closest stations measuring evaporation), an annual average evaporation of 3.25mm/day has been assumed. During periods of prolonged low rainfall (e.g. 10th percentile rainfall year), when mean daily solar exposure will be higher, the average daily evaporative rate would be higher (4mm/day). Similarly during periods of higher rainfall (e.g. 90th percentile rainfall year), when mean daily solar exposure will be lower, the average daily evaporative rate would be lower (2.75mm/day).
- Evaporation has been calculated by applying the evaporative rate to the surface area of the water storages on the Quarry Site (approximately 6 000m^2).

Table 5.2 presents the water balance for average, wet and dry years.

Table 5.2
Water Balance for the Quarry Site (Catchments F, G, H, I, K) – Current

Inputs and Outputs		Dry Yr[1] (ML)	Average Yr[2] (ML)	Wet Yr[3] (ML)
	Rainfall	461mm	648mm	847mm
Inputs	Rainfall/Runoff	59	59	77
	TOTAL	**59**	**59**	**77**
Outputs	Evaporation	7.7	7.7	7.0
	Dust Suppression and Processing	24.0	24.0	24.0
	Concrete Manufacture	3.0	3.0	3.0
	TOTAL	**34.7**	**34.7**	**34.0**
	EXCESS/DEFICIT (Input minus output)	**+24.3**	**+24.3**	**+43.0**

1. 10th percentile rainfall year 2. Mean rainfall 3. - 90th percentile rainfall year

The water balance provided in **Table 5.2** illustrates runoff generated by the Quarry Site catchments would exceed that required to supply the proposed activities, even during low rainfall years. It is therefore assessed as being highly probable that sufficient water would be available within the 8.96ML of MHRDC storage provided by Dams 1 to 9, i.e. these dams would be regularly filled by runoff from the Quarry Site catchments (Catchments F, G, H, I, K – see **Figure 5.2**).

The Applicant would review the site water balance for the Bogo Quarry annually, reflecting actual water use rates.

5.2.3.7 Assessment of Impacts

Construction and installation of the structures identified in Section 5.2.3.4 and illustrated on **Figure 5.2**, would ensure that all clean water is diverted away from areas of active disturbance and any additional rainfall and runoff within the areas of active disturbance captured and stored for operational use of the Proposal, i.e. dust suppression.

The Bogo Quarry would continue to obtain all water requirements from surface water runoff captured within Dams 1 to 9. No licence to capture surface water would be required as a maximum of 8.96ML would be extracted in accordance with the Maximum Harvestable Rights Dams Capacity (MHRDC, as detailed in Section 5.2.3.2).

Based on the proposed safeguards and mitigation measures to be implemented by the Applicant, it is assessed that the Proposal would be unlikely to have a significant impact on local and/or regional surface water quantity or quality.

5.3 ECOLOGY

5.3.1 Introduction

In accordance with the SEARs, the Applicant considered impacts on biodiversity, in particular threatened species and populations. An analysis of environmental risk (see Section 3.3) identified the following as specific flora and fauna-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment.

- Removal of native vegetation due to clearing activities, or other Proposal-related activity, leading to loss of, or alteration to, existing habitats (moderate risk);
- Direct adverse impact on threatened species, populations or endangered ecological communities (moderate risk);
- Local or regional reduction in distribution of threatened species, populations or endangered ecological communities (high risk).

The following subsections describe the existing vegetation communities and fauna habitat, flora and fauna species found within and surrounding the Quarry Site and their conservation significance. The potential impacts that the Proposal would have on these vegetation communities and threatened flora and fauna species are described together with the design and operational safeguards and management procedures to be employed. The description of the flora and fauna of the Quarry Site and assessment of impacts that follows, have been summarised from Biosis (2016), which is presented in full as **Appendix 4**.

5.3.2 Study Methodology

5.3.2.1 Desktop Research

The desktop component of the flora and fauna assessment involved a database search of records of threatened species, populations and communities from:

- Department of Environment (DoE) Protected Matters Search Tool for matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- NSW BioNet - the database for the Atlas of NSW Wildlife, Office of Environment and Heritage (OEH), *Threatened Species Conservation Act 1995*);

- PlantNET - The Royal Botanic Gardens and Domain Trust;
- Australian Government's Bureau of Meteorology, Groundwater Dependent Ecosystems Atlas; and
- OEH Vegetation Information System (VIS) Mapping through the Spatial Information eXchange (SIX) Vegetation Map Viewer.

A list of threatened entities was also provided by OEH, requiring assessment in accordance with the OEH correspondence attached to the SEARs.

5.3.2.2 Field Survey

Field survey techniques were designed to adequately target the subject species and community identified by Biosis (2016). This field survey built on a field survey carried out in 2008 by Ecotone Ecological Consultants.

Flora Survey

Biosis surveyed the Quarry Site on 30 September 2015 to document the flora and vegetation communities within the Quarry Site. The Quarry Site was thoroughly traversed, and all trees within the proposed area of impact were visited to assess their habitat values. All flora species encountered during the field survey were recorded, and general condition of vegetation was observed.

Fauna Survey

Biosis surveyed the Quarry Site on 30 September 2015 to confirm the fauna habitat values documented in the 2008 flora and fauna survey. All species of fauna observed during the assessment were noted and active searching for fauna was undertaken. This included direct observation, searching under rocks, and identifying calls. Particular attention was given to searching for threatened biota and their habitats. Fauna species were recorded with a view to characterising the values of the Quarry Site.

5.3.3 Results

5.3.3.1 Flora

Biosis (2016) notes the vegetation and fauna habitat throughout the Quarry Site has been highly modified by past and ongoing disturbances, which have included vegetation clearing, grazing and pasture improvement. The majority of the Quarry Site now consists of cleared, exotic pasture with scattered trees. Biosis (2016) did not record any threatened flora species within the Quarry Site. Flora recorded during the field survey is listed in **Appendix 4**. The dominant vegetation community at the Quarry Site is a predominantly exotic pasture/grassland which is not listed as threatened under the TSC or EPBC Acts. Biosis notes the exotic pasture/grassland would be unlikely to respond to assisted natural regeneration.

The additional impact to flora from the Proposal would be contained within the additional 1.32ha area within the proposed limit of extraction. **Figure 5.3** shows the area of pasture that would be disturbed and the four additional trees that would be removed as a result of the Proposal.

Endangered Ecological Communities

The Quarry Site contains degraded remnant patches of White Box Yellow Box Blakely's Red Gum Woodland (Box Gum Woodland), listed as an EEC under the TSC Act. The Box Gum Woodland community at the Quarry Site is generally in poor condition, but remnant trees and the associated ground layer are considered to marginally qualify as Box Gum Woodland because of the presence of Blakely's Red Gum (Yellow Box was recorded elsewhere at the Quarry Site, however White Box was not recorded at the Quarry). A total of only 0.05ha of poor condition Box Gum Woodland would be removed as a result of the Proposal, comprising just four habitat trees including small areas of predominantly native ground layer (**Figure 5.3**). Further patches of the Box Gum Woodland occur on the Quarry Site that would not be disturbed by the Proposal (Biosis, 2016).

5.3.3.2 Fauna

No threatened fauna were identified during the 2008 and 2015 surveys at the Quarry Site. A small number of fauna species were detected during the 2015 survey, predominantly birds (**Appendix 4**). The low fauna diversity is expected due to the modified landscape and lack of significant habitat features resultant from past clearing.

Biosis (2016) assessed the likelihood of each species identified in the desktop research occurring at the Quarry (**Appendix 4**). Threatened species listed under the TSC or EPBC Act with a medium or higher likelihood of occurring at the Quarry were included for assessment (**Table 5.3**). Biosis (2016) concluded there would be no significant impact to any threatened species that have a medium or higher likelihood of occurring at the Quarry as a result of the Proposal. The assessment noted the following.

- The Proposal would not adversely affect stages of the lifecycle of any threatened species.
- There would be no loss or disturbance of foraging or breeding resources for any threatened species.
- There would not be fragmentation of habitat.

As it was clear there would be no significant impacts on threatened species as a result of the Proposal, no threatened species impact assessment for fauna species was required.

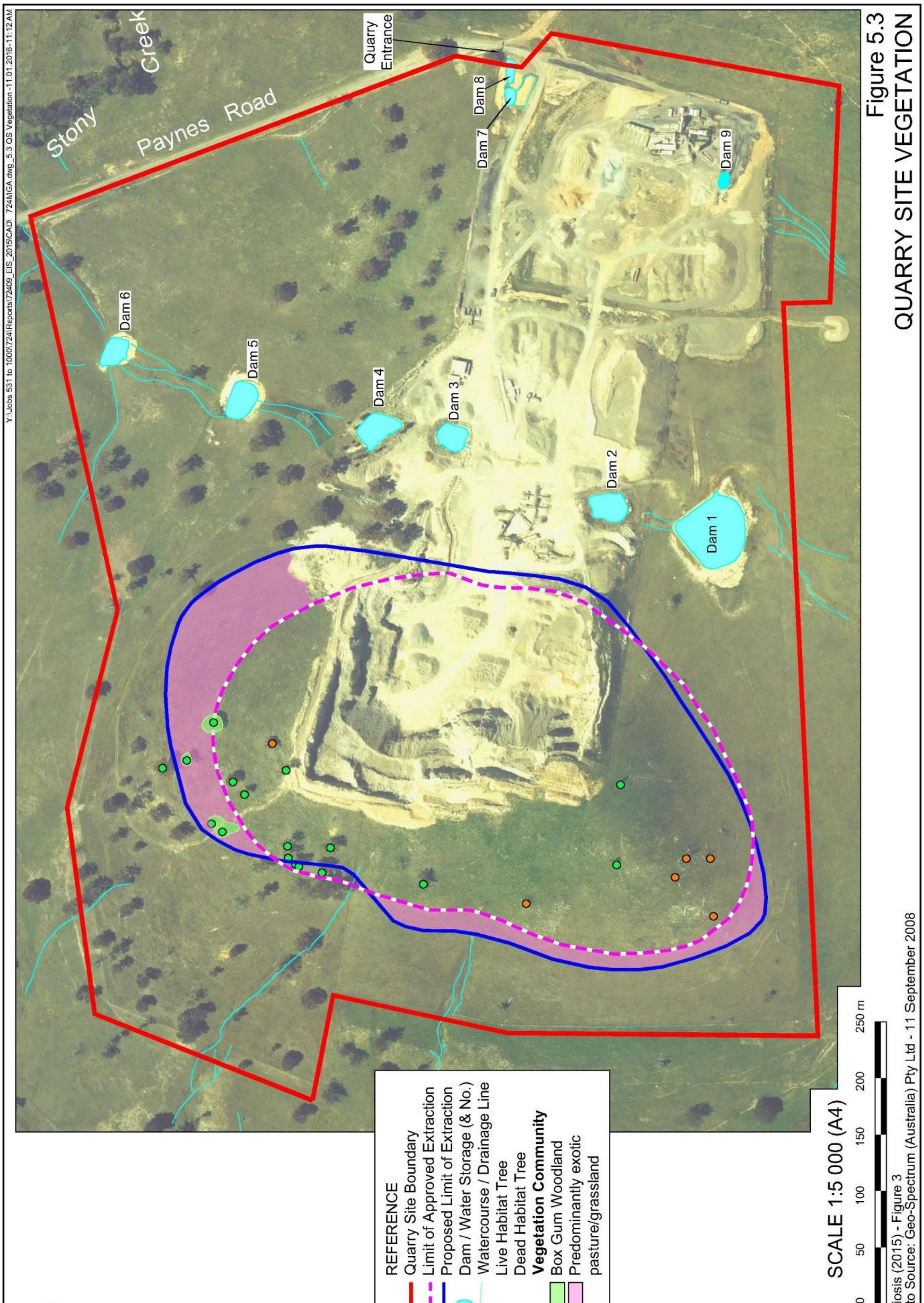

Figure 5.3
QUARRY SITE VEGETATION

Table 5.3
Threatened Species with a Medium or Higher Likelihood of Occurring at the Quarry Site

Scientific Name	Common Name	Status		Habitat Values within Subject Site	Assessment of Impacts on Threatened Species* Is there a potential for the proposed action to:			Species Impact Assessment required?
		TSC Act	EPBC Act		Adversely affect stages of the lifecycle of the species?	Loss or disturbance of limiting foraging or breeding resources?	Fragmentation of limiting habitat?	
Stagonopleura guttata	Diamond Firetail	V	-	Potential foraging habitat. Similar to the extensive foraging habitat in the locality.	No	No	No	No
Petroica phoenicea	Flame Robin	V	-	Potential foraging habitat. Similar to the extensive foraging habitat in the locality.	No	No	No	No
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Potential foraging habitat. Similar to the extensive foraging habitat in the locality.	No	No	No	No
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Some potential foraging habitat in the few mature trees. No roosting habitat.	No	No	No	No
Melanodryas cucullata cucullata	Hooded Robin (southeastern form)	V	-	Potential foraging habitat. No signs of breeding within the subject site.	No	No	No	No
Hieraaetus morphnoides	Little Eagle	V	-	Foraging habitat. No breeding activity (nests etc.) recorded.	No	No	No	No
Grantiella picta	Painted Honeyeater	V	V	Some potential foraging habitat in the few mature trees.	No	No	No	No
Anthochaera phrygia	Regent Honeyeater	CE	CE	Some potential foraging habitat in the few mature trees.	No	No	No	No
Petroica boodang	Scarlet Robin	V	-	Potential foraging habitat. Similar to the extensive foraging habitat in the locality.	No	No	No	No
Circus assimilis	Spotted Harrier	V	-	Foraging habitat. No breeding activity (nests, etc.) recorded.	No	No	No	No
Polytelis swainsonii	Superb Parrot	V	V	Some potential foraging habitat in the few mature trees.	No	No	No	No
Lathamus discolor	Swift Parrot	E	E	Some potential foraging habitat in the few mature trees.	No	No	No	No

CE=Critically Endangered E = Endangered Species V = Vulnerable Species

Source: Modified after Biosis (2015)

* This table has been adapted from the *Threatened Species Assessment Guidelines – The Assessment of Significance* (DECC 2007)

5.3.3.3 Habitat

No areas of critical habitat for flora or fauna have been declared within the Quarry Site. Habitat for the migratory species predicted to occur within the Quarry Site was considered by Biosis (2016), who concluded the Quarry Site is highly unlikely to constitute important habitat for any of the EPBC Act listed migratory species predicted to occur. The four trees which form the Box Gum Woodland EEC which would be removed as a result of the proposal do not appear to contain hollows. A small number of mature trees and standing dead trees with hollows within the section of the extraction area already approved would be removed throughout the life of the Quarry (see **Appendix 4**).

Biosis identified the following habitat features on the Quarry Site.

- scattered remnant paddock trees.
- remnants of native grassland under the canopies and around the bases of paddock trees.
- minor rocky areas.
- dams.

It is considered that the incremental increase in clearing as a result of the Proposal will have insignificant impacts on habitat at the Quarry Site.

5.3.4 Mitigation Measures

The Proposal has been designed to minimise impacts to significant biodiversity features of the Quarry Site wherever possible, including minimising impacts to the 0.05ha of Box Gum Woodland EEC and habitat area for potentially occurring threatened fauna. The Proposal would require the removal of four isolated trees. The following mitigation measures would be implemented.

- A wildlife ecologist or an experienced wildlife carer would be present when any of the habitat trees shown on **Figure 5.3** are felled.

In order to offset the loss of the small number of trees to be cleared as the extraction area advances, the Applicant would maintain the locally indigenous trees and shrubs planted by Greening Australia around the perimeter of the Quarry Site. The planted trees and shrubs are already well advanced as displayed in **Plates 5.1** and **5.2**.

Finally, the Applicant would continue to monitor for invasive weed species and undertake weed control as necessary. The existing surface water quality management controls would also minimise any potential contaminants or sediment leaving the Quarry Site.

Plate 5.1 Perimeter tree screen (Source: Biosis)

Plate 5.2 A view to the south across section of the perimeter tree screen. (E724G-017)

5.3.5 Conclusions

An assessment of the impacts of the Proposal on local ecology, in particular threatened flora, fauna, and ecological communities has been made based on a combination of literature review and field survey. No threatened flora or fauna species were detected on the Quarry Site during field surveys, and there are predicted to be no significant adverse impacts to any threatened species that were not recorded during field surveys but may frequent the Quarry Site during the life of the Quarry.

While 0.05 ha of the Box Gum Woodland EEC would be cleared as a result of the Proposal, this EEC is highly fragmented and in poor condition, with a high presence of exotic species. Only four mature Box Gum Woodland trees (which do not appear to contain habitat hollows) would be removed as a result of the Proposal. Further patches of the Box Gum Woodland occurring within the Quarry Site would not be disturbed.

The Proposal would involve a comparatively minor increase in the area of disturbance to that which is already approved, and as such the Proposal is considered unlikely to result in a significant impact to any threatened species, populations or communities.

5.4 NOISE AND VIBRATION

5.4.1 Introduction

The SEARs identify "Noise & Blasting" as a key issue requiring assessment in the *Environmental Impact Statement*. This includes construction, operational and traffic noise, as well as blasting. In addition to the SEARs, EPA and Council also requested an assessment of noise and vibration impacts, as well as a description of management and mitigation measures. Based on an analysis of environmental risk undertaken for the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) (see Section 3.3), the specific noise-related impacts that may result as a consequence of the Proposal and therefore require assessment include:

- exceedance of noise criteria resulting in reduced amenity of surrounding land owners / residents (high risk); and
- increased levels of vibration from quarry blasting resulting in nuisance/amenity impacts on surrounding landowners / residents (high risk).

As noted in Section 3.3, due to the lack of any non-Proposal related residences adjacent to Paynes Road, and the significant existing traffic levels on the Hume Highway, the potential for any noticeable effect on traffic noise generated from the Quarry is nil. As such, traffic noise levels (as distinct from noise generated by product trucks on the Quarry Site which is assessed as an operational noise level) have not been considered further in the *Environmental Impact Statement*.

SLR Consulting Australia Pty Ltd have completed an assessment of the potential noise and vibration impacts of the Proposal, in accordance with the SEARS and requirements from the EPA and Council. This section summarises the report of SLR Consulting (SLR, 2015a) which is reproduced in full as **Appendix 5**.

5.4.2 Existing Noise Climate

The noise environment surrounding the Bogo Quarry is dominated by traffic noise from the Hume Highway, particularly during periods of temperature inversions. Other existing sources of background noise, additional to Hume Highway traffic and the Quarry operations would be typical of a semi-rural environment with contributions from traffic, wind, farm machinery (e.g. tractors, pumps, etc.), livestock, agricultural industry and insects.

Background noise measurements taken in 1995 and 1996 by Mark Eisner & Associates (MEA, 1995, 1996) (reported in David Hogg Pty Ltd, 1995 & 1996) recorded background noise levels of between 38dB(A) (during the evening) and 41dB(A) during the afternoon at residences surrounding the Quarry. While it is assumed that background noise levels in the area are likely to have increased since 1996, as a result of the greater levels of traffic on the Hume Highway, no recent noise measurements have been taken. Given the lack of recent monitoring data, a conservative approach has been taken in setting a background noise level against which noise generated by the Quarry is to be assessed. It has been assumed that, excluding traffic noise from the Hume Highway, background noise levels would not exceed 30dB(A), averaged over a 15 minute period, i.e. $L_{Aeq(15\ minute)}$, and would be typical of a semi-rural setting. This approach is recognised as conservative, principally because of the existence of the Hume Highway near a number of the residences and the results of the 1995 and 1996 monitoring. Traffic on the highway is often audible at those residences and would contribute to the background noise level.

The fact that there have been no noise or vibration complaints to Council, the EPA or the Operator regarding on-site operations or traffic travelling to and from the Hume Highway, indicate that the existing Bogo Quarry is an unobtrusive source of noise in the local setting.

5.4.3 Sensitive Receivers

No sensitive locations such as schools or churches are located near the Quarry. The closest residential (non Proposal-related) residences to the Quarry are identified on **Figure 5.4** as receivers R1 to R6. **Table 5.4** identifies the ownership details of R1 to R5 as well as their relative proximity to quarry operations. The noise-related impacts of the Proposal on Residences R1 to R6 have been assessed by SLR (2015a).

Table 5.4
Residential Location References

Residence	Ownership	Approximate Distance from the Quarry Site
R1 – "Bogolong Cottage"	Refax Pty Ltd	2.9km west of the Quarry Site on the northern side of the Hume Highway
R2 – "Marilba"	Marilba Pastoral Co Pty Ltd	2.9km north of the Quarry Site on the northern side of the Hume Highway
R3 – "Linbrook" Residence	Linbrook Pty Ltd	2.9km southeast of the Quarry Site at the end of Paynes Road
R4 – "Cooinda"	RT Walker	3.8km south of the Quarry Site
R5 – "Bogo Cottage"	Bogo Pty Ltd	1.4km south of the Quarry Site
R6 – "Bogo"	Bogo Pty Ltd	3.6km south of the Quarry Site

5.4.4 Environmental Noise and Vibration Criteria

5.4.4.1 Noise Criteria

The INP states that in situations where there is no existing major noise generating industry in the vicinity of the Site, the governing noise criterion for the Proposal is the "intrusiveness" criterion. This limits the L_{Aeq} noise levels from industrial sources to the Rating Background Level (RBL) + 5dB(A). As noted in Section 5.4.2, a conservative approach has been taken to the assessment of noise and the RBL has been assumed to be 30dB(A). Therefore, the noise criterion for the Proposal is 30dB(A) + 5dB(A) = 35dB(A).

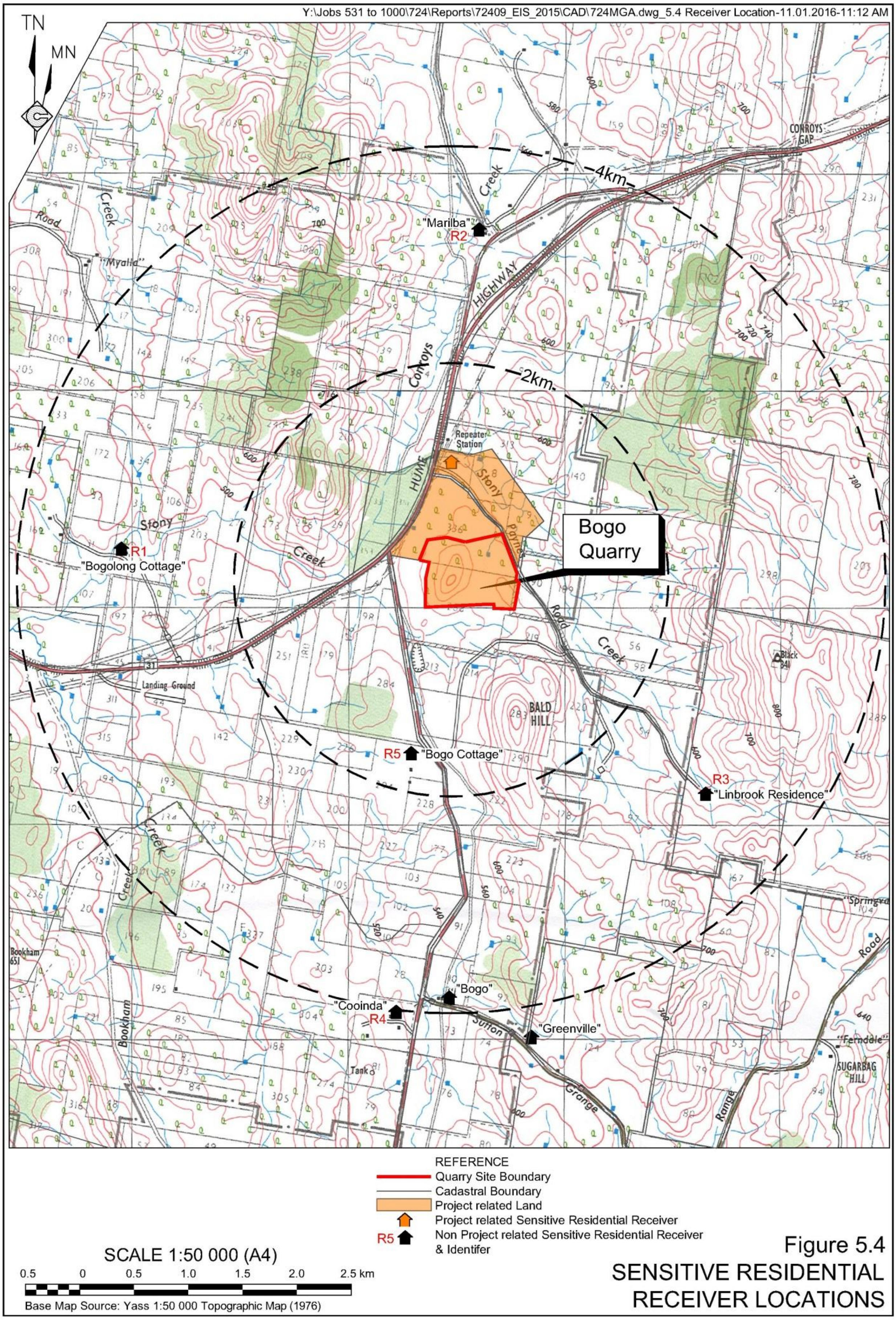

Figure 5.4
SENSITIVE RESIDENTIAL RECEIVER LOCATIONS

5.4.4.2 Blasting Criteria

The impacts associated with blasting are assessed against the ANZECC "annoyance" criteria which are routinely specified in project approvals, development consents and environment protection licences for quarries.

- The recommended maximum airblast level for blasting is 115dB (Linear).
- The level of 115dB (Linear) may be exceeded for up to 5% of the total number of blasts over a 12 month period, but should not exceed 120dB (Linear) at any time.
- The recommended maximum vibration velocity for blasting is 5mm/s Peak Vector Sum (PVS).
- The PVS level of 5mm/s may be exceeded for up to 5% of the total number of blasts over a 12 month period, but should not exceed 10mm/s at any time.
- Blasting is only permitted during the hours of 9:00am to 5:00pm Monday to Friday, and should not take place on Sundays and Public Holidays.

Criteria could also be developed based on issues related to building damage. However, as the annoyance criteria discussed above are significantly more stringent than the building damage criteria, they would be taken as the governing criteria for the Proposal.

5.4.5 Proposed Management

5.4.5.1 Noise Controls and Operational Safeguards

The Proposal would require the use of additional equipment, i.e. mobile asphalt plant, mobile concrete batching plant and associated mobile equipment, and would potentially operate this and existing equipment for longer periods of time (see **Table 2.3**). To mitigate against potential exceedances, the Applicant would implement the following noise mitigation measures, operational controls and safeguards.

- All mobile equipment would be fitted with standard muffling apparatus and mid-frequency modulated reversing alarms.
- Whenever possible, stockpiles would be constructed and maintained within the processing areas such that they provide an acoustic barrier to the noise generating activities undertaken within the processing area, i.e. operation of the front-end loader, loading of the feed hopper, loading and unloading of trucks.
- Whenever possible, all night loading of product trucks would occur in areas shielded by product stockpiles.
- Internal roads would be maintained to minimise truck noise.
- Noise-generating activities would be restricted to the nominated hours of operation.
- Equipment with lower sound power levels would be used in preference to similar equipment with higher sound power levels.
- Regular maintenance of all equipment would be undertaken.

Dialogue with neighbours would be maintained to ensure any concerns over operational noise are addressed. In addition, the Applicant has adopted a complaints management protocol such that in the event a community complaint is received, a swift response would be initiated. Central to the protocol would be the requirement for a verbal response to the complainant within 24 hours (during the nominated hours of operation) confirming the source of the noise and mitigation measures proposed (or underway) to reduce the risk of future elevated noise levels. The complaints protocol has been developed as required by EPL 4219.

5.4.5.2 Blast Controls and Operational Safeguards

Central to all safeguards is the conservative design and careful implementation of each blast to minimise impacts, i.e. designing each blast to satisfy environmental and public safety requirements as the first priority, with ongoing blast design refinement based on measured operational and environmental performance. Blast design and implementation would continue to be undertaken by a suitably qualified and appropriately certified shot-firer.

Careful design is also fundamental to safe, successful blasting. Industry has developed best practice procedures centred around the design of blasts that ensure:

- airblast overpressure and ground vibration levels are within nominated limits;
- the required fragmentation (the size of broken rock) is achieved; and
- all rock that is blasted is contained within a pre-determined blast envelope.

Blast design for the Bogo Quarry operations would continue to include the following features to meet these industry standards.

- Ensuring that the burden distance and stemming length are carefully selected and then implemented precisely.
- Ensuring that charges consistently detonate in carefully designed sequences.
- Ensuring that the blast hole spacing is implemented in accordance with the blast design.
- Ensuring that the maximum weight of explosive detonated in a given delay period (the maximum instantaneous charge (MIC)) is limited to conservative and proven levels.

5.4.6 Noise Impact Assessment

5.4.6.1 Assessment Methodology

In order to determine the acoustical impact of the increased production and additional activities at the Bogo Quarry, two dimensional computer models were developed to incorporate the significant noise sources and the intervening terrain to the closest potentially affected residential properties.

The SLR (2015a) assessment of operational noise was conducted using RTA Technologies Environmental Noise Model (ENM) v3.06, a computer model developed in conjunction with the NSW EPA, incorporating noise emissions and locations, screening and meteorological effects, topography, noise attenuation and receiver locations. The fixed plant and mobile equipment weighted sound power levels (SWLs) used in the noise model (shown in **Table 5.5**) were obtained from an existing database of noise source sound power levels maintained by SLR Consulting Australia Pty Ltd. All noise sources were assumed to be operating simultaneously for the full 15 minute assessment period.

Table 5.5
Weighted Sound Power Levels (SWLs) of Fixed Plant and Mobile Equipment at the Quarry Site

Operational Scenario	Equipment	SWL LAeq (dBA)
Extraction Area	CAT D7 bulldozer on the 575m AHD bench CAT 988B FEL on the extraction floor (555m AHD) Blasthole drill (daytime only - 590m AHD)	117 115 112
Processing Area	Processing plant (555m AHD) Mobile Processing Plant Hyundai FEL loading trucks Product truck arriving site Product truck leaving site Volvo BM L120 FEL loading in a stationary truck (560m AHD)	123 117 104 112 112 107
Asphalt Plant	Plant operating under normal conditions (555m AHD) CAT 988B FEL on the extraction floor (555m AHD) Product truck arriving at site Product truck leaving site	115 115 112 112
Concrete Batching Plant	Plant operating under normal conditions (555m AHD)	111
Source: SLR (2015a) – Table 6		

The modelling was undertaken under meteorological conditions considered to be features of the local setting (in accordance with the INP classification for meteorological features) for each scenario as follows.

- ***Day / evening (7am to 10pm) calm conditions***– 20ºC, 70% relative humidity, 0m/s wind speed and 0^{o}C/100m temperature gradient.
- ***Night time (5am to 7am) calm conditions***– 6ºC, 90% relative humidity, 0m/s wind speed and 0^{o}C/100m temperature gradient. Distinction is made between calms during summer and winter.
- ***Night time (5am to 7am) inversion* (3^{o}C/100m)** – 6^{o}C air temperature, 90% relative humidity, 0 m/s wind speed and 3^{o}C/100m temperature gradient.

SLR (2015a) provides further information on the establishment of these meteorological conditions in accordance with the INP.

The noise modelling scenarios used, including operational scenarios and meteorological conditions are described in **Table 5.6**.

Table 5.6
Noise Modelling Scenarios

Modelling Scenario	**Time of Day**	**Operational Scenario**	**Meteorological Condition**
1	Day/Evening (7am -10pm)	Extraction Area and Processing Area equipment listed in **Table 5.5** excluding the Mobile Processing Plant	Day/Evening Calm
2	Day/Evening (7am- 10pm)	Extraction Area and Processing Area equipment listed in **Table 5.5** in addition to the asphalt plant.	Day/Evening Calm
3	Night time (5am -7am)	Extraction Area and Processing Area equipment listed in **Table 5.5** excluding the Mobile Processing Plant	Night time Calm - Summer
4	Night time (5am -7am)	Extraction Area and Processing Area equipment listed in **Table 5.5** in addition to the asphalt plant.	Night time Calm - Summer
5	Night time (5am -7am)	Product trucks, Volvo front end loader and Asphalt Plant	Night time Calm - Winter
6	Night time (5am -7am)	Product trucks, Volvo front end loader and Asphalt Plant	Night time Temperature Inversion - Winter

5.4.6.2 Noise Modelling Results

Table 5.7 presents the results of the noise modelling at each of the five assessment locations under each modelling scenario.

Table 5.7
Predicted $L_{Aeq\ (15\ min)}$ Noise Levels

	Modelling Scenario					
Location	**1**	**2**	**3**	**4**	**5**	**6**
R1	25	26	26	26	18	30
R2	30	31	31	32	27	34
R3	29	29	29	30	22	34
R4	23	23	23	23	18	23
R5	35	**36 (+1)**	35	35	31	**36 (+1)**
Bold refers to exceedance of noise criteria (35 dB(A) LAeq (15minute) and (**scale of exceedance**)						
Source: Modified after SLR (2015a) – Table 8						

The results in **Table 5.7** illustrate that the proposed operations will comply with criteria at R1, R2, R3 and R4. Two potential marginal exceedances of the noise criteria by 1dB(A) at R5 were predicted under the following modelling scenarios.

- Scenario 2 – Use of all Extraction and Processing Area equipment listed in **Table 5.5** in addition to the asphalt plant during day/evening (7am to 10pm) calm conditions.
- Scenario 6 – Use of product trucks, a Volvo front-end loader and the asphalt plant (listed in **Table 5.5**) during a winter night-time (5:00am to 7:00am) temperature inversion.

Given the low likelihood of these operational scenarios occurring, the conservative assumption that all noise sources are operating simultaneously, and the provision of a 2 dB(A) allowance for compliance monitoring (Section 11.1.3 of the INP), these marginal exceedances are considered acceptable. The additional operation of the concrete plant is not predicted to increase noise emissions from the Quarry.

The occasional night-time despatch of Quarry products would also be acceptable from a noise perspective given the predicted noise levels for Scenarios 5 and 6.

5.4.7 Blast Impact Assessment

5.4.7.1 Assessment Methodology

SLR (2015a) predicted the level of blast emissions based on the formula given in the Australian Standard (AS) 2187.2-1993 and Orica Explosives Blasting Guide, applicable to blasting to a free face in hard or highly structured rock. The relative formulae are provided by SLR (2015a). This method of blast emission estimation is considered conservative.

Using the nominated formulae, and assuming a maximum MIC of 136kg, SLR (2015a) calculated a predicted level of blast emissions considering the closest distance of the nominated residences (R1 to R5) to the extraction area boundary.

5.4.7.2 Blast Emissions Predictions

Table 5.8 presents the predicted Peak Vector Sum (PVS) ground vibration and peak airblast at the nearest potentially affected residences to the Quarry.

Table 5.8
Predicted Levels of Blast Emissions

Residence	Distance from Blast (m)	PVS Ground Vibration (mm/s)	Peak Airblast (dB Linear)
R1 – "Bogolong Cottage"	2 890	0.2	107
R2 – "Marilba"	2 950	0.2	107
R3 – Linbrook Residence	2 910	0.2	107
R4 – "Cooinda"	3 790	0.1	105
R5 – "Bogo Cottage"	1 450	0.6	115
Source: Modified after SLR (2015a) – Table 10			

SLR (2015a) predicts that blasting associated with the Proposal would comply with the ANZECC general human comfort criterion for ground vibration (5mm/s) and for airblast overpressure (115dB Linear).

5.4.8 Monitoring

While minimal noise-related impacts are predicted, and in the absence of complaints to date, the Applicant would only undertake noise monitoring in the event a substantiated complaint regarding operational or traffic noise was received.

To confirm compliance with the blasting criteria, all blasts would be monitored to establish, and to progressively update, blast emissions site laws (ground vibration and airblast overpressure) in order to optimise future blast designs, based on actual site conditions.

5.5 AIR QUALITY

The SEARs identify air quality as a key issue for assessment in the *Environmental Impact Statement*. The EPA and Council have also identified air quality as a potential issue that requires assessment. SLR (2015b) has completed an assessment of the potential air quality impacts of the Proposal in accordance with the SEARs and requirements from EPA and Council. This section summarises the report of SLR (2015b) which is reproduced in full as **Appendix 6**.

5.5.1 Existing Environment

5.5.1.1 Local Setting

The air quality of the environs surrounding the Quarry Site is typical of a rural setting, albeit adjacent to the Hume Highway, with airborne contaminants such as dust generated by existing land uses, including predominantly agricultural uses. Local unsealed public roads and roads on private property, also periodically generate dust. Traffic movements on the Hume Highway are also expected to affect the existing air quality within the Quarry Site and surrounds.

It is noted that the existing stockpiling and processing areas are afforded a degree of protection from south-southeasterly and westerly winds by Bald Hill (700m AHD) and the hill (600m AHD) within the Quarry Site.

5.5.1.2 Background PM_{10} Concentration

There is no PM_{10} (particulate matter up to 10µm in size) monitoring data available for the Quarry Site.

Background PM_{10} concentrations have been established utilising data collected at the NSW EPA ambient air quality monitoring station at Wagga Wagga (approximately 125km west-southwest of the Quarry Site) where PM_{10} concentrations have been continually recorded since 2001 (the monitor was relocated from Wagga Wagga to Wagga Wagga North in 2011). **Figure 5.5** presents the range of recorded 24-hour PM_{10} concentrations at the Wagga Wagga air quality monitoring station. The elevated concentrations recorded are generally attributable to natural sources, e.g. bushfires and dust storms. To account for the significant spread of results, where elevated results (i.e. above 50µg/m^3) have been attributed to natural events, these data points have been removed from the dataset. The 75th percentile 24 hour PM_{10} concentration recorded at the Wagga Wagga North monitoring station between July 2011 and December 2013 (23.7µg/m^3) has been adopted as a conservative background PM_{10} concentration for the Quarry Site and surrounds.

5.5.1.3 Background Dust Deposition

In the absence of dust deposition data for the Quarry Site, it has been conservatively assumed that background levels would approximate 2g/m^2/month.

5.5.2 Sensitive Receivers

The sensitive residential receivers are the same as those identified in Section 5.4.3 and displayed on **Figure 5.4**.

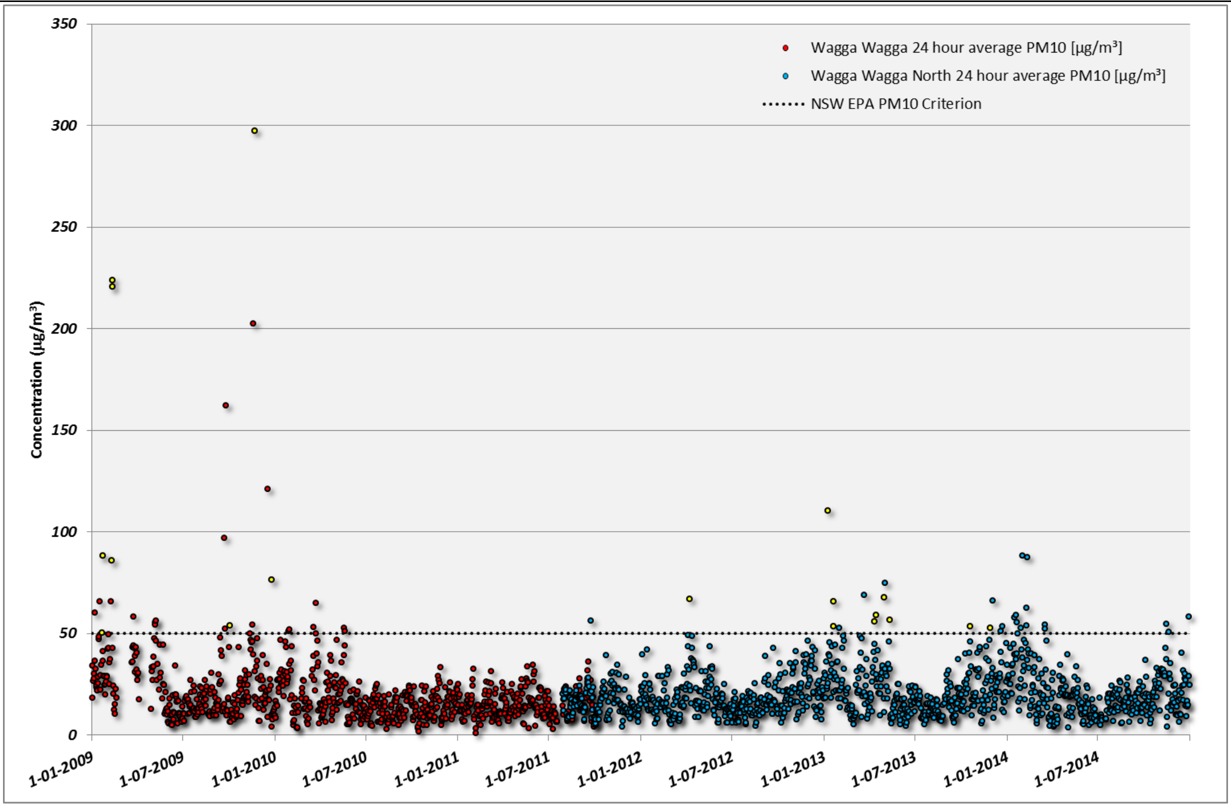

Figure 5.5
Background PM_{10} (Wagga Wagga Air Quality Monitoring Station [2009-2014])
Source: SLR 2015b

5.5.3 Potential Sources of Air Contamination

Particulate matter (airborne and deposited dust) would continue to be generated during drilling and blasting, transfer of blasted rock to the processing plant, processing, delivery of raw materials, despatch of products, from product stockpiles and hardstand areas.

Other potential sources of air emissions would be odour, nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and greenhouse gases which would be emitted during blasting, as part of the asphalt plant operation and vehicle and mobile equipment exhaust fumes.

5.5.4 Assessment Criteria

5.5.4.1 Introduction

Emissions of PM_{10} and $PM_{2.5}$ are considered important pollutants due to their ability to penetrate into the respiratory system. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

5.5.4.1.1 PM_{10} Criteria

The NSW EPA specifies PM_{10} criteria as follows.

- 24-hour maximum: 50µg/m^3.
- Annual average: 30µg/m^3.

5.5.4.1.2 $PM_{2.5}$ Criteria

The Ambient Air Quality National Environment Protection Measure (NEPM) sets targets for $PM_{2.5}$ concentrations as follows.

- 24-hour maximum: 25µg/m^3.
- Annual average: 8µg/m^3.

5.5.4.2 Dust Deposition

The NSW EPA criteria for dust deposition are as follows:

- 2g/m^2/month (annual mean) incremental; and
- 4g/m^2/month (annual mean) total.

It is generally accepted practice that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4g/m^2/month.

5.5.5 Operational Safeguards and Management

The Applicant would continue to implement a dust control strategy incorporating the following general components.

- Surface disturbance (and vegetation clearing) would be limited to the area required for a minimum of 12 months of operations. Soil stockpiles retained for periods greater than 3 months would be sown with a sterile cover crop.
- Exposed areas that are not part of active operational areas would be progressively revegetated.
- Wherever possible, soil stripping would continue to be undertaken at a time when there is sufficient soil moisture to prevent significant dust lift-off.

- Whenever possible, the Applicant would avoid stripping soil and overburden, and importing and placing VENM during periods of high winds.
- Dust sprays would continue to be used within the crushing and screening plant at locations that have high potential for dust generation, including at Screens 1 and 2.
- Product stockpiles would be limited to approximately 20 000 tonnes under normal operating conditions.
- The exhausts of all earthmoving equipment would continue to be diverted away from the ground surface so as not to generate dust.
- The front-end loader would continue to be fitted with appropriate exhaust controls. The Applicant would ensure that all plant and equipment is properly maintained to ensure no unacceptable exhaust emissions occur.
- The entrance to the Quarry Site and the entire length of Paynes Road to the Hume Highway is sealed and maintained by the Applicant thereby reducing dust dispersal from quarry-related traffic.
- Internal haul roads and the unsealed areas around the processing plant would continue to be maintained by periodic grading to remove unconsolidated material from the surfaces and regular application of water through the use of a 20 000 L water cart. The frequency of water application would be dependent on climatic factors, in particular wind and temperature, and usage.
- The internal haul roads would be clearly defined and vehicles and equipment restricted to those roads during normal operational activities.
- All product trucks leaving the Quarry would continue to be covered.

The following additional safeguards would be adopted in order to minimise potential dust dispersal from the Quarry Site during the operation of the two proposed mobile plants.

- The cement/fly ash silos would be filled using an enclosed pneumatic transfer system, i.e. the sealed trucks would be pressurised, and fitted with reverse pulse filters to ensure all air discharged to the atmosphere during the silo filling process would be free of dust particles. After each delivery, the pneumatic filling line would be blown through and capped.
- The cement/fly ash silos would also be fitted with high level alarms which would be interlocked with the filling line so that, in the event of a silo approaching an overfill condition, an audible alarm would sound and the pneumatic filling line would close.
- The asphalt plant would be fitted with a bag house which would be designed to control solid particles.
- The bitumen and asphalt storage tanks would be thermostatically controlled to prevent overheating and associated odour emissions.

- Water sprays would be installed at the point of discharge of aggregates onto the batching conveyor. These water sprays would be initiated when the material is not sufficiently damp to prevent dust generation.
- A conveyor scraper would be installed to clean the return side of the conveyors.
- The raw materials storage bins would be protected using shields above the storage bin walls.
- Routine clean up of any spillages resulting from delivery of raw materials and placement within either the appropriate stockpiles or within the wedge pit.

5.5.6 Assessment of Impacts

5.5.6.1 Assessment Methodology

5.5.6.1.1 Particulate Matter (PM_{10})

A dispersion modelling assessment was conducted by SLR (2015b) to predict potential worst-case impacts associated with emissions of PM_{10} from the Proposal. A dispersion modelling assessment was undertaken even considering the significant separation distance between the surrounding non Project-related residential receivers and the Quarry Site (see **Figure 5.4**),

Predictions of fugitive emission dispersions from the Quarry Site were undertaken using the Ausplume Gaussian Plume Dispersion Model software (Ausplume) developed by EPA (Victoria), an approved dispersion model in NSW. Ausplume combines the particulate emission factors for the various Quarry Site activities, meteorological data and local topography to predict the dispersion of dust and other particulate matter.

Particulate Emission Factors

The inputs to the Ausplume model have been taken primarily from the default emission factors identified in the *Emission Estimation Technique Manual for Mining, Version 3.1* (Australian Department of the Environment 2012). Where the moisture content of materials on the Quarry Site was not adequately reflected within the defaults emission factors, the equations presented within Department of the Environment (2012) or the *USEPA AP-42 Compilation of Air Pollutant Emission Factors* (USEPA 1997) were used.

Meteorological Data

The Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005) requires dispersion modelling to be conducted with a complete year of site representative meteorological conditions. The closest available complete meteorological input file to the Quarry Site was obtained for Woodlawn, near Tarago, (approximately 50km to the east south-east).

Local Topography

There are no significant topographic features which would impede atmospheric dispersion between the Quarry Site and surrounding residences. Considering such uncomplicated near field topography, topography has not been considered in the Ausplume dispersion model.

Modelled Quarry Site Activities

Given the large separation distance between the Quarry Site and surrounding residences, the exact siting of each emissions source was not considered critical for this assessment with all components within the extraction area modelled at one location. In order to derive the maximum potential 24-hour emissions from the Quarry Site, all sources are assumed to emit continuously within their respective hours of operation.

Further detail on the assessment methodology is provided by SLR (2015b).

5.5.6.1.2 Greenhouse Gas Assessment

In order to assess greenhouse gas emissions, greenhouse gas emitting activities were identified, established emission factors (AGO, 2005) were applied, and annual CO_2-equivalent emissions were calculated.

Activities related to Bogo Quarry have the potential to generate greenhouse gas emissions from the following sources.

i) The combustion of fuel by diesel-powered equipment and vehicles.

ii) Distribution of product materials.

Greenhouse gas emitting sources are classified according to accepted greenhouse gas protocol as either Scope 1, 2 or 3 emissions as follows.

Scope 1 Emissions

These emissions result from activities under the Applicant’s control or from sources which they own. Emission source (i) is considered a Scope 1 emission.

Scope 2 Emissions

Those emissions relate to the generation of purchased electricity consumed by owned or controlled equipment or operations. There are no scope 2 emissions relevant to the operation of Bogo Quarry.

Scope 3 Emissions

Scope 3 emissions are indirect emissions from sources not owned or controlled by the Applicant that occur as a result of operations. In the case of the Bogo Quarry, this includes the transportation of quarry products to customers.

Greenhouse gas emissions are measured as carbon dioxide (CO_2)-equivalent emissions. An accepted emission factor is used to calculate the actual CO_2-equivalent emissions attributable to greenhouse gas emitting activities, based on the default emission factors of the Australian Greenhouse Office publication "*Factors and Methods Workbook, December 2005"* (AGO, 2005). Activity levels have been estimated based on current operations. CO_2-equivalent emissions have been calculated for Scope 1, Scope 2 and Scope 3 emissions and compared against baseline (1990) Australian emissions.

5.5.6.2 Results

5.5.6.2.1 Particulate Matter (PM_{10})

Table 5.9 presents the predicted incremental 24-hour average and annual average PM_{10} concentrations at the five residences shown on Figure 5.4.

Table 5.9
Predicted Incremental 24-hour Average PM_{10} Concentrations

Residence	Maximum 24-hour Average PM_{10} (µg/m^3)	Annual Average PM_{10} (µg/m^3)
R1 – "Bogolong Cottage"	4.4	0.4
R2 – "Marilba"	4.1	0.1
R3 – Linbrook Residence	4.7	0.6
R4 – "Cooinda"	2.0	0.1
R5 – "Bogo Cottage"	6.7	0.3
Source: Modified after SLR (2015b) – Table 7		

When the predicted PM_{10} 24-hour and annual average incremental results presented in **Table 5.9** are added to the PM_{10} background concentrations obtained from the EPA ambient air quality monitoring station at Wagga Wagga North, the combined (or total) PM_{10} concentrations are below both the 24-hour assessment criterion value of 50µg/m^3 and the annual mean assessment criterion value of 30µg/m^3 at each location. Furthermore, SLR (2015b) states "As the predicted maximum 24-hour and annual mean PM_{10} concentrations (with background) are below the relevant assessment criteria at each residence, the potential for adverse impacts on the surrounding environment as a result of the proposed expanded operations at the Quarry is considered to be low".

5.5.6.2.2 Particulate Matter ($PM_{2.5}$)

SLR (2015b) notes that "$PM_{2.5}$ emissions are generally associated with combustion engines and, given the mix of sources at the Quarry, have a significantly smaller emissions profile than the PM_{10} emissions. Given the PM_{10} ground level concentrations predicted are significantly below the corresponding criterion, $PM_{2.5}$ results have not been presented".

5.5.6.2.3 Deposited Dust

Table 5.10 presents the predicted deposited dust concentrations at the five residences.

Table 5.10
Predicted Dust Deposition Concentrations

Residence	Dust Deposition (g/m^2/month)
R1 – "Bogolong Cottage"	<0.1
R2 – "Marilba"	<0.1
R3 – Linbrook Residence	<0.1
R4 – "Cooinda"	<0.1
R5 – "Bogo Cottage"	<0.1
Source: Modified after SLR (2015b) – Table 8	

Table 5.10 indicates that the mean incremental dust deposition rates predicted at each residence are well below the relevant assessment criterion of $2g/m^2$/month. Therefore, the potential for adverse impacts on the surrounding environment as a result of the proposed expanded operations at the Quarry Site is considered to be minimal.

5.5.6.2.4 Greenhouse Gas Emissions

Considering anticipated activity levels at the Quarry and product delivery routes, greenhouse emissions generated by the Proposal have been estimated using AGO (2005) emission factors.

Scope 1 Emissions

During 2009, approximately 212 000L of diesel fuel was used in the production of 197 000t of products. Projecting future diesel consumption at a production rate of 500 000tpa suggests that approximately 540 000L of diesel would be used annually.

Scope 3 Emissions

Indirect emissions of greenhouse gases from the transportation of quarry products to various customers has been estimated as follows.

- Road transportation between the Quarry and markets (approximately 50 000 annual movements under average operations as described in Scenario 3 of section 2.6.5). The average distance for each movement is estimated to be 75km. Based on a fuel consumption rate of 0.5L per kilometre travelled, it is anticipated approximately 1875kL of diesel would be consumed.
- Private vehicle transport by quarry employees, assuming an average of 16 light vehicle movements (as described in Scenario 3 of section 2.6.5) 6 days per week, travelling an average of 50km for each movement and a fuel consumption rate of 0.1L per kilometre travelled, would consume an estimated 25kL.

Average annual off-site Proposal-related fuel usage would be approximately 1900kL.

Table 5.11 presents the calculated greenhouse gas emissions (as CO_2 equivalents) for Scope 1, 2 and Scope 3 sources.

Table 5.11
Predicted Greenhouse Gas Emissions

Emission Source		Annual Use	Emission Factor	Emissions (t CO_2-e)
Scope 1 and 2 Emissions				
Diesel Fuel Consumption	Mobile Equipment	540 kL	2.7 [1]	1 458.0
Scope 3 Emissions				
Diesel Fuel Consumption	Product Transportation	1875 kL	2.7 [1]	5 062.5
	Employee Transport	25 kL	0.3 [1]	7.5
Total Emissions (Approximate)				**6528**
Note 1: Table 3 of the AGO document Factors and Methods Workbook, December 2005.				

A comparison of the predicted average emissions from the Proposal with Australian 1990 Estimates are presented in **Table 5.12**. This demonstrates that annual average emissions would represent an increase of less than 0.001% on the total baseline Australian emissions.

Table 5.12
Comparison of Proposal Emissions of Greenhouse Gases with Australian 1990 Estimates

Emissions Estimation Period	Scope 1 & 2 Emissions CO_2-equivalent (%-age Comparison with Australian 1990 emissions[1])	Scope 3 Emissions CO_2-equivalent (%-age Comparison with Australian 1990 emissions[1])	Total Proposal Emissions CO_2-e (%-age Comparison with Australian 1990 emissions[1])
Annual Average	1.46 kt (<0.001%)	5.07 kt (<0.001%)	6.53 kt (<0.001%)
Note 1: From AGO (2005)			

5.5.7 Monitoring

Given the considerable distance between the Quarry Site and surrounding residences and the absence of complaints relating to the Quarry's operations over the past 20 years, it is proposed not to undertake any air quality monitoring throughout the life of the Quarry. Should however, a substantiated complaint be received, the Applicant would commence an air quality monitoring program in consultation with the EPA.

5.6 INDIGENOUS HERITAGE

5.6.1 Introduction

Indigenous heritage was identified within the SEARs as a key issue for assessment in the *Environmental Impact Statement*. In accordance with the SEARs, the Applicant considered impacts on Aboriginal cultural heritage values in an analysis of environmental risk (see Section 3.3). The results of this assessment of risk identified the following as specific impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- disturbance or damage to items of Aboriginal heritage significance (high risk).

To address the potential risk associated with impacts to items of Aboriginal heritage significance, an Aboriginal cultural heritage assessment was conducted by Cultural Heritage Management Australia (CHMA, 2009). The objective of the assessment was to identify any sites or relics of Aboriginal heritage value within the Quarry Site and assess the Proposal within a regional Aboriginal heritage context. The assessment report is summarised in following sub-sections and included in full in **Appendix 7**. The report is supported by two recent letters from the registered Aboriginal parties who were involved with the survey and assessment conducted by CHMA (2009).

5.6.2 Assessment Methodology

The 2009 Aboriginal heritage assessment was undertaken in the following stages.

- Stage 1 – Background Research

  As part of the background research for the assessment, the Onerwal Local Aboriginal Land Council (OLALC) and Buru Ngunawal Aboriginal Corporation (BNAC) were contacted and invited to contribute to and participate in the assessment. A search of the OEH Aboriginal Heritage Information Management System (AHIMS) Database was undertaken to determine if any previously identified archaeological sites had been identified within a study area defined by Eastings 650 000 – 660 000 and Northings 6151400 – 614100. Available mapping (Yass 1:50 000 map sheet), relevant ethno-historic and anthropological literature of the region and previous archaeological reports of the Quarry Site and surrounding region (including Navin Officer, 1995) were reviewed and the current and historic land use considered.

- Stage 2 – Field Survey

  A field inspection and survey was undertaken on Thursday, 30 April 2009 by archaeologists of CHMA and representatives of OLALC and BNAC. Based on the background research conducted and the combined experience of the field survey team, a predictive model for the identification of sites was developed. The study area was traversed using vehicle and pedestrian transects. Mature trees were also closely inspected for signs of scarring. Discussions were held on-site regarding the findings of the field survey and the topics covered included cultural significance, management options and recommendations.

- Stage 3 – Analysis of Results

  The results of the field survey were assessed, taking into account factors including predictive modelling, the relationship between survey findings and environmental factors, and the variability of survey factors such as surface visibility, survey intensity and survey approaches.

5.6.3 Assessment Results

5.6.3.1 Known Cultural Heritage

The search of the AHIMS Database carried out by CHMA (2009) identified 19 previously recorded Aboriginal sites and places within the 10km x 10km area surrounding the Quarry Site. These sites comprise two isolated finds and 17 open sites with one (Site # 51-1-0042) located on the Quarry Site but outside the proposed extraction area (see **Figure 5.6**). Site # 51-1-0042 (also identified as Bogo Quarry 1) is an open camp site with a total of 40 identified artefacts scattered over an area of 130m x 50m (Navin Officer, 1995).

A review of the existing archaeological record of the local area identified that while scarred and carved trees, bora rings and ceremonial grounds occur, the most frequently occurring site type is the open artefact scatter (generally containing less than 50 artefacts.

An AHIMS search was conducted on 2 October 2015 which confirmed the existence of one registered Aboriginal site within the Quarry Site (Site # 51-1-0042).

5.6.3.2 Predictive Modelling

CHMA (2009) reported that the ethno-historic records and archaeological studies of the region indicate that open artefact scatter sites are most commonly found near creeks, on locally raised, flat terrain. Isolated artefacts are particularly common on slightly raised ground. CHMA (2009) note that deeper stratified sites and burial sites are unlikely to occur on the Quarry Site due to the absence of a deep soil profile.

Considering the above, CHMA (2009) divided the Quarry Site landscape into four zones of archaeological sensitivity (based on the likelihood of identifying archaeological material) (see **Figure 5.6**).

- Unit 1 – High Sensitivity. This restricted areas Includes the lower slopes on the northern side the Quarry Site, where Site # 51-1-0042 has been identified, through which a tributary to Stony Creek is aligned.
- Unit 2 – Medium Sensitivity. Occurring as two areas to the north and south of the hardstand areas of the Quarry, these areas extend from the ephemeral drainage lines which flow from Dams 1 and 4 respectively. Should archaeological material be present it is likely to be found in close proximity to the drainage channel on elevated flat terrain.
- Unit 3 – Low Sensitivity. This unit includes the steep hill sides and hill top of the Quarry Site. Isolated artefacts or low density scatters could occur and mature trees could contain scars or carves.
- Unit 4 – Nil Sensitivity. This unit includes the extraction area and hard stand of the existing Quarry Site.

5.6.3.3 Survey Results

Three sites were identified by CHMA (2009), the locations of which are displayed on **Figure 5.6**.

Site # 51-1-0042

The location of the previously identified artefact scatter (containing in excess of 60 artefacts) was confirmed. The area around the site is currently clear of vegetation and exposed. It is possible the site extends into the vegetation that runs along a slight ridge towards Stony Creek.

CHMA (2009) consider this site has moderate archaeological significance due to its size and density of artefact and should be protected from disturbance by extraction or related activities.

Bogo 2009-1

Comprising seven artefacts, this artefact scatter is located immediately downstream of Dam 1. The site is considered to be stable, however, should be monitored for signs of instability following heavy rainfall or flow from Dam 1.

Figure 5.6
CULTURAL HERITAGE SITES
WITHIN THE QUARRY SITE

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While there may be a potential for sub-surface material, the highly disturbed nature of the site reduces the archaeological significance.

Bogo 2009-2

Comprising two artefacts, this site is located on the western side of the hill slope beyond the proposed extraction area. The site is not considered to have high significance although should not be disturbed by operations related to the Proposal.

5.6.4 Operational Safeguards and Controls

In accordance with the recommendations of CHMA (2009), the Applicant would implement the following operational safeguards and controls.

i) A fence would be erected around Site # 51-1-0042.

ii) Representatives of OLALC and BNAC would be invited to be present during the construction of the fence to ensure correct placement.

iii) Sites Bogo 2009-1 and Bogo 2009-2 would remain undisturbed. Site personnel would be informed of the location, type and condition of these sites and obligations under the *National Parks and Wildlife Act 1974* (NPW Act).

iv) The Applicant is also aware of its obligations under the NPW Act and should any artefact or relic be uncovered during extraction-related activities, work in the surrounding area would cease and the OEH and representative Aboriginal groups informed of the find. A management strategy would then be prepared in consultation with OEH and representative Aboriginal groups.

Both BNAC and OLALC remain supportive of the recommendations made in the 2009 Cultural Heritage Assessment, with recent letters stating their support included in **Appendix 7**.

It is noted that given the proposed operational safeguards and controls, the Applicant will not need to apply for an Aboriginal Heritage Impact Permit.

5.6.5 Assessment of Impacts

Given the operational safeguards and mitigation measures that would be implemented, it is considered that there would be no direct impact on Indigenous cultural heritage as a result of the Proposal, nor would there be a need to apply for an Aboriginal Heritage Impact Permit (AHIP).

Given there would be no direct impact, there would also be no cumulative impact on the regional archaeological record.

5.7 TRANSPORTATION

5.7.1 Introduction

The SEARs identify Transport as a key issue for assessment in the *Environmental Impact Statement*. Based on an analysis undertaken for the Proposal (see Section 3.3), the specific transport-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- elevated risk of accident/incident on local roads (high risk).

The following subsections have been prepared with the assistance of Transport and Urban Planning (TUP) who has assessed the suitability of the existing Paynes Road – Hume Highway intersection for the proposed increase in traffic associated with the Proposal (see **Appendix 8**).

5.7.2 Existing Conditions

5.7.2.1 Existing Road Network

Bogo Quarry products are, and would continue to be, delivered to local and regional markets via Paynes Road and the Hume Highway. The intersection between Paynes Road and the Hume Highway was constructed by the (then) RTA to provide safe ingress/egress for trucks travelling to and from the quarry. The RTA were aware that quarry product trucks used the intersection when the intersection was designed and constructed.

Paynes Road

Paynes Road intersects with the Hume Highway (see **Plate 5.3**) and is a no-through road. It provides access to the Quarry, as well as providing access to the Applicant's residence on the "Stony Creek" property, and the "Bogo" and adjoining properties (although no access to the residences on these properties is provided from Paynes Road). The Applicant maintains this road, which has a sealed surface of approximately 6m wide (see **Plate 5.4**) between the Hume Highway and the Quarry entrance. On last inspection, the sealed surface of the road was in good condition with negligible pot-holes or significant edge deterioration.

The road is predominantly used by vehicles travelling to and from Bogo Quarry.

Hume Highway

This federal highway has separated carriageways providing two lanes of through traffic in each direction (see **Plates 5.5** and **5.6**). The Hume Highway route is one of Australia's highest quality inter-capital road links and connects Sydney, the ACT and Melbourne. The Sydney-Canberra Corridor Strategy (DoP, 2008b) recognises the Sydney-Melbourne corridor, with the Hume Highway identified as one of the main strategic routes of this corridor, as vital to the Australian economy, as it is the busiest inter-capital route. As would be expected for such a critically important piece of road infrastructure, the highway is heavily trafficked and regularly maintained.

At the Paynes Road intersection, the following road design features have been noted.

- A left turn deceleration lane of 135m (including taper) for the left turn into Paynes Road (see **Plate 5.7**).
- A right turn bay of 200m (including taper) for the right turn into Paynes Road (see **Plate 5.8**);
- A left turn acceleration lane of 80m (including taper) for the southbound departure lanes of the Highway for left turn out of Paynes Road. In addition, there is a 3.0m shoulder run off area for an extended distance, which could be used in an emergency (see **Plate 5.9**).
- A right turn entry point for the northbound departure lanes of the Highway for right turn out of Paynes Road (see **Plate 5.10**).
- The separation distance between the northbound and southbound carriageways is 12.4m, as measured between the holding lines (although TUP note that a 19m truck can stand in the centre section on an angle, clear of the through travel lanes if it occupies part of the right turn bay). The distance between the through lanes in each direction is 20.4m (as measured between the edge of lanes).

The sight distance for vehicles entering the Hume Highway from Paynes Road is estimated to be in excess of 400m to the north and 300m to the south.

5.7.2.2 Traffic Levels

Traffic on Paynes Road is dominated by quarry-related traffic, with only limited number of additional traffic movements, associated with vehicles accessing a small number of properties. Currently, an average of 52 heavy vehicles enter and exit the Quarry each day (104 movements). Up to approximately 20 light vehicle movements associated with transportation of site personnel also occur each day.

Current traffic levels on the Hume Highway have been obtained from the Hume Highway's permanent counting stations HHW006 (near Manton) and GNDSTC (north of Gundagai). Maximum volumes on the Hume Highway (over 2 lanes) during quarry operating hours are in the order of 300-400 vehicles per hour (vph) southbound, and 282-375 vph northbound. Trucks account for approximately 30% of total traffic on the Hume Highway.

Based on current number of truck movements, the Quarry accounts for an average of approximately 4% of truck movements per hour on the Hume Highway near Paynes Road, and a maximum of approximately 7%. This would fluctuate from day to day depending on daily demand for quarry products and background traffic levels.

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Plate 5.3: Southbound acceleration lane at the Intersection of Paynes Road and Hume Highway (Ref: E724-A082)

Plate 5.4: View southeast along Paynes Road approaching Bogo Quarry (Ref: E724-A077)

Plate 5.5: View south along the Hume Highway south of Paynes Road (Ref: E724-A087)

Plate 5.6: View south along southbound lanes of the Hume Highway north of Paynes Road (Ref: E724-A088)

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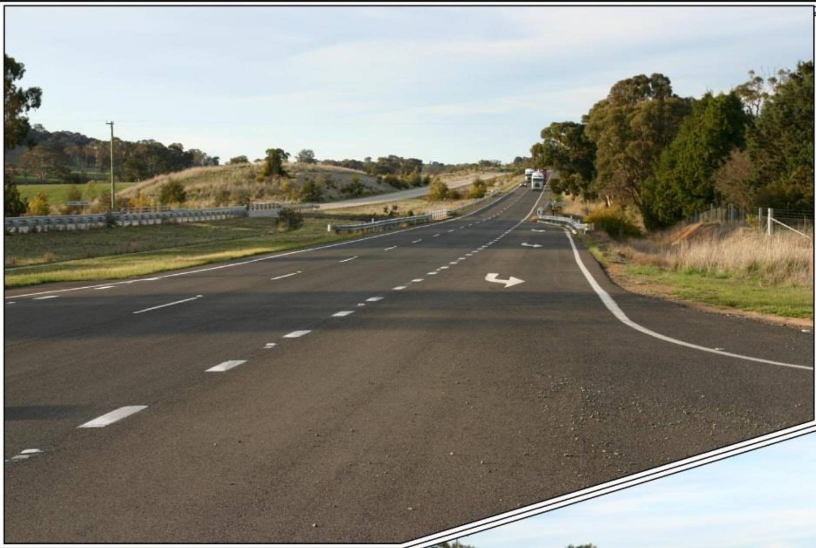

Plate 5.7: Left turn deceleration lane from the Hume Highway into Paynes Road
(Ref: E724-A083)

Plate 5.8: Right turn bay within the northbound lanes of the Hume Highway into Paynes Road
(Ref: E724-A085)

Plate 5.9: Left turn acceleration lane for southbound departure lanes of Hume Highway from Paynes Road
(Ref: E724-A084)

Plate 5.10: Right turn entry point onto the northbound lanes of the Hume Highway (from Paynes Road)
(Ref: E724-A086)

5.7.3 Proposed Traffic Generation

5.7.3.1 Proposed Traffic Levels, Schedules and Delivery Routes

The transportation of quarry products would continue to be undertaken using a variety of vehicle types, including:

- semi-trailers and rigid trucks;
- 19m mini B-doubles;
- 25m B-doubles; and
- truck and dog trailers.

As discussed in Section 2.6.5, average truck movements would increase to approximately 52 truck loads each day (104 truck movements) on an average day when only quarry aggregates are transported. On a busy day, transportation of quarry aggregates and operation of the asphalt and/or concrete plants would result in approximately 120 truck loads each day (240 truck movements).

The timing of truck movements to and from the Quarry Site would be dependent on customer locations and requirements, however, it is anticipated that these would be relatively evenly distributed throughout the day. During periods of increased activity, the Applicant would continue to ensure there are no more than a total of 8 laden vehicles leaving the Quarry during any hour.

All quarry products would continue to be transported from the Quarry Site by road registered trucks following Paynes Road for approximately 1.4km to where it intersects with the Hume Highway. Product trucks would then travel either east or west on the highway depending on product destinations.

5.7.3.2 Proportional Changes to Local Traffic Levels

The Quarry would account for approximately 5% of truck movements per hour on the Hume Highway near Paynes Road, and a maximum of approximately 9% of trucks per hour under the Proposal. This is an increase of approximately 1-2% of trucks per hour generated by the Quarry on the Hume Highway near Paynes Road. This level of increase in traffic would be imperceptible on such the highly trafficked Hume Highway.

5.7.4 Proposed Traffic Management

The Applicant will ensure all vehicles entering and exiting the Quarry Site are roadworthy and that the drivers act in a safe and courteous manner at all times. The following controls and safeguards would be implemented to traffic impacts on both Paynes Road and the Hume Highway.

- All transportation activities would be undertaken strictly in accordance with the conditions of the issued development consent.

- All exiting trucks would be required to pass over a weighbridge and unloaded of excess product, if necessary to meet weight restrictions. Poorly loaded vehicles would be prevented from exiting the Quarry Site.
- All trucks transporting quarry products would be required to be well maintained. Trucks assessed to be unroadworthy would not be loaded.
- Deliveries of any "oversize" loads, e.g. asphalt plant components or large earthmoving equipment, would be undertaken in accordance with RMS and Council restrictions on transport hours and safety/warning requirements.
- The Applicant would refuse entry to any driver seen or reported to act in a dangerous or discourteous manner. Complaints raised against truck drivers would be taken seriously and, if verified, the offending driver(s) refused future entry to the Quarry Site.
- All drivers would be encouraged to drive at a speed reflecting the road conditions and visibility.
- The Applicant would ensure that trucks leaving the Quarry Site do so in a manner that does not allow for a convoy to form when leaving the site.
- The Applicant would continue to maintain Paynes Road as part of its operational activities. This practice has been discussed with Yass Valley Council.
- The Applicant would continue to ensure there are no more than a total of 8 laden vehicles leaving the Quarry during any hour.

Each of the above controls and safeguards would be incorporated within the drivers' code of conduct to be developed following the receipt of development consent.

5.7.5 Assessment of Impacts

Product delivery from the Bogo Quarry is currently undertaken without significant impact on other road users or surrounding land owners. The proposed increase in traffic from the Quarry Site would be relatively minor when considered against background traffic on the Hume Highway. Notably, even on the busiest days of product transportation, truck movements generated by the Proposal would not increase total truck traffic on the Hume Highway by more than approximately 2%.

The suitability of the existing intersection between Paynes Road and Hume Highway has been reviewed by TUP (see **Appendix 8**) against road design standards. The following is a summary of this review.

- The length of the right turn lane from Hume Highway to Paynes Road (200m) complies with Austroads / RMS Road Design Standards for a design speed of 110km/hr.
- The left turn deceleration lane from Hume Highway to Paynes Road (135m) complies with Austroads / RMS Road Design Standard for a design speed of ll0km/hr. It is noted that this left turn lane could not be extended due to an existing bridge structure immediately adjacent the start of the lane and this would have been a factor considered in the original design of the intersection.

- The acceleration lane provided for the left movement out of Paynes Road (80 metres) does not comply with Austroads / RMS standards. However, TUP note that given the small volumes of vehicles (cars and trucks) that undertake the left turn, and examination of traffic volumes, it is considered that frequent gaps would regularly occur in the southbound direction for vehicles including trucks to safely turn left without the need for an acceleration lane for an extended distance.
- Similarly, an examination traffic levels on the Hume Highway indicates regular long gaps would allow trucks turning right out of Paynes Road to wait for a gap in both directions of the Hume Highway before undertaking the right turn. Additionally, sight distance in excess of 300m is available in both directions.
- There is no evidence of vehicle skid marks, broken glass or other material that would indicate that the current traffic arrangements at the intersection is not operating in a safe manner.

Considering the above assessment of the intersection design and the existing and proposed traffic levels to use this intersection, it is the conclusion of TUP that the additional movements would not appreciably alter the existing operating conditions at the intersection in terms of increased delay for the left and right turning movements out of Paynes Road that could result in risky behaviour and a decrease in road safety.

5.8 VISIBILITY

5.8.1 Introduction

Based on an analysis undertaken for the Proposal (see Section 3.3), the specific visibility-related impacts that may result as a consequence of the Proposal (without the implementation of the safeguards, controls and mitigation measures presented in this section) and therefore require assessment include:

- highly identifiable change to landscape following rehabilitation and final landform creation (high risk).

5.8.2 Existing Visual Amenity

Currently, the Bogo Quarry is visible from vantage points to the south of the Quarry Site, as well as from the Hume Highway and Burrinjuck Tourist Road (see **Plates 5.11** to **5.13**). In all cases, views are obscured by intervening topography and predominantly restricted to either the product stockpiles or advancing face of the extraction area.

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Plate 5.11: View southwards from the Melbourne-bound lanes of the Hume Highway. - (Ref:E724C-004)

Plate 5.12: View eastwards from the Sydney-bound lanes of the Hume Highway. - (Ref:E724D-035)

Plate 5.13: View looking northwards from Burrinjuck Dam Tourist Road. - (Ref:E724C-046)

PLATES 5.11 to 5.13

5.8.3 Operational Safeguards and Management

Extraction Area

- As the extraction area is advanced down the hill slope, the soil and overburden material stripped in advance of extraction would be stockpiled as a bund wall immediately down-slope of the extraction area. This would create a sight line barrier from vantage points to the west and north, e.g. from the Hume Highway.
- The control would be made more effective by the revegetation of the bund wall with a cover crop of grass.
- Additionally, Bald Hill would also shield the extraction areas from views to the south on Burrinjuck Dam tourist road.

Processing Plant, Mobile Concrete Batching Plant and Stockpiles

- The location of the proposed plants is effectively shielded from the Hume Highway by intervening topography and vegetation.
- The southern bund would create a sight line barrier from the south of the Quarry.

Mobile Asphalt Plant

- The southern bund would provide a sight line barrier from the south of the Quarry Site.

General

- A tree screen is currently being established around the perimeter of the Quarry Site. Once complete this will further reduce the visual impact of the quarrying operations.
- Effective dust management is to be implemented reducing the occurrence of dust ‘plumes’ from the Quarry Site.

Figure 5.7 provides cross-sectional illustrations of the visibility of quarry activities from the nearest residential vantage points to the Quarry Site. The Quarry Site may be visible from the some residences for short periods during the early stages of the Proposal, however, the Quarry will become less visible as extraction progresses to lower elevations, with bunds and natural topography providing greater visual screening.

5.8.4 Assessment of Impacts

Given the proposed operational controls to be implemented and effective implementation of dust management measures, it is considered that the Proposal would not significantly increase the visual impact of the approved operations.

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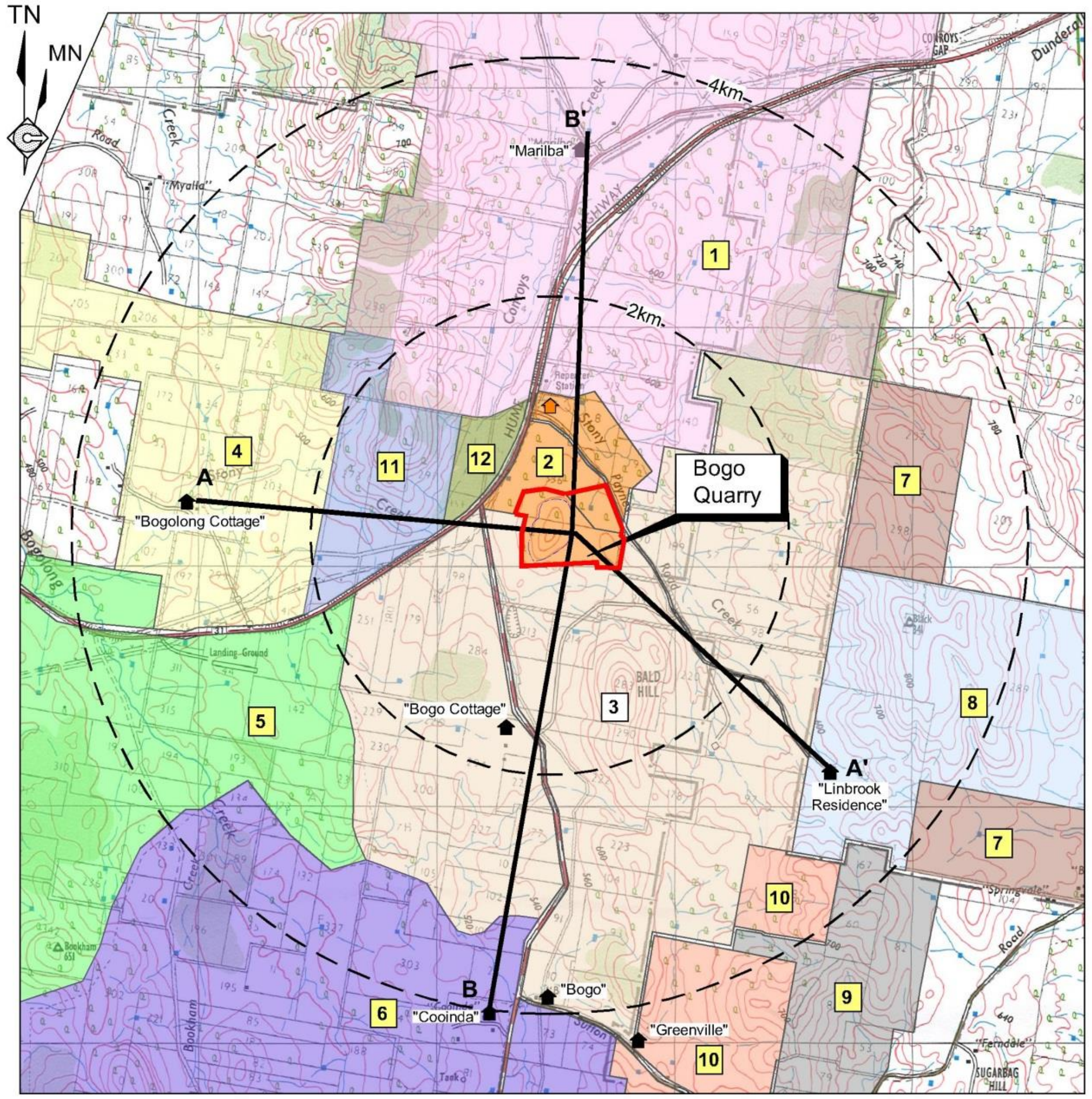


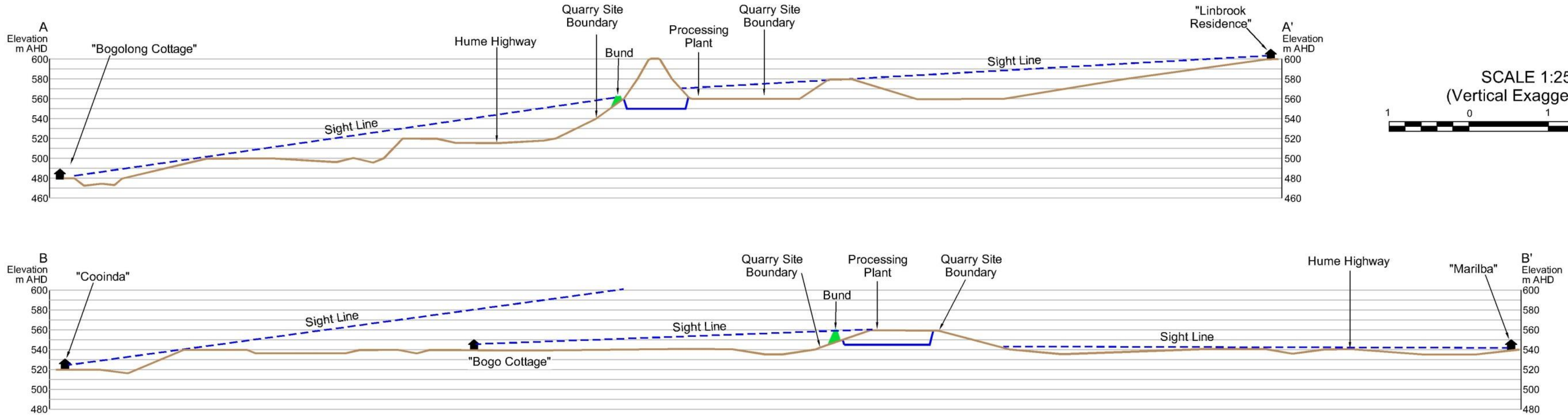
REFERENCE
- Quarry Site Boundary
- Cadastral Boundary
- 10 Land Ownership Reference (see Table right)
- Residence - Project-related
- Residence - Non Project-related

Ref	Landowner
1	Marilba Pastoral Co Pty Ltd
2	Bogo Quarry Pty Ltd
3	Bogo Pty Ltd
4	Refax Pty Ltd
5	RG Julian
6	RT Walker
7	JG & KA Payne
8	Linbrook Pty Ltd
9	DJ Payne
10	MJ & RM Lees
11	J Akhter & T Jamil
12	Yass Clay Target Club Inc

SCALE 1:60 000 (A3)

1 0 1 2 3km

Base Map Source: Yass 1:50 000 Topographic Map
Land Ownership Source: Yass Valley Council - 2015



SCALE 1:25 000
(Vertical Exaggeration = 5)

1 0 1 2 3km

Figure 5.7
VISIBILITY SECTIONS

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5.9 HAZARDS, PUBLIC SAFETY AND SITE SECURITY

5.9.1 Introduction

The SEARs issued by the Department of Planning and Environment identify "Public Safety" as a key issue for assessment within the *Environmental Impact Statement*, including transport, storage, handling and use of hazardous and dangerous goods..

5.9.2 Potential Hazards

The risk analysis undertaken to identify and prioritize the issues to be assessed in the *Environmental Impact Statement* identified a number of potential hazards associated with the Proposal. The potential hazards identified by the risk analysis are as follows (with the relevant section where each was assessed provided in brackets):

- airborne particulate matter impacts on health (Section 5.5);
- contamination of water (Section 5.2); and
- road safety (Section 5.7).

Notwithstanding consideration of the above hazards, the Applicant recognises that its proximity and visibility from the Hume Highway and adjacent landholdings necessitate the implementation of procedures and controls to protect the safety of the public in general, as well as that of local landowners/land users. Measures would also be required to ensure the security of the Quarry Site facilities and equipment, and to protect the safety of the Applicant's own and contracted employees, as well as that of visitors to the Quarry Site.

5.9.3 Operational Safeguards, Controls and Management Measures

It is policy of the Applicant that each person employed on, or visiting the, Quarry Site is provided with a safe and healthy working environment and, to achieve this, the Applicant would continue to implement its recruitment, induction and training program to achieve the following objectives.

- To ensure compliance with statutory regulations and maintain constant awareness of new and changing regulations.
- To eliminate or control safety and health hazards in the working environment in order to achieve the highest possible standards for occupational safety.
- To ensure the suitability of prospective employees through a structured recruitment procedure.
- To provide relevant occupational health and safety information and training to all personnel.
- To develop and constantly review safe working practices and job training.
- To conduct regular safety meetings and provide an open forum for input from all employees.

- To provide effective emergency arrangements for all employees, and general public protection.
- To maintain good morale and safety awareness through regular employee assessment and counselling (if required).

Central to all aspects of site security and safety at the Bogo Quarry is and would continue to be:

- the adoption of a pro-active approach to employee and public safety;
- strict compliance at all times with the requirements of the:
  - *Dangerous Goods (Roads and Rail Transport) Act 2008*;
  - *Occupational Health and Safety Act 2000*;
  - *Mine Health and Safety Act 2004*;
  - All other relevant legislation and Australian Standards;
  - WorkCover Authority; and
- an Occupational Health and Safety Policy covering all component activities at the Quarry.

The Applicant would implement the following measures in association with the Proposal, most of which are already in place for current operations.

- Maintenance of lockable gates at both entrances to the Quarry Site. The gates would be locked whenever extraction and associated activities are not being undertaken on the Quarry Site.
- Positioning security/warning signs at strategic locations around or within the Quarry Site. The signs would identify the presence of earthmoving equipment, deep excavations and steep slopes.
- Employee induction in safe working practices and regular follow-up safety meetings and reviews.
- Regular employee training on hazard identification and risk management.
- Installation of bunds along the margins of all internal haul roads where those roads are positioned adjacent to steep slopes, adjacent to the boundary of the extraction areas(s) and adjacent to all other steep slopes.
- All earthmoving equipment would be fitted with appropriate safety equipment, e.g. rollover protection structures and seatbelts, an operating broadband reversing alarm (or other approved warning device) and an approved location and method of operation for the fire suppression system, all of which would be maintained in a good condition and operated safely at all times.
- Ensuring all crushing equipment at all times complies with all relevant requirements, including:
  - AS 1657-1992 (fixed platforms, walkway, stairway and ladder design, construction and installation; and
  - AS 1755-1986 (conveyor – design, construction, installation and operation safety equipment).

- Strictly complying with all development consent and licence conditions.
- Ensuring all trucks transporting quarry products from the Quarry Site are roadworthy and well maintained.
- Ensuring all hazardous and dangerous goods are stored, handled and transported in a safe manner in accordance with the *Dangerous Goods (Roads and Rail Transport) Act 2008.*

5.9.4 Assessment of Impacts

The previous assessments of Section 5 determined that the Proposal would not result in any increase in, or unreasonable risk to, the safety and/or security of the Proposal personnel or the general public associated with water quality, airborne particulate matter and road safety and bushfire.

The additional safeguards and management measures identified in Section 5.9.3 would further safeguard site personnel, contractors and members of the general public from injury or impact on Applicant or private property.

5.10 AGRICULTURAL IMPACTS

5.10.1 Introduction

State Environmental Planning Policy (SEPP) (Mining, Petroleum Production and Extractive Industries) 2007 requires that existing and future land uses surrounding a proposed development be identified and these land uses be considered in assessing the Proposal particularly with respect to eh agricultural land. Accordingly, this section considers current and proposed land uses surrounding the Quarry Site, the proposed final land use and the possible impact of the Proposal on these current and future land uses.

5.10.2 Existing Land Uses

Section 4.4.2 identified the different land uses surrounding the Quarry Site which include agricultural lands, a recently approved wind farm development at Conroy’s Gap, the extractive industry of the Bogo Quarry itself and the Hume Highway. The Hume Highway is a particularly important feature of local land use as it represents one of the main strategic routes of the Sydney-Canberra and Sydney-Melbourne transport corridors. As illustrated by the Bogo Quarry development itself, which supplies road construction material (aggregates, road pavement materials, asphalt) for the periodic road maintenance campaigns on the highway, the Hume Highway is and will continue to be a driver of development and land use within the Sydney-Canberra and Sydney-Melbourne corridors (DoP, 2008b).

5.10.3 Future Land Uses

Future use of the land on and surrounding the Quarry Site is planned to remain comparable to current uses. The Quarry Site itself would be returned to agricultural use of equivalent style and scale of that currently undertaken on the "Bogo" property. Section 2.13 provided information on the proposed final landform, final land use, and rehabilitation methods to achieve these.

Land use along the Sydney-Canberra corridor generally, of which the Quarry Site forms part, is likely to develop to meet the logistic, material, energy and human resources of this main transport corridor between Sydney - Canberra – Melbourne. Reference is made to a fact sheet released by the Department of Planning in July 2008 (DoP, 2008c) identifying the likely beneficial development affects (and potential impacts on local land use) that will be felt within the Yass Valley Local Government Area (LGA) as a consequence of the Sydney-Canberra Corridor Strategy (DoP, 2008b).

Employment and Industry

- Increased employment and industry development in the areas of logistics, warehousing, transport and manufacturing anticipated. It is possible that land on the Quarry Site or surrounding properties could provide a suitable site for these industries.
- Potential demand for up to 30ha of new employment land has been identified in forecasts for the sub-region (including Yass LGA). Land on the Quarry Site or surrounds could prove suitable for such lands.

Housing

- DoP (2008c) anticipates the Yass Valley LGA population to grow by of approximately 4 000 by 2031 with a resulting demand for up to 2 000 new dwellings. The land on and surrounding the Quarry Site could prove suitable for future sub-division or rural residential blocks to supply the need for new dwellings.

Environment and Resources

- The rural landscapes of the Yass Valley LGA, such as those on and surrounding the Quarry Site, are a key resource for a range of economic contributors to the Region. Traditionally these rural landscapes have been, and continue to be, predominantly made up of agriculture, although future uses may include tourism, mineral and extractive resource extraction (e.g. Bogo Quarry), energy production (e.g. wind farms) and rural residential style living[1].

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[1] It is noted in DoP (2008c) that additional rural residential development areas will only be considered if justified by a Local Settlement Strategy that assesses the net benefit of additional rural residential land against the loss of valuable agricultural lands.

- This diversification of development within the Sydney-Canberra Corridor is demonstrated by an application for the approval of a further 152 turbines over 2 sites (Coppabella Hills and Marilba Hills[2]) with 2 separate substations and connecting transmission lines has been lodged with the Minister for Planning by Epuron Pty Ltd.

5.10.4 Assessment of Impacts

The Bogo Quarry is an established activity within the local setting. The proposal to increase production, slightly modify the extraction area and incorporate concrete batching and asphalt manufacture on the Quarry Site is therefore an extension of an accepted land use within the local setting and unlikely to have a significant effect on the overall land use of the surrounding land. That is, the Quarry development is compatible (or at the very least, not incompatible) with the surrounding agricultural land uses of the local area.

Importantly, the Quarry would not be incompatible with any future industry or land use. To the contrary, the further development of Bogo Quarry would be highly compatible with the aims and objectives of the NSW government's strategic planning document "*Sydney-Canberra Corridor Strategy*". The Quarry Site would, over the life of the Quarry, provide necessary resources for the continued development of the roads, towns and urban centres of the corridor. In addition, the provision of a concrete batching plant on the Quarry Site would be highly compatible with a recent wind farm development (and an additional wind farm project currently before the Minister for Planning) which will require large quantities of concrete for the construction of footings for the wind turbines. The final landform could also provide a suitable site for future industrial or transport related industry within the corridor.

In any event, the final landform has been designed such that a return to agricultural land is possible, which would be compatible with the surrounding land uses.

5.11 SOCIO-ECONOMIC CLIMATE

5.11.1 Introduction

The SEARs identify potential Social and Economic impacts as a key issue for assessment in the *Environmental Impact Statement* (see **Appendix 2**).

The socio-economic setting around the Quarry Site is described in Section 5.11.2 to provide an overview of the interaction between the local and wider community and the activities of the Proposal while Section 5.11.3 provides a summary of the potential positive and negative impacts of the Proposal on this setting. Section 5.11.4 provides a conclusion as to the likely level of impact on the local and wider community of the Proposal.

[2] Within 5km northeast of Bogo Quarry.

5.11.2 Existing Socio-economic Climate

The Quarry Site is located within the Yass Valley LGA, and is located within a rural setting 5km east of the town of Bookham. There are no communities or community facilities or groups surrounding the Bogo Quarry.

Yass and Goulburn to the east are the focus of most social and commercial activities of the neighbours of the Quarry Site. At the 2011 Census, the Yass Valley LGA had a population of 15 020, with 6 088 private dwellings and a median weekly household income of $1 625 (ABS 2013).

5.11.3 Socio-economic Adverse and Beneficial Impacts Provided by the Proposal

In order to assess the overall impact of the Proposal on the socio-economic environment, the various adverse and beneficial impacts are considered as follows.

Adverse Impacts

i) The previously considered impacts on local noise, air quality and traffic would each have a negligible impact on the neighbouring properties of the Bogo Quarry.

ii) The aesthetic appeal of the local setting, when viewed from local vantage points may be reduced. It is noted, however, that the proposed operational controls to minimise these impacts would be effective in screening the quarry activities from most vantage points. It is also noted that the recently approved and potential future wind farm operations would have far greater impact on the visual amenity than the Bogo Quarry. The approved and proposed wind turbines would be constructed over a much larger area and due to the nature of electricity generation by wind, would be placed in exposed and highly visible locations where winds are likely to be strongest.

Beneficial / Positive Impacts

i) The Bogo Quarry would continue to provide employment for the on-site employee(s) and local truck drivers.

ii) The Bogo Quarry would continue to supply high quality aggregates and road base material for construction and road building purposes.

iii) The agricultural value of the area of land incorporated within the Quarry Site would be progressively rehabilitated, with the creation of the significant water storages in the final landform ensuring the value of this land is at the very least maintained for future users.

iv) Through the establishment of an asphalt plant, the necessity to import asphalt from further afield, and subsequent increase in traffic, would be removed.

v) The Bogo Quarry would provide for a local source of concrete, reducing the reliance on sources further away and therefore cost. Notably, the Quarry is ideally placed to supply a recently approved wind farm with concrete for turbine footings.

5.11.4 Assessment of Impacts

Considering the potential socio-economic benefits against those deemed to be adverse, it is assessed that there would be a net socio-economic benefit arising from the approval of the Proposal.

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